Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendices

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Sealed Roads

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1 Overview

1.1 Description

Pavements and surfacing make up the core of the road network and are critical for providing road access throughout the region. This asset group includes:

- Sealed pavements
- Unsealed pavements
- Other (concrete; bridge decks etc).

Sealed pavements make up 2,457km or 42% of Northland's total road network.

The pavement and surfacing asset form a significant part of council's road asset portfolio. Representing a third to nearly a half of the asset base. This requires that council invest at the appropriate level to protect the asset in way that is equitable for the current and future generation.

The pavement base of the sealed roads consists of the following main pavement types:

- Stabilised pavements (generally with either lime or cement) of sub quality aggregates
- Structural Asphalt Pavements (growing need in Whangarei urban and Far North district)
- Other pavements (concrete bridges, paving blocks and concrete pavements generally vested etc.).

The majority of the current top surface length is chipseal (95%) with a growing amount of thin asphalt wearing courses making up the remaining length (along with a small amount of specialty surfaces).

Table 1-1 following summarises the current replacement cost / value of the pavements and surfacing (excluding the land under the roads) and its percentage of the total asset network.

Table 1-1: Pavements and surfacing asset value and percentage of total transportation assets

Sealed Road Value (Pavement and Surfacing Excludes Non-Depreciable Assets)				
District	Replacement Value	Depreciated Replacement Costs (Book Value)	Annual Depreciation	Percentage of Roading Asset Value of Replacement Cost
FNDC	$408,587,829	$280,161,792	$10,595,664	33%
KDC	$146,743,613	$101,816,690	$3,364,294	33%
WDC	$476,157,869	$181,587,254	$14,947,126	42%

The breakdown of the pavements by district and the urban/rural split is illustrated in Figure 1-1 below.

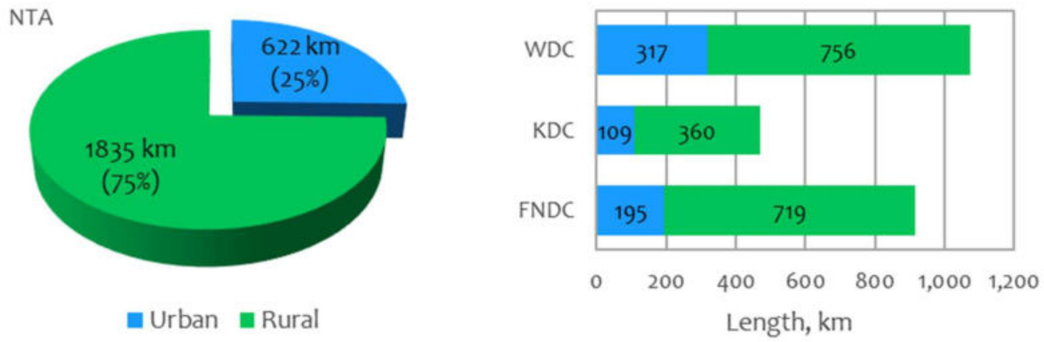
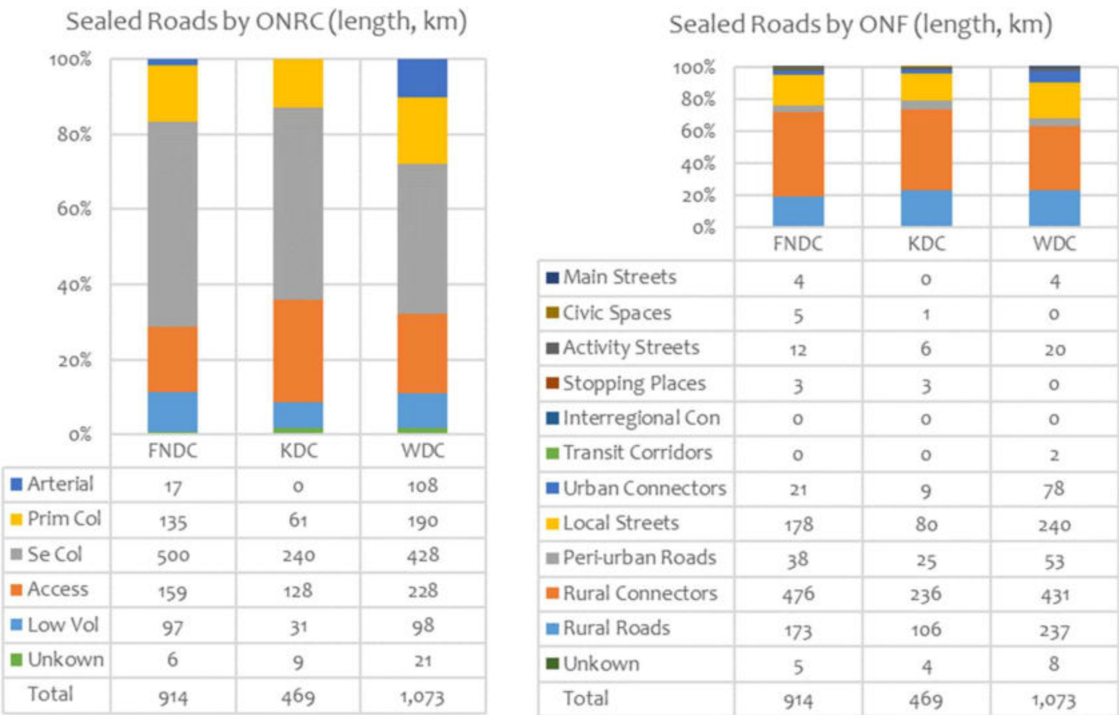


Figure 1-1: Urban and Rural classification and district distribution

Figure 1-2 below illustrates the sealed road length distribution by ONRC and ONF for the three districts:



	FNDC	KDC	WDC
Arterial	17	0	108
Prim Col	135	61	190
Se Col	500	240	428
Access	159	128	228
Low Vol	97	31	98
Unkown	6	9	21
Total	914	469	1,073

	FNDC	KDC	WDC
Main Streets	4	0	4
Civic Spaces	5	1	0
Activity Streets	12	6	20
Stopping Places	3	3	0
Interregional Con	0	0	0
Transit Corridors	0	0	2
Urban Connectors	21	9	78
Local Streets	178	80	240
Peri-urban Roads	38	25	53
Rural Connectors	476	236	431
Rural Roads	173	106	237
Unkown	5	4	8
Total	914	469	1,073

Figure 1-2: Sealed roads length by ONRC (left) and ONF (right)

1.2 Monitoring and Condition

1.2.1 *Inspections*

The sealed pavement condition is monitored through a number of process. The key ones are:

- High Speed Data (HSD) collection using Laser Crack Measuring System (LCMS). This survey uses at speed survey vehicle fitted with laser survey equipment to collect the following condition data each year on 100% of the sealed roads:
  - Roughness – Summarised to 20m sections by lane
  - Rutting – Summarised to 20m sections by lane
  - Texture – Summarised to 10m sections by lane
  - Cracking – Summarised to 10m sections by lane. This reports crack length, width, depth and potholes along with averages, minimums, maximums.
- Falling Weight Deflectometer (FWD) data. This data is developed based on programme of rehabilitation and thin asphalt work programmes. Typically the FWD survey is set in the following way:
  - Completed yearly or once every two year basis dependent on previous year's survey and coverage for the above.
  - Survey specification is as follows:
    - Network work level – one drop every 50m alternate lane (one drop per 100m centreline)
    - Project level – one drop every 25m alternate lane (one drop per 50m centreline). General for thin asphalt surfacing programme to assess adequacy of pavement and identify areas of heavy pavement maintenance.
    - Detail level – one drop every 10m alternate lane (one drop per 20m centreline). Generally used for detailed pavement design.

These surveys are used in several ways to assess the condition and performance of the sealed road network. Primarily:

- Utilised by external national reporting tools such as Transport Insights to assess performance against peer groups and national targets.
- Waka Kotahi New Zealand Transport Agency (NZTA) performance reporting and assessment in funding applications (such as this AMP).
- Used in the pavement management analysis tools such as Deighton Total Infrastructure Management System (dTIMS), Candidate Selection Algorithm (CSA) to assist in assessing the network level work requirement and model the performance outcome based on differing investment scenarios.
- For this AMP to provide evidence of the current network condition.

1.2.2 *Pavement Performance Model*

The current state of the network can be summarised in the following sections. This includes the current state of the network and predicted state based on the pavement performance modelling (PPM) (Draft NTA Pavement Performance Analysis – 2023-24) completed as part of the options assessment.

The main objective of the PPM analysis was to:

- Check the appropriateness of the current funding levels for each of the road networks managed by the NTA; and
- Determine the optimal funding split between resurfacing and rehabilitation renewal treatments within each network.

There are three types of model analysis within the dTIMS software:

- Trigger Model – defines the programme and cost required to meet a performance standard and specified level of service through the utilisation of a decision tree approach and applies treatments when certain triggers have been met without any budget constraint;
- Optimal Model – provides an optimal maintenance strategy to fit a given budget; and
- Specified Model – uses the current Forward Work Programme (FWP), calculates how much it will cost and predicts the condition based on the given treatments.

A review of the current expenditure and discussion with the Client resulted in the following annual budget scenarios being used for the optimal analysis.

Table 1-2 shows the five programme budget scenarios for each the FNDC, KDC and WDC networks to check the appropriate level of funding for the networks using the Optimal Model. The annual RSEAL, 2ndCoat, TAC and RHAB treatment costs are pooled and constrained by the programme budget in the model.

Table 1-2: Optimal Model Budget Scenarios

Budget Scenario	Network Annual Programme Budget, $Mill			Notes
	FNDC	KDC	WDC	
Very High (VH)	11.40	5.18	12.68	40% more than the Normal Budget
High (H)	9.36	4.26	10.42	15% more than the Normal Budget
Normal (N)	8.14	3.70	9.06	Representing current renewal expenditure
Low (L)	6.92	3.15	7.70	15% less than the Normal Budget
Very Low (VL)	5.70	2.59	6.34	30% less than the Normal Budget

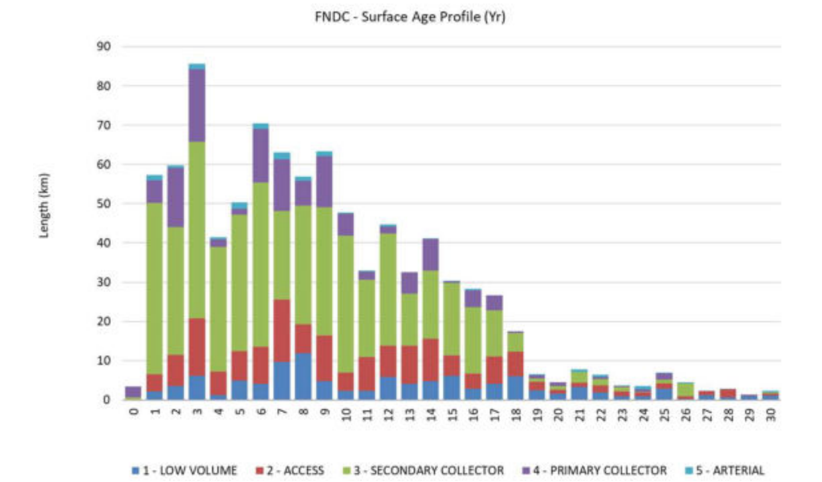
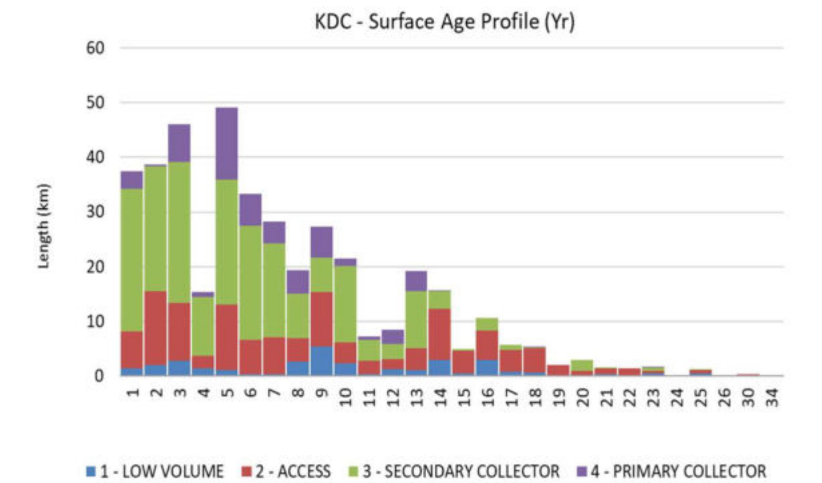
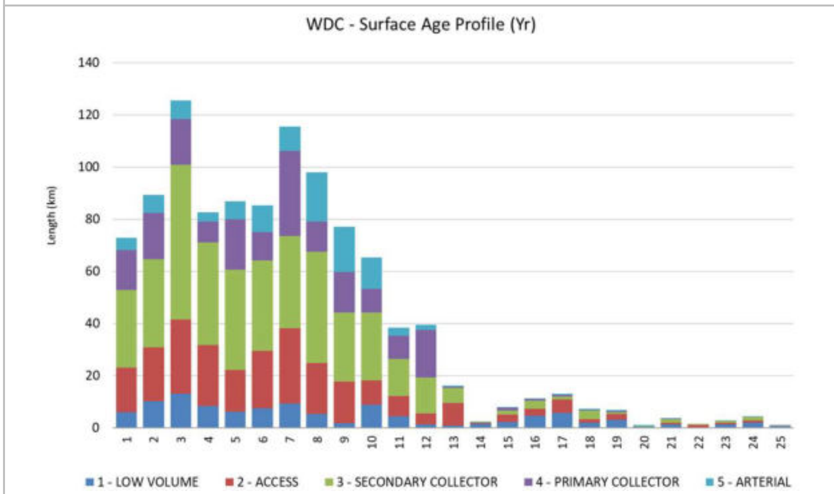
1.2.3 Surface

1.2.3.1 Surface Life – RAMM

The following is an overview of the surface profile of the three districts networks and pavement performance modelling outcomes.

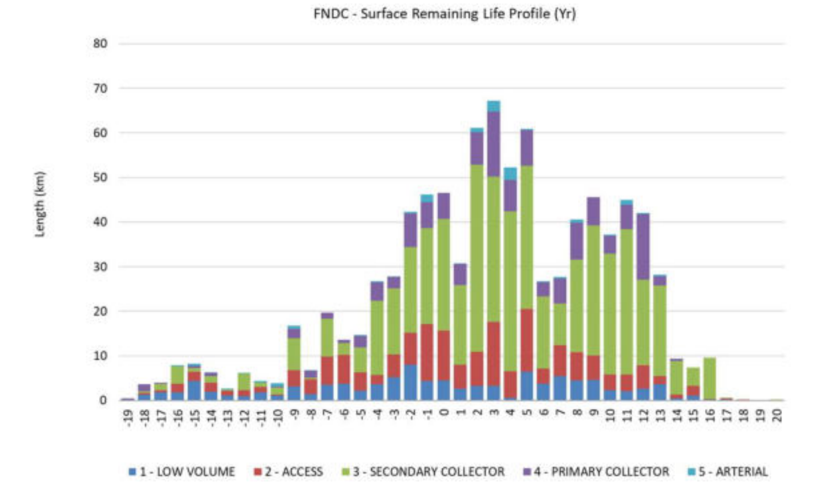
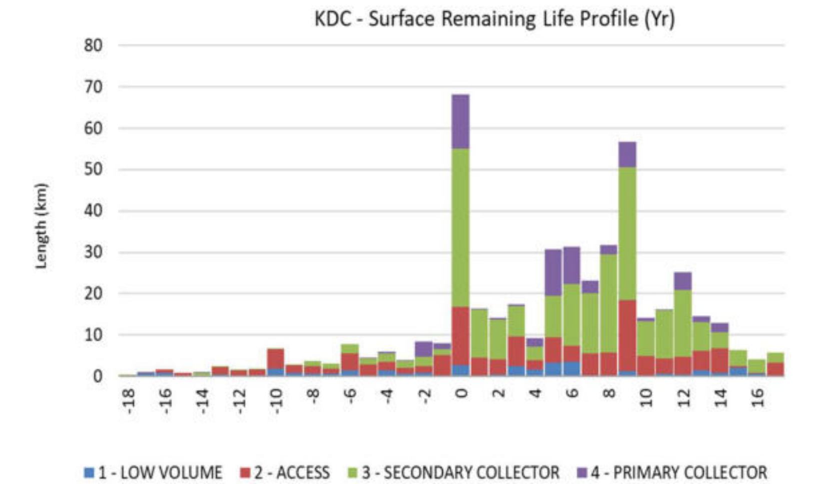
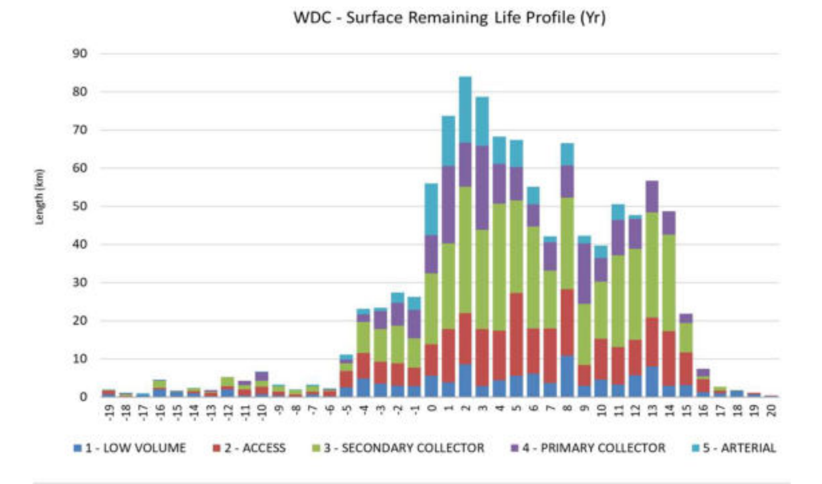
Tables 1-3 and 1-4 following provide an overview of the surface age and remaining life distribution for the three districts.

Table 1-3: Surface Age Distribution

	FNDC surface age profile reflects the surfacing programme. Especially in the Secondary and Primary collector parts of the network. During the course of the last plan the surface profile has been normalised indicating that optimised manage approach to surfacing delivery over the last 6 years has been effective.
	KDC similar issue to FNDC but not to the same extent.
	WDC shows a relatively young surface age. This is due in part to the large void fill/texturiser content on the network, refer LoS Analysis surface age review. These have shorter design life and are a treatment that prepares the surface to apply a more robust longer life surface. If these surfaces are not surfaced at the right time these become a maintenance issue and require a second Void/texture seal to prepare the site again.

Elements of the surface age profile are reflected in the remaining surface life profile of the networks. However, there is still a number of long-lived seals that are excessively beyond their useful life.

Table 1-4: Remaining Surface Life Distribution

<table>
<tr><td>
</td><td>FNDC have a significant quantity of Primary and Secondary class roads in terms of resurfacing either beyond or approaching end of life. Due to impacts recognised with the problem statement these roads are being pushed. When surfacing does occur these roads are often beyond pre-seal and reseal and need to manged into pavement rehabilitation programme.</td></tr>
<tr><td>
</td><td>KDC remaining surface life profile reflects the work done on applying second seal aging first coats. Resulting in reduction of overdue seals. This has removed some risk from the network but continued focus on the remain old seals is required to avoid more expensive rehabilitation treatments or significant pre-seal maintenance. As illustrated, there is significantly long tail in this profile.</td></tr>
<tr><td>
</td><td>The current WDC programme has treated a number of overdue seals and reduced the volume of old surfacing's on the network. There remains quite tail of old surfaces some of which are old low volume residential asphalt surfaces which remain in the network and has been identified as strategic and programme response in this AMP.</td></tr>
</table>

1.2.3.2 *Surface Life – Predicted by PPM*

Remaining surface life (RSL) is calculated on the basis that all chipseal surfaces treated by the model become two coat seals, which have longer expected lives than single coat seals, particularly void fill seals.

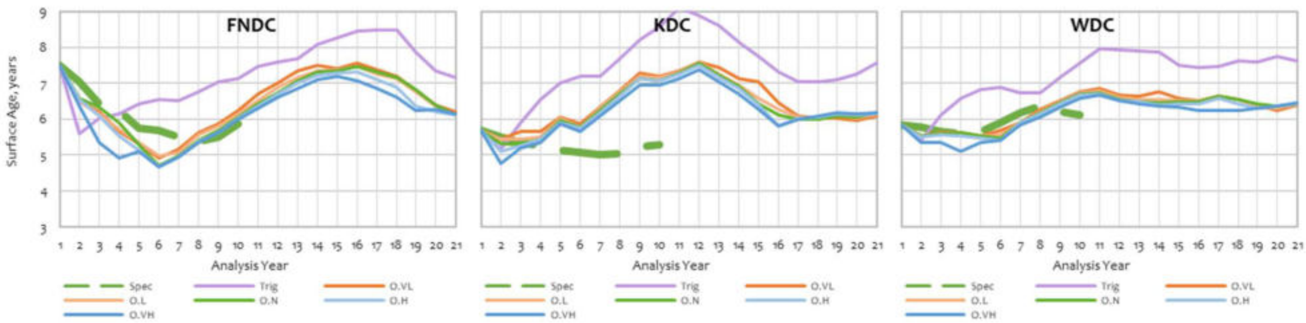


Figure 1-3: Weighted average surface age

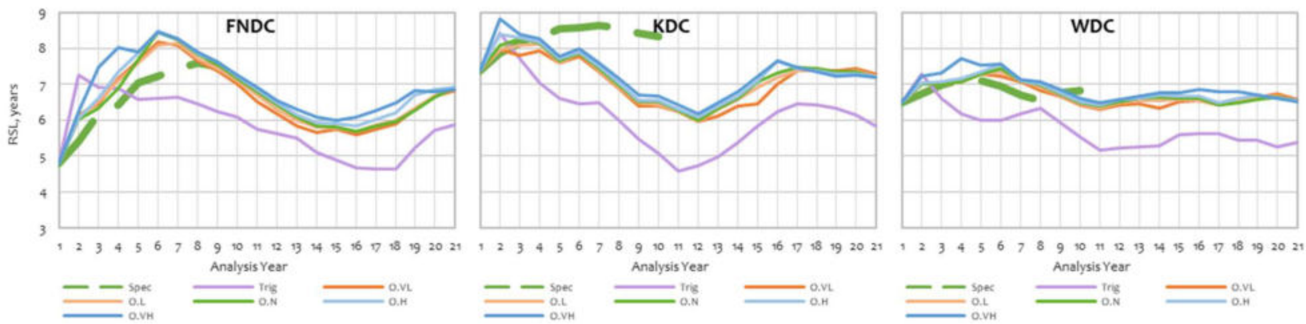


Figure 1-4: Weighted average remaining surface life (RSL)

For the combined networks, the Specified Model programme is able to the maintain the average age at the current level and improve the RSL within the next 10 years.

The model predicted network surface ages enter a phase of cyclic fluctuation at the start of the analysis period. Each trigger and optimised scenario complete large amounts of chipseal treatments during the first non-committed year (while deferring the more expensive asphalt resurfacing and pavement renewal treatments in the optimised scenarios). The optimised scenarios continue with a focus on chipseal treatments into the second, third, and for some scenarios, the fourth non-committed years. In general, the optimised scenarios have a similar surface age forecast by the end of the analysis period because there is normally adequate funding to do chipseal resealing, even at low funding levels. The average chipseal age levels out at between 6 and 7 years (depending on network) by the end of the 20-year analysis period.

1.2.3.3 Surface Integrity Index – Predicted by PPM

The Surface Integrity Index (SII) is a composite index for pavement surface conditions. The scale of this index is 0 (excellent) to 100 (very poor). SII is a function of the following:

- Surface age, which is activated when the design life is expired; and
- Surface condition, which includes cracking, flushing and potholes.

Figure 1-5 following shows the predicted network average SII for all model scenarios. The smaller the value the better the condition. Some of the early SII improvement can be attributed to treatment of old/aged surfaces.

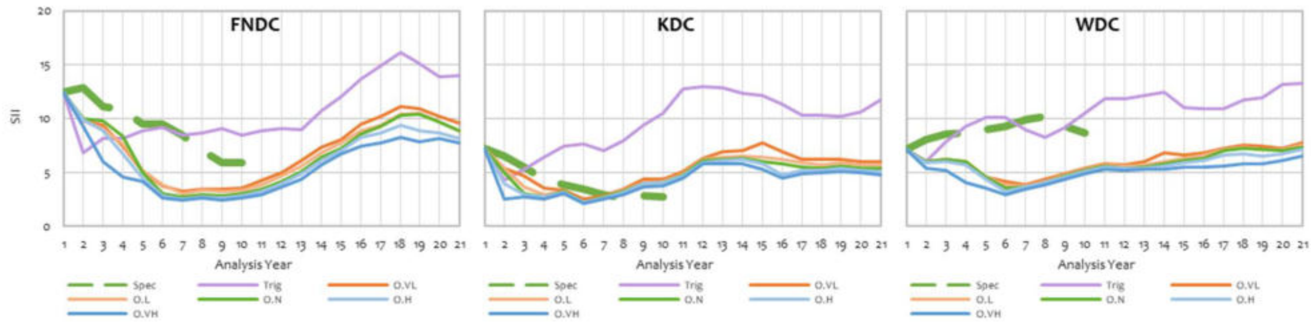


Figure 1-5: Weighted average Surface Integrity Index (SII) forecasts

The predicted long-term average SII is either improved or maintained relative to the current average SII throughout the analysis period for all optimised budget scenarios. The general trends are for SII to improve during the first decade of the analysis but deteriorates throughout the second decade. At the end of the analysis period, SII deteriorates to levels that are similar to the start.

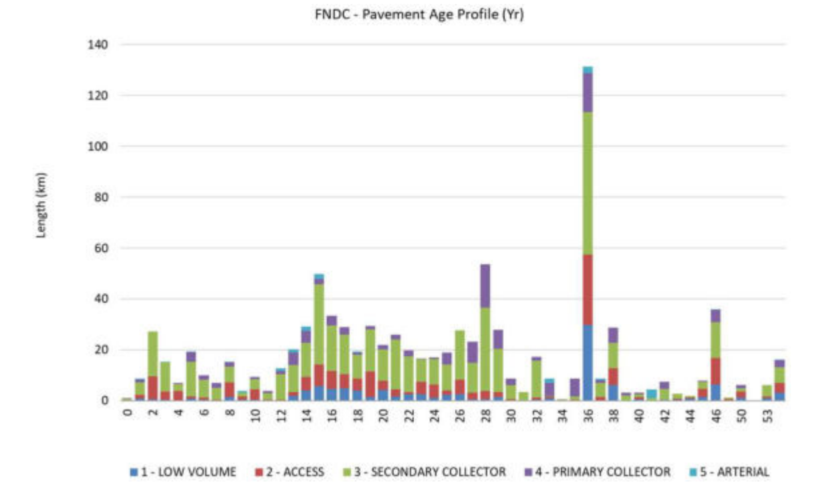
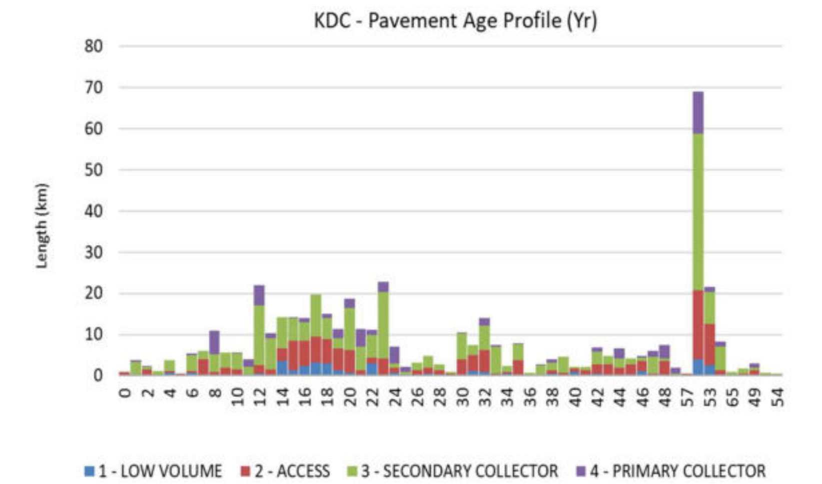
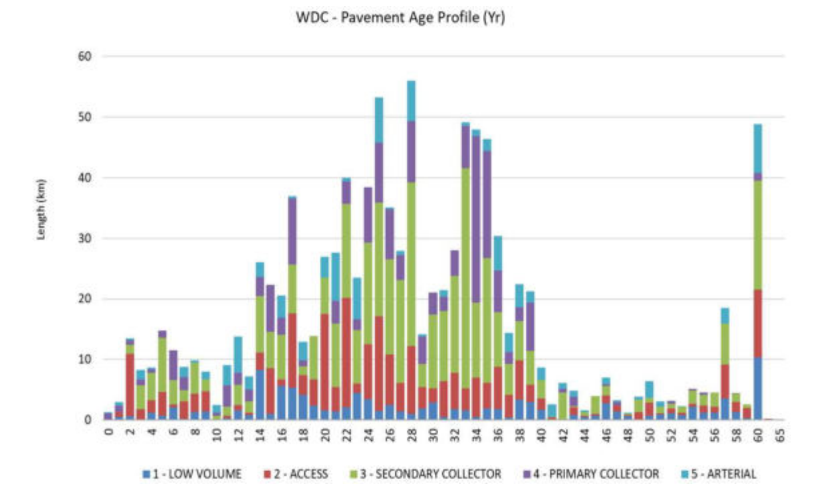
1.2.4 Pavement Base

1.2.4.1 Pavement Life – RAMM

The following is an overview of the pavement profile of the three districts networks and pavement performance modelling outcomes.

Tables 1-5 below provides an overview of the pavement age for the three districts.

Table 1-5: Pavement Age Distribution

<table>
<tr><td>
</td><td>The pavement age profile shows the primary, secondary network have peaks between 20-35 years of age. These are pavements that will present priority on the network in these classes. Given the current trend on pre-seal repairs monitoring of these roads is as these carry the bulk of heavy traffic on the network.</td></tr>
<tr><td>
</td><td>KDC has a relatively young pavement network. However, there is some older Primary and Secondary roads in this profile. The main issue is condition of some of these pavement and historic design practices and northland geology has led to some premature failure.</td></tr>
<tr><td>
</td><td>The pavement age profile of the network shows the Arterial and Primary has a peak in 26 to 37 year old. This represents approximately 100km of the network. This is not a problem within itself but when evidenced with the current condition and levels of pre-seal expenditure this needs careful management and ongoing investment to maintain a stable network investment into the future</td></tr>
</table>

1.2.4.2 Pavement Life – Predicted by PPM

Figure 1-6 following shows forecast network average pavement ages by various model scenarios The charts in Figure 1-6 show the weighted average pavement age will increase, even in the case of the Trigger Model that has an unconstrained budget. An increasing network average age is expected and demonstrates a trend similar to most road networks. Increasing pavement age indicates the pavement capacity will inevitably be consumed over a long period of time. The pavement will become less resilient to wear and less capable of absorbing deterioration that will occur if funding becomes overly constrained.

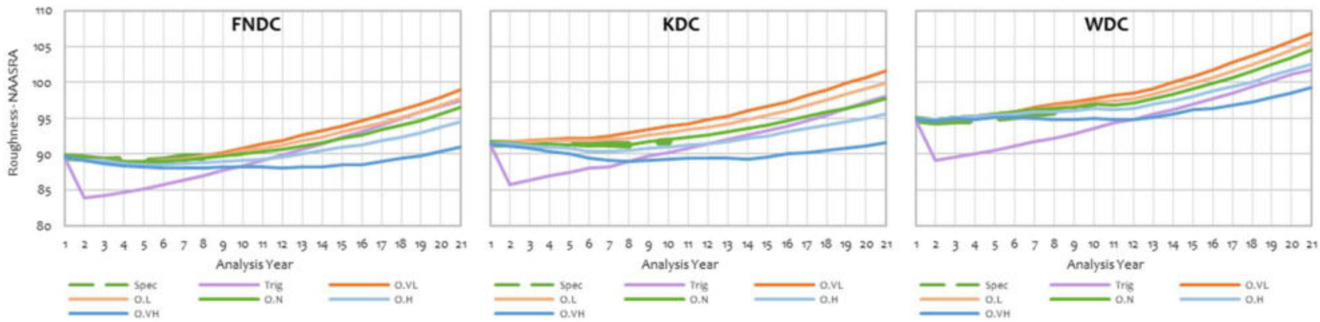


Figure 1-6: Network weighted average pavement age forecasts

1.2.4.3 Pavement Integrity Index – RAMM

Tables 1-6 below provides summary of pavement condition based on the Pavement Integrity Index (PII), as calculated in RAMM. This calculation uses pavement related high speed condition data collected on the network.

Table 1-6: Pavement Condition Profile (PII length metres)

FNDC

Pavement Condition	Low Volume	Access	Secondary Collector	Primary Collector	Arterial	Total
Very Poor	5,391	3,737	2,458	930	319	12,835
Poor	6,424	4,896	4,781	1,147	91	17,339
Average	17,658	22,397	26,784	4,469	168	71,476
Good	69,003	123,439	452,112	124,127	15,797	784,478
Excellent	7,032	8,403	7,794	706	–	23,935
Total	105,508	162,872	493,929	131,379	16,375	910,063

KDC

Pavement Condition	Low Volume	Access	Secondary Collector	Primary Collector	Arterial	Total
Very Poor	1,845	3,704	677	50	–	6,276
Poor	850	4,544	835	88	–	6,317
Average	3,066	4,726	4,019	540	–	12,351
Good	4,321	12,797	12,942	4,010	–	34,070
Excellent	24,617	105,586	218,390	57,671	–	406,264
Total	34,699	131,357	236,863	62,359	–	465,278

WDC

Pavement Condition	Low Volume	Access	Secondary Collector	Primary Collector	Arterial	Total
Very Poor	6,297	5,835	2,531	457	727	15,847
Poor	5,802	6,279	2,708	444	333	15,566
Average	8,157	10,389	10,019	2,037	1,607	32,209
Good	11,387	24,517	46,157	6,402	2,798	91,261
Excellent	81,138	196,843	353,549	179,439	101,119	912,088
Total	112,781	243,863	414,964	188,779	106,584	1,066,971

If we consider the matrix above as a risk profile, having higher class roads in condition setting related to that road class, this will indicate the amount (length given by red text above) of pavement that needs to be monitored and considered for renewal within the next 5-7 years for each district as follows:

- FNDC – approximately 13.6km (1.5% of the total pavement length)
- KDC – approximately 5.9km (1.3% of the total pavement length)
- WDC – approximately 14.6km (1.4% of the total pavement length).

When considering the current condition of the pavement the investment programme reflects how we will go about investing in the renewal of our pavements. Approximately 1.5 – 2.0%- of all networks is within an 'at risk' condition profile. Considering the current investment is set to approximately 0.8% per annum being treated, this needs to be monitored closely.

It's worth noting the Access and Low Volume ONRC network have a larger portion of poor to very poor condition pavements, this is acceptable on the basis of the resurfacing investment strategy of the network being supported with suitable pre-seal maintenance and that such treatments prove to be the whole-of-life least cost option.

Changes in the network level PII over time may indicate whether current investment levels are sustainable in the long term. Figure 1-7 shows the change in pavement condition over time for the three Districts.

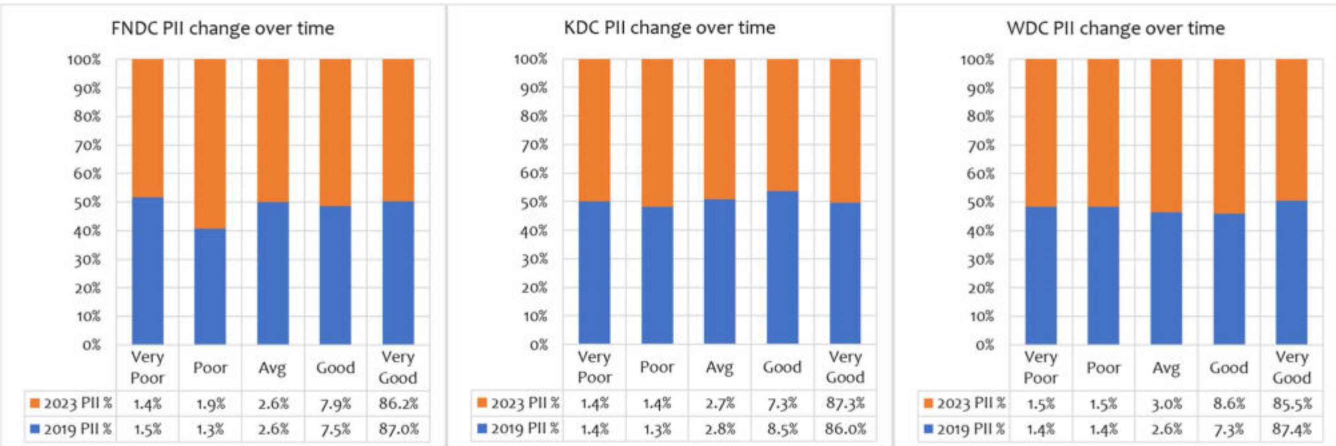


Figure 1-7: Change in pavement condition (2019 PII vs 2023 PII)

FNDC PII trend – the proportion of the very poor and poor condition combined has deteriorated from being 2.8% (25.2km) of the network to 3.3% (30.1km) of the network

KDC PII trend – the change remained fairly static, there has been slight increases in amount of Poor and Very Poor condition.

WDC PII trend – Very Good PII is reducing while Good PII has increased with resulting increase across the Average to Very Poor. These trends are a general reflection on the current impacts faced over the last three years and a reason for the continued increase in programmes to maintain the network in a stable state.

1.2.4.4 *Pavement Condition Index – Predicted by PPM*

The Pavement Condition Index (PCI) is a composite index of pavement base and surface conditions. The scale of this index is 100 (excellent) to 0 (very poor).The PCI is a function of roughness, rutting, texture and the Surface Integrity Index (SII). The PCI is a composite index that includes SII. Therefore, some of the predicted PCI improvement can be attributed to improvement in SII.

Figure 1-8 following shows forecast network average PCI by various model scenarios. PCI can be maintained within the first half of the 20-year analysis period for all optimised scenarios. However, PCI may not be able to be maintained in the long term at the current indicated levels by current renewal expenditure as the networks' pavement base continue to age.

FNDC PCI – has the lowest (worst) initial PCI and improves over the majority of the analysis period. It takes five years to reach a plateau, then eventually deteriorates relative to the plateau at a rate dependant on funding level.

KDC PCI – has long term deterioration at normal funding (and lower), indicating that greater amounts of pavement and surface renewal will be required than can be afforded by the normal funding scenario.

WDC PCI – has long term deterioration when funding levels are less than the very high funding scenario. WDC is at risk of long-term deterioration if funding is reduced below this level of funding.

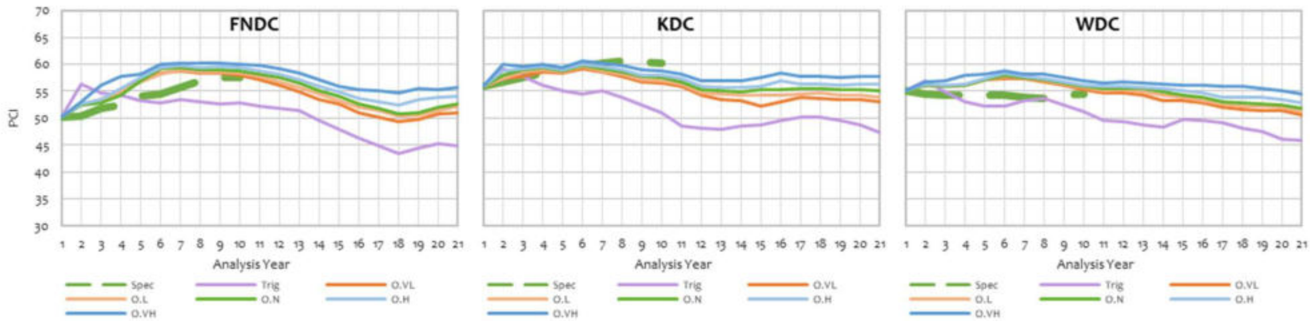


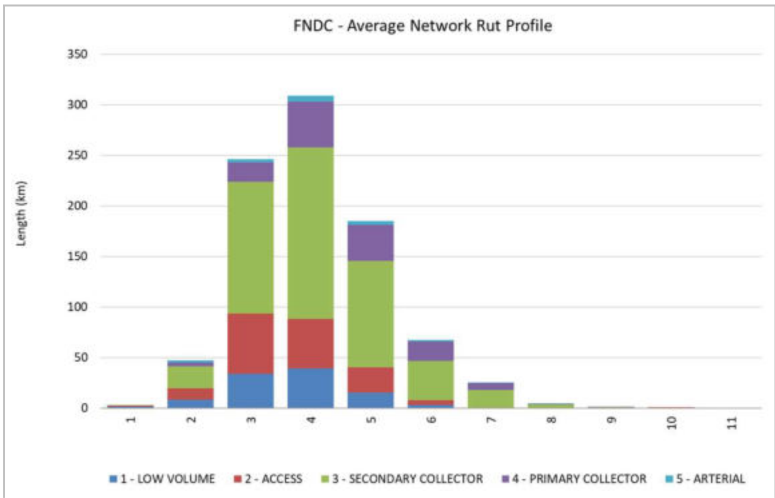
Figure 1-8: Network weighted average Pavement Condition Index (PCI) forecasts

1.2.5 Rutting

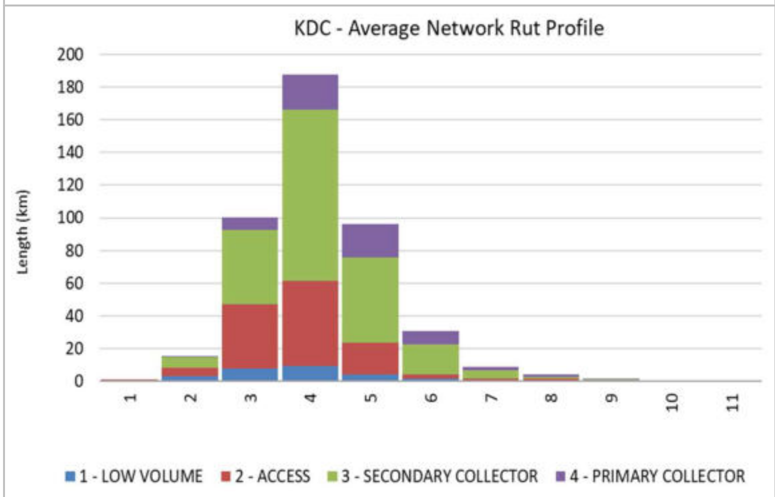
1.2.5.1 Mean Rut Depth – RAMM

The network average rutting profile is presented in Table 1-7 below. This shows that the secondary network has the highest proportion of rutting in the network. This aligns with the pavement renewal (rehabilitation) investment profile for year one of the programme. In terms of network condition the rut profile is average to poor at 4mm across the 1037 km of network is significant.

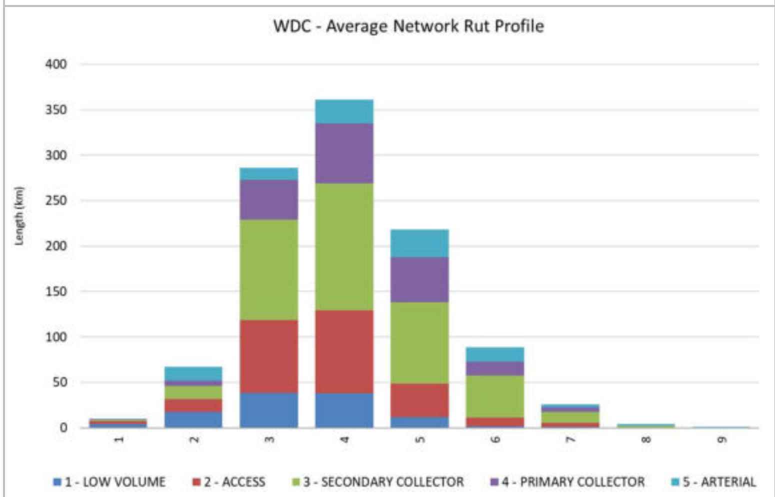
Table 1-7: Mean Rut Depth Profile



FNDC network average rutting profile shows that the secondary network has the highest proportion of rutting in the network. This aligns with the rehab investment profile for year one of the programme. The profile has not moved significantly from previous years meaning the current programmes have been able to maintain static rut profile. Future programmes will need to be managed at least at current levels or slightly above to ensure this managed going forward. To do this, higher levels of funding will be required due to rising costs.



KDC network average rutting profile shows that the secondary network has the highest proportion of rutting in the network. This aligns with the rehab investment profile for the term of this plan. AS above the previous and current plans have been able to maintain this profile in static. This would been seen as the an adequate service position for a network of this sort.

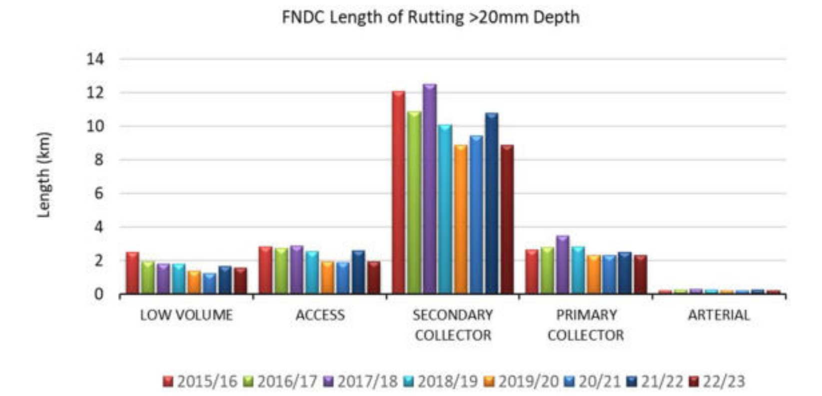


WDC network average rutting profile shows that the secondary network has the highest proportion of rutting in the network. This aligns with the rehab investment profile for of the proposed programme. In terms of network condition as note above this profile is adequate and should be maintained in this position.

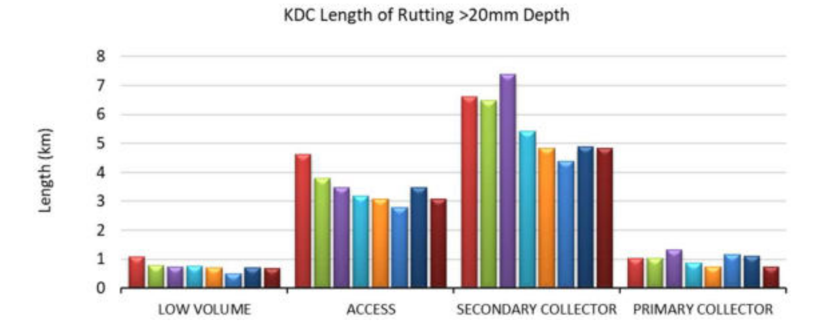
1.2.5.2 *Rutting Greater than 20mm – RAMM*

When we consider this further and extract just the length of rutting greater than 20mm in depth, which is reaching terminal pavement failure, this is generally increasing year on year for most road classes.

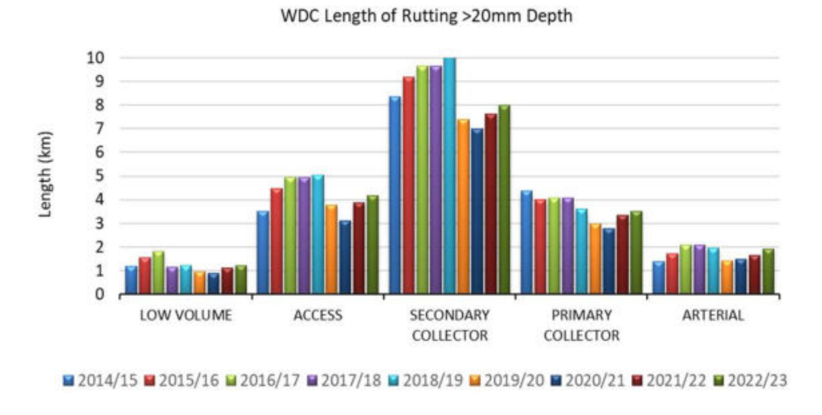
Table 1-8: Rutting greater than 20mm



FNDC length of rutting greater than 20mm in depth, reaching terminal pavement failure, is generally static or declining. The last plan has manged to keep rutting in check. However, the length of network greater than 20mm rutting is still concerning and represent a large quantity and requires continued delivery of this plan as proposed.



KDC length of rutting greater than 20mm in depth, reaching terminal pavement failure, is generally static or declining. The last plan had manged to keep rutting in check despite the impacts of the problems recognised in this plan.



WDC length of rutting greater than 20mm in depth, reaching terminal pavement failure, was generally increasing year on year for all ONRC from 2019/20 to present. The current plan has not kept pace with this trend. As identified through the problem statement, SBC, and PBC, noting the significant cost of treating the high volume urban areas.

1.2.5.3 Mean Rut Depth – Predicted by PPM

The majority of the current network length is beneath the model resurfacing treatment reset thresholds, hence the average rutting would be able to increase regardless of the optimised resurfacing programme. However, the amount of rehabilitation treatments forecast does have an impact on average rutting predictions.

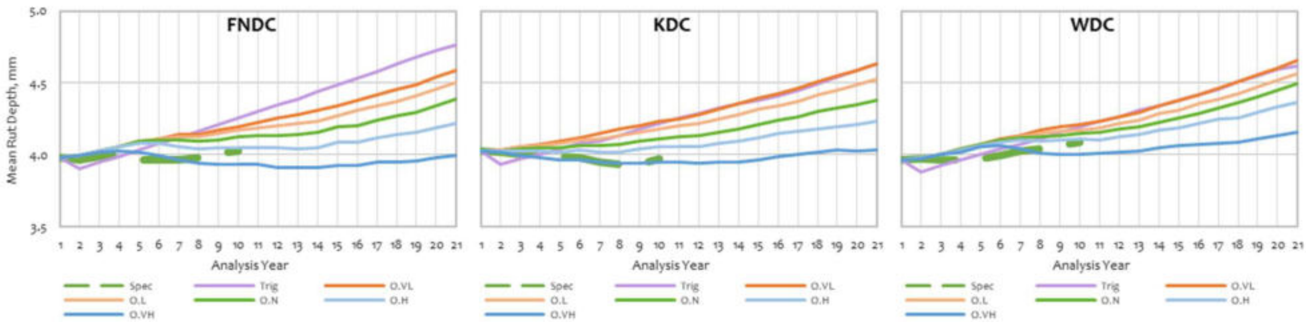


Figure 1-9: Network weighted average rutting

The average rutting performance is maintained for the FNDC network and the KDC network at the normal and higher funding levels. Rutting performance deteriorates for the WDC network when funding is beneath the Very High level.

The networks are mostly low traffic volume but with routes that cater for HCV’s (forestry and quarries). The current condition of the network is generally reasonable and parts can absorb some deterioration. However, this may not be sustainable and the risk for the network is the consumption of the good condition and the ability of the pavement to absorb further deterioration, this may lead to further and increased rates of deterioration. It can be seen in Figure above there is a risk of high deterioration for each of the rural networks at the normal funding level, as all rural ONRC have a trend of increasing median and upper distribution of rutting values.

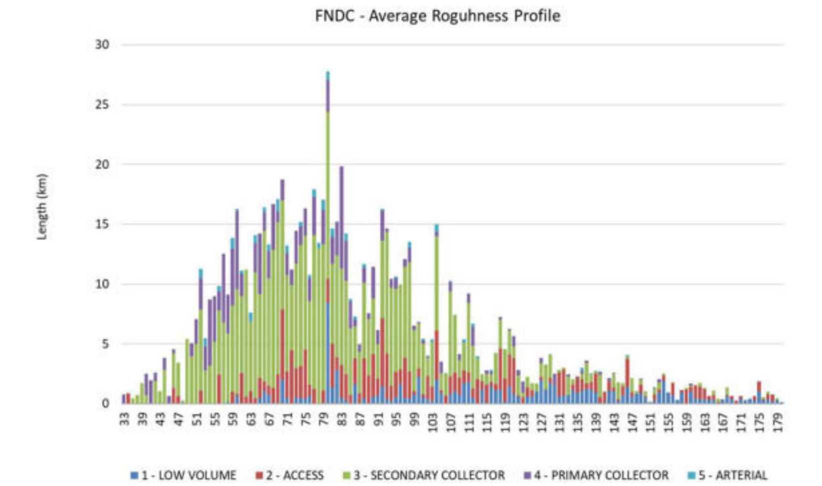
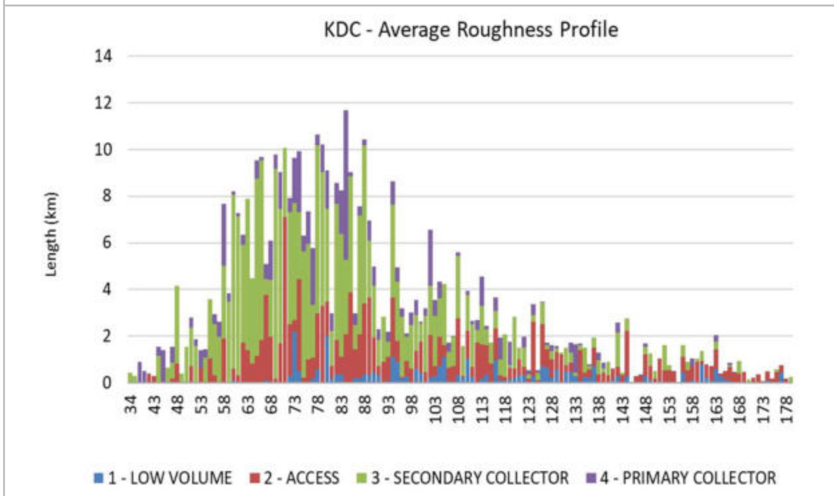
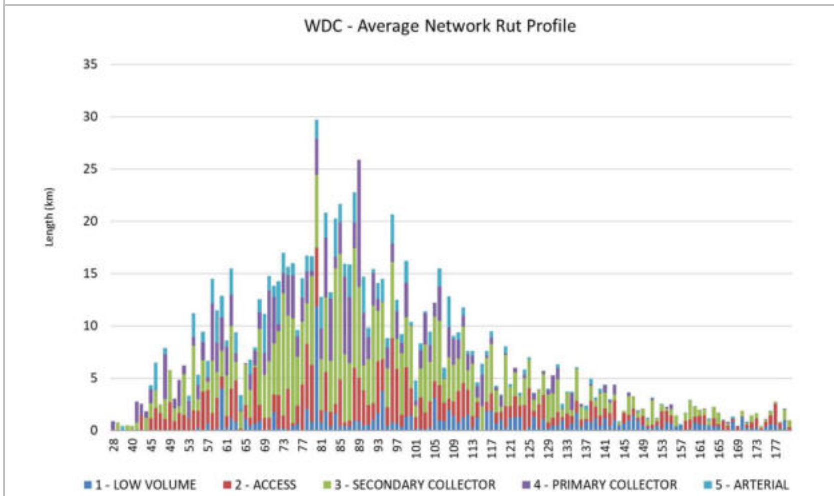
1.2.6 Roughness

1.2.6.1 Average Roughness Distribution – RAMM

The following provides an overview of the current state of the network roughness (expressed in units of NAASRA counts) and the modelled option assessment for the three districts networks.

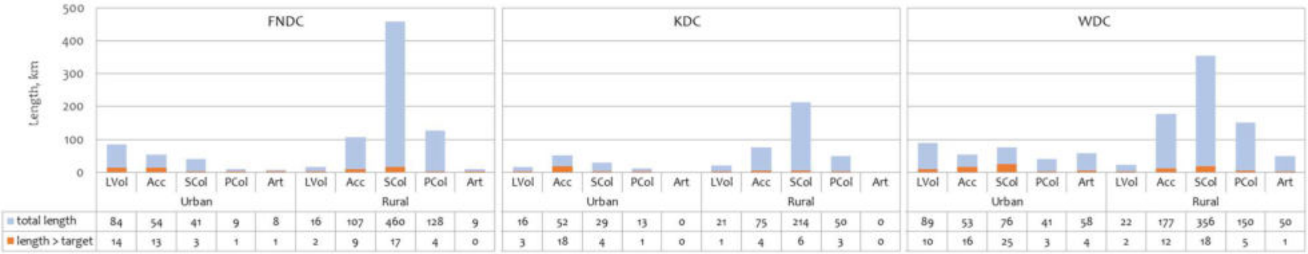
The network average roughness distributions are presented in Table 1-9 below.

Table 1-9: Average Roughness Distribution

	FNDC average roughness profile shows a long tail which indicates a rougher riding network. The large majority of this is Access and Low Volume. However as indicated under LoS analysis, STE and peak roughness remains a focus to improve ride quality.
	KDC average roughness profile shows a long tail which indicates a rougher riding network. The large majority of this is Access Low Volume. However as indicated under LoS analysis, STE and peak roughness remains a focus to improve ride quality.
	WDC average network distribution for roughness shows that there is some high levels of roughness on the arterials, primary and secondary network.

1.2.6.2 Roughness Exceedance – RAMM

Figure 1-10 following shows the network road classes and compares the roughness performance against the draft ONRC measures as well as how the ONRC length is distributed.



FNDC	Urban LVol	Urban Acc	Urban SCol	Urban PCol	Urban Art	Rural LVol	Rural Acc	Rural SCol	Rural PCol	Rural Art
total length	84	54	41	9	8	16	107	460	128	9
length > target	14	13	3	1	1	2	9	17	4	0

KDC	Urban LVol	Urban Acc	Urban SCol	Urban PCol	Urban Art	Rural LVol	Rural Acc	Rural SCol	Rural PCol	Rural Art
total length	16	52	29	13	0	21	75	214	50	0
length > target	3	18	4	1	0	1	4	6	3	0

WDC	Urban LVol	Urban Acc	Urban SCol	Urban PCol	Urban Art	Rural LVol	Rural Acc	Rural SCol	Rural PCol	Rural Art
total length	89	53	76	41	58	22	177	356	150	50
length > target	10	16	25	3	4	2	12	18	5	1

Figure 1-10: Roughness performance against the draft ONRC measures

The network averages are generally lower than the specified averages except for FNDC Urban Access, KDC Urban Access, and WDC Urban Access and Urban Secondary Collector roads. These parts of the network are lower risk for accelerated deterioration compared with higher ONRC categories.

The above figure show that around 7% to 9% of each network has roughness exceeding the specified targets. FNDC 7% (63km), KDC 9% (40km), and WDC 9% (95km). This result in Smooth Travel Exposure (STE) range of 92% to 96%.

1.2.6.3 Average Roughness – Predicted by PPM

Figure 1-11 below shows the predicted network average roughness over the analysis period.

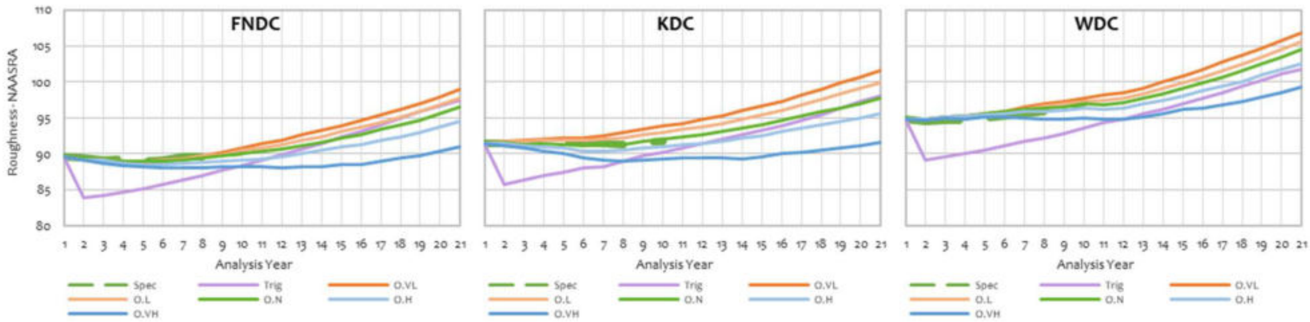


Figure 1-11: Network weighted average roughness

The network's average roughness can be maintained at near current levels within the first 10 years at the normal and higher funding levels. The optimised normal scenario (Normal funding level) is able to maintain network average roughness at near current levels during the first 10 years for FNDC and KDC (the average NAASRA is unchanged at the end of the period for each) but not for WDC where the average roughness increases by 2 NAASRA. The majority of each ONRC network are beneath the model resurfacing treatment reset thresholds, hence the average roughness is able to increase regardless of the optimised resurfacing programme. However, the amount of rehabilitation treatments forecast does have an impact on average roughness predictions.

There is a general upswing in roughness toward the end of the 20-year analysis period. This is caused by a combination of the roughness models dependency on pavement age as an input variable (average pavement age increases significantly over the next 20 years), pavement renewal quantity being too low to curtail the aging of the networks, and the model allowing deterioration to be absorbed by the network via the treatment reset thresholds.

In general, most of the median and upper quartile performance has deteriorated a little over the 20 year period, while the lower quartile performance has deteriorated more significantly. Deterioration of lower quartile performance contributes to much of the network averages increases that occur toward the end of the 20-year analysis period.

The rural ONRC median values have generally deteriorated by the Optimal Model at Normal funding level. Most current roughness values are beneath resurfacing reset thresholds and there is also limited scope for roughness improvement from current levels in the model.

The urban network is currently rougher than the rural network and has a greater distribution of roughness performance. The median values have held steady within the first decade of the analysis period for the urban ONRC. However, there is deterioration of median and lower quartile performance by the end of the second decade.

1.3 Overall Strategy

The overall sealed pavement management strategy is to maintain the sealed road network's condition at a stable state and having whole-of-life least cost through the provision of ongoing maintenance and renewal programmes.

The delivery of this strategy will ensure several outcomes that include:

- Customer service levels will be managed within expectations set through this AMP
- Intergenerational cost will be managed fairly
- Asset condition will be managed in a state that avoids programme shock and sudden maintenance and renewal programme backlogs.

This is set in context of Northland's issues such as the geology, hydrology, and climatic conditions. All of which are typical to the upper and eastern north island of New Zealand. This means the following is key to the delivery of this strategy:

- Water proofing of pavements is maintained through adequate surfacing programmes.
- Pavement renewal include drainage renewal and improvement, second coats are scheduled and completed in a timely manner.
- Routine maintenance is acted upon within the timeframes set.
- General pavement/pre-seal maintenance programmes are well designed through network inspections and delivered including second seals on maintenance patches.
- Associated drainage maintenance programmes are coordinated and delivered with surfacing and pavement programmes.

1.3.1 Geology

The geology of Northland generally consists of poor clay soils with some pockets of volcanic soils and sandy soils on the coast. In general, the common clay subgrades are weak and form a poor foundation for pavements. They are often highly sensitive to moisture and are not free draining which results in pavements failing during periods of wet weather. Ensuring adequate drainage in these soils is a priority. The low strength subgrades and unstable geology is also prone to landslides.

Due to the poor geology of the region there are limited sources of aggregates suitable for road maintenance and construction activities.

The combination of weak subgrades which require thicker pavements to support the design loads over the life of the pavement and limited sources of suitable materials which have to be hauled longer distances results in more expensive pavements.

1.3.2 Geometry

The geometry on the majority of the network was built well before any standardised design was developed, thus our roads have poor alignments and inadequate road widths particularly on corners causing safety issues.

2 Management Plan

2.1 Management

Each of the District Councils are responsible for maintaining the road network within their District. No Council is responsible for any pavements or surfacing on the State Highway network.

NZTA is responsible for the maintenance of State Highways and intersecting roads onto State Highways for a distance along the intersection as follows:

- Road maintenance up to 10m distance along district roads (sealed) intersecting with the State Highway from the edge of the state highway seal.
- Includes the repair costs to any raised traffic island and painting of island kerbing forming part of the intersection with State Highway.
- Regulatory signage associated with the junction intersection control on District Roads adjoining State Highways.

Exemptions which are works included in the maintenance contracts are:

- Replacing of road name blades and community amenity signs; urban and rural
- Footpath maintenance on State Highways
- Sweeping of State Highways in the urban environment.

The Memorandum of Understanding (MOU) between each Council and NZTA clarifies the responsibility of the parties for maintenance, incidence response and control of activities on state highways within each of the council's districts. The MOU changes from time to time therefore current MOU should be referred.

NZTA subsidise pavement related activities for maintenance, renewal, and capital improvement where this meets with NZTA funding rules.

Pavement, surfacing maintenance and renewal along with other operations are undertaken through the Road Maintenance and Renewals Contracts. There are five Contracts covering the following areas:

- FNDC - North: CON 7/18/100 (North)
- FNDC - South: CON 7/18/101 (South)
- KDC: CON 888
- WDC - North: CON 17085 (North)
- WDC - South: CON 17086 (South)

Each Maintenance Contract is required to:

- Maintain the Roading Network Assets
- Achieve the standards specified in the contract documents for the duration of the contract
- Provide the management of the maintenance services as specified in the latest contracts.

Some pavement rehabilitations, bridge renewals, seal extensions and other routine maintenance programmes are tendered using separate professional service contracts for design and physical works contracts (for construction).

2.2 Acquisition

Growth in the sealed pavement network is based on the following:

- Capital projects undertaken by Council to reduce congestion and delays by providing additional road links or road widening. These projects are usually major capital projects identified through the Council Whangarei Transportation Network Strategy. Future projects that will increase the sealed pavement network over the next 10 years are:
  - Urban intersection upgrades which will result in larger sealed intersections in Whangarei City
  - Riverside Drive 4-laning
  - Port Road/Kioreroa Road intersection upgrade and 4-laning
  - One Tree Point Road, Ruakaka Beach Road and McEwan Road widening
  - Priority Bus Lane Implementation.
- Assets that are created by a third party for development reasons and then vested to council.
- Assets that are given to Council due to revocation of State Highway. The 4-laning of SH1 to the south of Whangarei is likely to result in 20-30km of the old SH1 being revoked and included in Council's road network over the next 10-20 years.
- The Seal Extension Plan that upgrades unsealed pavements to sealed pavements.

In recent years, there has been a trend towards subdivisional development using expensive asphaltic concrete surfacing on local and collector roads where a chipseal surfacing would be suitable.

To address this issue, the Council will look to chipseal over asphalt where an asphalt surface is not required to handle either the traffic volume or the stress level of the road surface but will be balanced with amenity value and environment in which the change from asphalt to chipseal may occur. In general, asphalt will be applied where the Annual Average Daily Traffic (AADT is greater than 8,000 vehicles per day or on high stress intersections and tight corners where chipseal surfaces are not likely to survive.

2.3 Maintenance

The general overall approach to managing maintenance work is provided in Figure 2-1. This process is embedded in the five Road Maintenance Contracts awarded in July 2018.

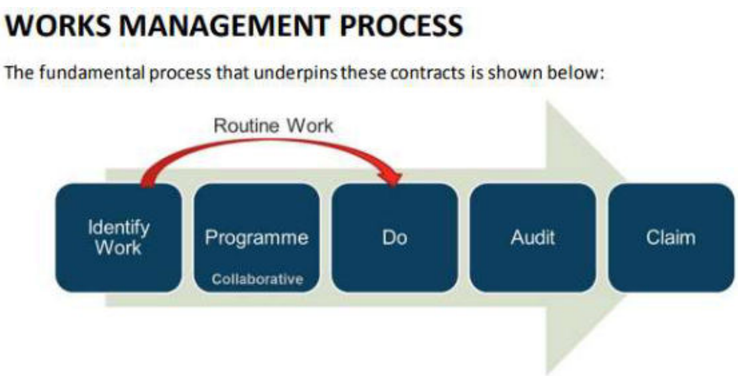


Figure 2-1: Works Management Process

The maintenance of sealed pavements is provided through the Road Maintenance Contract. Minor routine and reactive maintenance is undertaken as described in these contract specification with any major defects becoming programmed work and managed according to the maintenance plan under the approved LTP funding according to priority.

The application of major sealed maintenance is based on the Maintenance Intervention Strategy (MIS) and the renewals identified in the Forward Works Programme (FWP). The maintenance contract intervention sets out criteria for prioritising maintenance activities as described in Table 2-1 below:

Table 2-1: Maintenance Defect Priority Score

Priority	Name	Description	Note
(n/a)	Routine	Work completed as of right, the "housekeeping" generally found under the routine work lump sum items but may include routine measure and value work as well.	This work has a clear intervention point at which point a response time is initiated
Urgent	Urgent / Callout	Poses an immediate safety issue to customers	Respond
1	Must Do	Immediate work required or major failure/defect with significant impact on the network in terms of safety or asset preservation.	To be programmed.
2	Should Do	Work that is required in accordance with good practice and doesn't have an urgency that would make it a Priority 1.	Programmed after priority 1's and when resources and budget available.
3	Monitor	The defect does not require work at this stage, but it is apparent that at some point in the near future that it will require attention	Not to be programmed unless the repair exists in a Resurfacing site and needs to be completed as a pre-seal repair to protect the integrity of the Resurfacing treatment.

The maintenance decision process is based on the priority of the work in relation to the severity of the defect, the risk they pose based on the road hierarchy and their location in the road corridor.

In general, maintenance dispatches are raised and programmed by the contract as set within the contract specification. The Council's network inspector can identify work and then programme is verified by Council area engineers for delivery each month.

The strategy to maintain Council's pavements is to focus on carrying out the priority one repairs and priority two repairs to allow work efficiency where the budget allows. Funding of pre seal repairs down to priority two and in some cases priority three where these may look to have detrimental impact on resurfacing works into the future.

Routine maintenance works (pothole filling, street sweeping, etc) the housekeeping, is prioritised and delivered based on Operational Performance Measures (OPM) set out in the maintenance contracts. The OPM's set out the intervention level for a defect and the resulting response time based on the One Network Road Classification (ONRC) framework. Details of the OPM specification can be found in the current maintenance contracts.

2.4 Renewals

2.4.1 Pavement Renewal

Short to medium term renewal need is determined through pavement performance model analysis and field assessments. Identified potential rehabilitation site will undergo economic analysis and if rehabilitation is feasible the treatment will be flagged in the programme as rehabilitation.

High priority renewals will be undertaken based on increasing maintenance costs or to intervene on pavements where maintenance is no longer the most economic option. These will be prioritised by ONRC hierarchy, risk and criticality. The forestry and urban Arterial/Collector road networks will be a focus of this programme over the next three years with a mix of strategic rural sites. Access and Low Volume roads will not be treated unless they meet the criteria set out above and are deemed a high risk to the customers.

Pavement rehabilitations have been in past typically identified through high speed data collection, pavement performance model analysis, field assessment and then inclusion on the forward works programme. Any specific sites are identified from the maintenance teams and high cost maintenance sites are included from continual network maintenance inspection completed through the maintenance contracts.

There can be timing issue regarding pre-surface repairs being programmed and identification of the potential pavement rehabilitation sites within the reseal site due to either maintenance inspections. The maintenance teams through the contractors will advise of this but this does place pressure on reprogramming of rehabilitation works within the current year.

To address these issues, during the FWP development, both resurfacing and rehabilitation treatment sites are assessed in the field on an annual basis, which generally identifies potential new sites with access to good quality trend data using the Juno platform to make decisions about each site. This is supplemented with up to date maintenance dispatches and costs.

Upon sites being assessed as candidates for pavement rehabilitation, Economic analysis using Net Present Value (NPV) calculations are completed using current dispatches, historic maintenance costs, condition trend data and how the site is performing based on the ONRC performance measures. This process provides a robust selection process for identifying rehabilitation sites.

The process shown in Figure 2-2 below is applied once the pavement renewal has been committed into the following years programme. This process is embedded in the current 2018 Maintenance contracts.

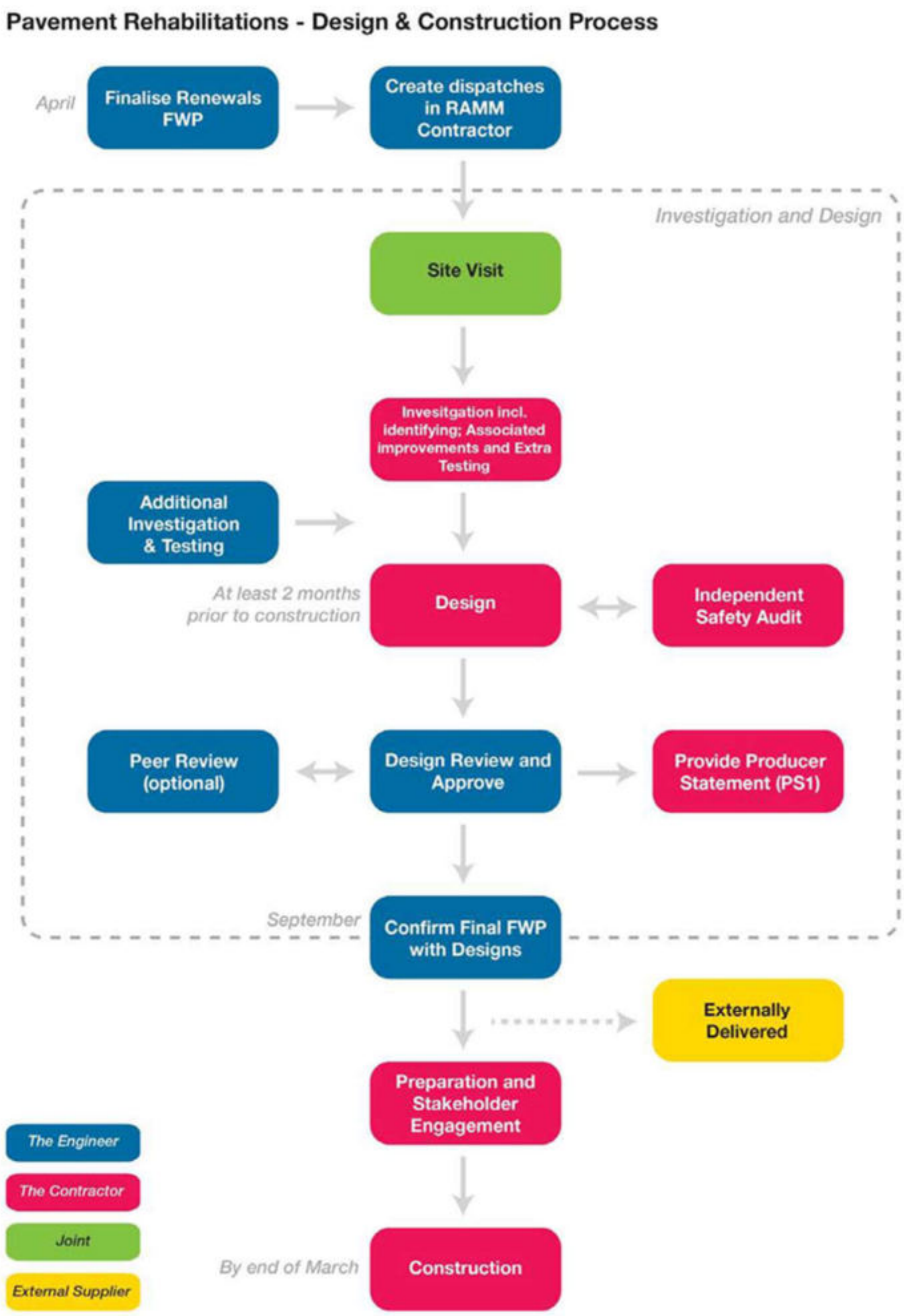


Figure 2-2: Pavement renewal design and construction process

2.4.2 *Surface Renewal*

Reseals are identified through pavement performance model analysis and field validation. The process is then to review the 5 year reseal programme by assessing seals on site and prioritised based on the ONRC hierarchy, cost, the condition and risk posed, the criticality of the route and the number of wet road crashes that have occurred at the site. The renewals plan will consist of as much high priority reseals as the funding allows.

If a surfacing treatment is too expensive to repair and the site has a history of repeated maintenance investment, the site will not be re-surfaced and will be managed until such time as a better long-term treatment, such as a pavement rehabilitation, can be undertaken.

The process shown in the following Figure 2-3 is applied once the surface renewal has been committed into the following years programme. This process is embedded in the current 2018 Maintenance contracts.

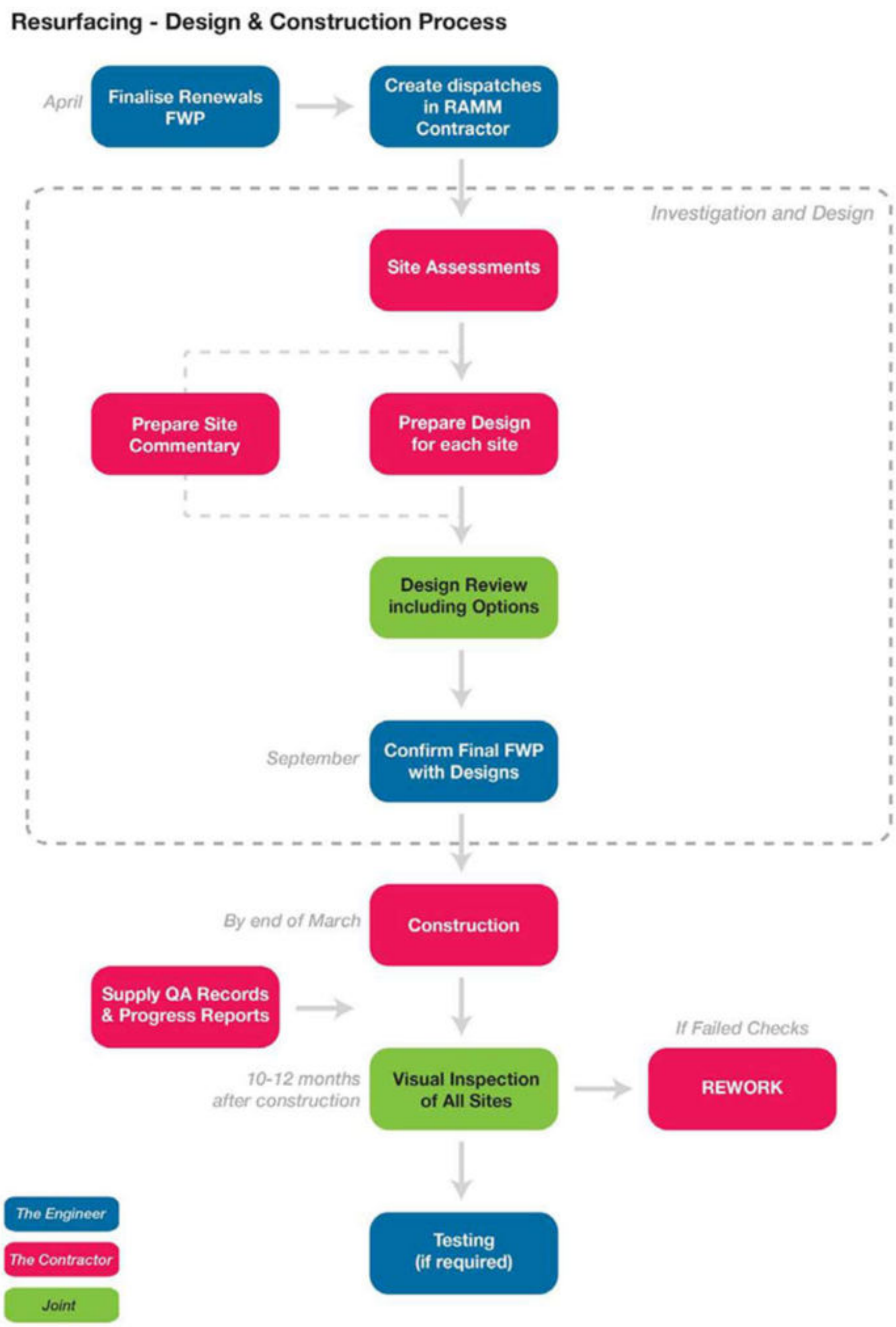


Figure 2-3: Resurfacing design and construction process

2.4.3 Skid Resistance Surface Renewal

The surfacing renewals programme also considers the application of high-quality skid resistant chip where the is a history of loss of control crashes on corners. The programme is defined in number of ways on a risk-based approach.

Assessment of the network is undertaken based on the curve data to derive several factors that include:

- Rural curves less than 500m curve radius
- Calculated Approach speeds
- Derive Curve risk rating.

This is applied to the network to develop a curve risk table, held in RAMM (under development). This table is then used to help define where high friction surface treatments should be undertaken.

As part of the programming process the latest surfacing renewal programme is compared with the crash data and the identified high-risk curves. This is used to then determine if as part of the current programme a surface renewal is being undertaken as an asset seal. If so, a High Friction Surface (HFS) material if accessible, is used for the asset seal surfacing. In the instance where there is no asset seal taking place within a five-year window of the programme, a HFS will then be considered for programming. Considerations for programming a HFS are:

- Curve Risk Rating;
- Loss of control wet curve crashes;
- Injury or Non-injury; and
- Loss of Control Dry Curve crashes.

Current funding application of $150,000 p.a. approximates to 3.3km of HFS each year. Where current total quantity of HFS exceeds current annual budget, the quantity would be spread over 5-year term of the programme on priority basis as set out above. The resurfacing renewal programme is naturally tending to treat areas of concern with new surfacing to increase the friction qualities on the road, as the assessment of wet loss of control crashes shows.

2.5 Improvement

Pavement improvement covers the widening and realignment of the pavement. This is often undertaken as associated improvements in conjunction with pavement rehabilitation projects. Improvements can also be through the minor improvements programme or major capital projects to increase the road width and capacity of critical routes.

Widening of seals will generally be done to provide a “fit for purpose” road width. For rural forestry and arterial routes this will generally be 7.5–8.0m width, and for other roads this will generally be 6.5–7.0m width depending on the road hierarchy and terrain.

In terms of new designs, the base design life assumption is 30 years for all new pavements.

For surfacing, improvements can be through the asphalting of previously chipsealed pavements. This is normally only considered on urban arterial roads and on tight rural curves where there are high tyre stresses.

2.6 Disposal

Opportunities to stop maintenance on pavements that serve only one property will be investigated.

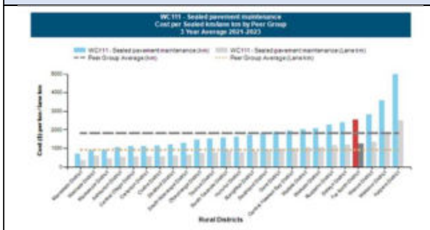
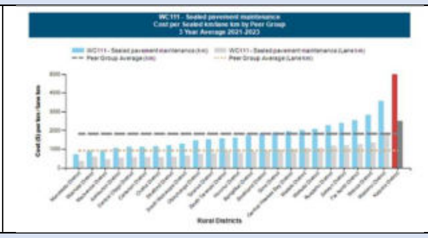
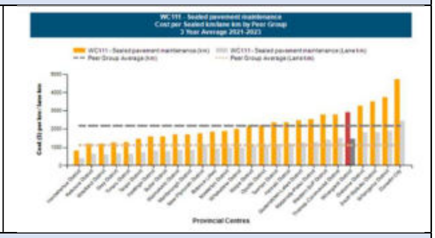
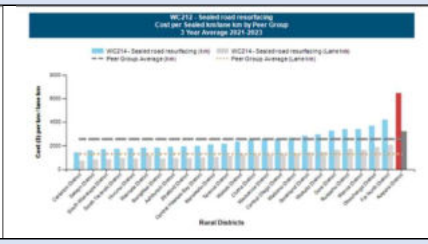
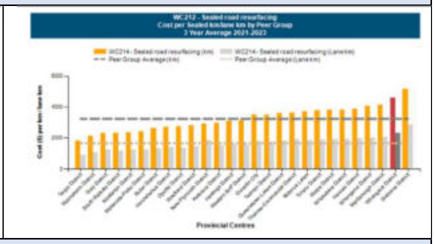
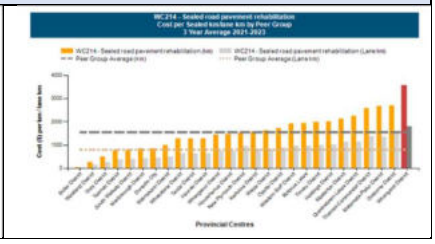
3 Problems, Benefits, and Consequences

This section outlines the problems affecting the sealed road network and details the benefits or consequences of doing or not doing something to address these problems.

3.1 Key Issues

3.1.1 Problem Description

All three councils have a seal road cost that is at the top end of their peer group. This is demonstrated in the NZTA cost comparison graphs for the last three-year average (2021-2023) for each sealed road work category below.

FNDC	KDC	WDC
WC 111 Sealed Road Maintenance		
		
WC 212 Sealed Road Resurfacing		
		
WC 214 Sealed Road Pavement Rehabilitation		
		

There are several environmental factors in Northland that contribute to the high costs and these are described below.

Due to the generally poor geology of Northland, pavement subgrades are often weak and very susceptible to moisture. This results in rutting and shove failures which means that maintenance and renewals are often required earlier than other parts of the country. It also requires new pavements to be thicker and more expensive to carry the traffic loading and more extensive drainage provisions to avoid water ingress leading to premature failure.

The geology of Northland also means that there are relatively few sources of quality aggregate suitable for road maintenance and construction activities in the region. There are few quarries that can produce aggregate to the NZTA M/4 specification and because of this the cost of producing this M/4 material is high. For this reason, most basecourses within the Northland region are constructed using inferior GAP40 aggregate which is then either lime or cement stabilised to bind the fines. Only a few quarries (Puketona Quarry, Winstones and Atlas Quarry at Piroa) are suitable for sealing chip. This can lead to long cartage runs to truck in metal and hence increased costs for constructing and maintaining roads.

In addition, there is only one asphalt plant in Northland (located in Whangarei) and the next nearest is in Auckland (Silverdale). This again leads to higher costs due to lack of competition and cartage distances, particularly for the Far North.

The geometry on the majority of the network was built well before any standardised design was developed, thus our roads have poor alignments and inadequate road widths particularly on corners causing safety issues.

Freight and forestry traffic results in significantly higher maintenance demands on the Northland road network, particularly due to long lengths of haulage on local roads for the Far North and Kaipara Districts. It is creating significant additional maintenance costs on the network, including premature failure of pavements. This is likely to increase in the future with larger, heavier trucks being used (50Max, HPMV). Freight demand is predicted to grow by almost 40% between 2012 and 2042. This will result in increasing levels of pavement wear and deterioration over time.

A Forestry Plan and FWP had been analysed and incorporated into the existing FWP to identify the demands and needs of the networks. This will help ensure that adequate long-term investment on forestry routes to maintain these in a fit for purpose condition.

For the above reasons, the sealed road costs in Northland are always expected to be in the upper half or third of its peer group.

As well as the above, lack of investment in the sealed road network in the past is influencing the current asset management decisions and costs. This is shown in the 10-year sealed road cost in Figure 3-1, Figure 3-2, and Figure 3-3.

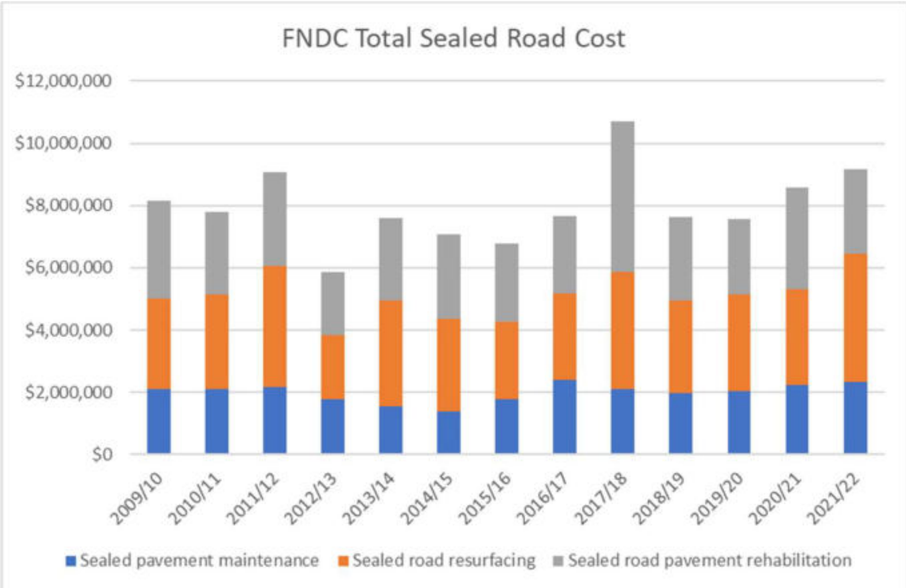


Figure 3-1: FNDC sealed roads cost

The Far North District sealed road costs are shown in Figure 3-1 above. This shows a reduced spend on the sealed network between 2012/13 and 2015/16. This was due to FNDC reducing the funding for sealed roads due to a tight economic climate following the global financial crisis.

There was a spike in resurfacing and rehabilitation costs in 2017/18 as a result of additional NZTA investment in a strengthening programme on the forestry road network. While this was a one-off catch up in forestry work, there needs to be an ongoing programme of work on forestry routes to keep these in a fit-for-purpose state.

The Far North District has a backlog of expensive thin asphalt surfacing to address due to cracking of some of its more important routes such as Commerce Street and North Ave in (Kaitaia), Kerikeri Road and the Kerikeri Heritage Bypass. These continue to be a focus area for 2024-27 to replace these surfacing and ensure that these pavements are kept waterproof. This also acts as a proxy for urban road rehabilitation when coupled with heavy maintenance repairs.

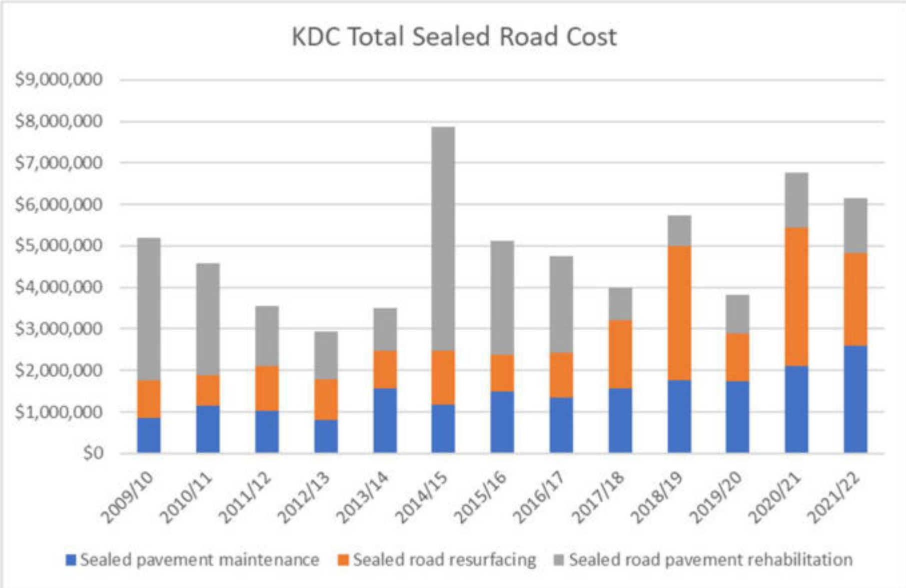


Figure 3-2: KDC sealed roads cost

The sealed road costs for the Kaipara District are shown in Figure 3-2,above. This shows a lean period of spending between 2011/12 to 2013/14 during the Kaipara rates strike, when residents in Mangawhai and some across the District refused to pay their rates in protest against the cost over-run from the Mangawhai Sewerage Scheme. This left a significant hole in the Kaipara sealed road programme, which was later recovered by additional investment in the 2014/15 – 2016/17 period.

The last plan had rebalanced the renewals programme to substantially reduce the rehabilitation programme and reinvest this money into resurfacing to reduce a significant backlog of single coat seals on the network. This also coincides with the implementation of pavement performance modelling for the Kaipara network to optimise the sealed road programme.

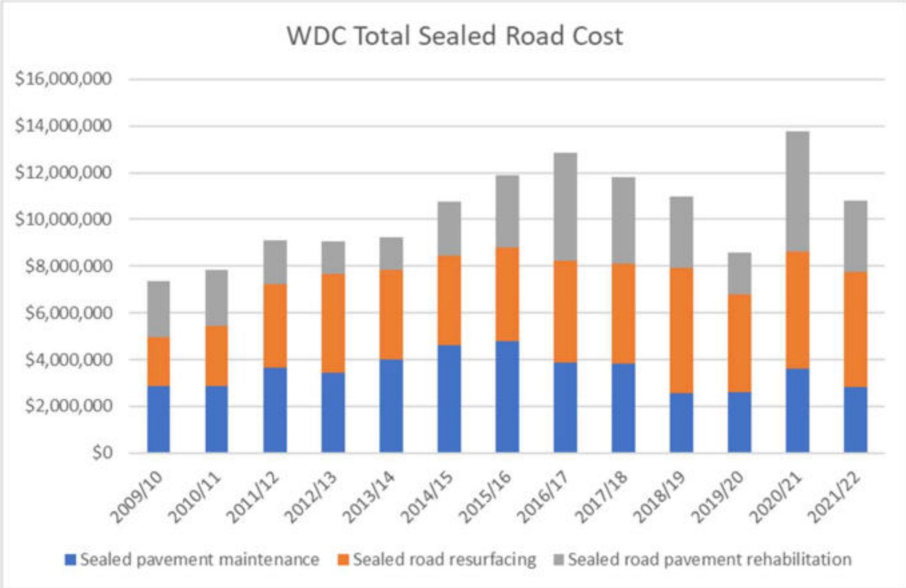


Figure 3-3: WDC sealed roads cost

The sealed road costs for the Whangarei District are shown in Figure 3-3 above. During the 2015/18 period there was an increase in pavement rehabilitation to recover from historically low rates of rehabilitation in the preceding years. These low rates were primarily due to renewal funding being diverted by council to fund emergency works and lack of local share caused by council accounting for property sales which did not occur.

In addition, pre-reseal costs rose substantially from 2009/10 to 2015/16 as a result of reseals being at historically low levels (60km/year or an 18-year average cycle). The focus on additional reseal funding from 2015/16 had resulted in a downward trend in maintenance costs. Due cost increase impacts and weather events (reduced programme delivery) increasing levels of pre-seal resurfacing levels are increasing.

A significant focus has been given to the Whangarei City urban network over the past 4 years and this has contributed to the high renewal costs through thin asphaltic concrete (TAC) surfacing and expensive structural asphaltic concrete (SAC) pavements. Further investment in the urban network will be required in the future. Alternative more cost-effective solutions are being considered however these treatments need to be balanced with customer travel disruption impacts and possible higher risk of failure on high volume parts of the network. There remains limited solutions to urban road rehabilitation which provide the same design certainty and speed of construction as SAC pavements.

3.1.2 Key Issues and Actions

- Pavement costs in Northland are likely to be higher than other areas due to poor geology which results in softer subgrades requiring thicker pavements, fewer good quality quarry sources which increase material cartage costs and a significant amount of forestry and freight on the local road network. Many pavements are thin and susceptible to changes in heavy vehicle traffic and weather impacts leading to higher rates of water ingress.
- An adequate level of pavement rehabilitation and chipseal surfacing needs to be sustained in the long term to preserve the pavement condition and to reduce long term maintenance costs.
- Continued investment in thin asphaltic surfacing is required in FNDC and WDC to address a backlog of overdue surfaces which are heavily cracked. This will help preserve water proofing

and avoid premature failure on major arterial routes resulting in very expensive rehabilitation treatments.

- Urban rehabilitations in Whangarei City are mostly using expensive structural asphaltic concrete (SAC) pavements which is driving up sealed road costs.

3.1.3 Benefits

- Continuation of an increased programme of pavement and surfacing renewals will enable the sealed pavement to be maintained in a fit for purpose condition while optimising the long-term maintenance costs. This needs to be coupled with a holistic drainage programme.
- Continuation of the integrated forestry FWP road programme will enable the forestry network to be maintained in a fit for purpose condition to allow safe and efficient cartage of logs to Northport, sawmills and processing plants located within the region. This will help ensure that the economic benefits from the forestry activity are sustainable in the long term.
- Maintaining other freight routes to a higher standard will make these roads better able to cope with the increasing freight loads over time, reduce continual disruptive maintenance patching and more resilient to adverse weather events.
- Further investment to replace thin asphaltic surfacing (TAC) will help preserve the pavements in the urban areas which are very expensive to otherwise rehabilitate. This needs to be coupled with an increased investment in heavy pavement maintenance repairs that are completed along with the TAC surfacing, acting as a proxy for urban structural asphaltic concrete (SAC) pavement treatments as a way to reduce the SAC programme and spread cost impact.
- Alternative solutions should be investigated for urban rehabilitations in Whangarei City to reduce the reliance on high cost SAC treatments.

3.1.4 Consequences

- Not increasing the current programme will see the sealed network condition deteriorate as pavements become less protected and more vulnerable to poor geological conditions and increasing traffic volume and freight demand. This will lead to reduced levels of service, reduced resilience during wet weather events, worsening pavement condition and increased road hazards (e.g. more potholes and failures), and an increase in long-term maintenance costs along with increased cost of ownership for future generations.
- Not carrying out effective maintenance and renewals of the freight and forestry routes will result in a deteriorating condition, more maintenance and costs, slower travel times and potential safety issues.
- Without addressing the poor condition thin asphaltic concrete (TAC) surfacing in the Far North and Whangarei Districts, these surfaces will allow water ingress leading to premature and expensive pavement failure.
- Continuing with expensive structural asphaltic concrete (SAC) pavements in Whangarei City will keep sealed road costs high.

3.2 Strategic Case – Bottom-Up Assessment

During the development of the AMP, a series of workshops were held to test previous problem statement from the 2021-24 plan and refine the problem statements and to determine the strategic response to address the problems. This is shown in the following tables.

Draft Problem Statement 1:
There has been an increase in renewal backlog due to general increased cost for pavement and surface renewal which allows less renewal achievement. Particularly, urban rehabilitation cost in each network has increased. This is resulting in increased reliance on routine maintenance, increased pre-seal repairs, and increased pavement base consumption.
Current AMP - Key responses outlined in Strategic Case:
WDC – Reduce rehabs to 6km/yr. Reduce reseals from 110km/yr to 90km/yr. Address service lids. Skid resistance seals to reduce wet road crashes. KDC – Decrease in rehab justified through dTIMs, balanced by increase in reseals to address first coat seal backlog. FNDC – Decrease in rehab justified through dTIMs, balanced by increase in reseal cost to target larger chip reseals. NTA – Include reseals and rehabs in maintenance contracts to get better buying power. Increase in water table maintenance to reduce water ingress. Sealed road MIS with visual guide to be developed and implemented.
Current Work that is being undertaken:
Maintenance activity based on contractor led inspection and response time. Contractor responsible for determining programme. NTA audit of work proposed, programme and finished work. Rehab/Reseal changes in programme as outlined above. However, the suggested reduction in programmes has not occurred as expected. Reseals and rehabs included in maintenance contracts which is mostly avoiding issues of timing of repairs and renewals. A more in-depth assessment of programmes including Curve risk analysis and wet road crashes. Whangarei targeting urban rehabs due to historic underinvestment in urban network. This has been limited due to cost of urban rehab work on high volume parts of the network. Currently being substituted with large Asphalt Mill & Fill patching under maintenance to maintain LoS condition.
Aspects of the problem not being addressed and benefits not being delivered?
Service lid work in Whangarei not being undertaken. Watertable maintenance on Drainage Plan/FWP currently under development. Limited urban rehabs in Whangarei are very expensive $1M plus per km due to structural asphalt required. Sealed road MIS with visual guide required to ensure the right treatment at the right time. The distribution of the new Maintenance Contract fixed costs for Kaipara and Far North is disproportionately loading the reseals and rehabilitation budgets. Due to cost increase impacts leading to programme reduction and excessive weather events the sealed pavements are deteriorating. This is leading to more pavement renewal work being identified through programme reviews and ad hoc through per-seal programme reviews. This is impacting the resurfacing programmes where section of resurfacing are now being removed from resurface programme and add to pavement renewal programme. This is either leading to in year reprioritisation of the pavement rehabilitation causing further disruption to in year delivery. Or programme or deferral of sites which in turn is driving a pavement renewal backlog. Overall sealed road costs are still likely to be high compared to peer group.
Is the Problem Statement still relevant? If "No" what are the deficiencies? If "Yes" has priority changed?
No. Cost increase programme reduction. Weather impacts exacerbated by northland geological conditions.

If Problem is not being addressed by the current work, what is the strategic response?			
Strategic response	**Y/N**	**Rank**	**Detail**
1 Programme adjustment example, Remove/reduce projects/activities	Y	1	Increase programme, resurfacing and rehabilitations, coupled with a more holistic drainage management programme (ties to Options 4 and 5)
2 Policy approach example, Adjust level of Service	Y	3	Get approval from council to implement resurfacing policy for low volume residential asphalt surface to be resurfaced in less expensive chipseals.
3 Demand management example, Manage use – up/down	N	N/A	Difficult to manage demands on a network wide basis
4 Funding adjustment. example, Increase/decrease	Y	2	Spread the Urban rehab requirement through Heavy pavement maintenance and asphalt surfacing renewal for high volume urban network. Can reduce budget, particularly for rehabs (ties to Options 1 and 5)
5 Risk based example, Hold Assets longer	Y	1	Increase heavy maintenance patching in conjunction with urban thin asphalt renewals to allow holding pavements longer before rehabbing in these urban areas (ties to Options 1 and 4)

How effective are the options? (as per Multi Criteria Assessment below)

Option 1 – Increase resurfacing and rehabilitation programme across the board to catchup backlog and treat high value urban roads - Score 0.85 out of 3 (preferred)

Option 2 – As for option 1 and include Resurfacing policy change to reduce surfacing service levels for low volume residential asphalt roads to chipseal - Score -0.3 out of 3

Option 3 – Moderately increase pavement rehabilitation funding, increase surfacing renewal with increase in heavy deep lift maintenance patching for urban asphalt resurfacing treatments with surfacing policy change as for option 2. – Score 0.6

Draft an updated problem statement (if applicable)

Increasing pavement maintenance and renewal backlog through not achieving prior programmed works due to major events, such as COVID lockdowns, cost escalations, limited resources and compounding storm events.

Strategic Case Multi Criteria Option Analysis, RCA: NTA

Problem No: 1 Sealed Roads

Short list up to 3 options from the following - Can we make-----

Option	Yes/No	Reason	Rank
1 Programme adjustment eg, Remove/reduce projects/activities	Yes	Increase programme, resurfacing and rehabilitations, coupled with a more holistic drainage management programme (ties to Options 4 and 5)	1
2 Policy approach eg, Adjust level of Service	Yes	Get approval from council to implement resurfacing policy for low volume residential asphalt surface to be resurfaced in less expensive chip seals	3
3 Demand management eg, Manage use – up/down	No	Difficult to manage demands on a network wide basis	N/A
4 Funding adjustment. eg, Increase/decrease	Yes	Spread the Urban rehab requirement through Heavy pavement maintenance and asphalt surfacing renewal for high volume urban network. Can reduce budget, particularly for rehabs (ties to Options 1 and 5).	2
5 Risk based eg, Hold Assets longer	Yes	Increase heavy maintenance patching in conjunction with urban thin asphalt renewals to allow holding pavements longer before rehabbing in these urban areas (ties to Options 1 and 4)	2

		How good is this option					
		Option 1 - – Increase resurfacing and rehabilitation programme across the board to catchup backlog and treat high value urban roads		Option 2 - As for option 1 and include Resurfacing policy change to reduce surfacing service levels for low volume residential asphalt roads to chip seal		Option 3 - Moderately increase pavement rehabilitation funding, increase surfacing renewal with increase in heavy deep lift maintenance patching for urban asphalt resurfacing treatments with surfacing policy change as for option 2	
Criteria/Drivers to consider	Weighting (Importance) (Total to 100%)	Raw	Score	Raw	Score	Raw	Score
Meets GPS	10%	2	0.2	2	0.2	2	0.2
Meets RLTP	10%	1	0.1	1	0.1	1	0.1
Addresses Problems	20%	2	0.4	2	0.4	1	0.2
Will realise Benefits	10%	1	0.1	1	0.1	0	0
Will meet Community Outcomes	10%	1	0.1	-1	-0.1	0	0
Will meet Customer Outcomes (CLOS)	10%	2	0.2	-2	-0.2	0	0
Provides high Performance impacts	10%	0	0	-1	-0.1	0	0
Provides high Environmental Impacts	5%	-1	-0.05	0	0	0	0
Provides Cultural Impacts	5%	0	0	0	0	0	0
How Costly	10%	-2	-0.2	-1	-0.1	1	0.1
Other 1			0		0		0
Totals	100%		0.85		0.3		0.6

Scale of Impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

3.3 Strategic Case Summary (Line of Sight in Action)

Based on the assessment of the problem statement and the strategic responses undertaken in the previous section, a summary of the results and the affected work categories are shown in the table below.

Issue	Sealed Roads
Problem Statement	Increasing pavement maintenance and renewal backlog through not achieving prior programmed works due to major events, such as COVID lockdowns, Cost Escalations, Limited resources and Compounding Storm Events.
Benefits	• Reduce whole of life costs of the sealed road network; • Improve surfacing and pavement life achievement rates; and • Improve ride quality by reducing roughness.
Trend	Static
Strategic Response	**Programme Adjustment** • Increase programme – surfacing and rehabilitations. • Supported through holistic drainage management programmes • Adjust the urban pavement rehabilitation risk-based approach to heavy pre-seal and asphalt resurfacing to spread pavement rehabilitation programme **Funding Adjustment** • Increase in targeted heavy pre-seal pavement maintenance.
Activity/Work Category	Sealed Road Maintenance and Renewals (WC 111, 212, 214)

4 Options, Assessment and Alternatives

4.1 Option Identification (Root Cause Analysis)

Following the identification of the problem statements, a root cause analysis was undertaken to identify the underlying causes of these problems. The root cause analysis was undertaken using the "5 Whys" type methodology in accordance with NZTA's Business Case Approach Practice Note No.3 – Root Cause Analysis in Business Case Development.

This process was undertaken through a series of workshops with the NTA Assets Team and NZTA local representative to determine the underlying causes of the identified problems. This was a bit of a deep dive into the myriad of issues that affect the transport network and a multitude of root causes were identified for each problem statement.

For each root cause, a possible solution (option or alternative) was identified to try and address this cause. These solutions ranged from high level interventions such as changing council policies and developing strategies to low level interventions such improving grader operator training.

The following table include the results of the root cause analysis and the possible solutions to address the problem statements.

Root Cause Analysis – Sealed Roads

Problem statement	**Increasing pavement maintenance and renewal backlog through not achieving prior programmed works due to major events, such as COVID lockdowns, cost escalations, limited resources and compounding storm events.**								
why 1	Optimized programme of renewals was moderated prior to subsidy funding approval, increasing backlog of renewals.	Council & SLT diverted local share of funding for sealed road renewals to other works in 2023, increasing the backlog of renewals	Moderated Programme of Renewals has not been implemented as planned through 2021-23 increasing the backlog of renewals			The sealed network is evidencing accelerated deterioration increasing maintenance and renewal requirements.			
why 2	Government issued an indicative constrained NLTF in May 2021 and approved a moderated NLTF budget in October 2021.	Lack of understanding and 'buy-in' for preventative asset management principles	Late approval of budgets in Year 1 of Programme (Nov 2021 for council approval of co-funding subsidy) reduced the construction window for reseals and renewals	Cost Escalation (approx 22% on Contract over years 1 & 2) have reduced the quantity of ordered works: renewals increasing the backlog	Inclement weather has delayed reseals and renewal operations in year 2 - too wet and too many storms.	Preventative maintenance including draiange maintenance has not been implemented for significant periods of time (2020 to present), which reduces the life period of the sealed road asset, increasing the requirement for renewals sooner.		Several local routes have had to take significant additional traffic loading, accelerating deterioration	Programmes of preventative maintenance are being poorly prioritised, increasing the risk of failure and accelerated deterioration of the network as a result of increasing reactive maintenance activities on the network.
why 3	Government has insufficient funds to co-fund optimized maintenance budgets across NZ	Poor communication and engagement to define technical need for renewals programme	There was insufficient seasonal weather (dry summer) within the construction season/window to implement the full Year 1 proposed programme	The balance of Lump sum and Measured works in the contract is susceptible to higher escalation	Ten significant storm events over eleven months have the maintenance contractors working on immediate storm response (Emergency Works) rather than preventative maintenance or renewals		World-wide pandemic	State Highway traffic has been diverted for months at a time onto local routes	With the 'fixed' contract value and increasing demand from storm events for reactive maintenance, preventative maintenance is unable to be fully actioned.
why 4	NLTF funding model does not support optimized maintenance works		Contractor did not resource up to compensate for shorter construction period	The Maintenance contract structure does not take account of escalation beyond that set in the LTP (approx 2.5%)	Maintenance contract structure was not set up to deal with continuous climatic impacts lasting months/years.		Country wide COVID lockdowns prevented maintenance contract works to be implemented.	State Highways (Mangamukas and Brynderwyns) have closed due to significant road slips	Insufficient funding for climatic conditions
why 5	Funding model was developed and has not fundamentally changed since before asset management principles on preventative maintenance rolled out (ISO 50550 - 2014).		No financial benefit under our maintenance contract for accelerated works.	Maintenance Contractor has been unwilling to undertake ordered works that cost more than their rates due to CPI being applied annually.	Climatic adaptation has not been a significant part of Northland strategic direction in the past. (Resilience strengthening)		Lockdown disruption and lack of resources (equipment / labour / plant / materials) led to increasing maintenance and renewals	Climatic adaptation has not been a significant part of State Highway strategic direction or investment in the past	Constrained funding is creating a fragile network prone to climatic impacts to failure
Potential Solutions	Request Council to lobby for national funding model review	Change the communication methods and frequency to ensure the fundamentals of roading is supported through council.	Include in review of Maintenance Contracts - acceleration in resourcing to ensure full preventative and renewals is implemented when disrupted by climate events	Include in review of Maintenance Contracts - of the balance and risk to fixed cost contracts between lump sum works and ordered works has to be reviewed.	Flexibility in Maintenance structure to address storm events. And we need to include Climatic adaptation Strategy response and programme of works to resilience strengthen our network of sealed roads.		Increase programme of maintenance and renewals to catch up with the backlog to prevent further deterioration of network.	Need to strengthen the State Highway diversion routes to carry HMPV loads and high traffic volumes for significant periods of time.	Need to request and justify optimum funding to resilience strengthen our network to cope with future demands.

4.2 Option Development

The following table was developed by the Roading Efficiency Group as part of a top-down assessment of options to address the identified problems. They summarise the responses in the existing AMP, the effectiveness of the existing programme and the proposed options which have been determined from the root cause analysis which should be considered as part of the option assessment.

Statement Problem	Key Responses In existing AMP	Summary of effectiveness of existing programme	Proposed Programme Business Case adjustments (from Root Cause Analysis)
Increasing pavement maintenance and renewal backlog through not achieving prior programmed works due to major events, such as COVID lockdowns, cost escalations, limited resources and compounding storm events.	• FNDC – Decrease in rehab justified through dTIMs, balanced by increase in reseal cost to target larger chip reseals. • KDC – Decrease in rehab justified through dTIMs, balanced by increase in reseals to address first coat seal backlog. • WDC - Reduce rehabs to 6km/yr. Reduce reseals from 110km/yr to 90km/yr. Address service lids. Skid resistance seals to reduce wet road crashes. • NTA – Include reseals and rehabs in maintenance contracts to get better buying power. RAPT type assessments of programme. Increase in watertable maintenance to reduce water ingress. Sealed road MIS with visual guide to be developed and implemented.	• Sealed road activity having a good effect on asset preservation, but costs remain high affecting the value for money. • It should be noted that Northland has poor subgrade conditions, which means that costs will be higher than in other parts of the country. • Key issues from Root Cause Analysis: o Cost of pre-seal repairs are high o FNDC and KDC in-house staff costs charged to Maintenance activities o Second coat seals for subdivisions and unsubsidised seal extensions are being treated o WDC and FNDC continue with catch up with backlog of urban rehabs and TAC o WDC using expensive SAC for urban rehabs o KDC have addressed the bulk of with second coat backlog of first coat seals o Few quarry sources driving up costs o Water ingress into pavements, exacerbated by prolonged aether events	• Request Council to lobby for national funding model review. • Change the communication methods and frequency to ensure the fundamentals of roading is supported through council. • Include in review of Maintenance Contracts - acceleration in resourcing to ensure full preventative and renewals is implemented when disrupted by climate events. • Flexibility in Maintenance structure to address storm events. And we need to include Climatic Adaptation Strategy response and programme of works to resilience strengthen our network of sealed roads. • Increase programme of maintenance and renewals to catch up with the backlog to prevent further deterioration of network. • Need to strengthen the State Highway diversion routes to carry HMPV loads and high traffic volumes for significant periods of time. • Need to request and justify optimum funding to resilience strengthen our network to cope with future demands.

5 Option Assessment

The following sections analyse options for addressing the problems and issues identified in the Strategic Case. These options have been identified through the Root Cause Assessment.

For the assessment of the data, peer group analysis and option assessment, a five point "traffic light" rating system has been used as shown in the following schematic. This rating system is based on a qualitative assessment of the LOS and cost comparison data.

Performance Rating	Symbol	For LOS this means:	For Costs & Achievement this means:	Trend Rating	Symbol	For LOS this means:
Very Good	● (dark green)	Much Better than Peer Group Average	Much Less than Peer Group Average	Improving Trend	↑ (green)	Positive Change towards a Very Good rating
Good	● (light green)	Better than Peer Group Average	Less than Peer Group Average	Worsening Trend	↓ (red)	Negative Change away from a Very Good rating
Average/Moderate	● (yellow)	Similar to the Peer Group Average	Similar to the Peer Group Average	Static Trend	▬ (grey)	No Change
Poor	● (orange)	Worse than Peer Group Average	Higher than Peer Group Average			
Very Poor	● (red)	Much Worse than Peer Group Average	Much Higher than Peer Group Average			
No Data	● (grey)	No Data	No Data			

Work Categories:	WC 111 Sealed Pavement Maintenance WC 212 Sealed Road Resurfacing WC 214 Sealed Road Pavement Rehabilitation & Associated activities: WC 113 Routine Drainage Maintenance & WC 213 Drainage Renewals

5.1 Links to Strategic Case

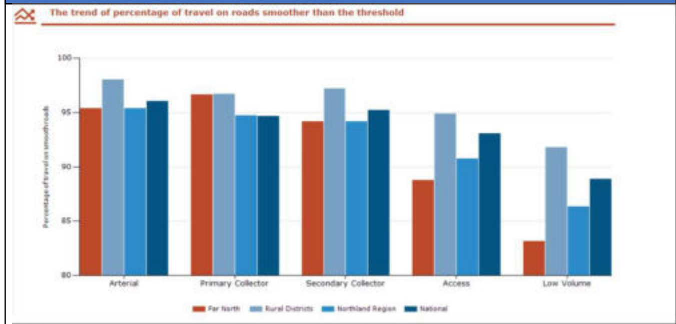
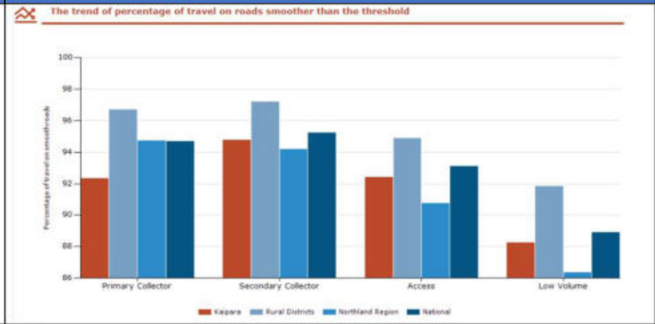
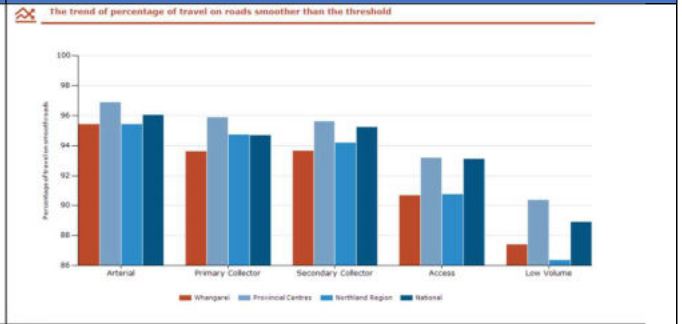
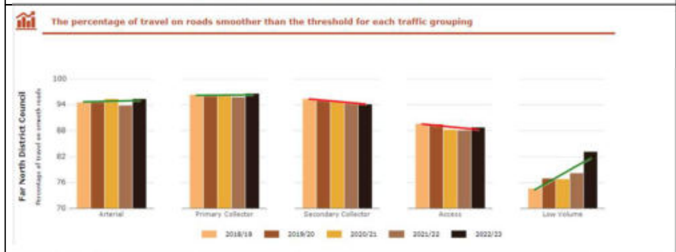
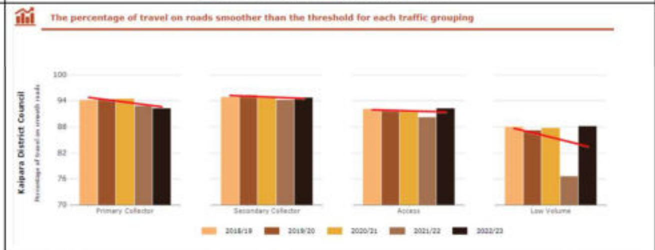
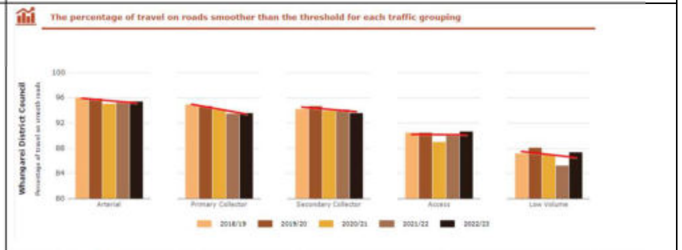
Problem Statement:	Increasing pavement maintenance and renewal backlog through not achieving prior programmed works due to major events, such as COVID lockdowns, Cost Escalations, Limited resources and Compounding Storm Events.
Benefits of Addressing Problem:	Maintain a stable fit for purpose Level of Service for the sealed roads that is suitable for the traffic demands, particularly freight, while optimising the long-term cost of ownership for future generations.
Consequences of Not Addressing the Problem:	The sealed network condition deteriorates as pavements become less protected and more vulnerable to poor geological conditions and increasing traffic volume and freight demand. This will lead to reduced levels of service, reduced resilience during wet weather events, worsening pavement condition and increased road hazards, and an increase in long-term maintenance costs along with increased cost of ownership for future generations.

5.2 Levels of Service

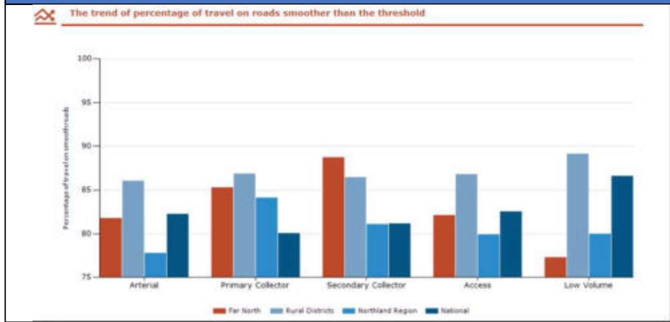
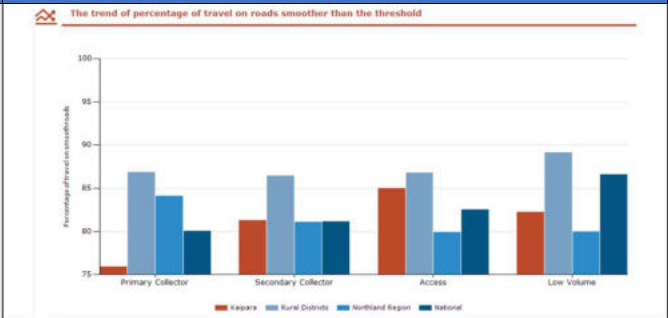
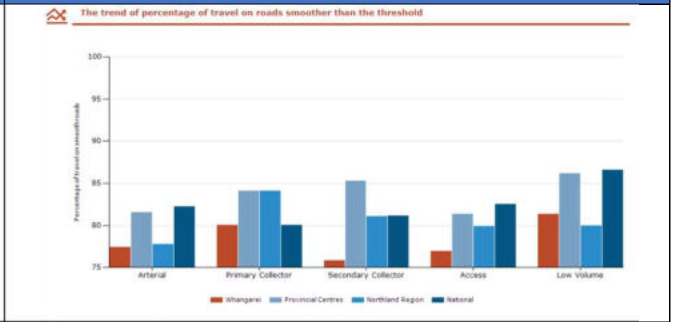
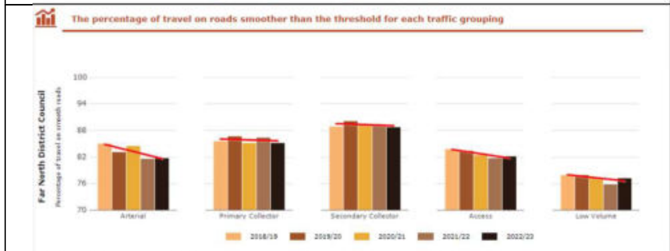
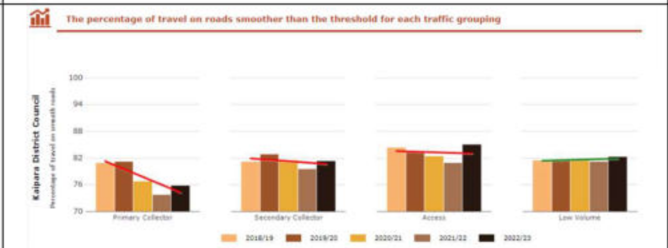
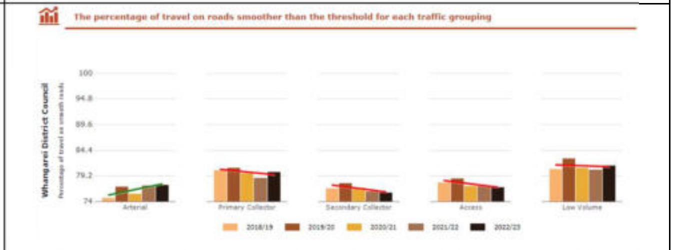
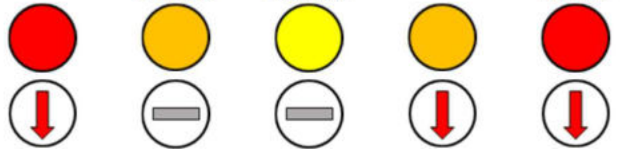
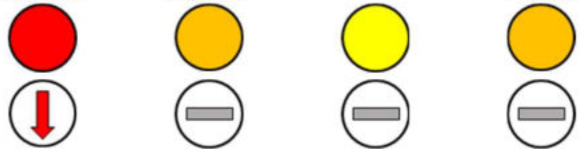
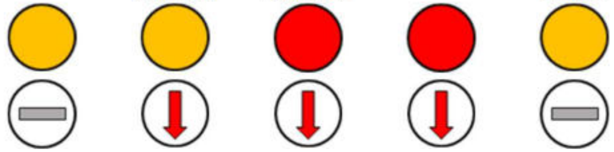
ONRC Customer Outcomes:	ONRC Amenity CO1 – Smooth Travel Exposure (STE) – roughness of the road ONRC Amenity CO2 – Peak roughness ONRC Amenity TO1 – Roughness of the road (median and average)
Customer Levels of Service:	ONRC Safety TO4 – Loss of Control on wet roads ONRC Cost Efficiency 1 – Pavement rehabilitation ONRC Cost Efficiency 2 – Chipseal resurfacing ONRC Cost Efficiency 3 – Asphalt resurfacing LTP 1.1.5 – Percentage of the sealed local network that is resurfaced (Current measure - DIA) LTP 1.1.6 – Percentage of the sealed road network that is rehabilitated (Current measure) LTP 1.1.X – Yr 1, 5, 10, 30 Condition distributions are maintained within the set condition envelope (new measure)

5.3 Evidence and Gap Analysis

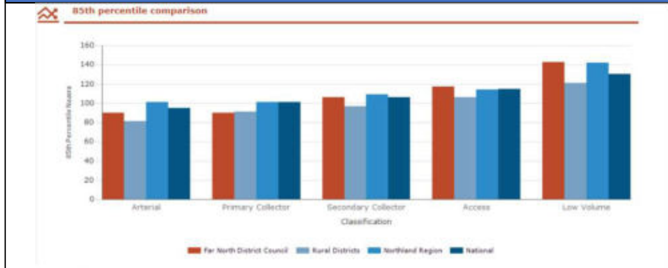
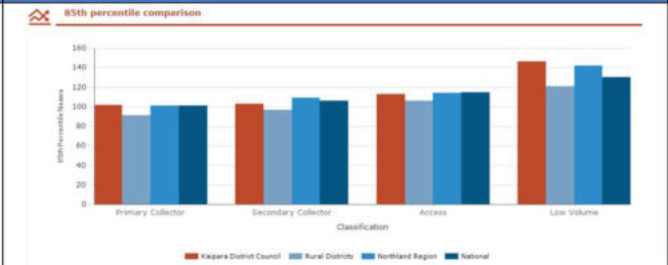
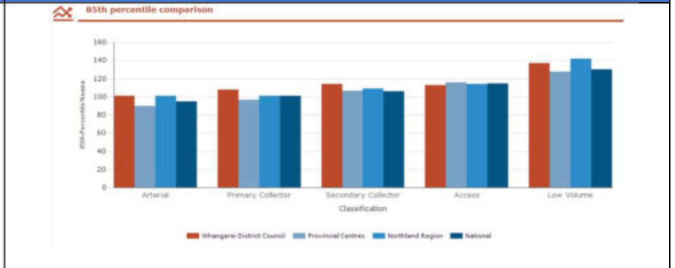
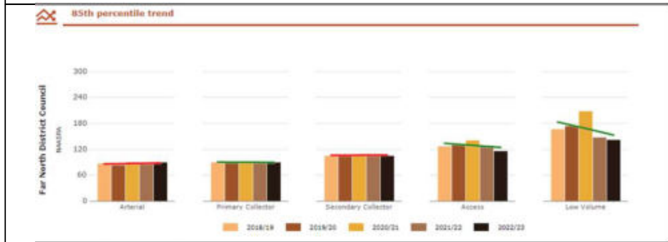
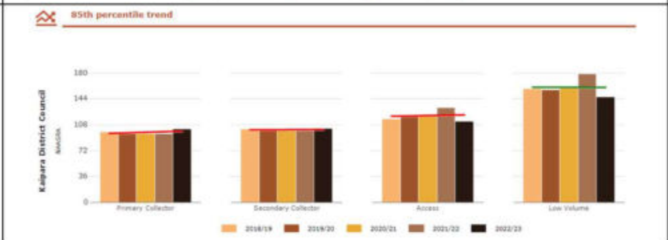
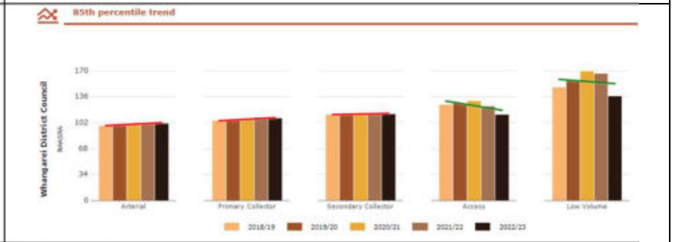
ONRC Amenity CO1 – Smooth Travel Exposure (STE) (and trend) – Rural Roads

<table>
<tr><th>FNDC</th><th>KDC</th><th>WDC</th></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Arterial | Primary Collector | Secondary Collector | Access | Low Volume</td><td>Primary Collector | Secondary Collector | Access | Low Volume</td><td>Arterial | Primary Collector | Secondary Collector | Access | Low Volume</td></tr>
<tr><td>FNDC Rural STE – The FNDC rural sealed network is rougher than the peer group for all categories apart from Primary roads.
There is a has been an improvement in the Arterial and Primary and Low Volume. The other road classes are showing a slightly declining trend.</td><td>KDC Rural STE – The KDC rural sealed across all categories is rougher than its peer group. The Access and Low Volume roads are much rougher than the peer group.
There is a worsening trend for the Primary network with all other categories generally static or slightly declining.</td><td>WDC Rural STE – The WDC sealed network is rougher than its peer group and national group for all road classes.
Across all categories apart from Access there is worsening trend of STE trend.</td></tr>
</table>

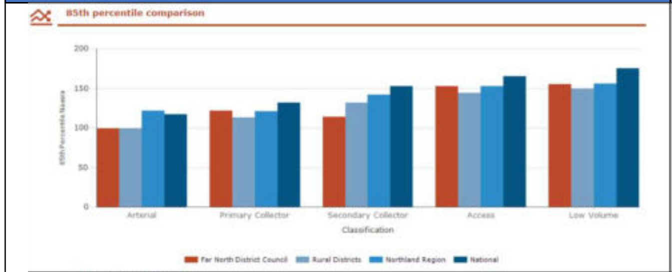
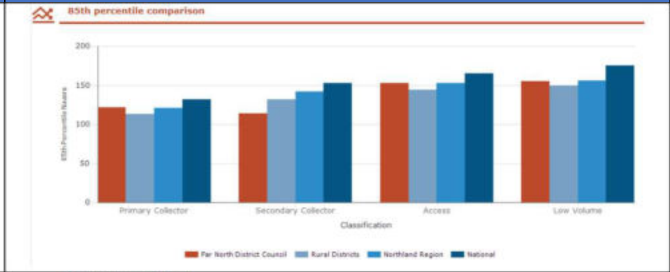
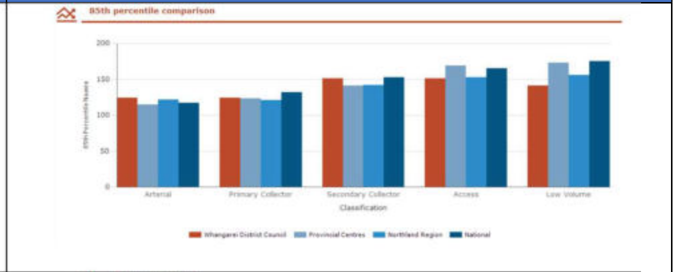
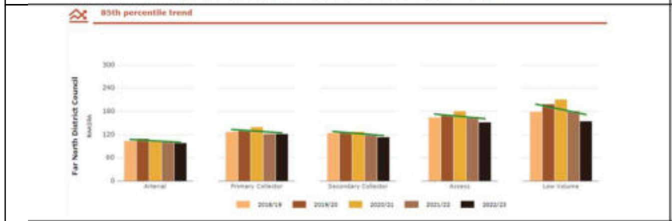
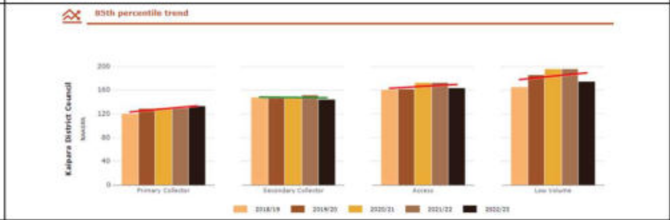
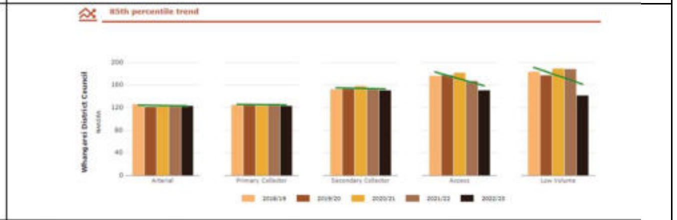
ONRC Amenity CO1 – Smooth Travel Exposure (STE) (and trend) – Urban Roads

FNDC	KDC	WDC
		
		
Arterial, Primary Collector, Secondary Collector, Access, Low Volume 	Primary Collector, Secondary Collector, Access, Low Volume 	Arterial, Primary Collector, Secondary Collector, Access, Low Volume 
FNDC Urban STE – The FNDC urban sealed road network is rougher than its peer group apart from Secondary roads. There is a worsening trend for the Arterial, Access and Low Volume roads. The Primary and Secondary remain fairly static with no improving trends	**KDC Urban STE** – The KDC urban sealed network has a consistently worse roughness than the peer group average across all of the road classes. Primary significantly worse. There is also a worsening for trend Primary road classes, with the Secondary, Access an Low Volume roads showing stabilising.	**WDC Urban STE** - The WDC urban sealed network has a consistently worse roughness than the peer group average across all of the road classes. Secondary Collector roads are significantly worse. There is also a worsening trend for all road classes, apart from Arterial roads which has shown slight improvement over the last 2 years however remains static.

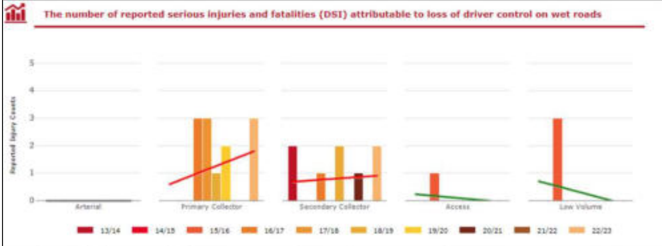
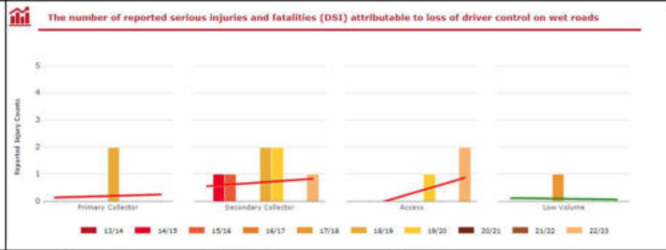
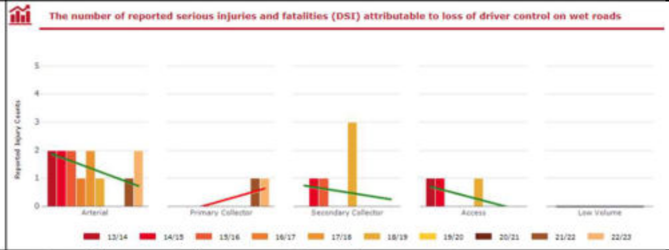
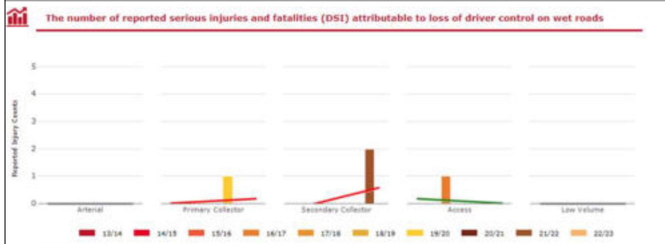
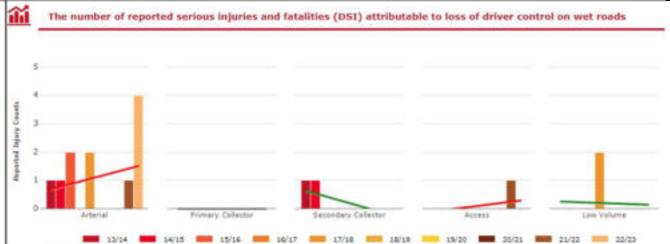
ONRC Amenity CO2 – Peak Roughness (and trend 85th %) – Rural Roads

FNDC	KDC	WDC
		
		
Arterial, Primary Collector, Secondary Collector, Access, Low Volume	Primary Collector, Secondary Collector, Access, Low Volume	Arterial, Primary Collector, Secondary Collector, Access, Low Volume
FNDC Rural Peak Roughness – Peak roughness on FNDC's rural sealed roads is equal to or higher across the board apart from the Primary network. There is an static or improving trend for all road classes. This be due to combination of targeted resurface programmes driving pre-seal repairs and correcting significant ride issues.	**KDC Rural Peak Roughness** – Peak roughness on KDC's rural sealed roads is slightly higher than its peer group average for all road classes. There is a worsening trend for Primary with all other classes showing static result. Again combination of targeted resurface programmes driving pre-seal repairs and correcting significant ride issues.	**WDC Rural Peak Roughness** - Peak roughness on WDC's rural sealed roads is slightly higher than its peer group average for all road classes, apart from Access. There static trend across all with improvement in the Access roads. Again combination of targeted resurface programmes driving pre-seal repairs and correcting significant ride issues.

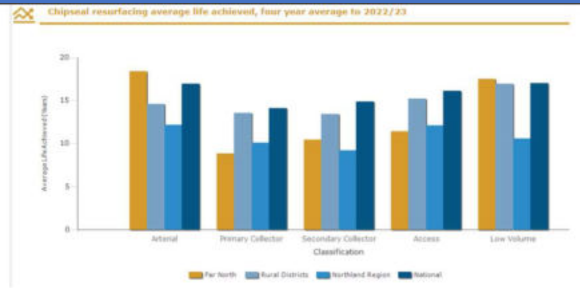
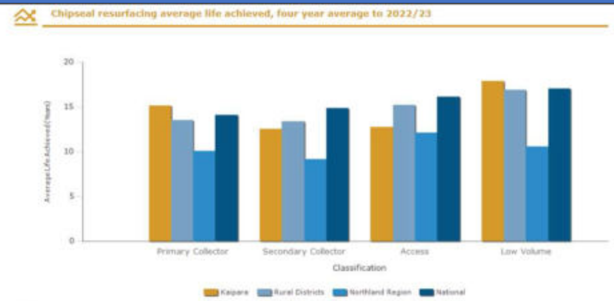
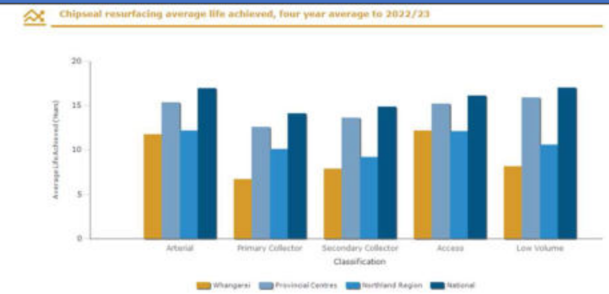
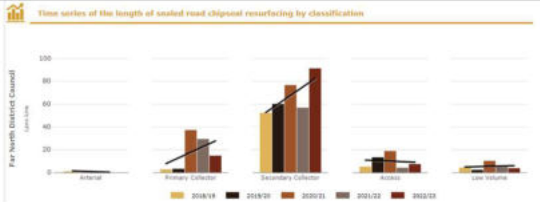
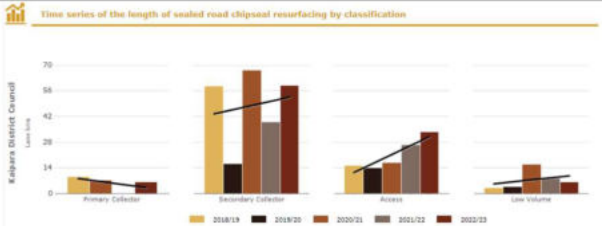
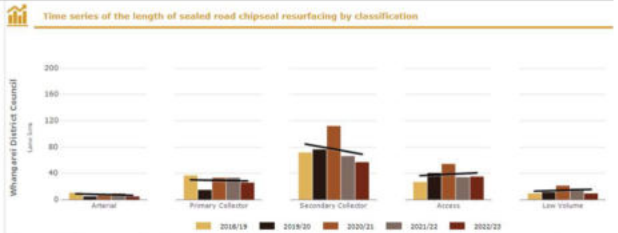
ONRC Amenity CO_2 – Peak Roughness (and trend) – Urban Roads

FNDC	KDC	WDC
		
		
Arterial, Primary Collector, Secondary Collector, Access, Low Volume	Primary Collector, Secondary Collector, Access, Low Volume	Arterial, Primary Collector, Secondary Collector, Access, Low Volume
FNDC Urban Peak Roughness – The peak roughness for FNDC's urban sealed roads is on par with peer group. The trend in peak roughness is has improved, again this due to programme of targeted surfacing driving pre-seal repairs and correcting significant ride issues.	**KDC Urban Peak Roughness** - The peak roughness for KDC's urban sealed roads is slightly higher than their peer group average all classes apart from Secondary. The trend in peak roughness is worsening for all of its road classes apart from Secondary. Again this due to programme of targeted surfacing driving pre-seal repairs and correcting significant ride issues.	**WDC Urban Peak Roughness** - The peak roughness for WDC's urban sealed roads is about the same or slightly higher than their peer group average for all of their road classes, apart from Secondary roads. The trend in peak roughness is now generally static and or showing improvement across all road classes. Whilst this is an improvement it is an improvement from a poor position. Resurfacing programme targeting old Access and Low Volume roads driving pre-seal repairs.

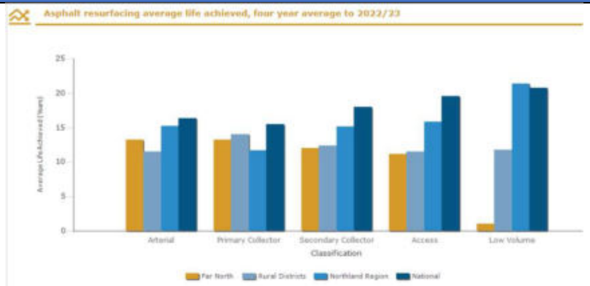
ONRC Safety TO4 – Loss of Driver Control on Wet Roads – Rural roads (top graph) & Urban roads (bottom graph) 10-year trend data

FNDC	KDC	WDC
		
Arterial, Primary Collector, Secondary Collector, Access, Low Volume	Primary Collector, Secondary Collector, Access, Low Volume	Arterial, Primary Collector, Secondary Collector, Access, Low Volume
		
Arterial, Primary Collector, Secondary Collector, Access, Low Volume	Primary Collector, Secondary Collector, Access, Low Volume	Arterial, Primary Collector, Secondary Collector, Access, Low Volume
FNDC Wet Road DSI – It should be noted that there is very little data for wet road crashes for rural roads and almost none for urban roads for FNDC. This makes it difficult to determine any issues or trends. From the limited data there may be an increasing trend on rural Primary roads and Secondary.	**KDC Wet Road DSI** - It should be noted that there is very little data for wet road crashes for rural roads and none for urban roads for KDC. This makes it difficult to determine any issues or trends. From the limited data available there could be an increasing trend on rural Primary and Secondary and Access roads.	**WDC Wet Road DSI** - It should be noted that there is very little data for wet road crashes for rural and urban roads for WDC. This makes it difficult to determine any issues or trends. However, it appears that there could be an increasing trend on its urban Arterial roads.

ONRC Cost Efficiency 2 – Chipseal Resurfacing – Life Achieved years (top graph) and Chipseal Length Lane/km (bottom graph)

FNDC	KDC	WDC
		
		
Arterial, Primary Collector, Secondary Collector, Access, Low Volume	Primary Collector, Secondary Collector, Access, Low Volume	Arterial, Primary Collector, Secondary Collector, Access, Low Volume
FNDC Chipseal Surfacing Life Achieved – Overall FNDC is achieving less life from its chipseals than its peer group average. The trend is generally improving, apart from the Arterial and Low Volume. This is likely to be due to the legacy of high rates of reseals to meet a Long Term Plan KPI. Also undertaken large amount of chipseal on forestry roads on Secondary Collectors as part of the additional Forestry Strengthening funding from NZTA.	**KDC Chipseal Surfacing Life Achieved** – KDC is achieving shorter chipseal longer than its peer group average. The trend is also worsening for its Primary Collectors and Access roads. The increasing trend on Secondary Collector roads was reversed in 2019/20. This is likely to be as a result of more focus on resurfacing over the past two years, to achieve a better balance between reseals and rehabilitations. This greater focus on reseals is try and get on top of a backlog of first coat seals requiring resurfacing.	**WDC Chipseal Surfacing Life Achieved** – WDC is generally shorter chipseal life achieved by its peer group average. The trend is generally stable or improving for most road classes. WDC has been investing more in reseals over the past 3-4 years, and it appears that their sealed road network is nearing a stable condition.

ONRC Cost Efficiency 3 – Asphalt Resurfacing – Life Achieved

<table>
<tr><th>FNDC</th><th>KDC</th><th>WDC</th></tr>
<tr>
<td>
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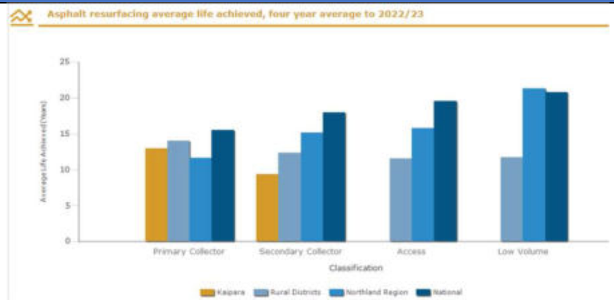
<td>
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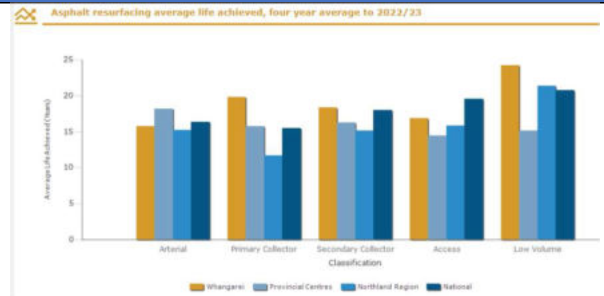
<td>
</td>
</tr>
<tr>
<td>Arterial | Primary Collector | Secondary Collector | Access | Low Volume</td>
<td>Primary Collector | Secondary Collector | Access | Low Volume</td>
<td>Arterial | Primary Collector | Secondary Collector | Access | Low Volume</td>
</tr>
<tr>
<td>FNDC Asphalt Surfacing Life Achieved – Overall FNDC is achieving significantly around the same life from asphalt surfacing’s than its peer group average. The exception to this is the Low Volm which is statically not relevant.

The life achieved seems in the right order at around 11-15 years given the that the asphalt surfaces have been introduced overtime in the network onto existing poor strength pavements. Resulting in generally poor performing surface through premature cracking.

The total proportion of asphalt surfacing in the Far North is about 4% (29km) of the sealed road network.</td>
<td>KDC Asphalt Surfacing Life Achieved –.

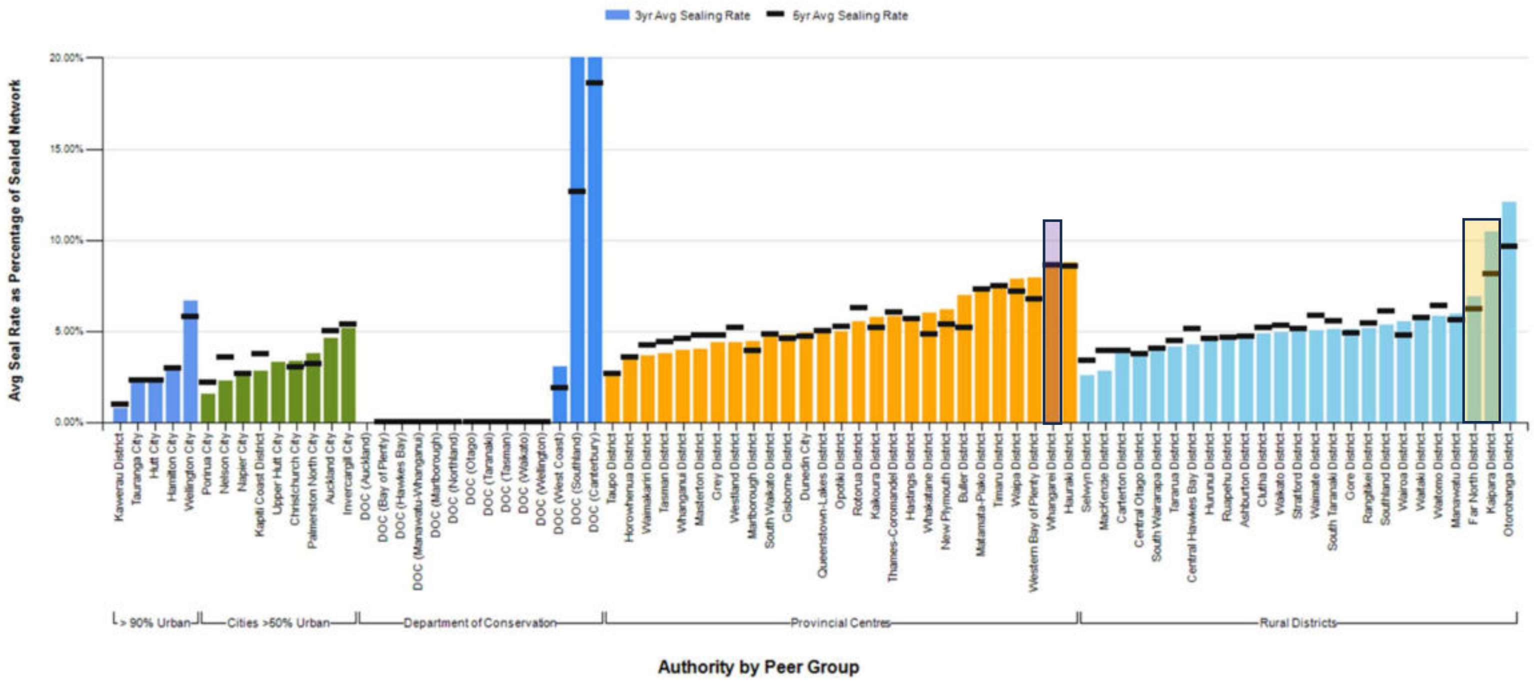
It should also be noted that there is only a small amount of asphalt surfacing in KDC (about 7.2km or 1.7% of the sealed road network) and so this measure is very subject to variation due to the small sample size.</td>
<td>WDC Asphalt Surfacing Life Achieved – WDC is generally matching the asphalt life achieved by its peer group average, and achieving much higher life for its Low Volume roads. The Primary Collector roads are achieving significantly longer life than the peer group.

For Arterial, Primary and Secondary is a concern and continues to reflect the issue for WDC on these high volumes roads and excessive surface lives leading to significant heavy M&F maintenance.

There is a backlog of asphalt surfacing that needs to be renewed in Whangarei City, primarily on urban arterials.

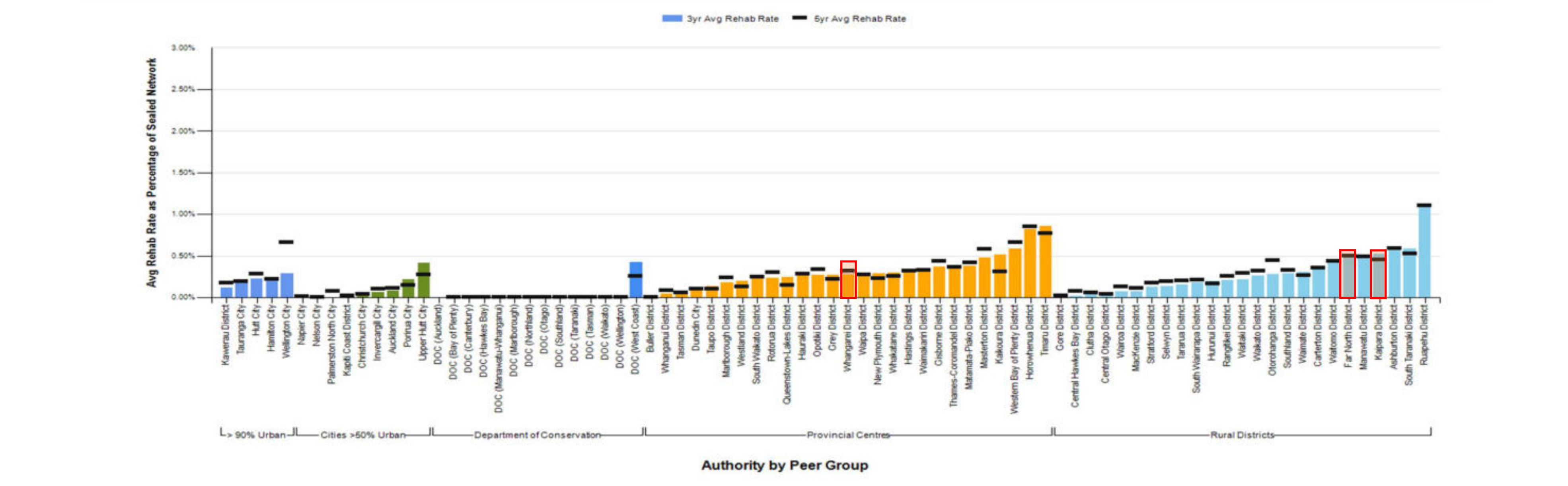
The total proportion of asphalt surfacing in Whangarei is about 5.4% (57km) of the sealed road network.</td>
</tr>
</table>

NZTA Peer Group Charts – 3-year Sealing Rates



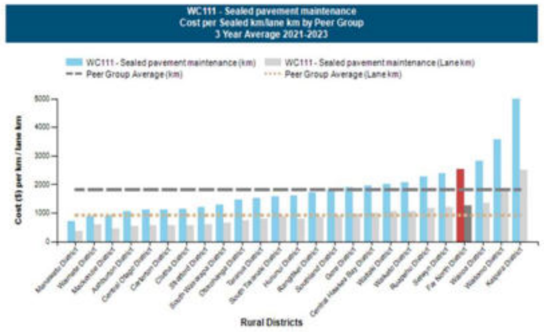
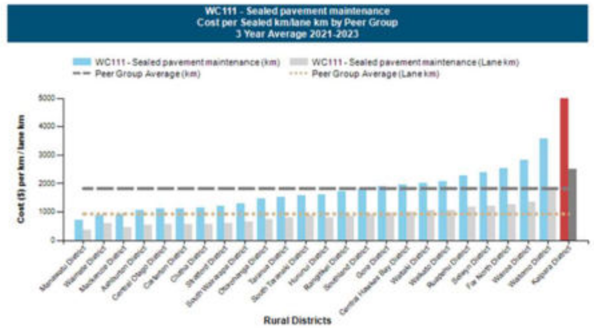
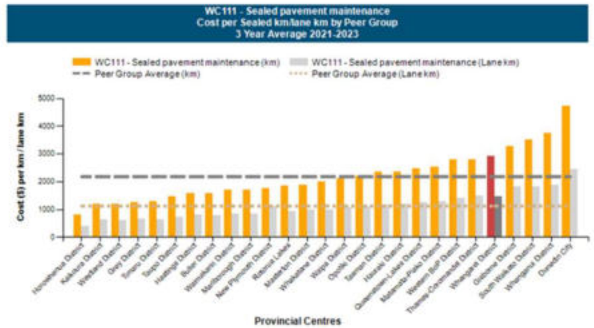
FNDC	KDC	WDC
FNDC Sealing Rate – The sealing rate in the Far North is towards the top of their peer group. For the last two years, resurfacing has been optimised through programme validation, dTIMS and moderation of 2021-24 plan has reduced this to current rate of 7-8% which are bit low. Which is now a reflection of the 2024-27 plan.	**KDC Sealing Rate** – KDC's was significantly below average for its peer group. The current 2021-24 plan focused on clearing the backlog of first coat seals that KDC is resealing due to the historic funding constraints caused by the Kaipara rates strike. This is currently increasing the amount of reseals, and this should stabilise to a relatively sustainable target of 12-13 year cycle (8% sealing rate) from 2021 onward.	**WDC Sealing Rate** – WDC's sealing rate is the highest in its peer group. This is primarily due to a catch up in resurfacing that has been ongoing for the last 5 years. The 2021-24 plan was aiming to get on top of its legacy of old void fill seals. There has been achievement in this space however this came a price of moderation and therefore deferral of other surfacing to get on top of the immediate issue.

NZTA Peer Group Charts – 3-year Rehabilitation Rates



FNDC	KDC	WDC
FNDC Rehabilitation Rate – FNDC has reduced and sits within the middle of pack. The programme continues to early failure of "cheap" seal extensions built in the late 1990's, however this trying to be address through pre-seal maintenance and resurfacing which is a reflection of the surfacing rate above.	**KDC Rehabilitation Rate** – KDC's rehabilitation rate is also middle of the pack for the peer group and is considered appropriate and sustainable with more focus on reseals. However, this is reflected through the surfacing rate above where low volume pavements are being treated with pre-seal and reseal. This plan suggest that this is not most economic or sustainable approach as the there is growing need for more rehabilitation which is in constant deferral through programme moderation and high risk heavy load forestry/industry routes failing rapidly.	**WDC Rehabilitation Rate** – WDC rates have reduced considerable and are in the middle of the pack as quantity of treatment. What is noted is the cost of treatment is high due to the requirement to trat high volume urban pavements with in the 2021-24 plan. This is significant issue as other high value rural rehab are being deferred in order to treat failed urban pavements which cannot be ignored.

NZTA Peer Group Charts – 3-year Cost/km WC 111 – Sealed Pavement Maintenance

<table>
<tr><th>FNDC</th><th>KDC</th><th>WDC</th></tr>
<tr><td>
</td><td>
</td><td>
</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>FNDC Sealed Pavement Maintenance Cost – FNDC's sealed pavement maintenance cost is the fourth highest in its peer group.
Pre-reseal costs are high as a result of a high reseal rate. Under any constrained budget scenario investing in pre-seals and reseal is the best economic and asset preservation option. The current 2021-24 focused on this delivery of this option in reaction to the moderated budgets. All current analysis would suggest that deterioration is occurring.</td><td>KDC Sealed Pavement Maintenance Cost – KDC has the highest sealed pavement maintenance cost in their peer group.
This is likely to be as a result of high pre-reseal repairs due to the current catch up in resurfacing to address old first coat seals on the network. Further as a result of moderated budgets and using pre-seal and reseal strategy to maintain he network as for FNDC.
This has built a backlog the this plan suggest continued investment in rep-seal and reseal will need to continue..</td><td>WDC Sealed Pavement Maintenance Cost – The WDC sealed pavement maintenance cost is in the upper third of their peer group.
As for the other councils, WDC is has delivered the majority of higher resurfacing programme to address old void fill seals and this has resulted in higher pre-reseal maintenance costs. As for KDC and FNDC continued programmes will still focus on pre-seal and reseal due to addition to backlogs as identified in the problem statement.</td></tr>
<tr><td colspan="3">NTA - It should be recognised that Northland has poor clayey subsoils, subtropical climate (high rainfall), significant forestry demands on its local road network and lack of access to good quality pavement materials leading to long cartage distances. For these reasons, it is likely that the sealed pavement maintenance costs for FNDC, KDC and WDC will always be in the upper half or third of the peer group.</td></tr>
</table>

NZTA Peer Group Charts – 3-year Cost/km WC 212 – Sealed Road Resurfacing

<table>
<tr><th>FNDC</th><th>KDC</th><th>WDC</th></tr>
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<tr><td></td><td></td><td></td></tr>
<tr>
<td> FNDC Sealed Road Resurfacing Cost – FNDC’s sealed road resurfacing cost is the second highest in its peer group. This is reaction to moderated funding and application of pre-seal and reseal strategy to maintain service levels on the network. </td>
<td> KDC Sealed Road Resurfacing Cost – KDC has the highest sealed road resurfacing cost in their peer group. As described previously, this is due to the current catch up in resurfacing to address old first coat seals on the network. There were also a number significant long reseal deferred in previous plans which had be competed in order to maintain the asset in fit for purpose state i.e. Oneriri Rd (+10km), highly unstable, the most economic approach was to pre-seal and reseal. </td>
<td> WDC Sealed Road Resurfacing Cost – WDC has the second highest sealed road resurfacing cost in their peer group. This is due in part to a higher resurfacing programme to address old void fill seals now mostly complete. However, WDC also has a large backlog of asphalt surfacing in Whangarei City which is in poor condition. This is currently driving up the resurfacing costs and will need to be increased going forward to avoid more expensive urban rehabilitations. The resealing costs are expected to stay high for a 3-year period while these asphalt surfacing are renewed. It will then drop to a more sustainable level. </td>
</tr>
<tr><td colspan="3">NTA - It should be recognised that Northland has poor clayey subsoils, subtropical climate (high rainfall), significant forestry demands on its local road network and lack of access to good quality pavement materials leading to long cartage distances. For these reasons, it is likely that the sealed road resurfacing costs for FNDC, KDC and WDC will always be in the upper half or third of the peer group.</td></tr>
</table>

NZTA Peer Group Charts – 3-year Cost/km WC 214 – Sealed Road Pavement Rehabilitation

FNDC	KDC	WDC
		
FNDC Sealed Road Pavement Rehabilitation Cost – FNDC's sealed road rehabilitation cost is the second highest in its peer group. As described previously, FNDC has been carrying a high rate of rehabilitations. This has mainly been due to early failure of "cheap" seal extensions built in the late 1990's, unstable surfacing through high historic sealing rates and poor optimisation of the programme. The condition indicators show that this only just maintaining a stable network.	**KDC Sealed Road Pavement Rehabilitation Cost** – The KDC sealed road rehabilitation cost is near the average of their peer group. KDC has been carrying out approximately 2km of rehabilitation per annum for the last 2 years. Forestry and industry parts of the network are now failing and becoming due for renewal.	**WDC Sealed Road Pavement Rehabilitation Cost** – WDC has the second highest sealed road rehabilitation cost in their peer group. This is due to targeting expensive urban rehabilitations using structural AC in Whangarei City to improve the poor condition of the urban network. This trend will continue given the current problem statement and expected increase in cost and condition trends on the network.
NTA - It should be recognised that Northland has poor clayey subsoils, subtropical climate (high rainfall), significant forestry demands on its local road network and lack of access to good quality pavement materials leading to long cartage distances. For these reasons, it is likely that the sealed road pavement rehabilitation costs for FNDC, KDC and WDC will always be in the upper half or third of the peer group.		

Summary

FNDC	KDC	WDC
Roughness and Smooth Travel Exposure – The general ride quality of the network is deteriorating with some improvement in reduction in peak roughness made through targeted resurfacing and pre-seal programmes. **Wet Road Crashes** – Whilst the data is statistically small it does show Primary and Secondary may require a targeted approach to wet crashes. It does remain difficult to draw any trends so the current process of Wet Crash reviews and Risk Curve analysis should continue to identify problem areas and treat these either though the asset resurfacing programme or through target friction surfacing. **Seal Life Achieved** – FNDC has extended seal lives in some areas but on average is in the right areas given the vulnerable nature of the network. FNDC has a backlog of old asphalt surfacing's which are overdue for replacement. **Sealing and Rehabilitation Rates** – FNDC has a high reseal rate and the second highest rehabilitation rate in its peer group. The reseal rate is likely to stabilise at about 8%/annum and the rehabilitation rate is likely to trend up. **Sealed Road Costs** – FNDC has the second highest sealed resurfacing and rehabilitation costs in its peer group. The amount of reseals was being driven by response to budget moderation in previous plans and impact of cost increases and weather events experience during the 2021-24 plan.	**Roughness and Smooth Travel Exposure** – The Primary and Secondary network is deteriorating with the remainder of the network exhibiting a stable state of ride quality. **Wet Road Crashes** - There is very little wet road crash history for the KDC network, but there could be an increasing trend in rural Secondary and Primary roads. As for FNDC the same approach will be applied. **Seal Life Achieved** – KDC is generally achieving more life for its chipseals than its peer group, and the trend is in the right area for this network. Suggesting the current surfacing programme is of the right order. KDC is achieving about the peer group average overall for its asphalt surfacing. **Sealing and Rehabilitation Rates** –.KDC has one of the highest reseal rates in the peer group. This is set to continue as a response to moderation under the 2021-24 plan continued deterioration and network growth. **Sealed Road Costs** – KDC has a high reseal and maintenance costs rate and low/average rehabilitation rate in its peer group. The reseal rate is likely to continue on this trend with rehabilitation rate to increase due to high sot roads need treatment e.g. Moir Rd Mangawhai area.	**Roughness and Smooth Travel Exposure** – The general ride quality across the WDC network is deteriorating across all road classes. There is some improvement in peak roughness in the low volume network. Again this is being achieved through pre-seal and resurfacing programmes targeted at these networks. **Wet Road Crashes** - There is very little wet road crash history for the WDC network, but there could be an increasing trend in rural Primary road crashes. Same management approach will be applied as for FNDC and WDC. **Seal Life Achieved** – WDC is generally achieving the less for its chipseals. The asphalt network continues to stretch seal lives which is building a backlog on the network. **Sealing and Rehabilitation Rates** – WDC has the highest reseal rate in its peer group and the rehabilitation rate is in the top third of its peer group. The sealing rate is likely to continue through the 2024-27 plan as result of backlog growth. Rehabilitation rates will be stab at around 1% of network however this will be impacted by cost of urban rehab. **Sealed Road Costs** – WDC has the second highest resurfacing costs in its peer group. This is due to catching up on a backlog of old void fill seals. It has the third highest rehabilitation cost in its peer group due to a focus on expensive urban arterials.

5.4 Options to be Considered

Based on the above data and the root cause analysis, the following options have been considered for sealed pavements:

Option	Description
Option 1 – Continue to Optimise Rehabs and Reseals	Increase amount of rural rehabilitation and or reseal as justified through dTIMS and field validation.
Option 2 – Skid resistance risk assessments and appropriate surfacing's	Carry out targeted assessment of skid resistance on at risk curves on network. Complete the risk assessment of high-risk curves for skid resistance issues and apply appropriate surfacing treatments.
Option 3 – Implement Inspection Management Change with next MO&R Contracts	Inspection process in the current MO&R contracts are high and the inspection led process from Contractors has not yield the outcomes required. Consider changing the inspection to inhouse process sup[ported by current AI technology.
Option 4 – Implement AI Video technology to support pavement and surfacing defect identification	Implement AI technology to use both network and ad hoc video collected through HSD and general inspections to build defect pool from which a better assessment of surface and pavement defect can be taken. Avoids High sites only being identified at time of pre-seal inspections. Extend use of AI into Asset capture e.g., signs, line markings, railings improve asset data quality.
Option 5 – Surfacing policy change, developers to fund second coats.	Change council policies to require developers to fund second coat seals of development roads before vesting to Council.
Option 6 – LoS change to resurface low volume residential asphalt roads in lower cost surfacing solution.	Get approval and Implement surfacing policy change for low volume residential asphalt surface roads to be resurfaced in Chip Seal/Slurry/Rejuvenation or other cheaper surfacing treatments. This will mean working with industry and providing quantity of work to incentives new technology in remote locations.
Option 7 – Alternative management approach for urban rehabilitations	This includes both investigating alternative designs for urban rehabilitations to reduce use of expensive SAC where possible and increase in heavy maintenance patching with Thin Asphalt surfacing as proxy for urban rehab to stretch urban rehab intervention.
Option 8 – Alternative quarry sources and/or ownership models	Investigate new quarry sources to reduce cartage. Also investigate ownership arrangements of existing quarries

PBC Multi Criteria Option Analysis, RCA: NTA

Activity/Work Categories: Sealed Roads (WC 111, 212, 214)

Short list up to 3 options from the following:

Option - Can we make	Yes/No	Rank	Reason
❑ Intervention response **timing** change			
❑ **LoS** adjustments	Yes	1	Option 1 - Continue to Optimise Rehabs and Reseals
❑ Use existing assets **differently**			
❑ **Blending** Work Categories differently	Yes	6	Option 7 - Alternative management approach for urban rehabilitations
❑ **Risk** - Hold Assets longer	Yes	7	Option 2 - Skid resistance risk assessments and appropriate surfacing's
❑ Managing **demand**	Yes	4 5	Option 6 - LoS change to resurface low volume residential asphalt roads in lower cost surfacing solution Option 5 – Surfacing policy change, developers to fund second coats
❑ **Route** Management			
❑ Alternative approaches – different **solutions/technology**	Yes	2	Option 4 – Implement AI Video technology to support pavement and surfacing defect identification
❑ **Maintenance vs Renewal** adjustments			
❑ **ONRC** Classification variance			
❑ Extended **temporary** management			
❑ **Supply chain** improvements	No	8	Option 8 - Alternative quarry sources and/or ownership models
❑ Improve **systems and capability**	Yes	3	Option 3 - Implement Inspection Management Change with next MO&R Contracts

Scale of Impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

How good is this option

Criteria	Weighting (Importance) (Total to 100%)	Option 1 – Continue to Optimise Rehabs and Reseals		Option 2 - Skid resistance risk assessments and appropriate surfacing's		Option 3 - Implement Inspection Management Change with next MO&R Contracts		Option 4 – Implement AI Video technology to support pavement and surfacing defect identification		Option 5 – Surfacing policy change, developers to fund second coats.		Option 6 - LoS change to resurface low volume residential asphalt roads in lower cost surfacing solution		Option 7 - Alternative management approach for urban rehabilitations		Option 8 - Alternative quarry sources and/or ownership models	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	10%	2	0.2	2	0.2	2	0.2	2	0.2	0	0	-1	-0.1	0	0	0	0
Problem solving effectiveness	10%	2	0.2	1	0.1	2	0.2	3	0.3	2	0.2	1	0.1	2	0.2	1	0.1
Benefits realised	15%	2	0.3	1	0.15	1	0.15	1	0.15	1	0.15	2	0.3	1	0.15	1	0.15
Good Environmental impacts	5%	0	0	-1	-0.05	-1	-0.05	2	0.1	0	0	0	0	-1	-0.05	-1	-0.05
Value for Money	10%	2	0.2	0	0	2	0.2	3	0.3	1	0.1	3	0.3	2	0.2	-2	-0.2
Closing Customer and Technical LoS gaps and impacts	10%	1	0.1	1	0.1	2	0.2	2	0.2	0	0	0	0	0	0	0	0
Closing ONRC Performance gaps	10%	3	0.3	0	0	1	0.1	1	0.1	1	0.1	1	0.1	1	0.1	0	0
Asset preservation and sustainability	10%	2	0.2	-1	-0.1	1	0.1	2	0.2	1	0.1	2	0.2	-2	-0.2	0	0
Total Cost of Ownership (whole of life Costs)	10%	3	0.3	-2	-0.2	1	0.1	1	0.1	2	0.2	2	0.2	-2	-0.2	-3	-0.3
Life Cycle Management	10%	2	0.2	-3	-0.3	2	0.2	2	0.2	1	0.1	1	0.1	1	0.1	0	0
etc.			0		0		0		0		0		0		0		0
Totals	**100%**		**2**		**-0.1**		**1.4**		**1.85**		**0.95**		**1.2**		**0.3**		**-0.3**

5.5 Option Assessment and Line of Sight

The options and the line of sight to the preferred strategic response and the problems they are addressing are shown in the table below. These options have been ranked in order of preference and then have been assessed through a multi-criteria assessment (MCA) to determine the highest scoring options that are preferred and are to be adopted. The MCA assessment is also provided as follows.

Work Activity	Problem Statements Addressing	Preferred Strategic Response	PBC Options to be Considered	Option Rank	MCA Score	Preferred Options
Sealed Roads	Increasing pavement maintenance and renewal backlog through not achieving prior programmed works due to major events, such as COVID lockdowns, Cost Escalations, Limited resources and Compounding Storm Events.	**Programme Adjustment** • Increase programme – surfacing and rehabilitations. • Supported through holistic drainage management programmes • Adjust the urban pavement rehabilitation risk based approach to heavy per-seal and asphalt resurfacing to spread pavement rehabilitation programme	**Programme Adjustment** **LoS Adjustments** • Option 1 – Continue to Optimise Rehabs and Reseals	1	2	Yes
			Alternative Approaches Solution/Technology • Option 4 – Implement AI Video technology to support pavement and surfacing defect identification	4	1.85	Yes
			Improve Systems Capability • Option 3 – Implement Inspection Management Change with next MO&R Contracts	3	1.4	Yes
			Managing Demand • Option 6 – LoS change to resurface low volume residential asphalt roads in lower cost surfacing solution	6	1.2	Yes
			• Option 5 – Surfacing policy change, developers to fund second coats	5	0.95	Yes
			Risk – Hold Assets Longer & LOS Adjustment • Option 2 – Skid resistance risk assessments and appropriate surfacing's	2	-0.1	Yes
		Funding Adjustment • Increase in targeted heavy pre-seal pavement maintenance	**Funding Adjustment** **Blending Work Categories Differently** • Option 7 – Alternative management approach for urban rehabilitations	7	0.3	Yes
			Supply Chain Improvements • Option 8 – Alternative quarry sources and/or ownership models	8	-0.3	No

PREFFERED OPTIONS: From the multi-criteria assessment the preferred options are in ranking order:

- Option 1 – Continue to Optimise Rehabs and Reseals.
- Option 4 – Implement AI Video technology to support pavement and surfacing defect identification.
- Option 3 – Implement Inspection Management Change with next MO&R Contracts.
- Option 6 – LoS change to resurface low volume residential asphalt roads in lower cost surfacing solution.
- Option 5 – Surfacing policy change, developers to fund second coats.
- Option 7 – Alternative management approach for urban rehabilitations.
- Option 2 – Skid resistance risk assessments and appropriate surfacing's.
- Option 8 – Alternative quarry sources and/or ownership models.

5.6 Financial Impact

The following tables show the work categories and examples of the associated tasks. For full financial details for the work categories, refer to Section 08 (Financials).

5.6.1 Far North District Council

Description	Financial Impact
WC 111 Sealed Pavement Maintenance	Increase in contract cost due to significant CAF index 2020/21 +22% on contract rates. Market rates expected to be significantly higher with retender of the MO&R contracts for July 2025. Current indications from across market is this between 25% -100% increase. Significant amount of LCLR builds in the last 3 years has had consequential maintenance impact e.g. speed tables leading to rapid deterioration of existing pavements. Required lift in pre-seal for thin asphalt surfacing to undertake deep lift patching to ensure we get life from new AC surfaces without widespread premature failure. Proposed budget of $10.077M increased from $7.028M for 2021-24, which is a total increase of $3.048M (+43.4%). This is to allow for inflation of $2.987M (+42.5%) and a minor increase of $61,318 (+0.9%) to accommodate increased quantities for pre-seal repairs required due to storm effects and deteriorating road surfaces being deferred longer than recommended.
WC 212 Sealed Road Resurfacing	Proposed budget of $24.180M increased from $12.877M for 2021-24, which is a total increase of $11.303M (+87.8%). This is to allow for inflation of $5.473M (+42.5%) and an increase of $5.830M (+45.3%) to accommodate: • Additional 28km p.a. of chipseal as a result from last plan moderation. • Additional 1km p.a. of TAC resurfacing as a result of stretching AC programme in last plan and continued and increased programme quantity required.
WC 214 Sealed Road Pavement Rehabilitation	Proposed budget of $15.207M increased from $9.606M for 2021-24, which is a total increase of $5.601M (+58.3%). This is to allow for inflation of $4.083M (+42.5%) and an increase of $1.519M (+15.8%) to accommodate additional 2km p.a. of rehabilitations (generally rural with some high value urban sites) being carried from previous plan moderation.

5.6.2 *Kaipara District Council*

Description	Financial Impact
WC 111 Sealed Pavement Maintenance	Increase in contract cost due to significant CAF index 2020/21 +22% on contract rates. Market rates expected to be significantly higher with retender of the MO&R contracts for July 2025. Current indications from across market is this between 25% -100% increase. Significant amount of LCLR builds in the last 3 years has had consequential maintenance impact e.g. speed tables leading to rapid deterioration of existing pavements. Required lift in pre-seal for thin asphalt surfacing to undertake deep lift patching to ensure we get life from new AC surfaces without widespread premature failure. Proposed budget of $9.348M increased from $6.537M for 2021-24, which is a total increase of $2.811M (+43.0%). This is to allow for inflation of $2.778M (+42.5%) and a minor increase of $33,180 (+0.5%) to accommodate increased quantities for pre-seal repairs required due to storm effects and deteriorating road surfaces being deferred longer than recommended.
WC 212 Sealed Road Resurfacing	Proposed budget of $16.262M increased from $6.127M for 2021-24, which is a total increase of $10.135M (+165.4%). This is to allow for inflation of $2.604M (+42.5%) and an increase of $7.531M (+122.9%) to accommodate additional 5km p.a. of chipseal, along with TAC surfacing which due to age and condition is requiring renewals in Mangawhai.
WC 214 Sealed Road Pavement Rehabilitation	Proposed budget of $12.858M increased from $4.008M for 2021-24, which is a total increase of $8.850M (+220.8%). This is to allow for inflation of $1.703M (+42.5%) and an increase of $7.147M (+178.3%) to accommodate additional 2km p.a. of rehabilitations (generally rural with some high value urban sites to be treated) being carried from previous plan moderation, generally rural with some high volume expensive urban sites that cannot be treated through pre-seal and TAC surface.

5.6.3 Whangarei District Council

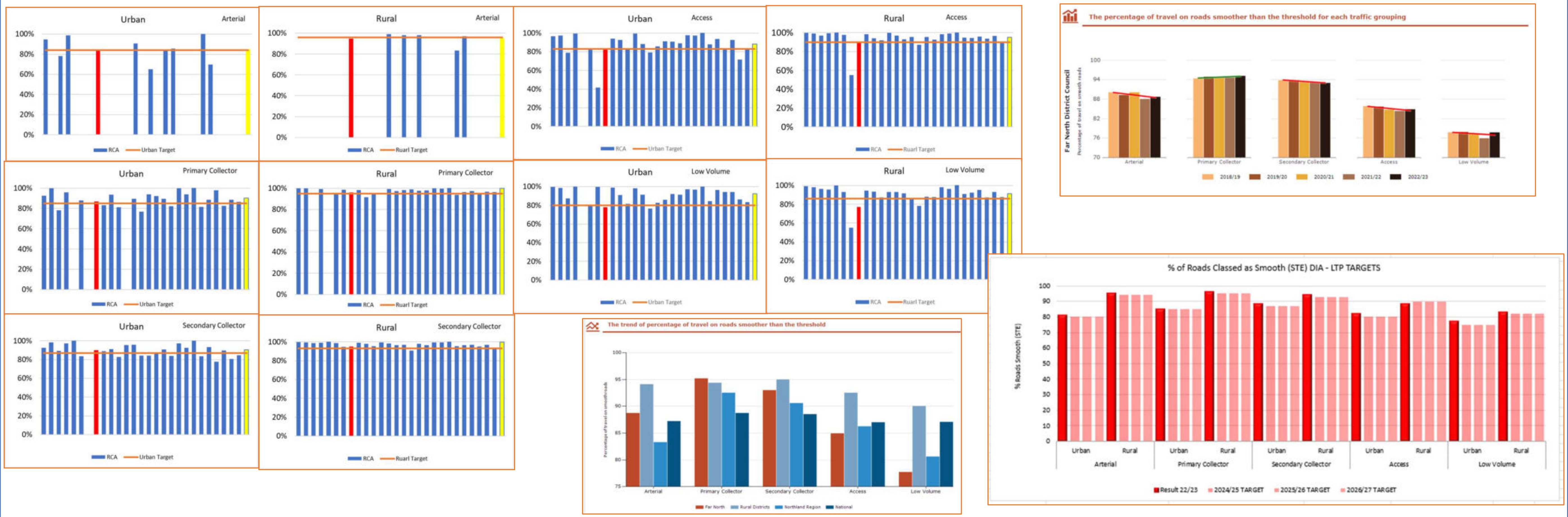
Description	Financial Impact
WC 111 Sealed Pavement Maintenance	Increase in contract cost due to significant CAF index 2020/21 +22% on contract rates. Market rates expected to be significantly higher with retender of the MO&R contracts for July 2025. Current indications from across market is this between 25% -100% increase. Significant amount of LCLR builds in the last 3 years has had consequential maintenance impact e.g. speed tables leading to rapid deterioration of existing pavements. Required lift in pre-seal for thin asphalt surfacing to undertake deep lift patching to ensure we get life from new AC surfaces without widespread premature failure. Proposed budget of $14.563M increased from $8.656M for 2021-24, which is a total increase of $5.907M (+68.2%). This is to allow for inflation of $3.679M (+42.5%) and an increase of $2.228M (+25.7%) to accommodate increased quantities for pre-seal repairs required due to storm effects and deteriorating road surfaces being deferred longer than recommended.
WC 212 Sealed Road Resurfacing	Proposed budget of $28.938M increased from $15.302M for 2021-24, which is a total increase of $13.637M (+89.1%). This is to allow for inflation of $6.503M (+42.5%) and an increase of 7.134M (+46.6%) to accommodate • Additional 15km p.a. of chipseal as a result of last plan moderation continuing to treat long tail of poor condition surfaces • Additional 2km p.a. of TAC resurfacing, having focus on old AC surfacing on arterial roads in Whangarei.
WC 214 Sealed Road Pavement Rehabilitation	Proposed budget of $20.124M increased from $10.093M for 2021-24, which is a total increase of $10.031M (+99.4%). This is to allow for inflation of $4.290M (+42.5%) and an increase of $5.741M (+56.9%) to accommodate additional 2.5km p.a. of rehabilitations (generally rural with growing need for high volume expensive urban sites that cannot be treated through pre-seal and AC surface).

5.7 Level of Service Impact

5.7.1 *FNDC Desired Levels of Service*

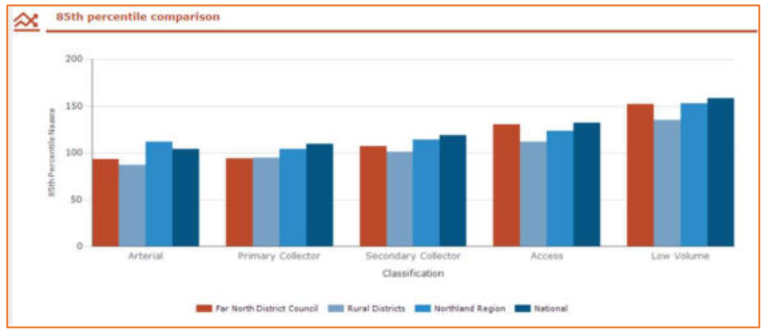
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	Urban Rural	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis / Peer Group Comparison	GAP / Response
FNDC **Amenity - Smooth Travel Sealed Roads**	Amenity	Customer Outcome	OM1, LTP	The % of Roads Classed as Smooth (STE) DIA	Arterial	Urban	82	82	82	Maintain current level of ride quality.	GAP – There has been a trend in of decreasing smooth roads on the Arterial, Primary, Access and Low Volume. There is some crash evidence, Motor Cycle, that may be in relation to poor ride quality. Response - The key focus is on maintaining safe smooth ride in the high speed rural environments especially in the Secondary and Access portion of the network, which represents 60 % of the sealed network. This will mean continued investment level in pavement rehabilitation at increased levels and resilience work.
						Rural	94	94	94	Maintain current level of ride quality	
					Primary Collector	Urban	85	85	85	The peer group average is 90%. A target of 85% has been set against a current achievement of 87%..	
						Rural	95	95	95	Target has been set 95% against an achievement of 96%. Trend has shown a steady improvement, and this now needs to be held steady to maintain a safe ride.	
					Secondary Collector	Urban	87	87	87	Target of 87% against an achievement of 90%. This looks to maintain steady state and a reasonable Customer LoS.	
						Rural	94	94	94	Target of 94% against an achievement of 94%. As noted above.	
					Access	Urban	80	80	80	Access and Low Volume are increased slightly to continue to provide a safe smooth travel environment. These have deteriorated quite rapidly over the last three years and are now quite low compared to peer group.	
						Rural	90	90	90		
					Low Volume	Urban	75	75	75		
						Rural	82	82	82		
					Network Average (Target >=)	All	86	86	86		

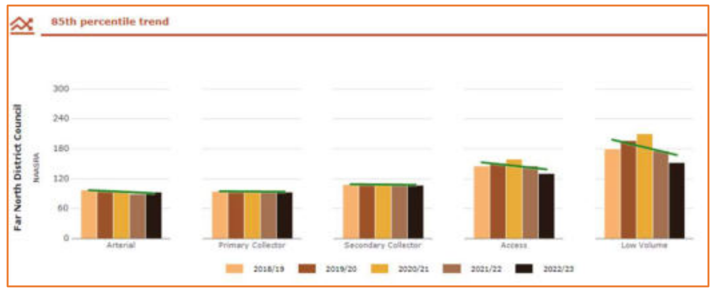
Yellow bar shows the peer group average the red bar is Far North DC current achievement. The Orange line is the target being set in relation to peer group average and the peer group as whole. A number of key issue can be observed; 1. Far North DC features poorly against the majority of comparative groups; 2. Far North DC STE across ONRC has been reducing over the term in the Arterial and Access LV over last LTP.

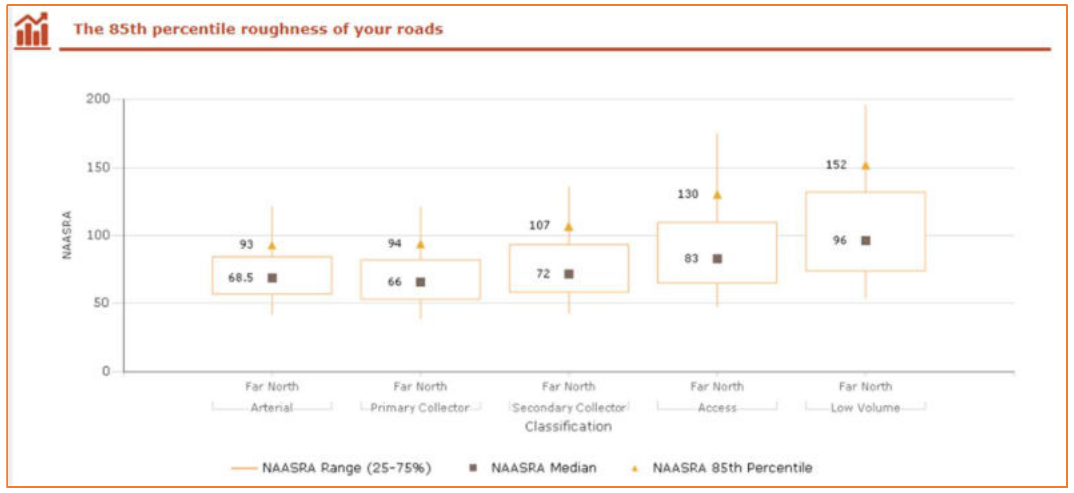


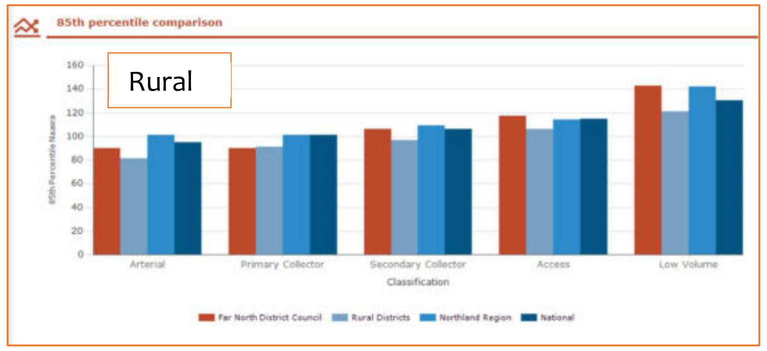
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	Urban Rural	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis / Peer Group Comparison	GAP / Response
FNDC **Amenity - Peak Roughness**	Amenity	Technical Output	PM1	Peak Roughness (85th%)/ Ride comfort	Arterial	Urban	110			Allowed to deteriorate against peer group	GAP - FNDC is above the peer group peak rough across the board. The secondary, Access and low Volume are deteriorating in relation. Vulnerable geology to water is a related symptom to peak rough. Response – Continue with Rehabilitation as set and fund along with targeted peak roughness programmes to address the issue, such as resilience, given the increasing trend in motor cycle crash on the network and the rat of deterioration Access and Low Volume.
						Rural	83			Set at peer group	
					Primary Collector	Urban	130	120	120	Allowed to deteriorate against peer group.	
						Rural	90	90	90	Set at peer group	
					Secondary Collector	Urban	130	140	140	Set at peer group	
						Rural	100	95	95	Some improvement required to meet peer group	
					Access	Urban	150	145	145	Ride quality is quite poor reduction in target to improve ride quality	
						Rural	115	110	110	As above	
					Low Volume	Urban	165	165	165	As above	
						Rural	130	125	125	As above	

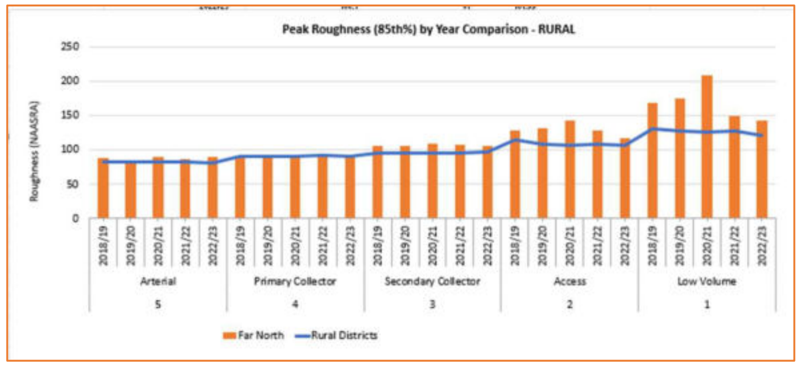
Far North DC peek roughness is above peer group across the board in all classes. The Primary Collector and Low Volume networks have been in state of deterioration over the last LTP period. Low Volume network has moved significantly out of step with peer group.

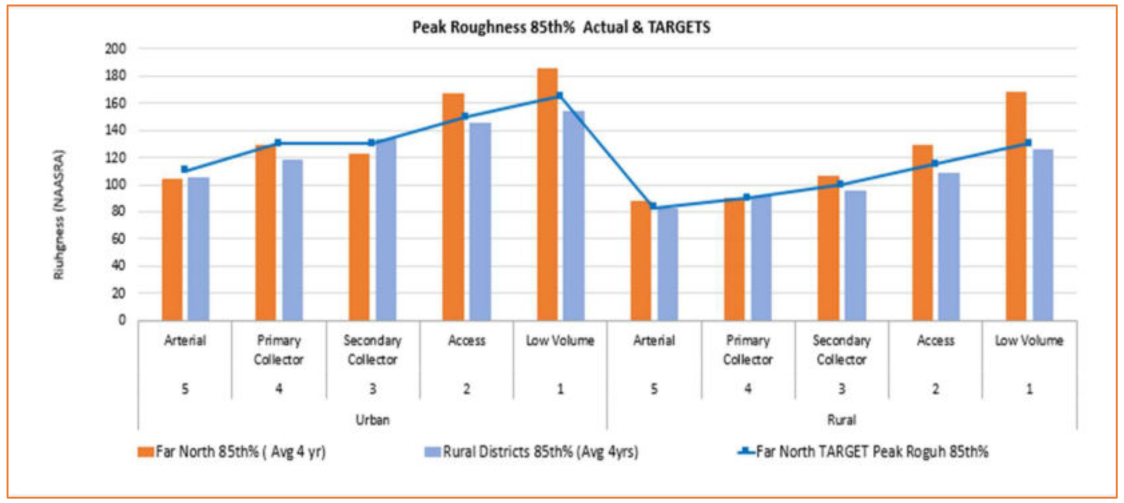


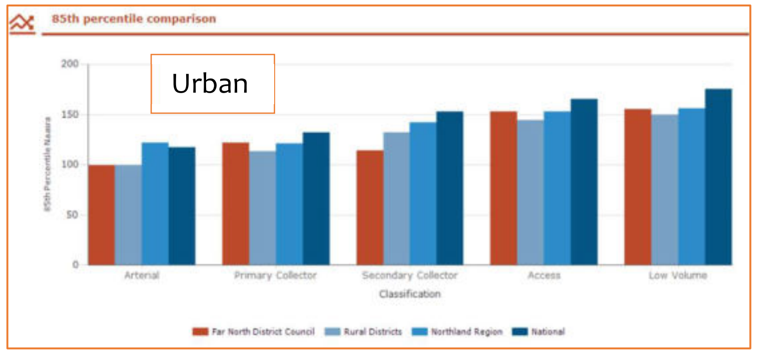


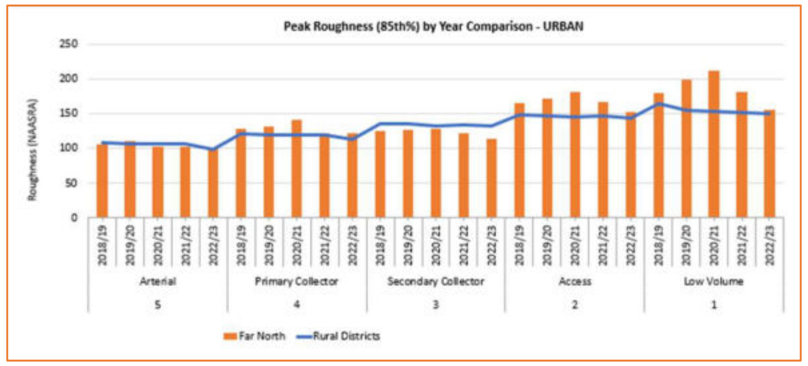






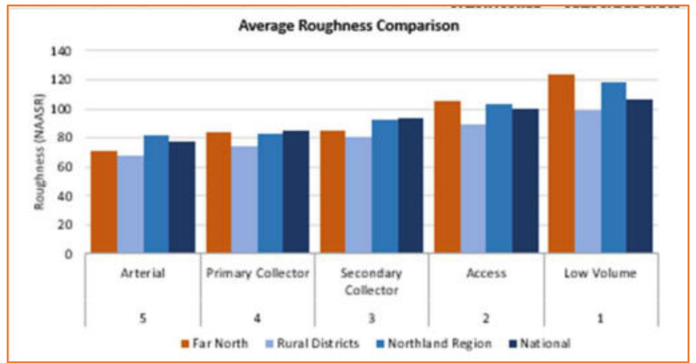


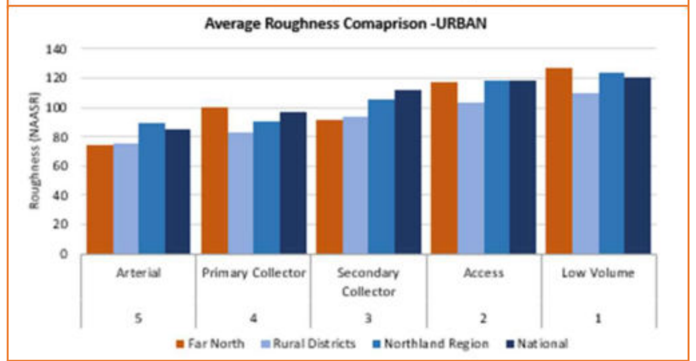


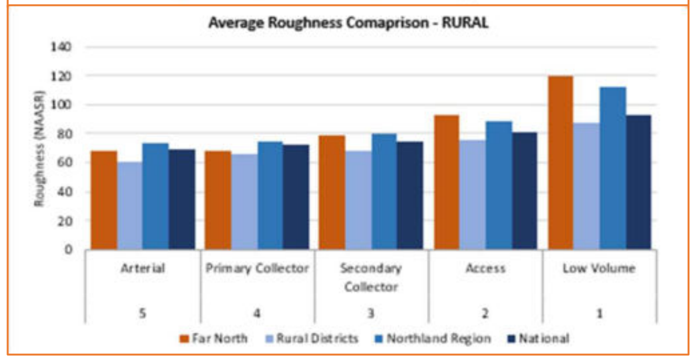


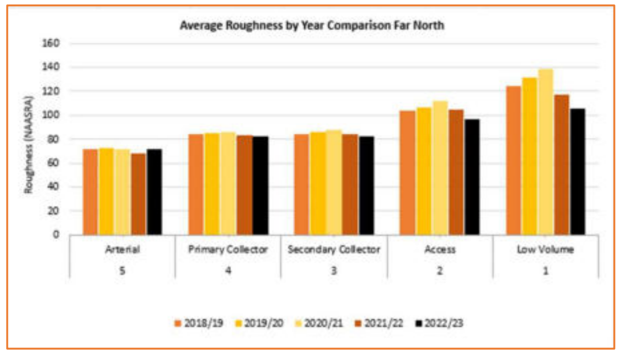
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	Urban Rural	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis / Peer Group Comparison	GAP / Response
FNDC **Amenity - Average Roughness**	Amenity	Customer Outcome	OM2	Average Roughness	Arterial	Urban	80	80	80	Maintain target to keep steady state	GAP –FNDC network is above the peer group with the biggest gap on the Rural network. The most significant gap is on Access/Low Volume network. The trend for FNDC has continued shown some improvement. Whilst the average remains above the peer group. Response – Deliver rehab programme as developed to maintain ride comfort for the network. There is adjustment required on the Secondary and Access/LV classes, this is naturally occurring as pavement start fail and become expensive to maintain/seal.
						Rural	70	70	70	Maintain target to keep steady state	
					Primary Collector	Urban	100	100	100	Maintain target to keep steady state	
						Rural	73	73	73	Maintain target to keep steady state	
					Secondary Collector	Urban	100	100	100	Maintain target to keep steady state	
						Rural	77	77	77	As above	
					Access	Urban	115	115	115	Reduce target to support STE and Peak rough improvement	
						Rural	82	82	82	As above	
					Low Volume	Urban	120	120	120	As above	
						Rural	105	105	105	As above	
					Network (Average)	All	93	93	93		

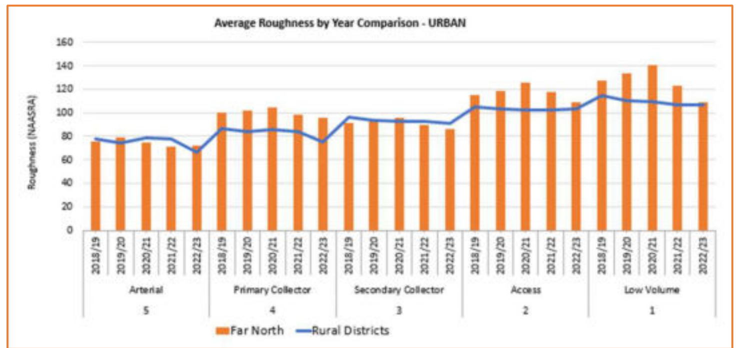
In comparison FNDC has higher roughness than the peer group. This is most apparent on the Rural Access and Low Volume network. Targets are being set against peer group to help reduce the overall average roughness to support the reduction in peak roughness and improvement in ride quality for STE.

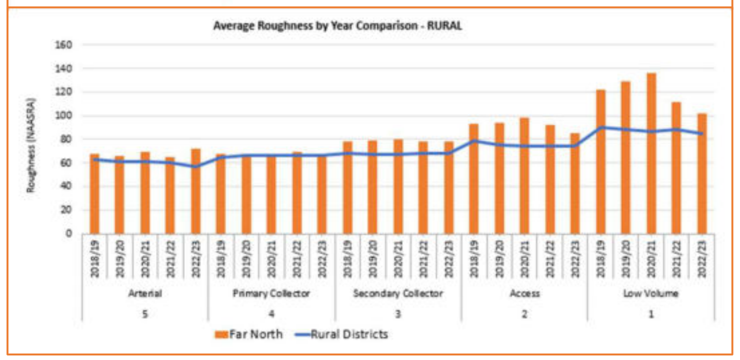


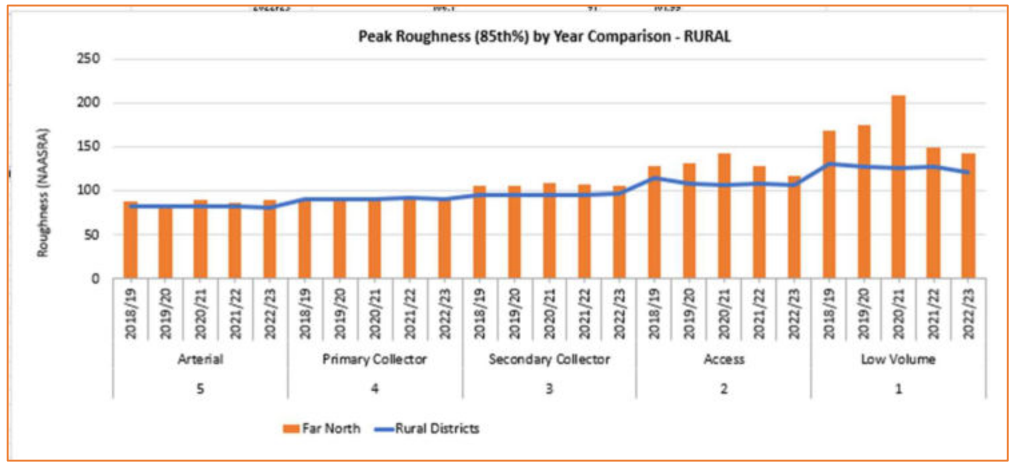


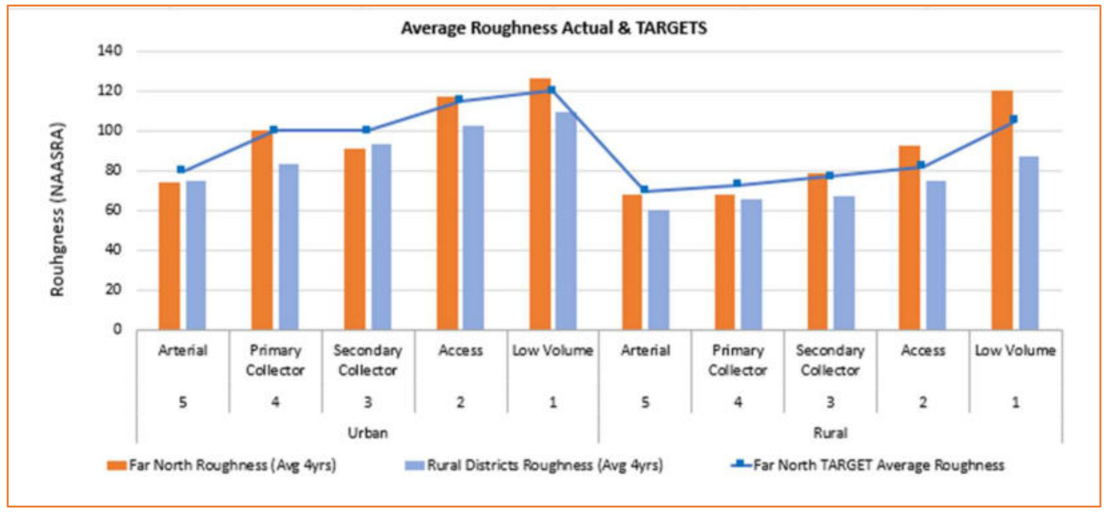








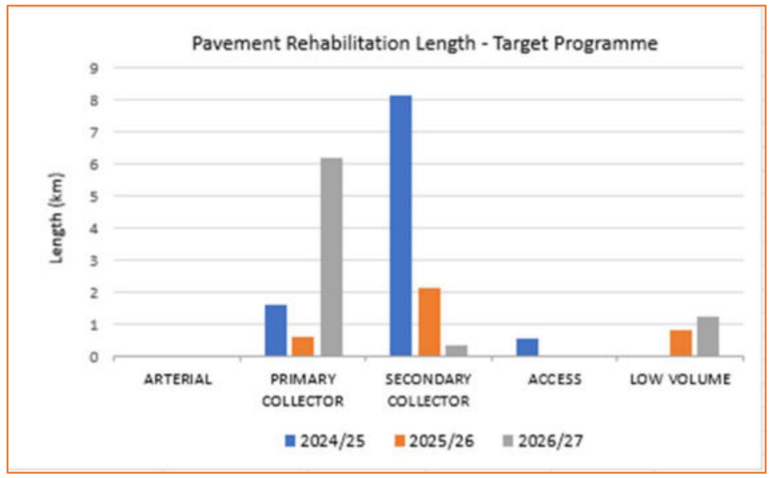


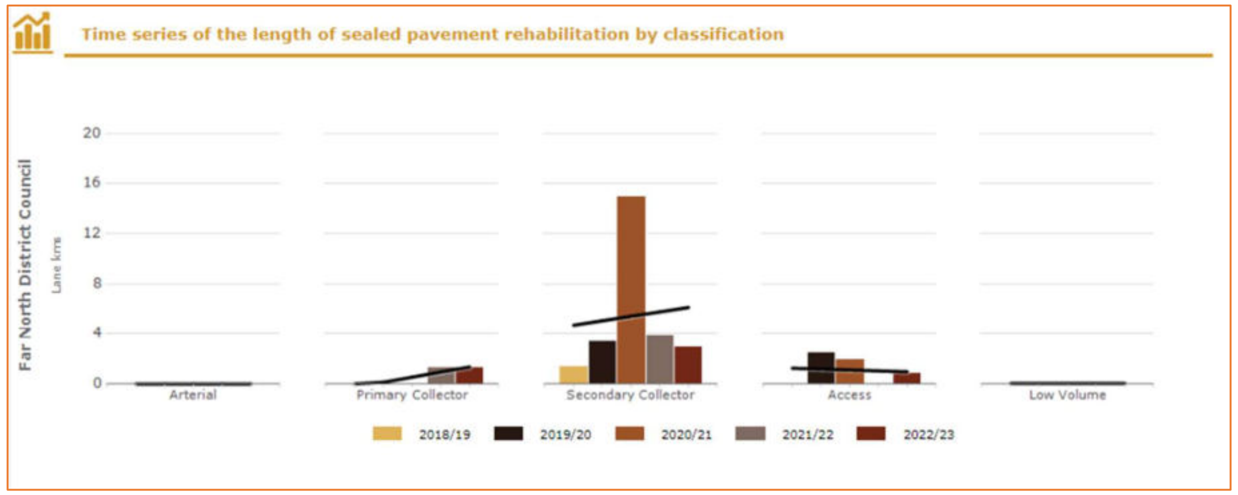


Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
FNDC **Cost Efficiency – The percentage of the sealed local road network that is rehabilitated**	Pavement Rehabilitation - Cost Efficiency	Efficiency Measure	EM	Was REG measure. Has been removed from PMRT. Change Target to % of network OLD Pavement Rehabilitation length - Lane km	Arterial	0.00%	0.00%	0.00%		This programme has been directed by several condition drivers, one of which is the customer ride comfort as set out under ONRC. Given that the network is exceeding roughness targets, this is where 2021-24 programme is targeted to deliver on the customer outcome. With targeted ride issue on Secondary and Low Volume roads.
					Primary Collector	1.18%	0.44%	4.55%	Loaded Rural roads and urban roads in poor condition	
					Secondary Collector	1.64%	0.43%	0.07%	Rural loaded ride quality	
					Access	0.35%	0.00%	0.00%	Peak roughness rural	
					Low Volume	0.00%	0.83%	1.24%	In response to peak roughness rural	
					Network (Total)>=0.4%	0.8% (7.4km)	0.7% (6.2km)	0.8% (7.1km)	On average 6.9km/yr next three years.	

Comparative analysis shows FNDC 5 year average at about 0.5% (NZTA Peer Group report. This is out of step with actual which was around 0.7% or 6km/yr. This is a concern given this data is being used to measure historic investments. The rehab programme is designed to target highly loaded rural pavements to maintain current performance and keep in check the deteriorating ride quality on rural Secondary and LV network. Further reduction in rehabilitation programme would see continued deterioration in customer outcomes. Northland sub quality construction materials and sensitive geology continue to have an impact on ride quality of the

Pavement Renewal – 20-2025

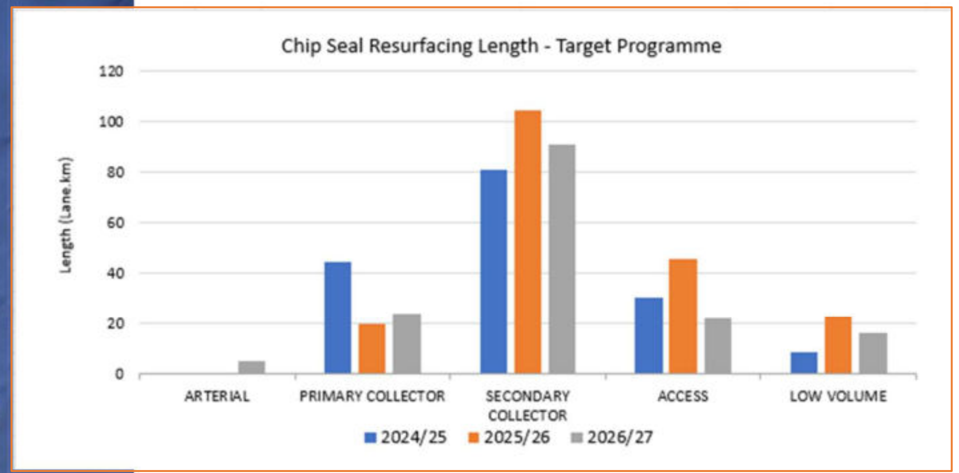




Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
FNDC **Cost Efficiency - Chipseal Lane/km**	Chipseal - Cost Efficiency	Efficiency Measure	EM2(a)	Chipseal Resurfacing Quantity - lane km (DIA mandatory) expressed as both Ln.km and % of sealed Network	Arterial			4.8		GAP – Reducing Rehab programme on Access/LV network. Heavily constrained environment has meant an under delivery of resurface compared to the network need. Response - Chipseal resurfacing programme is designed in response to the pavement renewal programme. No rehab for the LV. Resurfacing will help protect these parts of the network. There are vulnerable seals and if not treated will lead to premature pavement failure.
					Primary Collector	44.5	19.6	23.8	Continued programme of sealing old first coats	
					Secondary Collector	80.7	104.3	90.7	Continuing catch up on first coat seals from previous plan with decreasing programme over the period of this plan.	
					Access	30.5	45.3	22.2	As above	
					Low Volume	8.3	22.4	16.4		
					Network (Total) =>6%	163lnkm/ 9%	191lnkm/ 11%	157lnkm/ 9%		

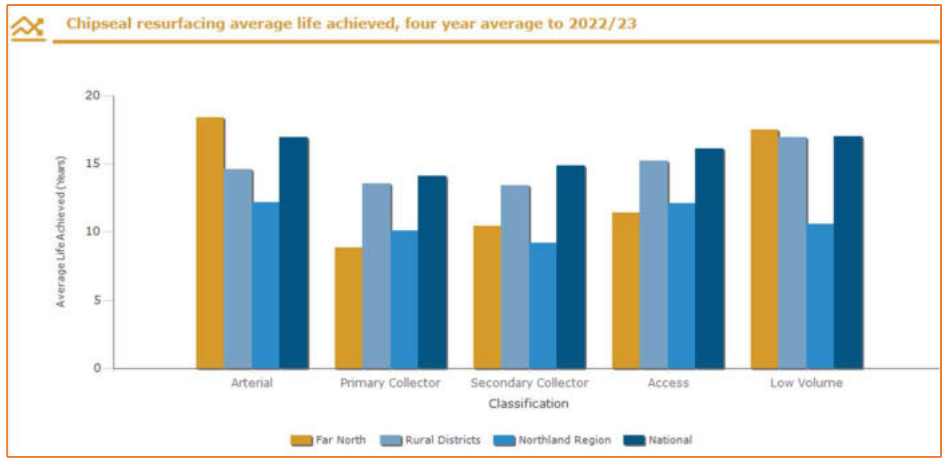
Peer group comparative shows that for FNDC less resurfacing of Arterial, Primary Collector and Low Volume is being undertaken. The FNDC programme on average is under delivering on the requirements of protecting the network and compared with its peers. The programme over the last 4 years has been significantly impacted by budget constraints and has had to focus in on the Secondary network, which represents 55% of the sealed network length.

Chipseal Resurfacing – 2024-27



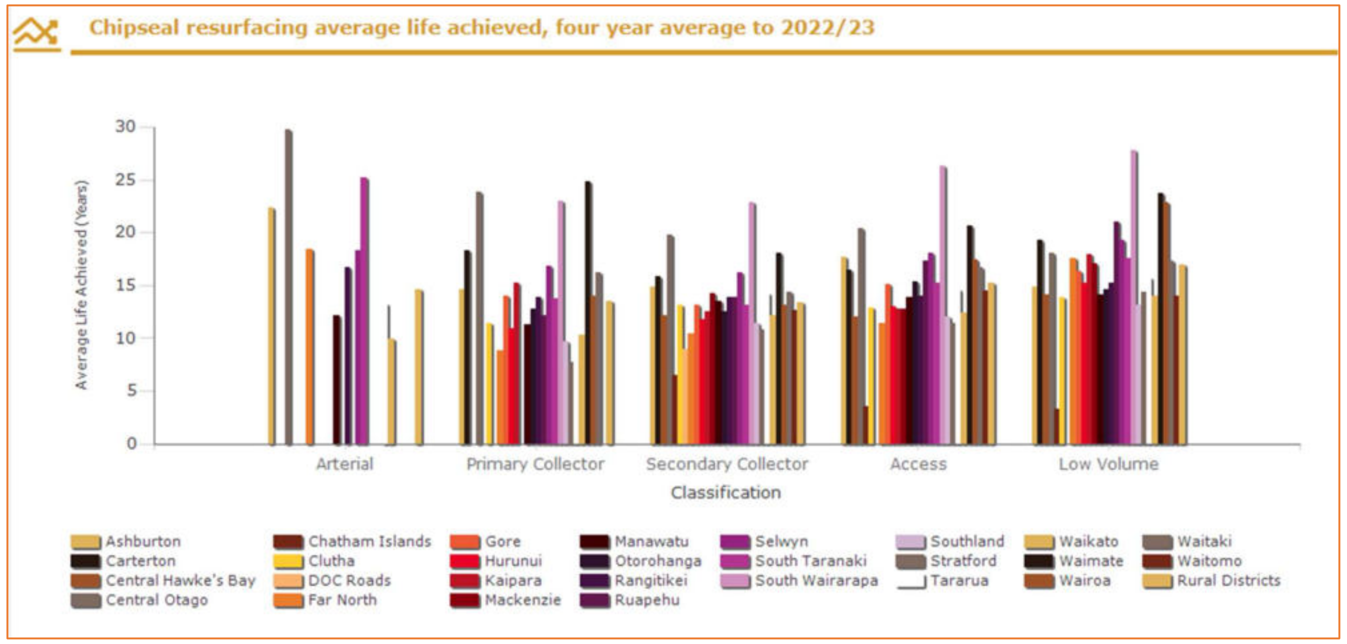
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
FNDC **Cost Efficiency - Chipseal Average Life Achieved**	Cost Efficiency	Efficiency Measure	EM	Chipseal Resurfacing - Average life achieved	Arterial	10	10	10	Targeted against the surface life analysis of the network and validated	GAP - Pre-surface cost $/km starting to rise associated with preparing first coat site for second coats. This would also appear to be in relation to resurfacing unstable areas of the network and investment to correct through maintenance is significant. Response – Deliver the programme as derived to continue to achieve average life profile and protect the network from escalating maintenance costs.
					Primary Collector	12	12	12	As above	
					Secondary Collector	12	12	12	As above	
					Access	13	13	13	As above	
					Low Volume	14	14	14	As above	
					Network (Avg)	13	13	13	This is the theoretical average life and, on the whole, will be achieved given the programme	

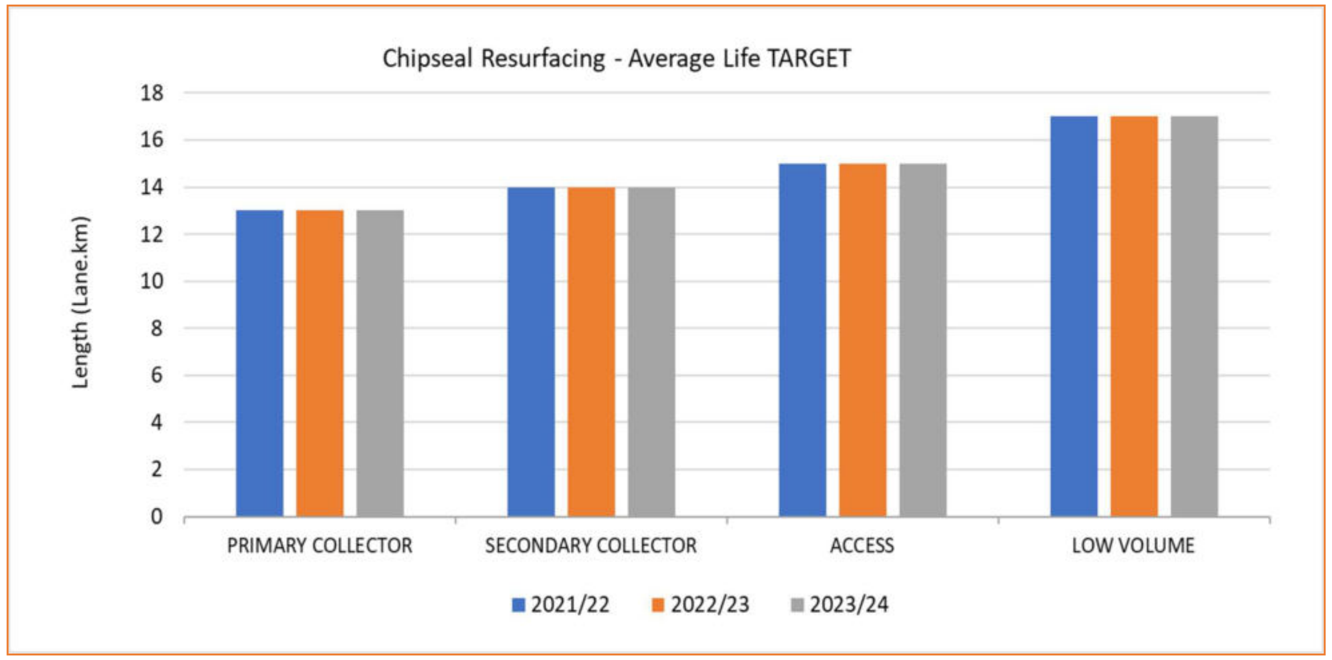
Comparatively FNDC compare well with the average life achieved (yellow bars) as they are sitting within the in average range of the peer. There is slight increase in the average life targets.



Chipseal Return Life Cycle of Proposed Programme

Class C	ONRC	2024/25	2025/26	2026/27	Average
5	ARTERIAL	0	0	7	2
4	PRIMARY COLLECTOR	6	14	11	10
3	SECONDARY COLLECTOR	12	9	11	11
2	ACCESS	11	7	15	11
1	LOW VOLUME	24	9	12	15
	Average	**11**	**10**	**12**	**11**

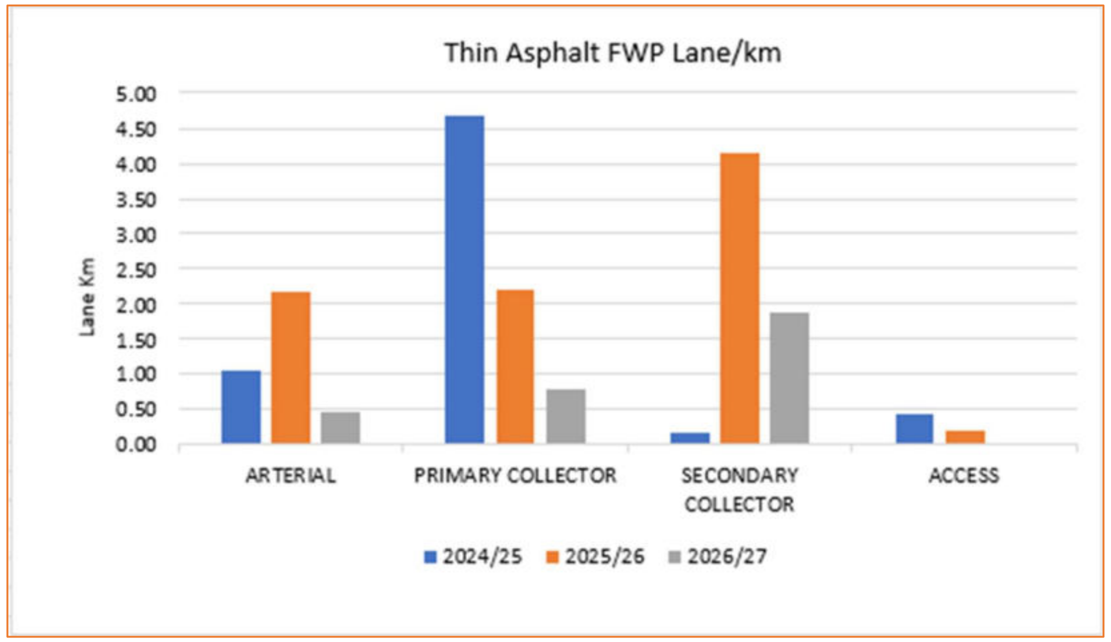


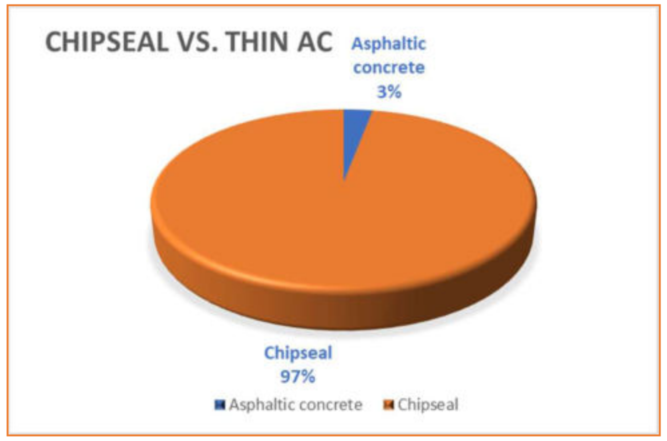


Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
FNDC **Cost Efficiency - Asphalt Lane/km**	Cost Efficiency	Efficiency Measure	EM	Asphalt Resurfacing Quantity - lane km	Arterial	1.06	2.18	0.48	Urban high value amenity area	GAP – Poor condition old urban CBD and Rural high stress corners failing. Response - This programme focuses on the urban high volume network. There are some isolated rural sites that are for high stress tight corners which are mostly on the roads on the east coast leading out to coastal areas.
					Primary Collector	4.69	2.22	0.81	Urban high value amenity area	
					Secondary Collector	0.16	4.14	1.87	Urban high value amenity area	
					Access	0.44	0.21		High stress rural corners	
					Low Volume	6.35	8.75	3.16		
					Network (Total)	1.06	2.18	0.48		

FNDC have 26km of thin asphalt on the network. Over the last few years, the focus has been on chipseal resurfacing. However, going forward there is a requirement to renew thin asphalt surfaces. This is becoming a priority in the current and future programmes to maintain the integrity of these surfaces and the underlying pavement as well as avoid costly maintenance and customer impacts. These are generally high amenity value sites in the central business district area of, Kaitaia, Kerikeri, Pihia and Kaikohe.ing

Asphalt Resurfacing – 2024-27

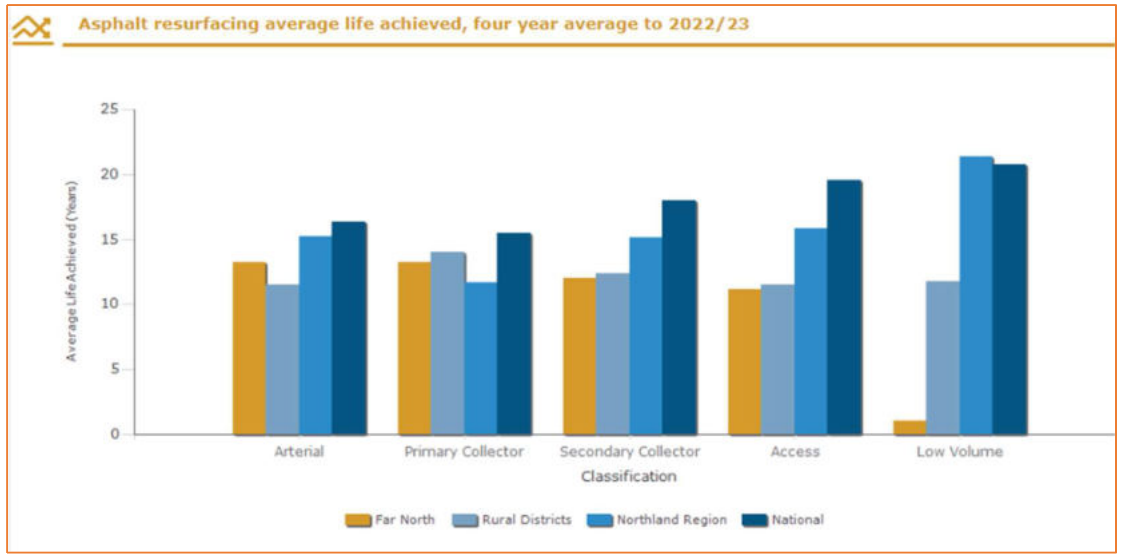


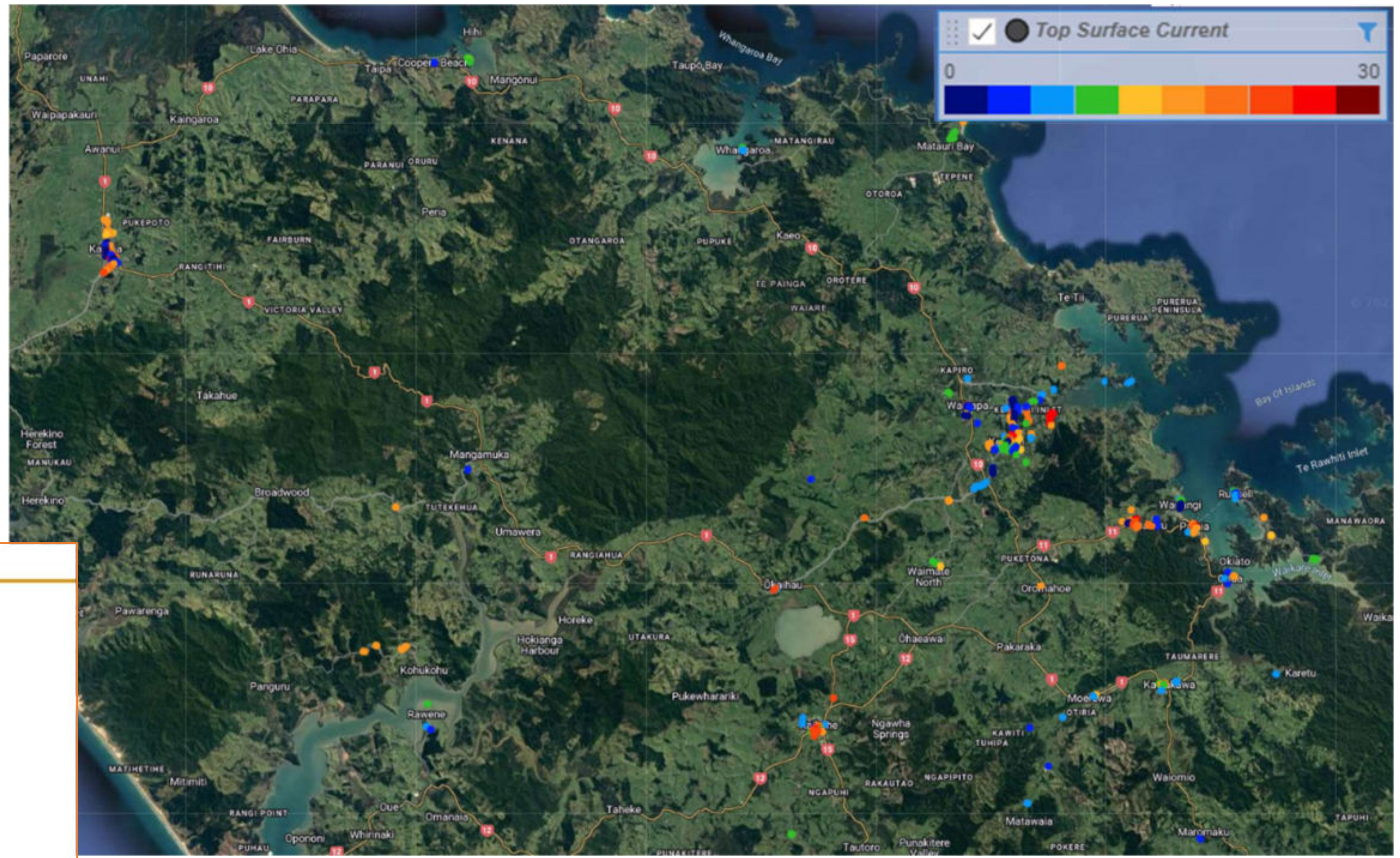


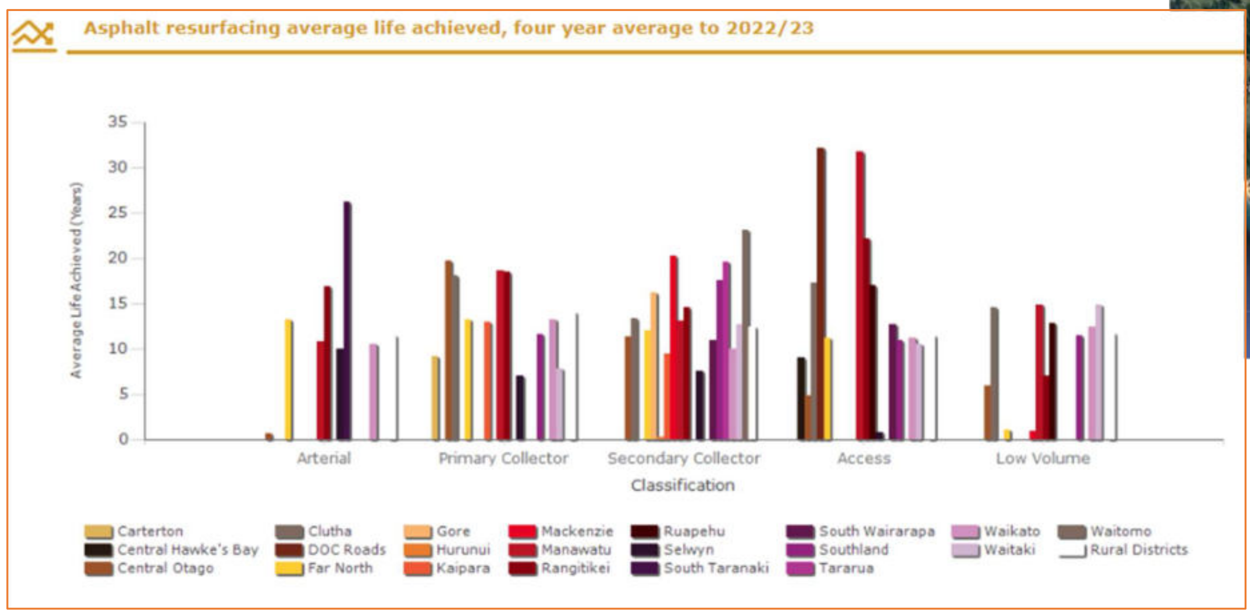
Surface Type	Length (m)
Asphaltic concrete	26279
Chipseal	869281
Grand Total	**895560**

Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
FNDC **Cost Efficiency - Asphalt Average Life Achieved**	Cost Efficiency	Efficiency Measure	EM	Asphalt Resurfacing - Average life achieved	Arterial	12	12	12	.	GAP – Emerging TAC requirement needs to be managed to ensure no impact on overall programme into the future. Response –Identified programme of surfacing that starts to deal with old poor condition TAC surfaces. As can be seen below, the bulk of the TAC surfaces are greater than 12 years old now.
					Primary Collector	14	14	14	No issue identified	
					Secondary Collector	16	16	16		
					Access	17	17	17		
					Low Volume	19	19	19	Cul-de-sac heads and rural TAC corners	
					Network (Avg)	16	16	16		

Yellow bar shows the Far North DC current achievement against the peer group. Several observations can made. FNDC does not fit well with peer group for the arterial and primary networks given limited data. FNDC have very old thin AC surface on the network and therefore have not in general replaced a lot of Thin AC surfaces on the network. At this stage the programme has been validated fully over the last number of years and is growing concern from a funding point of view. Efforts have been made to engineer TAC out of the network rather than replace like for like.





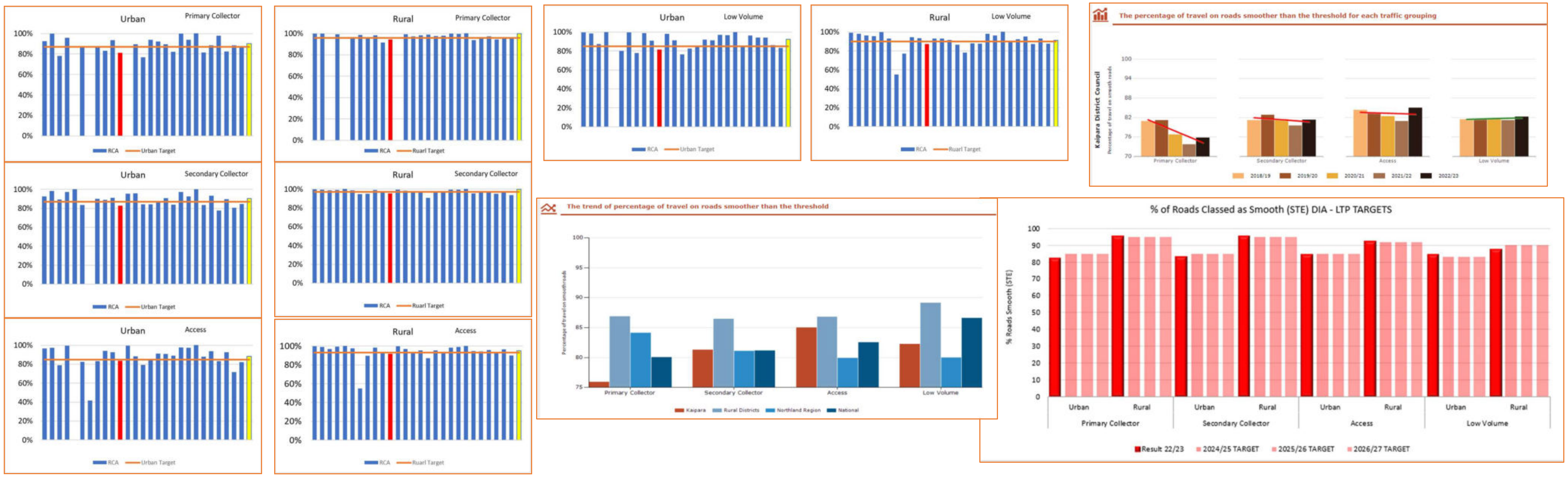


Age Profile Thin AC Surfaces

5.7.2 KDC Desired Levels of Service

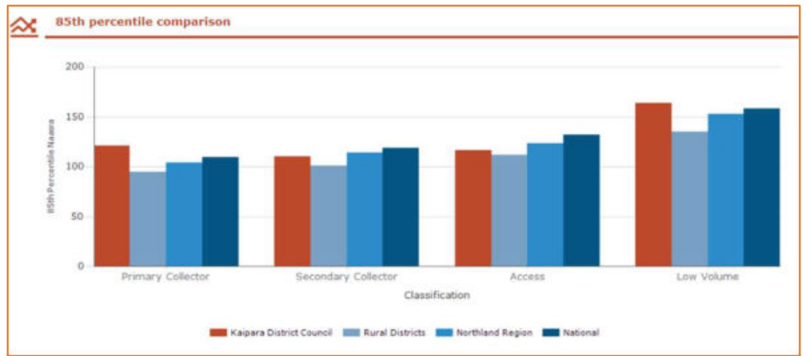
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	Urban Rural	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis / Peer Group Comparison	GAP / Response
KDC **Amenity - Smooth Travel Sealed Roads**	Amenity	Customer Outcome	OM1, LTP	The % of Roads Classed as Smooth (STE) DIA	Arterial	Urban	N/A	N/A	N/A		GAP – There has been a decrease in smooth 4 years. Response - The key focus is on maintaining safe smooth ride in the high speed rural environments especially in the Primary and Secondary portion of the network, which represents 66 % of the sealed network. This will mean continued investment level in pavement rehabilitation at slightly elevated levels and resilience work.
						Rural	N/A	N/A	N/A		
					Primary Collector	Urban	85	85	85	The peer group average is 90%. A target of 85% has been set against a current achievement of 81%.	
						Rural	95	95	95	Target has been set 99% against an achievement of 95%. Trend has shown a steady reduction, and this now needs to be held steady to maintain a safe ride. This target is in keeping with majority of the peer group.	
					Secondary Collector	Urban	85	85	85	Target of 85% against an achievement of 83%. This looks to now arrest further decline and maintain a reasonable Customer LoS.	
						Rural	95	95	95	Target of 95% against an achievement of 95%. As noted above.	
					Access	Urban	85	85	85	Access and Low Volume are increased slightly to continue to provide a safe smooth travel environment.	
						Rural	92	92	92		
					Low Volume	Urban	83	83	83		
						Rural	90	90	90		
					Network Average (Target >=)	All	88	88	88		

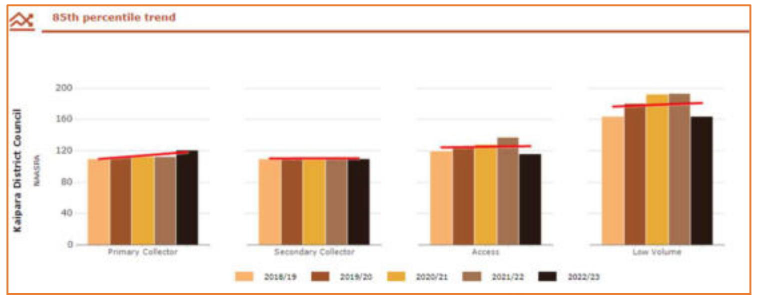
Yellow bar shows the peer group average the red bar is Kaipara DC current achievement. The Orange line is the target being set in relation to peer group average and the peer group as whole. A number of key issue can be observed; 1. Kaipara DC features poorly against all comparative groups; 2. Kaipara DC STE across ONRC has been reducing over the term of the last LTP for Primary and Secondary roads.

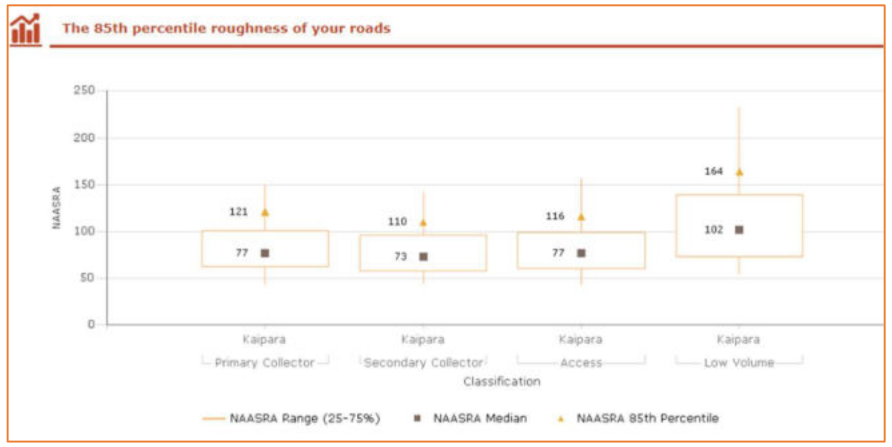


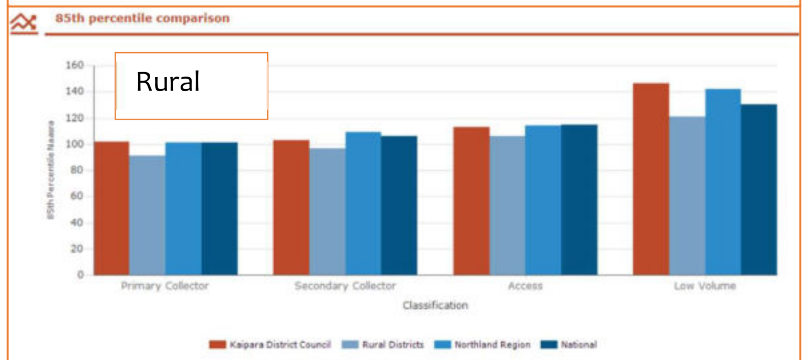
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	Urban Rural	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis / Peer Group Comparison	GAP / Response
KDC **Amenity - Peak Roughness**	Amenity	Technical Output	PM1	Peak Roughness (85th%)/ Ride comfort	Arterial	Urban	N/A	N/A	N/A		GAP - KDC is above the peer group peak rough across the board. The Primary and Secondary are deteriorating in relation to peer group year on year becoming rougher. This reflects the STE outcome. Geology vulnerable to water is a related symptom to peak roughness. Response – Continue with Rehabilitation as set and fund along with targeted peak roughness programmes to address the issue, such as resilience.
						Rural	N/A	N/A	N/A		
					Primary Collector	Urban	120	120	120	Set at peer group. Current achievement well above peer group and deteriorating.	
						Rural	90	90	90	As Above	
					Secondary Collector	Urban	140	140	140	As Above	
						Rural	95	95	95	As above	
					Access	Urban	145	145	145	As above	
						Rural	110	110	110	As above	
					Low Volume	Urban	165	165	165	As above	
						Rural	125	125	125	As above	

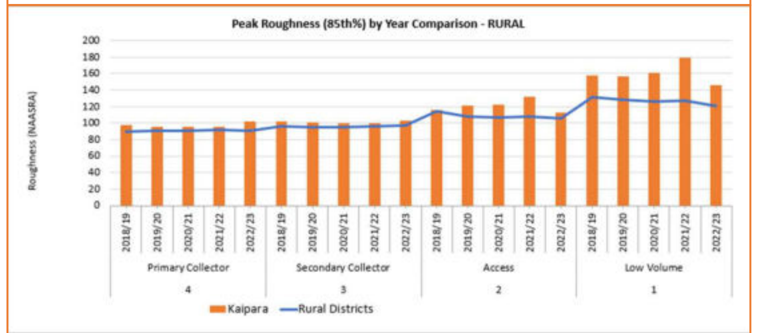
Kaipara DC peek roughness is above peer group across the board in all classes. The Primary and Secondary networks have been in state of deterioration over the last LTP period. Low Volume network has moved significantly out of step with peer group, rural.

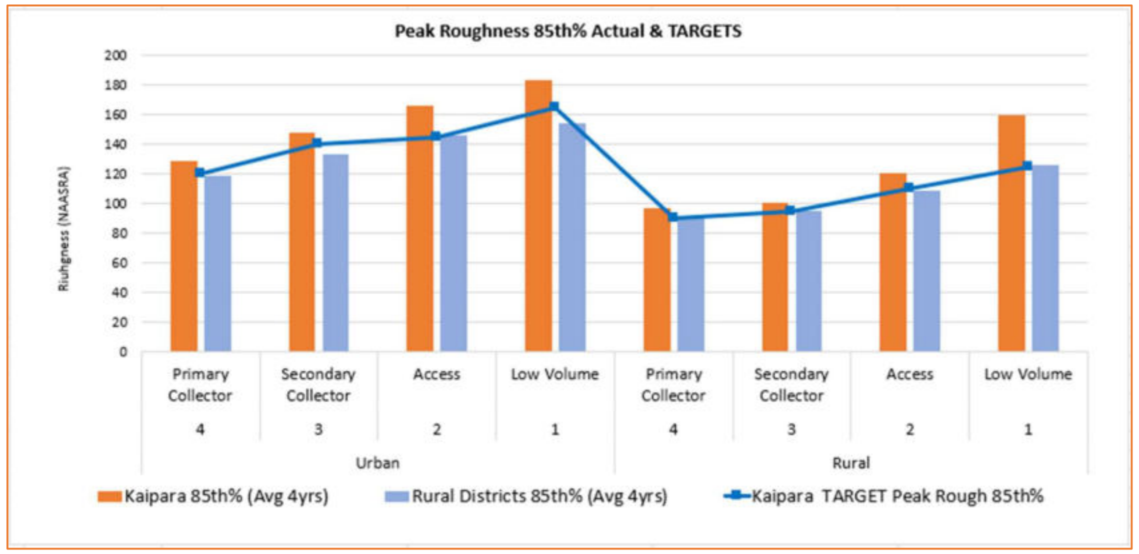


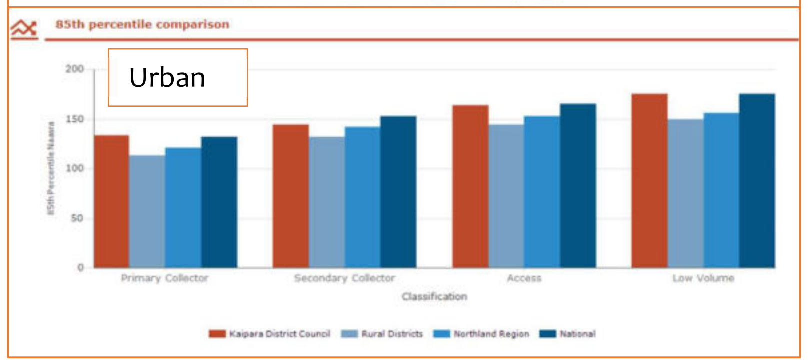


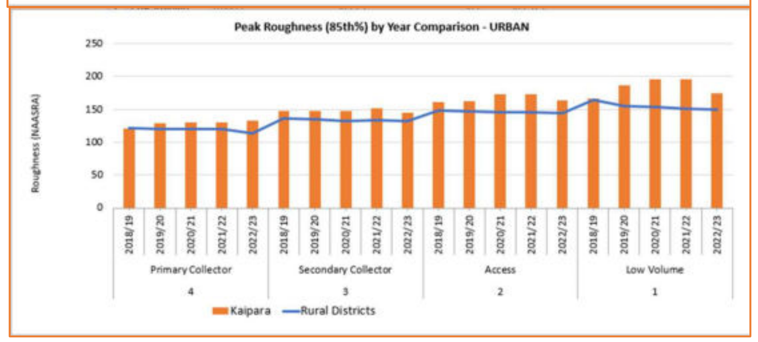






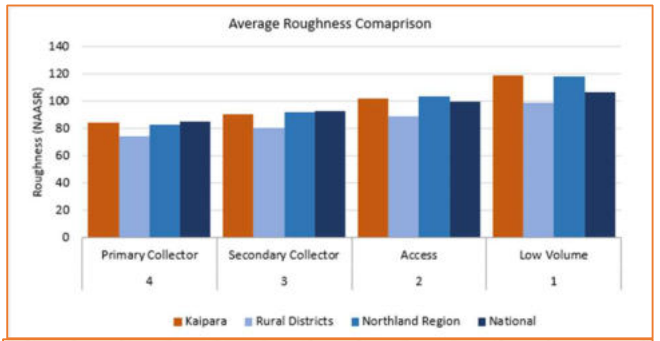


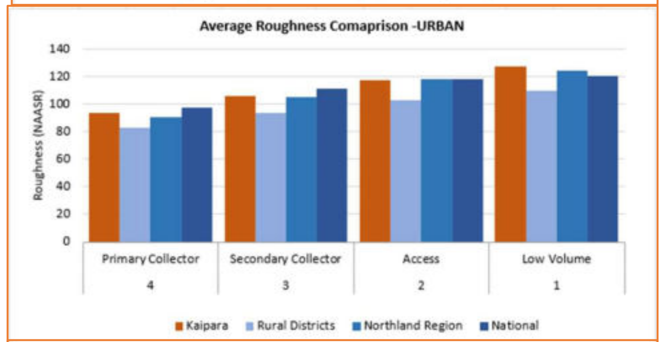


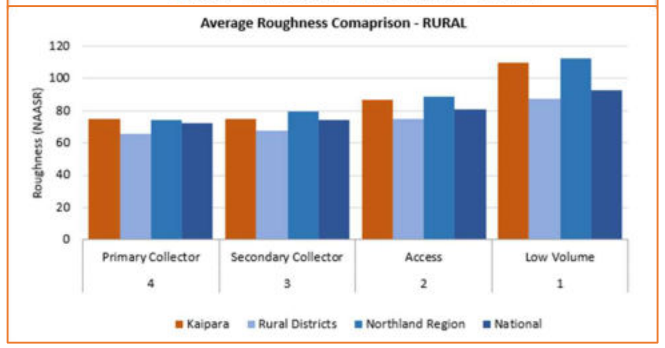


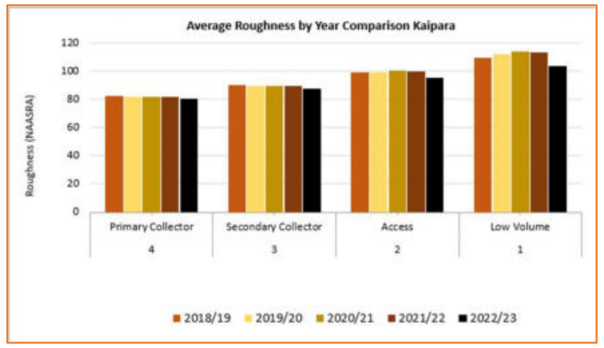
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	Urban Rural	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis / Peer Group Comparison	GAP / Response
KDC **Amenity - Average Roughness**	Amenity	Customer Outcome	OM2	Average Roughness	Arterial	Urban	N/A	N/A	N/A		GAP – KDC network is above the peer group across all road classes. The most significant gap is on Access/Low Volume network. The trend for KDC has continued to deteriorate year on year on the Primary and Secondary Collectors. Response – Deliver rehab programme as developed to maintain ride comfort for the Primary and Secondary Collector network. There is adjustment required on the Access and Low Volume classes, this is naturally occurring as pavement start to fail and become expensive to maintain/seal. This should have an impact on reducing DSI and peak rough/STE.
						Rural	N/A	N/A	N/A		
					Primary Collector	Urban	90	90	90	Maintain target to keep steady state	
						Rural	70	70	70	Small reduction in target to maintain steady state	
					Secondary Collector	Urban	100	100	100	KDC one of highest in peer group. Reduce target to help manage peak roughness	
						Rural	75	75	75	As above	
					Access	Urban	110	110	110	As above	
						Rural	85	85	85	As above	
					Low Volume	Urban	115	115	115	As above	
						Rural	100	100	100	As above	
					Network (Average)	All	93	93	93		

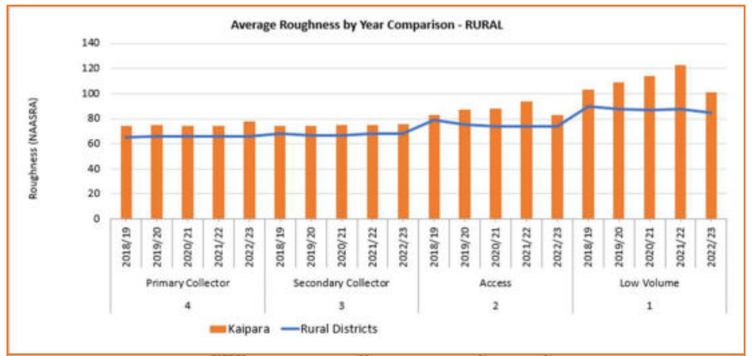
In comparison KDC has higher roughness than the peer group. This is most apparent on the Rural Access and Low Volume network. Targets are being set against peer group to help reduce the overall average roughness to support the reduction in peak roughness and improvement in ride quality for STE.

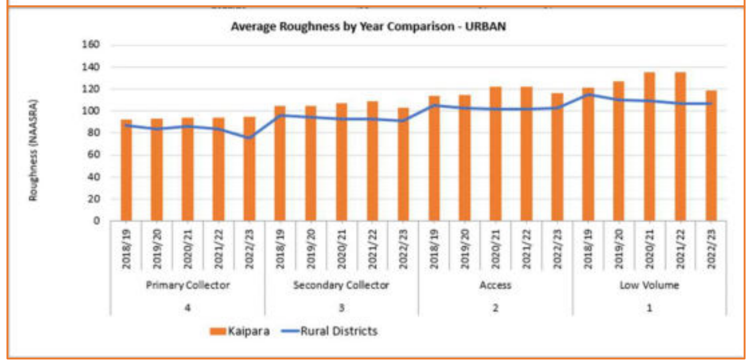


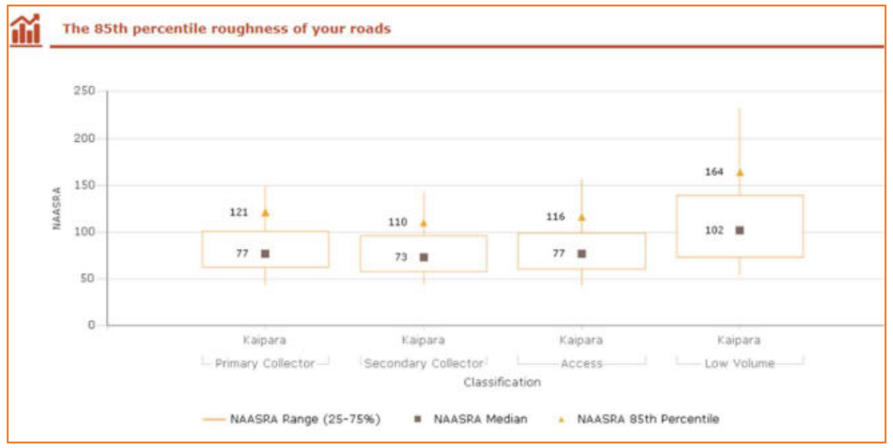


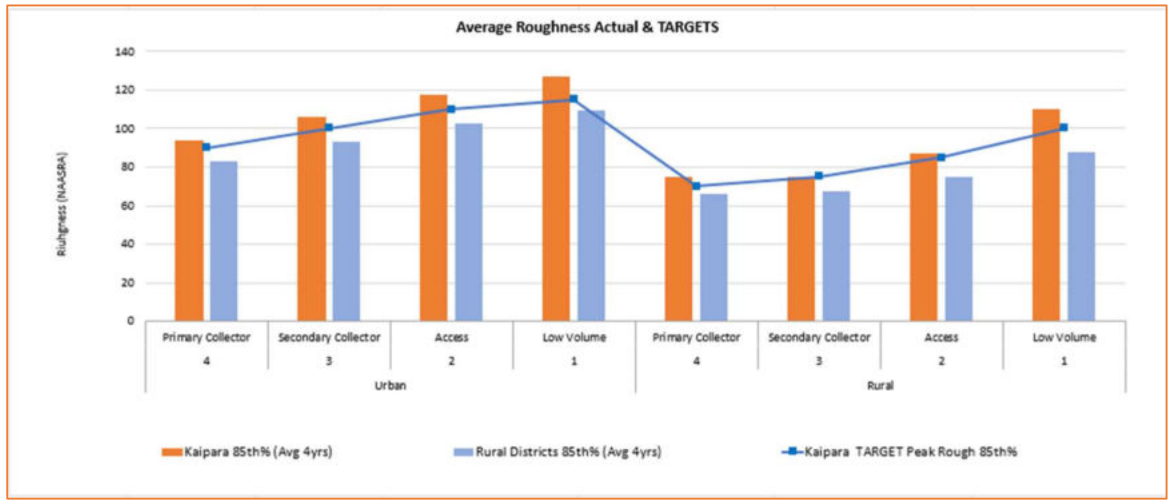








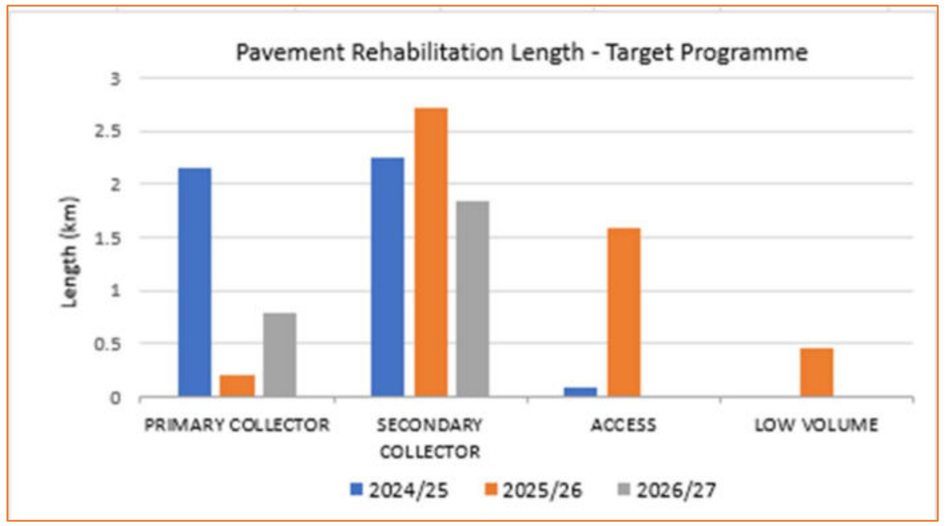




Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
KDC **Cost Efficiency – The percentage of the sealed local road network that is rehabilitated**	Pavement Rehabilitation - Cost Efficiency	Efficiency Measure	EM	Target to % of network	Arterial	N/A	N/A	N/A		This programme has been directed by several condition drivers, one of which is the customer ride comfort as set out under ONRC. Given that the network is exceeding roughness targets this is where 2024-27 programme is targeted to deliver on the customer outcome. With targeted ride issue on Primary, Secondary roads. This includes heavy industry routes which long and starting to fail.
					Primary Collector	3.58%	4.34%	2.95%	Loaded Rural roads and urban roads in poor condition	
					Secondary Collector	0.04%	0.66%	0.00%	Rural loaded ride quality	
					Access	0.00%	0.35%	0.00%	In response to peak roughness rural	
					Low Volume	0.96%	1.06%	0.56%	No works identified	
					Network (Total)>=0.4%	1.0% (4.5km)	1.1% (5km)	1.0% (4.6km)	On average 4.7 km/yr next three years.	

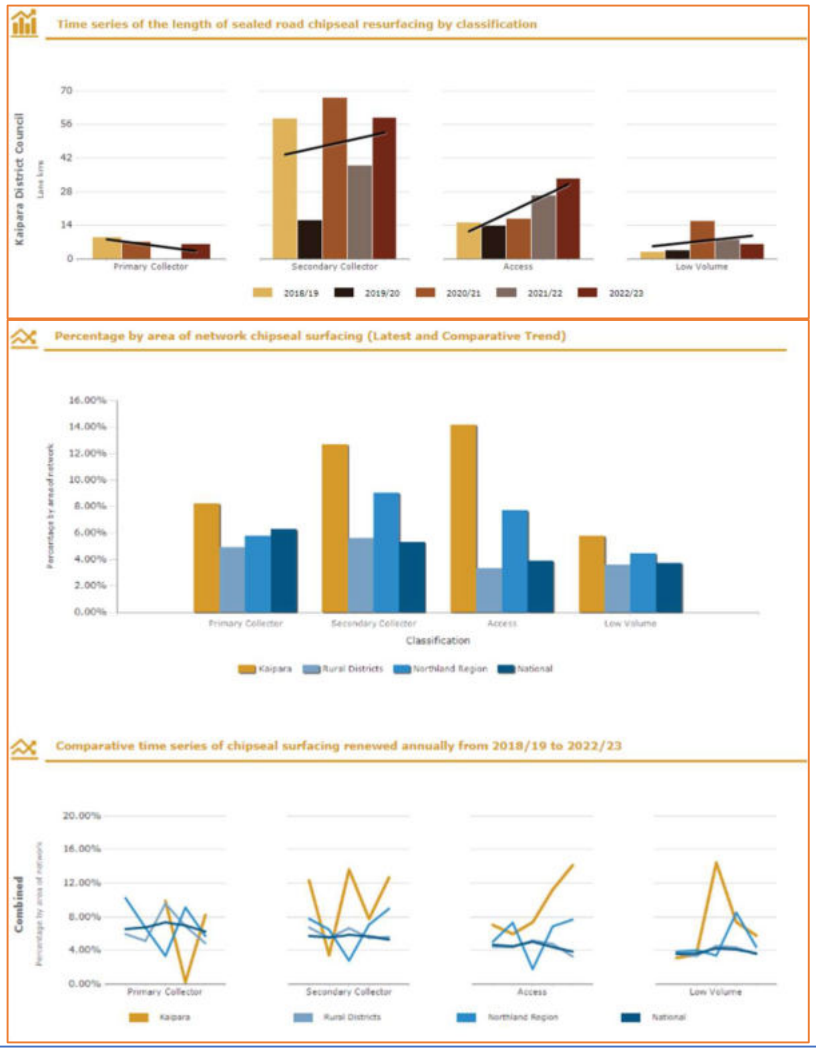
Comparative analysis shows KDC 5 year average at about 0.85% (bottom right NZTA report). This is out of step with what is now being achieved of around 0.5% or 2.2km/yr. The difference is due to a significant reduction in rehabilitations being undertaken from 2018 onward due to a change of strategy. The rehab programme is designed to target highly loaded rural pavements to maintain current performance and keep in check the deteriorating ride quality on rural network. Further reduction in rehabilitation programme would see continued deterioration in customer outcomes. Northland sub quality construction materials and sensitive geology continue to have an impact on ride quality of the network.

Pavement Renewal – 2024-2027

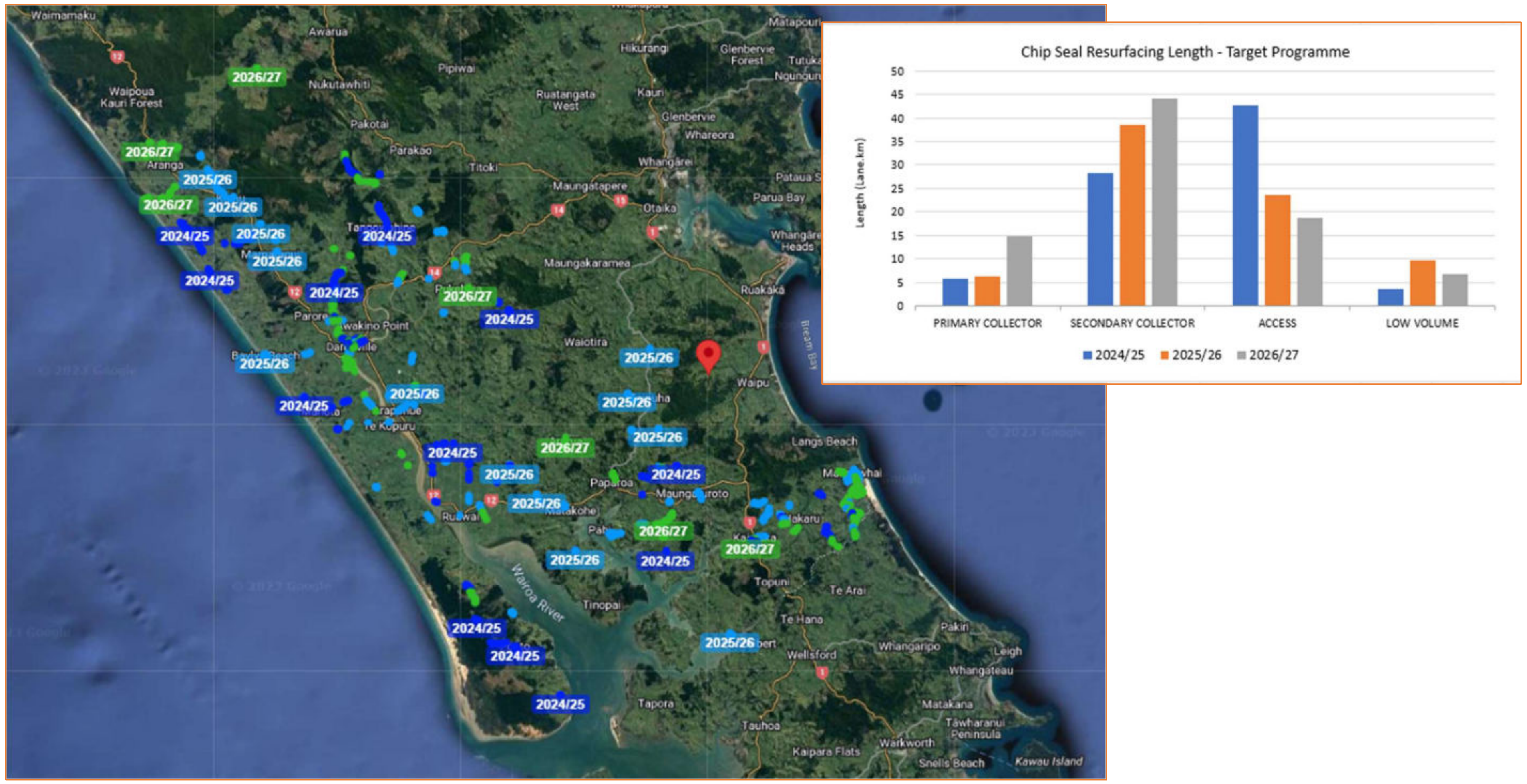


Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
KDC **Cost Efficiency - Chipseal Lane/km**	Chipseal - Cost Efficiency	Efficiency Measure	EM2(a)	Chipseal Resurfacing Quantity - lane km (DIA mandatory) expressed as both Ln.km and % of sealed Network	Arterial	N/A	N/A	N/A		GAP – Reducing Rehab programme Access/LV network. Old First coat seals on network. Response - Chipseal resurfacing programme is designed in response to the pavement renewal programme. No rehab for the LV. Resurfacing will help protect these parts of the network. The programme is clearly targeted at what is needed when it is needed as given by the how the quantities swing based on ONRC and year
					Primary Collector	5.83	6.31	14.70	Continued programme of sealing old first coats	
					Secondary Collector	28.27	38.50	44.12	Continuing catch up on first coat seals from previous plan with decreasing programme over the period of this plan.	
					Access	42.61	23.62	18.65	As above	
					Low Volume	3.64	9.61	6.64		
					Network (Total) =>8%	80.6lnkm/ 9%	78lnkm/ 8%	84lnkm/ 9%	Catch up on Second Coat seals	

Peer group comparative for the shows that for KDC are below the peer group achievement for the Primary and Secondary Collector network. In terms of Secondary and below there has been a targeted programme of removing a significant amount of old first coat seals from the network.

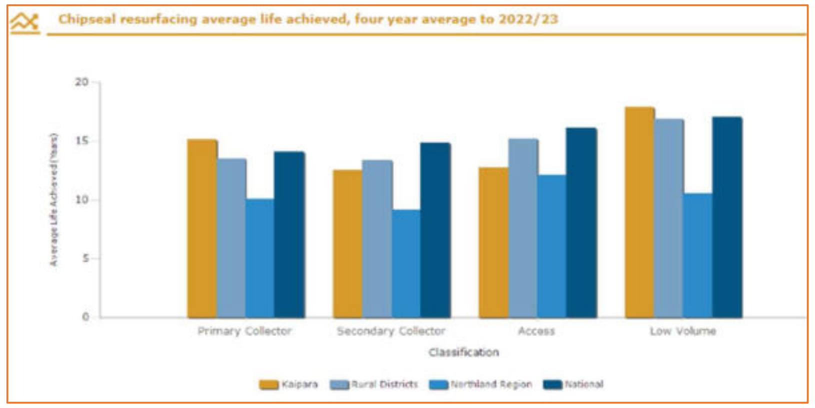


Chipseal Resurfacing – 2024-2027



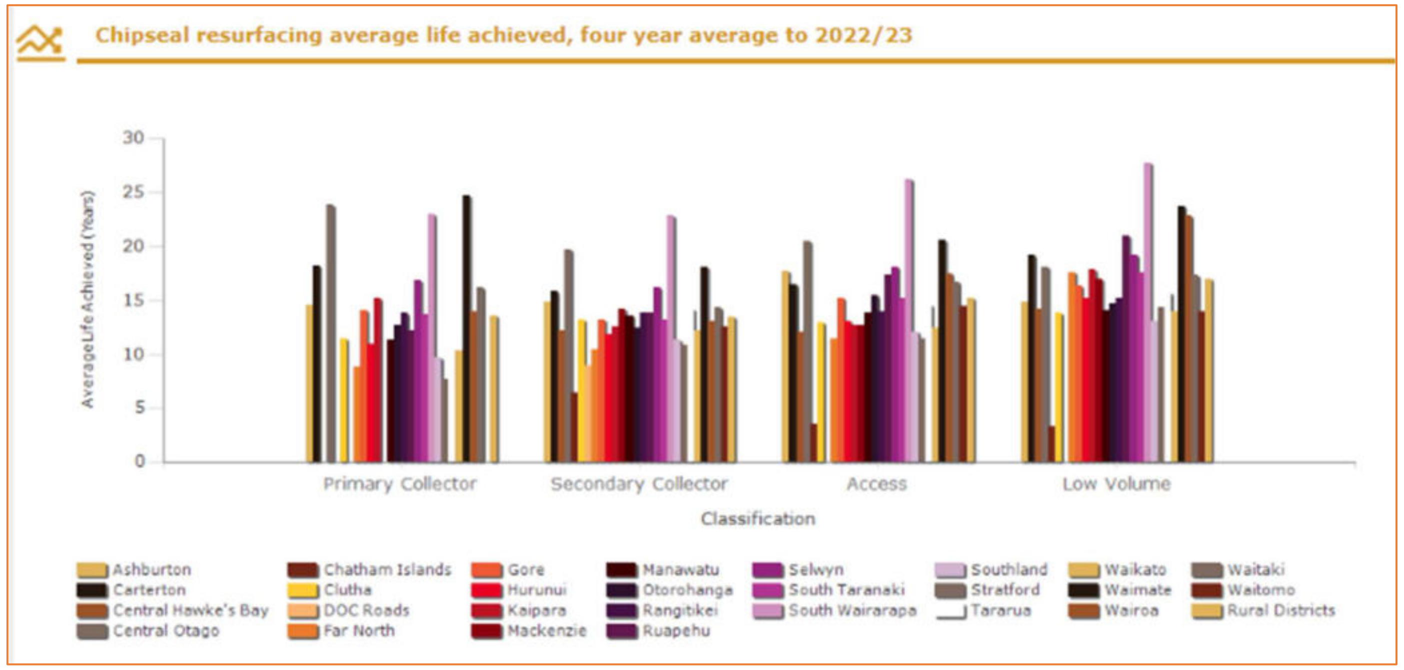
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
KDC **Cost Efficiency - Chipseal Average Life Achieved**	Cost Efficiency	Efficiency Measure	EM	Chipseal Resurfacing - Average life achieved	Arterial	N/A	N/A	N/A		GAP - Continue to treat old first coats on the network. Pre-surface cost $/km starting to rise associated with preparing first coat site for second coats. Response - The previous plan focused on sealing vulnerable surfaces, first coats. It maybe that this issue identified 3 years ago is impacting pre-surface repair cost. This continues to be the strategy for the first year of this plan as set above. A significant programme reduction in 19/20 has also had impact on delivery.
					Primary Collector	12	12	12	Maintain current targets	
					Secondary Collector	13	13	13		
					Access	15	15	15		
					Low Volume	15	15	15		
					Network (Avg)	13	13	13		

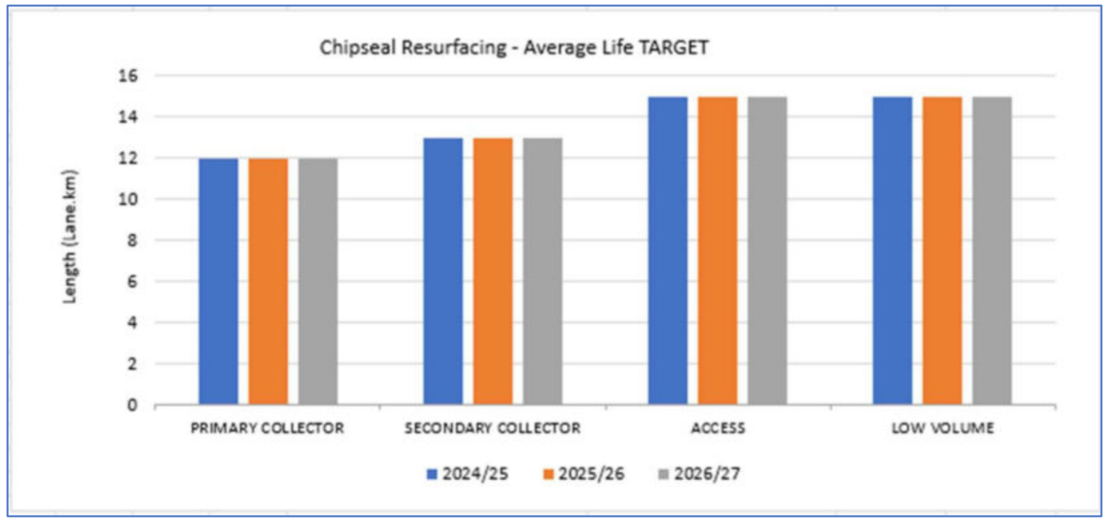
Comparatively KDC compare poorly with the average life achieved, yellow bars, with lower chip seal life achieved across the all classes. This maybe due to the focus over the past 2 years on addressing short life first coat seals. There is no change to the targets however, due to issue noted under surfacing achievement the actual programme year on year will show some low average return life cycles. At the end of the end of this plan the average return cycle will be generally aligned to these targets.



Chipseal Return Life Cycle of Proposed Programme

Class C	ONRC	2024/25	2025/26	2026/27	Average
5	ARTERIAL	0	0	0	0
4	PRIMARY COLLECTOR	22	20	9	17
3	SECONDARY COLLECTOR	17	13	11	14
2	ACCESS	6	11	14	10
1	LOW VOLUME	16	7	10	11
	Average	**12**	**12**	**11**	**12**

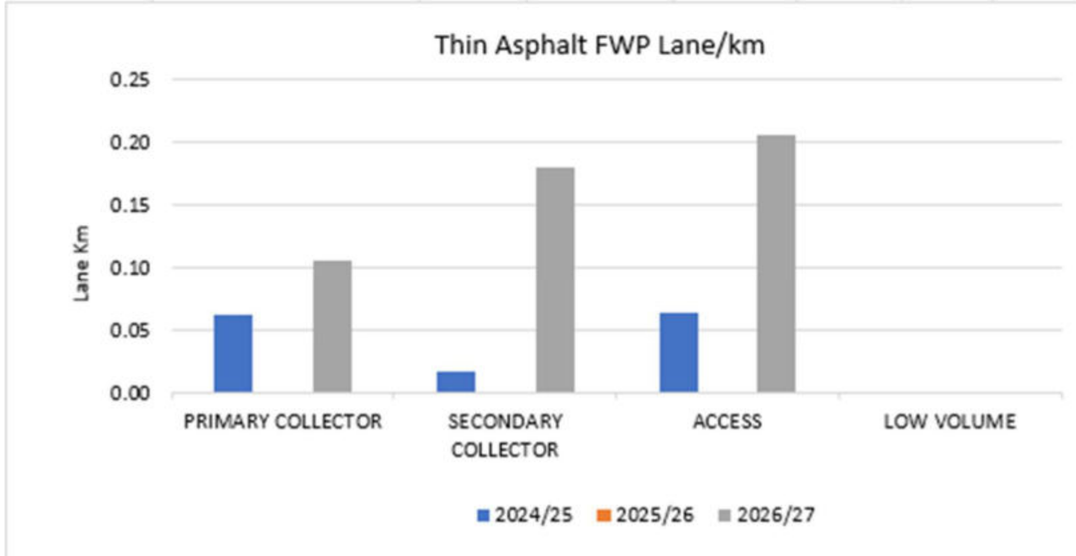


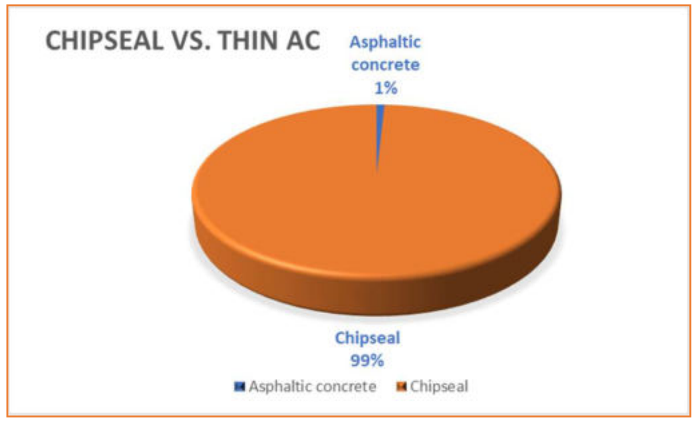


Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
KDC **Cost Efficiency - Asphalt Lane/km**	Cost Efficiency	Efficiency Measure	EM	Asphalt Resurfacing Quantity - lane km	Arterial					GAP – Poor condition old urban CBD and Rural high stress corners failing. Response - This programme focuses on the urban high volume network. There are some isolated rural sites that are for high stress tight corners.
					Primary Collector	0.06		0.11	Urban high value amenity area	
					Secondary Collector	0.02		0.18	Urban high value amenity area	
					Access	0.06		0.21	High stress rural corners	
					Low Volume					
					Network (Total)	0.14		0.49		

KDC have a small thin asphalt network. Over the last few years the focus has been on second coats resurfacing of first coats. However, going forward there is requirement to start to renew thin asphalt surfaces. These are generally high amenity value sites in central shopping area of Mangawhia and Dargaville, and high stress rural corners where chipseal has proven not to work in these instances, usually associated with the forestry network. The programme is very modest but is set in terms of need in locations considering factor such as, amenity value, high profile customer areas.

Asphalt Resurfacing – 2021-24

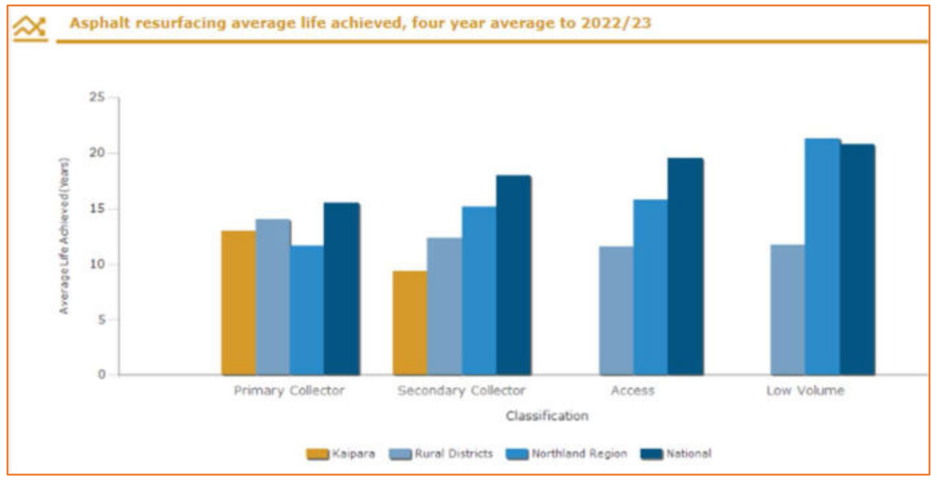


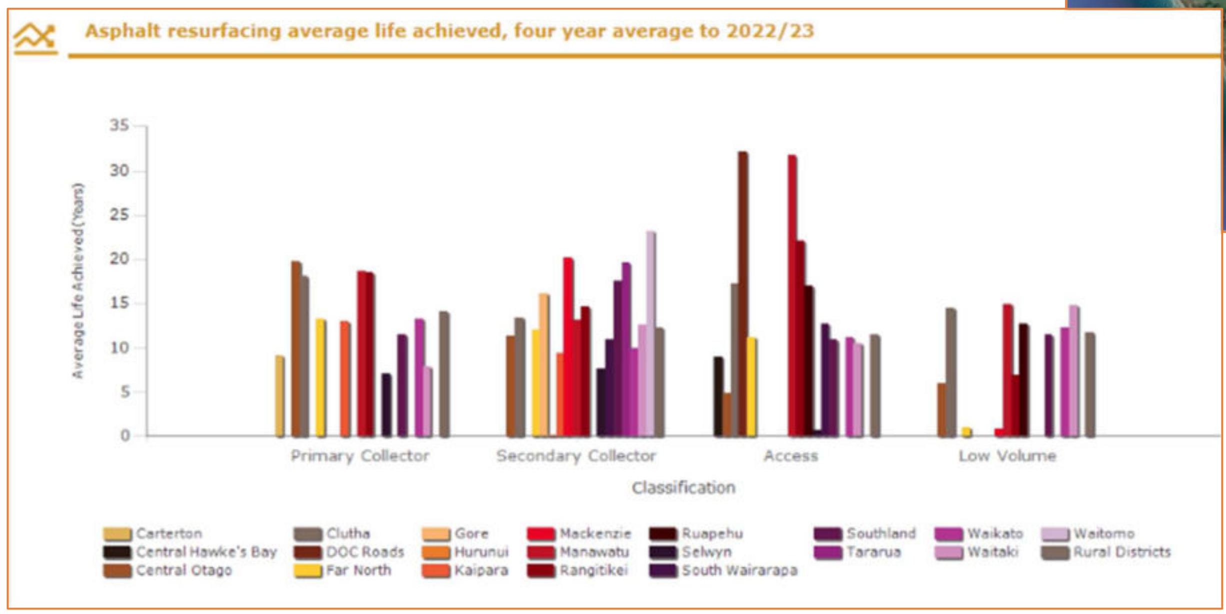


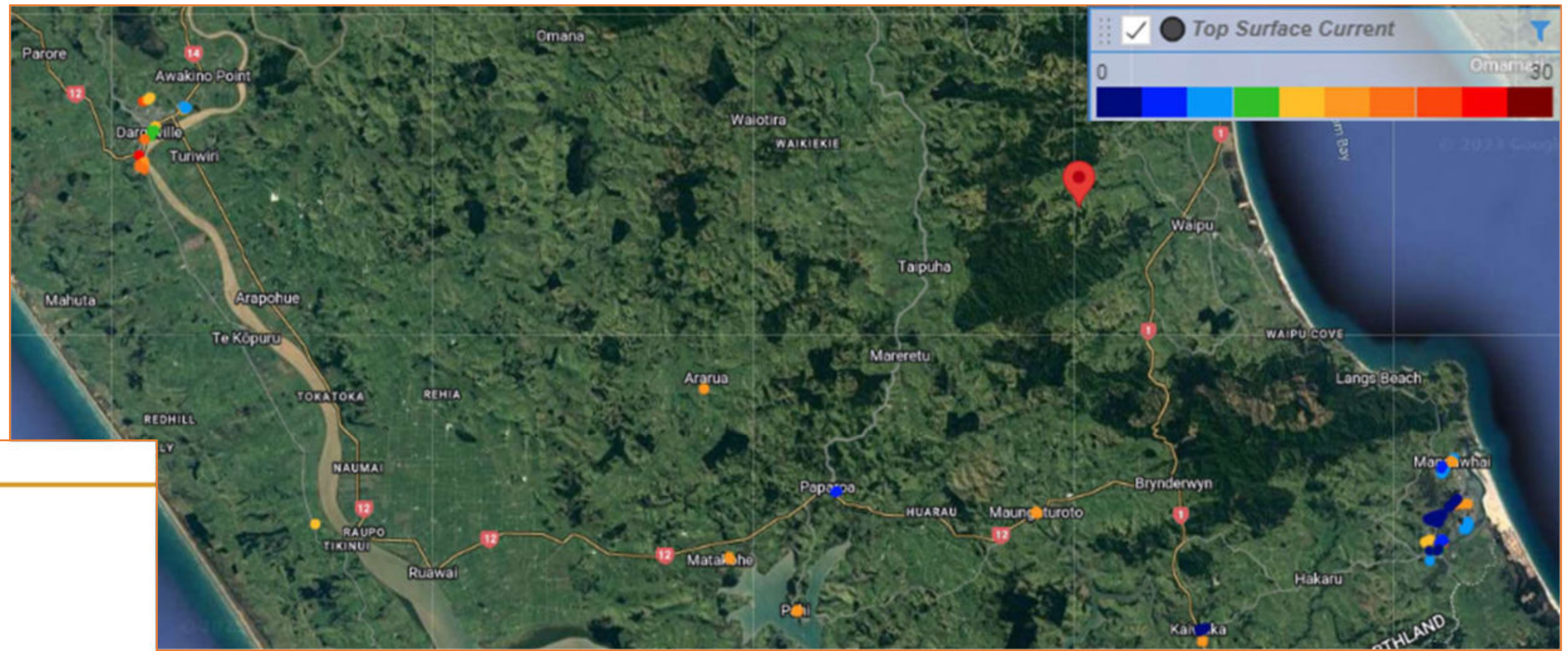
Surface Type	Length (m)
Asphaltic concrete	3890
Chipseal	458998
Grand Total	**462888**

Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
KDC **Cost Efficiency - Asphalt Average Life Achieved**	Cost Efficiency	Efficiency Measure	EM	Asphalt Resurfacing - Average life achieved	Arterial	N/A	N/A	N/A	.	GAP – Emerging TAC requirement needs to be managed to ensure no impact on overall programme into the future. Response –Identified programme of surfacing that starts to deal with old poor condition TAC surfaces. As can be seen below the bulk of the TAC surfaces in in the greater than 12 years old now.
					Primary Collector	13	13	13	No issue identified	
					Secondary Collector	15	15	15		
					Access	17	17	17		
					Low Volume	17	17	17	Cul-de-sac heads and rural TAC corners	
					Network (Avg)	15	15	15		

Several observations can made. KDC is stretching the life of its TAC surfacing on its Primary Collectors compared to the other networks, but are achieving less life out of their Secondary Collectors. It should be noted that KDC has a very small amount of TAC surfacing. However with development work and capacity projects in Mangwhai the content is growing.





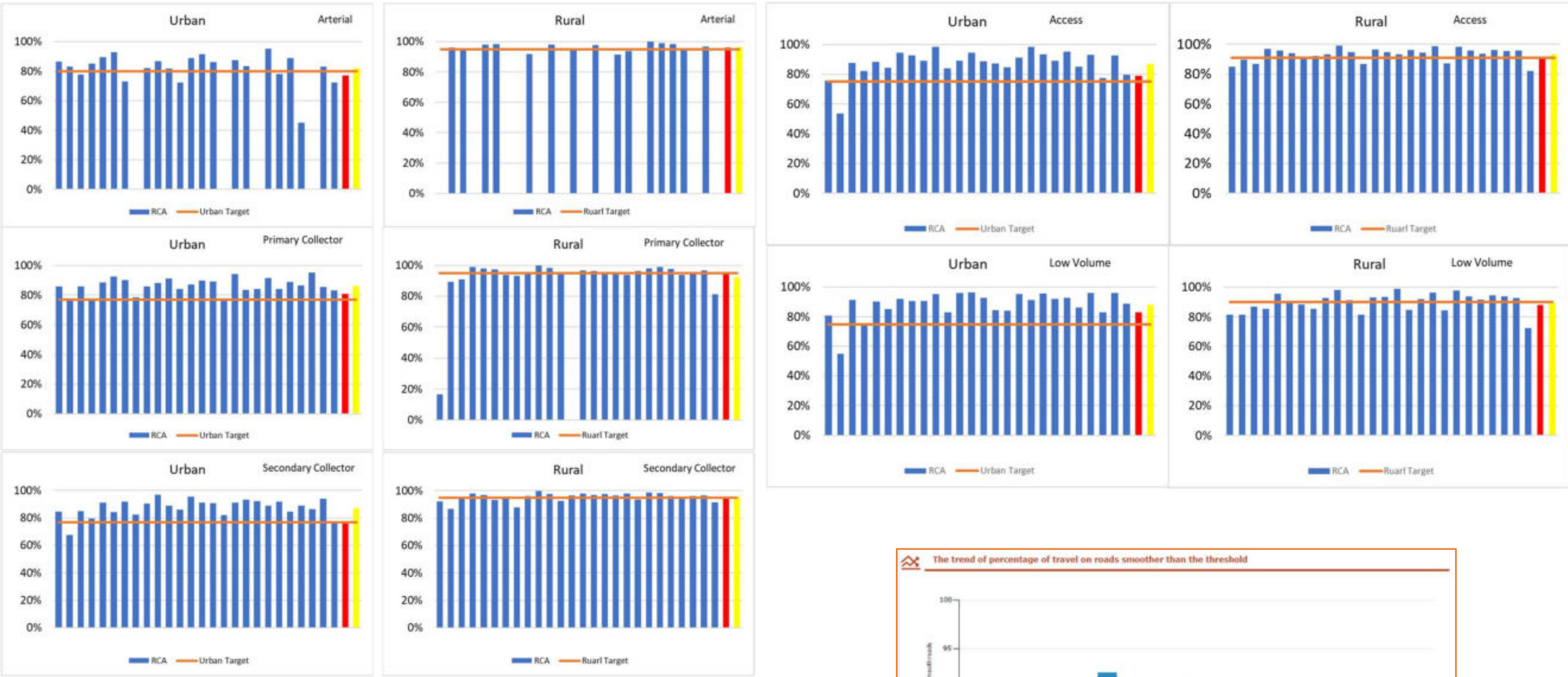


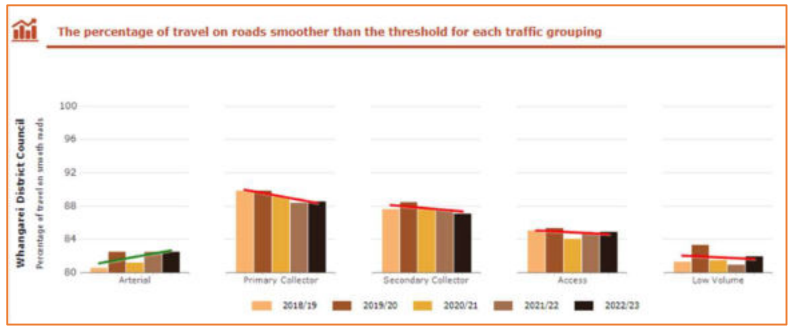
Age Profile Thin AC Surfaces

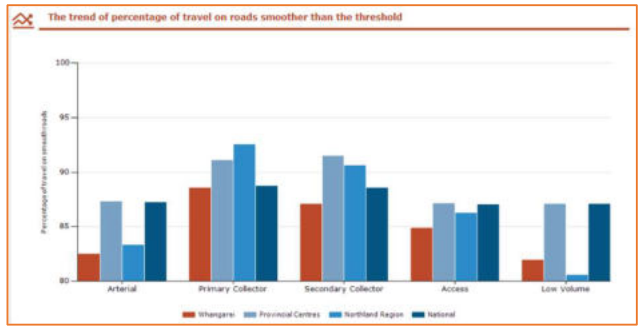
5.7.3 WDC Desired Levels of Service

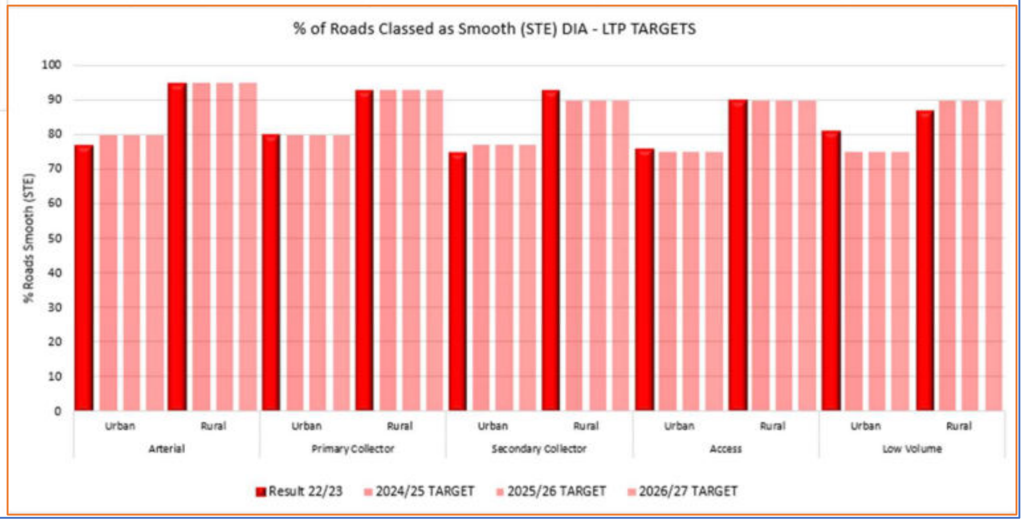
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	Urban Rural	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis / Peer Group Comparison	GAP / Response
WDC **Amenity - Smooth Travel Sealed Roads**	Amenity	Customer Outcome	OM1, LTP	The % of Roads Classed as Smooth (STE) DIA	Arterial	Urban	80	80	80	Peer group average is 81% smooth, WDC is set at 80% for this LTP. Achievement was 77% indicates a slip in condition.	GAP – specific gap exists for STE. This is more a revision of achievement and resetting targets to reflect achievement and in some cases reduce STE according to the environment.. Response - The key focus is on maintaining safe smooth ride in the high speed rural environments especially in the Primary and Secondary portion of the network.
						Rural	95	95	95	Based on peer group a target of 96% has been set against a current achievement of 95%. Key issue is maintaining a smooth ride in high speed environment.	
					Primary Collector	Urban	80	80	80	The peer group average is 84%. A target of 80% has been set against a current achievement of 80%.	
						Rural	93	93	93	Target has been set 93% against an achievement of 93%. Trend has shown a steady reduction. This target is in keeping with majority of the peer group.	
					Secondary Collector	Urban	77	77	77	Target of 77% against an achievement of 75%. This keeps this network in steady from Customer LoS point of view.	
						Rural	90	90	90	Rural of 90% against an achievement of 93%.	
					Access	Urban	75	75	75	Access and Low Volume have reduced for the urban network that reflects LoS for the urban Low speed environments. Rural targets have been set at current delivery, again providing a safe smooth travel environment.	
						Rural	90	90	90		
					Low Volume	Urban	75	75	75		
						Rural	90	90	90		
					Network Average (Target >=)	All	84	84	84		

Yellow bar shows the peer group average the red bar is Whangarei DC current achievement. The Orange line is the target being set in relation to peer group average and the peer group as whole. A number of key issue can be observed; 1.



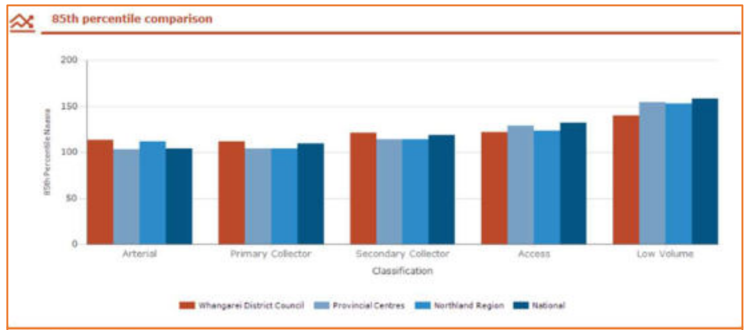


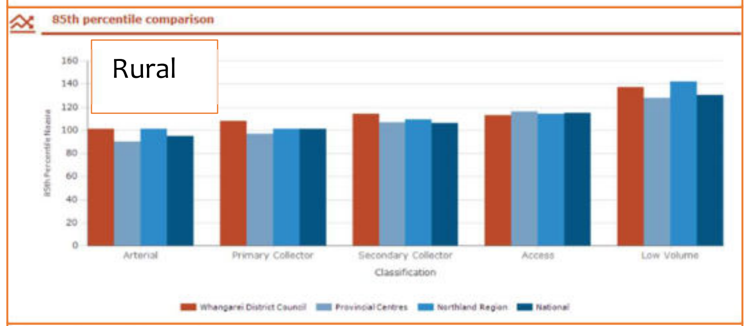


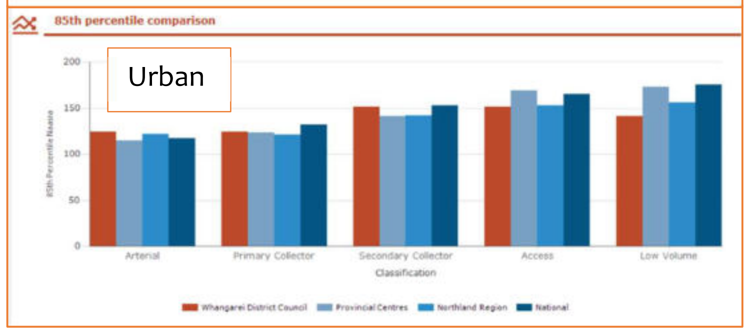


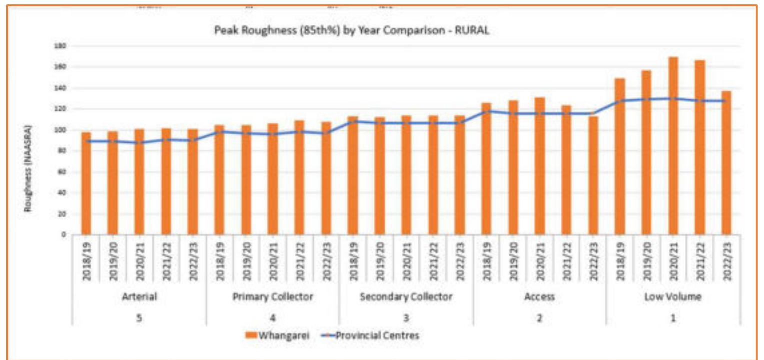
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	Urban Rural	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis / Peer Group Comparison	GAP / Response
WDC **Amenity - Peak Roughness**	Amenity	Technical Output	PM1	Peak Roughness (85th%)/ Ride comfort	Arterial	Urban	118	118	118	Set at peer average target, Current achievement above peer group	GAP - WDC is above the peer group peak rough across the board. The Secondary and below classes are deteriorating in relation to peer group year on year becoming rougher. This reflects the STE outcome. Geology vulnerable to water is a related symptom to peak roughness. Response – Continue with Rehabilitation as set and fund the Thin Asphalt in Urban centres along with targeted peak roughness programmes to address the issue.
						Rural	90	90	90	Set at peer average target Current achievement at peer group.	
					Primary Collector	Urban	125	125	125	Set slightly above peer group.	
						Rural	98	98	98	Set slightly above peer group. Current achievement is above peer group but holding steady.	
					Secondary Collector	Urban	140	140	140	Set at peer group. Current achievement well above peer group and deteriorating	
						Rural	107	107	107	As above	
					Access	Urban	160	160	160	As above	
						Rural	115	115	115	As above	
					Low Volume	Urban	165	165	165	As above	
						Rural	140	140	140	As above	

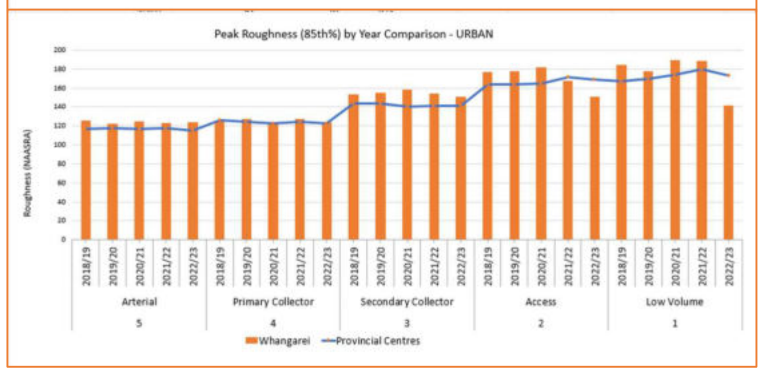
Whangarei DC peek roughness is above peer group across the board in all classes. The Arterial and Primary network have been I steady state over the last LTP period. The Secondary/Access and Low Volume network are beginning to deteriorate and move significantly out of step with peer group, rural and urban network.

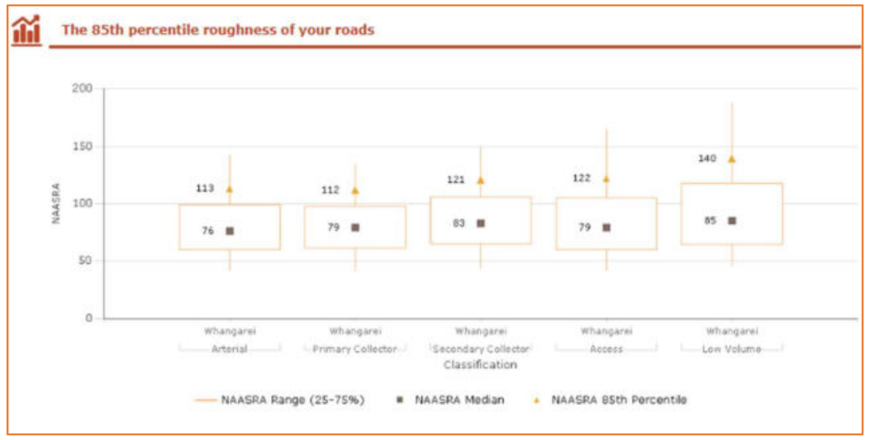


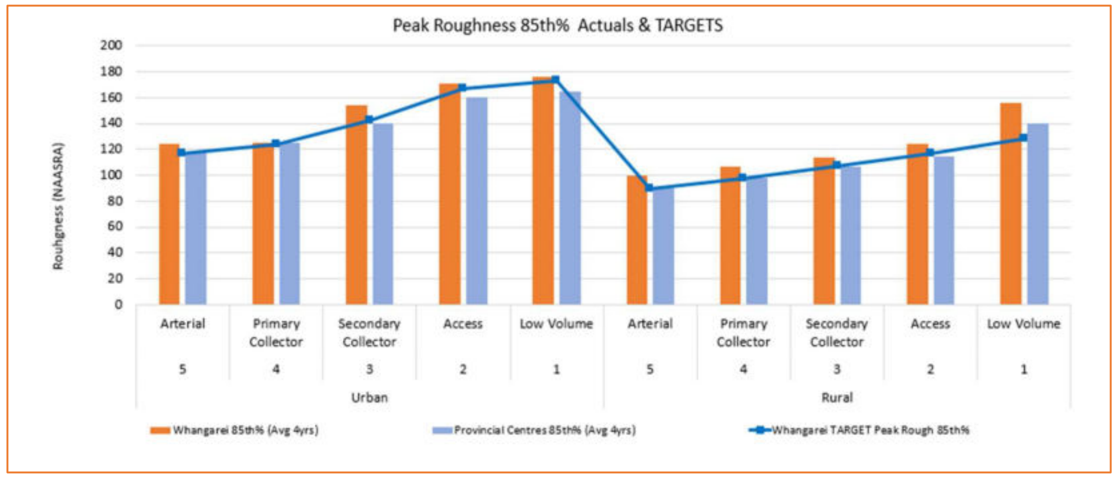






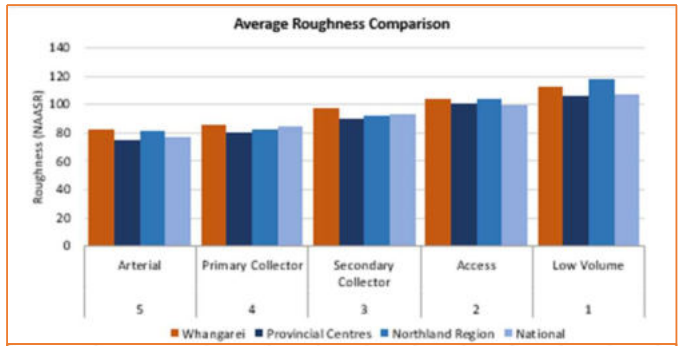


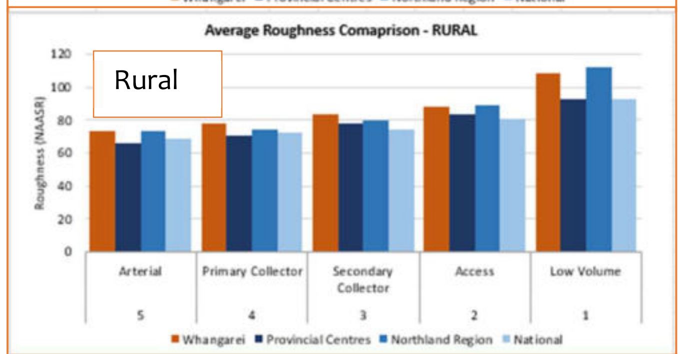


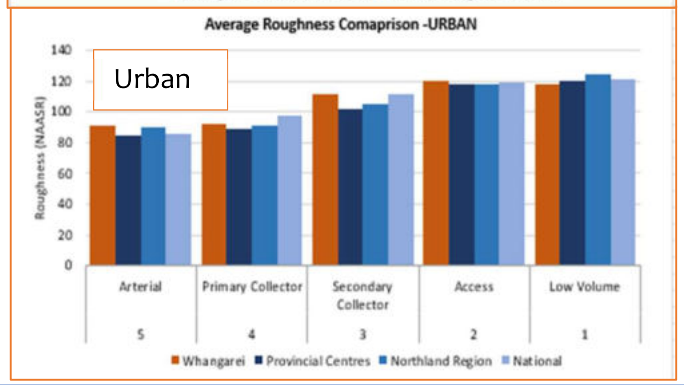


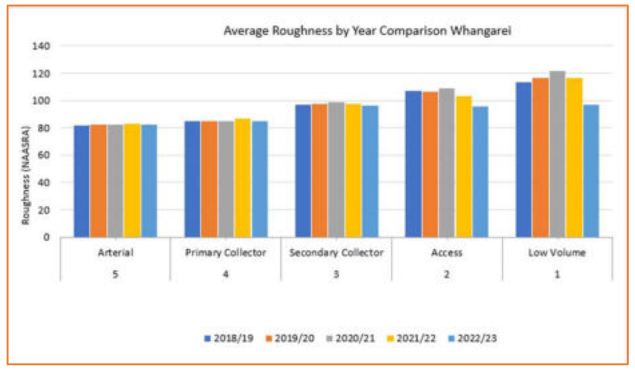
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	Urban Rural	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis / Peer Group Comparison	GAP / Response
WDC **Amenity - Average Roughness**	Amenity	Customer Outcome	OM2	Average Roughness	Arterial	Urban	90	90	90	Maintain target to keep steady state	GAP – WDC network is above the peer group with the biggest gap on the Rural network. The most significant gap is on Access/Low Volume network. The trend for WDC has continued to deteriorate year on year on the Secondary and below network. Arterial/Primary is in a stable state but has shown small lift in deterioration which will be monitored. Response – Deliver rehab programme as developed to maintain ride comfort for the Arterial/Primary network..
						Rural	75	75	75	Small reduction in target to maintain steady state	
					Primary Collector	Urban	90	90	90	Performing at target hold LoS	
						Rural	75	75	75	Small reduction in target to maintain steady state	
					Secondary Collector	Urban	100	100	100	WDC one of highest in peer group. Reduce target to help manage peak roughness	
						Rural	80	80	80	As above	
					Access	Urban	115	115	115	As above	
						Rural	85	85	85	As above	
					Low Volume	Urban	115	115	115	As above	
						Rural	100	100	100	As above	
					Network (Average)	All	93	93	93		

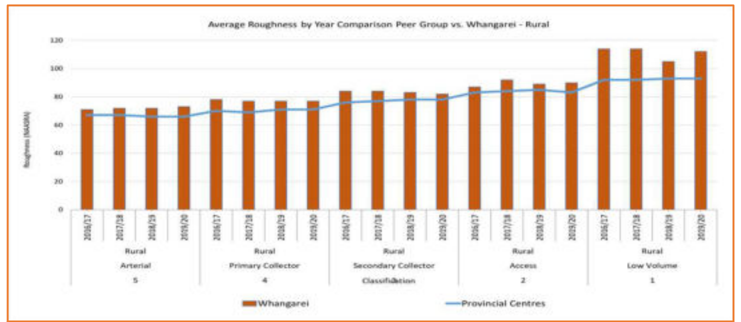
Yellow bar shows the peer group average the red bar is Whangarei DC current achievement. The Orange line is the target being set in relation to the peer group average and the peer group as whole. If the average is not well related to the peer group in general, then the target is revised to a position where Whangarei performance is set fairly for the road class in relation to its peers.

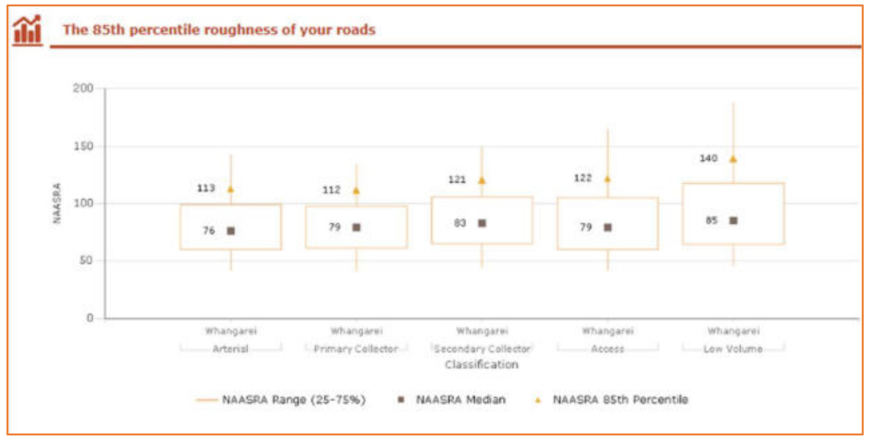


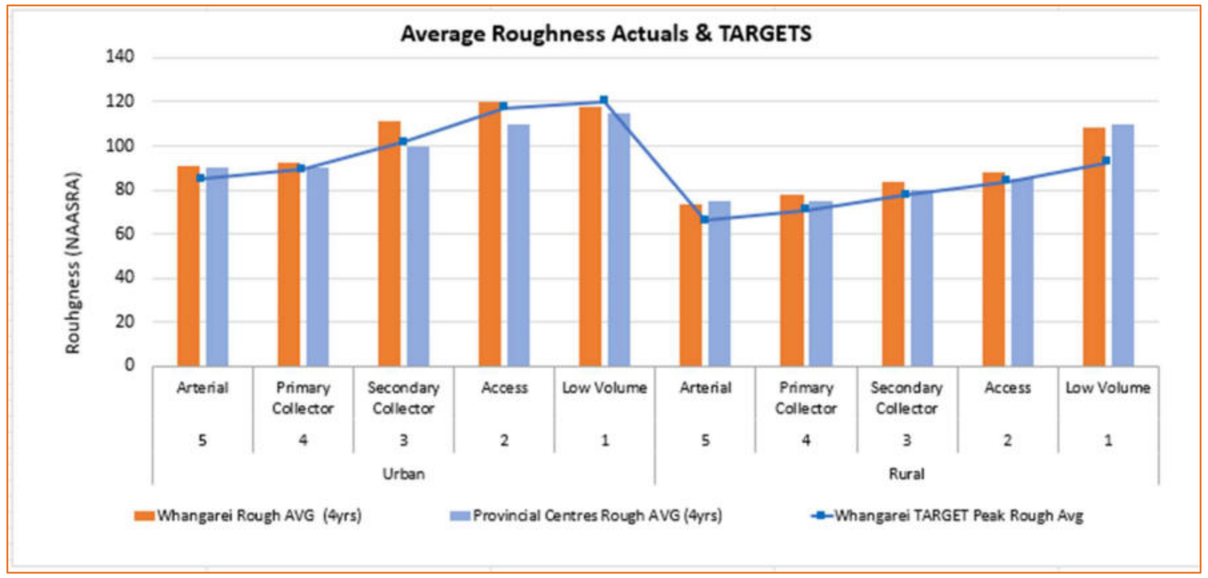






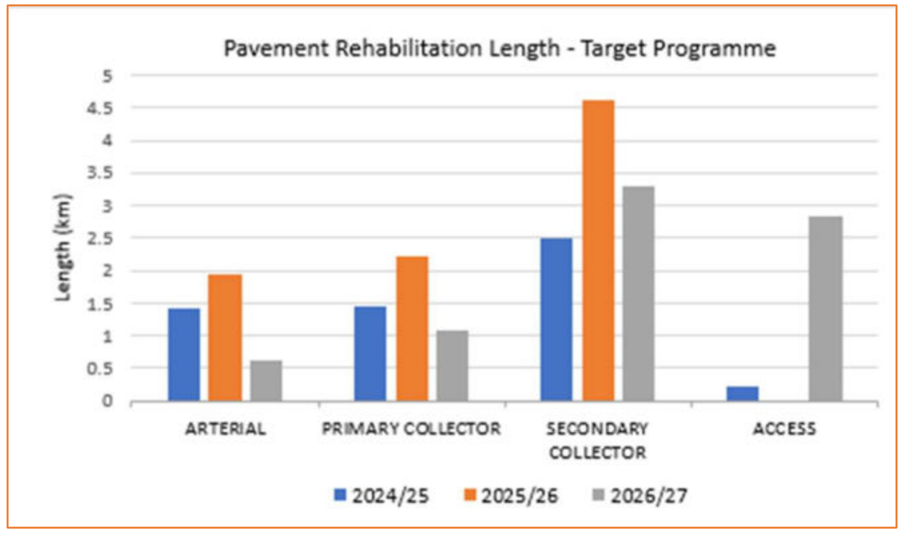






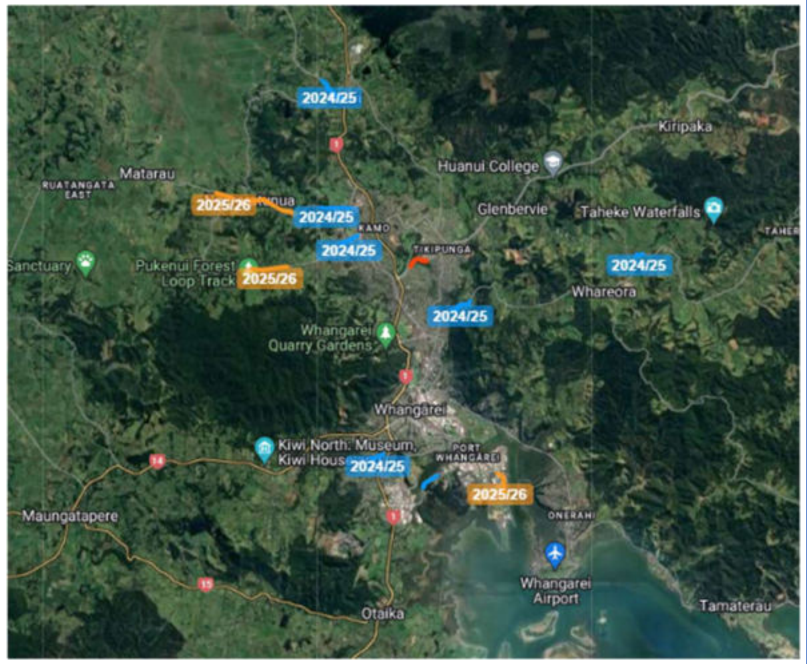
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
WDC **Cost Efficiency – The percentage of the sealed local road network that is rehabilitated**	Pavement Rehabilitation - Cost Efficiency	Efficiency Measure	EM	Target to % of network	Arterial	1.29%	1.78%	0.55%	Generally high volume urban sites,	This programme has been directed by several condition drivers, one of which is the customer ride comfort as set out under ONRC. Given that Secondary network is exceeding roughness targets this is targeted to deliver on the customer outcome.
					Primary Collector	0.74%	1.13%	0.55%	Urban and rural	
					Secondary Collector	0.59%	1.10%	0.79%	Targets customer ride comfort as noted above	
					Access	0.09%	0.00%	1.18%	In response to peak roughness rural	
					Low Volume	0.52%	0.82%	0.73%		
					Network (Total)>=0.4%	0.65% (5.5km)	0.97% (8.7km)	0.76% (7.8km)	On average 7.3 km/yr next three years. This is a reduction on previous plan set at approx. 6km/yr.	

Comparative analysis shows WDC around 0.6% per annum over the last 5 years. This is middle to high in comparison to peer group however as evidenced through the outcomes above WDC is not performing at the same level as its peers and most cases has shown slight deterioration in these outcomes. The rehab programme is designed to target high volume urban/rural pavements to maintain current performance and keep in check the poor ride quality on rural network. Further reduction in rehabilitation programme would see continued deterioration in customer outcomes. Northland sub quality construction materials and sensitive geology continue to have an impact on these outcomes.



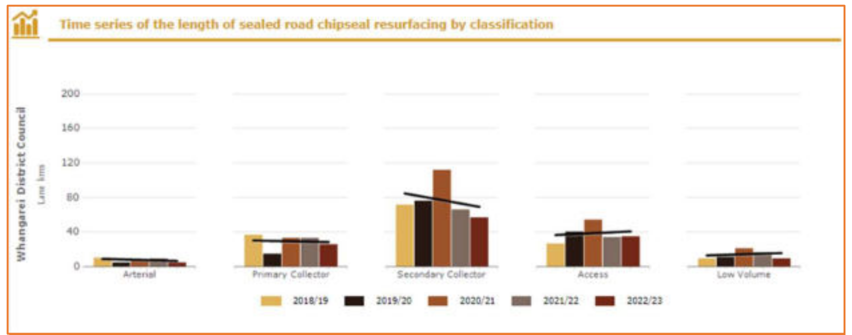
Pavement Renewal – 2025-2027

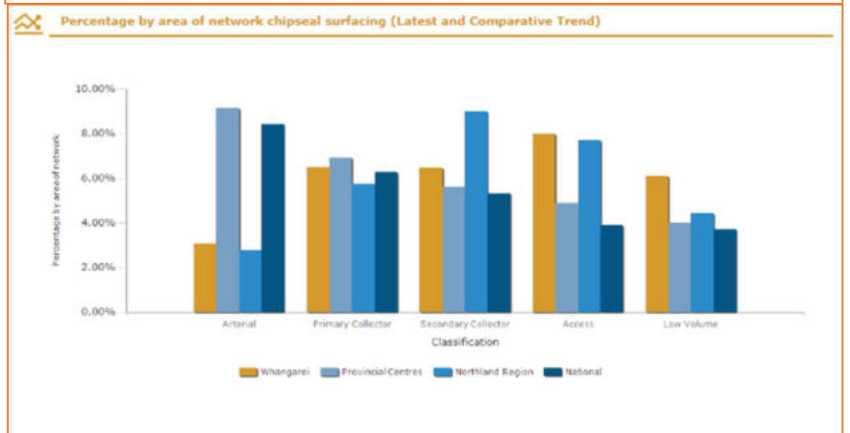
Pavement Renewal Urban– 2024-2027

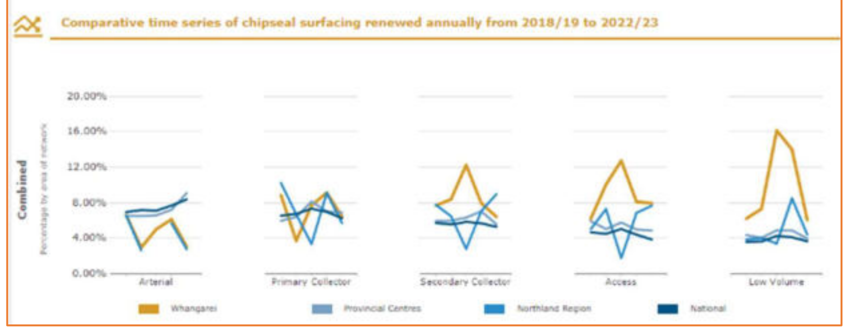


Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
WDC **Cost Efficiency - Chipseal Lane/km**	Chipseal - Cost Efficiency	Efficiency Measure	EM2(a)	Chipseal Resurfacing Quantity - lane km (DIA mandatory) expressed as both Ln.km	Arterial	14.88	31.92	16.29		GAP – Catch up on deferred sites due catch up old VFILL/TEXT and moderation of 2021-4 plan along with weather impacts. Response - Chipseal resurfacing programme is designed in response to the pavement renewal programme. No rehab for the LV. Resurfacing will help protect these parts of the network but we will see a rise in pre-seal maintenance investment in the lower-class network as result of this programme.
					Primary Collector	28.35	50.24	60.73	Catch up on VIFLL and TEXT seals	
					Secondary Collector	79.42	38.75	45.14	Continuing catch up on VIFLL/TEXT seals from previous plan with decreasing programme over the period of this plan.	
					Access	48.33	50.91	33.43		
					Low Volume	17.90	22.32	27.51	Average per/annum of 180ln.km	
					Network (Total)	188lnkm/ 9%	194lnkm/ 9%	183lnkm/ 9%	Catch up on deferred sites due catch up old VFILL/TEXT and moderation of 2021-4 plan along with weather impacts	

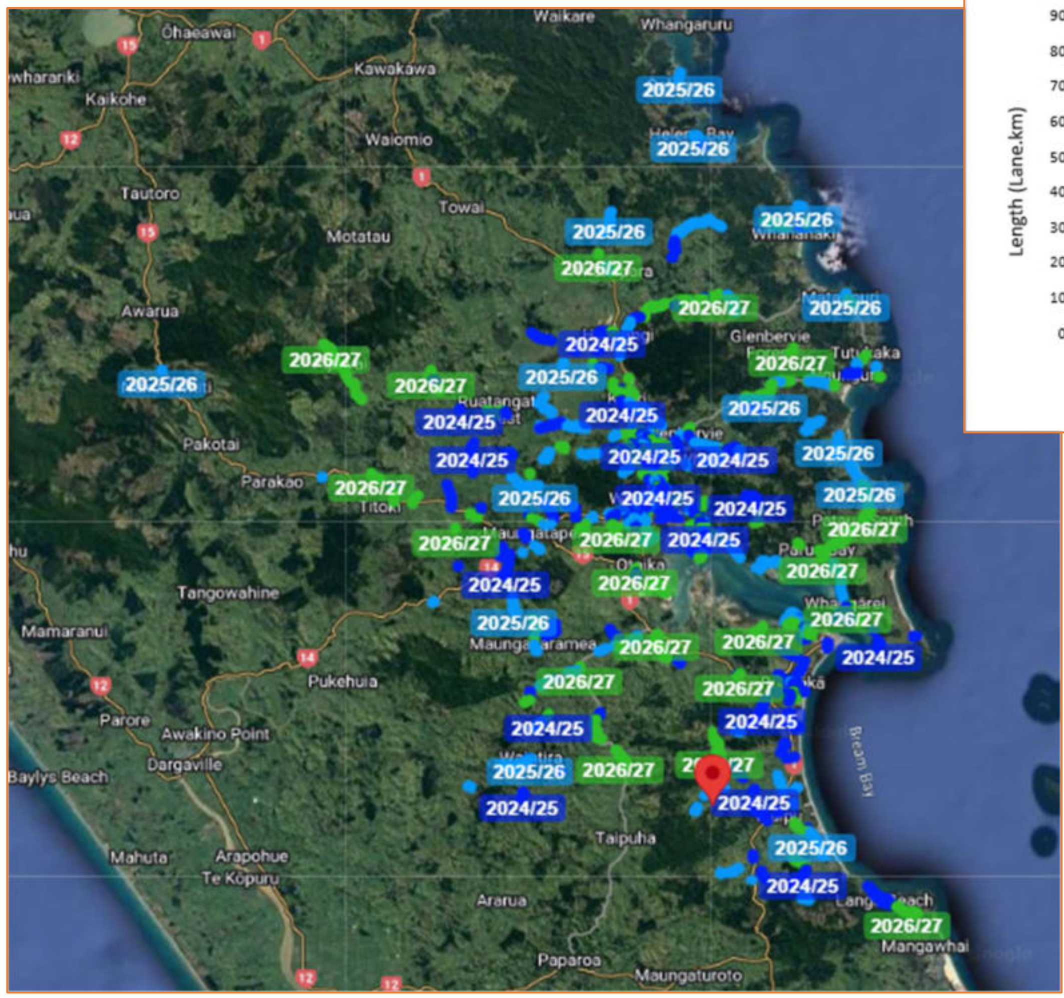
Peer group comparative for the shows that for WDC are under for the Arterial and Primary Collector network, this due to this network being predominately Thin Asphalt surface on this network. In terms of Secondary and below there has been a targeted programme of removing a significant amount of old Voidfill/Texturiser second coats and reseal from the network. These surfaces were applied in response to a very constrained financial environment during this period. It has taken time to respread the programme, target these surfaces and maintain a maintenance balance. This programme continues and will start to ease in the last year of this plan.

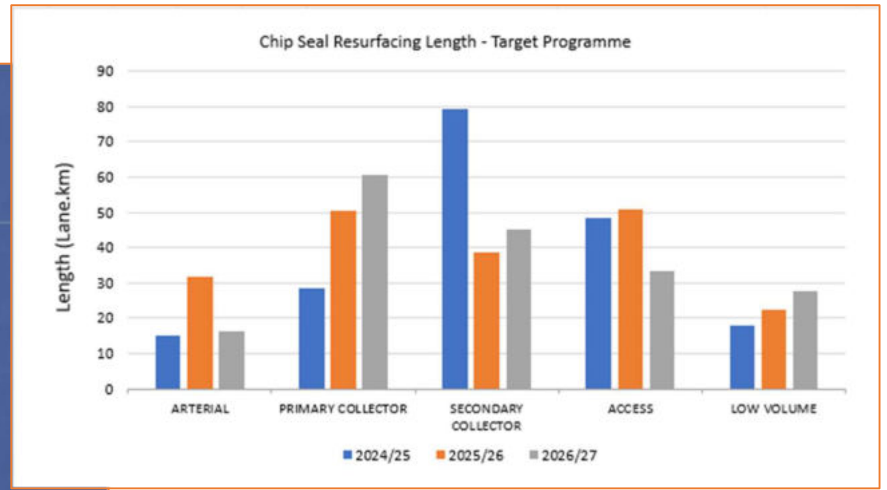






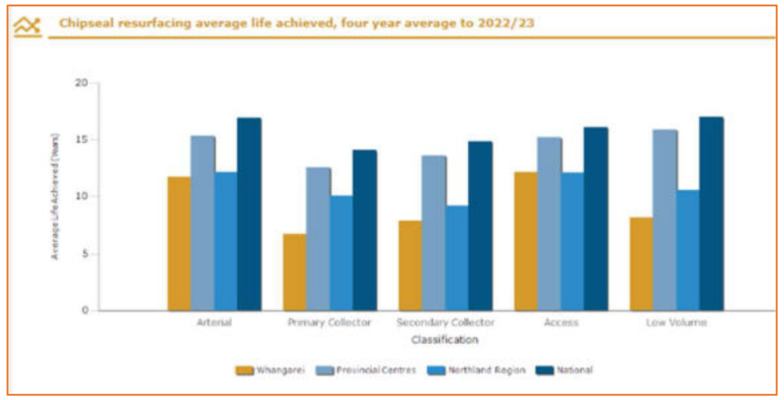
Chipseal Resurfacing – 2024-2027





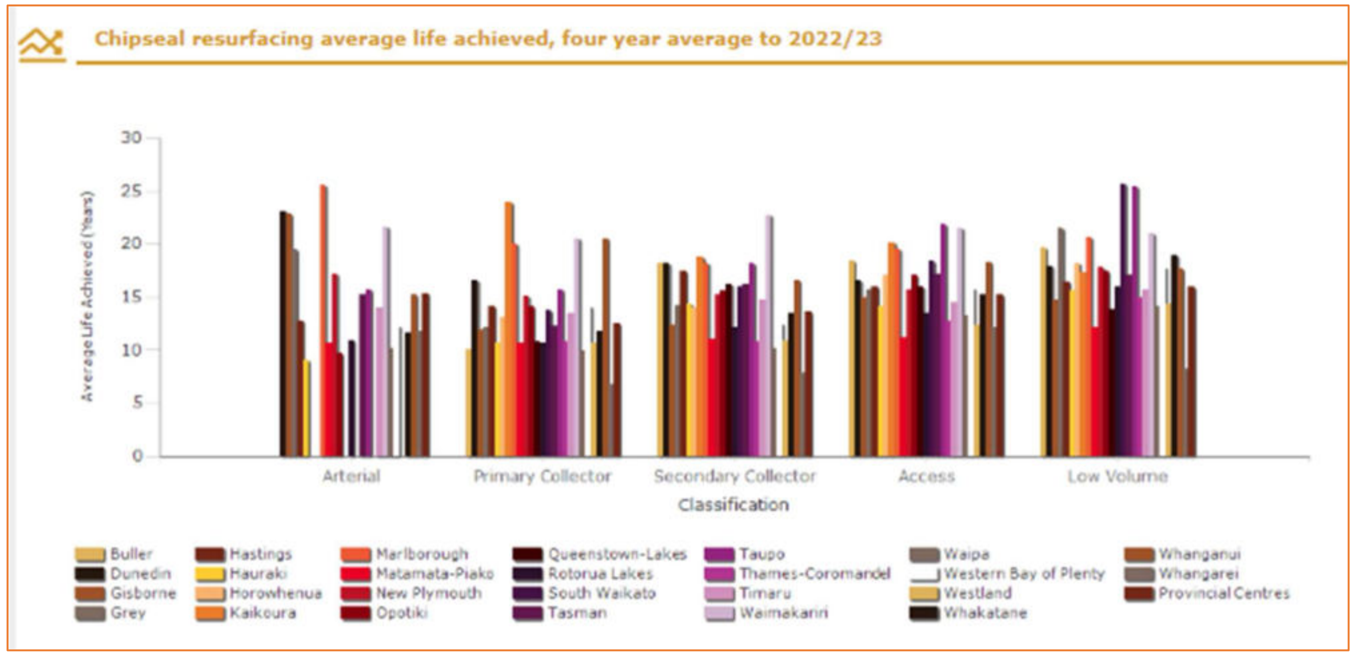
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
WDC **Cost Efficiency - Chipseal Average Life Achieved**	Cost Efficiency	Efficiency Measure	EM	Chipseal Resurfacing - Average life achieved	Arterial	12	12	12	In the top of the peer group for the longest average life	GAP - Gap the rising cost of pre-surface repair in terms of extending the life of surfaces. Response - The previous plan focused on sealing vulnerable surfaces(void fills) and this has had the desired effect in reducing per-surface cost. This continues to be the strategy for the first year of this plan as set above along with treating deferred sites.
					Primary Collector	11	11	11	Reduced as the large volume of rural network in this class deteriorating	
					Secondary Collector	13	13	13	As above	
					Access	15	15	15	As above	
					Low Volume	15	15	15	As above	
					Network (Avg)	13	13	13	As above	

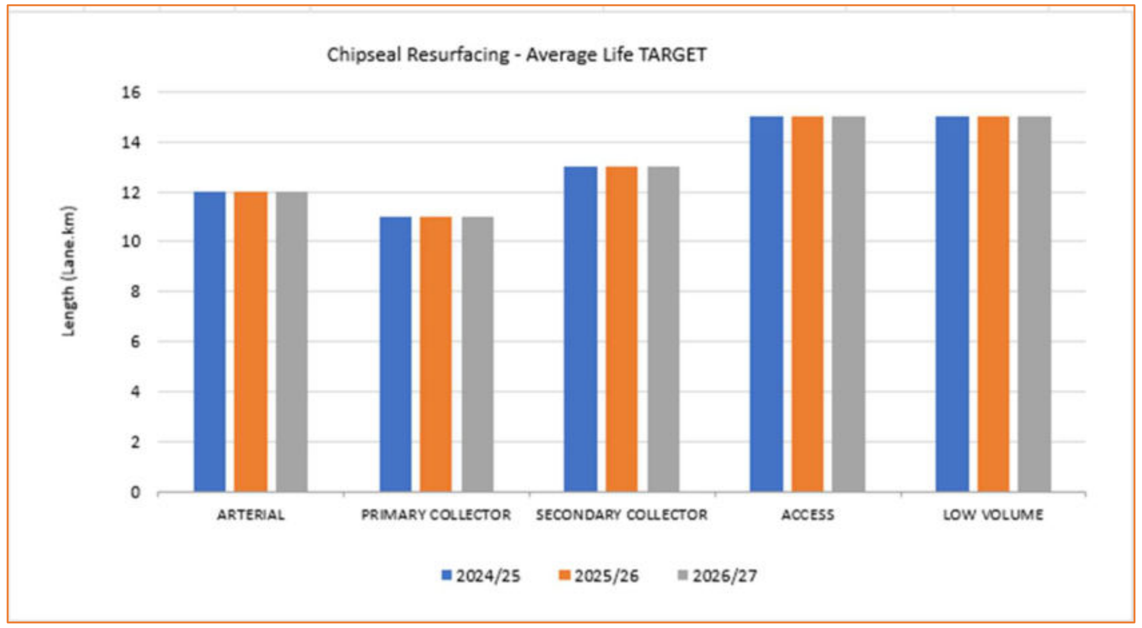
Comparatively WDC compare well with the average life achieved, yellow bars. Exceeding a large portion of the peer group in average return life of chip surfacing on the network. There is no change to the targets however, due to issue noted under surfacing achievement the actual programme year on year will show some low average return life cycles. At the end of the end of this plan the average return cycle will be generally aligned to these targets.



Chipseal Return Life Cycle of Proposed Programme

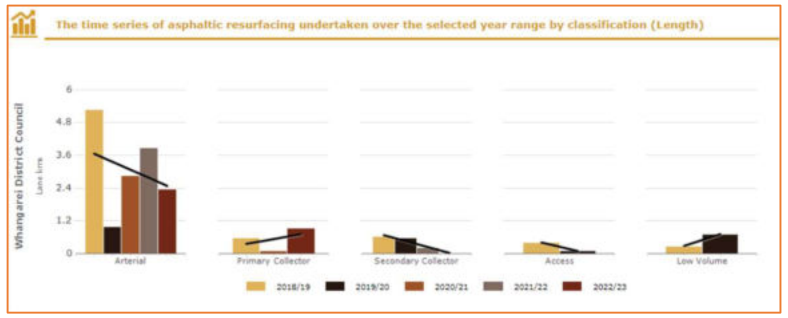
Class C	ONRC	2024/25	2025/26	2026/27	Average
5	ARTERIAL	15	7	13	12
4	PRIMARY COLLECTOR	14	8	6	9
3	SECONDARY COLLECTOR	11	21	19	17
2	ACCESS	10	9	14	11
1	LOW VOLUME	11	9	7	9
	Average	**11**	**11**	**12**	**11**

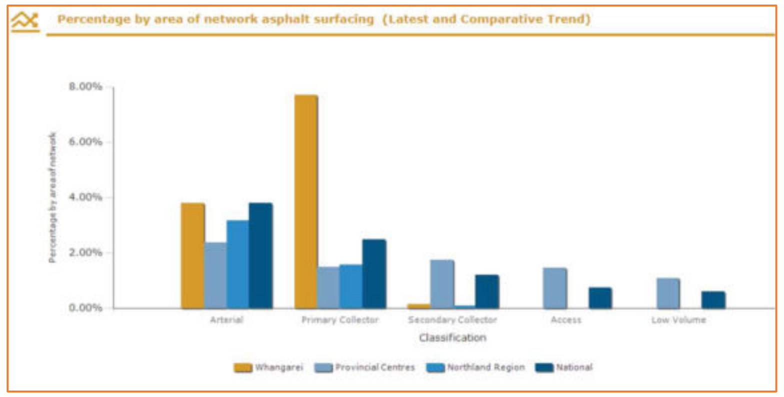




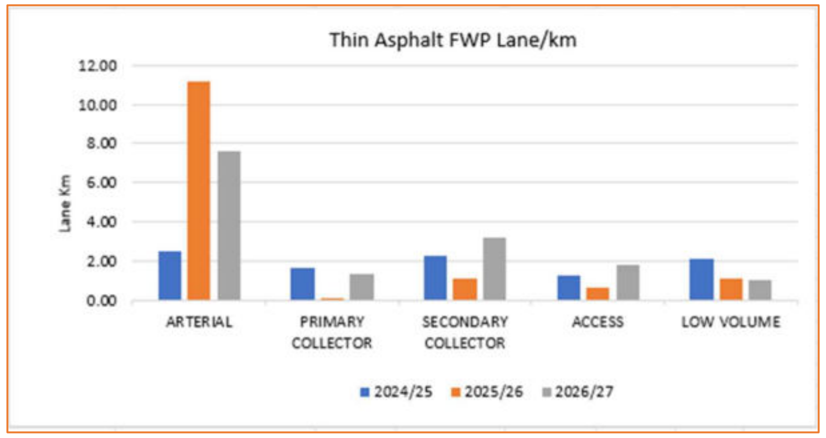
Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
WDC **Cost Efficiency - Asphalt Lane/km**	Cost Efficiency	Efficiency Measure	EM	Asphalt Resurfacing Quantity - lane km	Arterial	2.47	11.19	7.58	Urban network has significant mounting programme to be worked through	GAP – High volume urban network in poor condition and starting require high levels of maintenance. Rural high stress corners failing. Response - This programme focuses on urban high volume network. There are some isolated rural sites that are for high stress tight corners which are mostly on the road on the east coast leading out to coastal areas.
					Primary Collector	1.65	0.08	1.33		
					Secondary Collector	2.29	1.11	3.18		
					Access	1.22	0.63	1.77		
					Low Volume	2.10	1.09	0.99		
					Network (Total)	9.74	14.09	14.86		

The comparative analysis does not quite tell the picture as a large portion of the thin asphalt added to the network is through subdivision development which are typically surfaced in Asphalt. This is not recognised correctly in the PMRT reports as the surface is just added to the databases as Thin Asphalt 2nd coat. This process of subdivision development grows the thin asphalt content on the Secondary, Access and Low Volume network. The bulk of the renewal undertaken as part of true renewal programme is completed on the Arterial network as shown in the top left graph.





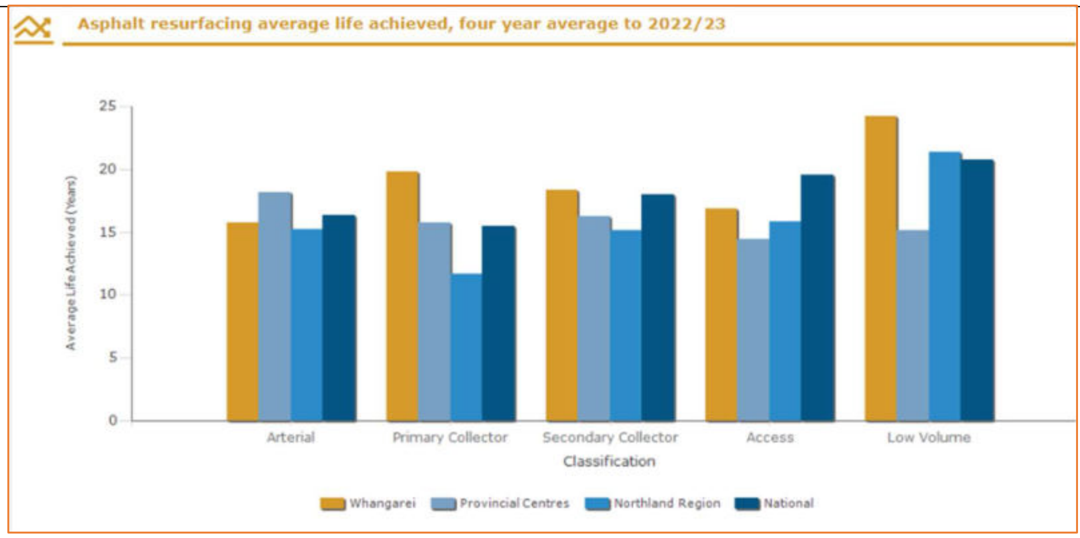
Asphalt Resurfacing – 2024-2027

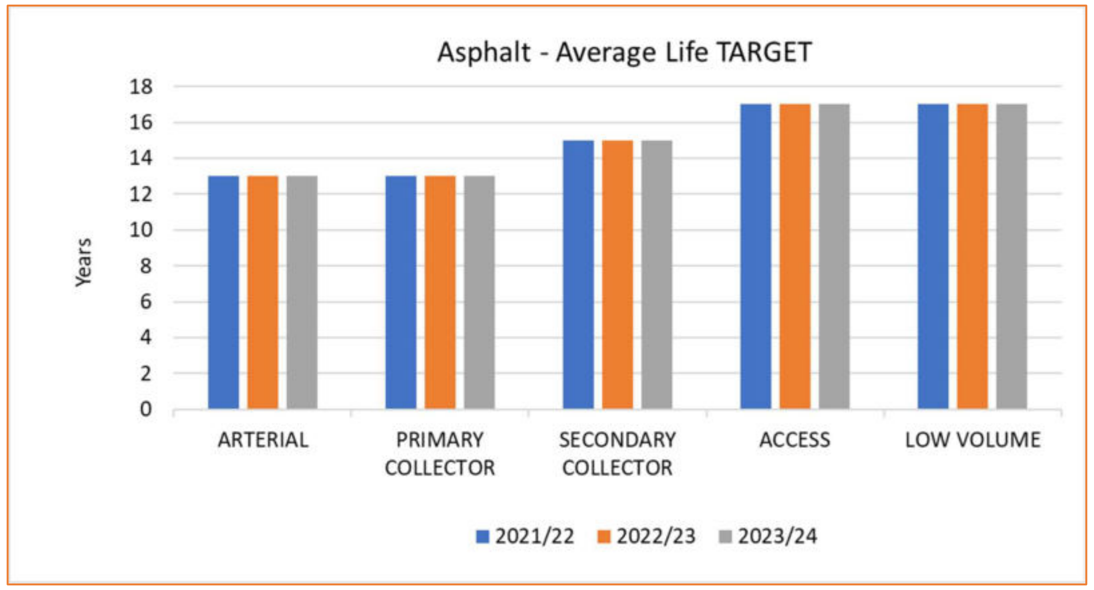


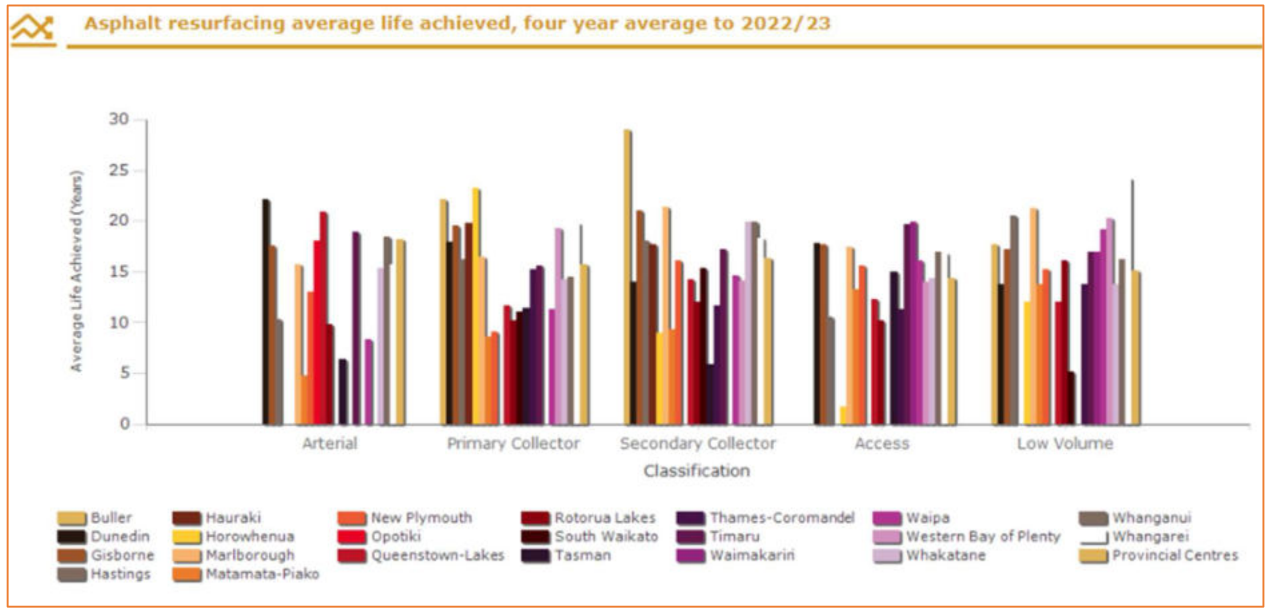
Urban Asphalt – 2024-2027

Name	CLoS	Type of Measure	Outcome Measure	Brief Description	ONRC	2024/25 TARGET	2025/26 TARGET	2026/27 TARGET	Analysis/ Peer Group Comparison	GAP/Response
WDC **Cost Efficiency - Asphalt Average Life Achieved**	Cost Efficiency	Efficiency Measure	EM	Asphalt Resurfacing - Average life achieved	Arterial	13	13	13	There are some wild variations in this peer group. For WDC these TAC surfaces are being stretched too far, particularly given that the peer group is not loaded in same way as the WDC TAC network.	GAP - The large majority of the TAC Arterial surfaces are showing signs of rapid deterioration. Response – This plan seeks to lift the TAC quantity to address the urban network and arrest the rate of deterioration occurring. However this may be too late due to funds in last plan being channelled into addressing the old VOID/TEXT on chipseal network. In general Asphalt is applied where the ADT is greater than 8,000 taking into account, stresses environment and resulting condition over time. This does mean that WDC are expecting to replace some chipseal Arterial surfaces with Asphalt at the time of pavement renewal.
					Primary Collector	13	13	13	No issue identified	
					Secondary Collector	15	15	15		
					Access	17	17	17	Peer group would appear to be intervening quite early on their TAC renewals	
					Low Volume	17	17	17	Cul-de-sac heads and rural TAC corners	
					Network (Avg)	15	15	15		

Yellow bar shows the Whangarei DC current achievement against the peer group. Several observations can made. WDC continues to stretch the life of surfacing compared to the other networks, there are number of networks in this group that do not compare well to WDC high VKT urban Arterial network, therefore the average life is not well related to the peer group in general.







5.8 AMP Improvement

The following improvements will be considered:

- Investigate alternative seal designs such as: Emulsion seals to reduce the health and safety risk to workers; Fibredek-type seals to extend the life of cracked surfaces; the use of plastic in asphalt mix design; and seal rejuvenation techniques to extend the seal life.
- Development of AI video analysis to assist in the capture of pavement defects and asset capture/validation.

6 Renewal Programme Development

6.1 Model Forecast Programme Analysis

Tables 6-1, 6-2 , and 6-3 following summarise the FNDC, KDC, WDC length of the pavement performance model analysis (Draft NTA Pavement Performance Analysis – 2023-24), including the current achievement and modelled funding levels, and the suggested programme.

6.1.1 Far North District Council

Table 6-1: FNDC model averages, current practice, and suggested programmes

Treatment		Trigger Model	Optimised Programme VH $11.40	H $9.36	N $8.14	L $6.92	VL $5.70	Current Practice (historic – current budget – 5 year FWP)	Suggested
RHAB	Length, km	4.8	9.6	6.7	4.7	3.4	2.3	14.1 – 7.3 – 10.8	6.0 – 8.0
	% of network length	0.5%	1.1%	0.7%	0.5%	0.4%	0.3%	1.5% – 0.8% – 1.2%	0.7% – 0.9%
2ndCoat	Length, km	6.8	10.0	7.4	6.1	5.2	4.5	(in RS)	(in RS)
RSEAL	Length, km	54	65	66	67	68	68	58 – 50 – 82	72 – 75
RS. & 2ndC.	% of chipseal length	6.9%	8.5%	8.3%	8.3%	8.2%	8.2%	6.6% – 5.7% – 9.3%	8.1% – 8.5%
TAC	Length, km	2.1	2.5	2.5	2.4	2.2	2.0	1.1 – 2.0 – 3.2	2.5 – 2.5
	% of asphalt length	7.2%	8.4%	8.4%	8.0%	7.5%	6.8%	3.5% – 6.6% – 10.7%	8.4% – 8.4%
Total	Length, km	68	87	83	80	79	77	73 – 59 – 96	81 – 86
	% of network length	7.4%	9.5%	9.0%	8.8%	8.6%	8.4%	8.0% – 6.5% – 10.5%	8.8% – 9.4%

A suggested programme for FNDC is based on the analysis of model outcomes to assess the long-term renewals need for the network.

The Normal Scenario budget (representing the current budget) has decreased for this analysis relative to last year. Unit rates have also increased for chipseal. The net result is the Normal Scenario is approximately 11% more constrained relative to last year's analysis.

The suggested renewal quantities are based on the following:

Resurfacing Renewal – Chipseal: 72 to 75 km

The range of Optimal Model scenarios 10-year and 20-year average annual chipsealing (RSEAL plus 2ndCoat) is 71 to 75 km.

The reseal quantities reached a steady level (where there is diminishing additional quantities with increased funding) at the Low scenario funding level. The reseal treatment is a priority because it offers asset preservation and some improvement (when required) at the most economic price.

A suggested 72 to 75 km is 8.1% to 8.5% of the chipseal network length per year. This amount is more than the past 5 years achievement. A greater amount is needed to cater for sealed network expansion, ensure second coat seals are catered for, and the age-based backlog quantity does not grow even further and become unmanageable in the future. The average of the suggested range (73.5 km/year) will result in a chipseal life cycle of 12.0 years. The suggested amount of chipseal treatments is affordable at the current budget.

Resurfacing Renewal – Asphalt: 2.5 km

The range of Optimal Model scenarios 10-year and 20-year average annual asphalt surface renewal (TAC) is 1.8 km to 2.5 km.

The TAC quantities reached a steady level at the Normal scenario funding level. There is also some additional TAC quantities forecast by the model within the rehabilitation treatments.

A suggested 2.5 km is 8.4% of the asphalt network length per year. This amount of asphalt treatments is required to cater for the existing asphalt surfaces that are currently at or near end of useful life. The suggested amount of asphalt treatment is affordable at the current budget.

Rehabilitation Renewals: 6.0 to 8.0 km

The range of Optimal Model scenarios 10-year and 20-year average annual rehabilitation (RHAB) is 2.1 km to 10.3 km.

The amount of RHAB treatments prioritised to the programme over the analysis period with the Normal budget is beneath the suggested range. This is a financial constraint as the model needed to cater for resurfacing needs first for the preservation and greater good of the network.

Based on RAMM data, over the last ten years, the average annual pavement base achievement was 14.1 km (1.5% of the network). The RAMM data includes recent seal extension and new pavements completed, which will overstate the historic pavement renewal achievement. The achievement of pavement renewals is much less than what pavement age data suggests, and this makes it difficult to quantify the amount of recent rehabilitation achievement.

A suggested range of 6.0 km to 8.0 km is in line with current practice and the optimised programme with higher funding. An annual allowance of 7.0 km will result in a pavement base life cycle of 131 years.

6.1.2 Kaipara District Council

Table 6-2: KDC model averages, current practice, and suggested programmes

Treatment		Trigger Model	Optimised Programme VH $5.18	H $4.26	N $3.70	L $3.15	VL $2.59	Current Practice (historic – current budget – 5 year FWP)	Suggested
RHAB	Length, km	3.3	5.5	3.8	2.8	1.8	1.1	4.9 – 2.9 – 5.5	3.0 – 5.0
	% of network length	0.7%	1.2%	0.8%	0.6%	0.4%	0.2%	1.0% – 0.6% – 1.2%	0.6% – 1.1%
2ndCoat	Length, km	4.7	6.4	4.8	4.1	3.3	2.7	(in RS)	(in RS)
RSEAL	Length, km	17	25	25	26	27	27	43 – 32 – 41	31 – 35
RS. & 2ndC.	% of chipseal length	4.6%	6.7%	6.5%	6.5%	6.5%	6.4%	9.3% – 7.0% – 8.8%	6.7% – 7.6%
TAC	Length, km	0.5	0.8	0.8	0.9	0.9	0.8	0.7 – 0.5 – 0.3	0.5 – 0.5
	% of asphalt length	7.0%	9.9%	9.9%	10.9%	10.9%	10.0%	9.0% – 6.4% – 3.8%	6.4% – 6.4%
Total	Length, km	25	37	35	34	32	32	49 – 36 – 47	35 – 41
	% of network length	5.3%	7.9%	7.4%	7.2%	6.9%	6.7%	10.4% – 7.6% – 9.9%	7.4% – 8.6%

A suggested programme for KDC is based on the analysis of model outcomes to assess the long-term renewals need for the network.

The Normal Scenario budget (representing the current budget) has increased for this analysis relative to last year. Unit rates have also changed for chipseal and rehabilitation treatments. The net result is the Normal Scenario is approximately 14% less constrained relative to last year's analysis.

The suggested renewal quantities are based on the following:

Resurfacing Renewal – Chipseal: 31 to 35 km

The range of Optimal Model scenarios 10-year and 20-year average annual chipsealing (RSEAL plus 2ndCoat) is 30 to 33 km.

The reseal quantities reached a steady level (where there is diminishing additional quantities with increased funding) at the Very Low scenario funding level. The reseal treatment is a priority because it offers asset preservation and some improvement (when required) at the most economic price.

A suggested 31 to 35 km is 6.7% to 7.6% of the chipseal network length per year. This amount is less than the past 5 years achievement since the historic backlog of second coat seal need has been adequately addressed in recent years. An amount at the higher end of the suggested range will be needed in the future to ensure future second coat seals are catered for and the age-based backlog quantity does not grow and become unmanageable. Furthermore, KDC is having a large amount of residential and related commercial development in the Mangawhai area, which is starting to impact on the surface and pavement life.

The average of the suggested range (33 km/year) will result in a chipseal life cycle of 14.0 years. The suggested amount of chipseal treatments is affordable at the current budget.

Resurfacing Renewal – Asphalt: 0.5 km

The range of Optimal Model scenarios 10-year and 20-year average annual asphalt surface renewal (TAC) is 0.8 km to 0.9 km.

The TAC quantities reached a steady level at the Very Low scenario funding level. There is also some additional TAC quantities forecast by the model within the rehabilitation treatments.

A suggested 0.5 km is 6.4% of the asphalt network length per year. This amount of asphalt treatments is required to cater for the existing asphalt surfaces that are currently at or near end of useful life. The suggested amount of asphalt treatment is affordable at the current budget.

Rehabilitation Renewals: 3.0 to 5.0 km

The range of Optimal Model scenarios 10-year and 20-year average annual rehabilitation (RHAB) is 0.7 km to 5.5 km.

The amount of RHAB treatments prioritised to the programme over the analysis period with the Normal budget is lower than the suggested range. This is a financial constraint as the model needed to cater for resurfacing needs first for the preservation and greater good of the network.

It is not realistic to expect a network to be managed over a long period of time without the need for rehabilitation treatments. The increasing pavement age indicates the pavement capacity will inevitably be consumed over a long period of time. The pavement will become less resilient to wear and less capable of absorbing deterioration.

Based on RAMM data, over the last ten years, the average annual pavement base achievement was 4.9 km (1.0% of the network). The RAMM data includes recent seal extension and new pavements completed, which will overstate the historic pavement renewal achievement. The achievement of pavement renewals is less than what pavement age data suggests.

A suggested range of 3.0 km to 5.0 km is in line with current practice and identified forward work, the optimised programme with higher funding. An annual allowance of 4.0 km will result in a pavement base life cycle of 117 years.

6.1.3 Whangarei District Council

Table 6-3: WDC model averages, current practice, and suggested programmes

Treatment		Trigger Model	Optimised Programme					Current Practice	Suggested
			VH $12.68	H $10.42	N $9.06	L $7.70	VL $6.34	(historic – current budget – 5 year FWP)	
RHAB	Length, km	7.8	8.3	5.3	3.8	2.8	1.5	8.8 – 5.7 – 7.4	6.0 – 8.0
	% of network length	0.7%	0.8%	0.5%	0.4%	0.3%	0.1%	0.8% – 0.5% – 0.7%	0.6% – 0.7%
2ndCoat	Length, km	8.7	8.5	5.7	4.6	4.1	3.2	(in RS)	(in RS)
RSEAL	Length, km	48	66	68	68	69	69	88 – 62 – 83	72 – 75
RS. & 2ndC.	% of chipseal length	5.7%	7.5%	7.4%	7.3%	7.3%	7.2%	8.8% – 6.2% – 8.3%	7.2% – 7.5%
TAC	Length, km	6.1	6.6	6.6	6.7	6.6	6.6	4.6 – 3.6 – 4.8	5.0 – 6.5
	% of asphalt length	8.0%	8.6%	8.6%	8.8%	8.6%	8.6%	6.1% – 4.7% – 6.3%	6.5% – 8.5%
Total	Length, km	71	90	85	83	82	80	101 – 71 – 95	83 – 90
	% of network length	6.6%	8.3%	7.9%	7.8%	7.6%	7.5%	9.4% – 6.6% – 8.9%	7.7% – 8.3%

A suggested programme for WDC is based on the analysis of model outcomes to assess the long-term renewals need for the network.

The Normal Scenario budget (representing the current budget) has increased for this analysis relative to last year. Unit rates have also changed for asphalt resurfacing and rehabilitation treatments. The net result is the Normal Scenario is approximately 1% less constrained relative to last year's analysis.

The suggested renewal quantities are based on the following:

Resurfacing Renewal – Chipseal: 72 to 75 km

The range of Optimal Model scenarios 10-year and 20-year average annual chipsealing (RSEAL plus 2ndCoat) is 72 to 75 km.

The reseal quantities reached a steady level (where there is diminishing additional quantities with increased funding) at the Very Low scenario funding level. The reseal treatment is a priority because it offers asset preservation and some improvement (when required) at the most economic price.

A suggested 72 to 75 km is 7.2% to 7.5% of the chipseal network length per year. This amount is less than the past 5 years achievement. The historic backlog of void fill/texturising seals and second coat seal need has been adequately addressed in recent years. An amount at the higher end of the suggested range will be needed in the future to ensure future second coat seals are catered for, and the age-based backlog quantity does not grow and become unmanageable. The average of the suggested range (73.5 km/year) will result in a chipseal life cycle of 13.6 years. The suggested amount of chipseal treatments is affordable at the current budget.

Resurfacing Renewal – Asphalt: 5.0 to 6.5 km

The range of Optimal Model scenarios 10-year and 20-year average annual asphalt surface renewal (TAC) is 6.4 km to 6.7 km.

The TAC quantities reached a steady level at the Very Low scenario funding level. There is also some additional TAC quantities forecast by the model within the rehabilitation treatments.

A suggested 5.0 to 6.5 km is 6.5% to 8.5% of the asphalt network length per year. This amount is greater than the past 5 years achievement. This amount of asphalt treatments is required to cater for the existing asphalt surfaces that are currently at or near end of useful life. The average of the suggested range (5.75 km/year) will result in an asphalt life cycle of 13.3 years. The suggested amount of asphalt treatments is affordable at the current budget.

Rehabilitation Renewals: 6.0 to 8.0 km

The range of Optimal Model scenarios 10-year and 20-year average annual rehabilitation (RHAB) is 0.9 km to 8.8 km.

The amount of RHAB treatments prioritised to the programme over the analysis period with the Normal budget is lower than the suggested range. This is a financial constraint as the model needed to cater for resurfacing needs first for the preservation and greater good of the network.

It is not realistic to expect a network to be managed over a long period of time without the need for rehabilitation treatments. The increasing pavement age indicates the pavement capacity will inevitably be consumed over a long period of time. The pavement will become less resilient to wear and less capable of absorbing deterioration.

Based on RAMM data, over the last ten years, the average annual pavement base achievement was 8.8 km (0.8% of the network). The RAMM data includes recent seal extension and new pavements completed, which will overstate the historic pavement renewal achievement. The achievement of pavement renewals is less than what pavement age data suggests, and this makes it difficult to quantify the amount of recent rehabilitation achievement.

A suggested range of 6.0 km to 8.0 km is greater than current practice, but within the identified forward work and forecast given by the optimised programme with higher funding. An annual allowance of 7.0 km will result in a pavement base life cycle of 153 years.

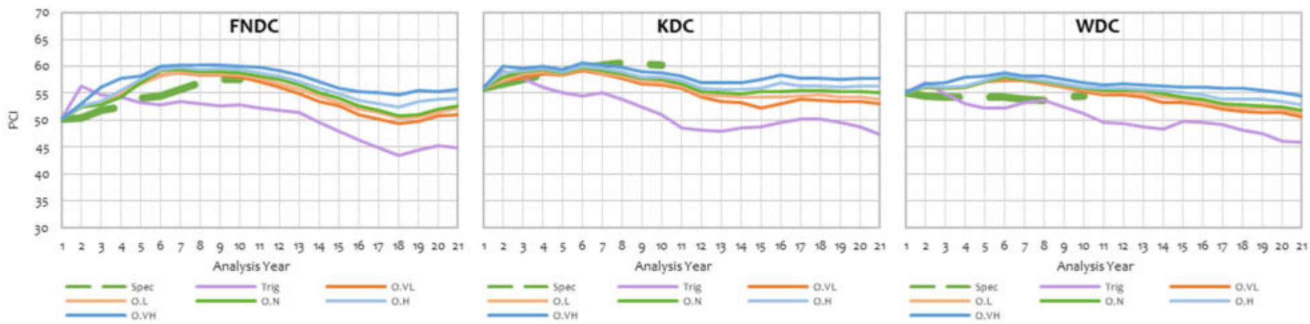
6.2 Renewal Programme

The programmes developed through pavement performance model analysis have been field validated and refined to match the actual need of the network. As a result of this field validation, we have adopted a slightly different (and generally higher) level of renewal than shown in the modelling. This is part of our optimisation process and will be further refined through continual reviews to further test and refine the programme.

This is evidenced through the model condition outcomes when testing the field validated programme (specified programme) against the optimised programmes (testing different budget scenarios).

The key indicators of a balanced and least whole of life investment profile can be seen through two key performance indicators. Pavement Condition Index (PCI) and Surface Integrity Index (SII).

In the case of the PCI, refer to Figure 1-8, also copied below, the field optimised specified programme (bold dashed green line) which is continually field validated and challenged by experienced practitioners. This indicates that even through the higher investment models providing an increase level of service during the analysis period (10 years), the resulting condition outcome at the end of year 10 is the same for both optimised models and specified programme. This means the specified programme is delivering a more sustainable investment profile that recognises both best whole-of-life cost outcomes and by recognising programme efficiencies to manage delivery costs e.g. grouping work to realise operational efficiencies. This can also be seen in the SII, refer to Figure 1-5, where there is a more stable programme approach to achieve the same outcome over the analysis period.



What has occurred over the last and current plan that each district has slowly reached the same similar levels in programme development and delivery as the forest models.

What can be seen is that from FNDC and KDC forecasted specified programme outcomes is that they look to improve network condition. And for WDC hold the network into average condition at the end of the 10-year analysis period.

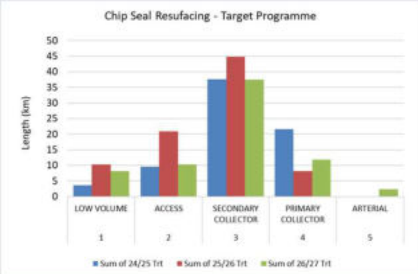
The recent storms and rainfall weather events during 2022/23 season have driven an amount of programme change not experienced previously, this has resulted in site priority changes to accommodate the events impacts.

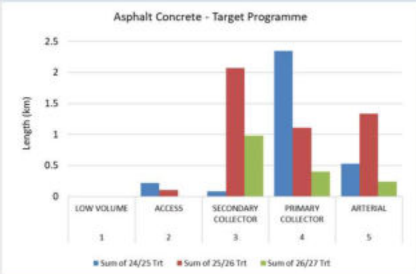
Following this optimisation process, the current proposed programmes for the 2024-27 period are summarised as follows:

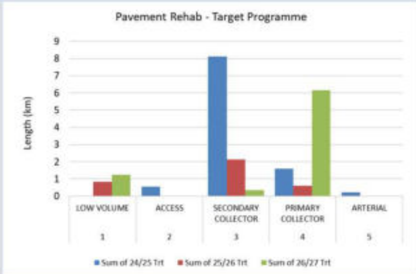
Far North District Council

Description	Chipseal Resurfacing	Asphalt Resurfacing	Pavement Rehabilitations
Average Length Treated/year	85km	3.8km	6.9km
% Network Treated/year	10%	13%	0.8%
Average Renewal Cycle Time	11 years	9 years	131 years
Comment: Asphalt programme is high to address backlog of old TAC on urban arterials.			

Programme by ONRC:



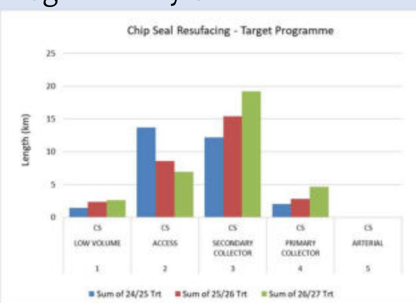


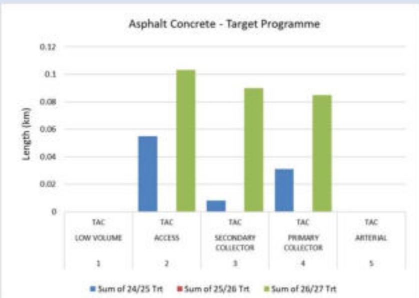


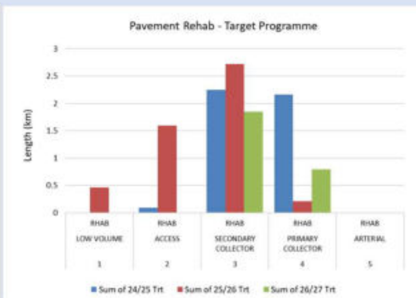
Kaipara District Council

Description	Chipseal Resurfacing	Asphalt Resurfacing	Pavement Rehabilitations
Average Treated/year	40km	0.4km	4.7km
% Network Treated/year	10.1%	6%	1%
Average Renewal Cycle Time	10 years	21 years	100 years
Comment: The surfacing programme continues to treat long tail of old poor condition seals			

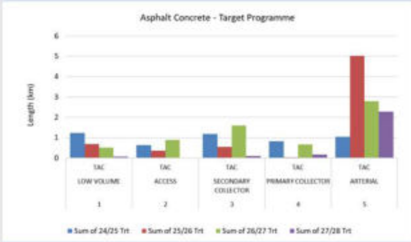
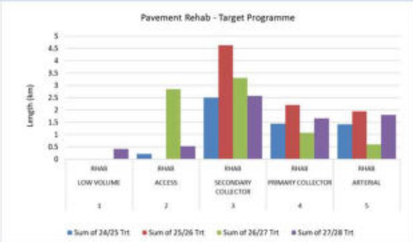
Programme by ONRC:







Whangarei District Council

Description	Chipseal Resurfacing	Asphalt Resurfacing	Pavement Rehabilitations
Average Length Treated/year	95km	5.2km	7.9km
% Network Treated/year	10%	11%	0.7%
Average Renewal Cycle Time	10 years	9.3 years	136 years
Comment: Chipseal resurfacing programme is slightly high while WDC finish off the resurfacing of their backlog of old void fill seals. Asphalt programme high to continue to address old asphalt surfacing on arterial roads in Whangarei city.			
Programme by ONRC:   			

6.2.1 *Rehabilitation Programme*

Figure 6-1 following provides break down of the pavement renewal programme by ONRC for FNDC, KDC and WDC.

Figure 6-1: Pavement renewal programmes by ONRC for FNDC, KDC & WDC

FNDC – FNDC has been carrying a high rate of rehabilitations relative to its peer group. This has mainly been due to early failure of "cheap" seal extensions built in the late 1990's, unstable surfacing through high historic sealing rates and poor optimisation of the programme. The spike in later programme years is typical of deferral in the programme development an indication of growing backlog.

The rehabilitation programme is now optimised through pavement performance modelling, field validation and review. However, ongoing poor weather resulted in increased surfacing and maintenance programme and with increased costs over the last couple of years of the 2021-24 plan. This is having an impact on pavement rehabilitation programmes with more sites transitioning from per-seal and reseal to pavement rehabilitation. Cost increase is set to be a continuing trend and retendering of the current 2018 maintenance contracts will only result in contract rates adjustment to current market pricing.

KDC – KDC has been carrying out approximately 2km of rehabilitation per annum for the last 3 years and based on pavement performance modelling, field validation processes the optimised quantities are being increased to 4.7kms per annum. The spike in later programme years is typical of deferral in the programme development an indication of growing need for rehabilitation.

WDC – KDC has been targeting expensive urban rehabilitations using structural asphaltic concrete (SAC) in Whangarei City to improve the poor condition of the urban network. The rehabilitation costs have been increasing over the last 3 years and are becoming increasingly unsustainable in the urban environment level.

6.2.2 *Resurfacing Programme – Chipseal*

Figure 6-2 following provides a summary of the chipseal renewals (achievement and programme for 3 years) reseals and second coat reseals, broken down by ONRC categories for each district.

	Sum of 24/25 Trt	Sum of 25/26 Trt	Sum of 26/27 Trt	Sum of 27/28 Trt	Sum of 28/29 Trt	Sum of 29/30 Trt
5 - ARTERIAL	0	0	2417	1940	0	1346
4 - PRIMARY COLLECTOR	21662	8222	11900	9482	12451	548
3 - SECONDARY COLLECTOR	37537	44784	37441	44470	49328	46543
2 - ACCESS	9631	20851	10297	9710	3724	15685
1 - LOW VOLUME	3619	10262	8202	11556	5485	3127

	Sum of 24/25 Trt	Sum of 25/26 Trt	Sum of 26/27 Trt	Sum of 27/28 Trt	Sum of 28/29 Trt	Sum of 29/30 Trt
5 - ARTERIAL	0	0	0	0	0	0
4 - PRIMARY COLLECTOR	2021	2832	4620	1839	12722	4939
3 - SECONDARY COLLECTOR	12183	15374	19190	21558	12319	15196
2 - ACCESS	13684	8560	6960	19383	6160	8592
1 - LOW VOLUME	1399	2363	2628	875	3825	2956

	Sum of 24/25 Trt	Sum of 25/26 Trt	Sum of 26/27 Trt	Sum of 27/28 Trt	Sum of 28/29 Trt	Sum of 29/30 Trt
5 - ARTERIAL	7441	15902	8145	9854	8160	2900
4 - PRIMARY COLLECTOR	14071	25119	30364	18543	14520	16479
3 - SECONDARY COLLECTOR	38729	19586	22572	35980	36599	36390
2 - ACCESS	19148	20854	16939	7709	6425	7321
1 - LOW VOLUME	9564	10452	11915	4148	2747	7246

Figure 6-2: Chipseal renewals - 6-year profile for FNDC, KDC & WDC

FNDC – Historically FNDC targeted a programme of high rates of reseals to meet a Long-Term Plan KPI. In 2017/18 there was also a larger number of reseals undertaken on Secondary Collectors as part of the additional Forestry Strengthening funding from NZTA. The resealing programme has since stabilised but will continue to be balanced in terms of addressing the backlog of TAC surfacing. The TAC will be kept as low as possible through an optimised programme based on pavement performance modelling backed up by field validation.

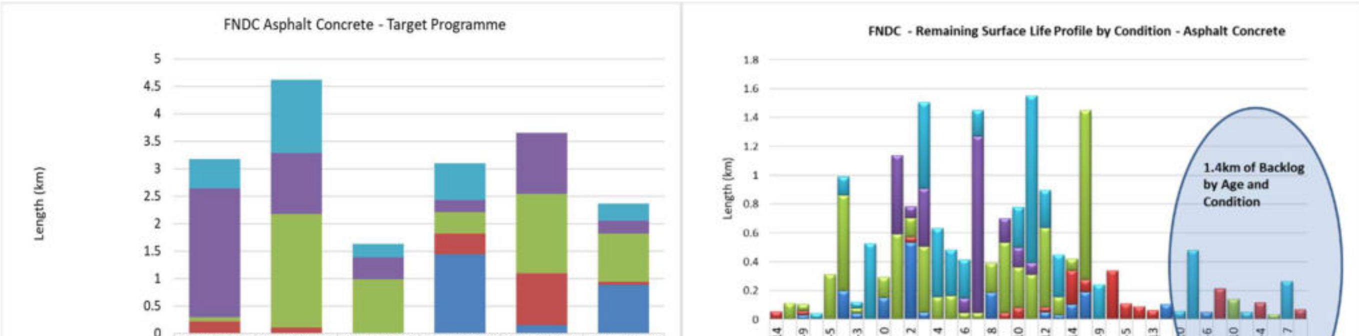
KDC – There remains a backlog of historic first coat seals that KDC is resealing due to the historic funding constraints caused by the Kaipara rates strike. The resealing quantities are now expected to stabilise going forward as a result of the seal road condition reaching a relatively stable condition and being based on an optimised programme based on pavement performance modelling backed up by field validation.

WDC – During the 21-24 plan WDC programme of chipseal resurfacing managed to treat the bulk of legacy of old void fill seals. This should enable the programme to stabilise over 24-27 and then lower its reseal programme to a more sustainable levels as shown in Figure 6-2 above.

6.2.3 Resurfacing Programme – Asphalt

The development of Thin Asphaltic Concrete (TAC) programme is completed in the same way as the pavement rehabilitation and chipseal programme, through pavement performance model analysis, field validation and balanced against affordability. The NTA take the approach to engineer TAC off the network where possible and to not introduce TAC as part of the renewal programme.

FNDC – Figure 6-3 following shows the TAC renewal profile and remaining life versus condition distribution for the FNDC network.



	Sum of 24/25 Trt	Sum of 25/26 Trt	Sum of 26/27 Trt	Sum of 27/28 Trt	Sum of 28/29 Trt	Sum of 29/30 Trt
5 - ARTERIAL	528	1335	241	665	0	308
4 - PRIMARY COLLECTOR	2345	1110	404	229	1107	240
3 - SECONDARY COLLECTOR	81	2069	985	379	1447	876
2 - ACCESS	219	103	0	377	943	55
1 - LOW VOLUME	0	0	0	1445	150	884

Figure 6-3: FNDC TAC renewal profile & remaining life versus condition

The FNDC TAC programme is shown in Figure 6-3 (left graph) reflects the growing asphalt renewal need on the network. Currently there is a significant length of high-volume roads and urban town city roads in or rapidly approaching poor to very poor condition. As can be seen most of the programme is in the Arterial Primary and Secondary network on the urban network mainly. Where there is asphalt programmed on the Access and Low Volume parts of the network these are on rural high stress corners which are due for replacement as condition dictates. There has been little to no investment made in previous plans to renew the asphalt network in the Far North. The 2018-21 and 2021-24 plan has started to treat the worst condition sites which require a higher level of deep structural maintenance patching prior to the TAC being applied. This plan looks to continue the investment in TAC renewals.

On further analysis, comparing condition with remaining age in Figure 6-3 (right graph) it becomes evident that most of this backlog is true condition backlog. The 21-24 plan cleared a significant amount of this condition/age back log. This programme looks to continue to manage the back log and focus on managing the high-volume parts of the network.

This currently shows a 1.4km of poor or very poor condition of FNDC TAC surface beyond remaining life on the higher volume network.

WDC – Figure 6-4 following shows the TAC renewal profile and remaining life versus condition distribution for the WDC network.

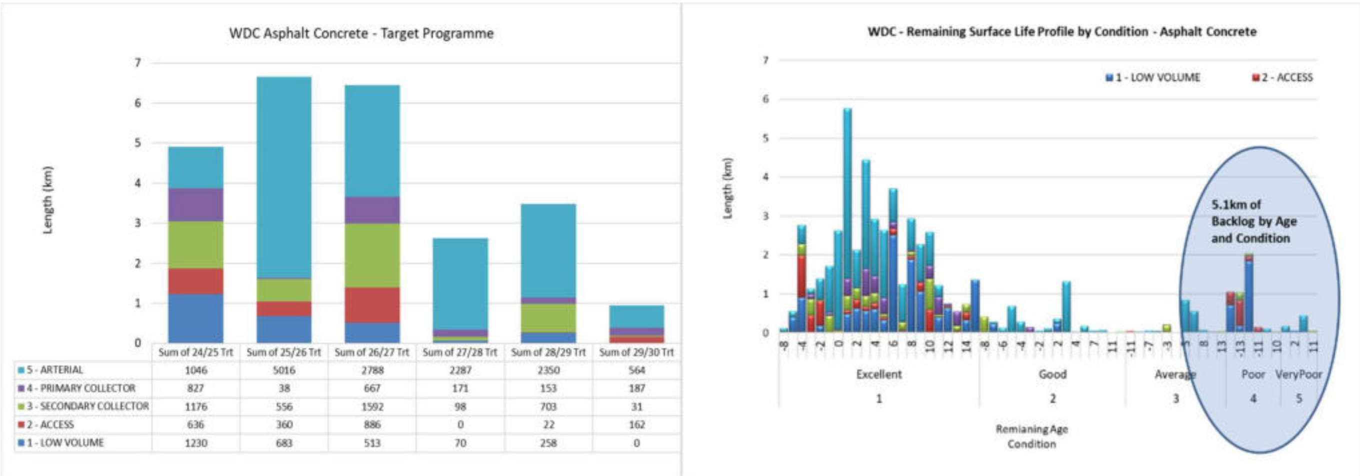


Figure 6-4: WDC TAC renewal profile & remaining life versus condition

The WDC TAC programme is shown in Figure 6-4 (left graph) reflects the growing asphalt renewal need on the network. Currently there is a significant length of high-volume roads that are rapidly approaching poor to very poor condition. As can be seen the clear majority of the programme is in the Arterial network. Where there is asphalt programmed on the Access and Low Volume parts of the network these are on rural high stress corners which are due for replacement as condition dictates. This method will create backlog at some become unavoidable to treat and present a significant programme risk. This profile has increased due to deferral of thin asphalt in the last plan due budget impacts. This has had an impact on the 24-27 plan quantities as predicted from the 21-24 plan.

On further analysis, comparing condition with remaining age in Figure 6-4 (right graph) it becomes evident that the large majority of this backlog is true condition backlog. This was at 5.1km at the start of the 18/21 and is now at 2.1km at the start of 21/24 plan.

Northland Transportation Alliance

Pavement Performance Analysis – 2023/24

October 2023

Northland Transportation Alliance (NTA)

Pavement Performance Analysis – 2023/24

October 2023

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Date October 2023 – Draft for Review

Executive Summary

The Northland Transportation Alliance (NTA) manages the local authority road networks in the Far North District Council (FNDC), Kaipara District Council (KDC) and Whangarei District Council (WDC).

This report has been completed as part of the continual process in the implementation of the pavement performance modelling (PPM) for the FNDC, KDC and WDC road networks.

The main objective of this PPM analysis is to:

- Check the appropriateness of the current funding levels for each of the road networks managed by the NTA; and
- Determine the optimal funding split between resurfacing and rehabilitation renewal treatments within each network.

The model analysis period is from 2023/24 to 2043/44 (21 years). The 2023/24 year is reserved for committed treatments supplied by the NTA and so the first non-committed year for the Trigger and Optimal models is 2024/25. The Trigger and Optimal model programme quanta are averaged over the period 2024/25 to 2033/34 (10 years) and over the period 2024/25 to 2043/44 (20 years) for reporting purposes.

Five optimised funding levels were tested in the Optimal Model to check the appropriate level of funding for the programme treatments. A Normal budget scenario represents the current funding for renewals and has been set for each of the FNDC, KDC, and WDC networks. The Normal budget is $8.14, $3.70, and $9.06 million per year for each network respectively. For each network, two scenarios at greater than Normal budget funding level were tested and two scenarios at less than the Normal budget funding level were tested.

A supplementary Trigger Model analysis was completed. This model does not have a budget limitation as it applies a decision tree approach to applying treatments if certain interventions (triggers) have been met.

A Specified Model was run using the existing forward work programme imported to the model; this model reports the cost and predicted conditions for the given programme.

During the 2022/23 season the NTA networks were impacted by several severe weather events that had caused slips and closed roads. A less obvious affect was that many pavements had been inundated and spent extended periods with high moisture contents. This will compromise the structural capacity of the network's pavements to some degree but which currently cannot be quantified. Consequently, there may be more need for renewals in the future

Model Outputs – Predicted Condition

Surface Integrity Index (SII) – The system is designed to prioritise resurfacing first, then with more funding available it will start undertaking rehabilitation treatments. The resurfacing treatments, especially chipseal, are priority treatments because they offer asset preservation and improvement (when required) at the most economic price. The predicted long term average SII is either improved or maintained relative to the current average SII throughout the analysis period for all optimised budget scenarios. The general trends are for SII to improve during the first decade of the analysis but deteriorates throughout the second decade. At the end of the analysis period, SII deteriorates to levels that are similar to the start.

Pavement Condition Index (PCI) – The current NTA network level PCI can be maintained within the first half of the 20 year analysis period for all optimised scenarios. However, PCI may not be able to be maintained in the long term at the current indicated levels by current renewal expenditure as the networks' pavement base continue to age.

FNDC has the lowest (worst) initial PCI and improves over the majority of the analysis period. It takes five years to reach a plateau, then eventually deteriorates relative to the plateau at a rate dependant on funding level. KDC has long term deterioration at normal funding (and lower), indicating that greater amounts of pavement and surface renewal will be required than can be afforded by the normal funding scenario. WDC has long term deterioration when funding levels are less than the very high funding scenario. WDC is at risk of long term deterioration if funding is

<u>Model Outputs – Forecast Programme</u>

In the Optimal analysis, the funding resource is used to its full capacity in each scenario throughout the analysis period. Suggesting the network is not overfunded, even at the highest funding scenario.

The model follows asset management best practice by giving priority to preservation treatments. After the committed year, the model is hardcoded to resurface the first coat seals to protect prior rehabilitation investment. After which, the model's first priority is to satisfy the resurfacing need (because it offers asset preservation and some improvement at the most economic price) and then apply more expensive renewal treatments if funding permits. Therefore, chipseal has first priority at low funding and increasing funding normally results in affording more asphalt resurfacing treatments. There will be a gradual introduction of more pavement rehabilitation treatments as funding is increased further.

A suggested programme for each network is based on the analysis of model outcomes to assess the long-term renewals need of the networks.

FNDC Funding Level – It is suggested the annual expenditure should be in the order of $9.2 to $10.4 million per year. The current budget (Normal Scenario $8.14M) is beneath the low end of this range. The suggested expenditure is based on the following:

FNDC Resurfacing Renewal – Chipseal: 72 to 75 km ($4.3 to $4.5 million)

The range of Optimal Model scenarios 10-year and 20-year average annual chipsealing (RSEAL plus 2ndCoat) is 71 to 75 km ($4.3 to $4.5 million).

The reseal quantities reached a steady level (where there is diminishing additional quantities with increased funding) at the Low scenario funding level. The reseal treatment is a priority because it offers asset preservation and some improvement (when required) at the most economic price.

A suggested 72 to 75 km is 8.1% to 8.5% of the chipseal network length per year. This amount is more than the past 5 years achievement. A greater amount is needed to cater for sealed network expansion, ensure second coat seals are catered for, and the age-based backlog quantity does not grow even further and become unmanageable in the future. The average of the suggested range (73.5 km/year) will result in a chipseal life cycle of 12.0 years. The suggested amount of chipseal treatments is affordable at the current budget of $8.14 million.

FNDC Resurfacing Renewal – Asphalt: 2.5 km ($1.7 million)

The range of Optimal Model scenarios 10-year and 20-year average annual asphalt surface renewal (TAC) is 1.8 km to 2.5 km ($1.3 to $1.8 million).

The TAC quantities reached a steady level at the Normal scenario funding level. There is also some additional TAC quantities forecast by the model within the rehabilitation treatments.

A suggested 2.5 km is 8.4% of the asphalt network length per year. This amount of asphalt treatments is required to cater for the existing asphalt surfaces that are currently at or near end of useful life. The suggested amount of asphalt treatment is affordable at the current budget.

FNDC Rehabilitation Renewals: 6.0 to 8.0 km ($3.1 to $4.1 million)

The range of Optimal Model scenarios 10-year and 20-year average annual rehabilitation (RHAB) is 2.1 km to 10.3 km ($1.2 to $5.4 million).

The amount of RHAB treatments prioritised to the programme over the analysis period with the Normal budget is beneath the suggested range. This is a financial constraint as the model needed to cater for resurfacing needs first for the preservation and greater good of the network.

Based on RAMM data, over the last ten years, the average annual pavement base achievement was 14.1 km (1.5% of the network). The RAMM data includes recent seal extension and new pavements completed, which will overstate the historic pavement renewal achievement. The achievement of pavement renewals is much less than what pavement age data suggests and this makes it difficult to quantify the amount of recent rehabilitation achievement.

A suggested range of 6.0 km to 8.0 km is in line with current practice and the optimised programme with higher funding.

The annual cost for an allowance for the average of the suggested range (7.0 km) is $3.6 million. This will result in a pavement base life cycle of 131 years.

KDC Funding Level – It is suggested the annual expenditure should be in the order of $3.7 to $5.0 million per year. The current budget (Normal Scenario $3.70M) is at the low end of this range. The suggested expenditure is based on the following:

KDC Resurfacing Renewal – Chipseal: 31 to 35 km ($1.9 to $2.2 million)

The range of Optimal Model scenarios 10-year and 20-year average annual chipsealing (RSEAL plus 2ndCoat) is 30 to 33 km ($1.8 to $2.0 million).

The reseal quantities reached a steady level (where there is diminishing additional quantities with increased funding) at the Very Low scenario funding level. The reseal treatment is a priority because it offers asset preservation and some improvement (when required) at the most economic price.

A suggested 31 to 35 km is 6.7% to 7.6% of the chipseal network length per year. This amount is less than the past 5 years achievement since the historic backlog of second coat seal need has been adequately addressed in recent years. An amount at the higher end of the suggested range will be needed in the future to ensure future second coat seals are catered for and the age-based backlog quantity does not grow and become unmanageable. Furthermore, KDC is having a large amount of residential and related commercial development in the Mangawhai area, which is starting to impact on the surface and pavement life.

The average of the suggested range (33 km/year) will result in a chipseal life cycle of 14.0 years. The suggested amount of chipseal treatments is affordable at the current budget of $3.70 million.

KDC Resurfacing Renewal – Asphalt: 0.5 km ($0.2 million)

The range of Optimal Model scenarios 10-year and 20-year average annual asphalt surface renewal (TAC) is 0.8 km to 0.9 km ($0.3 to $0.4 million).

The TAC quantities reached a steady level at the Very Low scenario funding level. There is also some additional TAC quantities forecast by the model within the rehabilitation treatments.

A suggested 0.5 km is 6.4% of the asphalt network length per year. This amount of asphalt treatments is required to cater for the existing asphalt surfaces that are currently at or near end of useful life. The suggested amount of asphalt treatment is affordable at the current budget.

KDC Rehabilitation Renewals: 3.0 to 5.0 km ($1.6 to $2.6 million)

The range of Optimal Model scenarios 10-year and 20-year average annual rehabilitation (RHAB) is 0.7 km to 5.5 km ($0.4 to $2.9 million).

The amount of RHAB treatments prioritised to the programme over the analysis period with the Normal budget is lower than the suggested range. This is a financial constraint as the model needed to cater for resurfacing needs first for the preservation and greater good of the network.

It is not realistic to expect a network to be managed over a long period of time without the need for rehabilitation treatments. The increasing pavement age indicates the pavement capacity will inevitably be consumed over a long period of time. The pavement will become less resilient to wear and less capable of absorbing deterioration.

Based on RAMM data, over the last ten years, the average annual pavement base achievement was 4.9 km (1.0% of the network). The RAMM data includes recent seal extension and new pavements completed, which will overstate the historic pavement renewal achievement. The achievement of pavement renewals is less than what pavement age data suggests.

A suggested range of 3.0 km to 5.0 km is in line with current practice and identified forward work, the optimised programme with higher funding.

The annual cost for an allowance for the average of the suggested range (4.0 km) is $2.1 million. This will result in a pavement base life cycle of 117 years.

WDC Funding Level – It is suggested the annual expenditure should be in the order of $10.5 to $12.9 million per year. The current budget (Normal Scenario $9.06M) is beneath the low end of this range. The suggested expenditure is based on the following:

WDC Resurfacing Renewal – Chipseal: 72 to 75 km ($3.6 to $3.8 million)

The range of Optimal Model scenarios 10-year and 20-year average annual chipsealing (RSEAL plus 2ndCoat) is 72 to 75 km ($3.6 to $3.8 million).

The reseal quantities reached a steady level (where there is diminishing additional quantities with increased funding) at the Very Low scenario funding level. The reseal treatment is a priority because it offers asset preservation and some improvement (when required) at the most economic price.

A suggested 72 to 75 km is 7.2% to 7.5% of the chipseal network length per year. This amount is less than the past 5 years achievement. The historic backlog of void fill/texturising seals and second coat seal need has been adequately addressed in recent years. An amount at the higher end of the suggested range will be needed in the future to ensure future second coat seals are catered for, and the age-based backlog quantity does not grow and become unmanageable. The average of the suggested range (73.5 km/year) will result in a chipseal life cycle of 13.6 years. The suggested amount of chipseal treatments is affordable at the current budget of $9.06 million.

Resurfacing Renewal – Asphalt: 5.0 to 6.5 km ($2.5 to $3.3 million)

The range of Optimal Model scenarios 10-year and 20-year average annual asphalt surface renewal (TAC) is 6.4 km to 6.7 km ($3.3 to $3.4 million).

The TAC quantities reached a steady level at the Very Low scenario funding level. There is also some additional TAC quantities forecast by the model within the rehabilitation treatments.

A suggested 5.0 to 6.5 km is 6.5% to 8.5% of the asphalt network length per year. This amount is greater than the past 5 years achievement. This amount of asphalt treatments is required to cater for the existing asphalt surfaces that are currently at or near end of useful life. The average of the suggested range (5.75 km/year) will result in an asphalt life cycle of 13.3 years. The suggested amount of asphalt treatments is affordable at the current budget.

Rehabilitation Renewals: 6.0 to 8.0 km ($4.4 to $5.8 million)

The range of Optimal Model scenarios 10-year and 20-year average annual rehabilitation (RHAB) is 0.9 km to 8.8 km ($0.7 to $5.7 million).

The amount of RHAB treatments prioritised to the programme over the analysis period with the Normal budget is lower than the suggested range. This is a financial constraint as the model needed to cater for resurfacing needs first for the preservation and greater good of the network.

It is not realistic to expect a network to be managed over a long period of time without the need for rehabilitation treatments. The increasing pavement age indicates the pavement capacity will inevitably be consumed over a long period of time. The pavement will become less resilient to wear and less capable of absorbing deterioration.

Based on RAMM data, over the last ten years, the average annual pavement base achievement was 8.8 km (0.8% of the network). The RAMM data includes recent seal extension and new pavements completed, which will overstate the historic pavement renewal achievement. The achievement of pavement renewals is less than what pavement age data suggests and this makes it difficult to quantify the amount of recent rehabilitation achievement.

A suggested range of 6.0 km to 8.0 km is greater than current practice, but within the identified forward work and forecast given by the optimised programme with higher funding.

The annual cost for an allowance for the average of the suggested range (7.0 km) is $5.1 million. This will result in a pavement base life cycle of 153 years.

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List of Abbreviations

Term	Description
1CHIP	Single Coat Chip seal
2CHIP	Two Coat Chip seal
AADT	Annual Average Daily Traffic
AC	Asphaltic concrete - surfacing treatment
CONC	Concrete Pavement
dTIMS	Deighton's Total Infrastructure Management System
ESA	Equivalent Standard Axle
FNDC	Far North District Council
FWD	Falling Weight Deflectometer
FWP	Forward Work Programme
IDS	Infrastructure Decision Support
INBLK	Interlocking Block Pavers
IRI	International Roughness Index
KDC	Kaipara District Council
MAINT	Routine Maintenance
NAASRA	National Association of Australian State Roading Authorities
NTA	Northern Transport Alliance
NZTA	New Zealand Transport Authority
ONRC	One Road Network Classification
PCI	Pavement Condition Index
PPM	Pavement Performance Model
PSR	Pre-seal Repairs
RACK	Racked-in Seal
RAMM	Road Assessment and Maintenance Management System
RHAB	Base renewal / Rehabilitation Treatment
RS	Chipseal reseal
RSEAL	Chipseal reseal
RSL	Remaining Surface Life
RUTM	Mean Rut Depth (mm)
SC	Chip seal second coat
SII	Surface Integrity Index
SLRY	Slurry Seal
SMA	Stone Mastic Asphalt
SNP	Structural Number
TAC	Thin Asphalt concrete - surfacing treatment
TL	Treatment Length, pre-defined homogenous sections from RAMM
VFILL	Void Fill Seal
WDC	Whangarei District Council

1 Introduction

The Northland Transportation Alliance (NTA) manages the local authority road networks in the Far North District Council (FNDC), Kaipara District Council (KDC) and Whangarei District Council (WDC).

This report has been completed as part of the continual process in the implementation of the pavement performance modelling (PPM) for the FNDC, KDC and WDC road networks.

The main objective of this PPM analysis is to:

- Check whether current funding levels are appropriate for each of the road networks managed by the NTA; and
- Determine the optimal funding split between resurfacing and rehabilitation renewal treatments within each network.

The NZ - dTIMS CT V8 Enterprise software was utilised to perform the pavement modelling for these networks. The use of dTIMS in New Zealand is guided by Infrastructure Decision Support (IDS) Ltd.

The dTIMS software package is designed to enable infrastructure owners and managers to identify maintenance needs and plan forward work and associated budgets in the long term. It is a useful tool in testing the implication of different funding strategies and, as part of a pavement management system, ensures that the maximum return is derived from the road infrastructure investment.

There are three types of model analysis within the software:

- **Trigger Model** – defines the programme and cost required to meet a performance standard and specified level of service through the utilisation of a decision tree approach and applies treatments when certain triggers have been met without any budget constraint;
- **Optimal Model** – provides an optimal maintenance strategy to fit a given budget; and
- **Specified Model** – uses the current Forward Work Programme (FWP), calculates how much it will cost and predicts the condition based on the given treatments.

Data quality is an important part of the pavement modelling and will influence the model output quality accordingly. The FNDC, KDC and WDC RAMM databases were used as the primary source of input data. The data was downloaded from RAMM using the dTIMS CT express unload facility during September 2023.

This is the fourth NTA full network PPM incorporating cracking data that has been collected by high speed data (HSD). The HSD cracking was downloaded directly from the RAMM user defined table and processed (cracking quantities summarised) to the input file outside of RAMM.

The input file for the dTIMS analysis was further prepared using the IDS interface database software and desktop review where data updates were completed where required.

2 Model Inputs – Funding, Budgets, Unit Rates

This section provides a discussion on the current funding levels, the modelled budget scenarios for the analysis and the supplied unit rates.

2.1 Analysis Period

The model analysis period is from 2023/24 to 2043/44 (21 years).

The 2023/24 year is reserved for committed treatments supplied by the NTA and so the first non-committed year for the Trigger and Optimal models is 2024/25. The Trigger and Optimal model programme quanta are averaged over the period 2024/25 to 2033/34 (10 years) and over the period 2024/25 to 2043/44 (20 years) for reporting purposes.

The Specified Model programme contains treatments from 2023/24 to 2032/33. The 2023/24 year treatments in the Specified Model are also committed within the Trigger and Optimal models. The Specified Model programme quanta are averaged over the period 2024/25 to 2032/33 (9 years) for reporting purposes.

2.2 Current Expenditure and Funding Levels

Table 2-1 below shows the current expenditure and funding levels for the NTA managed road networks. The values were updated as per the Clients email September 2023.

Table 2-1 also shows the model treatment codes associated with the network maintenance and renewal activities.

Table 2-1: Current annual funding level

Category	Activity	Model Code	Network Cost, $Million			
			FNDC	KDC	WDC	Total NTA
Routine (expenditure)	Routine Maintenance	MAINT	1.00	0.96	0.99	2.95
	Pre-seal Repairs	PSR	0.73	0.80	0.90	2.43
	Total Routine	–	1.73	1.76	1.89	5.38
Programme (funding level)	Chipseal resurfacing & Asphaltic Concrete resurfacing	RSEAL, 2ndCoat TAC	4.39	2.20	4.91	11.50
	Rehabilitation	RHAB	3.75	1.50	4.15	9.40
	Total Programme	–	8.14	3.70	9.06	20.90
Total	Grand Total	–	9.87	5.46	10.95	26.28

2.4 Trigger Model Budget

The Trigger Model does not have a budget limitation as it applies a decision tree approach to applying treatments if certain interventions (triggers) have been met.

2.5 Specified Model Budget

The Specified Model is the existing FWP imported to the model; the model will report the cost and condition of the given programme. The latest FWP was used to run the Specified Model, the FWP was downloaded from the RAMM FWP module during September 2023 using the dTIMS CT express unload facility.

2.6 Optimal Model Budget Scenarios

Optimised modelling usually considers five different budget scenarios, as well as the Least Cost scenario.

The Least Cost scenario is the sum of the least cost strategies for each modelled road section. The model will use the least cost strategies as a base-line programme from which optimised programmes are developed. It is not possible to have an optimised programme with a lower budget than the Least Cost programme cost.

RSEAL, 2ndCoat, TAC and RHAB treatment costs are normally pooled and constrained by a single programme budget category. Each of these treatment's costs are assigned to this budget and the Optimal Model will select the treatments that provide the best possible network outcome for the available programme budget.

The modelled budgets include the cost of the physical works and the professional services for design and supervision. Modelled budgets do not allow for the following:

- Any associated improvement costs such as drainage costs;
- Seal extension costs; and
- Routine maintenance and pre-seal repairs (these are assigned an unlimited budget within the model).

Routine and pre-seal treatments are unconstrained by having an unlimited budget in the model. This ensures the programme treatments are not unduly constrained by routine outcomes. The predicted maintenance cost are indicative and should only be used for relativities and comparison purposes.

A review of the current expenditure and discussion with the Client resulted in the following annual budget scenarios being used for the optimal analysis.

Table 2-2 shows the five programme budget scenarios for each the FNDC, KDC and WDC networks to check the appropriate level of funding for the networks using the Optimal Model. The annual RSEAL, 2ndCoat, TAC and RHAB treatment costs are pooled and constrained by the programme budget in the model.

Table 2-2: Optimal Model Budget Scenarios

Budget Scenario	Network Annual Programme Budget, $Mill				Notes
	FNDC	KDC	WDC	(Total)	
Very High (VH)	11.40	5.18	12.68	29.26	40% more than the Normal Budget
High (H)	9.36	4.26	10.42	24.04	15% more than the Normal Budget
Normal (N)	8.14	3.70	9.06	20.90	Representing current renewal expenditure
Low (L)	6.92	3.15	7.70	17.77	15% less than the Normal Budget
Very Low (VL)	5.70	2.59	6.34	14.63	30% less than the Normal Budget

It is not possible to have an optimised programme with a lower budget than the Least Cost programme cost. This has been the case for this analysis as the Very Low and (to a lesser extent) Low scenario programme budgets are close to the values generated by the Least Cost programme. The Least Cost programme has years with cost spikes and these have needed to be incorporated in the programme budget profiles. Consequently, the 10-year average budget values are a little higher than the nominal budgets.

2.7 Unit Rates

Table 2-3 summarise the modelled unit rates. Unit rates had been supplied by the Client.

Table 2-3: Unit Rates

Code	Description	Network Unit Rate, $/m^2		
		FNDC	KDC	WDC
PSR	Mill and Fill	45.00	45.00	45.00
	Rut Filling	70.00	70.00	70.00
	Levelling	30.00	30.00	30.00
RSEAL & 2ndCoat	All Roads	9.00	9.20	7.20
TAC	All Roads	75.00	54.00	50.00
RHAB	Chipseal Surfaced	70.00	70.00	70.00
	Asphalt Surfaced	250.00	250.00	250.00

3 Model Inputs – Network Characteristics and Condition

A basic understating of the networks is an essential part of the modelling process. The following sections summarise some of the main network characteristics and conditions.

3.1 Modelled Network

The number of sections imported through the dTIMS input file dTAG_TL is 7,303 sections and the total length analysed is 2,457 km, 622 km is urban and 1,835 km is rural.

Table 3-1: Modelled network; number of sections and length

Road Class	Number of Sections				Length, km			
	FNDC	KDC	WDC	Total NTA	FNDC	KDC	WDC	Total NTA
Urban	836	641	1,581	3,058	195	109	317	622
Rural	1,451	1,137	1,657	4,245	719	360	756	1,835
Total	2,287	1,778	3,238	7,303	914	469	1,073	2,457

Figure 3-1 illustrates the urban and rural road length distribution within the network.

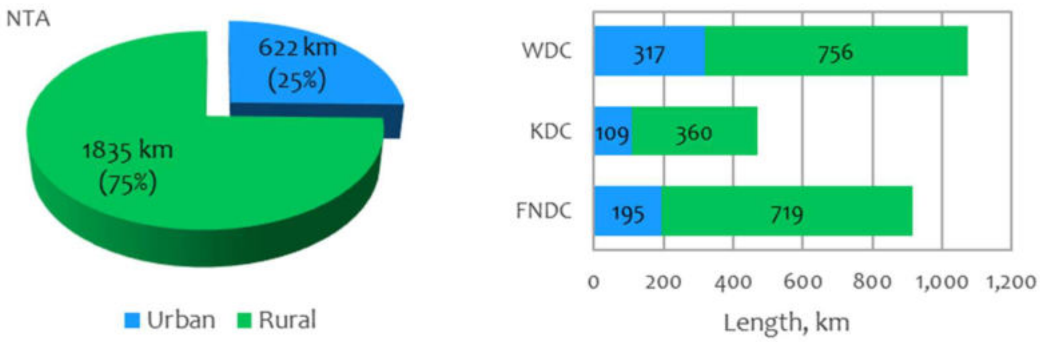


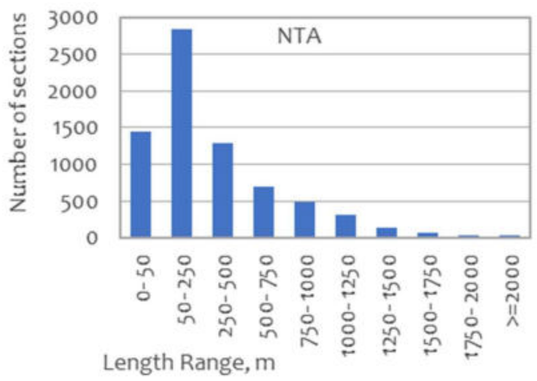
Figure 3-1: Urban/ Rural distribution

3.2 Treatment Lengths

Figure 3-2 shows the distribution of the modelled treatment lengths within the networks. Approximately 20% of the NTA treatment lengths are less than 50 metres long. On the other hand, approximately 8% have length more than 1,000 metres.

Of the three networks, KDC and WDC have the greatest amount of short treatment lengths (less than 50 m). KDC typically has treatment lengths in the range of 50 to 250 m, while FNDC and WDC tend to have a greater spread of longer treatment lengths.

Normally in PPM, lengths greater than 1,000 metres are considered to be on the high side, they should be reviewed and segmented where possible as part of continuous data improvement. Similarly, short sections may also need to be aggregated.



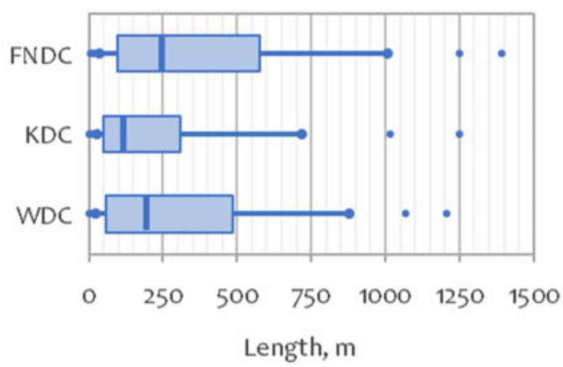
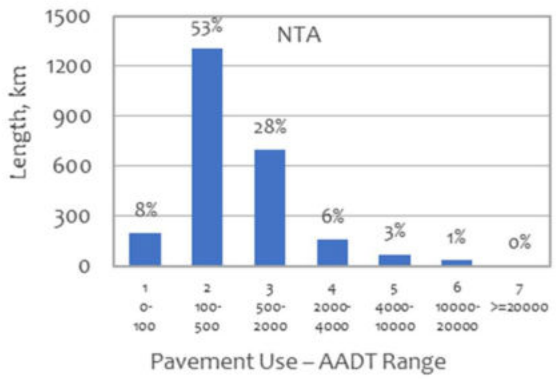


Figure 3-2: Treatment Length distribution

Figure 3-3: Treatment Length quartile distribution

3.3 Traffic Loading

Figure 3-4 below illustrates the distribution of traffic, expressed as Annual Average Daily Traffic (AADT) based on the RAMM Pavement Use ranges. The Figure indicates that approximately 61% of the NTA network length has traffic volume less than 500 vehicles per day and 89% of the network length carries less than 2,000 vehicles per day.



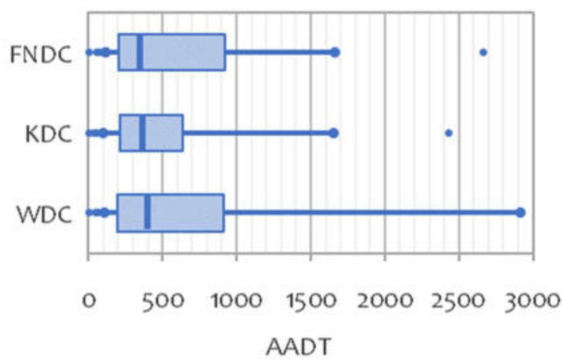


Figure 3-4: Pavement Use length distribution

Figure 3-5: AADT quartile distribution

Figure 3-6 following illustrates the distribution of traffic, expressed as Vehicle Kilometres Travelled (VKT) within the RAMM Pavement Use ranges. VKT is a function of the length of a treatment length and the associated AADT. VKT shows how many vehicle kilometres are travelled on the networks.

The Figure indicates that more than half of all NTA travel is on roads with Pavement Use 4 or greater (roads with more than 2,000 AADT) despite these roads having just 11% share of the network length. This illustrates why service levels are higher and why renewal investment is proportionately greater for roads with higher AADT. It is also noteworthy that Pavement Use 6 roads carry more traffic than the Pavement Use 2 roads despite the difference in length between these two categories.

The VKT in million per annum for FNDC, KDC, and WDC respectively are; 255, 121, 490. The WDC network has more VKT than the FNDC and KDC networks combined. FNDC and KDC have similar traffic density when taking in account the length of each network. The WDC network stands out as being almost twice as densely trafficked compared to these other two networks.

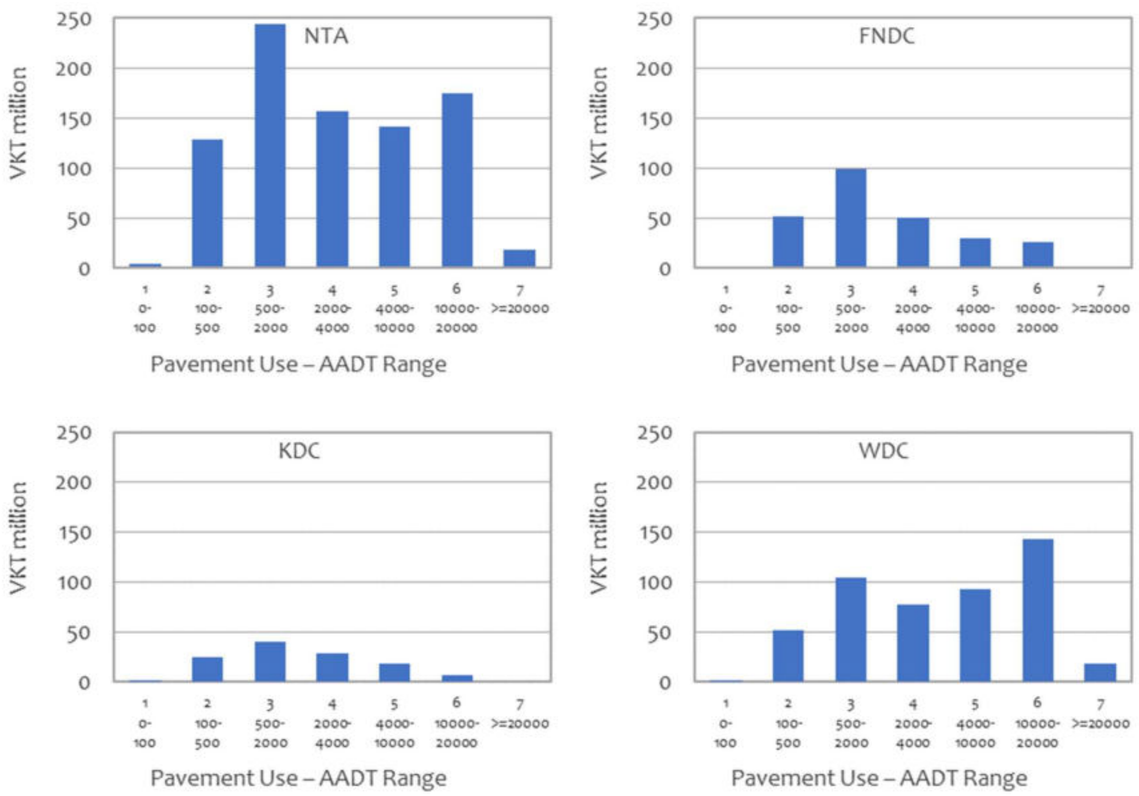


Figure 3-6: Pavement Use VKT distribution

3.4 Surface Types

Approximately 95% of the modelled NTA network is chipseal (predominantly two coat seals, coded 2CHIP), while thin asphaltic concrete (AC), SMA, OGPA and Slurry combined make up the remaining 5%.

Table 3-2: Surface type length

	Length, km			
Surface Type	FNDC	KDC	WDC	Total NTA
Asphalts and Slurry	30	8	77	114
Chipseal	884	461	997	2,342
Total	914	469	1,073	2,457

Figure 3-7 below illustrates the length of different surface types on the sealed networks.

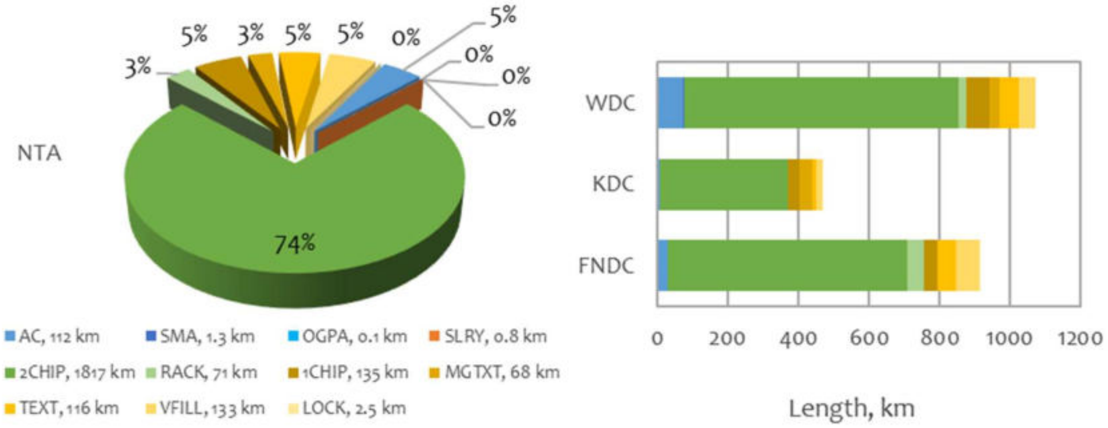


Figure 3-7: Surface type distribution

Figure 3-8 below shows that 3% of the modelled NTA network length has first coat chipseal surfaces (approximately 78 km). These will need to be managed within the FWP to ensure that backlog for the needed second coats does not accumulate.

The FNDC network has the greatest amount of first coat seals of the three networks, having approximately 43 km (5% of FNDC modelled length). The KDC network has approximately 16 km (3% length) and the WDC network has approximately 19 km (2% length).

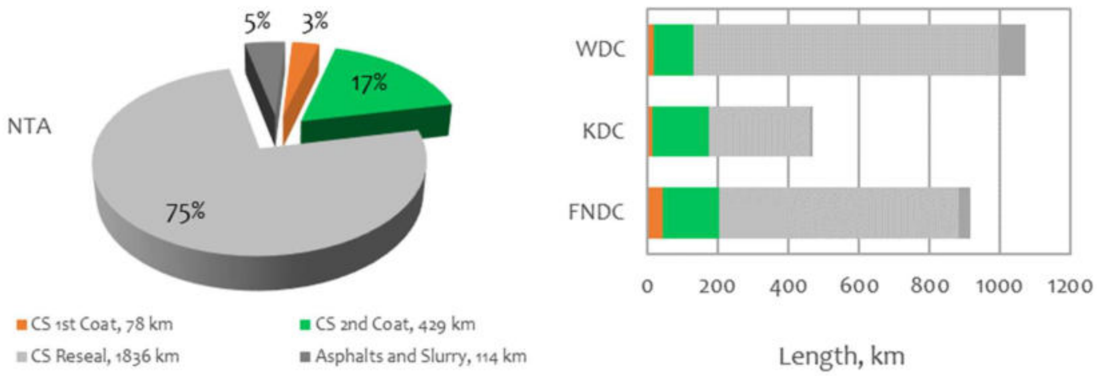


Figure 3-8: Surface function distribution

3.5 Surface Age

A review of the surface age data can provide insight on recent historic surface renewal investment and whether there are any potential implications for renewal need for the future.

The overall NTA network weighted average surface age is 6.7 years. The weighted average surface age for FNDC, KDC, and WDC respectively are; 7.9, 6.0, and 5.9 years. A distribution of the surface ages are represented in Figure 3-9.

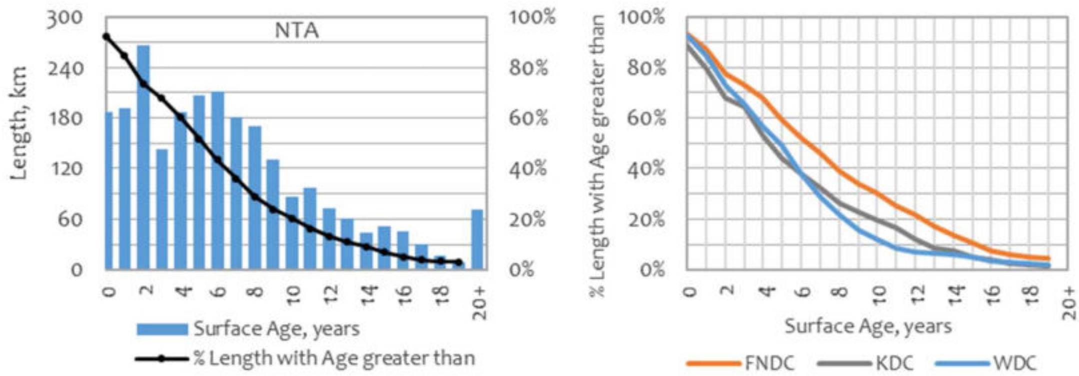


Figure 3-9: Surface age distribution

Table 3-3 shows a breakdown of the surface types that had been completed during the past five years. These quantities represent all surfacing done and includes network expansion and special projects as well as maintenance and renewal activity.

The total NTA average annual achievement during the past five years was 195 km (7.9% of the modelled NTA network length). This indicates the NTA had a renewal rate of 7.9% per year which equates to an average renewal cycle of 12.6 years. The historic renewal cycles for FNDC, KDC and WDC were 15.5 years, 10.7 years, and 11.6 years, respectively.

An annual average of 10 km of first coat chipseals and 21 km of void-fill and texturising type chipseals had been completed on the NTA network during the past five years. These seal types typically have shorter design lives than ordinary reseals and it is expected these seals will need to be retreated during the first half of the 10 year analysis period.

Table 3-3: Average annual surface achievement during the past 5 years

	1st Coat Chipseal	2nd Coats & Reseals		Total Chipseals		Total Asphalts and Slurry		Total	
		Small Chip Only: Void Fill & Texturising Seals	Includes Large Chip: Two Coat & Single Coat Seals						
	Length, km	Length, km	Length, km	Length, km	% of chipseal length	Length, km	% of asphalt length	Length, km	% of network length
FNDC	7	11	40	58	6.6%	1.1	3.5%	59	6.5%
KDC	1	2	40	43	9.3%	0.7	9.0%	44	9.3%
WDC	2	8	78	88	8.8%	4.6	6.1%	92	8.6%
Total	10	21	158	189	8.1%	6	5.6%	195	7.9%

3.6 Remaining Surface Life (RSL)

Residual life provides a better view of the surface life capacity remaining on the network than the surface age profile. It can be misleading to observe the age distribution only because surfaces have varying expected (design) lives.

The remaining surface life is theoretical and can be calculated using age and RAMM design life of the surface. Surfaces with zero or negative remaining life indicate the surfaces are expired and require renewal. The sum of the length of surfaces with negative remaining life is known as the age-based backlog. It may not necessarily mean that all surfaces in the backlog need renewal as some surfaces can last beyond their design life.

The overall average remaining surface life for the NTA network is 5.5 years. The weighted average remaining surface life for FNDC, KDC, and WDC respectively are; 4.0, 6.8, and 6.2 years. Figure 3-10 illustrates the remaining surface life distributions for the networks.

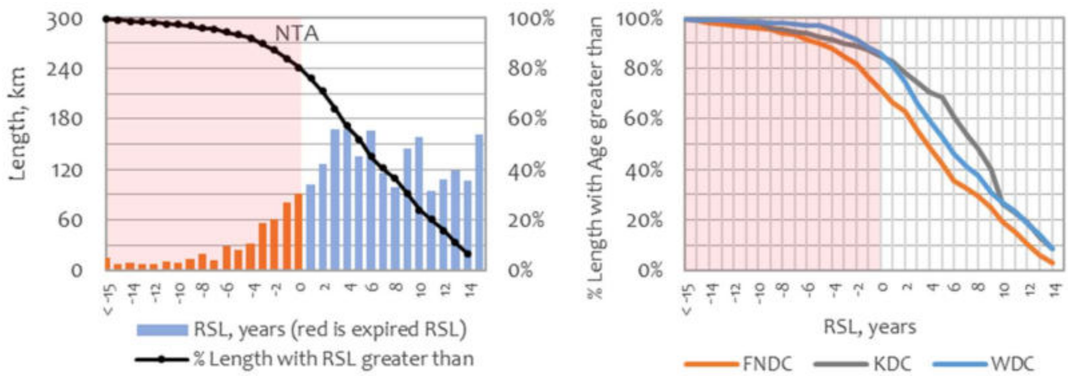


Figure 3-10: Remaining Surface Life (RSL) distribution

The quantity of backlog is important and 10% to 20% backlog is considered acceptable to allow for well performing surfaces.

Table 3-4 following shows a breakdown of the surface type's current age-based backlog and the 5-year forecast average annual surface life expiry. The forecast average annual surface life expiry length is the total amount of surface length that is due to expire during the next five years divided by five to give an average annual value. This gives an indication of the amount that age-based backlog will grow each year if no action is taken.

There is currently a total of 485 km of backlog length which is equivalent to 20% of the modelled NTA network length. The FNDC network has the greatest proportion of total backlog at 29%, while the WDC network has the lowest proportion of total backlog at 14%.

29 km of first coat chipseals and 159 km of void-fill and texturising type chipseals currently have a residual life of zero or less and are in backlog. These seal types typically have shorter design lives than ordinary reseals. An additional 10 km and 21 km per year of these current seal types are due to expire each year during the next five year horizon.

271 km of the other (large chip second coats and reseal) chipseal types currently have a residual life of zero or less. An additional 104 km per year of these current seal types are due to expire each year during the next five year horizon.

Table 3-4: Current age-based backlog and 5-year forecast average annual surface life expiry

		1st Coat Chipseal	2nd Coats & Reseals		Total Chipseals		Total Asphalts and Slurry		Total	
			Small Chip Only: Void Fill & Texturising Seals	Includes Large Chip: Two Coat & Single Coat Seals						
		Length, km	Length, km	Length, km	Length, km	% of chipseal length	Length, km	% of asphalt length	Length, km	% of network length
FNDC	Current age-based backlog	9	73	170	252	28%	10	34%	262	29%
	5-year forecast average annual life expiry	7	11	34	52	5.9%	1	4.9%	53	5.8%
KDC	Current age-based backlog	12	28	32	72	16%	0	3%	72	15%
	5-year forecast average annual life expiry	1	2	13	15	3.3%	0.3	3.4%	15	3.3%
WDC	Current age-based backlog	8	58	69	135	14%	16	21%	151	14%
	5-year forecast average annual life expiry	2	8	57	67	6.7%	4	5.2%	71	6.6%
Total	Current age-based backlog	29	159	271	458	20%	27	24%	485	20%
	5-year forecast average annual life expiry	10	21	104	134	5.7%	6	5.0%	140	5.7%

Some of the sections with expired surface life may be due to data error either in surface date (age) or the design life. All sections with expired surface life should be validated, prioritised, and managed within the FWP.

3.7 Pavement Age

Pavement age information can be used as a useful guide to view historical pavement rehabilitation, construction, and historic funding levels.

The overall NTA network weighted average pavement age is 25 years. The network weighted average pavement ages for FNDC and KDC are 23 and 24 years, while WDC is 28 years. A very small proportion of the NTA network (2%) has unknown pavement age. Figure 3-11 shows the modelled pavement age distributions.

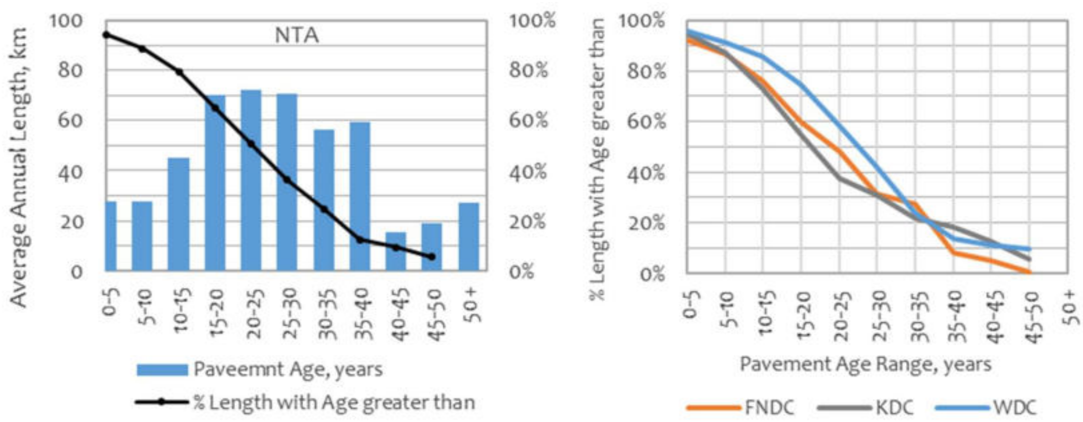


Figure 3-11: Pavement age distribution

In the input data, there is 28 km (1.1% of modelled network length) average annual renewal done during the past 10 years and this equates to an 88 year renewal return period. The 28 km value will include recent seal extensions, new pavements, and special projects completed along with the reconstructed/renewed pavements. Only 13% of pavements have age data older than 40 years.

Table 3-5 shows a breakdown of the pavement with surface types that had been completed during the past five years. These quantities represent all pavement construction done and includes network expansion and special projects as well as the renewal activity.

There has been a large programme of seal extensions and new pavements in recent years. Therefore, the achievement of pavement renewals is much less than what pavement age data suggests and this makes it difficult to quantify the amount of recent rehabilitation achievement.

The overall pavement age distribution appears to be young relative to the recent annual renewal achievement. The 10 to 35 year old pavements may require verification as these may contain default estimates in RAMM.

Table 3-5: Average annual pavement achievement during the past 5 years

	Chipseal Top Surface		Asphalt Top Surface		Total Sealed Pavement	
	Length, km	% of chipseal length	Length, km	% of asphalt length	Length, km	% of network length
FNDC	13.9	1.6%	0.2	0.8%	14.1	1.5%
KDC	4.2	0.9%	0.7	8.7%	4.9	1.0%
WDC	6.1	0.6%	2.7	3.5%	8.8	0.8%
Total	24	1.0%	4	3.2%	28	1.1%

3.8 Pavement Strength

In the dTIMS input file the structural strength of each treatment length is represented by a single number known as the structural number (SNP). SNP is an important factor in the PPM. This number is calculated from Falling Weight Deflectometer survey data and is stored within RAMM.

The input file contains 55% of the NTA network length having SNP values from RAMM. The remaining sections without SNP data have default values applied based on the pavement age and traffic volume. Figure 3-12 illustrates the SNP distribution for the modelled network.

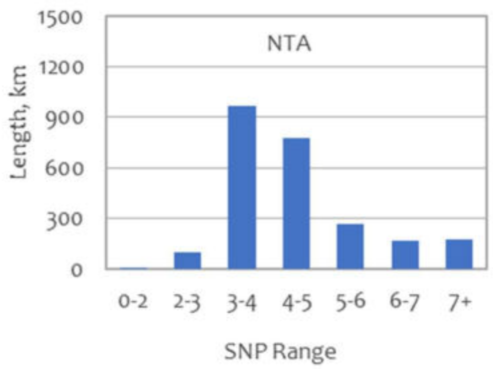


Figure 3-12: SNP distribution

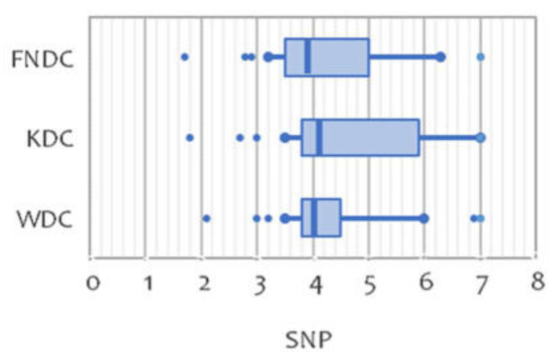


Figure 3-13: SNP quartile distribution

3.9 Roughness

Roughness is collected as part of the High-Speed Data (HSD) survey. It is one of the most important measured conditions as it represents the riding comfort and is used as one of the main key performance indicators by road controlling authorities. Figure 3-14 illustrates the distribution of roughness for the urban and rural networks.

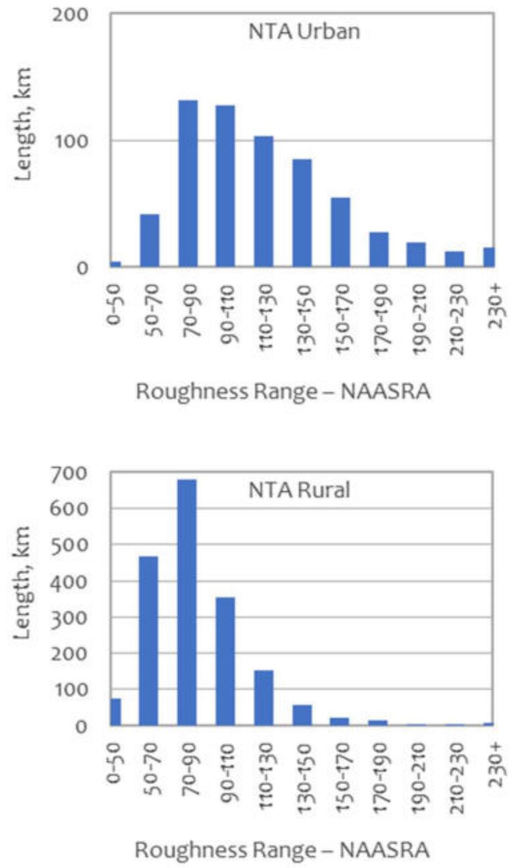


Figure 3-14: Roughness distribution (NAASRA)

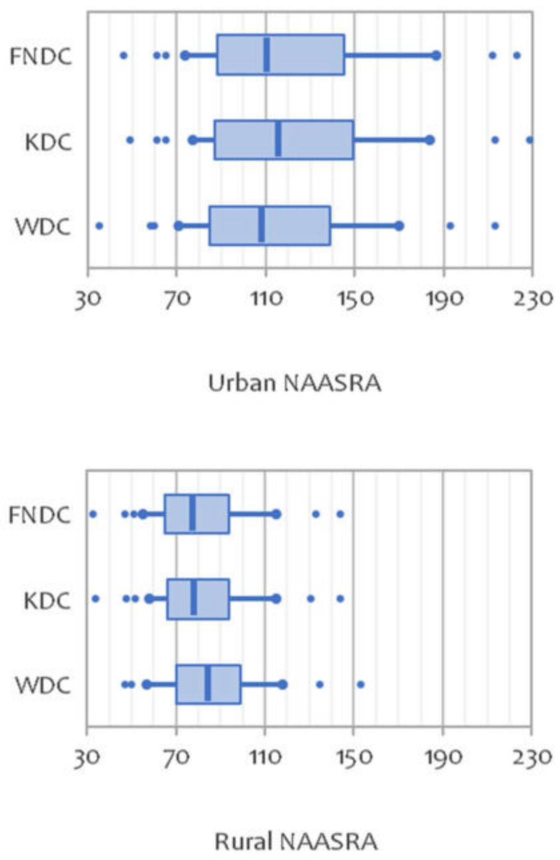


Figure 3-15: Roughness quartile distribution (NAASRA)

3.11 ONRC Performance

Figure 3-16 shows the distribution of the One Network Road Classifications (ONRC) for the NTA road network. The largest ONRC set is the Rural Secondary Collector roads, having 1,030 km of length and comprise approximately 42% of the network.

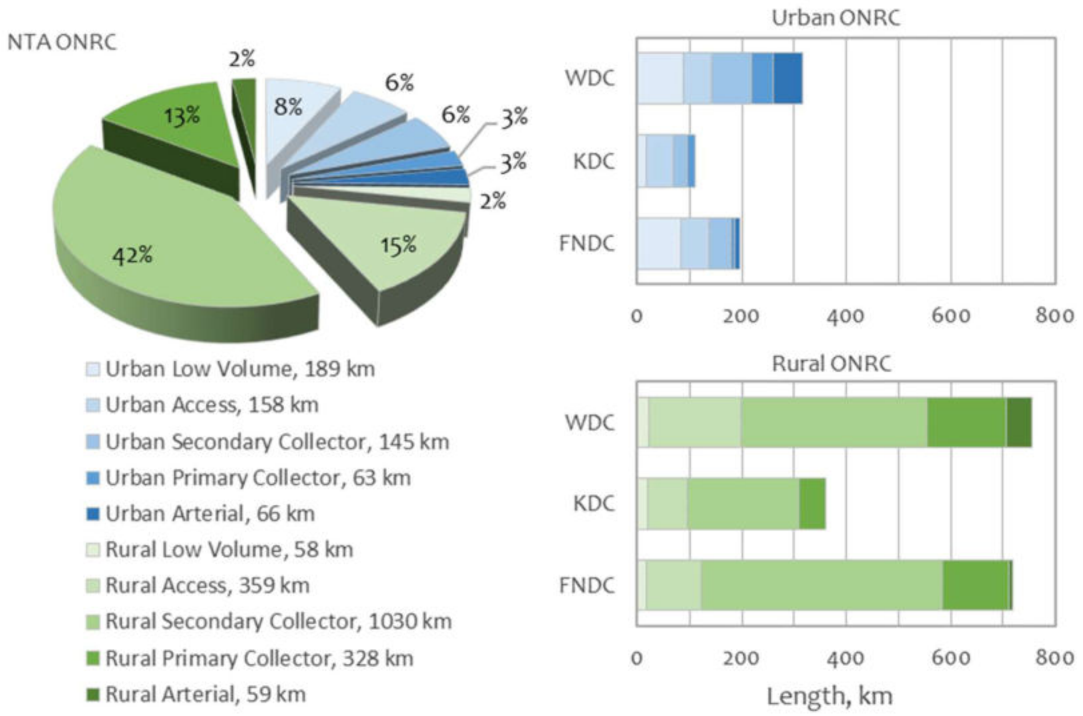


Figure 3-16: ONRC – Network length distribution

Table 3-6 following shows the network road classes and compares the roughness performance against the draft ONRC measures as well as how the ONRC length is distributed.

The ONRC measures have been used to define the trigger thresholds for treatments in the model setup.

The average roughness values are highlighted in yellow in Table 3-6 where they are higher than the ONRC specified averages.

The table shows that the network averages are generally lower than the specified averages except for the;

- FNDC Urban Access,
- KDC Urban Access, and
- WDC Urban Access and Urban Secondary Collector roads.

These parts of the network are lower risk for accelerated deterioration compared with higher ONRC categories.

The table also shows that around 7% to 9% of each network has roughness exceeding the specified targets.

Table 3-6: ONRC draft guideline and current network roughness performance

FNDC

Urban/ Rural	ONRC Code	ONRC Description	ONRC Average Rough (NAASRA)	ONRC Target Rough (NAASRA)	Length (km)	% of Network Length	Wavg Rough (NAASRA)	Length (km) with NAASRA > Target	% of ONRC Length with NAASRA > Target	Smooth Travel Exposure (VKT <= Target)
Urban	LVol	Low Volume	140	180	84	9%	132	14	22%	86%
	Acc	Access	120	150	54	6%	127	13	21%	83%
	SCol	Secondary Collector	110	140	41	4%	97	3	5%	94%
	PCol	Primary Collector	110	140	9	1%	109	1	1%	93%
	Art	Artierial	100	130	8	1%	86	1	1%	91%
Rural	LVol	Low Volume	140	180	16	2%	121	2	3%	93%
	Acc	Access	120	150	107	12%	97	9	14%	93%
	SCol	Secondary Collector	110	130	460	50%	81	17	27%	98%
	PCol	Primary Collector	100	120	128	14%	72	4	6%	98%
	Art	Artierial	100	120	9	1%	72	0	0%	99%
Total					914	100%		63	7%	96%

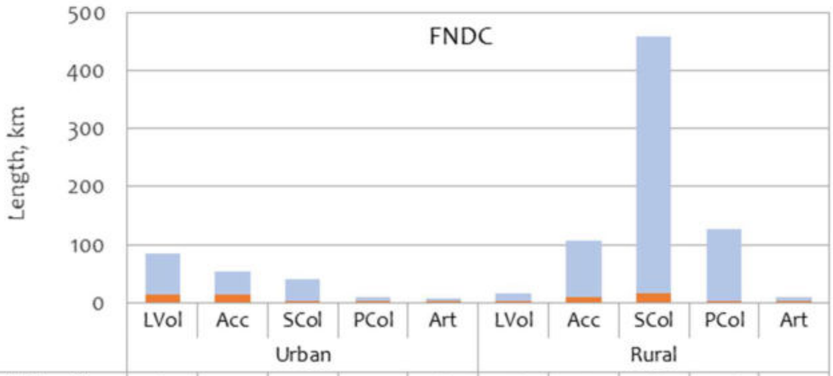
KDC

Urban/ Rural	ONRC Code	ONRC Description	ONRC Average Rough (NAASRA)	ONRC Target Rough (NAASRA)	Length (km)	% of Network Length	Wavg Rough (NAASRA)	Length (km) with NAASRA > Target	% of ONRC Length with NAASRA > Target	Smooth Travel Exposure (VKT <= Target)
Urban	LVol	Low Volume	140	180	16	3%	130	3	6%	90%
	Acc	Access	120	150	52	11%	135	18	45%	77%
	SCol	Secondary Collector	110	140	29	6%	109	4	10%	86%
	PCol	Primary Collector	110	140	13	3%	99	1	3%	94%
	Art	Artierial	100	130						
Rural	LVol	Low Volume	140	180	21	4%	113	1	3%	95%
	Acc	Access	120	150	75	16%	89	4	11%	97%
	SCol	Secondary Collector	110	130	214	46%	79	6	15%	97%
	PCol	Primary Collector	100	120	50	11%	81	3	6%	98%
	Art	Artierial	100	120						
Total					469	100%		40	9%	94%

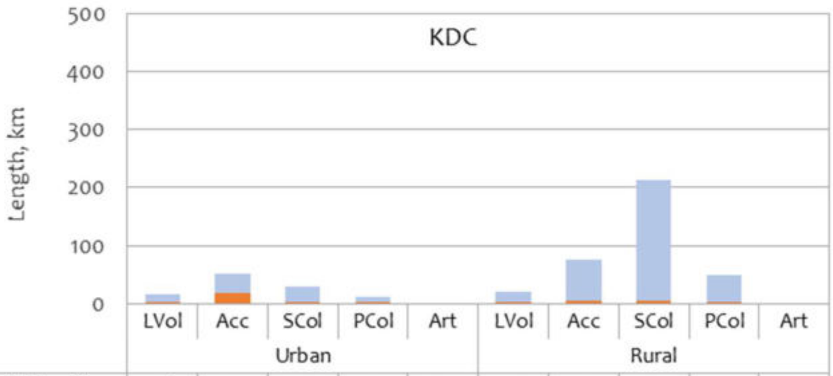
WDC

Urban/ Rural	ONRC Code	ONRC Description	ONRC Average Rough (NAASRA)	ONRC Target Rough (NAASRA)	Length (km)	% of Network Length	Wavg Rough (NAASRA)	Length (km) with NAASRA > Target	% of ONRC Length with NAASRA > Target	Smooth Travel Exposure (VKT <= Target)
Urban	LVol	Low Volume	140	180	89	8%	120	10	11%	87%
	Acc	Access	120	150	53	5%	133	16	17%	72%
	SCol	Secondary Collector	110	140	76	7%	127	25	26%	68%
	PCol	Primary Collector	110	140	41	4%	98	3	3%	88%
	Art	Artierial	100	130	58	5%	92	4	5%	92%
Rural	LVol	Low Volume	140	180	22	2%	110	2	2%	96%
	Acc	Access	120	150	177	17%	93	12	12%	94%
	SCol	Secondary Collector	110	130	356	33%	87	18	19%	96%
	PCol	Primary Collector	100	120	150	14%	82	5	5%	98%
	Art	Artierial	100	120	50	5%	75	1	1%	98%
Total					1073	100%		95	9%	92%

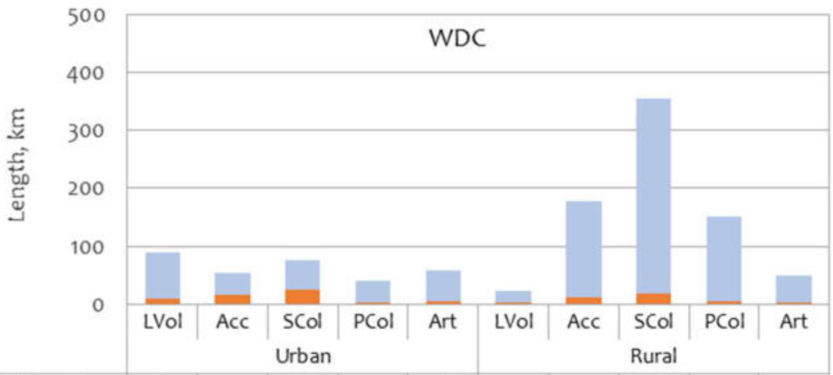
Figure 3-17 illustrates the length with roughness exceeding the draft ONRC target roughness as well as how the overall ONRC length is distributed.



	Urban LVol	Urban Acc	Urban SCol	Urban PCol	Urban Art	Rural LVol	Rural Acc	Rural SCol	Rural PCol	Rural Art
total length	84	54	41	9	8	16	107	460	128	9
length > target	14	13	3	1	1	2	9	17	4	0



	Urban LVol	Urban Acc	Urban SCol	Urban PCol	Urban Art	Rural LVol	Rural Acc	Rural SCol	Rural PCol	Rural Art
total length	16	52	29	13	0	21	75	214	50	0
length > target	3	18	4	1	0	1	4	6	3	0



	Urban LVol	Urban Acc	Urban SCol	Urban PCol	Urban Art	Rural LVol	Rural Acc	Rural SCol	Rural PCol	Rural Art
total length	89	53	76	41	58	22	177	356	150	50
length > target	10	16	25	3	4	2	12	18	5	1

Figure 3-17: ONRC – Network length distribution and length with roughness exceeding the draft ONRC target roughness

4 Model Outputs – Forecast Programme

4.1 Renewal Programme

This section provides a discussion of the treatment forecasts of the Trigger Model and Optimal Model – where different budget scenarios varying around the Normal budget were tested.

The Trigger Model applies treatments based on a decision tree approach using fixed trigger points and without budget constraint. In the trigger analysis, there is usually a large treatment quantity in the first non-committed year when treatments are triggered on historically accumulated conditions that exceed policy thresholds. A relatively smaller programme of renewals then follows, where the remaining untreated sections deteriorate to the threshold levels.

In the Optimal Model analysis, the funding resource is used to its full capacity in each scenario throughout the analysis periods. This suggests the networks are not overfunded, even at the highest funding scenarios.

It is not possible to have an optimised programme with a lower budget than the Least Cost programme cost. This has been the case for this analysis as the Least Cost programme values exceeded programme budgets in a number of instances. The years with cost spikes in the Least Cost programme have needed to be incorporated in the programme budget profiles. The first non-committed year and lower funded scenarios are the most affected by the Least Cost programme interference. The FNDC, KDC, and WDC budgets required a respective $10.9, $3.2, and $10.1 million allowance for the first non-committed year.

The Optimal Model follows asset management best practice by giving priority to preservation treatments. After the committed year, the model is hardcoded to resurface the first coat seals to protect prior rehabilitation investment. After which, the model’s first priority is to satisfy the resurfacing need and then apply more expensive renewal treatments if funding permits. Therefore, RSEAL has first priority at low funding and increasing funding normally results in affording more TAC treatments. There will be a gradual introduction of more RHAB treatments as funding is increased further.

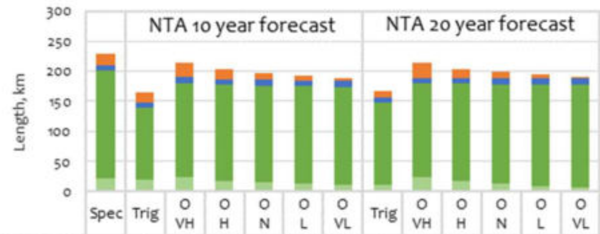
For the combined networks (NTA), it appears the model is satisfied with the resurfacing quantities that can be afforded at the Normal scenario funding level.

For the Normal scenario, the NTA 10 year average annual RSEAL quantity is 161 km/year, which is below the greatest (optimised) forecast value of 164 km/year, and the TAC quantity of 10 km/year remains near the value given at the highest funding level. The forecast amount of chipseal and asphalt renewal treatments is affordable at the combined current budget of $20.90 million.

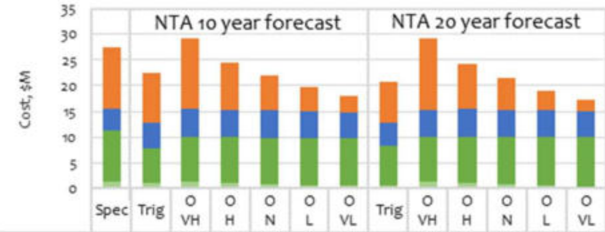
The 20 year average shows a slightly higher demand for RSEAL than the 10 year average over the longer term. TAC remains near 10 km/year on average over the longer 20 year term.

The Normal scenario allows a limited amount of RHAB treatments, where 11.2 km per year on average is forecast for the NTA during the next ten years. RHAB is less affordable at the Very Low funding scenario, having just 4.9 km of RHAB, while keeping 164 km/year of RSEAL as the priority for the preservation of the whole network.

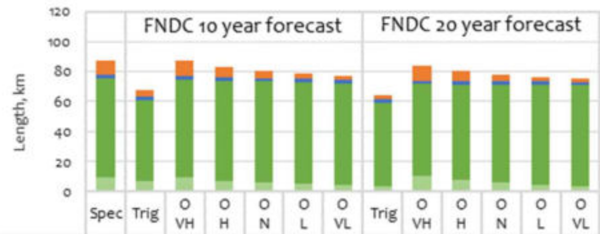
Figure 4-1 below shows the forecast 10 and 20 year average annual programme lengths and costs for all networks and scenarios.



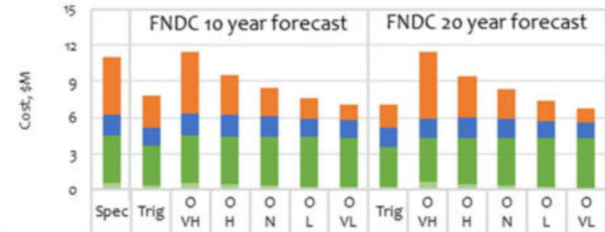
	Spec	Trig	O VH	O H	O N	O L	O VL	Trig	O VH	O H	O N	O L	O VL
km Total	230	164	214	202	197	193	188	167	213	204	198	195	191
km RHAB	21.0	15.9	23.4	15.8	11.2	7.9	4.9	10.8	24.3	15.8	10.5	6.9	3.8
km TAC	7.1	8.8	9.9	9.9	10.0	9.7	9.4	7.8	9.7	9.7	9.7	9.5	9.2
km RSEAL	179	119	156	159	161	163	164	136	155	161	165	169	171
km 2ndC.	22.8	20.3	24.9	17.9	14.8	12.5	10.3	12.1	24.9	17.5	12.9	9.7	6.8



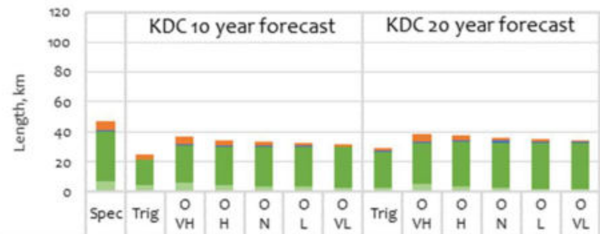
	Spec	Trig	O VH	O H	O N	O L	O VL	Trig	O VH	O H	O N	O L	O VL
$M Total	27.4	22.5	29.3	24.4	22.0	19.8	18.0	20.8	29.3	24.2	21.4	19.1	17.4
$M RHAB	11.9	9.8	13.7	9.1	6.7	4.7	3.2	7.9	13.9	8.8	6.0	3.9	2.3
$M TAC	4.2	4.8	5.3	5.4	5.4	5.2	5.0	4.4	5.3	5.3	5.4	5.2	5.0
$M RSEAL	10.0	6.8	8.7	8.9	9.0	9.1	9.2	7.7	8.6	9.0	9.3	9.5	9.6
$M 2ndC.	1.3	1.1	1.5	1.0	0.9	0.7	0.6	0.7	1.5	1.0	0.8	0.6	0.4



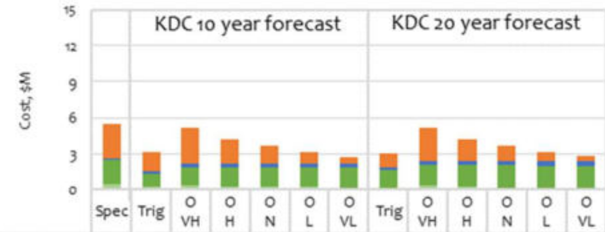
	Spec	Trig	O VH	O H	O N	O L	O VL	Trig	O VH	O H	O N	O L	O VL
km Total	88	68	87	83	80	79	77	65	84	81	78	77	75
km RHAB	9.6	4.8	9.6	6.7	4.7	3.4	2.3	3.1	10.3	6.9	4.7	3.3	2.1
km TAC	2.4	2.1	2.5	2.5	2.4	2.2	2.0	2.1	2.3	2.4	2.3	2.0	1.8
km RSEAL	66	54	65	66	67	68	68	56	61	63	65	67	68
km 2ndC.	9.8	6.8	10.0	7.4	6.1	5.2	4.5	3.8	10.6	7.8	5.9	4.4	3.3



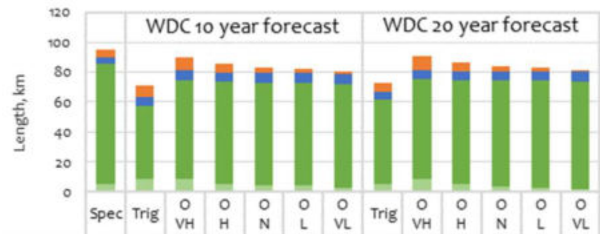
	Spec	Trig	O VH	O H	O N	O L	O VL	Trig	O VH	O H	O N	O L	O VL
$M Total	11.0	7.8	11.4	9.5	8.5	7.7	7.0	7.0	11.4	9.4	8.3	7.4	6.8
$M RHAB	4.7	2.6	5.1	3.3	2.4	1.7	1.3	1.9	5.4	3.4	2.4	1.7	1.2
$M TAC	1.7	1.5	1.8	1.8	1.7	1.5	1.4	1.5	1.6	1.7	1.6	1.4	1.3
$M RSEAL	4.0	3.3	3.9	4.0	4.1	4.1	4.1	3.4	3.7	3.8	3.9	4.0	4.1
$M 2ndC.	0.6	0.4	0.6	0.4	0.4	0.3	0.3	0.2	0.6	0.5	0.4	0.3	0.2



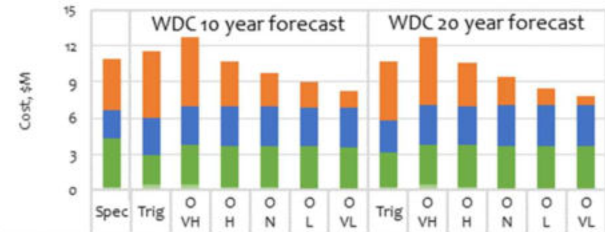
	Spec	Trig	O VH	O H	O N	O L	O VL	Trig	O VH	O H	O N	O L	O VL
km Total	47	25	37	35	34	32	32	30	39	38	36	35	35
km RHAB	6.0	3.3	5.5	3.8	2.8	1.8	1.1	2.1	5.2	3.5	2.4	1.4	0.7
km TAC	0.3	0.5	0.8	0.8	0.9	0.9	0.8	0.6	0.8	0.9	0.9	0.9	0.8
km RSEAL	33	17	25	25	26	27	27	24	28	29	30	31	31
km 2ndC.	7.2	4.7	6.4	4.8	4.1	3.3	2.7	2.8	5.3	4.0	3.1	2.2	1.6



	Spec	Trig	O VH	O H	O N	O L	O VL	Trig	O VH	O H	O N	O L	O VL
$M Total	5.5	3.2	5.2	4.3	3.7	3.1	2.8	3.1	5.2	4.3	3.7	3.2	2.8
$M RHAB	2.9	1.6	2.9	2.1	1.5	1.0	0.6	1.2	2.8	1.9	1.3	0.8	0.4
$M TAC	0.1	0.2	0.3	0.3	0.4	0.4	0.3	0.2	0.3	0.4	0.4	0.4	0.4
$M RSEAL	2.0	1.0	1.5	1.5	1.6	1.6	1.7	1.5	1.7	1.8	1.8	1.9	1.9
$M 2ndC.	0.5	0.3	0.4	0.3	0.3	0.2	0.2	0.2	0.3	0.3	0.2	0.1	0.1



	Spec	Trig	O VH	O H	O N	O L	O VL	Trig	O VH	O H	O N	O L	O VL
km Total	95	71	90	85	83	82	80	73	90	86	84	83	81
km RHAB	5.4	7.8	8.3	5.3	3.8	2.8	1.5	5.6	8.8	5.3	3.3	2.2	0.9
km TAC	4.4	6.1	6.6	6.6	6.7	6.6	6.6	5.2	6.6	6.4	6.5	6.6	6.6
km RSEAL	80	48	66	68	68	69	69	56	66	69	70	71	72
km 2ndC.	5.7	8.7	8.5	5.7	4.6	4.1	3.2	5.4	9.0	5.7	4.0	3.1	1.9

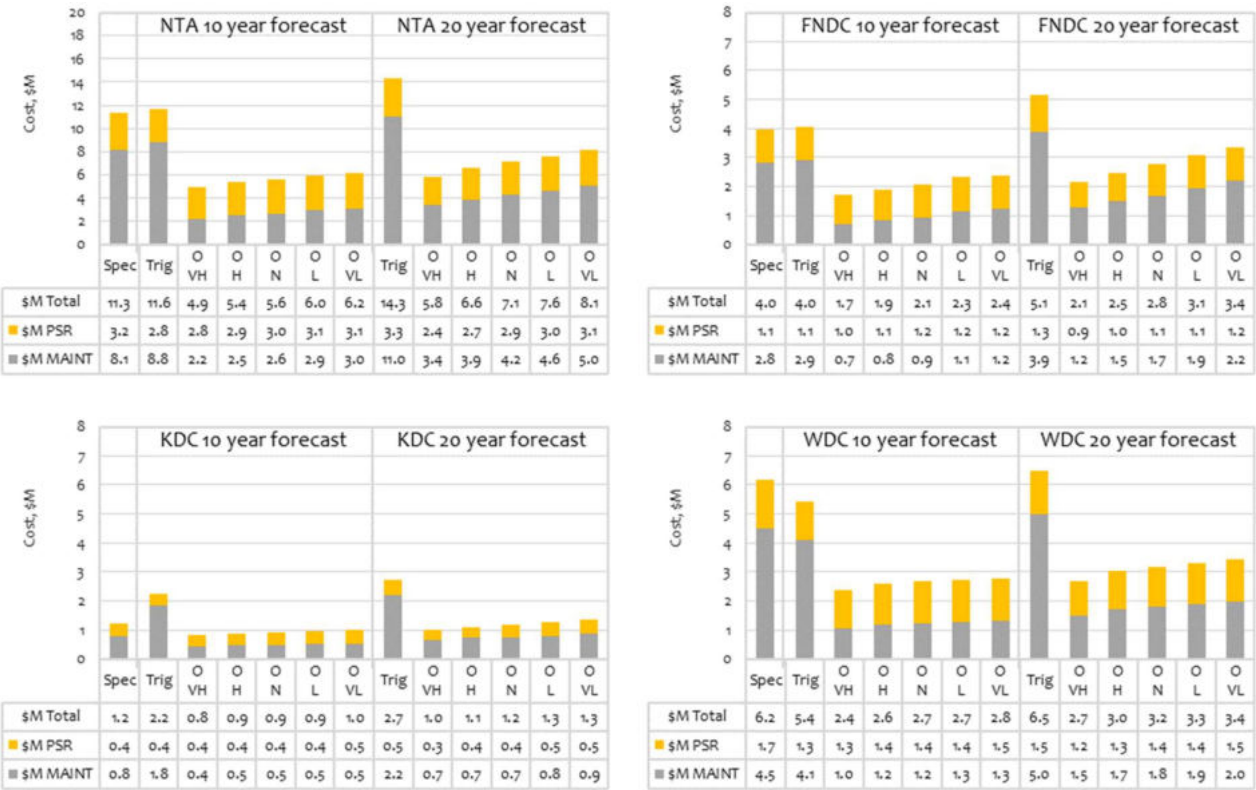


	Spec	Trig	O VH	O H	O N	O L	O VL	Trig	O VH	O H	O N	O L	O VL
$M Total	10.9	11.5	12.7	10.7	9.8	9.0	8.2	10.7	12.7	10.5	9.4	8.5	7.8
$M RHAB	4.3	5.6	5.7	3.7	2.8	2.1	1.3	4.8	5.6	3.5	2.4	1.4	0.7
$M TAC	2.3	3.1	3.3	3.3	3.4	3.3	3.3	2.7	3.3	3.3	3.3	3.4	3.3
$M RSEAL	4.1	2.5	3.3	3.4	3.4	3.4	3.4	2.8	3.3	3.4	3.5	3.6	3.6
$M 2ndC.	0.3	0.5	0.4	0.3	0.2	0.2	0.2	0.3	0.5	0.3	0.2	0.2	0.1

Figure 4-1: Forecast average annual programme length and cost

4.2 Pre-Seal and Maintenance Cost

Figure 4-2 below shows the forecast of routine maintenance (MAINT) and pre-seal repair (PSR) costs. These costs are indicative only and can be used for relativities and comparison purposes. The routine maintenance model is relatively basic and reacts to the predicted conditions. The pre-seal cost is directly linked to the amount and timeliness of resurfacing. The MAINT and PSR cost are assigned an unconstrained budget within the model.



NTA	Spec	Trig	O VH	O H	O N	O L	O VL	Trig	O VH	O H	O N	O L	O VL
$M Total	11.3	11.6	4.9	5.4	5.6	6.0	6.2	14.3	5.8	6.6	7.1	7.6	8.1
$M PSR	3.2	2.8	2.8	2.9	3.0	3.1	3.1	3.3	2.4	2.7	2.9	3.0	3.1
$M MAINT	8.1	8.8	2.2	2.5	2.6	2.9	3.0	11.0	3.4	3.9	4.2	4.6	5.0

FNDC	Spec	Trig	O VH	O H	O N	O L	O VL	Trig	O VH	O H	O N	O L	O VL
$M Total	4.0	4.0	1.7	1.9	2.1	2.3	2.4	5.1	2.1	2.5	2.8	3.1	3.4
$M PSR	1.1	1.1	1.0	1.1	1.2	1.2	1.2	1.3	0.9	1.0	1.1	1.1	1.2
$M MAINT	2.8	2.9	0.7	0.8	0.9	1.1	1.2	3.9	1.2	1.5	1.7	1.9	2.2

KDC	Spec	Trig	O VH	O H	O N	O L	O VL	Trig	O VH	O H	O N	O L	O VL
$M Total	1.2	2.2	0.8	0.9	0.9	0.9	1.0	2.7	1.0	1.1	1.2	1.3	1.3
$M PSR	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.3	0.4	0.4	0.5	0.5
$M MAINT	0.8	1.8	0.4	0.5	0.5	0.5	0.5	2.2	0.7	0.7	0.7	0.8	0.9

WDC	Spec	Trig	O VH	O H	O N	O L	O VL	Trig	O VH	O H	O N	O L	O VL
$M Total	6.2	5.4	2.4	2.6	2.7	2.7	2.8	6.5	2.7	3.0	3.2	3.3	3.4
$M PSR	1.7	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.2	1.3	1.4	1.4	1.5
$M MAINT	4.5	4.1	1.0	1.2	1.2	1.3	1.3	5.0	1.5	1.7	1.8	1.9	2.0

Figure 4-2: Forecast average annual pre-seal repair and routine maintenance cost

Each of the optimised scenarios show similar predicted pre-seal cost, these costs are associated with the resurfacing treatments and resurfacing treatment quantities are near constant within the range of the funding levels tested.

Routine maintenance cost decreases with increasing funding. For NTA, the 10 year average annual cost ranges from $3.0 million at the Very Low funding scenario to $2.2 million at the highest funding level. The 20 year average shows a significant increase in maintenance cost across all optimised scenarios. This is mostly attributable to an upswing in average roughness that occurs during the second decade of the analysis period.

The Specified and Trigger Model results are not optimised (Trigger Model being based on a decision tree approach) which causes a higher need for maintenance. The Trigger Model forecasts low resurfacing quantities because the trigger thresholds for resurfacing are set at worst tolerable condition for cracking. The penalty for having reduced resurfacing in the trigger programme is much greater routine maintenance cost relative to the optimised programmes.

Figure 4-3 below and 4-4 following compares historic maintenance cost to that forecast by the optimal model normal scenario.

Historic maintenance cost is the recorded cost of routine maintenance over a four year period for each contract area within the NTA, from 2018/19 to 2021/22 inclusive. A review of this historic data was done for the previous network analysis (2022/23) to ensure the model is suitably set up and calibrated.

The model has been setup so that maintenance cost is assigned at a slightly earlier stage of the life cycle for most of the surfaces (the cracking threshold for maintenance had been lowered relative to earlier analyses), and provision had been made to distinguish between the urban and rural use categories. Calibration was adjusted to put more emphasis on the rural roads. These changes have resulted in greater maintenance cost overall relative to earlier year's model setups and provides better alignment to where maintenance activity is actually done.

Figure 4-3 shows how maintenance cost is distributed across different road categories by the historic dataset and by the optimal model normal scenario. Historically, the expenditure distribution has approximated the same proportion as the length distribution within the rural and urban road categories but having more emphasis toward the rural road categories. For instance, the rural roads with less than 500 AADT comprise 48% of the network length and received 51% of the maintenance expenditure. Where-as urban roads with less than 500 AADT comprise 12% of the network length and received 8% of the maintenance expenditure. In contrast, the optimal model normal scenario has more of a bias to where there is traffic volume, which is highlighted by the urban roads with greater than 5000 AADT.

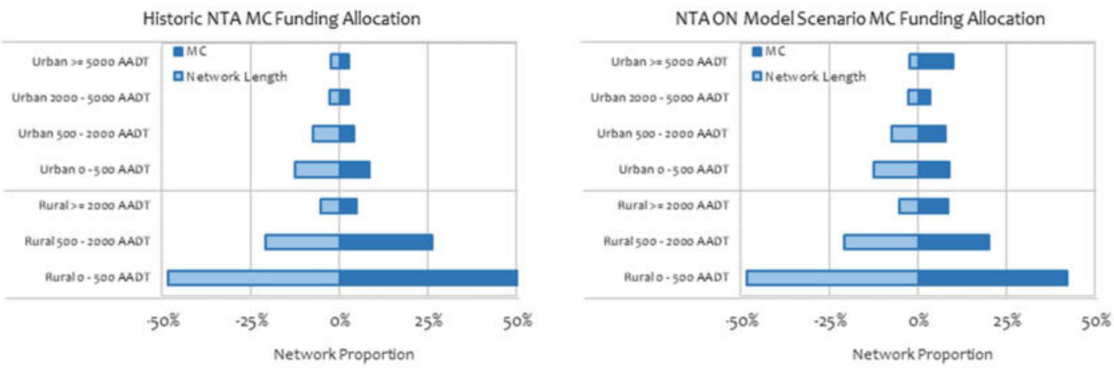


Figure 4-3: Proportion of maintenance cost relative to length of traffic use categories for historic cost data (LHS) and as forecast by optimal model normal scenario (RHS)

Figure 4-4 following shows how maintenance cost is distributed across the surface ages by the historic dataset and by the optimal model normal scenario during the first decade of the analysis period. The secondary axis show the average cost per km that is spent at the different surface ages.

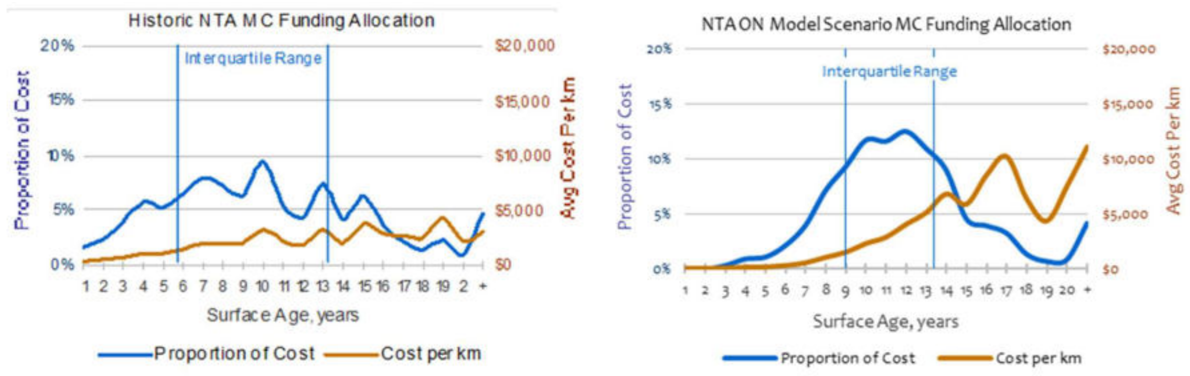


Figure 4-4: Proportion of maintenance cost relative to surface age for historic cost data (LHS) and as forecast by optimal model normal scenario (RHS)

The historic dataset shows that maintenance expenditure is relatively uniformly distributed across a wide range of surface ages. 50% of the expenditure (between the interquartile range) is spent at surfaces that are between 6 and 13 years of age. 25% of expenditure is at surfaces that are less than 6 years old. These include surfaces that are over poor pavement and consume a disproportionate amount of maintenance and renewal budget during their life. 25% of expenditure is at surfaces that are greater than 13 years. Older surfaces are scarce on the network, currently, just 13% of the NTA network surfaces are greater than 13 years old. Older surfaces may either be aging well and have no requirement for maintenance at all, or are overdue for renewal and require maintenance. Older surfaces that require maintenance tend to have more expenditure on $/km basis than younger surfaces.

The average cost per km that had been spent at the different surface ages is a nearly straight line curve starting from 1 years age up to around 10 years of age, where the average maintenance costs plateaus at around $3000/km. The average values masks the amount of skew in the data, since the majority of length at any age has either no or very little maintenance expenditure while a small length has significantly large values.

The optimal model normal scenario has a peaked distribution across the surface ages. 50% of the expenditure is spent at surfaces that are between 9 and 14 years of age, which is a narrower range then the historic data. There is less maintenance expenditure on young surfaces by the model. This highlights the challenge of identifying sites that may have early surface life failure in the future. Similar to the historic data, the older surfaces receive a smaller portion of the network maintenance spend but individual sites become more costly.

The network average cost per km spent on older surfaces is greater than the historical data. This is because there is less skew in the distribution of cost at any given age. The model is more likely to assign a maintenance cost to an older site. The value of the cost per site is not normally significantly greater than the historic data but there is a greater likelihood of having a cost assigned by the model when the surface is becoming due for renewal.

5 Model Outputs – Predicted Condition

This section provides a summary of the main condition indicators to view the predictions of each model analysis. The presented charts have vertical axis ranges that capture the extent of predicted values and to highlight the differences between the scenarios. The trends shown may appear exaggerated relative to if they were shown within larger ranges.

5.1 Roughness

Figure 5-1 shows the predicted network average roughness over the analysis period. Network average roughness can be maintained at near current levels within the first 10 years at the normal and higher funding levels. The optimised normal scenario (Normal funding level) is able to maintain network average roughness at near current levels during the first 10 years for FNDC and KDC (the average NAASRA is unchanged at the end of the period for each) but not for WDC where the average roughness increases by 2 NAASRA. The majority of each ONRC network are beneath the model resurfacing treatment reset thresholds, hence the average roughness is able to increase regardless of the optimised resurfacing programme. However, the amount of rehabilitation treatments forecast does have an impact on average roughness predictions.

There is a general upswing in roughness toward the end of the 20 year analysis period. This is caused by a combination of the roughness models dependency on pavement age as an input variable (average pavement age increases significantly over the next 20 years), pavement renewal quantity being too low to curtail the aging of the networks, and the model allowing deterioration to be absorbed by the network via the treatment reset thresholds.

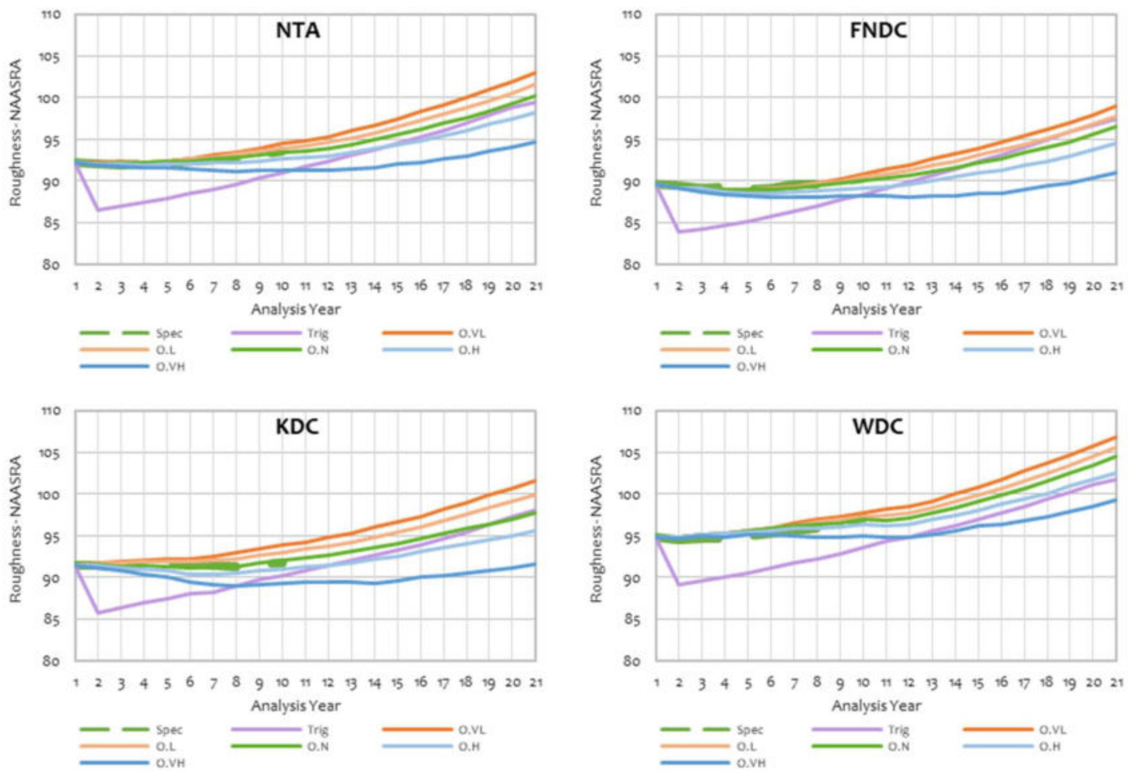


Figure 5-1: Network weighted average roughness

Figure 5-2 following shows the predicted median and interquartile range roughness distributions by the optimised normal scenario for each ONRC, as at the end of the committed year 2023/24 (which is common to all of the models), and predicted for the 10th non-committed year and predicted for the 20th non-committed year.

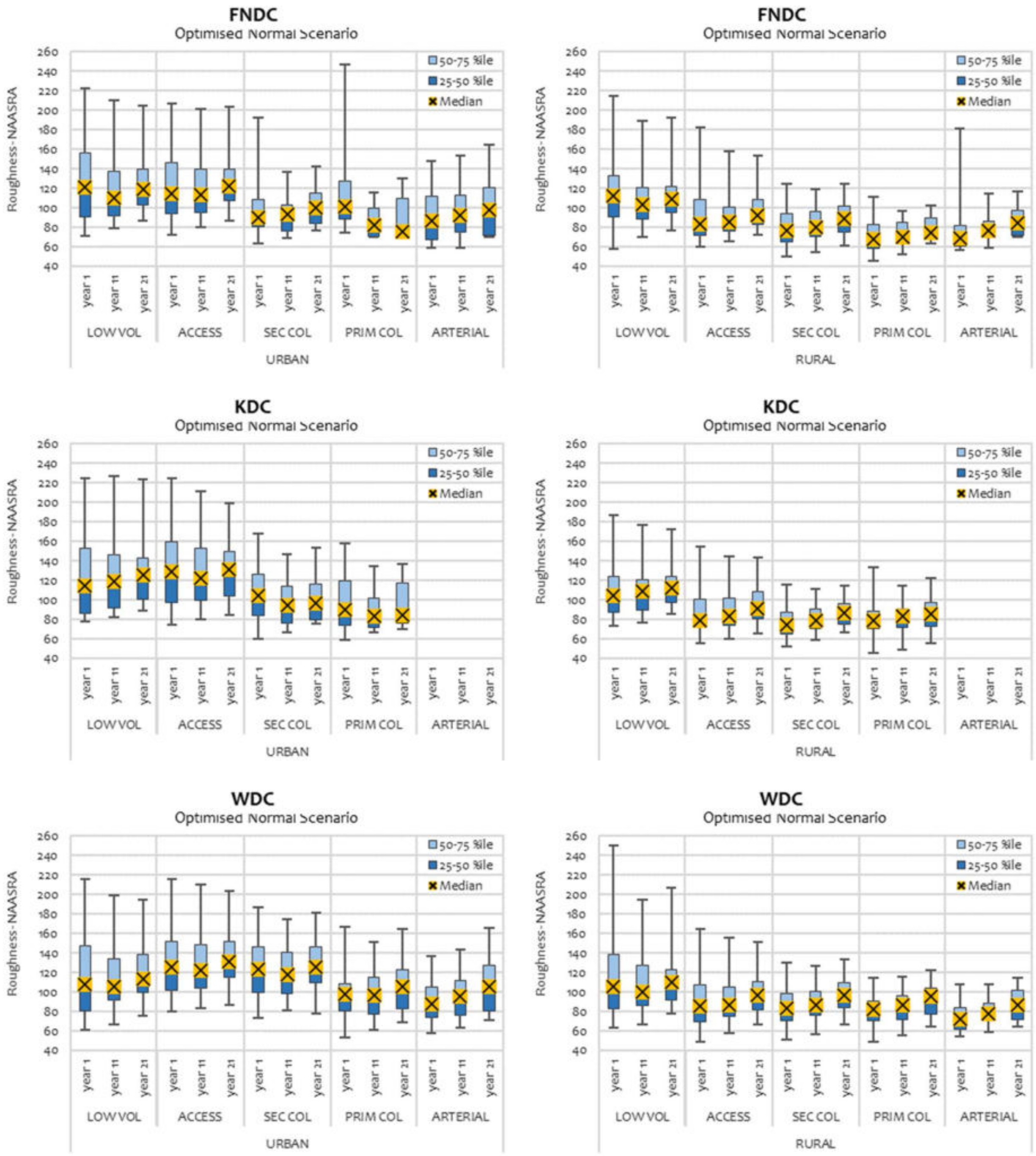


Figure 5-2: Roughness distributions for urban and rural ONRC predicted by the optimal model normal scenario (Normal funding)

In general, most of the median and upper quartile performance has deteriorated a little over the 20 year period, while the lower quartile performance has deteriorated more significantly. Deterioration of lower quartile performance contributes to much of the network averages increases that occur toward the end of the 20 year analysis period.

The rural ONRC median values have generally deteriorated by the Optimal Model at Normal funding level. Most current roughness values are beneath resurfacing reset thresholds and there is also limited scope for roughness improvement from current levels in the model.

The urban network is currently rougher than the rural network and has a greater distribution of roughness performance. The median values have held steady within the first decade of the analysis period for the urban ONRC. However, there is deterioration of median and lower quartile performance by the end of the second decade.

5.2 Rutting

Figure 5-3 shows the predicted network average rutting over the analysis period.

The majority of the current network length is beneath the model resurfacing treatment reset thresholds, hence the average rutting would be able to increase regardless of the optimised resurfacing programme. However, the amount of rehabilitation treatments forecast does have an impact on average rutting predictions.

The average rutting performance is maintained for the FNDC network and the KDC network at the normal and higher funding levels. Rutting performance deteriorates for the WDC network when funding is beneath the Very High level.

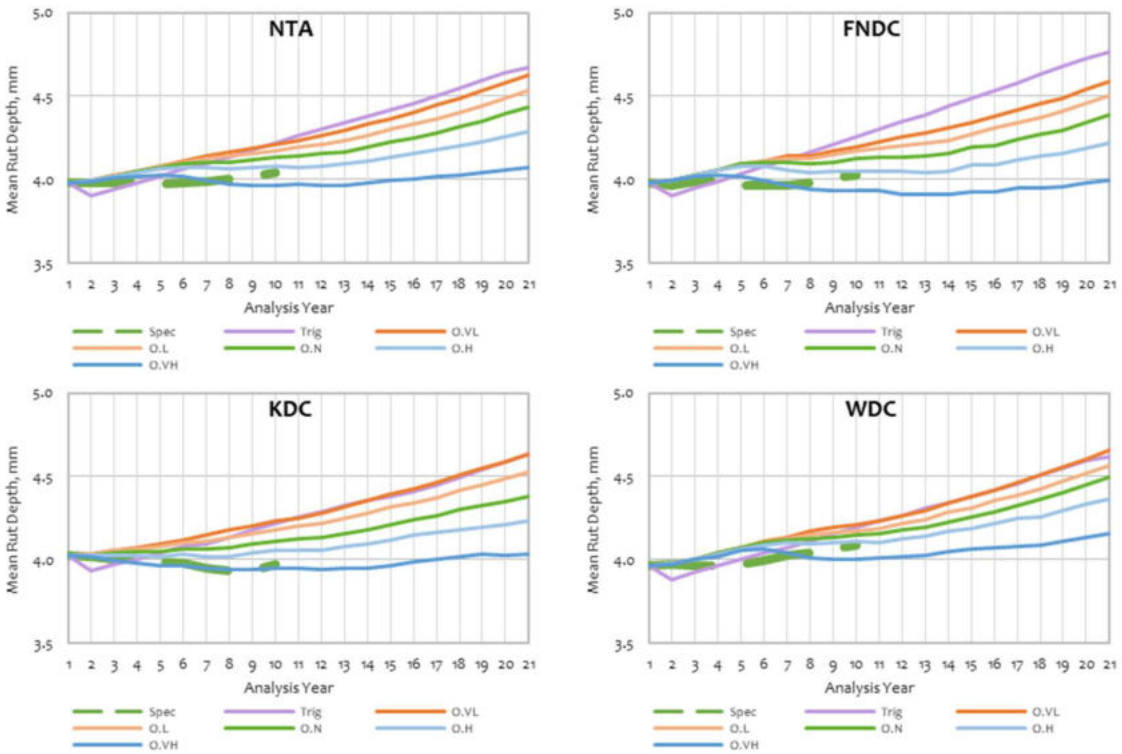


Figure 5-3: Network weighted average rutting

Figure 5-4 following shows the predicted median and interquartile range mean rut depth distributions by the optimised normal scenario for each ONRC, as at the end of the committed year 2023/24 (which is common to all of the models), and predicted for the 10^{th} non-committed year and predicted for the 20^{th} non-committed year.

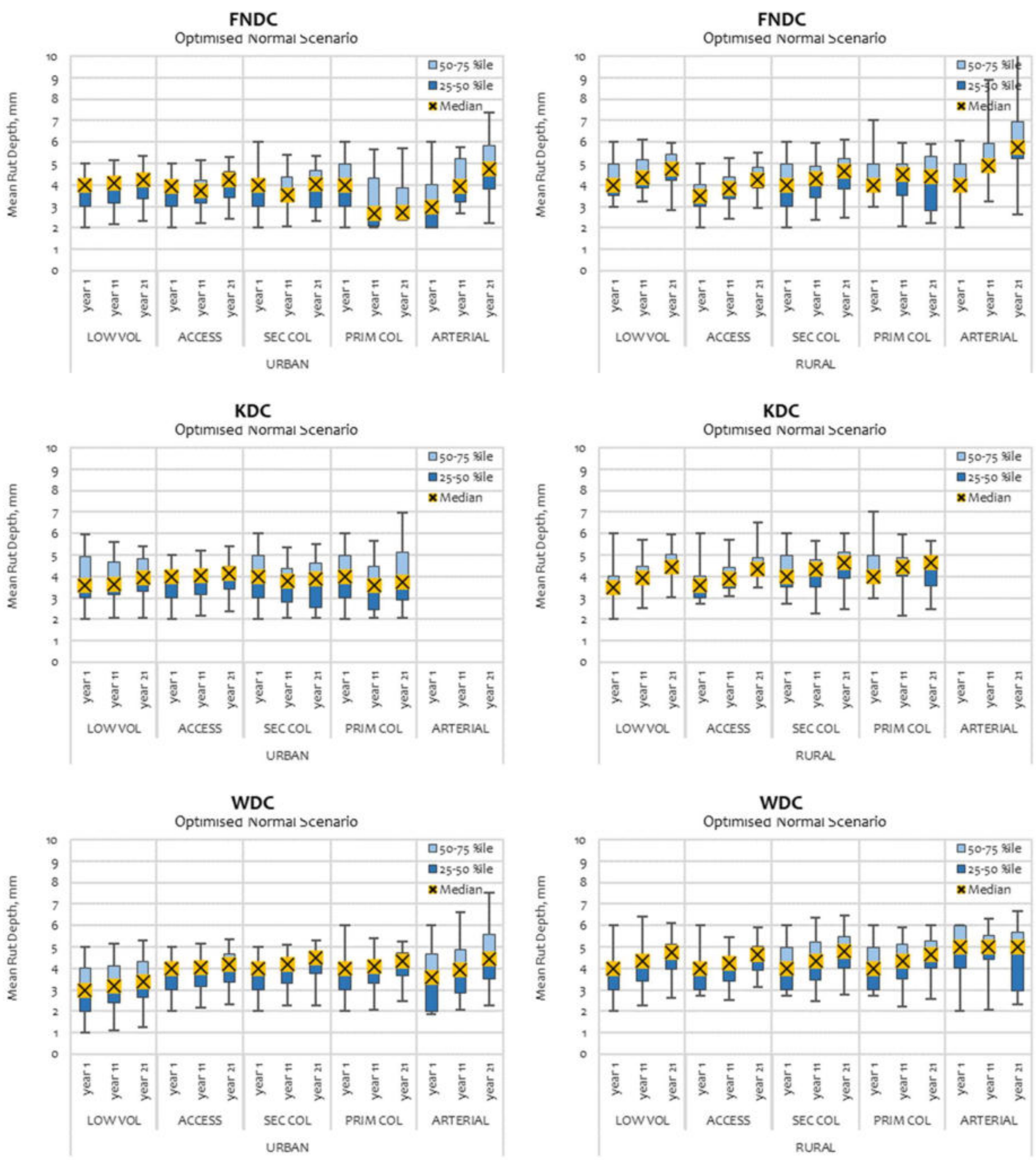


Figure 5-4: Mean rut depth distributions for urban and rural ONRC predicted by the optimal model normal scenario (Normal funding)

In general, the optimised median values have deteriorated slightly with each passing 10 year period. Most current rutting values are beneath the resurfacing reset thresholds and rutting will increase regardless of the amount of resurfacing treatments done. However, rehabilitation treatments (that fully reset rutting) can keep the 95th percentile rutting value in check when funding is adequate.

The networks are mostly low traffic volume but with routes that cater for HCV's (forestry and quarries). The current condition of the network is generally reasonable and parts can absorb some deterioration. However, this may not be sustainable and the risk for the network is the consumption of the good condition and the ability of the pavement to absorb further deterioration, this may lead to further and increased rates of deterioration. It can be seen in Figure 5-4 there is risk of high deterioration for each of the rural networks at the normal funding level, as all rural ONRC have a trend of increasing median and upper distribution of rutting values.

5.3 Pavement Age

Figure 5-5 shows the predicted network average pavement age. It shows the weighted average pavement age will increase, even in the case of the Trigger Model that has an unconstrained budget. An increasing network average age is expected and demonstrates a trend similar to most road networks. Increasing pavement age indicates the pavement capacity will inevitably be consumed over a long period of time. The pavement will become less resilient to wear and less capable of absorbing deterioration that will occur if funding becomes overly constrained.

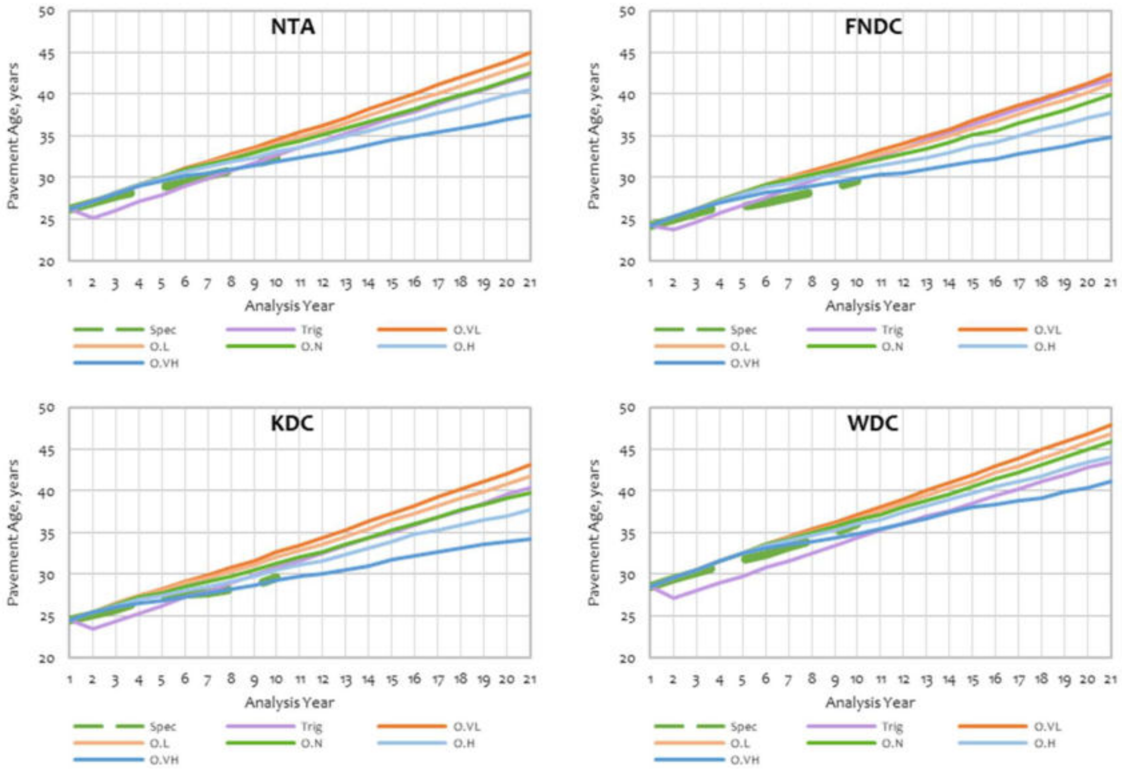


Figure 5-5: Network weighted average pavement age

5.4 Surface Age and Remaining Surface Life

Figures 5-6 and 5-7 following show the network average surface age and remaining surface life (RSL) predictions for the networks. The RSL is calculated on the basis that all chipseal surfaces treated by the model become two coat seals, which have longer expected lives than single coat seals, particularly void fill seals.

For the combined networks (NTA), the Specified programme is able to the maintain the average age at the current level and improve the RSL within the next 10 years.

The model predicted network surface ages enter a phase of cyclic fluctuation at the start of the analysis period. Each trigger and optimised scenario completes large amounts of RSEAL treatments during the first non-committed year. The optimised scenarios continue with a focus on RSEAL treatments into the second, third, and for some scenarios, the fourth non-committed years. In general, the optimised scenarios have a similar surface age forecast by the end of the analysis period because there is normally adequate funding to do RSEAL, even at low funding levels. The average chipseal age levels out at between 6 and 7 years (depending on network) by the end of the 20 year analysis period.

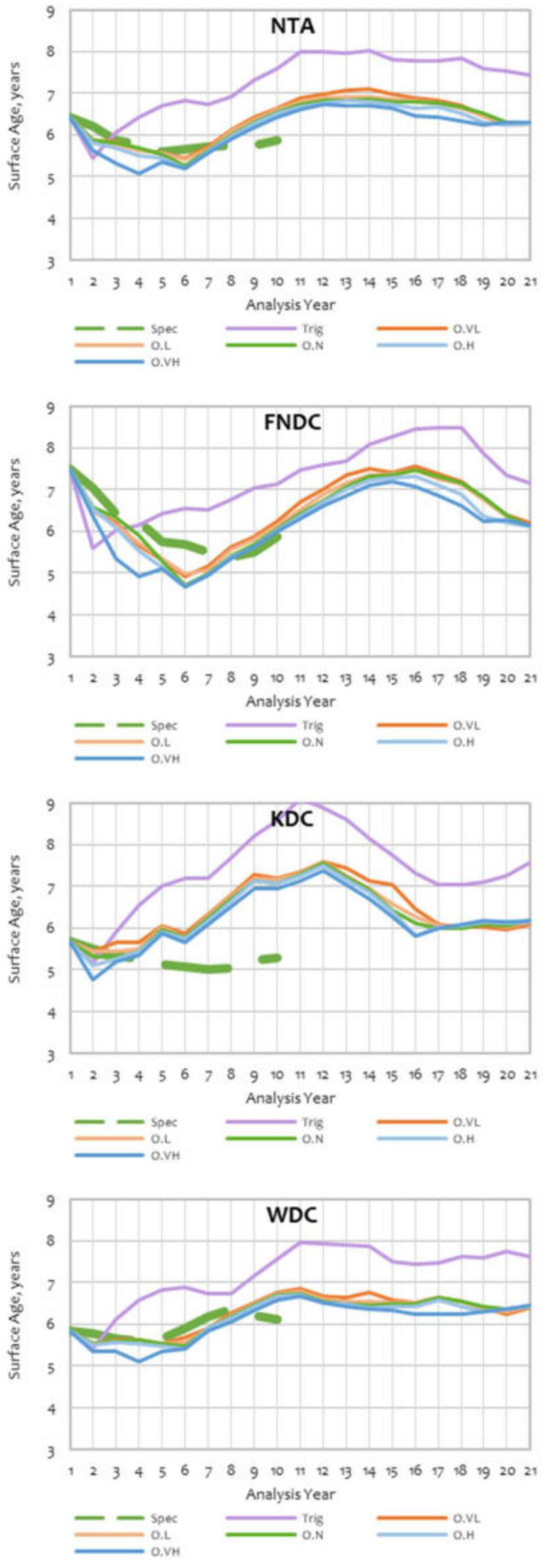


Figure 5-6: Network weighted average surface age

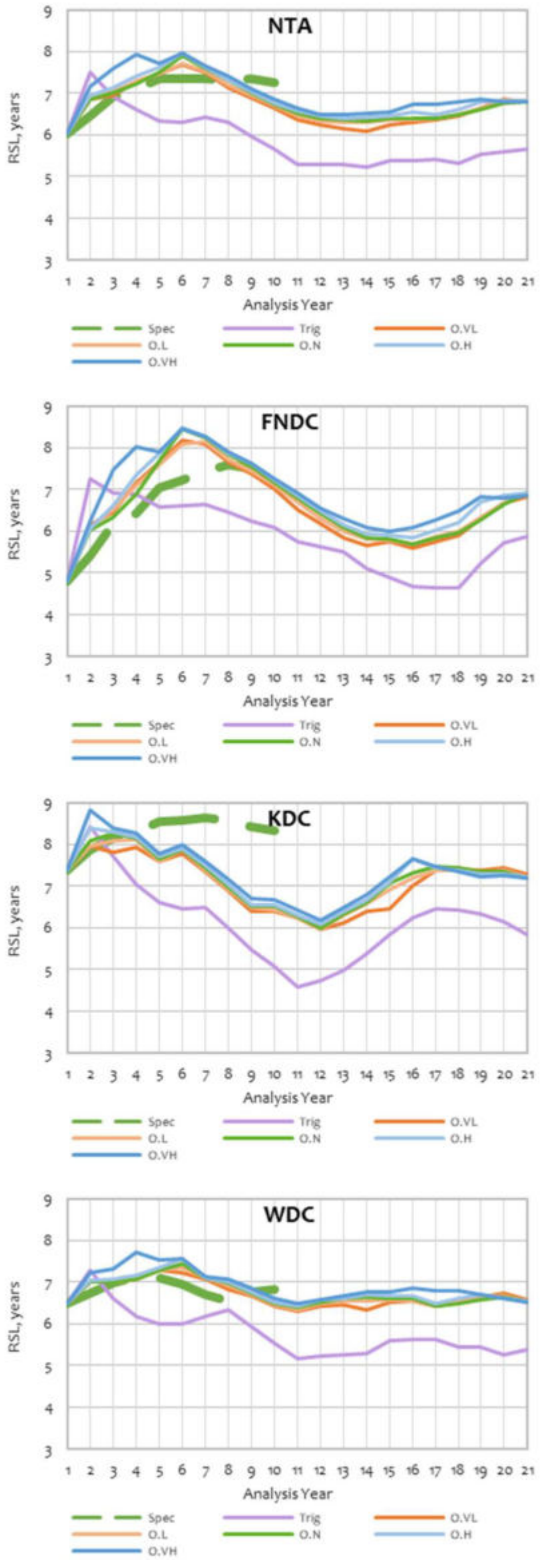


Figure 5-7: Network weighted average remaining surface life (RSL)

Figures 5-8 and 5-9 following show the predicted median and interquartile range surface age and residual surface life distributions by the optimised normal scenario throughout the analysis period. Figure 5-8 shows that, throughout the second decade of the analysis period, the median surface age is typically 6 years and the interquartile range is maintained between 2 and 12 years. The future surface age and residual life distributions indicate the networks should be able to have adequate surface renewal quantity at the normal funding level.

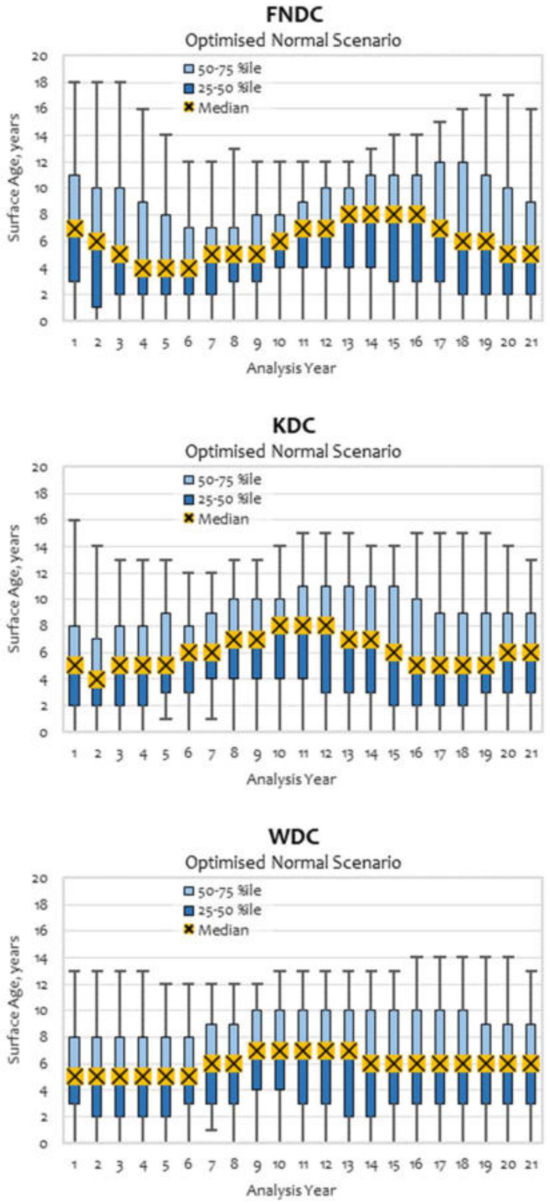


Figure 5-8: Surface age distribution

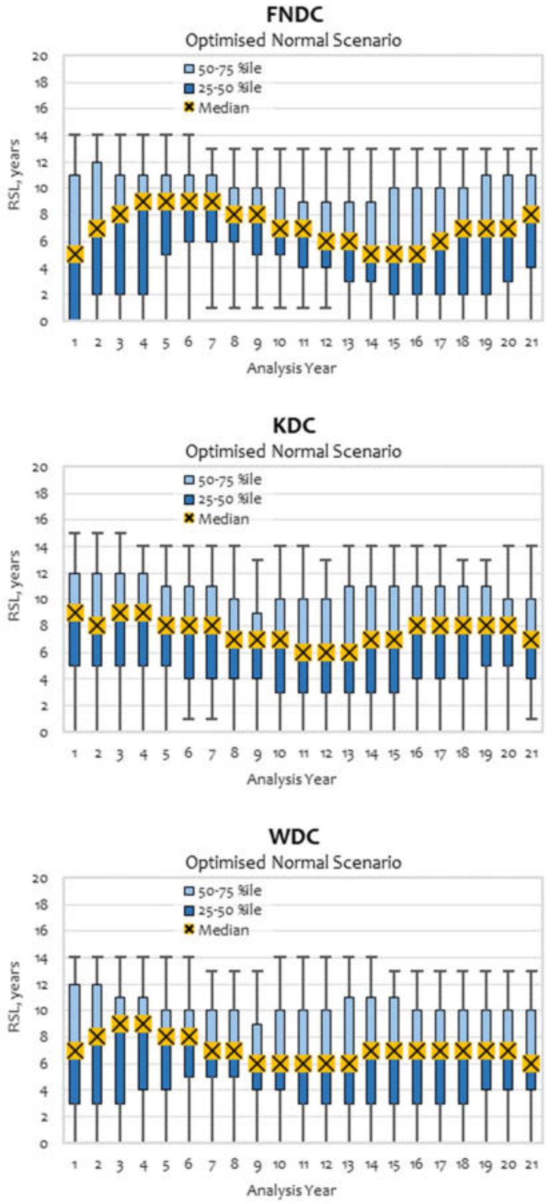


Figure 5-9: Remaining surface life (RSL) distribution

5.5 Cracking

This network analysis incorporates the findings of the NTA studies of High Speed Data (HSD) cracking (October 2020). The development of the Crack Model included the initialisation of HSD cracks within the models, the progression of cracks, and recalibration of the initiation time for cracking to begin. The development comprised two main components:

1. Initialisation from HSD crack data to modelled cracked area: this has been updated to align the initialisation with the findings of the NTA High Speed Cracking Data Analysis, October 2020.

2. Crack progression: this has been updated to reflect the findings of Chipseal Cracking, November 2015 (NZ Transport Agency research report 579), which contained findings of crack progression from analysis of data collected from LTPP chipseal sites throughout New Zealand.

Implementation of HSD cracking within the dTIMS PPM setup is fully detailed in the NTA report Pavement Performance Analysis – Model Development to Accommodate High Speed Rating Data, January 2021.

The general difference for the updated crack performance model, relative to earlier NTA network analysis, is that cracks will initiate earlier but will take longer to reach the threshold for treatment.

Figure 5-10 shows the predicted network average cracked area for all budget scenarios. The smaller the value the better the condition.

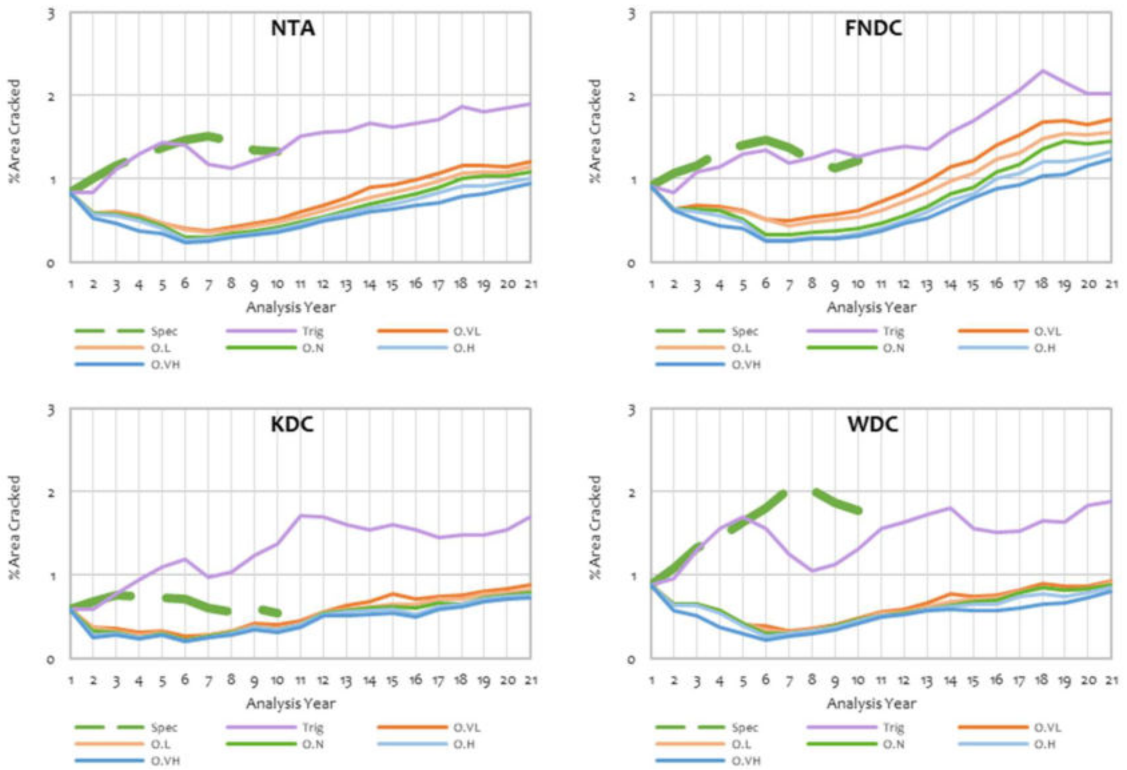


Figure 5-10: Network weighted average cracked area

It can be seen in Figure 5-10 that average crack area is 1% or less at the start of the analysis period for each network. In general, the average crack area is maintained at a lower or similar level through the first decade of the analysis period and crack area increases during the second decade of the analysis period.

The optimised very low funding scenario for FNDC has crack area deteriorating at a greater rate than the other optimised scenarios. Resurfacing quantities are too low in this case. It can also be seen that FNDC has greater crack area than KDC and WDC at the end of the analysis period. This suggests that FNDC resurfacing quantities during the second decade may be too low to manage the cracking.

The predicted median for the optimised normal funding scenarios is a zero value, i.e. the majority of treatment lengths have a cracked area of 0% at any given time. In this analysis, for the combined NTA networks, about 60% of the network does not have cracks initiated (based on initialisation using the findings of the NTA High Speed Cracking Data Analysis, October 2020) at the start of the analysis period. It is normal for surfaces to have negligible cracking for much of the life span and cracking initiates and deteriorates toward the end of the surface's useful life.

Figure 5-11 below shows the predicted 80th percentile and 70th to 90th percentile range crack area distributions by the optimised normal scenario throughout the analysis period. Figure 5-11 shows that, throughout the second decade of the analysis period, the 80th percentile crack area is typically 1.6%. During the second decade about 60% of each network have no cracks initiated.

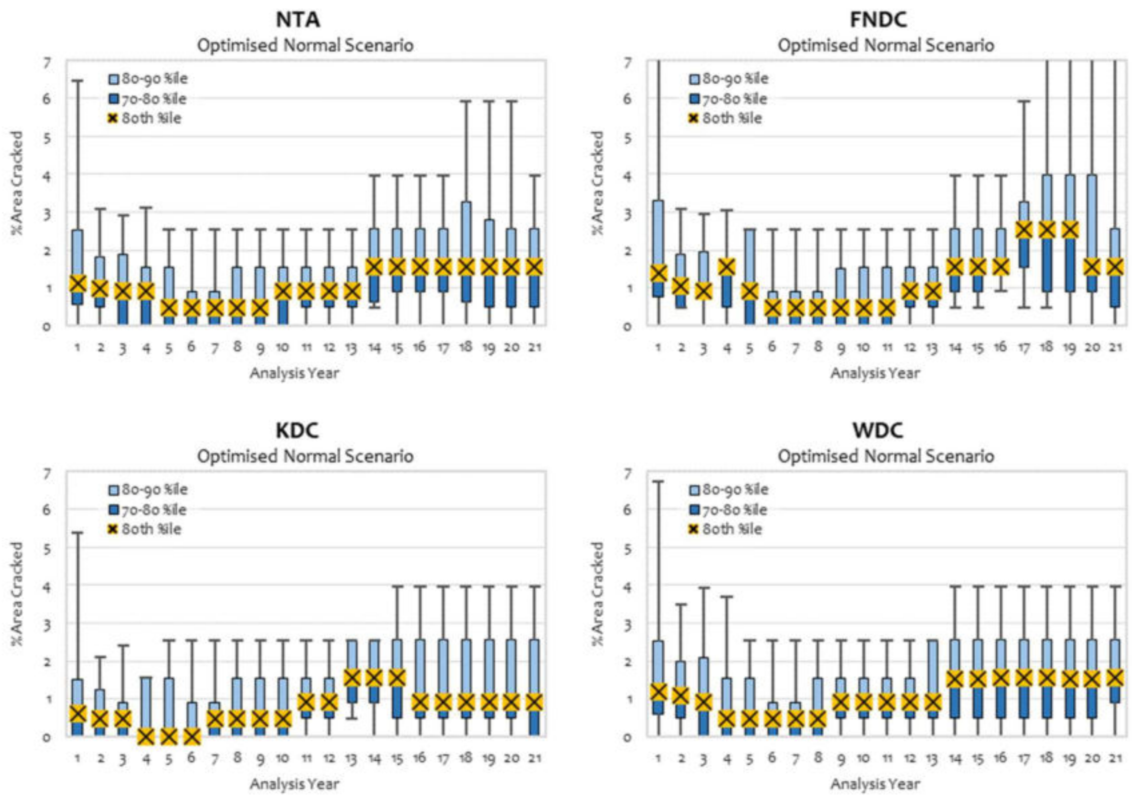


Figure 5-11: Network cracked area distribution

The long term increase in crack area indicates each network would benefit with more surface renewal quantity during the second decade than the optimised normal scenarios have provided. Higher funding scenarios do mitigate the amount of cracked area but at the funding levels tested there is a limit to how much of the cracking can be controlled. The reason for this is the model is optimising multiple conditions and as rutting and roughness increase there is more emphasis on controlling these conditions. There is a core of analysis sections that have mild roughness and rutting deterioration, and these are considered to be less important to resurface in the future (more than a decade away) than other sections with more aggressive deterioration that receive rehabilitation treatments.

5.6 Surface Integrity Index

The Surface Integrity Index (SII) is a composite index for pavement surface conditions. The scale of this index is 0 (excellent) to 100 (very poor). SII is a function of the following:

- Surface age, which is activated when the design life is expired; and
- Surface condition, which includes cracking, flushing and potholes.

The predicted median SII is a zero value for the optimised scenarios, i.e. the majority of treatment lengths have an SII of 0 (excellent) at any given time. It is normal for surfaces to have excellent or good SII for much of the life span and SII starts to deteriorate toward the end of the surface's useful life.

The optimisation system prioritises resurfacing first, then, with more funding available, it will start undertaking rehabilitation treatments. Resurfacing treatments, especially chipseal, are priority treatments because they offer asset preservation and minor improvement (when required) at the most economic price.

Figure 5-12 shows the predicted network average SII for all budget scenarios. The smaller the value the better the condition. Some of the early SII improvement can be attributed to treatment of old/aged surfaces.

The predicted long term average SII is either improved or maintained relative to the current average SII throughout the analysis period for all optimised budget scenarios. The general trends are for SII to improve during the first decade of the analysis but deteriorates throughout the second decade. At the end of the analysis period, SII deteriorates to levels that are similar to the start.

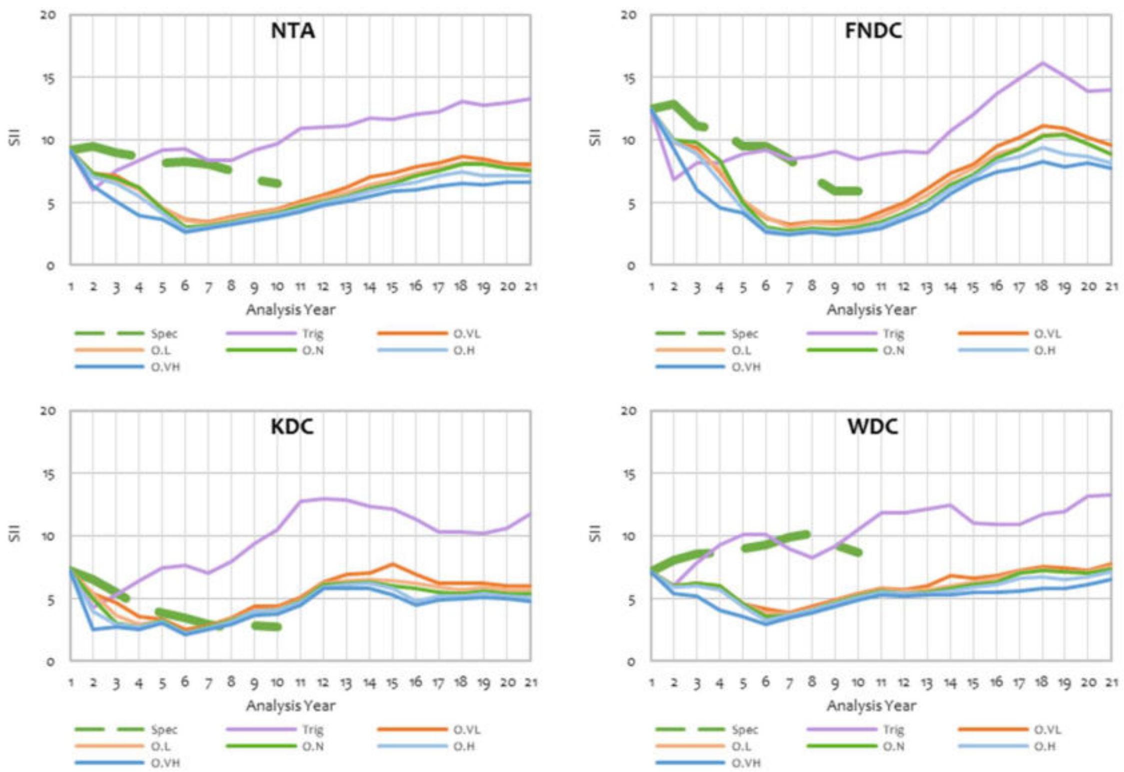


Figure 5-12: Network weighted average SII

5.7 Pavement Condition Index

The Pavement Condition Index (PCI) is a composite index of pavement base and surface conditions. It also represents the objective function that is maximised using optimisation in the optimal model. The scale of this index is 100 (excellent) to 0 (very poor).

PCI is a function of roughness, rutting, texture and SII. The PCI is a composite index that includes SII. Therefore, some of the PCI performance can be attributed to the SII performance.

Figure 5-13 shows the predicted network average PCI for all budget scenarios. The greater the value the better the condition.

Figure 5-13 indicates the current NTA network level PCI can be maintained within the first half of the 20 year analysis period for all optimised scenarios. However, PCI may not be able to be maintained in the long term at the current indicated levels by current renewal expenditure as the networks' pavement base continue to age.

FNDC has the lowest (worst) initial PCI and improves over the majority of the analysis period. It takes five years to reach a plateau, then eventually deteriorates relative to the plateau at a rate dependant on funding level.

KDC has long term deterioration at normal funding (and lower), indicating that greater amounts of pavement and surface renewal will be required than can be afforded by the normal funding scenario.

WDC has long term deterioration when funding levels are less than the very high funding scenario. WDC is at risk of long term deterioration if funding is reduced below this level of funding.

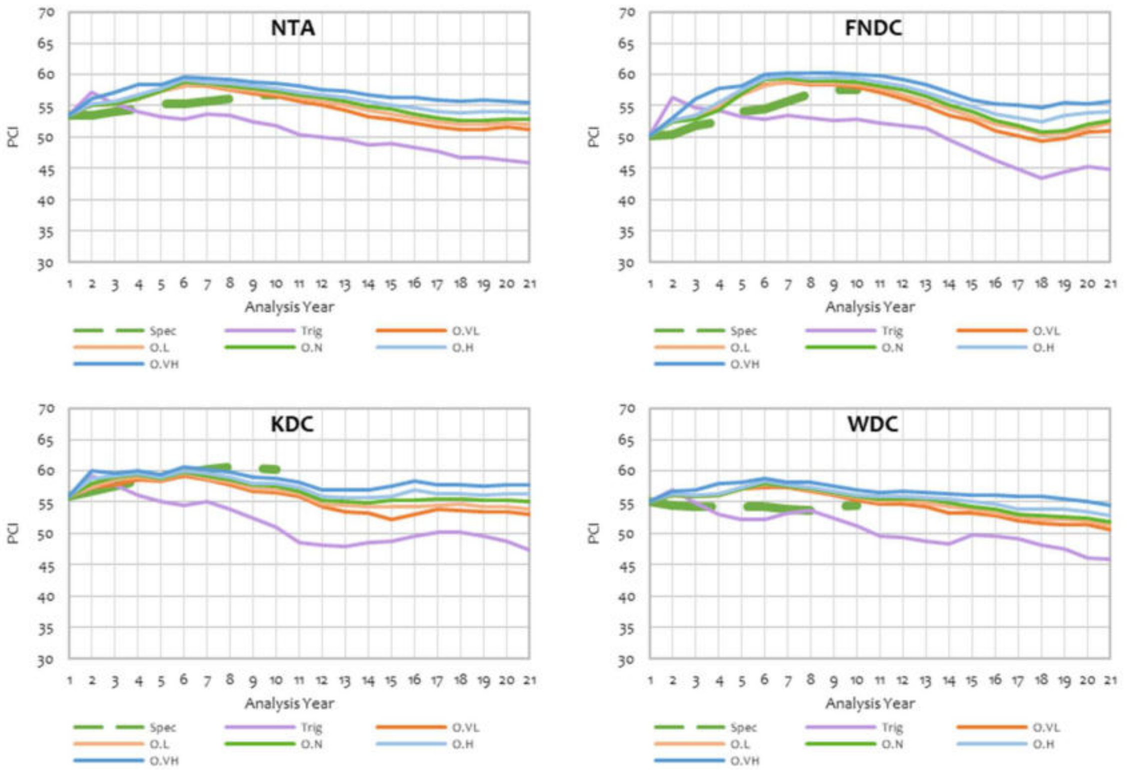


Figure 5-13: Network weighted average PCI

6 Summary and Conclusions

The main objective of this PPM analysis is to:

- Check whether current funding levels are appropriate for each of the road networks managed by the NTA; and
- Determine the optimal funding split between resurfacing and rehabilitation renewal treatments within each network.

During the 2022/23 season the NTA networks were impacted by several severe weather events that had caused slips and closed roads. A less obvious affect was that many pavements had been inundated and spent extended periods with high moisture contents. This will compromise the structural capacity of the network's pavements to some degree but which currently cannot be quantified. Consequently, there may be more need for renewals in the future.

Tables 6-1, 6-2, 6-3 following summarise the FNDC, KDC, WDC 10 year average annual length and cost of model analysis results, the current achievement and funding levels, and the suggested programme.

6.1 FNDC

Table 6-1: FNDC model 10 year averages, current practice, and suggested programmes

Treatment		Trigger Model	Optimised Programme					Current Practice	Suggested
			VH $11.40	H $9.36	N $8.14	L $6.92	VL $5.70	(historic – current budget – 5 year FWP)	
RHAB	Length, km	4.8	9.6	6.7	4.7	3.4	2.3	14.1 – 7.3 – 10.8	6.0 – 8.0
	% of network length	0.5%	1.1%	0.7%	0.5%	0.4%	0.3%	1.5% – 0.8% – 1.2%	0.7% – 0.9%
	Cost, $M	2.6	5.1	3.3	2.4	1.7	1.3	7.3 – 3.8 – 5.6	3.1 – 4.1
2ndCoat	Length, km	6.8	10.0	7.4	6.1	5.2	4.5	(in RS)	(in RS)
	Cost, $M	0.4	0.6	0.4	0.4	0.3	0.3		
RSEAL	Length, km	54	65	66	67	68	68	58 – 50 – 82	72 – 75
RS. & 2ndC.	% of chipseal length	6.9%	8.5%	8.3%	8.3%	8.2%	8.2%	6.6% – 5.7% – 9.3%	8.1% – 8.5%
RSEAL	Cost, $M	3.3	3.9	4.0	4.1	4.1	4.1	3.5 – 3.0 – 5.0	4.3 – 4.5
TAC	Length, km	2.1	2.5	2.5	2.4	2.2	2.0	1.1 – 2.0 – 3.2	2.5 – 2.5
	% of asphalt length	7.2%	8.4%	8.4%	8.0%	7.5%	6.8%	3.5% – 6.6% – 10.7%	8.4% – 8.4%
	Cost, $M	1.5	1.8	1.8	1.7	1.5	1.4	0.7 – 1.4 – 2.2	1.7 – 1.7
Total	Length, km	68	87	83	80	79	77	73 – 59 – 96	81 – 86
	% of network length	7.4%	9.5%	9.0%	8.8%	8.6%	8.4%	8.0% – 6.5% – 10.5%	8.8% – 9.4%
	Cost, $M	7.8	11.4	9.5	8.5	7.7	7.0	11.5 – 8.1 – 12.7	9.2 – 10.4

A suggested programme for FNDC is based on the analysis of model outcomes to assess the long-term renewals need for the network. It is suggested the annual expenditure should be in the order of $9.2 to $10.4 million per year. The current budget (Normal Scenario $8.14M) is beneath the low end of this range.

The Normal Scenario budget has decreased for this analysis relative to last year. Unit rates have also increased for chipseal. The net result is the Normal Scenario is approximately 11% more constrained relative to last year's analysis.

The suggested expenditure is based on the following:

Resurfacing Renewal – Chipseal: 72 to 75 km ($4.3 to $4.5 million)

The range of Optimal Model scenarios 10-year and 20-year average annual chipsealing (RSEAL plus 2ndCoat) is 71 to 75 km ($4.3 to $4.5 million).

The reseal quantities reached a steady level (where there is diminishing additional quantities with increased funding) at the Low scenario funding level. The reseal treatment is a priority because it offers asset preservation and some improvement (when required) at the most economic price.

A suggested 72 to 75 km is 8.1% to 8.5% of the chipseal network length per year. This amount is more than the past 5 years achievement. A greater amount is needed to cater for sealed network expansion, ensure second coat seals are catered for, and the age-based backlog quantity does not grow even further and become unmanageable in the future. The average of the suggested range (73.5 km/year) will result in a chipseal life cycle of 12.0 years. The suggested amount of chipseal treatments is affordable at the current budget of $8.14 million.

Resurfacing Renewal – Asphalt: 2.5 km ($1.7 million)

The range of Optimal Model scenarios 10-year and 20-year average annual asphalt surface renewal (TAC) is 1.8 km to 2.5 km ($1.3 to $1.8 million).

The TAC quantities reached a steady level at the Normal scenario funding level. There is also some additional TAC quantities forecast by the model within the rehabilitation treatments.

A suggested 2.5 km is 8.4% of the asphalt network length per year. This amount of asphalt treatments is required to cater for the existing asphalt surfaces that are currently at or near end of useful life. The suggested amount of asphalt treatment is affordable at the current budget.

Rehabilitation Renewals: 6.0 to 8.0 km ($3.1 to $4.1 million)

The range of Optimal Model scenarios 10-year and 20-year average annual rehabilitation (RHAB) is 2.1 km to 10.3 km ($1.2 to $5.4 million).

The amount of RHAB treatments prioritised to the programme over the analysis period with the Normal budget is beneath the suggested range. This is a financial constraint as the model needed to cater for resurfacing needs first for the preservation and greater good of the network.

Based on RAMM data, over the last ten years, the average annual pavement base achievement was 14.1 km (1.5% of the network). The RAMM data includes recent seal extension and new pavements completed, which will overstate the historic pavement renewal achievement. The achievement of pavement renewals is much less than what pavement age data suggests and this makes it difficult to quantify the amount of recent rehabilitation achievement.

A suggested range of 6.0 km to 8.0 km is in line with current practice and the optimised programme with higher funding.

The annual cost for an allowance for the average of the suggested range (7.0 km) is $3.6 million. This will result in a pavement base life cycle of 131 years.

6.2 KDC

Table 6-2: KDC model 10 year averages, current practice, and suggested programmes

Treatment		Trigger Model	Optimised Programme VH $5.18	H $4.26	N $3.70	L $3.15	VL $2.59	Current Practice (historic – current budget – 5 year FWP)	Suggested
RHAB	Length, km	3.3	5.5	3.8	2.8	1.8	1.1	4.9 – 2.9 – 5.5	3.0 – 5.0
	% of network length	0.7%	1.2%	0.8%	0.6%	0.4%	0.2%	1.0% – 0.6% – 1.2%	0.6% – 1.1%
	Cost, $M	1.6	2.9	2.1	1.5	1.0	0.6	2.5 – 1.5 – 2.9	1.6 – 2.6
2ndCoat	Length, km	4.7	6.4	4.8	4.1	3.3	2.7	(in RS)	(in RS)
	Cost, $M	0.3	0.4	0.3	0.3	0.2	0.2		
RSEAL	Length, km	17	25	25	26	27	27	43 – 32 – 41	31 – 35
RS. & 2ndC.	% of chipseal length	4.6%	6.7%	6.5%	6.5%	6.5%	6.4%	9.3% – 7.0% – 8.8%	6.7% – 7.6%
RSEAL	Cost, $M	1.0	1.5	1.5	1.6	1.6	1.7	2.6 – 2.0 – 2.5	1.9 – 2.2
TAC	Length, km	0.5	0.8	0.8	0.9	0.9	0.8	0.7 – 0.5 – 0.3	0.5 – 0.5
	% of asphalt length	7.0%	9.9%	9.9%	10.9%	10.9%	10.0%	9.0% – 6.4% – 3.8%	6.4% – 6.4%
	Cost, $M	0.2	0.3	0.3	0.4	0.4	0.3	0.3 – 0.2 – 0.1	0.2 – 0.2
Total	Length, km	25	37	35	34	32	32	49 – 36 – 47	35 – 41
	% of network length	5.3%	7.9%	7.4%	7.2%	6.9%	6.7%	10.4% – 7.6% – 9.9%	7.4% – 8.6%
	Cost, $M	3.2	5.2	4.3	3.7	3.1	2.8	5.5 – 3.7 – 5.5	3.7 – 5.0

A suggested programme for KDC is based on the analysis of model outcomes to assess the long-term renewals need for the network. It is suggested the annual expenditure should be in the order of $3.7 to $5.0 million per year. The current budget (Normal Scenario $3.70M) is at the low end of this range.

The Normal Scenario budget has increased for this analysis relative to last year. Unit rates have also changed for chipseal and rehabilitation treatments. The net result is the Normal Scenario is approximately 14% less constrained relative to last year's analysis.

The suggested expenditure is based on the following:

Resurfacing Renewal – Chipseal: 31 to 35 km ($1.9 to $2.2 million)

The range of Optimal Model scenarios 10-year and 20-year average annual chipsealing (RSEAL plus 2ndCoat) is 30 to 33 km ($1.8 to $2.0 million).

The reseal quantities reached a steady level (where there is diminishing additional quantities with increased funding) at the Very Low scenario funding level. The reseal treatment is a priority because it offers asset preservation and some improvement (when required) at the most economic price.

A suggested 31 to 35 km is 6.7% to 7.6% of the chipseal network length per year. This amount is less than the past 5 years achievement since the historic backlog of second coat seal need has been adequately addressed in recent years. An amount at the higher end of the suggested range will be needed in the future to ensure future second coat seals are catered for and the age-based backlog quantity does not grow and become unmanageable. Furthermore, KDC is having a large amount of residential and related commercial development in the Mangawhai area, which is starting to impact on the surface and pavement life.

The average of the suggested range (33 km/year) will result in a chipseal life cycle of 14.0 years. The suggested amount of chipseal treatments is affordable at the current budget of $3.70 million.

Resurfacing Renewal – Asphalt: 0.5 km ($0.2 million)

The range of Optimal Model scenarios 10-year and 20-year average annual asphalt surface renewal (TAC) is 0.8 km to 0.9 km ($0.3 to $0.4 million).

The TAC quantities reached a steady level at the Very Low scenario funding level. There is also some additional TAC quantities forecast by the model within the rehabilitation treatments.

A suggested 0.5 km is 6.4% of the asphalt network length per year. This amount of asphalt treatments is required to cater for the existing asphalt surfaces that are currently at or near end of useful life. The suggested amount of asphalt treatment is affordable at the current budget.

Rehabilitation Renewals: 3.0 to 5.0 km ($1.6 to $2.6 million)

The range of Optimal Model scenarios 10-year and 20-year average annual rehabilitation (RHAB) is 0.7 km to 5.5 km ($0.4 to $2.9 million).

The amount of RHAB treatments prioritised to the programme over the analysis period with the Normal budget is lower than the suggested range. This is a financial constraint as the model needed to cater for resurfacing needs first for the preservation and greater good of the network.

It is not realistic to expect a network to be managed over a long period of time without the need for rehabilitation treatments. The increasing pavement age indicates the pavement capacity will inevitably be consumed over a long period of time. The pavement will become less resilient to wear and less capable of absorbing deterioration.

Based on RAMM data, over the last ten years, the average annual pavement base achievement was 4.9 km (1.0% of the network). The RAMM data includes recent seal extension and new pavements completed, which will overstate the historic pavement renewal achievement. The achievement of pavement renewals is less than what pavement age data suggests.

A suggested range of 3.0 km to 5.0 km is in line with current practice and identified forward work, the optimised programme with higher funding.

The annual cost for an allowance for the average of the suggested range (4.0 km) is $2.1 million. This will result in a pavement base life cycle of 117 years.

6.3 WDC

Table 6-3: WDC model 10 year averages, current practice, and suggested programmes

Treatment		Trigger Model	Optimised Programme VH $12.68	H $10.42	N $9.06	L $7.70	VL $6.34	Current Practice (historic – current budget – 5 year FWP)	Suggested
RHAB	Length, km	7.8	8.3	5.3	3.8	2.8	1.5	8.8 – 5.7 – 7.4	6.0 – 8.0
	% of network length	0.7%	0.8%	0.5%	0.4%	0.3%	0.1%	0.8% – 0.5% – 0.7%	0.6% – 0.7%
	Cost, $M	5.6	5.7	3.7	2.8	2.1	1.3	6.4 – 4.2 – 5.4	4.4 – 5.8
2ndCoat	Length, km	8.7	8.5	5.7	4.6	4.1	3.2	(in RS)	(in RS)
	Cost, $M	0.5	0.4	0.3	0.2	0.2	0.2		
RSEAL	Length, km	48	66	68	68	69	69	88 – 62 – 83	72 – 75
RS. & 2ndC.	% of chipseal length	5.7%	7.5%	7.4%	7.3%	7.3%	7.2%	8.8% – 6.2% – 8.3%	7.2% – 7.5%
RSEAL	Cost, $M	2.5	3.3	3.4	3.4	3.4	3.4	4.4 – 3.1 – 4.2	3.6 – 3.8
TAC	Length, km	6.1	6.6	6.6	6.7	6.6	6.6	4.6 – 3.6 – 4.8	5.0 – 6.5
	% of asphalt length	8.0%	8.6%	8.6%	8.8%	8.6%	8.6%	6.1% – 4.7% – 6.3%	6.5% – 8.5%
	Cost, $M	3.1	3.3	3.3	3.4	3.3	3.3	2.3 – 1.8 – 2.4	2.5 – 3.3
Total	Length, km	71	90	85	83	82	80	101 – 71 – 95	83 – 90
	% of network length	6.6%	8.3%	7.9%	7.8%	7.6%	7.5%	9.4% – 6.6% – 8.9%	7.7% – 8.3%
	Cost, $M	11.5	12.7	10.7	9.8	9.0	8.2	13.2 – 9.1 – 12.0	10.5 – 12.9

A suggested programme for WDC is based on the analysis of model outcomes to assess the long-term renewals need for the network. It is suggested the annual expenditure should be in the order of $10.5 to $12.9 million per year. The current budget (Normal Scenario $9.06M) is beneath the low end of this range.

The Normal Scenario budget has increased for this analysis relative to last year. Unit rates have also changed for asphalt resurfacing and rehabilitation treatments. The net result is the Normal Scenario is approximately 1% less constrained relative to last year's analysis.

The suggested expenditure is based on the following:

Resurfacing Renewal – Chipseal: 72 to 75 km ($3.6 to $3.8 million)

The range of Optimal Model scenarios 10-year and 20-year average annual chipsealing (RSEAL plus 2ndCoat) is 72 to 75 km ($3.6 to $3.8 million).

The reseal quantities reached a steady level (where there is diminishing additional quantities with increased funding) at the Very Low scenario funding level. The reseal treatment is a priority because it offers asset preservation and some improvement (when required) at the most economic price.

A suggested 72 to 75 km is 7.2% to 7.5% of the chipseal network length per year. This amount is less than the past 5 years achievement. The historic backlog of void fill/texturising seals and second coat seal need has been adequately addressed in recent years. An amount at the higher end of the suggested range will be needed in the future to ensure future second coat seals are catered for, and the age-based backlog quantity does not grow and become unmanageable. The average of the suggested range (73.5 km/year) will result in a chipseal life cycle of 13.6 years. The suggested amount of chipseal treatments is affordable at the current budget of $9.06 million.

Resurfacing Renewal – Asphalt: 5.0 to 6.5 km ($2.5 to $3.3 million)

The range of Optimal Model scenarios 10-year and 20-year average annual asphalt surface renewal (TAC) is 6.4 km to 6.7 km ($3.3 to $3.4 million).

The TAC quantities reached a steady level at the Very Low scenario funding level. There is also some additional TAC quantities forecast by the model within the rehabilitation treatments.

A suggested 5.0 to 6.5 km is 6.5% to 8.5% of the asphalt network length per year. This amount is greater than the past 5 years achievement. This amount of asphalt treatments is required to cater for the existing asphalt surfaces that are currently at or near end of useful life. The average of the suggested range (5.75 km/year) will result in an asphalt life cycle of 13.3 years. The suggested amount of asphalt treatments is affordable at the current budget.

Rehabilitation Renewals: 6.0 to 8.0 km ($4.4 to $5.8 million)

The range of Optimal Model scenarios 10-year and 20-year average annual rehabilitation (RHAB) is 0.9 km to 8.8 km ($0.7 to $5.7 million).

The amount of RHAB treatments prioritised to the programme over the analysis period with the Normal budget is lower than the suggested range. This is a financial constraint as the model needed to cater for resurfacing needs first for the preservation and greater good of the network.

It is not realistic to expect a network to be managed over a long period of time without the need for rehabilitation treatments. The increasing pavement age indicates the pavement capacity will inevitably be consumed over a long period of time. The pavement will become less resilient to wear and less capable of absorbing deterioration.

Based on RAMM data, over the last ten years, the average annual pavement base achievement was 8.8 km (0.8% of the network). The RAMM data includes recent seal extension and new pavements completed, which will overstate the historic pavement renewal achievement. The achievement of pavement renewals is less than what pavement age data suggests and this makes it difficult to quantify the amount of recent rehabilitation achievement.

A suggested range of 6.0 km to 8.0 km is greater than current practice, but within the identified forward work and forecast given by the optimised programme with higher funding.

The annual cost for an allowance for the average of the suggested range (7.0 km) is $5.1 million. This will result in a pavement base life cycle of 153 years.

7 Suggested Improvements

The following improvement tasks are suggested:

- High Speed Data Cracking – this is the third network analysis incorporating the findings of the NTA studies of High Speed Data (HSD) cracking (October 2020). The development of the Crack Model included the initialisation of HSD cracks within the models, the progression of cracks, and recalibration of the initiation time for cracking to begin. Our understanding of HSD cracking is at an early stage and our experience of using this type of data is relatively limited. Further calibration and refinements within the model are anticipated to continue as our understanding of HSD outcomes improves.

- Network level strength testing – continue with the network level strength testing programme (to periodically cover the network) to maintain the strength data and enhance the model predictions and overall network management.

- Over the past three years we have noticed a general trend of increasing SNP values with successive network level (FWD) surveys. This is trend of apparent improvement to pavement base life is unlikely to exist in reality and further investigation is required.

- Traffic data – continue on collecting and update traffic counts and classified counts to capture the traffic growth and the routes with heavies, including forestry routes.

- Treatment length segmentation, continuous refinement and keep up to date to reflect work completed on the network.

- RAMM data update – continue to validate the sealed network length and update the surface table and pavement type.

Appendix 1

Model Setup

Functional Group (ONRC) Parameters

Functional Group (ONRC)	Urban LOW VOL	Urban ACCESS	Urban SEC COL	Urban PRIM COL	Urban ARTERIAL	Rural LOW VOL	Rural ACCESS	Rural SEC COL	Rural PRIM COL	Rural ARTERIAL
POLICY										
FPol_AC_Traffic_Threshold	8000	8000	8000	8000	8000	10000	10000	10000	10000	10000
FPol_2CHIP_Traffic_Threshold	0	0	0	0	0	0	0	0	0	0
FPol_CommittedYears	1	1	1	1	1	1	1	1	1	1
FPol_2ndCoat_WaitTime	4	3	2	1	1	4	3	2	1	1
THRESHOLDS										
FThresh_CrackINIProb_AC	50	50	50	50	50	50	50	50	50	50
FThresh_CrackINIProb_CS	50	50	50	50	50	50	50	50	50	50
FThresh_FlushINIProb	50	50	50	50	50	50	50	50	50	50
FThresh_RutAccelProb	50	50	50	50	50	50	50	50	50	50
FThresh_Rut_Exceedence	10	10	10	10	10	10	10	10	10	10
FThresh_IRI_Exceedence	6.84	5.71	5.33	5.33	4.96	6.84	5.71	4.96	4.58	4.58
UNIT RATES										
FUnitRate_ancPSEAL_ACA	45	45	45	45	45	45	45	45	45	45
FUnitRate_ancPSEAL_Rut	70	70	70	70	70	70	70	70	70	70
FUnitRate_ancPSEAL_IRI	30	30	30	30	30	30	30	30	30	30
FUnitRate_EcoAC	57	57	57	57	57	57	57	57	57	57
FUnitRate_EcoCS	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
FUnitRate_EcoRHAB_AC	250	250	250	250	250	250	250	250	250	250
FUnitRate_EcoRHAB_CS	70	70	70	70	70	70	70	70	70	70
(FNDC) FUnitRate_ancAC	75	75	75	75	75	75	75	75	75	75
(FNDC) FUnitRate_ancCS	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
(FNDC) FUnitRate_ancRHAB_AC	250	250	250	250	250	250	250	250	250	250
(FNDC) FUnitRate_ancRHAB_CS	250	250	250	250	250	250	250	250	250	250
(KDC) FUnitRate_ancAC	54	54	54	54	54	54	54	54	54	54
(KDC) FUnitRate_ancCS	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2
(KDC) FUnitRate_ancRHAB_AC	250	250	250	250	250	250	250	250	250	250
(KDC) FUnitRate_ancRHAB_CS	250	250	250	250	250	250	250	250	250	250
(WDC) FUnitRate_ancAC	50	50	50	50	50	50	50	50	50	50
(WDC) FUnitRate_ancCS	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
(WDC) FUnitRate_ancRHAB_AC	250	250	250	250	250	250	250	250	250	250
(WDC) FUnitRate_ancRHAB_CS	250	250	250	250	250	250	250	250	250	250
ROUTINE MAINTENANCE										
FMaint_Cracking_Threshold	2	1	1	1	1	2	1	1	1	1
PRESEAL REPAIRS										
FTrg_PSEAL_MaxExtent	15	15	15	15	15	15	15	15	15	15
FTrg_PSEAL_ACA	3	3	3	3	3	3	3	3	3	3
FTrg_PSEAL_Rut_Exceedence	11	10	9	8	8	11	10	9	8	8
FTrg_PSEAL_IRI_Exceedence	7.6	7.6	6.84	6.47	6.09	6.84	6.47	6.09	5.71	5.71

TRIGGERS										
FTrg_Surf_PCT_LifeExceedence	150	150	150	150	150	150	150	150	150	150
FTrg_CS_Flushing_Upper	16	16	13	13	10	18	18	15	15	12
FTrg_CS_Flushing_Lower	10	10	8	8	6	12	12	10	10	8
FTrg_AC_Ravelling_Upper	10	10	10	10	10	10	10	10	10	10
FTrg_AC_Ravelling_Lower	5	5	5	5	5	5	5	5	5	5
FTrg_RHAB_Rut_Upper	15	12	10	10	10	15	12	10	10	10
FTrg_RHAB_Rut_Lower	8	7	6	6	6	8	7	6	6	6
FTrg_RHAB_IRI_Upper	6.84	6.09	5.71	5.71	5.33	6.84	6.09	5.71	5.33	5.33
FTrg_RHAB_IRI_Lower	5.71	4.58	4.2	4.2	3.82	5.71	4.58	4.2	3.82	3.82
FTrg_Discard_WaitTime	7	7	6	6	5	7	7	6	6	5
RESETS										
FRes_AC_Hnew	50	50	50	50	50	50	50	50	50	50
FRes_Pave_AvgThickness	200	200	250	250	300	200	200	250	250	300
FRes_SNP	4.0	4.5	5.5	5.8	6.0	4.0	4.5	5.5	5.8	6.0
FRes_Deflection	0.6	0.5	0.3	0.25	0.2	0.6	0.5	0.3	0.25	0.2
FRes_IRI	3.45	3.07	2.88	2.69	2.69	3.07	2.88	2.69	2.69	2.69
FRes_Rut	2	2	2	2	2	2	2	2	2	2

Traffic Parameters

AADT Range	0-500	500-2000	2000-5000	5000-10000	>= 10000
CALIBRATION FACTORS					
TCal_Crack_KCP	1	1	1	1	1
TCal_CrackIniProb_KPI_ACUO	0.35	0.38	0.4	0.6	0.8
TCal_CrackIniProb_KPI_ACRO	0.35	0.38	0.4	0.6	0.8
TCal_CrackIniProb_KPI_CSUO	2.75	2.75	2.75	2.85	3.3
TCal_CrackIniProb_KPI_CSRO	2.75	2.85	3.3	3.85	4.4
TCal_CrackIniProb_KPI_CSUV	3.4	3.4	3.2	2.95	2.7
TCal_CrackIniProb_KPI_CSRV	5	5	5	5	5
TCal_Flushing	0.2	0.2	0.2	0.2	0.2
TCal_FlushIniProb	0.55	0.55	0.55	0.55	0.55
TCal_IRI_CritAge_U	55	50	35	35	35
TCal_IRI_CritAge_R	55	50	35	35	35
TCal_MCost_Calib_U	0.95	0.90	0.90	0.85	0.85
TCal_MCost_Calib_R	1.25	1.10	1.00	1.00	0.95
TCal_MCost_CCI	1	1	1	1	1
TCal_Ravelling	1	1	1	1	1
TCal_Rut_KRP_U	0.2	0.4	0.6	0.8	1
TCal_Rut_KRP_R	0.5	0.8	1	1.2	1.3
TRIGGERS					
TTrg_AC_ACA_Upper	36	24	24	24	24
TTrg_AC_ACA_Lower	6	6	6	6	6
TTrg_CS_ACA_Upper	12	9	9	9	9
TTrg_CS_ACA_Lower	3	3	3	3	3

Surface Parameters

Chip Size	0-3	3-4	4-5	5-6	6-7	7-9
TEXTURE						
SLOPE_CS	0.85	0.85	0.8	0.5	0.5	0.15
SLOPE_AC	0.1	0.1	0.1	0.1	0.1	0.1
RESET_CS	3	2.8	2.6	2	1.6	1.4
RESET_AC	1	1	1	1	1	1
ALD	10	8.75	6.75	4.75	3.25	3.25
CHIP ROTATION						
FollowingChipGrade_1CHIP	4	5	3	2	3	3
FollowingChipGrade_2CHIP	2	3	4	3	4	3
SURFACE LIFE						
P17_SurfLifeFactor_1CHIP	1.3	1.2	1.2	1	1	1
P17_SurfLifeFactor_2CHIP	1	1	1	1	1	1
SurfLifeFactor_AC	1					
SurfLifeFactor_OG	1					

Appendix 2

ONRC 10-year Average Annual Length and Cost Forecast

ONRC 10-year Average Length and Cost Forecast

Network	Treatment	ONRC	Trigger Model	Optimised Programme					Spec Prog
				VH	H	N	L	VL	
FNDC	RHAB Length, m	Low Volume	1546	6	4	0	28	14	235
FNDC	RHAB Length, m	Access	1833	257	98	80	25	12	675
FNDC	RHAB Length, m	Secondary Collector	1046	4830	2833	1327	870	570	5545
FNDC	RHAB Length, m	Primary Collector	283	4092	3678	3204	2366	1698	2679
FNDC	RHAB Length, m	Arterial	67	417	128	96	96	32	118
FNDC	2ndCoat Length, m	Low Volume	2013	526	526	526	535	531	487
FNDC	2ndCoat Length, m	Access	2490	871	840	763	762	762	1840
FNDC	2ndCoat Length, m	Secondary Collector	1958	4578	2945	1902	1676	1496	6107
FNDC	2ndCoat Length, m	Primary Collector	363	3804	2991	2817	2173	1620	2558
FNDC	2ndCoat Length, m	Arterial	21	227	140	44	44	44	72
FNDC	RSEAL Length, m	Low Volume	4831	7341	7332	7332	7321	7248	7413
FNDC	RSEAL Length, m	Access	8142	11095	11119	11133	11133	11015	11397
FNDC	RSEAL Length, m	Secondary Collector	30943	36159	36698	37563	37602	37462	37438
FNDC	RSEAL Length, m	Primary Collector	9628	9621	10175	10520	10999	11389	9341
FNDC	RSEAL Length, m	Arterial	686	593	680	703	703	703	849
FNDC	TAC Length, m	Low Volume	356	380	368	327	374	347	310
FNDC	TAC Length, m	Access	336	381	381	381	356	254	334
FNDC	TAC Length, m	Secondary Collector	519	640	629	628	549	521	581
FNDC	TAC Length, m	Primary Collector	506	577	577	556	556	556	597
FNDC	TAC Length, m	Arterial	426	541	541	514	405	346	467
FNDC	RHAB Cost, $	Low Volume	670995	1397	1120	0	9390	6498	112978
FNDC	RHAB Cost, $	Access	867859	116281	38760	50840	8897	4039	314856
FNDC	RHAB Cost, $	Secondary Collector	628898	2315681	1370508	669334	463937	367112	2633536
FNDC	RHAB Cost, $	Primary Collector	253864	2031475	1838152	1614370	1184528	889389	1310035
FNDC	RHAB Cost, $	Arterial	175653	638312	74263	52557	52557	20453	154472
FNDC	2ndCoat Cost, $	Low Volume	104310	26686	26686	26686	27093	26949	25321
FNDC	2ndCoat Cost, $	Access	137790	48510	46729	43157	43059	43059	99280
FNDC	2ndCoat Cost, $	Secondary Collector	105904	266566	164877	102114	90509	78630	334643
FNDC	2ndCoat Cost, $	Primary Collector	22958	243111	191170	182957	140530	106668	160305
FNDC	2ndCoat Cost, $	Arterial	1822	17291	10542	3623	3623	3623	5162
FNDC	RSEAL Cost, $	Low Volume	306399	443902	443168	443168	442784	438589	447350
FNDC	RSEAL Cost, $	Access	486971	653573	655713	654580	654580	647690	679948
FNDC	RSEAL Cost, $	Secondary Collector	1868932	2176500	2210419	2260182	2262410	2255842	2242527
FNDC	RSEAL Cost, $	Primary Collector	595138	594215	628450	649633	680794	702326	575065
FNDC	RSEAL Cost, $	Arterial	54377	47233	53982	55945	55945	55945	68935
FNDC	TAC Cost, $	Low Volume	208258	224940	218040	188831	220294	203373	189767
FNDC	TAC Cost, $	Access	228571	249478	249478	249478	235955	160763	216176
FNDC	TAC Cost, $	Secondary Collector	325180	423412	415780	414821	344894	326560	364433
FNDC	TAC Cost, $	Primary Collector	372176	423143	423143	412637	412637	412637	441613
FNDC	TAC Cost, $	Arterial	363326	452763	452763	432315	325991	297599	390510

Network	Treatment	ONRC	Trigger Model	Optimised Programme					Spec Prog
				VH	H	N	L	VL	
KDC	RHAB Length, m	Low Volume	353	18	7	8	4	4	0
KDC	RHAB Length, m	Access	1937	446	227	162	59	34	515
KDC	RHAB Length, m	Secondary Collector	664	3232	2275	1547	992	452	3782
KDC	RHAB Length, m	Primary Collector	361	1759	1279	1037	723	619	1667
KDC	2ndCoat Length, m	Low Volume	645	336	330	330	330	330	406
KDC	2ndCoat Length, m	Access	2525	1111	909	877	776	766	1397
KDC	2ndCoat Length, m	Secondary Collector	1040	3349	2371	1901	1341	932	3751
KDC	2ndCoat Length, m	Primary Collector	490	1575	1164	971	817	662	1460
KDC	RSEAL Length, m	Low Volume	1365	1972	1971	1967	1971	1967	2359
KDC	RSEAL Length, m	Access	4424	7815	7905	7914	8010	8011	9481
KDC	RSEAL Length, m	Secondary Collector	8022	12316	12762	13220	13630	13952	17491
KDC	RSEAL Length, m	Primary Collector	2729	2538	2674	2804	2925	3082	4561
KDC	TAC Length, m	Low Volume	215	242	242	242	242	242	63
KDC	TAC Length, m	Access	156	168	168	168	168	168	94
KDC	TAC Length, m	Secondary Collector	6	19	19	19	19	19	19
KDC	TAC Length, m	Primary Collector	170	351	351	431	431	355	92
KDC	RHAB Cost, $	Low Volume	151018	4358	1793	2073	735	735	0
KDC	RHAB Cost, $	Access	856328	192158	99931	66747	21386	12031	243819
KDC	RHAB Cost, $	Secondary Collector	408276	1634002	1169518	840987	539023	256873	1808575
KDC	RHAB Cost, $	Primary Collector	215600	1112513	811375	589205	400047	342949	831302
KDC	2ndCoat Cost, $	Low Volume	33488	19538	19370	19370	19370	19370	24178
KDC	2ndCoat Cost, $	Access	143027	62175	51500	49734	44151	43549	82376
KDC	2ndCoat Cost, $	Secondary Collector	71532	221172	157323	131118	92721	63814	237620
KDC	2ndCoat Cost, $	Primary Collector	34729	109303	79866	67481	57651	44255	94889
KDC	RSEAL Cost, $	Low Volume	70827	106706	106552	106352	106552	106352	125352
KDC	RSEAL Cost, $	Access	263415	461610	466598	467081	472422	472544	564582
KDC	RSEAL Cost, $	Secondary Collector	500309	759546	787582	814572	842250	864249	1067945
KDC	RSEAL Cost, $	Primary Collector	185449	174299	182353	192239	202263	212800	296242
KDC	TAC Cost, $	Low Volume	69962	77666	77666	77666	77666	77666	18419
KDC	TAC Cost, $	Access	65612	71630	71630	71630	71630	71630	51492
KDC	TAC Cost, $	Secondary Collector	3266	9614	9614	9614	9614	9614	8173
KDC	TAC Cost, $	Primary Collector	86633	161445	161445	191912	191912	163997	49919

Network	Treatment	ONRC	Trigger Model	Optimised Programme					Spec Prog
				VH	H	N	L	VL	
WDC	RHAB Length, m	Low Volume	1369	0	0	0	0	0	52
WDC	RHAB Length, m	Access	2318	105	44	43	25	0	724
WDC	RHAB Length, m	Secondary Collector	3171	2535	1373	898	569	308	2463
WDC	RHAB Length, m	Primary Collector	428	3096	1991	1464	937	328	1229
WDC	RHAB Length, m	Arterial	489	2559	1848	1373	1227	850	1357
WDC	2ndCoat Length, m	Low Volume	1432	281	281	281	281	281	103
WDC	2ndCoat Length, m	Access	2688	548	522	525	507	482	784
WDC	2ndCoat Length, m	Secondary Collector	3455	2622	1564	1069	902	844	2880
WDC	2ndCoat Length, m	Primary Collector	952	3007	1895	1694	1464	901	1331
WDC	2ndCoat Length, m	Arterial	220	2022	1450	1054	939	697	739
WDC	RSEAL Length, m	Low Volume	2916	4876	4876	4876	4876	4876	6638
WDC	RSEAL Length, m	Access	8163	15118	15146	15147	15165	15181	13712
WDC	RSEAL Length, m	Secondary Collector	21363	30141	30870	31227	31280	31383	33267
WDC	RSEAL Length, m	Primary Collector	10774	11369	11753	11775	11980	12108	18866
WDC	RSEAL Length, m	Arterial	5151	4743	4945	5100	5212	5286	7809
WDC	TAC Length, m	Low Volume	1830	1949	1949	1949	1947	1945	373
WDC	TAC Length, m	Access	481	561	557	550	550	541	244
WDC	TAC Length, m	Secondary Collector	386	473	472	467	465	465	508
WDC	TAC Length, m	Primary Collector	388	461	435	432	432	432	512
WDC	TAC Length, m	Arterial	3029	3110	3170	3301	3161	3192	2599
WDC	RHAB Cost, $	Low Volume	799645	0	0	0	0	0	20167
WDC	RHAB Cost, $	Access	1177233	42813	15819	14944	8749	0	338816
WDC	RHAB Cost, $	Secondary Collector	1977871	1256681	657309	443104	265647	139924	1208131
WDC	RHAB Cost, $	Primary Collector	449044	1678355	1071739	788115	464185	175013	585457
WDC	RHAB Cost, $	Arterial	1149067	2698436	1981557	1529715	1316832	997244	2134818
WDC	2ndCoat Cost, $	Low Volume	68469	13046	13046	13046	13046	13046	4392
WDC	2ndCoat Cost, $	Access	127875	22583	21600	21697	21060	20160	32463
WDC	2ndCoat Cost, $	Secondary Collector	191517	128606	74657	52133	44062	40769	140683
WDC	2ndCoat Cost, $	Primary Collector	50986	160590	100858	87570	70270	43318	67218
WDC	2ndCoat Cost, $	Arterial	15404	119379	86261	62565	57382	43610	41616
WDC	RSEAL Cost, $	Low Volume	145813	246811	246811	246811	246811	246811	357418
WDC	RSEAL Cost, $	Access	402761	727362	728501	728591	729228	729860	670921
WDC	RSEAL Cost, $	Secondary Collector	1064166	1495726	1532537	1548475	1551243	1556584	1646684
WDC	RSEAL Cost, $	Primary Collector	549433	572938	593120	594066	605838	611816	966537
WDC	RSEAL Cost, $	Arterial	288018	265876	276528	286002	291457	295105	475370
WDC	TAC Cost, $	Low Volume	713495	750934	750934	750934	750114	749431	149641
WDC	TAC Cost, $	Access	178022	205274	204074	202373	202373	199397	84777
WDC	TAC Cost, $	Secondary Collector	189482	237215	236676	234707	234032	234032	231711
WDC	TAC Cost, $	Primary Collector	224610	266823	251078	249384	249384	249384	277373
WDC	TAC Cost, $	Arterial	1766531	1792650	1830875	1920213	1837601	1854578	1507649

Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendix 02

Unsealed Roads

Overview and Management
Problems, Benefits, Consequences
Options Assessment

Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendix 02

Unsealed Roads

Table of Contents

1 Overview

1.1 Description

Unsealed road activities include the following work categories:

- Unsealed maintenance (WC 112); and
- Unsealed rehabilitation (WC 211).

These activities also have dependence on:

- Drainage maintenance and renewals;
- Environmental maintenance; and
- Traffic services maintenance and renewals.

The unsealed roads are broken into four level of service Use Bands as follows:

- **Band 1** – A 20-year life cycle was chosen from the following assessment. Investigations into the use of these roads showed that approximately 65% of the network had very little to no use. The observed and estimated AADT for these roads was up to 100 vehicles per day and the HCV percentage was almost 0 in most cases. As there is no significant pavement loading occurring due to the limited or no volume of HCV's using these roads as the predominant traffic occurring is private use motor vehicles it can be concluded from this number when gravel loss models are applied, the attrition could be predicted at approximately 8mm lost to attrition annually. It is reasonable to expect that these roads only require routine maintenance with an average aggregate replacement of 100mm every 20 years if routine maintenance is done in accordance with best practice guidelines.
- **Band 2** (normal use) – A 15-year pavement life cycle and 7 year wearing course life cycle was chosen for the following reasons: investigations into the band 2 roads showed that approximately 20% of the network had some private motor vehicle use but almost no HCV usage. The observed and estimated AADT for these roads was between 101 and 200 vehicles per day and that the predominant traffic using these roads was light motor vehicles performing daily commutes to and from work or school. Unlike band 1 roads, the band 2 roads have enough pavement loading through their increased usage and from the gravel loss attrition modelling showing the predicted wearing course attrition is between 8 and 14mm annually to warrant a simplistic pavement design and wearing course approach. The pavement design indicates an average depth required to support the AADT volume of approximately 100mm of structural pavement and 70-100mm of sacrificial wearing course every 7 years to mitigate the effects of attrition on the structural pavement.
- **Band 2 Commercial** (including periodic forestry, farm and other commercial activities) – A 10-year pavement life cycle and 5 year wearing course life cycle were chosen for the following reasons: investigations into the Band 2 Commercial use roads showed that approximately 10% of the network had mix of private motor vehicle use and forestry use with HCV usage being 7-12%. The observed and estimated AADT for these roads was between 101 and 200 vehicles per day and that the predominant traffic using these roads was light motor vehicles performing daily commutes to and from work or school and episodic forestry harvest or other freight and/or agricultural vehicle activity. Unlike Band 2 (normal) use roads, the Band 2 Commercial use roads have increased pavement loading through their increased usage and from the gravel loss attrition modelling showing the predicted wearing course attrition is between 14 and 20mm annually. Due to the increased loading a detailed pavement design

and wearing course application approach is required. The pavement design indicates an average depth required to support the AADT and HCV volumes of approximately 250mm of structural pavement and 70-100mm of sacrificial wearing course every 5-7 years to mitigate the effects of attrition on the structural pavement.

- **Band 3** – A 10-year pavement life cycle and 5 year wearing course life cycle were chosen for the following reasons: investigations into the Band 3 use roads showed that approximately 5% of the network had mix of private motor vehicle use and forestry use with HCV usage being 10% or greater. The observed and estimated AADT for these roads was greater than 201 vehicles per day and that the predominant traffic using these roads was light motor vehicles performing daily commutes to and from work or school and continual forestry harvest or other freight and/or agricultural vehicle activity. Unlike Band 2 Commercial use roads, the Band 3 roads have increased pavement loading through their increased usage and from the gravel loss attrition modelling showing the predicted wearing course attrition is between 14 and 20mm annually. Due to the increased loading a detailed pavement design and wearing course application approach is required. The pavement design indicates an average depth required to support the AADT and HCV volumes of approximately 250mm of structural pavement and 70-100mm of sacrificial wearing course every 3-5 years to mitigate the effects of attrition on the structural pavement.

These use bands and associated treatments are not currently specified in the current maintenance contracts, the aim is to include them in the next generation of maintenance contract starting 2025/26.

There is a total of 3,371km of unsealed pavements (58% of the total road network length) in the region, which broken into the three districts are:

- FNDC – 1,586km or 63% of their district roads;
- KDC – 1,108km or 70% of their district roads; and
- WDC – 677km or 39% of their district roads.

Almost all of the unsealed roads are classed as rural road.

Figure 1-1 below illustrates the unsealed road length distribution by ONRC and Use Band for the three districts:

	FNDC	KDC	WDC
Arterial	0.0	0.0	0.0
Prim Col	3.4	0.0	0.2
Sec Col	217.1	23.4	27.3
Access	787.9	424.5	368.7
Low Vol	576.0	656.7	278.7
Unkown	1.5	3.2	2.1
Total	1586.0	1107.8	677.0

	FNDC	KDC	WDC
B3	186.8	68.8	46.5
B2 Com.	296.8	68.8	97.5
B2	257.8	339.7	181.5
B1	844.6	630.6	351.5
Total	1586.0	1107.8	677.0

Figure 1-1: Unsealed roads length by ONRC (left) and Use Band (right)

1.2 Monitoring and Condition

The following condition data are collected for the unsealed road network:

- HSD roughness and geometry, the last data set was collected in 2018; the geometry data was used in the setup of the LoS Band model. Network level roughness is not a key performance measure of the unsealed road network. Geometry data was utilised in the model setup and this is unlikely to change on the existing network, therefore going forward there is no need to collect network level HSD in the near future.
- GPR data on annual project level basis is collected for road sections that are Band 2 or greater, the data is used to refine the annual renewal sites pavement designs.

1.3 Overall Strategy

The NTA has been in developing a Centre of Excellence for Unsealed Roads and this includes a draft regional unsealed road strategy Maintenance Management Plan (MMP, attached Appendix 02.A). The vision for the Centre of Excellence for Unsealed Roads and the MMP is an asset management led proactive approach to all unsealed road maintenance work. It is the intention that all work undertaken will be programmed, planned and have the appropriate intervention that is weighed up against all other programmes and activities to achieve the best value for money investment decisions and the optimum life cycle return on a given asset.

An asset management led structured approach to maintenance work will enable the district councils to invest in renewals work along with any required operational maintenance work. Councils will be able to systematically work through the networks and build an appropriate level of service that meets the needs of all road users. This will be achieved by focusing capital (Capex) investment in granular pavements, Paige-Green compliant bound wearing courses and culvert & drainage renewals while focusing operational (Opex) investment on appropriate drainage maintenance and keeping unsealed carriageways within the specification of the maintenance contract through better grading/blading frequencies.

Included in this work are the activities like forestry and dairy freight which from vehicle kilometres travelled (VKT) affect small portions of the network, but, if not included and the appropriate level of service catered for, lead to significant damage and maintenance expenditure. However, it is the intent that, rather than catering specifically to industry, the wider needs of all the community will be met through improved and sometimes decreased levels of service that will be a direct outcome of appropriately timed Interventions and treatment types led by asset management strategy.

The strategy has identified the following issues so far:

- There is very little data collection for unsealed roads which makes it difficult to determine maintenance programmes;
- Maintenance that is undertaken on unsealed roads is poorly recorded in RAMM making it difficult to identify where this work was undertaken, what its cost was and what was done;
- Maintenance interventions are largely reactive in response to customer complaints which leads to inappropriate maintenance treatments such as grading in summer, which typically requires an expensive wet, roll and grade treatment; and
- Maintenance aggregate are generally blue aggregates, while these are a good foundation material for structural pavement, result in poorly bound surfaces having higher rates of metal loss and dust generation. Most of these pavements were constructed when there was an expectation these roads would be subject to a future seal extension and the pavement would form part of the sealed road subgrade.

Based on the strategy, the following improvements are being proposed in the 2024/27 period:

- Continue with the asset management led approach;
- Accurately record the location, type and cost of maintenance activities, including wearing course applications on the unsealed road network;
- Improve data collection of the unsealed road network using:
    - Ground Penetrating Radar (GPR) to better understand the pavement makeup;
    - High Speed Data (HSD) including, roughness, geometry, and crossfall, this will help to establish a baseline and enable quantifying improvements overtime; and
    - Improving other input data such as traffic volume and composition for model analysis and treatment selection.
- Carry out test pits on some of the annul rehabilitation sites to validate the GPR data and design assumptions;
- Carry out metal trials to determine appropriate metal blends to provide a bound, low maintenance, low dust wearing surface for unsealed roads;
- Develop, implement, and maintain forward works programmes;
- Develop NTA visual inspection guidelines;
- Improve operational efficiencies and delivery outcomes by undertaking regular alignment sessions.

This information will provide continuation of the baseline data established in the 2018/21 programme that can be used in the asset management planning of appropriate grading and metalling cycles. It will also enable the determination of appropriate structural pavement thicknesses and tightly bound wearing courses to provide a long-term treatment to improve the level of service and reduce maintenance costs and dust on the unsealed road network.

A programme of dust suppression has been established to address PM10 dust on forestry routes with a dust risk assessment of 12 or more (using NZ Transport Agency's General Circular 16/04). This was expected to be a short-term programme until such time as appropriate low maintenance/low dust wearing courses could be constructed on these forestry routes. This programme is now fully developed for FNDC and had been implemented.

The introduction of a proactive maintenance regime and the application of a suitable wearing course is also expected to improve customer satisfaction with the unsealed road network and reduce the pressure on Council to carry out seal extensions.

2 Management Plan

2.1 Acquisition

NTA does not create unsealed pavements; however, some unsealed assets may be vested to Council as per the Councils Environmental Engineering Standards;

"Council may, by specific approval, allow rural roads to be unsealed. Approval will not normally be given where the road will service properties that are predominantly urban, lifestyle, horticultural or similar, or that extend or join a sealed road. Approval for unsealed roads shall be confirmed in writing at the time of resource consent application."

Council also has the right to create paper roads, which are unsealed and generally unmaintained, however there are no plans to do create any within the timeframe of this plan.

2.2 Maintenance

Unsealed maintenance consists of the following activities:

- Grading/ shape maintenance
- Maintenance metalling
- Drainage
- Pavement defect repairs.

Maintenance activities has focus on the following aspects:

- Forestry roads – preparing roads based on anticipated logging traffic supplied by the forest managers. These roads will be strengthening by the addition of pavement aggregate to restore the structural strength and shape of the pavement; i.e. Heavy Metal Maintenance.
- Heavy trafficked roads – these are predominantly lifestyle residential, farming and timber haul routes. Roads will be maintained according to specification and metal applied where necessary. The level of service and response time will be adhered to, to minimise legitimate ratepayer complaints.
- Light trafficked roads – the balance of the rural roads. Grade and pothole patching as required.
- Dust suppression – carryout dust suppression on high risk forestry routes over summer when dust levels reach unacceptable levels.

Going forward, the new maintenance contract will include provision for the use of blended material using the Paige/Green chart or similar to provide wearing courses that are less prone to unravelling and dust production.

The maintenance of unsealed pavements is based on intervention levels and response times set in the maintenance contract. The intervention levels are considered to be the level at which the defect becomes a hazard to property or safety and the response times are based on the ONRC hierarchy, the criticality of the road and the level of work required to repair the defect. There will be limited ability to react to unforeseen impact on any portion of the unsealed network.

The traffic use and loads on some roads, particularly those in coastal areas and those leading to production forests, will continue to be a problem due to the demand peaks experienced. The future expenditure on unsealed roads is expected to increase to meet the current impact from logging operations over the horizon of this plan.

The maintenance decision process, what level of defects requires repairs and in what timeframe, are based on the requirements of the Road Maintenance Contract.

2.2.1 *Dust Suppression*

As described above, dust suppression is being proposed as a short-term measure on high risk roads to reduce the health effects of PM10 dust on adjoining dwellings. This treatment would be required until such time as an appropriate pavement structure and wearing course can be applied. This is expected to reduce PM10 dust to acceptable levels in the long term. However, there is still a risk that dust suppression is required following this long-term treatment.

2.3 Renewals

The renewals plan involves the strengthening of the pavement, by adding road aggregate to restore or improve the structural strength of the pavement (GAP heavy metalling). The most common method of strengthening the road is to add additional metal. Strengthening can also be achieved by adding a proprietary product, such as lime or cement, to modify the metal, improving its properties. Drainage improvements and width adjustment are usually carried out in conjunction with these strengthening operations.

There is a seasonal regime of adding clean GAP12 material when the moisture condition is just right to bind up with bony material. This generally occurs prior to winter when there is a programme of bringing metal onto the road.

With the development of the Forestry Road Management Strategy, the plan is to proactively plan renewals on roads prior to logging commencing so the pavement will be in an adequate condition to cope with the additional loading. This should prevent situations that have occurred in the past when an unplanned logging activity starts up which results in catastrophic failure of the road and requires significant metal to bring the road back to a trafficable condition.

The MMP recommends unsealed roads have a proper pavement structure built with a capping of a wearing course. The wearing course will meet the Paige-Green Chart for material properties so that it will form a firm base that is resistant to unravelling and dust production. This should result in less metal loss and reduced dust generation that will reduce the cost of managing these roads. This will have continued developed and will be incorporated in the next generation of maintenance contract starting 2025/26.

2.4 Improvement

Unsealed pavements can be improved as a result of demand changes (use Band upgrade) and may be either by widening (which often also includes strengthening) or through seal extension. Both are discussed below.

Widening Plan

Widenings are undertaken based on a number of triggers such as increased maintenance, safety concerns and heavy vehicle loading. These triggers are as follows:

- Increase in use (heavy commercial, bus traffic, logging activities) – strengthening and widening.
- Demand changes (Annual Daily Traffic, customer) – more grading (see renewals plan).
- Road starts to service key community facilities (schools) – seal extension.

Seal Extension Plan

The Council has for a number of years developed a Strategic Seal Extension Programme to manage the needs and funding for seal extensions across the District. The objective of the Council's Strategic Seal Extension Programme is *"to develop a sealed network over a reasonable planning period which meets the needs of the District at an affordable cost".*

The criteria taken in account include:

- Completing the sealing of the arterial road network.
- Developing links between communities.
- Meeting the requirement for no ratepayer to be more than five kilometres from a sealed road.
- Sealing roads affected by significant heavy traffic, if that is the best solution for upgrading that particular section of road, such as the Wright Road/McCardle Road forestry route.
- Considering dust control sealing, if that fits as the best solution for upgrading a particular section of road.
- Maximising the level of NZTA subsidy and/or ratepayer contribution in the development of the annual seal extension programme.

It is accepted that a fairly high proportion of the region's roads will remain unsealed into the foreseeable future.

Bridge Approach and Traction Seals

Sealing of the approach to bridges is aimed at decreasing the maintenance involved with these sections as it decreases the rate at which potholes are created.

Traction seals are to be created on roads where the lack of traction due to the metalled surface is a safety issue (such as the approach to intersections or on steep hill sections).

Intersection Sealing

Intersection sealing is done to limit the amount of aggregate that is dragged from unsealed roads onto sealed roads.

3 Problems, Benefits, and Consequences

This section outlines problems affecting the unsealed road network and details the benefits or consequences of doing or not doing something to address these problems.

3.1 Key Issues

3.1.1 Problem Description

The unsealed road network in Northland is one of the longest of any region in the Country. The proportion of the road network that is unsealed is also high. This means that the unsealed road network plays a significant part in providing access to remote communities and to productive land. A large proportion of forestry, agriculture and dairy land is served by unsealed roads. Most primary production trips start on an unsealed road.

Because Northland's economy is supported by significant forestry, agriculture and dairy industries, the amount of heavy vehicle traffic using the unsealed road network is comparatively high. This results in a high level of traffic loading on unsealed freight routes. The loading on these freight routes has increased over the last decade, particularly with the rapid increase in logging activity as forestry blocks have been harvested. This has placed increasing demands on the unsealed road network. Freight demand is predicted to grow by almost 40% between 2012 and 2042. This will result in increasing levels of pavement wear and deterioration over time.

From the customer satisfaction surveys, there is a high level of dissatisfaction with the unsealed road network. The main reason for dissatisfaction was a perceived lack of maintenance and potholes, corrugations and being out of shape. The customer generally wants a smooth road, so managing potholes and corrugations is important in achieving a reasonable level of customer satisfaction.

The current maintenance regime is reactive resulting in work being undertaken in summer in dry conditions which requires expensive wet, roll and grade maintenance to adequately compact the road. Lack of adequate geometry and cross fall is also an issue which can accelerate the generation of potholes and corrugations. Restoring adequate shape is often not manageable under the current heavy metalling and grading regime due to lack of pavement thickness.

There is also ongoing pressure from residents on unsealed heavy vehicle routes to seal their roads or frontages. This is to reduce the impacts of dust on resident's health and to improve road safety. In particular, in January 2017 residents blocked logging trucks on two locations on Pipiwai Road over a two-week period to force councils to address dust on forestry roads in the area.

As a result of these blockades, the Far North and Whangarei councils have implemented programmes of dust suppression on forestry roads over the dry summer months to try to address dust issues. In addition, both councils have undertaken subsidised seal extensions on significant forestry and freight routes – for WDC on Wright Road, McCardle Road and for FNDC on Pipiwai Road and Ngapipito Road. These projects have been justified on the basis of having a high or medium-high dust risk in accordance with the Dust Risk Matrix from NZTA's General Circular 16/04. Both the Far North and Whangarei councils are also undertaking programmes of unsubsidised seal extensions on other roads. The Kaipara District Council is not currently using dust suppression or carrying out sealing to mitigate dust impacts.

NTA has undertaken an assessment of its highest risk roads for dust using the Dust Risk Matrix from NZTA's General Circular 16/04. An extract from an assessment for FNDC is shown in Table 3-1 below for illustration purposes.

Table 3-1: FNDC – NZTA General Circular 16/04 Assessment

RAMM DATA					NZTA DMI (General Circular 16/04)											
Road Name	Location	Road ID	Start	End	16/04 SCORE HCV 5 day AADT	16/04 SCORE HCV Speed	16/04 SCORE LDV 5 day AADT	16/04 SCORE Speed of LDVs (Est)	16/4 SCORE Houses / km (80m from road)	16/04 SCORE sensitive locations/ km schools, marae, or hospitals	16/04 SCORE Ecological Areas / km	16/04 SCORE Horicul-tural areas / km	16/04 SCORE Location of roadway	16/04 SCORE Frequency of rain days (>5mm)	16/04 SCORE Longevity of logging route use	SCORE NZTA Circular 16/04 OVERALL
Beach Road	DOVES BAY	3103	0	188	5	2	2	2	5	0	0	0	1	2	0	19
Quarry Road	AWANUI	2209	0	720	5	2	2	2	5	0	0	0	1	2	0	19
West Coast Road	KOHUKOHU	2543	25,619	26,214	4	2	1	2	5	1	0	0	1	1	2	19
Koropewa Road		1872	0	1,692	4	2	2	2	5	0	0	1	1	1	0	18
Waterfront Road	HOUHORA	2529	456	1,386	5	2	2	2	4	0	0	0	1	2	0	18
TOTARA SCHOOL ROAD	TOTARA NO	3122	0	472	5	2	2	2	4	1	0	0	1	1	0	18
Arawhata Road		3057	285	1,329	4	2	1	2	5	0	0	0	1	2	0	17
Clough Road		1607	506	806	4	2	2	2	2	0	2	0	1	2	0	17
Purerua Road		2205	9,893	10,198	4	2	2	2	2	0	2	0	1	2	0	17
Te Tii Road		2431	0	150	4	2	1	2	5	0	0	0	1	2	0	17
Aurere Beach Road		1510	0	543	3	2	1	2	5	0	0	0	1	2	0	16
Church Road	KAITAIA	1596	13,104	13,851	5	2	1	2	3	0	0	0	1	2	0	16
Church Road	KAITAIA	1596	13,937	15,041	5	2	1	2	3	0	0	0	1	2	0	16
Doel Road	WAIPAPAKA	1642	0	282	2	2	0	2	5	0	2	0	1	2	0	16
Kaimaumau Road		1838	8,580	9,933	4	2	1	2	4	0	0	0	1	2	0	16
Kerikeri Inlet Road		1795	8,911	9,820	5	1	2	1	4	0	0	0	1	2	0	16
Mcfarlane Street	NORTH	3043	0	199	5	1	2	0	5	0	0	0	1	2	0	16
Oturu Road		2113	2,058	2,430	4	2	1	2	3	1	0	0	1	2	0	16
Wireless Road		2585	2,123	2,423	5	2	2	2	2	0	0	0	1	2	0	16
Quarry Road	AWANUI	2210	4,844	5,531	4	2	2	2	3	0	0	0	1	2	0	16
West Coast Road	KOHUKOHU	2543	36,639	37,253	4	2	1	2	3	0	0	0	1	1	2	16

The number of dwellings exposed to a medium dust risk score of 10 or more is 1,918 for FNDC, 334 for KDC and 441 for WDC. Most of these dwellings are on forestry or other freight routes. This indicates that there is likely to be a significant exposure to health effects of PM10 dust to people living on these routes.

The unsealed roads in Northland have been maintained for many years using a General All-Passing (GAP) type material which is readily sourced from the local quarries. This material is permeable and allows water into the pavement surface. Because of this, the unsealed road surfaces are prone to potholing if the pavement shape is not sufficient to shed surface water (a cross fall of 6% or more). As described above, it is often difficult to achieve the correct cross-fall due to lack of metal depth.

The GAP material also is quite granular and lacks cohesive material to bind it into a tight surface, which results in the gravel moving around on the surface (like marbles). This makes the surface prone to corrugations forming during dry periods. It also means that significant dust is produced through the particles moving and grinding against each other, particularly under heavy vehicle traffic. Gravel loss is another significant issue because the loose stones on the surface are flicked off the road as vehicles pass. Over time this results in the pavement thickness wearing away until eventually clay patches of the subgrade are exposed and heavy vehicles "punch" through the surface. The aggregate that is flicked off the road often fills up the side drains creating on-going drainage issues. Figure 3-1 following shows an example of a logging truck on a typical GAP type material pavement.

Figure 3-1: Logging trucks on a typical GAP type material pavement

The GAP material was probably fit for purpose when traffic volumes, and in particular heavy vehicle volumes, were less. However, with growth in the region and increasing freight demands, this material is becoming more unsustainable on routes carrying freight or high traffic volumes. In particular, the recent recognition that dust is a health hazard to residents has elevated the needs for dust control on freight routes. Because of the above reasons, there is increasing demand for more and more maintenance of the unsealed network, including pothole patching, grading, metalling and dust suppression. It is also resulting in more desire for expensive seal extensions.

The maintenance contracts that were awarded across Northland in 2018 are strongly focussed on changing to a more sustainable blended material using the South African Paige-Green chart (see Figure 3-2 below) which has been adopted by Austroads. This material includes more cohesive clay material and results in a tightly bound surface which is more resistant to potholing, corrugations, ravelling and dust generation.

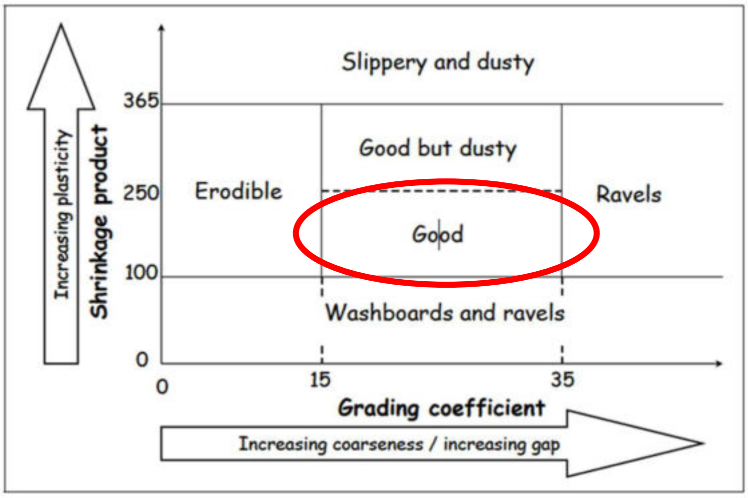


Figure 3-2: South African Paige-Green chart

However, to date there has been limited use of this material on the network. This appears mainly due to a lack of available funding within the maintenance contracts to use this wholesale across the region.

For the roads where the Paige-Green compliant material has been used, such as Cames Road in Mangawhai, there has been an improvement of the road condition and less maintenance required. There has also been less dust generated, and the dust that is formed settles more quickly than for

GAP pavements. Figure 3-3 below shows an example of a pavement using Paige-Green compliant material.

Figure 3-3: Cames Road with Paige-Green compliant

The NTA has been developing a Centre of Excellence for Unsealed Roads and the key initiatives include:

- The development of an unsealed demand-based prioritisation tool,
- An unsealed cost model, and
- An unsealed road forward works programme.

This work is based on transitioning from the current GAP materials to having Paige-Green compliant wearing courses along with pavement strengthening (GAP heavy metalling) on medium and high demand roads. Low demand roads would continue to be maintained as normal but would have Paige-Green materials applied whenever any make up material is required.

Over time, this approach is likely to result better pavement condition, improved road user satisfaction and lower maintenance costs. Although it is not a 'silver bullet' treatment, the use of Paige-Green complaint material is also likely to reduce dust impacts to local residents. This may reduce or eliminate the need for costly dust suppression, particularly on low and medium demand roads.

High demand routes which are subject to forestry or other freight movements, may still require dust suppression to control dust, but with fewer applications per annum. Unsealed roads that are subject to high, long term forestry or freight volumes may be considered for house frontage sealing or seal extension to reduce long term maintenance costs and to mitigate dust impacts to residents.

There is not much information on the amount of pavement depth or condition of the unsealed road network. The limited testing that has been undertaken indicates that there is very little pavement depth on most of the unsealed road network due to the historic amount of re-metalling achieved being insufficient to match the gravel loss of the GAP materials.

It is expected that further investment is needed on the unsealed road network to restore pavement strength that has been consumed through metal loss. Test pit data should be gathered whenever metalling operations are being undertaken to determine the appropriate level of metalling required. This will help determine existing pavement depths which will enable appropriate amounts of Paige-Green compliant materials being used to provide the required shape and pavement strength.

The use of new technology such as RoadRoid has been included in the current maintenance contracts and this should be enforced so that data on the unsealed road roughness can be determined which will enable a proactive grading programme to be developed rather than reacting to customer complaints.

Further development of houses on unsealed roads is leading to more people being exposed to dust and more pressure for dust mitigation and road sealing. The Whangarei District Council has recently approved a plan change which would limit future rural development on unsealed roads and would help limit further dwellings being exposed to road dust. The planning rules in the Far North and Kaipara districts should also be reviewed and rules developed to either limit the development of houses on unsealed roads or to require new dwellings to be located well back (ideally greater than 80m) from unsealed road frontages.

The cost to maintain the unsealed road network for each district is shown in the following figures.

FNDC Historic Cost

The spend on Far North's unsealed road network over the past 10 years is shown in Figure 3-4 below. It shows that in 2017/18 there was a significant spike in spending through the additional NZTA investment in the forestry road strengthening programme and the Ngapipito and Pipiwai Road sealing. This resulted in a short term reduction in spend in the following years (2018/19 to 2020/21). However, this effect was expected to be short lived as the gravel loss on these forestry routes is high and will require increasing levels of investment over time. Cost have begun to creep up and spend is currently similar to that prior to 2017/18, albeit with increase to the maintenance cost component and a corresponding decrease in the metalling cost component.

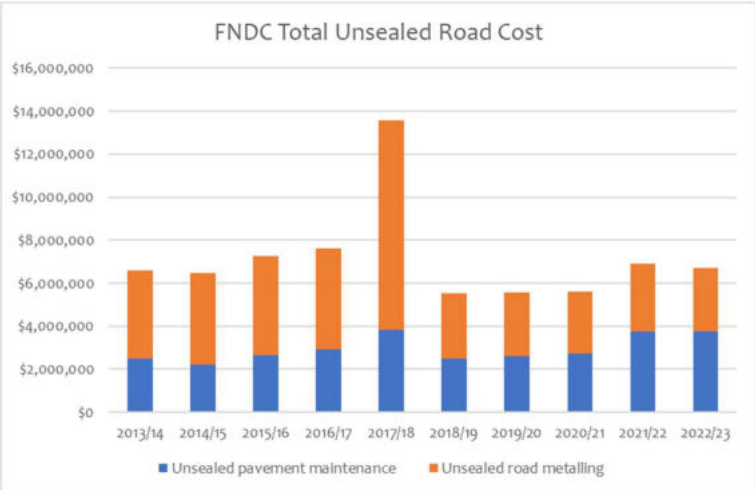


Figure 3-4: FNDC total unsealed roads cost

In the last three years, Far North has one of the highest total unsealed cost in their peer group as shown in Figure 3-5 below.

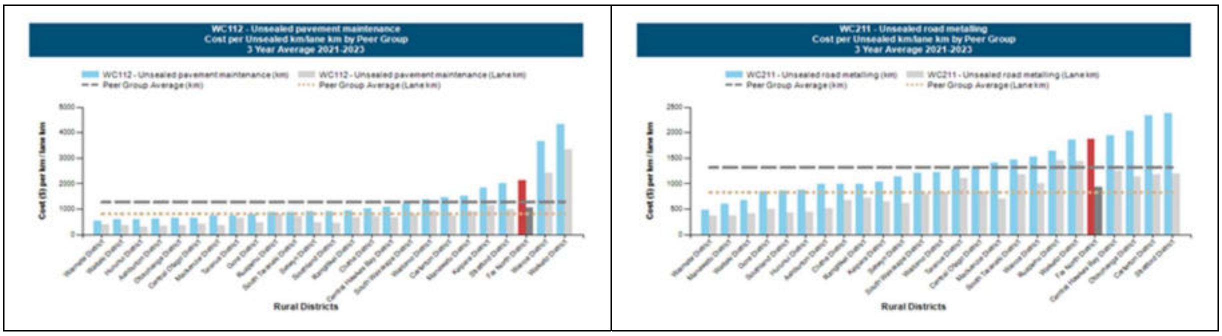


Figure 3-5: FNDC Unsealed Road Cost – 3 Year Peer Group Comparison

In addition to this, FNDC is currently having to spend on unsubsidised dust suppression and on seal extensions, of which a significant amount is targeted through the Low-Cost Low Risk programme with the rest being unsubsidised. Most of this work is being undertaken due to pressure from the community due to health concerns due to dust and general dissatisfaction with the unsealed road network. This demonstrates that the current approach to unsealed roads is not sustainable in the Far North.

KDC Historic Cost

The spend on Kaipara's unsealed road network over the past 10 years is shown in Figure 3-6 below. It shows there had been a step change in funding of KDC's unsealed network in the period between 2014/15 and 2017/18, which was the recovery from the impacts of the Mangawhai rates strike and also included additional investment in the sealed road network through the NZTA forestry strengthening programme. The maintenance cost component has been relatively low and stable during the five years since then. However, metalling cost have remained at relatively high levels.

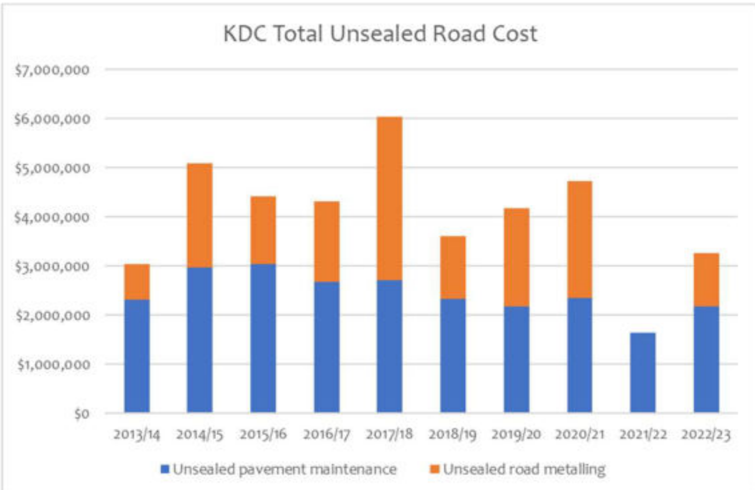


Figure 3-6: KDC total unsealed roads cost

The spend on Kaipara's unsealed network over the past three years is shown in Figure 3-7 below. The figure indicates that Kaipara remains one of the most expensive in its peer group for pavement maintenance and is mid-range in its peer group for road metalling. Road metalling improvement relative to the previous three year period has been influenced by Provincial Growth Fund (PGF) contributions and that Kaipara has been piloting the initiatives from the Centre of Excellence for Unsealed Roads.

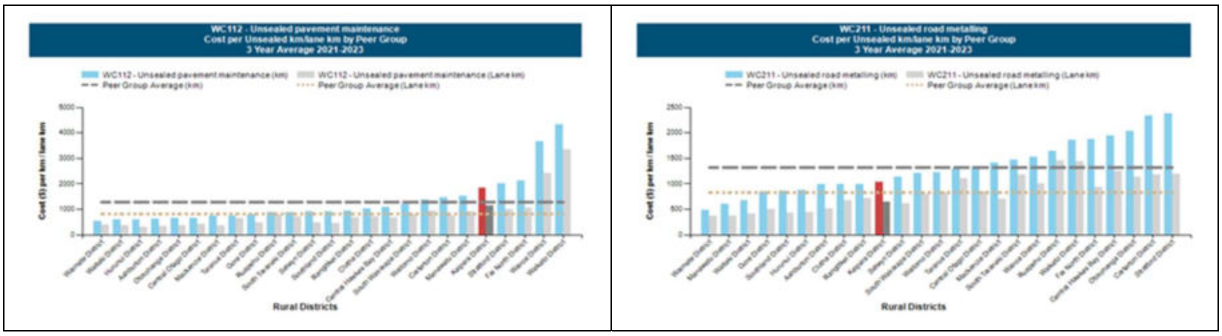


Figure 3-7: KDC Unsealed Road Cost – 3 Year Peer Group Comparison

However, Kaipara is not investing in dust suppression or seal extensions, although it is noted that through the PGF Kaipara Kickstart project, the sealing of the remaining 20km of Pouto Road is complete. Over the past four or five years, Kaipara has been focusing on utilising blended materials and this has led to the roll out of Paige-Green compliant wearing courses to improve road condition, reduce maintenance costs and help control dust. The impacts of this investment are starting to be realised in reduced complaints and maintenance costs on these routes.

WDC Historic Cost

The spend on Whangarei's unsealed road network over the past 10 years is shown in Figure 3-8 below. It shows a spike in 2017/18, this was due to the investment in the Wright/McCardle seal extensions which were funded through WC 211 Unsealed Road Metalling. The overall investment into Whangarei's unsealed road network prior to 2018/19 was too low, given the spend for the other two districts and Northland's poor subgrade conditions and heavy vehicle volumes. The spending profile, starting in 2018/19, was increased to address historic under investment in maintenance and metalling of the unsealed network and is considered a more sustainable level of funding.

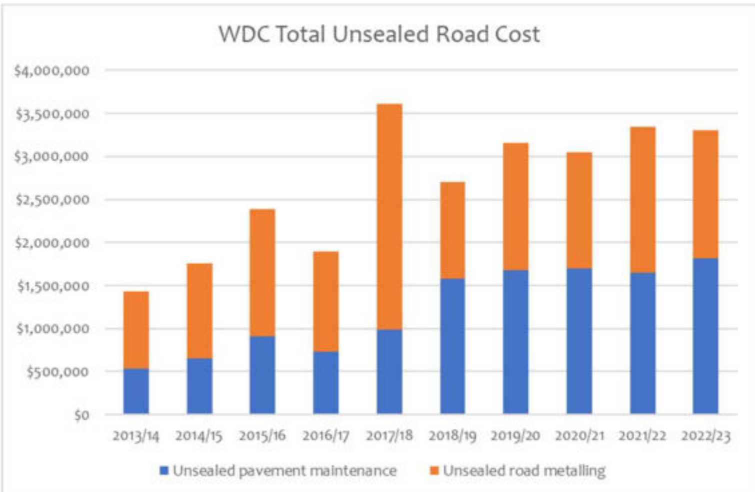


Figure 3-8: WDC total unsealed roads cost

The spend on Whangarei's unsealed network over the past three years is shown in Figure 3-9 following. The figure indicates that Whangarei is one of the most expensive in its peer group for pavement maintenance and is at the high end of the range in its peer group for road metalling.

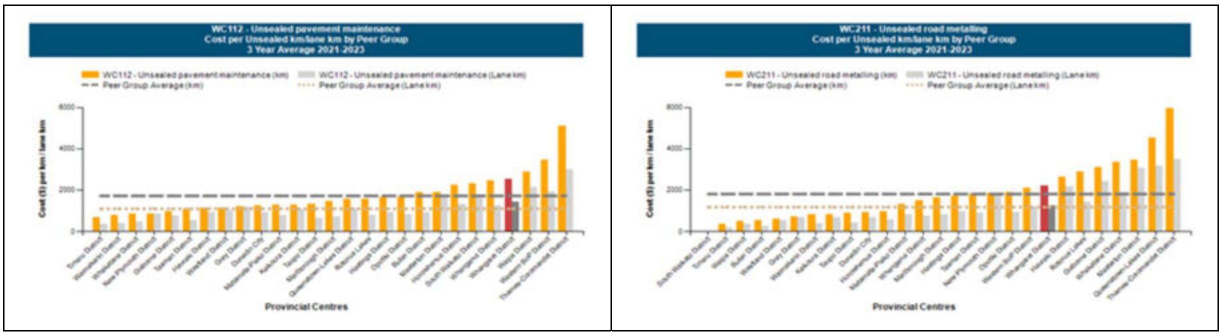


Figure 3-9: WDC Unsealed Road Cost – 3 Year Peer Group Comparison

In addition, WDC is spending $1M/year on seal extensions, but this was increased to $3M for the 2019/20 financial year. Going forward, WDC will be spending $1.5M for 2024/25 and 2025/26, most of this work is being funded as unsubsidised seal extensions.

Forecast Costs

As part of the development of the Centre of Excellence for Unsealed Roads, a normative cost model had been developed to determine a sustainable cost profile for the unsealed road networks. This model is based on using Paige-Green compliant materials on Medium and High demand roads in conjunction with appropriate strengthening. It is based on industry research into gravel loss to determine appropriate frequencies of between 5 and 7 years for re-application of the wearing course and structural pavement lives of between 10 and 20 years depending on the demand. The results of this model indicate the required sustainable funding levels are as per Table 3-2 below.

Table 3-2: Modelled sustainable funding levels

FNDC treatment	$/km	total prog. cost $Million	$M/year required	3-year prog. $M ($M/year required, less 30% allowance for insitu metal)
do min/routine maintenance (incls drainage)	$ 24,240	$ 21.1	$ 1.9	$ 4.0
100mm	$ 61,250	$ 96.8	$ 9.7	$ 20.3
rehab	$ 128,040	$ 60.7	$ 6.1	$ 12.7
total			$ 17.7	$ 37.1
KDC treatment	$/km	total prog. cost $Million	$M/year required	3-year prog. $M ($M/year required, less 30% allowance for insitu metal)
do min/routine maintenance (incls drainage)	$ 24,240	$ 16.1	$ 1.3	$ 2.7
100mm	$ 61,250	$ 19.4	$ 6.8	$ 14.3
rehab	$ 128,040	$ 17.1	$ 1.7	$ 3.6
total			$ 9.8	$ 20.7
WDC treatment	$/km	total prog. cost $Million	$M/year required	3-year prog. $M ($M/year required, less 30% allowance for insitu metal)
do min/routine maintenance (incls drainage)	$ 24,240	$ 9.2	$ 1.0	$ 2.0
100mm	$ 61,250	$ 41.4	$ 4.1	$ 8.7
rehab	$ 128,040	$ 9.7	$ 1.0	$ 2.0
total			$ 6.1	$ 12.8

The model indicates that Kaipara’s and Whangarei’s unsealed road spending will need to increase relative to the past five year’s spending by an order of 40% to 60% to achieve a sustainable programme. Moreover, a more significant increase, by an order of 100%, is required to Far North’s spend to reach a sustainable programme. This is mainly due to the higher number of high demand unsealed forestry roads in the Far North District.

There will be a period of transition while the Paige-Green compliant material is rolled out where costs will be higher until the benefits of this investment are realised through reduced maintenance and metalling costs. The majority of the medium and high demand roads are expected to be addressed over a ten-year period (three 3-year NLTP periods). During this 10-year period, the unsealed maintenance costs will drop progressively to more sustainable levels.

Figure 3-10 following contains three graphs from an initial study for the Centre of Excellence for Unsealed Roads and show the unsealed road costs over a 30-year timeframe for both the current approach (solid lines) and the Centre of Excellence approach using Paige-Green complaint materials (dashed lines). Note the values in Figure 3 10 are adjusted for inflation at a rate of 2.2% p.a..

The graphs in Figure 3-10 indicate that, in the long-term, the FNDC and WDC unsealed road costs will be almost the same as the current approach. KDC’s unsealed road costs will be significantly less than the current approach, due to the investment already made in rolling out Paige-Green compliant materials and the acceleration of the roll-out through the PGF funded unsealed road strengthening programme.

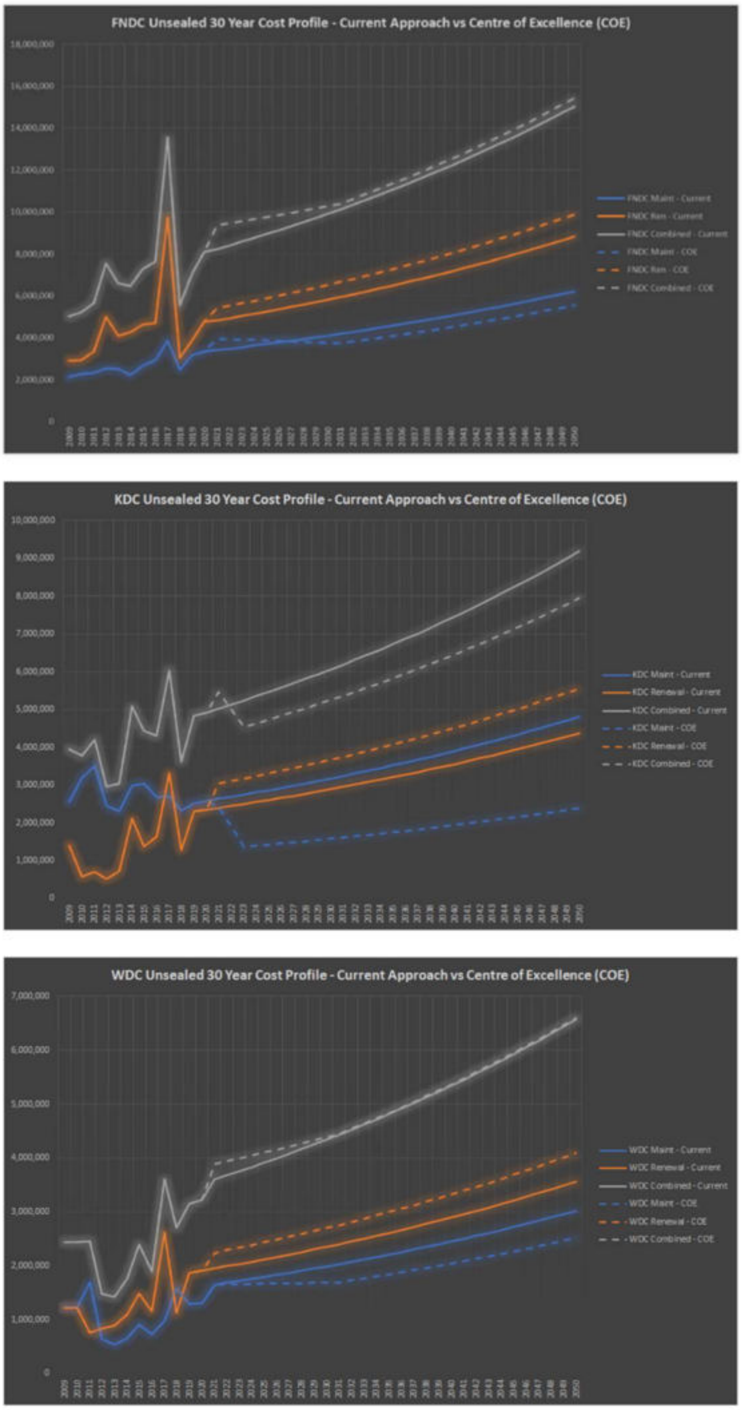


Figure 3-10: All networks – current approach versus Centre of Excellence

3.1.2 Key Issues and Actions

- The use of General All-Passing (GAP) materials is resulting in the unsealed road network being prone to potholing, corrugations, gravel loss and dust which is leading to high levels of customer dissatisfaction, and health concerns and maintenance costs.
- Dust has become a significant concern for resident's health, particularly on freight routes, which is driving significant demand for dust suppression and sealing of roads in the Far North and Whangarei districts.
- The roll out of the use of Paige-Green compliant materials is expected to address a lot of these issues. The focus will be on providing a wearing course of Paige-Green compliant material on

high and medium demand roads. Additional pavement strengthening will also be required on these routes to provide the required strength and shape. Additional funding would be required to enable this roll out to be properly implemented.

- For low demand unsealed roads, Paige-Green compliant materials should be used whenever undertaking metalling of these routes.
- Gather information on pavement depth and condition on unsealed roads to determine re-metalling programmes and to develop a proactive programme of works rather than reacting to customer complaints.
- Testing of road metal sources is recommended, and potential blending of aggregates may be required to develop Paige-Green compliant materials.
- The use of dust coat seals or dust suppression in front of houses should only be considered when Paige-Green compliant materials have been applied and excessive dust is still an issue. However, it should be recognised that dust could still be an issue on unsealed road with high demand, such as long-term heavy vehicle routes.
- Limit further residential development on unsealed roads or require dwellings on unsealed roads to be set back well away from unsealed roads (ideally greater than 80m) through relevant provision in the council district plans.

3.1.3 Benefits

- The roll out of Paige-Green compliant materials will result is less potholing, corrugations, gravel loss and dust, which will improve resident satisfaction, reduce dust and reduce maintenance costs. It should also help reduce the demand for expensive dust suppression and road sealing. In the long-term, the use of Paige-Green compliant materials should result in an optimal and sustainable unsealed road network.
- Further information on pavement depth and condition will enable a proactive programme of re-metalling and grading to be adopted.
- On high demand routes with Paige-Green materials that are still subject to excessive dust, mitigation such as dust suppression will help reduce health issues of residents inhaling fine dust particles (PM10) and road safety issues of dust blinding oncoming drivers.
- Limiting residential development on unsealed roads or ensuring new dwellings on unsealed roads are well setback will help avoid further demand for sealing roads and dust issues affecting local residents.

3.1.4 Consequences

- The continued use of GAP materials will result in ongoing dissatisfaction issues with the unsealed road network due to potholing, corrugations, gravel loss and dust. It will also continue the high maintenance cost of the unsealed network and continue to drive demand for expensive dust suppression and sealing.
- Continuing to maintain the unsealed network without knowing the pavement depth or condition will retain the current reactive approach to customer complaints which is likely to be suboptimal and result in more customer dissatisfaction.
- On high demand routes with Paige-Green materials that are still subject to excessive dust, without addressing this dust issue, health impacts of fine dust particles on local residents will continue and crashes involving drivers becoming blinded by dust may occur. Pressure from local residents including roadblocks may also continue.
- If rural subdivisions on unsealed roads are allowed to continue or if dwelling are allowed to be built close to unsealed road frontages, there will be more demand for expensive seal extensions and more issues associated with dust.

3.2 Strategic Case – Bottom-Up Assessment

During the development of the AMP, the NTA held a series of workshops to test and refine the problem statements and to determine the strategic response to address the problems. This is shown in the following tables.

Draft Problem Statement:
The limited availability of specification aggregate for unsealed roads is resulting adverse health impacts to residents due to dust, and high levels of community dissatisfaction due to poor road condition, and high maintenance cost. there is not enough renewal budget to address all unsealed roads and much of the network has become out of shape, too wide and too thin, and blocked drainage. There is need to adopt the NTA Maintenance Management Plan for Unsealed Pavement Activities and create an optimised programme for available funding.
Current AMP - Key responses outlined in Strategic Case:
• NTA – New Maintenance Contracts to bring in use of Paige-Green compliant materials and to use RoadRoid or similar to capture roughness data. Development of a Centre of Excellence with Unsealed Roads FWP. Development of an Unsealed Road MIS and visual guide; • FNDC – Funding for dust suppression, $2M/year for unsubsidised seal extension, increase in heavy metalling on forestry roads; • KDC – Increase in heavy metalling to build up strength and shape, balanced by decrease in maintenance; and • WDC – Increase in funding for dust suppression on forestry routes, $1.5M/year for unsubsidised seal extension.
Current Work that is being undertaken:
• Maintenance and metalling based on General All Passing (GAP) material. Grading largely on a reactive basis either identified through inspections or service requests. Heavy metalling required on a cyclic basis to replenish aggregate loss to retain pavement strength; • FNDC and WDC progressing unsubsidised seal extensions. FNDC have developed a complex prioritisation matrix for seal extensions; • FNDC and WDC – Dust suppression being undertaken to manage dust.; and • KDC - Trial Paige-Green compliant aggregate site on Cames Rd has reduced maintenance and dust on this route.
Aspects of the problem not being addressed, and benefits not being delivered?
• Maintenance and metalling practices still based on using a GAP material which has high gravel loss, is dusty, and prone to corrugations and potholes. Demand for heavy metalling is still high due to high gravel loss. Grading often reactive due to corrugations and potholes – hard to develop a programmed grading cycle because GAP material looses shape quickly and is very subject to weather. Higher levels of funding would be required to sustain this approach; • The health effects of dust is still an issue with significant demand for dust suppression and seal extension, particularly in the Far North and Whangarei. Additional NZTA funding would be required to make dust suppression sustainable; • Roll out of Paige-Green compliant aggregate across Northland, and particularly in the Far North still to happen. Limited Paige-Green compliant aggregate being used although this is included in the maintenance contracts; • Training of grader operators needs to be improved so that they meet the grading specifications in the new maintenance contracts; • RoadRoid or similar not being used so no condition data being collected; • Centre of Excellence & Unsealed FWP and MIS/visual guide still under development; and • FNDC funding for forestry road strengthening not funded by NZTA.

Is the Problem Statement still relevant? If "No" what are the deficiencies? If "Yes" has priority changed?			
Yes – Still a high priority but should focus on our current maintenance practice of using GAP material.			
If Problem is not being addressed by the current work, what is the strategic response?			
Strategic response	**Y/N**	**Rank**	**Detail**
1 - Programme adjustment: example, Remove/reduce projects/activities.	Y	3	Increase GAP heavy metalling programme to provide structural pavements on heavy vehicle routes. Increase funding to sustainably provide for dust suppression on routes with matrix score of 12 or more.
2 - Policy approach: example, Adjust level of Service.	Y	1	Implement Paige-Green compliant wearing courses with structural pavements for High and Medium risk pavements to reduce maintenance costs, reduce dust and improve ride comfort. Low risk pavements to be maintained using current approach but using Paige-Green compliant material. Improve training of grader operators to meet the specification of the new maintenance contracts.
3 - Demand management: example, Manage use – up/down.	Y?	2	Difficult to change heavy vehicle demands on unsealed roads as there is normally no alternative route, particularly for forestry where the forestry is normally at the end of the road. Some potential for using alternative internal forestry roads to direct forestry traffic onto preferred routes exists. Already doing this where possible.
4 - Funding adjustment: example, Increase/decrease	Y	1,3	Increase budget to fund additional heavy metalling and dust suppression (ties to Option 1). May also require increase in funding for the roll out of Paige-Green compliant aggregate wearing courses (Option 2).
5 - Risk based: example, Hold Assets longer.	N	NA	Unsealed pavements already have limited metal depths and holding the assets longer will just create a bigger issue with more maintenance required and costly intervention to reinstate pavement depth in the future.
How effective are the options? (as per Multi Criteria Assessment below)			
Option 1 – Increase heavy metalling and fund dust suppression - Score 0.6 out of 3 Option 2 – Paige-Green compliant wearing courses and structural pavements. Improved training of grader operators - Score 2.05 out of 3 (Preferred) Option 3 – Use internal forestry roads to change haul routes – Score 0.8 out of 3			
Draft an updated problem statement (if applicable)			
The majority of the network has poor shape, excess widths, limited functioning drains and with limited availability of specified aggregates, resulting in: • Adverse health impacts to residents due to dust. • High levels of community dissatisfaction due to poor road condition. • High maintenance costs.			

Strategic Case Multi Criteria Option Analysis, RCA: NTA
Problem: Unsealed Roads

Short list up to 3 options from the following - Can we make-----

Option	Yes/No	Reason	Rank
1 Programme adjustment eg, Remove/reduce projects/activities	Yes	Increase heavy metalling programme to provide structural pavements on heavy vehicle routes. Increase funding to provide for dust suppression.	3
2 Policy approach eg, Adjust level of Service	Yes	Implement Paige-Green complaint wearing courses on structural pavements to reduce maint costs, reduce dusts and improve ride comfort. Also improve training of grader operators to meet the specification of the new maintenance contracts.	1
3 Demand management eg, Manage use – up/down	Possibly	Difficult to change heavy vehicle demands on unsealed roads as there is normally no alternative route, particularly for forestry where the forestry is normally at the end of the road. Some potential for using alternative forestry roads to direct forestry traffic onto preferred routes exists.	2
4 Funding adjustment. eg, Increase/decrease	Yes	Increase budget to fund additional heavy metalling and dust suppression (ties to Option 1) May also require increase in funding for the roll out of Paige-Green compliant aggregate wearing courses (Option 2).	1, 3
5 Risk based eg, Hold Assets longer	No	Unsealed pavements already have limited metal depths and holding the assets longer will just create a bigger issue with more maintenance required and costly intervention to reinstate pavement depth in the future.	N/A

Criteria/Drivers to consider	Weighting (Importance) (Total to 100%)	How good is this option					
		Option 1 - Increase existing heavy metalling		Option 2 - Paige-Green compliant wearing courses and grader operator training		Option 3 - Re-route forestry through internal roads	
		Raw	Score	Raw	Score	Raw	Score
Meets GPS	10%	1	0.1	2	0.2	1	0.1
Meets RLTP	10%	2	0.2	2	0.2	1	0.1
Addresses Problems	20%	1	0.2	3	0.6	1	0.2
Will realise Benefits	10%	1	0.1	3	0.3	1	0.1
Will meet Community Outcomes	10%	2	0.2	2	0.2	1	0.1
Will meet Customer Outcomes (CLOS)	10%	1	0.1	2	0.2	0	0
Provides high Performance impacts	10%	-1	-0.1	2	0.2	0	0
Provides high Environmental Impacts	5%	1	0.05	2	0.1	1	0.05
Provides Cultural Impacts	5%	1	0.05	1	0.05	1	0.05
How Costly	10%	-3	-0.3	0	0	1	0.1
Other 1							
Other 2							
Other 3							
Other 4							
Totals	100%		0.6		2.05		0.8

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

3.3 Strategic Case Summary (Line of Sight in Action)

Based on the assessment of the problem statement and the strategic responses undertaken in the previous section, a summary of the results and the affected work categories are shown in the table below:

Issue	Unsealed Roads
Problem Statement	Use of out of specification GAP aggregates on our unsealed roads is resulting in: • Adverse health impacts to residents due to dust; • High levels of community dissatisfaction due to poor road condition; and • High maintenance costs.
Benefits	• Reduce the effects of dust on the community; • Improve the condition of the unsealed road network; and • Reduce whole of life maintenance costs of the unsealed road network.
Trend	Static
Strategic Response	**Policy Approach** • Paige-Green compliant wearing courses and structural pavements; and • Improved training of grader operators.
Activity/Work Category	WC 112 Unsealed Pavement Maintenance WC 211 Unsealed Road Metalling WC 325 Seal Extension (Associated activities: 113 Routine Drainage Maintenance & 213 Drainage Renewals)

4 Options, Assessment and Alternatives

4.1 Option Identification (Root Cause Analysis)

Following the identification of the problem statements, a root cause analysis was undertaken to identify the underlying causes of these problems. The root cause analysis was undertaken using the "5 Whys" type methodology in accordance with NZTA's Business Case Approach Practice Note No.3 – Root Cause Analysis in Business Case Development.

This process was undertaken through a series of workshops with the NTA Assets Team and NZTA local representative to determine the underlying causes of the identified problems. This was a bit of a deep dive into the myriad of issues that affect the transport network and a multitude of root causes were identified for each problem statement.

For each root cause, a possible solution (option or alternative) was identified to try and address this cause. These solutions ranged from high level interventions such as changing council policies and developing strategies to low level interventions such improving grader operator training.

The following table include the results of the root cause analysis and the possible solutions to address the problem statement.

Root Cause Analysis – Unsealed Roads

<table>
<tr><td>Problem statement</td><td colspan="17">Unsealed roads have high levels of customer dissatisfaction and high maintenance costs</td></tr>
<tr><td>why 1</td><td colspan="7">Road conditions are poor with potholes, corrugations and pavement failure.</td><td colspan="4">Unsealed road costs are higher than the peer group average.</td><td colspan="6">Dust generation on gravel roads is high which affects residents health and agricultural production of adjoining properties.</td></tr>
<tr><td>why 2</td><td colspan="3">Poor road shape allows water into the surface.</td><td colspan="3">Grading and maintenance is reactive.</td><td>There is insufficient metal depth.</td><td colspan="2">High rate of heavy metalling.</td><td>Expensive wet, roll and grade treatments in summer.</td><td>Use of costly dust suppressants.</td><td colspan="3">There is a high volume of heavy vehicles which generate higher amounts of dust.</td><td>Northland has long dry summer periods that allow more dust to be generated.</td><td colspan="2">Houses are located close to unsealed roads which makes people more susceptible to dust impacts.</td></tr>
<tr><td>why 3</td><td colspan="3">Grading is not providing the correct pavement cross fall to shed water.</td><td>The maintenance is only undertaken when someone complains.</td><td>There are no maintenance programmes or grading cycles rolled out for each Council District.</td><td>Potholes form rapidly in wet conditions making grading cycles difficult to establish.</td><td colspan="2">High levels of gravel loss has resulted in pavements having reduced thickness.</td><td>Topography such as steep grades require more aggregate.</td><td>Corrugations forming over dry summer months.</td><td>To control dust generation in dry summer months.</td><td colspan="2">Heavy vehicles stir up more dust on loose metal roads.</td><td>There are high levels of primary production in Northland such as forestry and agriculture which generate heavy vehicle flows on unsealed roads.</td><td>Northland has a subtropical climate with low rainfall during summer.</td><td>Locating houses close to the road reduces the costs of providing driveway access and power/ telephone services.</td><td>The councils planning rules allow rural dwellings to be constructed close to unsealed roads.</td></tr>
<tr><td>why 4</td><td>Grading not being undertaken in accordance with the maintenance specifications.</td><td colspan="2">There is insufficient aggregate or poor subgrade shape on many roads which means that the grader operator cannot achieve the correct crossfall.</td><td>Customers often want the unsealed road kept to a high standard and so may raise service requests even when an adequate level of service is being provided.</td><td>There is insufficient asset and condition data to develop maintenance programmes and grading cycles</td><td>The pavement surface is loose which results in water ingress causing potholes.</td><td colspan="2">The pavement surface is loose which results in high gravel loss.</td><td>Steep grades result in loss of traction or scouring of the road surface during heavy rain.</td><td>The pavement surface is loose which results in corrugations forming.</td><td colspan="2">The pavement surface is loose which results in higher levels of dust generation.</td><td>Heavy vehicles create a vortex that "sucks" dust from the road and vehicle tyres.</td><td>Forestry and agriculture is often located on land that is less productive which is normally accessed via unsealed roads</td><td>Northland's climate combined with the influences of climate change are resulting in longer drier summers.</td><td>Rural areas on unsealed roads are normally in areas of high social deprivation which drives a need for cheaper housing.</td><td>The councils may not have properly considered the impacts of dust when setting these rules.</td></tr>
<tr><td>why 5</td><td>Lack of enforcement of maintenance contract and grader operator training.</td><td>Grading operations have pushed aggregate into drains and have widened the road which means there is less metal</td><td>Legacy issue of insufficient road metalling and poor subgrade formation (built off old "goat tracks"</td><td>Lack of customer understanding of the provided level of service</td><td>There are no defined processes to collect asset and condition data</td><td colspan="7">Use of out-of-specification unbound GAP aggregates with no tightly bound wearing course.</td><td>Vehicle speed and aerodynamic shape influences dust generation.</td><td>These roads are normally unsealed as they do not justify sealing due to low overall traffic volumes.</td><td>Northland has had 6 droughts in the last 10 years which restricts the ability to use water for dust suppressants or</td><td>Northland has one of the highest rates of social deprivation in the country.</td><td>The health effects of dust were not previously well understood.</td></tr>
<tr><td>Potential Solutions</td><td colspan="2">Enforce the maintenance contract grading specification. Provide training for NTA maintenance staff and grader operators.</td><td>Provide sufficient funding to enable appropriate aggregate depths and shaping of subgrade on high risk routes in line with unsealed road FWP.</td><td>Educate the public on the level of service being provided. Back this up with a proactive programme of grading to ensure the correct level of service is maintained.</td><td>NTA to develop methods and processes to collect asset and condition data through the maintenance contract. Continue to develop the unsealed road MIS and FWP</td><td colspan="7">Enforce the maintenance contract to provide tightly bound Paige-Green specification compliant wearing courses. Determine appropriate material sources and blends to provide Paige-Green specification compliant material. Provide adequate guidance and training in the supply, construction and maintenance of Paige-Green specification compliant materials.</td><td>Consider setting temporary speed limits on dusty roads. Consider discussions with the heavy vehicle operators to use vehicle skirts to limit dust discharge.</td><td>Consider sealing only where there is sufficient traffic to warrant it. Gather and analyse forestry and agriculture heavy vehicle demands to better plan for their impacts (eg Forestry Plan currently underway). Develop a 3 year/10 year programme for seal extension</td><td>Develop water storage in rural areas to enable water-based treatments during drought events.</td><td colspan="2">Consider advocating for making council planning rules require houses on unsealed roads to be at least 80m from the road edge. This needs to be weighed up against the need for low cost rural housing. Where houses are still allowed to be in close proximity to unsealed roads, appropriate rules should be developed to minimise the impacts of dust such as the requirement for shelter belts to be planted on the road frontage etc.</td></tr>
</table>

4.2 Option Development

The following table was developed by the Roading Efficiency Group as part of a top-down assessment of options to address the identified problems. They summarise the responses in the existing AMP, the effectiveness of the existing programme and the proposed options which have been determined from the root cause analysis which should be considered as part of the option assessment.

Statement Problem	Key Responses In existing AMP	Summary of effectiveness of existing programme	Proposed Programme Business Case adjustments (from Root Cause Analysis)
Unsealed Roads – The majority of the network has poor shape, excess widths, limited functioning drains and with limited availability of specified aggregates, resulting in: • Adverse health impacts to residents due to dust. • High levels of community dissatisfaction due to poor road condition. • High maintenance costs.	• FNDC – Funding for dust suppression, $2M/year for unsubsidised seal extension, increase in heavy metalling on forestry roads; • KDC – Increase in heavy metalling to build up strength and shape, balanced by decrease in maintenance. • WDC – Increase in funding for dust suppression on forestry routes, $1.5M of unsubsidised seal extension. • NTA – New Maintenance Contracts to bring in use of Paige-Green compliant materials and to use RoadRoid or similar to capture roughness data. Development of a Centre of Excellence with Unsealed Roads FWP. Development of an Unsealed Roads MIS and visual guide.	• Unsealed road activity is not sustainable, with high gravel loss, corrugations, potholes and dust, which is diving high customer dissatisfaction. • Dust suppression and sealing of roads is effective but expensive. • Unsealed road maintenance and renewal could be used as a COVID-19 stimulus. • Key issues from Root Cause Analysis: ○ Legacy issue of insufficient metal on unsealed roads ○ Grader operators not achieving the correct cross-fall or pushing metal into drains ○ Customer expectations are too high ○ Lack of condition data ○ Using out-of-specification GAP type materials without tightly bound wearing course ○ Trucks creating significant dust on HCV routes. Likely to get worse with more droughts, which also is likely to restrict water based dust suppression treatments. Houses located closer than 80m to roads due to council policies. High levels of social deprivation also means houses are more likely to be on sealed roads and closer to the road because cheaper.	• Complete the unsealed road strategy, FWP and MIS. • Enforce the new maintenance contract grading specification. • Provide training to grader operators and maintenance staff • Provide sufficient metal depths on key routes. • Educate the public on the level of service being provided. • Carry out a proactive programme of grading based on condition data. • Develop methods to gather and analyse condition data on unsealed roads. • Enforce the new maintenance contract specifications to provide Paige-Green compliant wearing courses. Back this up with adequate training for contractor and NTA staff. • Determine sources and blends to provide Paige-Green compliant material. • Temporary speed limits for dusty HCV routes. Consider advocating for HCV skirts to reduce dust. • Sealing should be only considered where dust or traffic warrants it. Develop long term seal extension FWP. • Consider water storage in rural areas for dust suppression • Advocate for changing council house set back requirements on unsealed roads.

5 Option Assessment

The following sections analyse options for addressing the problems and issues identified in the Strategic Case. These options have been identified through the Root Cause Assessment.

For the assessment of the data, peer group analysis and option assessment, a five point "traffic light" rating system has been used as shown in the following schematic. This rating system is based on a qualitative assessment of the LOS and cost comparison data.

5-point traffic light rating system schematic

Performance Rating	Symbol	For LOS this means:	For Costs & Achievement this means:	Trend Rating	Symbol	For LOS this means:
Very Good		Much Better than Peer Group Average	Much Less than Peer Group Average	Improving Trend		Positive Change towards a Very Good rating
Good		Better than Peer Group Average	Less than Peer Group Average	Worsening Trend		Negative Change away from a Very Good rating
Average/Moderate		Similar to the Peer Group Average	Similar to the Peer Group Average	Static Trend		No Change
Poor		Worse than Peer Group Average	Higher than Peer Group Average			
Very Poor		Much Worse than Peer Group Average	Much Higher than Peer Group Average			
No Data		No Data	No Data			

Work Categories:

WC 112 Unsealed Pavement Maintenance
WC 121 Environmental Maintenance
WC 211 Unsealed Road Metalling
WC 325 Seal Extension
WC 341 Low Cost / Low Risk Local Road Improvement
(Associated activities: 113 Routine Drainage Maintenance & 213 Drainage Renewals)

5.1 Links to Strategic Case

Problem Statement:

The majority of the network has poor shape, excess widths, limited functioning drains and with limited availability of specified aggregates, resulting in:

- Adverse health impacts to residents due to dust;
- High levels of community dissatisfaction due to poor road condition; and
- High maintenance costs.

Benefits of Addressing Problem:

A fit for purpose Level of Service for our unsealed roads that improves customer satisfaction, while optimising the long-term maintenance costs. Road dust on unsealed freight routes will be controlled to minimise health impacts to residents.

Consequences of Not Addressing the Problem:

Our customers will continue to be dissatisfied with our condition and maintenance practices on unsealed roads, with continued dust issues on heavy vehicle routes and ongoing high maintenance costs.

5.2 Levels of Service

ONRC Customer Outcomes:

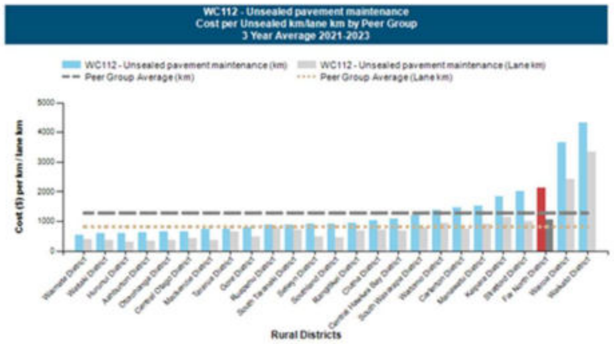
None

Customer Levels of Service:

ONRC Safety TO7 – Hazardous faults (no data available)
ONRC Cost Efficiency 4 – Unsealed road metalling (no data available)
ONRC Cost Efficiency 5 – Overall network cost (no data available)
LTP 1.1.7 – Average quality of ride on the unsealed local network (Current measure)
Dust Risk – Dwellings exposed to Medium dust risk (as determined by NZTA General Circular 16/04) (Current measure)

5.3 Evidence and Gap Analysis

NZTA Peer Group Charts – 3yr Cost/km WC 112 - Unsealed Pavement Maintenance

<table>
<tr><th>FNDC</th><th>KDC</th><th>WDC</th></tr>
<tr>
<td>
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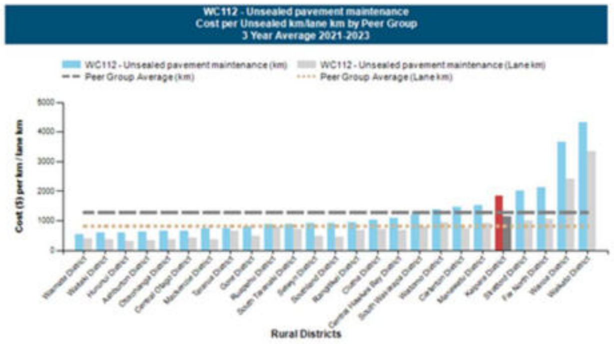
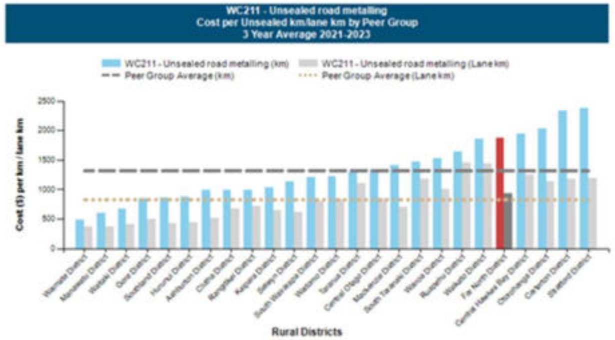
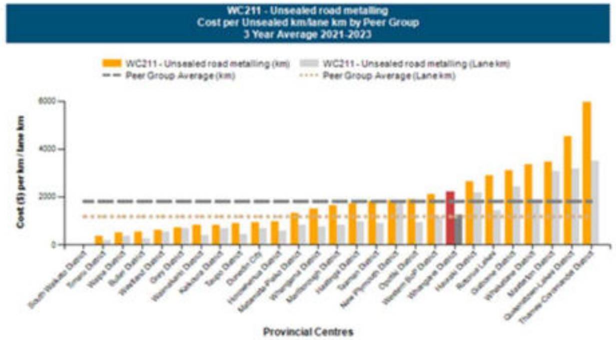
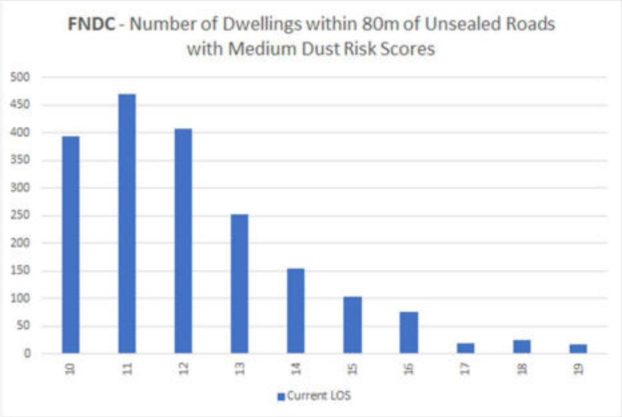
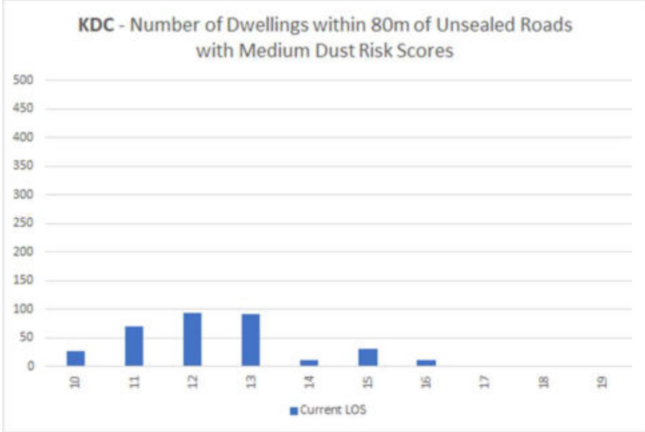
<td>
</td>
<td>
</td>
</tr>
<tr><td></td><td></td><td></td></tr>
<tr>
<td> FNDC Unsealed Pavement Maintenance Cost – FNDC's unsealed pavement maintenance cost is in the top quartile of its peer group. The high maintenance cost is primarily due to the use of out-of-specification granular pavement materials which are prone to corrugations and potholing. There is also a lack of metal depth and poor watertables which requires spot metaling and digout repairs. </td>
<td> KDC Unsealed Pavement Maintenance Cost – KDC's unsealed pavement maintenance cost is in the top quartile of its peer group. As for FNDC, the high maintenance cost for KDC is due to the use of out-of-specification granular pavement materials which are prone to corrugations and potholing. There is also a lack of metal depth and poor watertables which requires spot metaling and digout repairs. </td>
<td> WDC Unsealed Pavement Maintenance Cost – WDC's unsealed pavement maintenance cost is in the top quartile of its peer group. WDC has underinvested in its unsealed road network for many years and is starting to address this issue with additional heavy metalling. This under investment had resulted in lack of metal depth, which is driving up maintenance costs. As for the other districts, Whangarei also suffers from the use of out-of-specification granular materials and poor watertables. </td>
</tr>
<tr><td colspan="3">NTA – It should be recognised that Northland has poor clayey subsoils, subtropical climate (high rainfall), significant forestry demands on its local road network and lack of access to good quality pavement materials leading to long cartage distances. For these reasons, it is likely that the unsealed pavement maintenance costs for FNDC, KDC and WDC will always be in the upper half or third of the peer group.</td></tr>
</table>

NZTA Peer Group Charts – 3yr Cost/km WC 211 - Unsealed Road Metalling

FNDC	KDC	WDC
		
FNDC Unsealed Road Metalling Cost – FNDC's unsealed road metalling cost is in the top quartile of its peer group. As described above, the high cost is due to the use of out-of-specification granular materials that ravel more readily and result in significant levels of gravel loss requiring higher levels of metalling. There will be a transition to Paige-Green compliant materials and wearing courses which should reduce the overall costs of maintaining the unsealed road network in the future.	**KDC Unsealed Road Metalling Cost** – KDC's unsealed road metalling cost is in the lower-mid quartile of its peer group. Cost had historically been relatively high due to the use of out-of-specification granular materials that ravel more readily and result in significant levels of gravel loss requiring higher levels of metalling. In recent years there had been a transition to Paige-Green compliant materials and wearing courses and these are starting to have an impact on reducing the overall costs of maintaining the unsealed road network.	**WDC Unsealed Road Metalling Cost** – WDC's unsealed road metalling cost is in the top third of its peer group. This reflects higher spends in recent years on heavy metalling to recover from historic underinvestment in the unsealed road network. As for the other districts, the cost is also due to the use of out-of-specification granular materials that ravel more readily and result in significant levels of gravel loss requiring higher levels of metalling. There will be a transition to Paige-Green compliant materials and wearing courses which should reduce the overall costs of maintaining the unsealed road network in the future.
NTA – It should be recognised that Northland has poor clayey subsoils, subtropical climate (high rainfall), significant forestry demands on its local road network and lack of access to good quality pavement materials leading to long cartage distances. For these reasons, it is likely that the unsealed road metalling costs for FNDC, KDC and WDC will always be in the upper half or third of the peer group.		

Dust Risk – NZTA General Circular 16/04 Dust Matrix Scores (2020)

<table>
<tr><th>FNDC</th><th>KDC</th><th>WDC</th></tr>
<tr>
<td>
</td>
<td>
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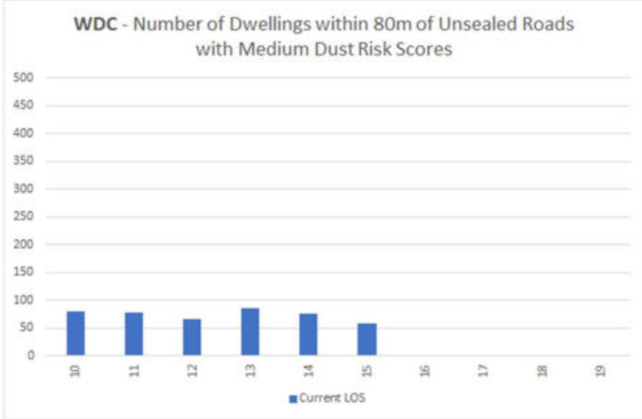
<td>
</td>
</tr>
<tr><td></td><td></td><td></td></tr>
<tr>
<td> FNDC Dust Risk – Far North has 1,918 dwellings exposed to a medium dust risk (score of 10 or more on the General Circular 16/04 matrix). This is substantially more exposure than for the other two councils. Many of these dwellings are on forestry or other freight routes. This indicates that there is likely to be a substantial exposure to health effects of PM10 dust to people living on these routes.
Because of this high exposure to dust, there is substantial public pressure to address this issue. As a result, FNDC has been applying a significant amount of unsubsidised dust suppression and is also carry out seal extensions.
The proposed transition to Paige-Green wearing courses, this should result a reduction to exposure to dust by providing a more tightly bound surface. </td>
<td> KDC Dust Risk – Kaipara has 334 dwellings exposed to a medium dust risk (score of 10 or more on the General Circular 16/04 matrix). Most of these dwellings are on forestry or other freight routes. This indicates that there is likely to be an exposure to health effects of PM10 dust to people living on these routes.
Over the past 3-4 years, KDC has been trialling Paige-Green complaint wearing courses, and this is showing a reduction on dust generation on roads with this treatment. This has been accelerated by the PGF investment in Kaipara's unsealed road network.
It is proposed to continue the roll-out of Paige-Green wearing courses, and this should result in a further reduction to exposure across the network. </td>
<td> WDC Dust Risk – Whangarei has 441 dwellings exposed to a medium dust risk (score of 10 or more on the General Circular 16/04 matrix). Approximately half of these dwellings are on forestry routes. This indicates that there is likely to be an exposure to health effects of PM10 dust to people living on these routes.
Because of this exposure to dust, there has been public pressure to address this issue. As a result, WDC has been applying a dust suppression on forestry routes and is also carry out seal extensions on high risk routes.
The proposed transition to Paige-Green wearing courses, this should result a reduction to exposure to dust by providing a more tightly bound surface. </td>
</tr>
<tr><td colspan="3">NTA - It is currently developing a standardised dust matrix scoring system that will be applied to the three districts.</td></tr>
</table>

Summary

FNDC	KDC	WDC
FNDC Summary – Both the unsealed pavement maintenance and metalling cost are in the top quartile of the peer groups. The cost to maintain Far North's unsealed roads is high and they have heavy metalling cost is in the top quartile of their peer group. This is a reflection of the significant amount of FNDC's unsealed network, which is subject to heavy vehicle traffic, and in particular logging trucks. The resident satisfaction with the unsealed road network is low due which is likely to be due to variable conditions (potholes and corrugations), that are subject to substantial change due to weather effects. As of 2020 there was over 1,900 dwellings located on roads with a medium dust risk. This is a significant number of residents exposed to dust risk and is driving pressure from the public for dust suppression and seal extensions. This indicates that further effort is required to improve the unsealed road network.	**KDC Summary** – Unsealed pavement maintenance cost is in the top quartile of its peer group, however, the unsealed road metalling cost is in the lower-mid quartile of its peer group. The investment in Paige-Green complaint wearing courses should result in less maintenance being required in the future due to having a tightly bound surface and should see the maintenance costs decrease over time. Unsealed metalling costs are relatively low compared to the peer group because of inputs from the PGF. The resident satisfaction with the unsealed road network is low but is expected to increase with the continued roll-out of Paige-Green complaint wearing courses. As of 2020 there was over 300 dwellings located on roads with a medium dust risk. This indicates that continuing the wearing course roll-out will also help reduce dust effects to local residents.	**WDC Summary** – Unsealed pavement maintenance cost is in the top quartile of its peer group and unsealed road metalling cost is in the top third of its peer group. Whangarei has poor subgrade conditions, high freight demand and dust issues. As of 2020 there was over 400 dwellings located on roads with a medium dust risk. This indicates that further effort is required to improve the unsealed road network.

5.4 Options to be Considered

Based on the above data and the root cause analysis, the following options have been considered:

Option	Description
Option 1 – Complete the Centre of Excellence, FWP and MIS	Complete the unsealed Centre of Excellence road strategy, develop an unsealed road Forward Works Programme and Maintenance Intervention Strategy.
Option 2 – Enforce Paige-Green compliant materials with training	Enforce the new maintenance contract specifications to provide Paige-Green compliant wearing courses. Back this up with adequate training for contractor and NTA staff. Determine sources and blends to provide Paige-Green compliant material.
Option 3 – Improve grading with operator training and pro-active operations based on condition	Provide training to grader operators and maintenance staff. Enforce the new maintenance contract grading specification. Develop methods to gather and analyse condition data on unsealed roads. Carry out a proactive programme of grading based on condition data
Option 4 – Provide sufficient pavement thickness based on the FWP	Provide sufficient metal depths on key routes, such as forestry and other freight routes, through the forward works programme. This should ensure that these routes have sufficient strength throughout the life of the pavement.
Option 5 – Educating the public on the appropriate level of service	Education campaigns to educate the public on the appropriate level of service being provided. This should help the public understand what the appropriate condition of their unsealed road should. This will help mitigate complaints and requests for maintenance.
Option 6 – Dust mitigation and control measures	Temporary speed limits for dusty HCV routes. Consider advocating for HCV skirts to reduce dust. Consider water storage in rural areas for dust suppression. Advocate for changing council house set back requirements on unsealed roads.
Option 7 – House frontage sealing on dusty roads	Sealing of house frontages on roads with long term exposure to dust. This should only be considered where dust or traffic warrants it.

PBC Multi Criteria Option Analysis, RCA: NTA

Activity/Work Categories: Unsealed Roads (WC 112, 211)

Short list up to 3 options from the following:

Option - Can we make	Yes/No	Rank	Reason
❑ Intervention response **timing** change	Yes	3	Carry out a proactive programme of grading based on condition data
❑ **LoS** adjustments			
❑ Use existing assets **differently**	Yes	3	Enforce the new maintenance contract grading specification
❑ **Blending** Work Categories differently			
❑ **Risk** - Hold Assets longer			
❑ Managing **demand**	Yes	A - 5 B - 7 C - 6	A - Educate the public on the level of service being provided. B - Sealing should only to be considered where dust or traffic warrants it. C - Advocate for changing council house set back requirements on unsealed roads
❑ **Route** Management	Yes	4	Provide sufficient metal depths on key routes through the FWP.
❑ Alternative approaches – different **solutions/technology**	Yes	2	Enforce the new maintenance contract specifications to provide Paige-Green compliant wearing courses. Back this up with adequate training for contractor and NTA staff. Determine sources and blends to provide Paige-Green compliant material
❑ **Maintenance vs Renewal** adjustments			
❑ **ONRC** Classification variance			
❑ Extended **temporary** management	Yes	A - 6 B - 6 C - 6	A - Temporary speed limits for dusty HCV routes. B - Consider advocating for HCV skirts to reduce dust. C - Consider water storage in rural areas for dust suppression
❑ **Supply chain** improvements			
❑ Improve **systems and capability**	Yes	A - 1 B - 3 C - 3	A - Complete the unsealed road strategy, FWP and MIS. B - Provide training to grader operators and maintenance staff. C - Develop methods to gather and analyse condition data on unsealed roads

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

Criteria	Weighting (Importance) (Total to 100%)	How good is this option													
		Option 1 - Complete the Centre of Excellence, FWP and MIS		Option 2 - Enforce Paige-Green compliant materials with training		Option 3 - Improve grading with operator training and pro-active operations based on condition		Option 4 - Provide sufficient pavement thickness based on the FWP		Option 5 - Educating the public on the appropriate level of service		Option 6 - Dust mitigation and control measures		Option 7 - House frontage sealing on dusty roads	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	10%	1	0.1	2	0.2	2	0.2	2	0.2	2	0.2	1	0.1	3	0.3
Problem solving effectiveness	10%	2	0.2	2	0.2	1	0.1	1	0.1	1	0.1	1	0.1	1	0.1
Benefits realised	10%	2	0.2	2	0.2	2	0.2	1	0.1	1	0.1	1	0.1	1	0.1
Good Environmental impacts	5%	0	0	2	0.1	1	0.05	-1	-0.05	0	0	2	0.1	3	0.15
Value for Money	10%	3	0.3	3	0.3	3	0.3	1	0.1	2	0.2	-1	-0.1	-2	-0.2
Closing Customer and Technical LoS gaps and impacts	10%	1	0.1	2	0.2	1	0.1	2	0.2	1	0.1	1	0.1	1	0.1
Closing ONRC Performance gaps	10%	1	0.1	2	0.2	1	0.1	0	0	1	0.1	0	0	-1	-0.1
Asset preservation and sustainability	10%	1	0.1	3	0.3	2	0.2	1	0.1	0	0	0	0	0	0
Total Cost of Ownership (whole of life Costs)	10%	1	0.1	2	0.2	1	0.1	1	0.1	1	0.1	-1	-0.1	-2	-0.2
Life Cycle Management	10%	1	0.1	2	0.2	1	0.1	1	0.1	0	0	0	0	-1	-0.1
COVID-19 Recovery	5%	1	0.05	1	0.05	1	0.05	1	0.05	0	0	1	0.05	0	0
Totals	100%		1.35		2.15		1.5		1.0		0.9		0.35		0.15

5.5 Option Assessment and Line of Sight

The options and the line of sight to the preferred strategic response and the problems they are addressing are shown in the table below. These options have been ranked in order of preference and then have been assessed through a multi-criteria assessment (MCA) to determine the highest scoring options that are preferred and are to be adopted. The MCA assessment is also provided as follows.

Work Activity	Problem Statements Addressing	Preferred Strategic Response	PBC Options to be Considered	Option Rank	MCA Score	Preferred Options
Unsealed Roads	The majority of the network has poor shape, excess widths, limited functioning drains and with limited availability of specified aggregates, resulting in: - Adverse health impacts to residents due to dust. - High levels of community dissatisfaction due to poor road condition. - High maintenance costs.	**Policy Approach** Paige-Green compliant wearing courses and structural pavements, and Improved training of grader operators	**Policy Approach** **Improve Systems and Capability** • Option 1 - Complete the Centre of Excellence, FWP and MIS.	1	1.35	Yes
			Alternative Approaches – Different Solutions/Technologies • Option 2 - Enforce Paige-Green compliant materials with training.	2	2.15	Yes
			Improve Systems and Capability, Using Assets Differently & Intervention Response Timing Change • Option 3 - Improve grading with operator training and pro-active operations based on condition.	3	1.5	Yes
			Route Management • Option 4 - Provide sufficient pavement thickness based on the FWP.	4	1.0	Yes
			Managing Demand • Option 5 - Educating the public on the appropriate level of service.	5	0.9	Yes
			• Option 7 - House frontage sealing on dusty roads.	7	0.15	No
			Extended Temporary Management and Managing Demand Option 6 - Dust mitigation and control measures.	6	0.35	Yes

Preferred Options: From the multi-criteria assessment the preferred options are:

- Option 1 – Complete the Centre of Excellence, FWP and MIS.
- Option 2 – Enforce Paige-Green compliant materials with training.
- Option 3 – Improve grading with operator training and pro-active operations based on condition.
- Option 4 – Provide sufficient pavement thickness based on the FWP.
- Option 5 – Educating the public on the appropriate level of service.
- Option 6 – Dust mitigation and control measures – dust suppression only to be used where Paige-Green compliant materials are insufficient to control dust.

5.6 Financial Impact

The following tables show the work categories and examples of the associated tasks. For full financial details for the work categories, refer to Section 08 (Financials).

5.6.1 Far North District Council

Work Category	Financial Impact
WC 112 Unsealed Pavement Maintenance	Funding to continue routine metalling using Paige-Green compliant materials.
WC 121Environmental Maintenance	Funding to continue the programme of dust sealing of unsealed roads that have long term heavy vehicle volumes resulting in health impacts of local residents due to dust (i.e. Dust Risk score of 15 or more on the General Circular 16/04 matrix).
WC 211 Unsealed Road Metalling	Funding for the roll-out of a programme of Paige-Green complaint wearing courses and metal strengthening on high risk routes.
WC 325 Seal Extension	No Programme.
WC 341 Low Cost / Low Risk Improvement	Funding for a new programme of traction seals to address unsealed roads that have high maintenance costs due to steep grades and geometry. Funding for a new programme of bridge approach seals to reduce maintenance costs and improve safety on the approaches to bridges on unsealed roads.
Unsubsidised	Funding to continue the programme of unsubsidised seal extensions on high demand routes. Funding to continue the programme of unsubsidised dust suppression on dusty roads.

5.6.2 Kaipara District Council

Work Category	Financial Impact
WC 112 Unsealed Pavement Maintenance	Funding to continue routine metalling using Paige-Green compliant materials.
WC 121 Environmental Maintenance	New funding application for dust sealing of unsealed roads that have long term heavy vehicle volumes resulting in health impacts of local residents due to dust (i.e. Dust Risk score of 15 or more on the General Circular 16/04 matrix).
WC 211 Unsealed Road Metalling	Funding to continue the roll-out of a programme of Paige-Green complaint wearing courses and metal strengthening on high risk routes. Funding increase applied for adjusted programme.
WC 325 Seal Extension	No Programme.
WC 341 Low Cost / Low Risk Improvement	Funding for a new programme of traction seals to address unsealed roads that have high maintenance costs due to steep grades and geometry. Funding for a new programme of bridge approach seals to reduce maintenance costs and improve safety on the approaches to bridges on unsealed roads.
Unsubsidised	New funding for unsubsidised seal extensions on high demand routes.

5.6.3 Whangarei District Council

Work Category	Financial Impact
WC 112 Unsealed Pavement Maintenance	Funding to continue routine metalling using Paige-Green compliant materials.
WC 121 Environmental Maintenance	Funding to continue dust sealing of unsealed roads that have long term heavy vehicle volumes resulting in health impacts of local residents due to dust (i.e. Dust Risk score of 15 or more on the General Circular 16/04 matrix).
WC 211 Unsealed Road Metalling	Funding to continue the roll-out of a programme of Paige-Green complaint wearing courses and metal strengthening on high risk routes. Funding increase applied for adjusted programme.
WC 325 Seal Extension	No Programme.
WC 341 Low Cost / Low Risk Improvement	Funding for programme of traction seals to address unsealed roads that have high maintenance costs due to steep grades and geometry. Funding for programme of bridge approach seals to reduce maintenance costs and improve safety on the approaches to bridges on unsealed roads.
Unsubsidised	Funding for unsubsidised seal extensions on high demand routes.

5.7 Level of Service Impact

Overall, it is expected there will be an improvement in the condition of the unsealed road network, a decrease in the number of dwellings affected by PM10 dust and there will be an increase in the level of satisfaction of the Council's unsealed road network.

5.8 AMP Improvement

The following improvements will be considered:

- Air monitoring of adjoining unsealed sections with and without Paige-Green compliant material to determine the reduction in PM10 dust emissions.
- Review method of payment, change unsealed Lump Sum items for pothole patching and grading in Maintenance Contracts to measure and value items to realise the savings through the Unsealed Centre of Excellence.
- Improve unsealed road data collection including implementing regular roughness monitoring through RoadRoid or similar, and visual dust assessment tool that can determine likely PM10 dust emission.
- Continue with the project level GPR testing and plan to do the testing work for the first two years of the FWP, this will allow adequate time to cost and plan the renewals work.
- Continued development of a Centre of Excellence for Unsealed Roads and the FWP.
- Development of an Unsealed Road Maintenance Intervention Strategy (MIS) and visual guide.
- Finalise development of a standardised dust matrix scoring system that will build upon NZTA General Circular 16/04 Assessment.
- The planning rules in the FNDC and KDC districts should be reviewed and rules developed similar to WDC to either limit the development of houses on unsealed roads or to require new dwellings to be located well back (ideally greater than 80m) from unsealed road frontages.

Maintenance Management Plan: Unsealed Pavement Activities

Northland Transportation Alliance

Contents

1. Introduction

Unsealed roads are the economic backbone of New Zealand due to our significant dependence on farming and forestry and people's desire to live rural lifestyles. This requires different roads to have different yet appropriate levels of service within the various networks and therefore different interventions and approaches to maintenance and renewals. This Maintenance Management Plan has been developed with ONRC/ONF in mind to address these differing demands and provides guidance to address the various LOS required. By using ONRC/ONF the importance of people, place, form and function can be used to determine how best to manage the maintenance needs of the various types of roads.

To set the scene for Northland and help the reader gain context around the unsealed network it is worthy to describe what occurs following the research that has gone into developing this manual and the development of the guiding principles.

Northlands 3460km of unsealed roads has 24% of the network with significant use from freight, dairy and forestry traffic interwoven with private motor vehicle use, 32% of the network provides residential access through private motor vehicle use such as trips from home to work and school and back and the remaining 44% of the network sees almost no traffic and only serves to provide access to land and coastal areas that are largely unused by the public or business but still require some form of vehicular access. Although the traffic volumes on unsealed roads are normally significantly lower than sealed roads and therefore upgrading to sealed surfaces is not warranted or economically justifiable, it is important to understand that an appropriate level of service is still required and possible, so that the roads cater for the demand of the traffic and use they receive. Almost all unsealed roads are on local networks managed by local councils and the importance of these roads cannot be overstated in a national context, with New Zealand local roads annually carry approximately 3,786 Million-ton Kilometres of forestry and farm produce, and providing a significant contribution to the country's GDP. More than half of this haulage would be on unsealed roads and providing a well-formed road that does not add significant repairs and maintenance burden to these commercial operations is a key part in economic sustainability. Along with this is a need to keep people safe so addressing dust and road safety also plays a key role in understanding how best to manage the maintenance of unsealed roads.

The unsealed road networks of New Zealand make up approximately 40% of the entire country's road network and approximately 20 to 25% of the over-all investment for road maintenance activities. It is an important part of the public investment into road infrastructure, yet the planning aspects of unsealed road maintenance significantly lack transparent standard practices like those used for sealed road maintenance planning. A significant portion of this unsealed network has a lack of the condition and traffic data and the historic maintenance and renewals information needed to proactively manage the network and develop proper forward works programmes.

There are numerous documents providing best practice advice for unsealed road maintenance and management (Refer to Section **Error! Reference source not found.**). This MMP's purpose is to set out how the Northland district councils best use the existing documentation to adopt the best approach to manage and maintain their unsealed roads and provide other agencies with a starting point for inclusion of these improved practices across the sector.

Research into unsealed road management systems shows significant reliance on intensive data collection. The issues with data sourcing for these management systems are:

- Material specific characteristics normally do not exist for individual unsealed roads
- The condition of unsealed roads changes rapidly, often leading to existing data being out of date soon after it has been collected
- Maintenance records are often poorly kept or not at all

To make the management system sufficiently robust, more frequent data collection is required. However, more frequent data collection may not be cost effective and may be onerous from an administrative perspective.

In summary, current data collection efforts for unsealed roads is of questionable value. This is because as asset management science has developed, the tendency has been to apply sealed road asset management techniques to unsealed roads.

In contrast, this Maintenance Management Plan (MMP) for Unsealed Pavement Activities, which has been prepared by the Northland Transportation Alliance specifically addresses improving the unsealed roads asset management decision making processes, the maintenance interventions used across the network and the practices delivered on the ground by the contractors to improve the unsealed road networks. The MMP is designed to provide the in-depth technical guidance for the NTA's Maintenance teams and the contractors by providing the strategic guidance, maintenance approaches and specifications for Unsealed Road networks with the aim of achieving an efficient proactive management process, value for money investment and improved whole of life returns across the networks.

The MMP needs to be read in the wider context of the Maintenance Intervention Strategy (MIS), Activity Management Plan (AMP) and Councils Long Term Plans (LTP). There is an expectation that users of this MMP will have experience in maintenance of roads and have a broad overview of network management, that the users will be experienced practitioners of unsealed road maintenance and that they will have an understanding of Asset Management processes and the tools utilised to make informed decisions around road maintenance treatments.

It is intended that this document be reviewed regularly and continually improved as best practice evolves, as the MMP implementation matures and as the NTA improves its approach to managing the Northland network. Ideally It should be reviewed in alignment with NZTA and Councils three yearly funding cycles to ensure that it meets the current demands that trigger road maintenance investment such as the Government Policy Statement (GPS) and other statutory requirements or industry guidance.

By continual improvement that is also aligned with the Road Efficiency Group's (REG) pillars of success it will become the foundation for a Centre of Excellence (CoE) for unsealed roads and can be utilised by the wider transport sector to improve the management of unsealed roads nationally.

The influences that will affect the MMP approach and its refinement over time are:

- Evolution of industry best practice;
- Feedback from clients, consultants and contractors regarding their experience in using it;
- Feedback from road users;
- Incorporation of any learnings from trials;
- Changes in any Council Policy; and
- Changes in the Forward Works Programme (FWP) as a result of traffic patterns; e.g. Forest harvesting updates and land development.

2. Vision

1.1 Centre of Excellence

The vision for the unsealed roads centre of excellence is an asset management led proactive approach to all unsealed road maintenance work. It is the intention that all work undertaken will be programmed, planned and have the appropriate intervention that is weighed up against all other programs and activities to achieve the best value for money investment decisions and the optimum life cycle return on a given asset.

An Asset Management led structured approach to maintenance work will enable the district councils to invest in renewals work before operational maintenance work. By focusing capital (Capex) investment in Granular Pavements, Paige-Green compliant Bound Wearing Courses and Culvert & Drainage renewals while focusing operational (Opex) investment on appropriate drainage maintenance and keeping unsealed carriageways within the specification of the maintenance contract through better grading/blading frequencies, Councils will be able to systematically work through the networks and build an appropriate level of service that meets the needs of all road users.

Included in this work are the activities like forestry and dairy freight which from vehicle kilometres travelled (VKT) affect small portions of the network but, if not included and the appropriate level of service catered for, lead to significant damage and maintenance expenditure. It is the intent though that rather than catering specifically to industry the wider needs of all the community will be met through improved or sometimes decreased levels of service that will be a direct outcome of appropriately timed Interventions and treatment types led by asset management strategy.

2.1 Fig 1.3 - Coverage of Unsealed Roads Guidelines

Guide	Functional Categorisation	Design	Construction	Material Specification	Maintenance Practices	Asset Management	Maintenance Planning	Economic and Financial Aspects	Alternative Surfaces and stabilisers
Austroads Part 6 (2)	✓	✓	✓	✓	✓	◉	◉	✓	✓
ARRB unsealed roads manual (3)	✓	✓	✓	✓	✓	✓	◉	◉	✓
RRU TR8 unsealed roads manual (4)	✓	✓	✓	✓	✓	◉	◉	◉	✓
TRH 20 Unsealed roads design construction and maintenance (5)	✓	✓	✓	✓	✓	◉	◉	◉	◉
NZTA Research Report 348 (Henning et al, 2008) (6)	✓		✓		✓	◉	◉	◉	✓
SADC	✓	✓	✓	✓	✓	◉	◉	✓	◉

Legend:

✓	Strong coverage directly relevant to New Zealand conditions
◉	Cover the topic but not always directly applicable to New Zealand conditions
	Not covered

3. Understanding Unsealed Roads

Dust emissions and uncomfortable driving conditions often lead motorists and farmers to apply political pressure to get unsealed roads upgraded. However, it is important to realise that unsealed roads may be the most cost-effective infrastructure solution for lower volume roads. As a result, the historical promotion of seal extensions due to political pressure has resulted in numerous sealed roads that councils' simply cannot afford to maintain and also do not meet the national investment priorities of central government and Waka KoTahi (NZTA). There is also now evidence that some sealed roads have been reverted to unsealed roads and even ownership of some roads have been returned to local communities and the industry to curb exponential maintenance expenditure.

For these reasons, there are two fundamental principles in asset management for lower volume roads that need consideration.

1. Deciding the appropriate surface technology for the given traffic loading and environmental conditions.

Figure 1 illustrates a typical continuum of road technology that normally varies according to the traffic load. Other factors that may influence surfacing technology may include specific geometric and application situations. Sections 4 and 5 go into more detail on selecting appropriate surfacing for some special situations and conditions.

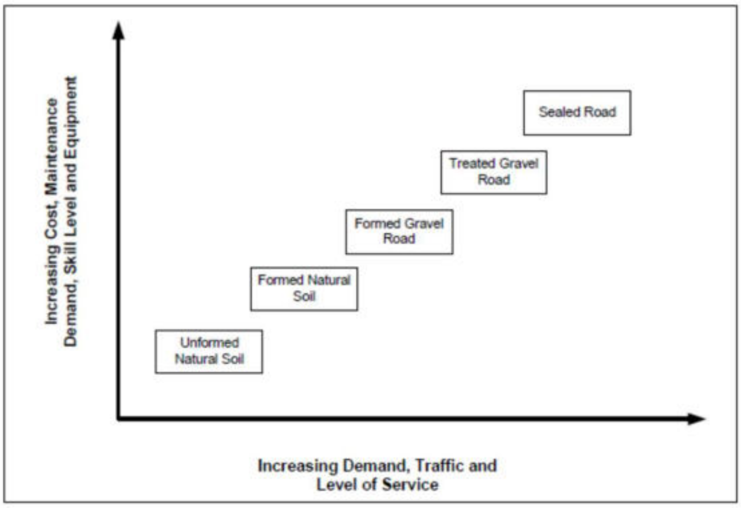
2. Constructing and maintaining unsealed roads to a standard that will

    a) satisfy a target Level of Service (LoS) and,

    b) operate at the optimal maintenance investment from a long-term perspective.

Measures to ensure unsealed roads receive value for money optimal investment are discussed in the later chapters.

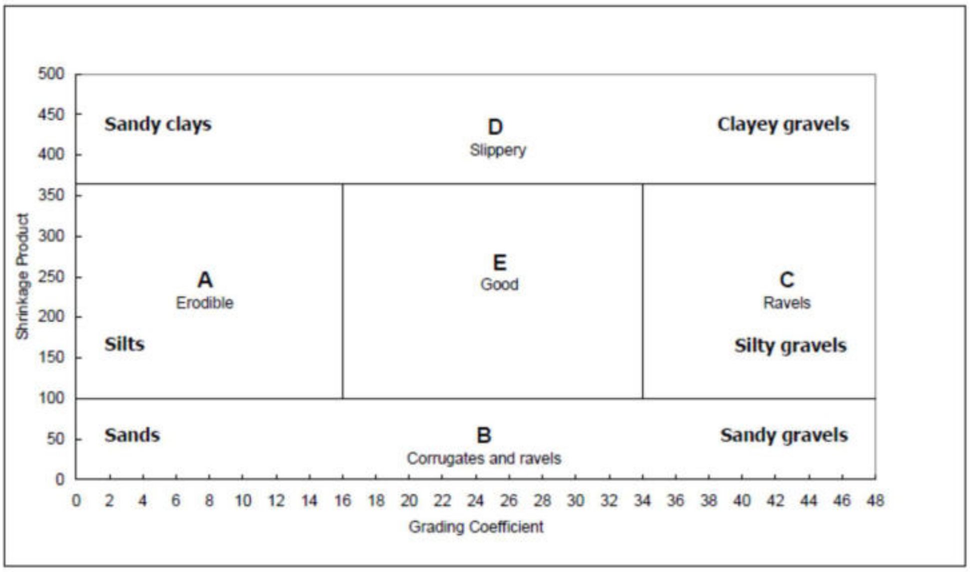
Fig 1 – Continuum of road technology



4. Material Properties and Performance of Unsealed Roads

Long term Unsealed Road performance can be significantly improved by understanding and using materials that perform in specific ways. This is particularly true when selecting a designed wearing course to preserve a constructed structural pavement.

Based on the research completed by Paige-Green all materials used in unsealed roads can be classified according to their behaviour (see Figure 2).



Legend

A	Erodible	Comprises sandy and clayey silts with insufficient plasticity to provide tight bonding. Erosion sensitive with crossfall runoff and inclines.
B	Corrugates and ravels (you had Ravels and corrugates)	Comprises sands and sandy gravels with little plasticity; therefore aggregate becomes loose (ravelling) and corrugations develop from vehicle suspension oscillation. Can also erode in high rainfall areas.
C	Ravels	Comprises coarse gravels with little fines or plasticity to bind the aggregate and therefore ravels quickly.
D	Slippery	Comprises silty clays and clayey gravels with high fines content producing slippery surfaces when wet.
E	Good	Comprises well-graded soil aggregate mixes with sufficient plasticity to bind aggregate fractions into a hard wearing tight surface. Higher fines content can produce a dusty surface.

Figure 1: Material Classification and Expected Behaviour (2)

Note: Grading is a function calculated from a grading test (wet sieve test)
Shrinkage is a function of linear shrinkage x 0.425mm from sieve analysis
Refer to Section 3.9 of ARRB's Unsealed Roads Manual: Guideline
Standard tests are also described in Sections 2.3, 2.4, 2.5, and 2.6 from NZS 4402:1986.

The Figure shows the following performance characteristics can be determined:

- In terms of grading and plasticity, zone “E” material characteristics are ideally suited for unsealed roads. *Cohesive Clay material properties that resist wear and reduce dust.*
- that wearing course material would be prone to corrugation and ravelling with any material that has a shrinkage product of less than 100. *Dust generating properties.*
- If materials have a shrinkage product > 360 the road will become slippery and rutting may become an issue. *Roads become unsafe when wet.*
- If the grading coefficient is < 16, the material will be sandy and silty, which leads to the materials eroding. *Accelerated gravel loss.*
- If the grading co-efficient >34, the material will be too coarse. In these cases, ravelling and stoniness may be typical defects. *Poor ride quality and dust generation.*

Traditionally the Paige-Green classification has not been used in New Zealand to select and design the materials used on unsealed roads. This MMP not only adopts the Paige-Green concept but takes the concept a bit further by making the Paige-Green classification an integral part of the unsealed road management approach. This is because knowing how roads will perform, given their material characteristics, minimises the need for further condition monitoring. This concept can also be used to determine performance expectations of alternative sources. An outcome of this type of economic comparison is that trade-offs between materials that perform better but may be more expensive can be made with cheaper materials that may offer lower levels of service. Incorporating material characteristics in a trade-off with haulage costs is further discussed in subsequent sections.

5. Typical Unsealed Road Management Issues

Many international studies have attempted to forecast unsealed road the behaviour. A common difficulty with all the forecasting models is the complex interaction between material properties (characteristics), maintenance regimes, climate, drainage, construction quality, geometric design and subgrade conditions.

In their research Van Zyl et Al compared the outcomes predicted by forecasting models with roads' actual performance. The roads Van Zyl et al selected for the study were mostly constructed using ideal material according to the Page-Green classification. Most of the materials plotted within Zone "E" on Figure 2. The comparison between the predicted roughness and gravel LoS versus the actual behaviour are depicted in Figures 3 and 4.

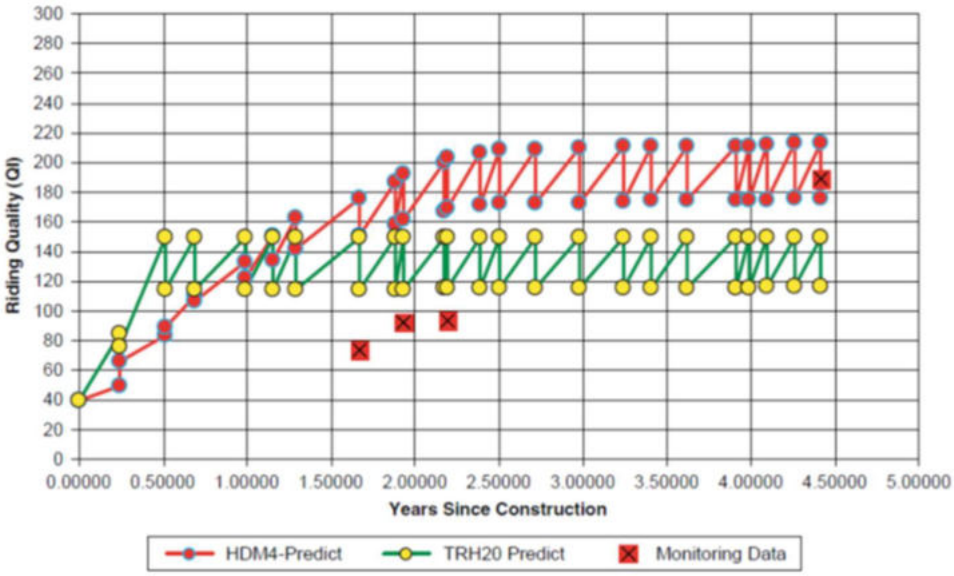
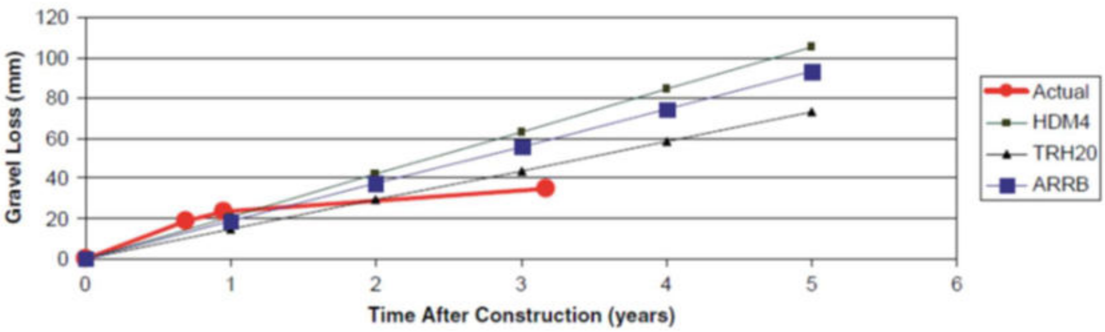


Figure 2 Poor Correlation between Forecast Roughness and Actual Behaviour

Figure 3 shows a change in roughness over time for smooth, newly constructed roads. Roughness increases until a steady state is reached at a higher level which remains through the latter years of their life.   During the later stage of deterioration, the variation of roughness within the upper and lower range is a function of the blading cycles (this is a typical saw-tooth trend). The Figure also shows the actual roughness values measured during the same period. It is apparent that the roughness after 4.5 years was close to the roughness forecast by the HDM-4 model. However, for the most part the actual roughness was much lower throughout the life of the unsealed roads. It is important to keep in mind that these roads were constructed with ideal material, and the roughness deterioration may well be worse for roads constructed with less-than-ideal material.

Road Section A



Road Section B

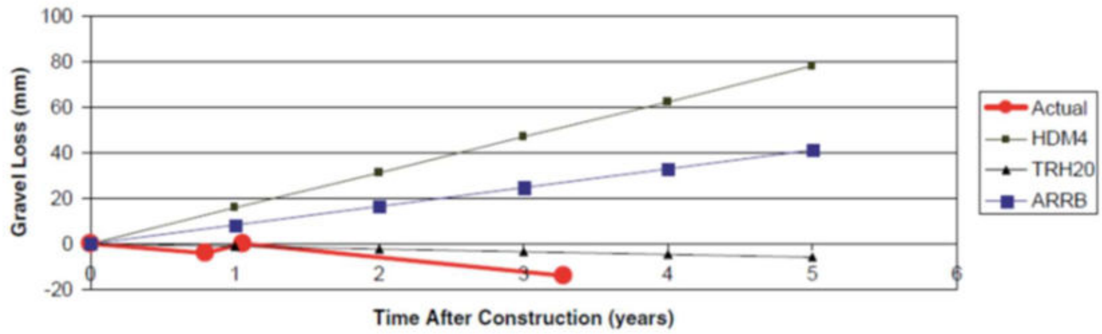


Figure 4: Forecast versus Actual Gravel LoS in Two Road Sections

A similar observation about forecast versus actual outcomes was also made regarding actual gravel LoS, which was significantly lower than forecast. In the two road sections being monitored, a common trend was observed in Road Section B where a gravel increase was measured over time. The reason for the increase was because the grading operator was cutting a significant amount of extra material from the side drains onto the road profile. Observing true gravel Loss in these situations could be problematic.

The main findings from Van Zyl et AL's paper are that there are a significant number of variables influencing the deterioration of unsealed roads, and that getting a strong statistical model from the available data is near impossible. This research is backed up further by research from the University of Queensland by Van Wijk et. Al.

6. Significant Data Collection Needs

There are two approaches to unsealed road data collection. One is to collect a significant amount of condition data at frequent intervals. The alternative is to depend on frequent road inspections by experienced engineers to assess the over-all condition of the unsealed network. The first approach causes a significant onus on authorities, while latter does not provide satisfactory information for longer term planning processes. Because neither approach is completely satisfactory, data collection practice in New Zealand varies significantly according to ad-hoc processes.

A more efficient method of data collection on unsealed roads is to record borrow pit/Quarry Source material characteristics, actual maintenance and actual costs so that real world evaluation of network specific characteristics can be undertaken to better understand the expected performance across the various unsealed roads that form the wider network. This concept is further detailed in this MMP as the approach taken by the NTA as part of the modelling, programme development and blading frequency approach.

7. Variability in Level of Service and Maintenance Practices

As a result of the relative flexibility in accepted specifications for unsealed roads in comparison with sealed roads, there is a great variation in both the levels of service on unsealed roads and the maintenance practices. There are also significant differences in the geology, topography, subgrades, climate and material available between regions, which leads to big differences in unsealed road performance. A consistent planning approach that caters for these differences is difficult to establish but can be achieved with better understanding of the regional specific material properties and by defining LOS through ONRC/ONF and developing contractor guidelines for the management and maintenance. By not over or under delivering in intervention more consistency can be achieved with a more balanced better value for money investment.

8. Long-term Maintenance Planning for Unsealed Roads

The Paige-Green concept (refer to Section **Error! Reference source not found.**) has been officially adopted in a number of design guidelines including the Austroads Part 6 and the TRH 20 Unsealed Roads Design Construction and Maintenance. Elis and Andrew have taken the concept a step further by using it to optimise gravel selection on a network basis. This MMP uses dTIMS modelling developed by RIMS/IDS which takes Elis and Andrew’s concept as a starting point to develop a complete tactical planning tool for managing unsealed road networks.

The fundamental principle for decision making on unsealed roads is to link each road to its origin material source on the basis of a geospatial platform (Refer to **Error! Reference source not found.**). This will involve having material tests undertaken on each borrow pit or other material source. With this information available, principles from Figure 1 are applied to forecast the behaviour of the unsealed road section and to associate it with a particular material source. This method makes it possible to associate a low or high blading and gravelling cycle with a specific material and within a specific location and topography on the network. The outcome would yield an economic zone associated with each borrow pit (see **Error! Reference source not found.**). Note this Figure shows 3 material sources and indicates the extent of the roads for where the best long-term value for money is achieved using material from each source.

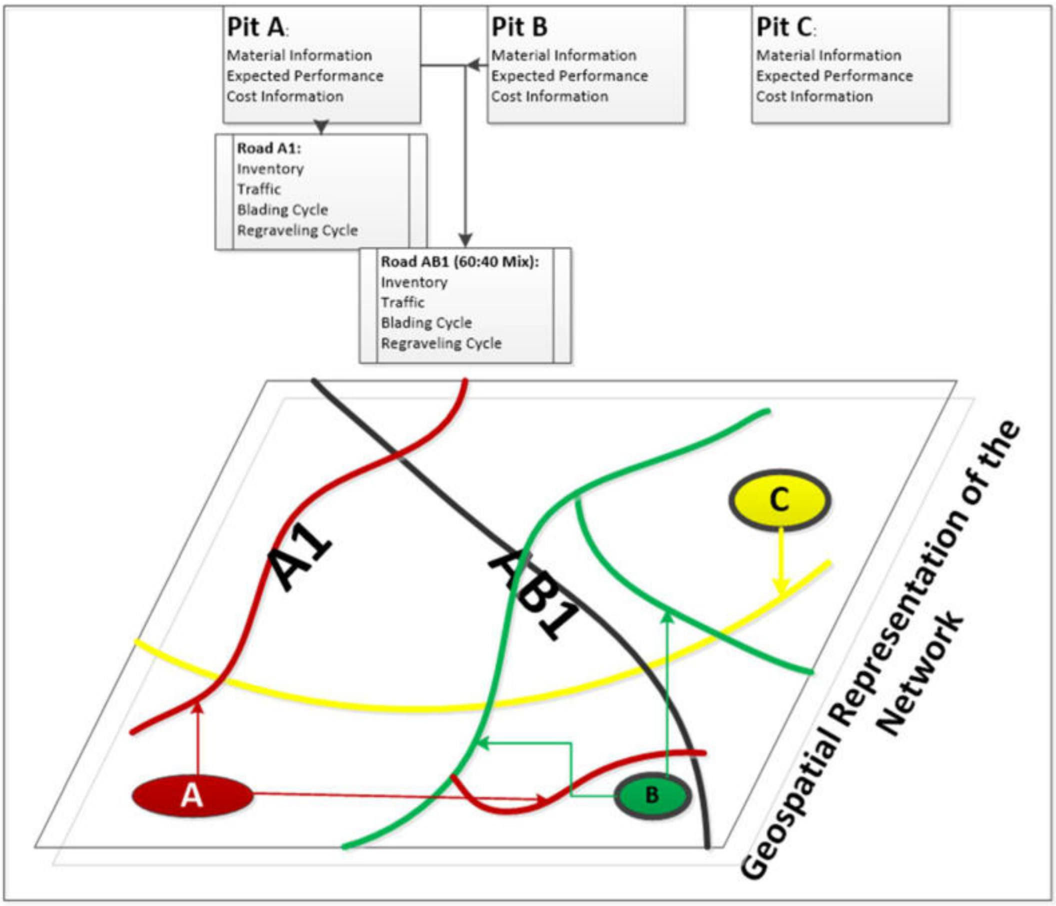


Figure 5: Linking Gravel Source to Unsealed Road Network

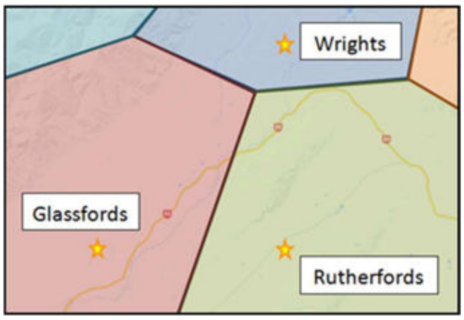


Figure 6: Example Outcome from the Analysis: Economic Zones around Borrow Pits

The suggested decision framework and associated data inputs are shown in Figure 7.

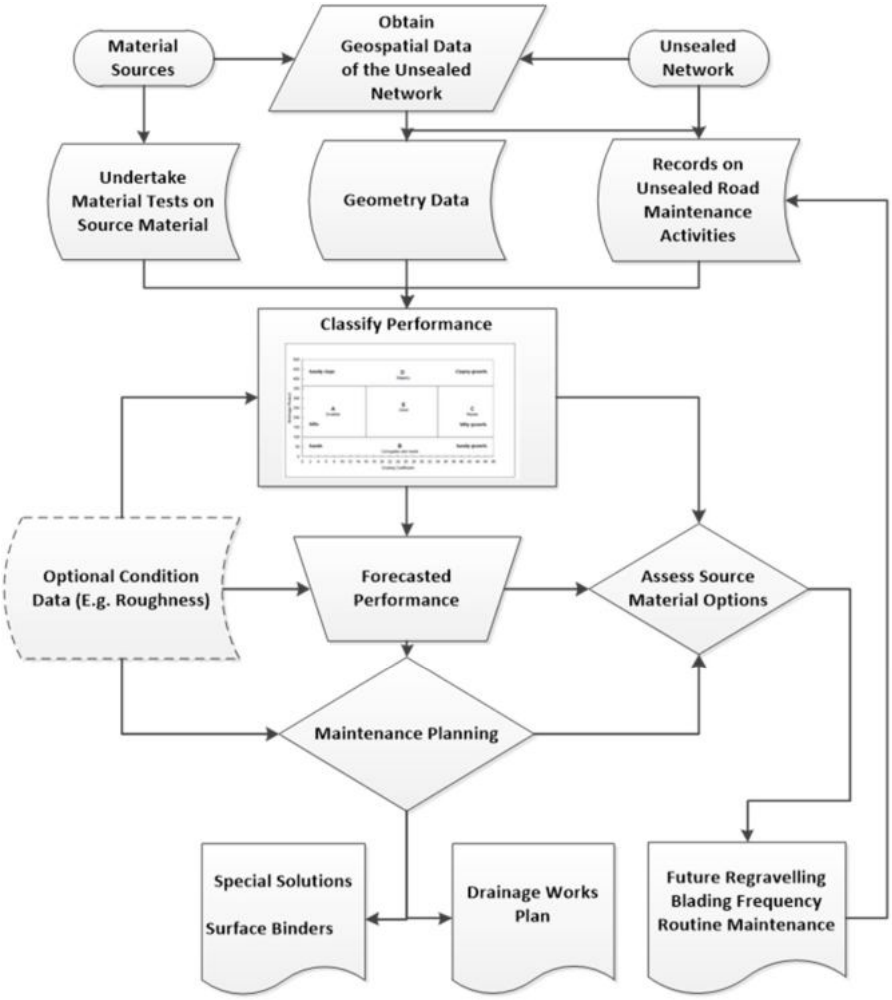


Figure 7: A Framework for Long-Term Maintenance of Unsealed Roads

The Framework consists of three core data items, including laboratory information from borrow pits, geometry data and any available maintenance records on the unsealed roads. All this information is integrated in a geospatial platform. Specific analysis within the geospatial platform is discussed in later sections. Once the material class and subsequent performance are linked to each individual road section, the long-term planning of investment requirements and subsequent work programme becomes possible.

The Framework is a self-learning system that can take account of any additional information. Examples would be condition data and/or problem areas identified through recording repeated routine maintenance within a given location (and stored and analysed on the geospatial system). As a result, the system will grow in robustness as more information becomes available.

9. Implementation Steps

Implementation was tested in a case study on the Central Otago District Council (CODC) network. The outcome of this study is presented in Appendix A. The following implementation process was developed as a result of the experience gained on the CODC network.

Table 2: Implementation Stages of the Forecasting System

Implementation Stage	Details of Activities	Notes
1. **Data Collection**	**Borrow Pits**: Laboratory test results and classification on Paige-Green charts **Network Wide Data** **Required:** An inventory of all unsealed roads A qualitative horizontal geometry classification (Tortuous, Some Curves, Straight) A qualitative vertical alignment classification (Hilly, Rolling, Flat) Links between each road section and the source borrow pit (geospatially or on a map) Traffic counts, including truck numbers *Maintenance cost records for each road **Optional:** Geospatial data for the network Additional strength, layer information and/or some condition records	* Initially complete maintenance cost records may not be available. For the initial stages of the implementation, approximate blading frequencies and gravelling cycles for each road may be sufficient. Once the process is established, more detail and accurate maintenance cost data should be recorded. With an increase in cost data, the system will become more robust in its forecast and economic analysis.
2. **Set up relationship for blading and gravelling**	Firstly, group roads together for borrow pits that plot in similar zones on the Paige-Green chart. Further relationship models are developed for each one of the cluster groups of pits. Then undertake a linear regression to develop a specific model for each peer group. The model formats are: * BF $= B - a_1 * AGE + a_2 * EVL + a_3 * G_H$ * GrafLife $= D - c_1 * EVL + c_2 * G_H$ Where: BF = Blading Frequency AGE = Average current gravel layer age	Note the climate plays a significant role in the gravel road deterioration. If a network includes more than one climatic region, separate relationships must be developed for each region.

	GrafLife = gravel life of pavement (Re-gravel Frequency) EVL = Equivalent Average Daily Traffic (where one heavy commercial vehicle is equal to ten equivalent light vehicles) Horizontal geometry factor (G_H) **1** – Straight road with very few bends. Bends at obtuse angle so speed is not restricted. **2** – Some curves are present which limit driver speed, but do not induce significant discomfort. Acceleration and deceleration is necessary to safely navigate corners. **3** – Curvature severely restricts driver speed. Significant acceleration and deceleration is necessary to safely navigate corners.	
3. Undertake economic outcomes for each peer group	Option 1 Undertake the economic analysis for each road in relation to the most likely borrow pits that could be used. Option 2 (Geospatial) For each borrow pit carry out an economic analysis that determines a zone around the pit (as shown in Figure 6) where best value is gained relative to adjacent pits. Traffic loading is an input and could define roads in 3 categories say.	
4. Undertake Strategic/Tactical Analysis	Assess the value return between the pit and road combinations to yield the following outcomes: a. Determine the most cost-efficient pits in the region b. Determine the most optimal gravel selection for each road c. Identify problem roads (Refer to Section **Error! Reference source not found.**) d. Consider mixing different pit material to yield better outcomes on the network e. Consider surfacing options for gravel road with significant LoS issues and or uneconomic operation costs.	

* Note: Blading and gravelling are co-linear variables (i.e. they are dependent on each other). The expression could be used as noted in the table. However, if the Gravel Life (GrafLife) formula is used in isolation it should include a factor for the blading frequency.

10. Unsealed Road Maintenance Structure

The unsealed road maintenance is divided into two strategies: periodic maintenance carried out on an annually developed programme and monthly routine maintenance undertaken on a cyclic programme.

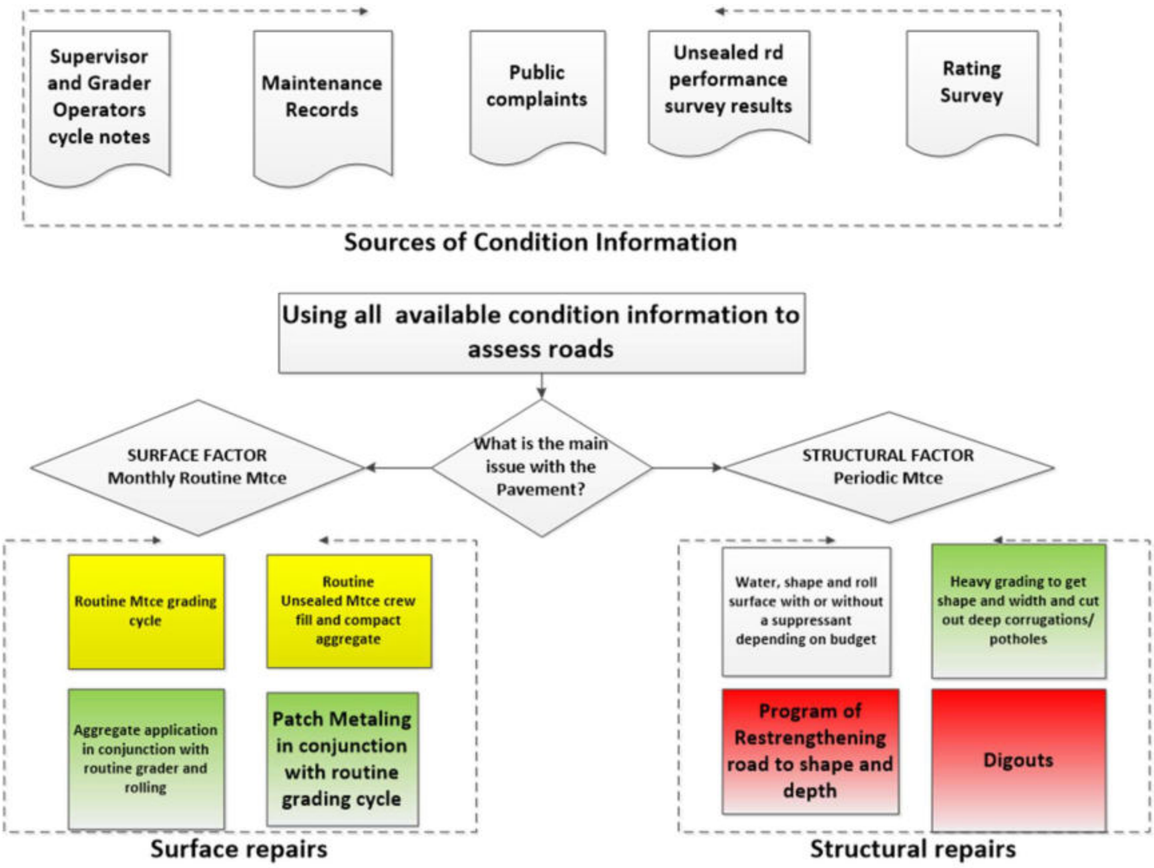


Figure 3: Determining the Maintenance Needs of an Unsealed Road Network

11.

12. Key Definitions

Forward Works Program

A Forward Works Programme is a “grid” of all treatment lengths (TL) that make up the network. The development of the FWP is done through a process that involves modelling of the network, engineer’s knowledge and assessment of historic interventions. The grid will identify when a renewal, maintenance or improvement work is planned and may identify when/if a renewal or improvement work last occurred.

The accuracy of proposed TL intervention/treatment in the current year is expected to be close to 100%, as the proposed treatments get further into the future the level of accuracy reduces as the network is dynamic and can change if demand on a TL changes.

The MIS code for each treatment length is shown on the FWP "grid." The FWP is "rolled" forward one year, at the end of each financial year. The process then considers all renewal and improvement work achieved in the previous financial year and the FWP is re-validated for the next year of the program and the grid updated for all years of the program.

A Rapt process as used in the sealed road program validation will be applied to the unsealed road program validation process.

Renewals Model

An Unsealed Road Renewal's Model has been developed by the Northland Transportation Alliance (NTA) in collaboration with WSP International Consultants. Advice was sought during the development from IDS to ensure the completed work that informed the model was in adherence with industry best practice and that the data once compiled, could be further utilised by the NTA and IDS under the dTIMS framework. The model is one of the tools that forms the Centre of Excellence (CoE) for unsealed roads. The CoE work was undertaken with the programme support funding provided by the Provincial Development Unit for Kaipara District Council's Provincial Growth Fund (PGF) package.

The goal was to establish a model that could:

- Provide a robust process for establishing a forward works programme (FWP) for Northland's unsealed roads that enables proactive and programmed management of the networks,

- Adapt to changing Levels of Service (LOS) that may result from the outcomes of additional PGF projects or when activities on the unsealed network change the function of a road

- Be aligned with the New Zealand Transport Agencies (NZTA) One Network Road Classification (ONRC) and One Network Framework (ONF), and

- Be migrated into dTIMS for automation and continuous improvement of the model.

The Triggers used in the model were developed by holding Investment Logic Mapping (ILM) workshops attended by members of the NTA Strategy and Planning, Maintenance and Capital Works teams and WSP International Consultants. These ILM workshops determined the major triggers and rationalised a scoring system to provide a balanced overview of the triggers and enable the network to be evaluated and a programme developed that aligns with ONRC and ONF.

The model uses 10 triggers to build a score for each carriageway section from RAMM that enables all roads to be compiled into a potential programme ready for field validation using a RAPT process similar to sealed roads programme assessment and validation.

The score categorises the network into three bands, high, medium, and low demand that are aligned with ONRC. It also provides granulation between forestry and private vehicle usage on medium demand roads, which is a critical part of investment decision making on unsealed roads. By taking this approach and using ONRC hierarchy when building a programme consideration is given to use, people, place and function of roads in their overall programme priority.

The final triggers and the scores used are:

No.	Trigger	Sub-Trigger	Sub-Weighting	Weighting	Overall Score %
1	Iwi – Cultural Significance, Marae etc			1	
2	ADT			4	
3	% HCV			5	
4	Horizontal Geometry			3	
5	Vertical Geometry			4	
6	Use			4	
6a	Use	Forestry	10		
6b		Tourist/Holiday	4		
6c		Dairy	4		
6d		Lifestyle	2		
6e		Quarry	3		
6f		School/Community Hall	3		
7	Width			2	
8	Remoteness			2	
9	Resilience/Detour Routes			3	
10	Change – PGF factors Marae, Wharf, Kai. Economic Improvement/development			1	

	opportunity, Developments				

Limitations of the model

Data quality is key to a robust programme development, the model uses the available information stored within Councils RAMM system. The NTA recognises that this data may need improvement and has been working on continuous improvement tasks to further refine the information held in RAMM and improve the accuracy of the draft programme produced by the renewals model.

The model does not prioritise the timing of works but instead provides a programme outcome that experienced asset managers and maintenance staff who have the local knowledge of the network performance can use to assess the treatment lengths for intervention timing using a RAPT approach as is undertaken on the sealed road network programmes.

Traffic Count Data

Accuracy of the traffic count data on the unsealed network poses some limitations as this is generally not collected through normal count programmes, instead estimated from the adjacent sealed road counts. The strategy that the NTA uses to estimate unsealed road counts has been reviewed and revised as of 2019-20FY. This strategy has now evolved to consider applying unsealed road data collection where appropriate and the NTA is now investigating options for improved technology to begin the data improvement task.

Forestry harvest

Northland has both continuous and episodic harvest cycles. This has been recognised and an improved forestry road management strategy has been developed by the NTA and WSP team that informs this renewals model, see appendix xx. A consultant to the forestry industry that was collating information for the Northland Wood Council and wider Northland forestry industry was engaged to provide improved timing, volume and route analysis information to assist the NTA in developing the refined programmes and timing of interventions across the network. This data improvement task is now completed and the NTA and WSP are undertaking an update to the forestry use trigger of the model. Additional use of this data beyond the model intervention type prediction will be the timing and volume of wood and truck movement information. This improved data enables experienced asset management staff to perform desktop evaluation of intervention timing when undertaking the RAPT analysis of the programme. This will optimise the intervention timing and provide a validated programme for current investment delivery and future AMP evidence.

Kaipara Kickstart

Data from the Kaipara Kickstart for land use change was not available at the time of the Forward Works Programme development. It was recognised while building the model that this might not be included at the time of programme draft and so the model has been developed in a manner that enables continuous improvement of data quality.

13. Normative Cost Model

1.1.1 Objective of Calculating Normative Cost

The objectives for calculating normative costs are:

- To facilitate the calculation of an overall cost for pavement, maintenance and wearing course investment activities on unsealed roads,
- Provide the budgetary projections for the AMP and Councils LTP,
- To use the normative cost in the process of project prioritisation when considering investment and intervention on the network aligned with ONRC hierarchy.

2.1.1 What is World Best Practice for Normative Costs?

It is an accepted international practice for road authorities to standardise on a common unit schedule of rates for road construction and maintenance activities. These standard unit rates are then used in estimate process and contract documents for road construction and maintenance works. (CSRA, 1987)

There are many benefits of using such a standard schedule of rates for both the contractual aspects as well as the estimation process, with the main benefit being that estimates can be regularly updated based on the latest contract or tender information.

3.1.1 Cost Calculation Process

The normative cost calculation process has been developed on the following basis and principles:

- It must be accurate enough for its intended purpose – unsealed roads are relatively simple in terms of the activities needed to maintain and renew them and are often over complicated in their management approaches. The normative cost model took a simplistic approach of calculating from RAMM maintenance records the average cost of undertaking the various types of work needed to maintain and renew an unsealed network at a per kilometre rate.
- The cost calculation process must be integrated with the overall decision process. The normative cost is only calculated once and used throughout the maintenance decision process. The basis of the calculations are the existing maintenance contract rates and the quantum of each activity achieved annually, held in RAMM.
- The normative cost should **represent the outcome of the intended maintenance**. The outcome of the intended maintenance is determined by the analysis undertaken in the renewals model such as pavement rebuild or Rehab, wearing course replacement for pavement preservation and routine maintenance. This is particularly relevant when considering ONRC as different hierarchy roads require different interventions and at different times throughout the lifecycle of the pavement and wearing course. This is due to the demand placed on differing road sections through different use, such as forestry use versus private motor vehicle use, where it can be assumed a higher demand in traffic volume would consume the road lifecycle than a lower traffic volume road. Rather than using staff and machine costs, costs have been averaged for specific road maintenance activities. Rehabilitation for heavy and light vehicle usage, Wearing Course (WC) replacement and restorative routine maintenance have had their specific intervention average costs developed for the ONRC hierarchical guided intervention.

- The normative cost calculation process should be **flexible to allow for changes to the procurement of maintenance work or change in marketplace rates when procurement of new contracts occur.** It is important to be able to easily reassess and reprioritise forward works programmes when contracts change or have variations accepted that change rates. This enables reprioritising of programmes to balance the programme to the available existing budget whilst planning for future investment needs.

The cost calculation process is presented in **Error! Reference source not found.**. It shows that the normative costs that were developed by the NTA for use in the renewals model for each intervention type was determined using the following steps:

1. The standard maintenance contract items for unsealed road maintenance were established in RAMM along with the tendered unit rates for each item from the maintenance contract schedule.

2. Treatment type average resource requirements establishment. This was determined for each intervention activity using ARRB and Austroads unsealed roads manuals as best practice guidance for road maintenance and construction. This average was validated by experienced road maintenance engineers and contractors and their corporate best practice documentation, the outcome was to establish the appropriate construction methodology and resource requirements for each type of intervention that could then have a cost per kilometre average cost calculated from the unit rates held in RAMM.

3. Average aggregate replacement quantity and cost establishment. Using the knowledge base and experience of asset managers, road maintenance engineers and contractors in Northland, an informed and experience driven assumption was made that by statistical average, pavement renewal activities would not require full depth aggregate replacement. Unsealed roads are generally built with lesser quality aggregates and it was therefore accepted that Insitu material would always be suitable for reworking into the pavement layer being constructed. It was assumed that remaining Insitu material would provide approximately 40% of the design depth requirements and imported new aggregate assumptions were then calculated using Austroads and ARRB design charts where an average CBR of 3 was used. The low CBR value was chosen as Northlands poor subgrade and sub-base aggregates are widely acknowledged as having very poor CBR’s due to the poor geology of Northland. This is well documented and defined through the strategic case and in the problem statements in the Northland Councils Activity Management Plans. To determine a per kilometre average quantity and cost from these assumptions the volume of new aggregate needed per kilometre was calculated and then multiplied by contract rate to establish an average per kilometre cost.

4. The cost per intervention activity per kilometre was calculated by adding the rates from the required resources of each activity and the costs per kilometre for replacement aggregate.

Item	Description of Work	Updating Requirements
1. Establish standard unit items	In RAMM create…..	The standard list of unit items only need to be updated if a new items needs to be created. (It is not expected to get to many changes like this after the first year of implementation.)
2. Undertake estimates of unit costs on regional level	Undertake an estimate of as many unit cost items as possible based on prior year's costs. It is realised that not all units may be populated and for some a 'best guess' maybe sufficient.	The standard unit rate cost could be updated on 6 monthly or annual bases depending on the cost fluctuations throughout a year. It is recommended to do the unit cost updating during times when regional staff are not busy with other priority activities such as planning.
3. Perform cost estimates of planned projects on a regional level	In order to validate unit cost, it is proposed that regions use their unit cost rates to calculate planned project costs for candidate projects.	Only the cost estimate of medium and long-term forecasted projects needs to be updated. For example, if a rehabilitation project is forecasted say four years from now, it is advisable to update the estimate as required.
4. Processing and reporting of unit rates at national level	During the pilot study a process will be implemented at head office that will allow the collation of regional	Processing and reporting of head office unit rates need to occur prior to every planning round (e.g. once a year).

	information. As an outcome of this process head office will be able to: Identify outliers / erogenous data Calculate regional adjustment factors; Calculate escalation figures.	

Figure 7.1 Implementation and Updating of Normative Cost Calculation Process

4.1.1 *Example of a Cost Estimate Calculation Process Using Standard Normative Unit Rates*

In order to illustrate the normative cost calculation, process a typical rehabilitation project is presented in Figure 13.1. It illustrates the theoretical/potential treatment option that was used when developing the normative cost assumption for a rehabilitation project on high AADT high HCV unsealed road. The rehabilitation option consists of rip and remake of an existing base layer with imported pavement material to a depth of 250mm followed by capping the completed pavement build with a sacrificial wearing course layer 70-100mm thick.

Assumptions:

- Section width 6-7m
- Section Length 1km
- Location of this project is on a secondary collector or low volume road where high HCV and/or forestry activity occurs
- Insitu material accounts for 40% of completed pavement build
- Wearing course is Paige-Green compliant sacrificial layer
- Subbase material is not disturbed or modified
- Drainage is adequate or remedied during the rehabilitation process at additional cost from drainage maintenance budget.

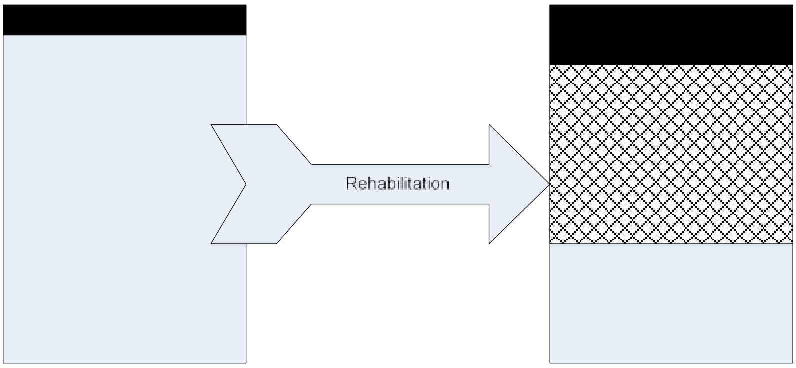


Figure 13.1 Graphical Presentation of a Typical Rehabilitation Project

14. Life Cycles

In order for further analysis and normative cost modelling to be undertaken on the forward works model a set of lifecycles was developed for the different interventions after the initial model data sets were established. Four interventions and their lifecycles were determined for different volumes of traffic after researching best practice information such as Austroads and ARRB unsealed roads manuals, RIMS gravel loss analysis and research performed by A G Ferry on quarry sources available to the Rodney district council.

For aggregates available to Kaipara District Council the Rodney District Council Quarry sources are directly linked to the current supplies being utilised in Paige-Green wearing courses and the following linear progression of aggregate attrition versus AADT can be used.

Insert gravel loss model graphing here

ONRC	Classification	Width	Characteristics
Primary Collector	Major	>6.0m	Band 3
Secondary Collector	Major	>6.0m	Band 3
Access	Major	5.0-6.0m	Band 3
	Minor	4.0-5.0m	Band 2 Forestry
Access Low Volume	Minor	4.0-5.0m	Band 2 Private use
	Lane	3.0-4.0m	Band 1
	Track	<3.0m	Band 1

Insert gravel loss model graphing here

The lifecycles used are

- Band 1 – AADT is less than 100 vehicles per day - 20-year Lifecycle, Routine maintenance and aggregate replacement where needed,
- Band 2 – AADT is between 101 and 200 vehicles per day - 15-year Lifecycle, 100mm Pavement layer with Paige – Green Wearing course at a 7-year Lifecycle average,
- Band 2 Forestry use – AADT is between 101 and 200 vehicles per day and forestry operations occur - 10-year Lifecycle on pavement plus 5-year return on Paige-Green Wearing course,
- Band 3 – AADT is greater than 101, HCV is high and forestry operations occur daily – 10-year Lifecycle on pavement plus 5-year lifecycle on Paige-Green Wearing course.

5.1.1 Band 1

A 20-year life cycle was chosen from the following assessment
Investigations into the use of these roads showed that approximately 65% of the network had very little to no use. The observed and estimated AADT for these roads was up to 100 vehicles per day and the HCV percentage was almost 0 in most cases. As there is no significant pavement loading occurring due to the limited or no volume of HCV's using these roads as the predominant traffic occurring is private use motor vehicles it can be concluded from this number when gravel loss models are applied, the attrition could be predicted at approximately 8mm lost to attrition annually. It is reasonable to expect that these roads only require routine maintenance with an average aggregate replacement of 100mm every 20 years if routine maintenance is done in accordance with best practice guidelines.

6.1.1 Band 2

A 15-year pavement life cycle and 7 year wearing course life cycle was chosen for the following reasons
investigations into the band 2 private use roads showed that approximately 20% of the network had some private use but almost no HCV usage. The observed and estimated AADT for these roads was between 101 and 200 vehicles per day and that the predominant traffic using these roads was light motor vehicles performing daily commutes to and from work or school. Unlike band 1 roads, the band 2 roads have enough pavement loading through their increased usage and from the gravel loss attrition modelling showing the predicted wearing course attrition is between 8 and 14mm annually to warrant a simplistic pavement design and wearing course approach. The pavement design indicates an average depth required to support the AADT volume of

approximately 100mm of structural pavement and 70-100mm of sacrificial wearing course every 7 years to mitigate the effects of attrition on the structural pavement.

7.1.1 Band 2 forestry

A 10-year pavement life cycle and 5 year wearing course life cycle were chosen for the following reasons

investigations into the band 2 forestry use roads showed that approximately 10% of the network had mix of private use and forestry use with HCV usage being 7-12%. The observed and estimated AADT for these roads was between 101 and 200 vehicles per day and that the predominant traffic using these roads was light motor vehicles performing daily commutes to and from work or school and episodic forestry harvest or other freight and/or agricultural vehicle activity. Unlike band 2 private use roads, the band 2 forestry use roads roads have increased pavement loading through their increased usage and from the gravel loss attrition modelling showing the predicted wearing course attrition is between 14 and 20mm annually. Due to the increased loading a detailed pavement design and wearing course application approach is required. The pavement design indicates an average depth required to support the AADT and HDCV volumes of approximately 250mm of structural pavement and 70-100mm of sacrificial wearing course every 5-7 years to mitigate the effects of attrition on the structural pavement.

8.1.1 Band 3

A 10-year pavement life cycle and 5 year wearing course life cycle were chosen for the following reasons

investigations into the band 3 use roads showed that approximately 5% of the network had mix of private use and forestry use with HCV usage being 10% or greater. The observed and estimated AADT for these roads was greater than 201 vehicles per day and that the predominant traffic using these roads was light motor vehicles performing daily commutes to and from work or school and continual forestry harvest or other freight and/or agricultural vehicle activity. Unlike band 2 forestry use roads, the band 3 roads roads have increased pavement loading through their increased usage and from the gravel loss attrition modelling showing the predicted wearing course attrition is between 14 and 20mm annually. Due to the increased loading a detailed pavement design and wearing course application approach is required. The pavement design indicates an average depth required to support the AADT and HDCV volumes of approximately 250mm of structural pavement and 70-100mm of sacrificial wearing course every 3-5 years to mitigate the effects of attrition on the structural pavement.

15. Pavement Design

All pavement designs will follow the Austroads manual for unsealed roads process.

A revision of the ARRB unsealed roads manual was released t industry in April 2020, where an improvement has occurred in this manual that supersedes the Austroads manual this will be adopted.

16. Construction

Construction will follow industry best practice as detailed in the Austroads Unsealed roads manual. It will also follow the current maintenance contract specifications

A revision of the ARRB unsealed roads manual was released t industry in April 2020, where an improvement has occurred in this manual that supersedes the Austroads manual this will be adopted.

17. Maintenance

Maintenance will be delivered to the current maintenance contract requirements and specifications.

It will also follow industry best practice as detailed in the Austroads Unsealed roads manual.

A revision of the ARRB unsealed roads manual was released to industry in April 2020, where an improvement has occurred in this manual that supersedes the Austroads manual this will be adopted.

18. Wearing Coarse

Wearing coarse is detailed in the maintenance contract. This is to be a Paige-Green compliant AP30 aggregate. These specifications along with the grading curve requirements can be found in the material specifications reference chart in the maintenance contract.

Further research is required for wearing coarse aggregate used on formed granular structural pavements following the ARRB Unsealed roads manual update. The revision now recommends the use of a low sand equivalent, high clay content AP20 that contains the largest stone size of 19mm. This investigation will be undertaken in collaboration between the Maintenance contractors and the NTA engineering staff.

19. Competency of Contractors

Development of a competency framework for unsealed road maintenance workers is required.

Grader Operator

The grader operators need to be trained, assessed and signed off as deemed competent to undertake each maintenance activity described in the ARRB manual.

Although no a formal qualification exists and there is no national requirement for the grader operator to be deemed competent, it is recommended by the NTA that due to the levels of distrust from the public in the industry to perform maintenance appropriately, the Northland District Council maintenance contractors engage with its engineers to commence development of this competency framework immediately.

Following the ARRB unsealed roads manual revision it now contains the following industry best practice operation and maintenance guides for grader operators that can be used as a baseline to begin a competency framework.

- a visual guideline for appropriate operation of a grader.
- a visual defect identification and intervention guideline that explains and demonstrates what techniques should be applied in the repair of distress.

Fulton Hogan Northland and Downers Northland have provided as reference material their most recent Competent to operate instructional material which should also be utilised. This collaborative approach will enable a regionally consistent delivery of grading and unsealed road maintenance.

20. ARRB (Australian Road Research Board) Unsealed Roads Manual

Latest document version XXXXXX

21. Austroads Unsealed Roads Manual

Latest Document version XXXXXX

22.

23.

24. RAMM Treatment Lengths

RAMM (Road Asset Maintenance Management) Treatment Lengths (TL) are sections of road with similar characteristics and properties that essentially behave and perform uniformly as contiguous sections of pavement. Because of the variable nature of the network and the various factors it is subject to, different TL's require different treatments at different times.

25. Maintenance Intervention Strategy

A Maintenance Intervention Strategy is a concise document that details the strategies and approaches that are adopted for scheduling and approving roading maintenance and improvement work within the Ten-Year Forward Works Programme (FWP).

Several categories of work type are determined by applying the MIS when developing a FWP depending on when or if a future treatment is programmed or, if a treatment has been completed within the expected treatment length's lifecycle.

For a large portion of the roading network where normal use of the road exists and no change in demand is forecast, Normal Maintenance will continue. Where a Treatment Length is programmed for major works, and hence significant investment, the scope and type of maintenance work that should be undertaken in the years preceding investment are to either, achieve the requisite standard/level of service (LoS), or to prevent unnecessary maintenance expenditure. These maintenance interventions are specified by applying the MIS to the forward works programme and then performing a validation of the proposed treatment which could include a robust desktop validation exercise and/or a field validation process that are undertaken by experienced maintenance and asset engineers.

26. Forward Works Programme

27. Maintenance Management Plan

A Maintenance Management Plan (MMP) is a detailed plan setting out how the network will be managed, how renewals of assets are planned and how and when maintenance will be carried out. It focuses on processes used to determine maintenance and renewal need, design of repairs, and includes work and actions for physical work.

28. Activity (Asset) Management Plan

An Activity Management Plan (AMP) is a detailed document that defines:

- Customer Levels of Service;
- Each asset and how that asset is to be managed from its construction through to its demolition & disposal,
- Problems the transport network faces and options for addressing these problems;
- Financial position of the council and its proposed expenditure;
- What else?

NB. Sometimes this is also known as an Asset Management Plan.

29. Background to the MMP

The MMP has been developed from the research undertaken on unsealed roads by the NTA. It incorporates current industry thinking but has also had bespoke asset management process and systems developed within its thinking.

30. Network Segmentation

The unsealed networks in Northland have been classified into NZTA's One Network Road Classification (ONRC). It was identified through the planning stages of the MMP that further segmentation beyond ONRC was required to better understand the people, place and movement functions on the network. This additional granulation of the network is aligned to NZ Transport Agencies evolution of ONRC to the One Network Framework (ONF).

Segmentation of Northlands unsealed network has been completed and a Low, Medium and High demand categorisation designed that is aligned to the maintenance contract inspection led work programming requirements.

The segmentation identifies potential interventions for treatment lengths for all levels of demand.

Levels of demand are set out in the MMP as detailed below:

1. High Demand
2. Medium Demand
3. Low Demand

Three possible interventions can be applied across all levels of road. The demand of the road dictates initial treatment identification into the grid program and further field validation of the proposed treatment is required to confirm a program.

The possible interventions are:

- **Rehabilitation (Rehab) - NZTA Work Category WC211**
    - Design Structural Pavement and Wearing Course
    - Widening (if required)
    - Width Reduction to reduce ongoing maintenance cost where a road is wider than the desired level of service
    - Drainage improvements
    - Safety Improvements
- **Heavy Maintenance - NZTA Work Category WC211 & WC112**
    - Resheeting - Application of a designed wearing course
    - Rip and Remake
    - Shape correction where material depth allows (Lump Sum Item)
    - Dig out and repair
    - Drainage maintenance
- **Routine Maintenance (Do Minimum) - NZTA Work Category WC112**
    - Routine Grading
    - Pothole patching
    - Drainage maintenance
    - Culvert clearing
    - Vegetation control
    - Application of maintenance metal

31. Network Demand

As detailed earlier in the document network demand has been broken into three categories. Low, Medium and High demand.

For these three categories a series of criteria was developed that looks further into the use, people, place and function of a given road rather than just classifying the road section by its AADT.

The three levels of demand have broken the regional and district networks into lengths as follows:

Unsealed Roading Potential Treatment					
Band	Treatment	Length (Km)	WDC (Km)	KDC (Km)	FNDC (Km)
1 – Low Demand	Light/Routine Maintenance	1524	386	667	471
2 – Medium Demand	Heavy Maintenance	1095	221	325	549
3 – High Demand	Rehabilitation	838	84	129	624

From the table above it can be concluded that 44% of Northlands network is very low demand, 31% medium demand and 24% high demand. What this means is that for 75% of rural unsealed roads in Northland intervention in road maintenance can be managed through the application of either a structural wearing course or a do minimum strategy (routine maintenance + sacrificial wearing course). Whilst the remaining 24% of the network carries almost all of the traffic, has significant people, place and function value and therefore requires the establishment of a designed and constructed granular pavement that is protected by a sacrificial wearing course, or unique sections that do not perform as contiguous treatment lengths require a significantly different intervention to minimise lifecycle costs whilst providing consistent levels of service (LoS).

This is a summary of the table and not fully representative of the three individual district networks, where further evaluation of the data shows both Whangarei District Council and Kaipara District Councils networks tend to have significantly lower demands than the Far North District Councils Network. This is particularly noticeable in the high demand banding and aligns to the levels of significant forestry, dairy and produce movements that occur throughout the Far North District.

32. Future Demand

All roads are classified by the NZTA One Network Road Classification (ONRC). For the three Northland networks there are five hierarchy classifications. Arterial, Primary Collector, Secondary Collector, Low Volume and Low Volume Access. The Unsealed network roads for Northland fit into Secondary Collector, Low Volume and Low Volume Access hierarchy's with approximately 85% of all roads falling into the two lowest classifications.

The ONRC classification system sets out guidance for the Level of Service given the roads function, its connection with people, place and movements. Currently there is an evolution from ONRC to the One Network Framework (ONF) being developed by NZTA, this intends to put more focus on the place and people functions of a road. With this change to the ONF some reclassification of the roading network hierarchy will be required once the ONF is adopted by the wider industry.

The Hierarchy is established from traffic volumes that are counted regularly across the network and estimates that are calculated from surrounding growth change where a road is not counted as part of the physical count program.

Validation of the networks ONRC/ONF hierarchy classification is undertaken as part of the AMP and LTP process to determine any changes to LOS when evaluating the networks investment requirements.

If a road or multiple roads LOS has been affected by population growth or decline, a change to the ONRC/ONF hierarchy will occur at the time of AMP development to ensure the appropriate level of investment for road maintenance is provided.

With Northland considered one of the regions experiencing significant population growth it can be expected that the demand on the networks will grow as more people move into the region. Increased population provides more opportunity for the district councils to access the local share component of road maintenance investment but does not necessarily justify NZTA subsidised investment. It is crucial that the networks demand is understood, validated and road hierarchal classifications maintained as part of the evidence and background for the AMP story for all road maintenance investment.

33. Maintenance Practices

All work is identified by the contractor in RAMM through an inspection led process. Currently the rehab of unsealed roads is included into this process. It is planned that adoption of this MIS and the Unsealed Roads MMP will move the pavement preservation activities from this program into a 10-year modelled program. Normal maintenance activities will remain in the find, program, present and fix regime under the maintenance contracts.

For the unsealed network, all work is presented monthly as a proposed program to the clients Maintenance Engineer for consideration and approval. The priority is to protect the safety of the users whilst maintaining the integrity of the existing pavement, surfacing/wearing course and associated assets. Programming drainage maintenance before failure occurs and wearing course applications before pavement layers are exposed will preserve the structural aspect of the carriageway and provide more consistent levels of service and ride quality.

34. Maintenance Contract Standards

New contracts were awarded and commenced on July 1st, 2018. There are now 5 consistent contracts across Northland which enables consistent maintenance management of the three networks. The standards in the Maintenance Contract relate to the physical work required to maintain the condition and extent of the unsealed road network and detail the level of service for maintenance across Northland.

35. Maintenance Assessment Techniques

Maintenance requirements (defect identification) and interventions (treatment selection) are identified and programmed by experienced practitioners based on their knowledge of the network and the data captured that provides informed decision making. This practice should be supported by the impartial measurement of the road condition utilising systems such as Romdas or similar vehicle mounted high speed data collection devices that meet international road profilometry requirements. Additional data collection for monitoring localised change overtime can support the overall maintenance management of the unsealed network and the decision-making process. Smart phone software such as RoadRoid or other types of data collection instruments are expected to be utilised by both the network contractors and Client reps to provide additional snapshots in time of network performance.

36. Current Maintenance Capabilities

The current industry capability is constrained by lack of resources. The Northland Industry has limited access to engineers, project managers and skilled road maintenance workers. This is a result of the lack of regional appeal and being able to attract high calibre staff.

The inability to attract competent high calibre staff was recognised by the three Northland District Councils, the Northland Regional Council, and The New Zealand Transport Agency in 2015. As a result, the Northland Transportation Alliance was established to provide better Client-side professional services to the region.

Through the provision of better client-side management of the networks a more programmed approach to road maintenance should be realised. The programmed approach allows better planning and in return more efficient delivery of programmes.

To assist in delivering better roading services the NTA developed standardised road maintenance contracts. This enables better cross boundary collaboration, attract and retain top tier contractors to Northland and improve the overall capacity and competency of the workforce in Northland. The contract method of delivery for unsealed road maintenance is a combination of fixed monthly lump sums and measure and value.

Further development and as a direct result of the NTA and NZTA's collaboration on road maintenance is a centre of excellence for unsealed road maintenance. The CoE will offer improved delivery consistency to the industry and region, has inclusion of the contractors on the journey to better road maintenance delivery and will have detailed work instructions on how tasks for unsealed road maintenance are to be performed to achieve the levels of service established by ONRC, the Maintenance contracts and the district councils.

Budgets may still be a constraint on delivery largely due to lack of evidence at the time of the 2018-21 AMP delivery, lack of consistent maintenance practices across the region and the reactive nature of unsealed road maintenance delivery historically.

These influences have led to the networks being deficient of budget to apply the right treatment first time and with the lack of programmed renewals, has left the networks suffering from significant distress and lack of granular pavements that support the activities Northlands roads are exposed to such as forestry, dairy & farming traffic, and private users.

The CoE is addressing these issues and a more accurate forecast of ongoing maintenance and renewals costs combined with the programmed approach to maintenance and renewals work will enable efficiencies in the physical delivery of work as well as addressing the shortfalls that have become apparent with the existing levels of investment.

37. Customer Complaints

It is important that there is not overreaction to public complaints or service requests regarding road condition. While some will be of value others are often subjective and the result of other agendas. Before responding to these issues an inspection of the site should be undertaken by an experienced road maintenance practitioner and/or inspector.

The extent of any work otherwise known as intervention and treatment selection needs to be assessed against the level of service provided. Then an intervention will be programmed to protect the integrity of the pavement structure through surface restoration, drainage maintenance or improvements.

38. Maintenance Management and Intervention

39. Maintenance Intervention Strategies

The MIS determines the limitations to be set for maintenance and renewal work on all TL's within the network. The MIS should be aligned with the AMP and all other strategic documents that form part of and inform the intervention decision making process.

The MIS sets the parameters that define the timing, the level of priority, the repair type and dimension guidelines appropriate to each TL at least one year in advance of the treatment proposed in the FWP. The intervention strategies are identified in the FWP grid by an MIS code that is tagged to each TL. The MIS codes guide the Contractor and Client to plan, structure and program the proposed maintenance work in accordance with the appropriate intervention that considers all works completed and all works planned in the FWP. This approach reduces unnecessary work and subsequently inappropriate investment and should be forward looking enough to program all work that is not as a result of an emergency situation such as a cyclone or vehicle accident.

40. Intervention Codes

The following codes are used to identify the various intervention strategies for maintenance and renewals that make up the FWP.

Maintenance Intervention Strategy Codes		
Forward Work Treatment Code	**Code Description**	**Activity**
Maintenance Codes		

NW	Normal Routine Maintenance - Wearing Course Preservation	Treatment length that has been strengthened and received a Wearing Course and is now subject to programmed maintenance to protect and replenish the Wearing Course surface in accordance with FWP cycle and to specification detailed in the maintenance contract.
N	Normal Routine Maintenance – Least Cost Option	Treatment Length is not programmed within years 1-2 of the grid program. Apply the required maintenance to provide the Level of Service to meet the unsealed road standards at least cost. Required treatment to be updated and inclusion into the FWP Grid
HST	Holding Maintenance - Strengthening	Treatment length is programmed for unsealed pavement strengthening and/or wearing course application within Years 1 or 2 of the grid program. Limitations on the use of pavement materials apply, and additional requirements may apply regarding geometry, width, drainage and safety etc.
HSE	Holding Maintenance - Seal Extension	Treatment length is programmed for seal extension or similar within Years 1 or 2 of the grid program. Limitations around the use of pavement materials apply and there may be additional requirements in regard to geometry, width, drainage and safety improvements etc
W	Pavement under Warranty	Pavement Upgrading works undertaken by Council Contractors or by another supplier and under defect liability period or subject to a separate maintenance agreement
S	Special Site	Dust Suppressant, Chemical Stabilisation or other Experimental Trials are programmed or have been undertaken on a Treatment Length. A “do-nothing” approach is applied to enable the long-term performance of the treatment length to be monitored.
DM	Drainage maintenance (restore)	Treatment length is programmed 1 or 2 years into the future and improvements through maintenance works prior to Rehab or Wearing Course intervention

Renewal Codes		
DI	Drainage Improvement	Drainage Improvement Work tagged to a treatment length as part of a wider treatment option in order to prioritise before pavement work commences.
PROJ	Development Project (e.g. realign)	Used to pick up projects that maybe be within a TL that need to be recognised as part of the renewal planning process. Minor safety projects, development conditions of consent ect.
HVYMT	Heavy Maintenance Sites	Generally, indicates a site that requires over ordinary maintenance prior to treatment with Resheeting a wearing course in the following maintenance season.
SE	Seal Extension	Seal Extension

UPS	Unsealed Pavement Strengthening	Rehabilitation of pavement includes appropriate wearing course
UWC	Unsealed Wearing Course	Replenishing of wearing course component, between 70 & 100mm in depth
OS	Otta seal	Used on treatment lengths that have a high Dust Nuisance, or high maintenance costs which may be from higher demand sections, sections with steep elevation and/or proving difficult to manage through normal Unsealed Wearing Course and grading practice.
TS	Traction Seals	Used to identify step hill section that are under continual demand and stress. Resulting in high levels of maintenance where a traction Seal would be the best long-term whole of life cost
BAS	Bridge Approach Seals	Treatment lengths on approaches to bridges that are unsealed where application of a built pavement followed with a chipseal treatment are the best whole of life cost option
UDS	Unsealed Dust Suppression	Treatment Lengths that have or need a Dust Suppression strategy applied by either council or road users, eg. Forestry activity dust suppressant application.
DS	Dust Seals	This identifies Dust Seal specifically targeted at reducing dust nuisance outside of house frontages. This is not a Seal Extension
SFTY	Safety issues	A treatment length that has safety issues that need further investigation or where investigation has occurred and awaiting on the intervention to be applied
URR	Unsealed Rip & Remake	Treatment length where an Insitu intervention is best whole of life option, eg. Road has adequate material but poor shape – Likely routine maintenance Lump Sum item??

41. Treatment Code Maintenance Contract Alignment

All work is aligned to the requirements of and allowances detailed in the maintenance contract. Within the contract there are three streams of work:

- Routine maintenance - Lump Sum operations and client approved dayworks
- Renewals – Client approved Dayworks or Measure and Value activities
- Emergency works – Client approved emergency interventions.

42. Inspection Lead Work Prioritising

The following MIS codes are applied in RAMM on a given Treatment Length to trigger maintenance intervention decision making in in accordance with the maintenance contract work activities described below:

Maintenance Contract Activity	Allowable Intervention

UR01 Pothole Repairs	No Restriction
UR02 Grading	No Restriction
UR03 Failure Repairs	Approval via programme
UR04 Wet Roll and Grade	Approval via programme
UR05 Rip and Remake	Approval via programme
UR06 Pavement Strengthening	Requires Approval
UR07 Wearing Course	Requires Approval

9.1.1 Category NW - Normal Routine Maintenance - Wearing Course Preservation

Application

Normal Routine Maintenance applies where pavement and surfacing renewal has occurred to preserve the wearing course and limit pavement attrition. Occurs where no treatment is nominated in Years 1 to 3 of the FWP.

Objective

To ensure the constructed wearing course is maintained and the underlying pavement is not disturbed, or attrition of the pavement does not occur.

Normal Routine Maintenance – Wearing Course Preservation. Activities comprise of pothole repairs and grading. Placing of additional wearing course aggregate may also occur under this activity.

Preservation of wearing course is paramount to achieve lifecycle return on investment. No rip and remake or major grading should occur within the TL, no or limited use of Sandvik grader blades is necessary to reduce aggregate crushing.

10.1.1 Category N - Normal Routine Maintenance

Application

Normal Routine Maintenance applies where no pavement or surfacing renewal treatment is nominated in Years 1 or 2 of the FWP.

Objective

To ensure optimal use is made of the existing formation, shape and available pavement and surfacing material to minimise expenditure.

Normal Routine Maintenance comprises of pothole repairs, grading & placing maintenance aggregate as agreed.

11.1.1 Category HST - Holding Maintenance Strengthening

Application

This strategy applies to treatment lengths where pavement strengthening is planned in Years 1 or 2 of the FWP.

Objective

To minimise the use of wearing course, pavement aggregates and maintenance aggregate where pavement strengthening is programmed.

12.1.1 Category HSE- Holding Maintenance-Seal Extension

Application

This strategy applies to treatment lengths where, seal extensions or other projects are planned in year 1or 2.

Objective

To limit maintenance inputs that may compromise the proposed future treatment. e.g. Aggregates containing high clay or lime contents on roads proposed for seal extension.

To target road carriageway geometry, width, drainage, and safety improvements in advance of future works.

43. Restricted Activity MIS Codes

The following MIS codes are for all activities where a treatment length has had work undertaken and routine maintenance is now restricted to Asset Managers Approval only.

The MIS codes are applied in accordance with the maintenance contracts allowable works activities described below:

Repair Type	Allowable Intervention
UR01 Pothole Repairs	Requires Asset Manager Approval
UR02 Grading	Requires Asset Manager Approval
UR03 Failure Repairs	Requires Asset Manager Approval
UR04 Wet Roll and Grade	Requires Asset Manager Approval
UR05 Rip and Remake	Requires Asset Manager Approval
UR06 Pavement Strengthening	Requires Asset Manager Approval
UR07 Wearing Course	Requires Asset Manager Approval

13.1.1 Category W - Pavement under Warranty

Application

This strategy applies to treatment lengths that are subject to a warranty or defect liability period due to works being carried by either a third party or under a separate contract arrangement.

Objective

To ensure any faults that appear during the warranty / defect liability period are repaired by the appropriate contractor at no cost to the maintenance contractor and/or council.

Implementation

The network maintenance contractor shall undertake immediate action to make safe any identified safety deficiencies and advise the Engineer. It is anticipated that this will typically involve erecting appropriate temporary traffic management.

The network maintenance contractor shall advise the Engineer immediately of any surface or pavement orientated failures identified within this warranty period and the Engineer shall notify the relevant Contractor as appropriate.

14.1.1 Category S - Special Sites

Application

This strategy applies to treatment lengths that for one reason or another have been excluded from the other maintenance categories, such as trial sites, where the long-term performance of the treatment length is being monitored.

Objective

To protect the test sections from being destroyed inadvertently by maintenance activities.

Implementation

No maintenance work to the road surface shall be programmed unless it's for safety reasons and then only with the express approval of the Maintenance Engineer or Engineers Representative.

Any approved repairs shall be undertaken in accordance with the target standards of Category N.

44. Priorities

The Principal reserves the right to change priorities of programmed work.

These priorities are defined as follows:

15.1.1 *Priority 9 Routine*

Work completed as of right, the “house-keeping” generally found under the routine work lump sum items but may include routine measure and value work as well. This work has a clear intervention point at which point a response time is initiated.

16.1.1 *Priority U Urgent*

Urgent / Callout Poses an immediate safety issue to customers.

17.1.1 *Priority 1 Must Do*

Immediate work required or major failure/defect with significant impact on the network in terms of safety or asset preservation.

18.1.1 *Priority 2 Should Do*

Work that is required in accordance with good practice and doesn’t have an urgency that would make it a Priority 1. Programmed after Priority 1’s and when resources and budget are available.

19.1.1 *Priority 3 Monitor*

The defect does not require work at this stage, but it is apparent that at some point in the near future that it will require attention. Not to be programmed unless the repair exists in a Resurfacing site and needs to be completed as a pre-seal repair to protect the integrity of the Resurfacing treatment.

45. Further Considerations

20.1.1 *Performance Criteria and Intervention Levels*

Appendix A sets out the maintenance contract Performance Criteria and Intervention Levels for each Sub Activity and MIS Category.

It is acknowledged that the levels will not be appropriate to all situations. Their purpose is to provide guidance only on when a defect should be programmed for repair and does not absolve the contractor from maintaining the unsealed network in a safe condition

Appendix A

Allowable Interventions, Performance Criteria and Intervention Levels for MIS Categories

Appendix B

Standard Pavement Treatments in RAMM

UPDATE FOR UNSEALED

AC10	Thin Asphaltic Surf - Mix10
AC15	Thin Asphaltic Surf - Mix15
AC20	Thin Asphaltic Surf - Mix20
CONC	Concrete
DIR	Drainage Imp - Associated with Renewals
DR	Drainage Renewals - Kerb and Channel
DRY5	Drylock - Grade 5
DRY6	Drylock - Grade 6
MAC14	Macadam 14
MEM5	Grade 5 Membrane Seal
MILL	Milling and removal (eg rounda)
OGPA	Open Graded Porous Asphalt
PROJ	Development Project (eg realig)
RECON	Reconstruction - Smoothing
RHAB	Rehabilitation
RHABM	Rehab - Recycling & Make Up Metal
RHABO	Rehab - Overlay
RHABR	Rehab - Recycling
RS	Reseal (chip unknown)
RS2	Reseal - Grade 2

RS24	Reseal - Grade 2/4 Two Coat
RS24R	Reseal - Grade 2/4 Racked in
RS24S	Reseal - Grade 2/4 Sandwich
RS25	Reseal - Grade 2/5 Two Coat
RS25C	Reseal - Grade 2/5 Combo
RS3	Reseal - Grade 3
RS35	Reseal - Grade 3/5 Two Coat
RS35C	Reseal - Grade 3/5 Combo
RS35R	Reseal - Grade 3/5 Racked in
RS35S	Reseal - Grade 3/5 Sandwich
RS4	Reseal - Grade 4
RS46	Reseal - Grade 4/6 Two Coat
RS46R	Reseal - Grade 4/6 Racked in
RS5	Reseal - Grade 5
RS6	Reseal - Grade 6
RSB	Reseal - Big Chip
RSM	Reseal - Multiple Chip Grades
RSS	Reseal - Small Chip
RSU	Reseal - Unknown Chip
SEALX	Seal Extension
SLRY	Slurry Seal
SMA	SMA 10
STAC	Structural asphaltic concrete
SWM	Seal Widening - Maintenance
SWR	Seal Widening - Associated with Renewals
SWS	Seal Widening - Safety
TAC	Thin asphaltic concrete
TEXT	Texturising Seal
USB40	Unsealed Basecourse - AP40
USB65	Unsealed Basecourse AP65 (log routes)
USBLOC	Unsealed Basecourse - Local Material
USW30	Unsealed Wearing Course - CRAP30
USWLOC	Unsealed Wearing Course - Local Material

VF	Void Fill Seal

Standard Reasons for Treatments in RAMM

REASON	REASON DESCRIPTION
BD	Birthday seal
CR	Cracking
CR	Cracking
DI	Inadequate Drainage
FL	Flush
LT	Loss of Texture (not flushing)
OT	Other (reason notes required)
PA	Pavement Repairs and their Patches (subgrade)
PH	Potholes and their Patches (surface issue)
PS	Polished Stone (from SCRIM)
RG	Roughness
RU	Rutting
SC	Scabbing
SE	Second Coat
SH	Shoving and its Patches (roadbase)
TT	Traffic Threshold
UI	Urban Issues (noise, etc)

Appendix C

Forward Work Programme

Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendix 03

Drainage

Overview and Management
Problems, Benefits, Consequences
Options Assessment

Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendix 03

Drainage

Table of Contents

1. Overview

1.1 Description

The drainage activity consists of the following breakdown of categories:

- 44,657No Culverts – only those not considered 'major culverts' as these are covered in the Bridges and Major Culverts Activity (FNDC – 19,784No, KDC – 12,678No, WDC – 12,195No)
- 10,933No Catchpits & Sumps & Drains (FNDC – 2,628No, KDC – 1,949No, WDC – 6,356No)
- 806No of Subsoil Drains (FNDC – 265No, KDC – 275No, WDC – 266No)
- 1,204No Manholes (FNDC – 290No, KDC – 122No, WDC – 792No)
- 5,698km of Surface Water Channels (SWC) (FNDC – 2,163km, KDC – 1,735km, WDC – 1,800km)
- 96km of Dished Channel (FNDC – 28km, KDC – 12km, WDC – 56km)
- 894km of Kerb (with and without Channel) (FNDC – 262km, KDC – 108km, WDC – 524km)

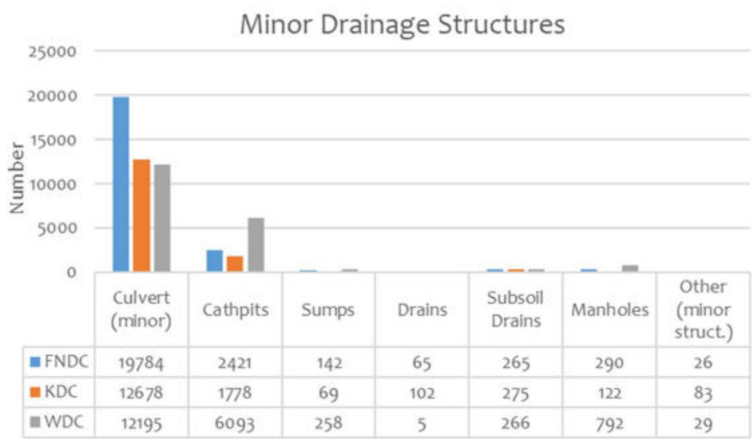


Figure 1-1: Number of minor drainage structures

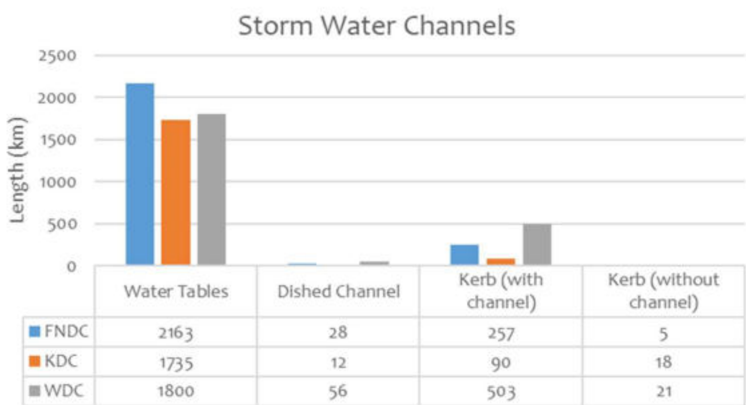
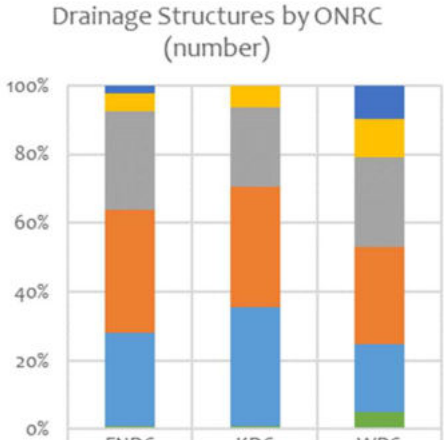
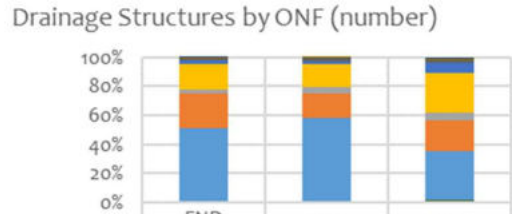


Figure 1-2: Length of storm water channels

Figure 1-3 below shows the minor drainage structures asset distribution by ONRC (Left) and ONF (right).



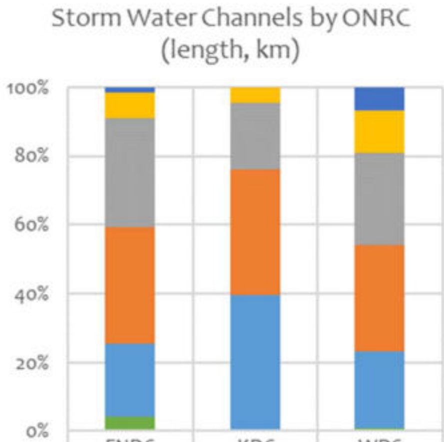
	FNDC	KDC	WDC
Arterial	488	0	1,912
Prim Col	1,230	976	2,230
Se Col	6,636	3,468	5,110
Access	8,211	5,275	5,549
Low Vol	6,267	5,266	3,834
Unkown	161	122	1,003
Total	22,993	15,107	19,638



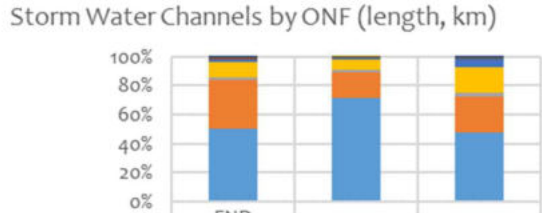
	FNDC	KDC	WDC
Main Streets	64	0	166
Civic Spaces	67	3	121
Activity Streets	262	346	431
Stopping Places	6	31	3
Interregional Con	0	0	0
Transit Corridors	0	0	6
Urban Connectors	623	298	1,427
Local Streets	4,061	2,393	5,415
Peri-urban Roads	633	688	1,002
Rural Connectors	5,463	2,493	4,229
Rural Roads	11,742	8,728	6,560
Unkown	72	127	278
Total	22,993	15,107	19,638

Figure 1-3: Minor Drainage Structures by ONRC (Left) and ONF (right)

Figure 1-4 below shows the storm water channel asset distribution by ONRC (Left) and ONF (right).



	FNDC	KDC	WDC
Arterial	40	0	159
Prim Col	183	81	295
Se Col	771	362	639
Access	832	678	739
Low Vol	527	722	530
Unkown	100	12	17
Total	2,454	1,855	2,380



	FNDC	KDC	WDC
Main Streets	6	0	8
Civic Spaces	4	0	0
Activity Streets	24	15	29
Stopping Places	6	2	0
Interregional Con	0	0	0
Transit Corridors	0	0	1
Urban Connectors	43	22	141
Local Streets	256	123	409
Peri-urban Roads	51	42	76
Rural Connectors	826	318	587
Rural Roads	1,232	1,320	1,110
Unkown	6	11	19
Total	2,454	1,855	2,380

Figure 1-4: Strom Water Channels by ONRC (Left) and ONF (right)

1.2 Monitoring and Condition

1.2.1 *Inspection*

Routine inspections are carried out through the maintenance contracts.

1.2.2 *Condition*

Condition rating is completed on surface water channels to identify maintenance issues. The items that are rated for condition are:

- % blocked
- channel ineffective
- broken channel.

This data is used in the Treatment Selection Analysis in RAMM to help define the maintenance requirement and identify where defective channels may be having a detrimental impact on the allowing the ingress of water into the pavement.

Only five of the sub-surface drainage assets have been assigned a condition rating, with two being 'average' and three being 'excellent'. There is no formal condition rating of culverts and catch pits and drop structures. The routine inspections are relied upon to identify priority issues and report these accordingly.

1.3 Overall Strategy

Known flooding hotspots will be identified in RAMM. Prior to an extreme weather event, these locations will have a routine drainage maintenance crew inspect and clear any blockages. After the extreme weather event, and when it is safe to do so, the routine drainage maintenance crew will reinspect these locations, addressing any defects that can be remedied immediately, and programming other more significant repairs.

A summary of the overall strategy for the next 5–10 years is:

1.3.1 *Surface Water Channels*

- **Maintenance** – It is intended to carry out a programme of storm water channels (SWC) maintenance to reinstate proper roadside drainage throughout the network. This will reduce water ingress into pavements and extend pavement life as well as minimising the impact of severe weather events and flooding.

  SWC maintenance is planned for Spring, Summer and Autumn. Undertaking a four-year cycle to complete the full length of the network using the criticality model to address the most critical roads first and then working down through the ONF demand. This will provide a functioning drainage network where it is needed and positively contribute to mitigating flooding during storm events.

- **New SWC** – develop a programme of work to create SWC where no assets currently exist.

1.3.2 Kerb and Channel

The amount of kerb and channel is increasing as a result of the regional growth and new subdivisions.

- **Maintenance** –undertake four rounds of street sweeping a year, one per season.
- **Renewals** – will be aligned with the footpath renewal programme, and sealed road resurfacing and rehabilitation programmes.

1.3.3 Catchpits

There are various types of catchpits across the networks, some with kerb and channel, some in SWC, and others that are isolated to manage roadside stormwater runoff.

- **Maintenance** – All catchpits will be cleaned at least once a year. Certain catchpits will need to be cleaned more frequently due to reoccurring blockages and flooding. These need to be identified in RAMM so an additional cleaning programme can be managed.
- **Renewal** – Damaged catchpits will be replaced as required. Replacement can be programmed with kerb and channel renewals.

1.3.4 Culverts

An annual workload for culvert maintenance is derived from the annual inspection of all culverts. Updating the condition and culvert information is part of this process. In time the workload on this asset will stabilise after the first few rounds of inspection and maintenance. A heightened workload of culvert cleaning usually following storm events.

- **Maintenance** – All culverts will be inspected annually, culverts identified as blocked will be programmed to be cleaned.

  Culvert inlets and outlets will be cleaned while undertaking SWC maintenance, if the barrel is deemed to be blocked after attempting to clear the barrel with a spade, the culvert will be programmed for jetting no later than one month from date of identification.
- **Renewal** – culverts need to be replaced if they are undersized, misaligned, damaged, or deemed to be inadequate where geometric improvements are to be undertaken. Renewal work can be aligned with other activities such as pavement rehabilitation, and footpath renewals or as bespoke activities.

2. Management Plan

2.1 Management

2.1.1 *Maintenance Contract*

Most of the maintenance and operations associated with this activity are conducted by the maintenance contractors and governed by the Road Maintenance Contract. This contract only covers components such as kerb and channel, surface water channels, culverts, catchpits and manholes, it does not cover underground pipe networks as these are owned and maintained by the Councils Waste and Drainage Division.

2.1.2 *Ownership*

Both the Roading Department and the Waste and Drainage Department are responsible for drainage assets. In general, the Roading Department is responsible for roadside drainage (kerb and channel etc.) while the Waste and Drainage Department are responsible for any under-ground assets.

2.1.3 *NZTA*

As part of the MOU with NZTA, NZTA is responsible for all the drains in the state highway corridor other than land drains in the rural area and where they form part of the reticulation system in the urban area. Each respective Council is responsible for channel cleaning of all urban state highways which is funded from the State Highway Programme.

2.2 Acquisition

Acquisition of drainage facilities is generally as part of new infrastructure through roads being vested with Council, major capital projects and road improvement projects such as rehabilitations and seal extensions.

2.3 Maintenance

Drainage facilities are inspected during the routine network inspections. Any minor maintenance requirements identified are undertaken as per the Maintenance Contract, with major maintenance requirements becoming programmed work.

There is a pool of identified deficiency on the network related to drainage. These are continually being recorded as dispatches in RAMM Contractor and ranked accordingly.

Budget constraints continue to hinder the ability of the NTA to implement and treat the identified drainage deficiency on the network. The focus will be on carrying out surface water channel maintenance on arterial and forestry roads on the network to minimise water ingress into pavements to extend the pavement life and reduce pavement maintenance.

A maintenance plan has been developed for the sealed condition ratings, undertaken annually for high traffic volume roads and once every two years for lower volume road, as it identifies the level of surface water fault on the network. This is based on the outcomes of the treatment selection algorithm in RAMM and the works required are generally completed as part of any associated pavement and surface renewal works.

In addition, the council has over the past few years implemented a maintenance strategy of allocating a portion of the kerb and channel maintenance budget to replace damaged kerb and channel in conjunction with the road resealing programme. As part of the annual reseal programme, all kerb and channel defects are removed.

2.4 Renewals

The bulk of all drainage renewals is associated with pavement and surface renewal works. At the time of design, the effectiveness and condition of the related drainage is assessed and renewed where required. Surface water channel renewal works are identified through routine inspections and programmed maintenance. Where this is the case, the project is recorded as a dispatch in RAMM Contractor and prioritised based on risk and benefit.

The failure modes and condition indicators that are used to determine the renewal of drainage facilities are shown in the Maintenance Contract.

2.5 Improvement

Minor Improvements generally consists of the up sizing of specific culverts or the construction of drainage structures in relation to the restoration of a flood damage site. These improvements are to be considered at the time of undertaking renewals of the drainage system.

The Northland Transport Alliance (NTA) has developed a Resilience Strategy. This strategy identifies critical culverts and overland flow paths that are at high risk of causing road washout or slips during heavy rain events. Drainage improvement identified through this strategy will be prioritised and undertaken as funding allows.

3. Problems, Benefits, and Consequences

This section outlines problems affecting the drainage network and details the benefits or consequences of doing or not doing something to address these problems.

3.1 Key Issues

3.1.1 Problem Description

Until recently drainage maintenance and renewals on the local road network in Northland has been undertaken in a piece-meal manner as and when funding allows. The focus to date has been largely reactive, addressing drainage when culverts become blocked or flooding is identified through members of the public or inspection. Drainage renewals are also undertaken on roads being rehabilitated.

The maintenance contracts for each council that commenced in 2018 include annual culvert inspections. This has gone a long way to helping keep culverts clear of debris and to identify programmes to clean the culvert barrels.

A big concern has been the lack of adequate focus and investment of the roadside watertables which make up about 90% of the drainage system. Watertables ensure that water is channelled away from the pavement to reduce the likelihood that it will either soak into the pavement or soften the subgrade causing premature failure. They also prevent water from scouring out the road or ponding on the carriageway through having a high lip. Watertables often become blocked due to vegetation growth, sediment build up or minor overslips filling up the watertable. Watertables on unsealed roads are a particular issue through grader operations pushing gravel into the drains or creating a high lip which prevents water from draining off the pavement.

Some examples of inadequate watertables are shown below Figure 3-1 and Figure 3-2 following.

Figure 3-1: Inadequate watertables

Figure 3-2: Inadequate watertables

FNDC, KDC and WDC have no regular cycle of watertable clearing and this is undertaken on an ad-hoc basis as problem areas are identified.

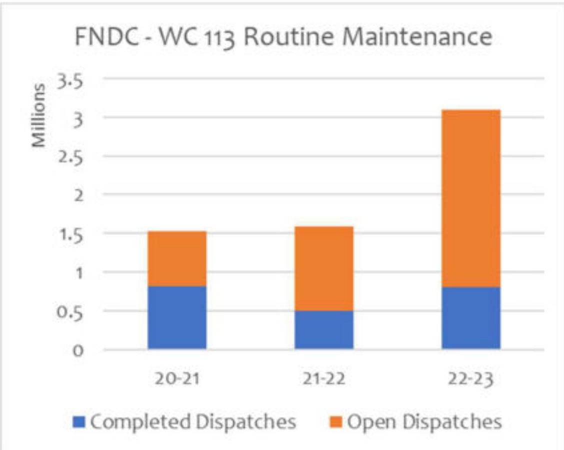
The NTA is nearing the completion of a Drainage Plan and Maintenance Intervention Strategy. This needs to be rolled out to the NTA maintenance teams and maintenance contractors to ensure that the right interventions are undertaken at the right time.

A key part of this plan is the development of a forward works programme for drainage works and in particular watertable maintenance. This programme will identify the highest risk drainage needs on the council networks, which will mean that these works will be able to undertaken in a proactive manner and be timed to precede pavement renewals such as resurfacings, rehabilitations or heavy metalling which will extend the life of the pavements and reduce overall spend on the network.

Adequate drainage funding is required to ensure that these drainage renewals are able to be undertaken in a timely fashion to maximise the benefits of this work.

Far North District Council (FNDC)

The drainage routine maintenance and renewals completed and opened dispatches over the last three years is summarised in Figure 3-3 below. The figure shows a steady trend of completed dispatches for both maintenance and renewals activities and increasing trend of opened dispatches for both maintenance and renewal activities, which is concerning.



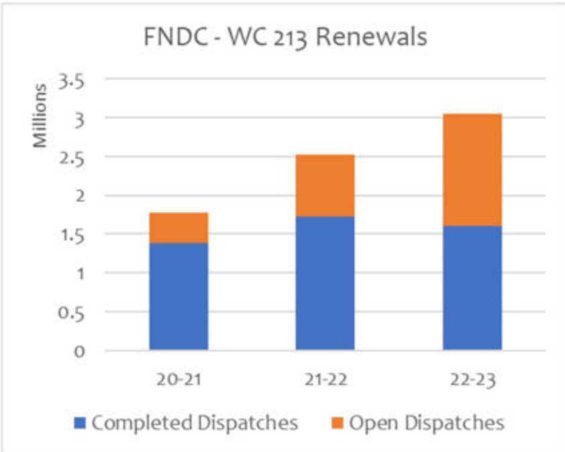


Figure 3-3: FNDC drainage dispatches for routine maintenance and renewals

Kaipara District Council (KDC)

The drainage routine maintenance and renewals completed and opened dispatches over the last three years is summarised in Figure 3-4 below. The figure shows a fluctuating trend of completed dispatches for maintenance, decreasing trend of completed renewals, and increasing trend of opened dispatches for both maintenance and renewal activities, which is concerning.

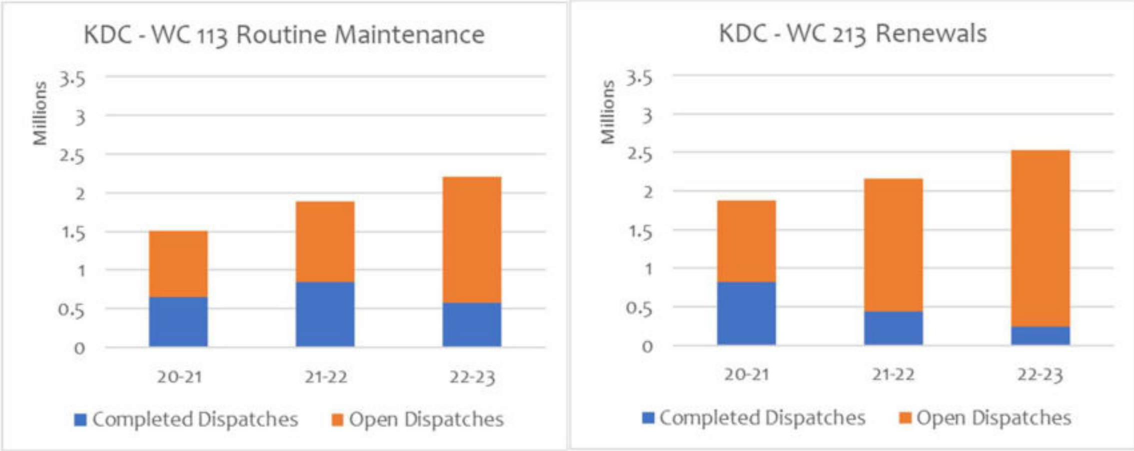


Figure 3-4: KDC drainage dispatches for routine maintenance and renewals

Whangarei District Council (WDC)

The drainage routine maintenance and renewals completed and opened dispatches over the last three years is summarised in Figure 3-5 below. The figure shows a steady trend of completed dispatches for maintenance, decreasing trend of completed dispatches for renewals, and increasing trend of opened dispatches for both maintenance and renewal activities, which is concerning.

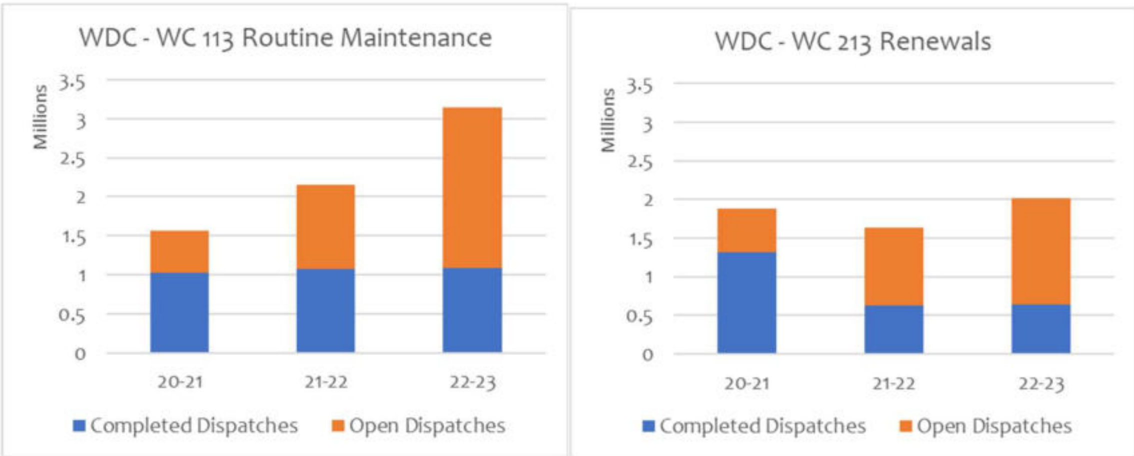


Figure 3-5: WDC drainage dispatches for routine maintenance and renewals

Overall, there is a general trend on increased opened dispatches for both maintenance and renewals activities. Therefore, more funding is required to address the backlog and risk based prioritised forward work programme.

3.1.2 Key Issues and Actions

- The maintenance and renewals of drainage systems in the past has been inadequate to control water flows to keep pavements free of water ingress and to prevent flooding and scour of roads, particularly on the unsealed network.
- Culverts are now being inspected annually and this is addressing culvert blockages, however there is no adequate programme to address blocked watertables which make up 90% of the drainage network.
- The NTA Drainage Plan and Maintenance Intervention Strategy is being finalised which should enable proactive treatment of high-risk areas. This needs to be rolled out to the NTA maintenance teams and maintenance contractors to ensure that the right interventions are undertaken at the right time.
- Overall, there is a general trend on increased opened dispatches for both maintenance and renewals activities. Adequate drainage funding is required to ensure that these drainage renewals are able to be undertaken in a timely fashion to maximise the benefits of this work.

3.1.3 Benefits

- A fit for purpose drainage system that minimises water ingress into pavements thus extending pavement life and reduces the likelihood of flooding and slips during heavy rain events.
- The roll out of the Drainage Plan and Maintenance Intervention Strategy should result in more focus to identify inadequate watertables in areas that are high risk for water ingress, flooding and scour.
- Adequate funding of the Drainage Plan's forward works programme will enable proactive treatment of these high-risk areas which should prolong the life of the pavement and surfacing and will reduce the amount of water flooding across roads.

3.1.4 Consequences

- Pavements will continue to fail prematurely due to water ingress. Slips and flooding will continue to cause resilience issues on our roads during heavy rain events resulting in road closures that often affect freight, tourist and detour routes, key lifelines and isolated communities.
- Without the roll out of the Drainage Plan and Maintenance Intervention Strategy, maintenance teams and crews will continue to identify watertable issues only when they cause pavement failures or flooding problems.
- Without the provision of adequate funding to fund the Drainage Plan's forward works programme, watertables will carry-on being maintained in an ad-hoc manner which will continue to allow water into pavements causing premature failure and additional pavement costs.

3.2 Strategic Case – Bottom-Up Assessment

During the development of the AMP, the NTA held a series of workshops to test and refine the problem statements and to determine the strategic response to address the problems. This is shown in the following tables.

Draft Problem Statement			
Fragmented historic maintenance of drainage systems has increased the susceptibility of our pavements to water ingress and premature failure. It also increases the likelihood of flooding and slips during heavy rain events.			
Current AMP - Key responses outlined in Strategic Case:			
WDC & FNDC - Record condition data on drainage assets through the maintenance contracts. Drainage programme to be included in the dTIMS model to prioritise the optimum programme of watertable maintenance. Develop a programme of culvert renewals through the proposed Resilience Strategy. KDC – Increase spend on culvert replacements to replace undersized culverts on Primary and Secondary collectors. NTA – Develop a programme of drainage renewals. Increase funding to prioritise watertable maintenance.			
Current Work that is being undertaken:			
New Maintenance Contracts are now doing an annual culvert inspection and inlet/outlet cleaning regime. Inadequate drainage systems are being addressed through pavement rehabilitation projects. Inspections of other drainage systems such as watertables and kerb & channel are carried out on a cyclic basis, but maintenance activity is still being carried out on an ad-hoc basis. Annual culvert inspections – these are resulting in a programme of culvert barrel cleaning. Work being programmed to change the alignment and grade of the culvert where necessary. Some culverts are being upsized in conjunction with the realignment/regrading work. Grading activities on unsealed roads – are cleaning out watertables but not to specification.			
Aspects of the problem not being addressed and benefits not being delivered?			
Insufficient watertable maintenance being undertaken to keep drainage system working properly. Significant backlog of watertable maintenance likely. Drainage Plan and FWP still being developed. MIS and maintenance guideline also being developed. Training of grader operators needs to ensure watertables being maintained to specification.			
Is the Problem Statement still relevant? If "No" what are the deficiencies? If "Yes" has priority changed?			
High priority – because area where big gains can be made.			
If Problem is not being addressed by the current work, what is the strategic response?			
Strategic response	**Y/N**	**Rank**	**Detail**
1 - Programme adjustment: example, Remove/reduce projects/activities.	Y	1	Increase the amount of watertable maintenance and renewals to provide a fit for purpose network of drainage systems which will reduce water ingress into pavements. In the long term, this approach is likely to result in less pavement rehabilitation and resurfacing being required.
2 - Policy approach: example, Adjust level of Service.	Y	2	Increase in culvert sizes, where appropriate, can result in less debris build up, flooding and outlet scour.
- Demand management: example, Manage use – up/down.	Y	3	Demand is largely dictated by weather patterns. However, demand can be partially governed by factors such as culvert placement (to align with watercourses) and appropriately located cut-outs and discharge points. This can reduce the amount of water flow on watertables.
4 - Funding adjustment: example, Increase/decrease	Y	-	Ties to Options 1, 2 and 3 above.
5 - Risk based: example, Hold Assets longer.	N	-	Holding drainage assets longer is inappropriate. This effectively has been the approach in the past and have resulted in the drainage systems not currently being fit for purpose.
How effective are the options? (as per Multi Criteria Assessment below)			

Option 1 – Increase watertable maintenance and renewal programme - Score 1.8 out of 3 (Preferred). Option 2 – Increase culvert sizes - Score 1.2 out of 3 (Preferred). Option 3 – Change demand by reducing length of water running along the road – Score 0.3 out of 3.
Draft an updated problem statement (if applicable)
The procurement structure of the maintenance contract combined with the major events, such as COVID lockdowns, cost escalations, limited resources and compounding storm events are creating a large increase in drainage work, which in turn results in further deterioration on all roads.

Strategic Case Multi Criteria Option Analysis, RCA: NTA
Problem: Drainage

Short list up to 3 options from the following - Can we make-----

Option	Yes/No	Reason	Rank
1 Programme adjustment eg, Remove/reduce projects/activities	Yes	Increase the amount of watertable maintenance and renewal to provide a fit for purpose network of drainage systems which will reduce water ingress into pavements. In the long term, this approach is likely to result in less pavement rehabilitation and resurfacing being required.	1
2 Policy approach eg, Adjust level of Service	Yes	Increase in culvert size, where appropriate, can result in less debris build up, flooding and outlet scour.	2
3 Demand management eg, Manage use – up/down	Yes	Demand is largely dictated by weather patterns. However, demand can be partially governed by factors such as culvert placement (to align with watercourses) and appropriately located cut-outs and discharge points. This can reduce the amount of water flow on watertables.	3
4 Funding adjustment. eg, Increase/decrease	Yes	Ties to Options 1, 2 and 3 above.	-
5 Risk based eg, Hold Assets longer	No	Holding drainage assets longer is inappropriate. This effectively has been the approach in the past and have resulted in the drainage systems not currently being fit for purpose.	N/A

Criteria/Drivers to consider	**Weighting** (Importance) (Total to 100%)	**How good is this option**					
		Option 1 - Increase watertable maintenance		**Option 2 - Increase culvert size/capacity**		**Option 3 - Improve cutout and culvert locations**	
		Raw	**Score**	**Raw**	**Score**	**Raw**	**Score**
Meets GPS	10%	2	0.2	2	0.2	0	0
Meets RLTP	10%	2	0.2	2	0.2	1	0.1
Addresses Problems	20%	2	0.4	1	0.2	1	0.2
Will realise Benefits	10%	2	0.2	1	0.1	1	0.1
Will meet Community Outcomes	10%	2	0.2	2	0.2	0	0
Will meet Customer Outcomes (CLOS)	10%	2	0.2	2	0.2	0	0
Provides high Performance impacts	10%	2	0.2	1	0.1	0	0
Provides high Environmental Impacts	5%	2	0.1	2	0.1	0	0
Provides Cultural Impacts	5%	0	0	0	0	0	0
How Costly	10%	1	0.1	-1	-0.1	-1	-0.1
Other 1							
Other 2							
Other 3							
Other 4							
Totals	100%		1.8		1.2		0.3

Scale of impact

Impact	**Score**
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

3.3 Strategic Case Summary (Line of Sight in Action)

Based on the assessment of the problem statement and the strategic responses undertaken in the previous section, a summary of the results and the affected work categories are shown in the table below:

Issue	Drainage
Problem Statement	The procurement structure of the maintenance contract combined with the major events, such as COVID lockdowns, cost escalations, limited resources and compounding storm events are creating a large increase in drainage work, which in turn results in further deterioration on all roads.
Benefits	• Improve pavement and surfacing life by reducing water ingress. • Reduce flooding and slips.
Trend	Getting Worse
Strategic Response	**Programme Adjustment** Increase watertable maintenance and renewal programme. **Policy Approach** • Increase culvert sizes.
Activity/Work Category	WC 113 Routine Drainage Maintenance. WC 213 Drainage Renewals. WC 341 Low Cost / Low Risk Improvements.

4. Options, Assessment and Alternatives

4.1 Option Identification (Root Cause Analysis)

Following the identification of the problem statements, a root cause analysis was undertaken to identify the underlying causes of these problems. The root cause analysis was undertaken using the "5 Whys" type methodology in accordance with NZTA's Business Case Approach Practice Note No.3 – Root Cause Analysis in Business Case Development.

This process was undertaken through a series of workshops with the NTA Assets Team and NZTA local representative to determine the underlying causes of the identified problems. This was a bit of a deep dive into the myriad of issues that affect the transport network and a multitude of root causes were identified for each problem statement.

For each root cause, a possible solution (option or alternative) was identified to try and address this cause. These solutions ranged from high level interventions such as changing council policies and developing strategies to low level interventions such improving grader operator training.

The following table include the results of the root cause analysis and the possible solutions to address the problem statements.

Root Cause Analysis – Drainage

Problem statement	**Cost escalations, limited resources and compounding storm events are creating a large increase in drainage work, which in turn results in further deterioration on all roads.**						
why 1	Significant gaps in a continuous Surface water channel systems.	Inadequate culvert sizes.			Fragmented historic maintenance and renewals of existing drainage systems.		
why 2	Roadside channels and Culverts were installed to old standards which are no longer relevant for capacity.				No consistent Maintenance intervention strategy (MIS).	Cost Escalation (approx. 22% on Contract over years 1 & 2) have reduced the quantity of ordered works: renewals increasing the backlog.	Inclement weather has delayed preventative and renewal operations in year 2 - too wet and too many storms.
why 3	catchment management plans not considered by district council.	Climate Change impacts include increase in storm intensity and associated storm flows.	Urban growth and old drainage planning systems are not coping.	No provision for Fish Passage in original culvert sizing.	Moderated programme of ordered maintenance works increasing the backlog of maintenance dispatches.	The balance of Lump sum and Measured works in the contract is susceptible to higher escalation.	Ten significant storm events over eleven months have the maintenance contractors working on immediate storm response (Emergency Works) rather than preventative maintenance or renewals.
why 4	Road adjacent land owners inappropriately developing land, causing water passage blockages - vehicle crossings!	Under investment in upgrading to deal with increased in capacity.	Not designed for urban intensification.	Relevant new Document only issued in 2020.	Contractor did not resource up to compensate for backlog of works.	The Maintenance contract structure does not take account of escalation beyond that set in the LTP (approx. 2.5%).	Maintenance contract structure was not set up to deal with continuous climatic impacts lasting months/years.
why 5	lack of QA undertaken by council at consent sign off.	No funding for resilience strengthening our network.	EES document out of date from sector.		No financial benefit under our maintenance contract for accelerated works.	Maintenance Contractor has been unwilling to undertake ordered works that cost more than their rates due to CPI being applied annually.	Climatic adaptation has not been a significant part of Northland strategic direction in the past. (Resilience strengthening).
Potential Solutions	Need to fund improvements for full catchment management and strengthen Council QA and consenting processes. Improve watertable maintenance to avoid water ingress into pavements.	Funding increase to upgrade system to cope with increased demand. Provide additional culverts or cut-outs to reduce watertable flows.	Need to fund improvements for urban intensification in drainage stormwater systems.	Need to align with new standards: Wai Māori Matuatua - Essential Freshwater, fish passage. Culverts to be properly designed. Replace culverts that are too flat, disjointed or have inadequate cover.	Need to fund backlog of drainage maintenance as a priority as it impacts on several other assets. Provide drainage FWP and MIS.	Include in review of Maintenance Contracts - of the balance and risk to fixed cost contracts between lump sum works and ordered works has to be reviewed. Improve grading with operator training to avoid watertables being filled with gravel.	Flexibility in Maintenance structure to address storm events. And we need to include Climatic adaptation Strategy response and programme of works to resilience strengthen our network of sealed roads. Maintenance of drainage system where there is a high risk of flooding or slips.

4.2 Option Development

The following table was developed by the Roading Efficiency Group as part of a top-down assessment of options to address the identified problems. They summarise the responses in the existing AMP, the effectiveness of the existing programme and the proposed options which have been determined from the root cause analysis which should be considered as part of the option assessment.

Statement Problem	Key Responses In existing AMP	Summary of effectiveness of existing programme	Proposed Programme Business Case adjustments (from Root Cause Analysis)
The procurement structure of the maintenance contract combined with the major events, such as COVID lockdowns, cost escalations, limited resources and compounding storm events are creating a large increase in drainage work, which in turn results in further deterioration on all roads.	• WDC & FNDC - Record condition data on drainage assets through the maintenance contracts. Drainage programme to be included in the dTIMS model to prioritise the optimum programme of watertable maintenance. Develop a programme of culvert renewals through the proposed Resilience Strategy. • KDC – Increase spend on culvert replacements to replace undersized culverts on Primary and Secondary collectors. • NTA – Develop a programme of drainage renewals. Increase funding to prioritise watertable maintenance.	• Current drainage activity is insufficient to properly maintain the drainage system and is resulting in localised flooding and water ingress into pavements. • Drainage maintenance (particularly watertable maintenance) could be used as a COVID-19 stimulus. • Key issues from Root Cause Analysis: o Watertables and cut outs not being cleared by the grader operations. o Historic lack of investment in watertable maintenance. o Lack of condition data for watertables o Some areas have no drainage systems provided, e.g. urban grass berms o Blockage of culverts causing slips, washouts or flooding. o Culvert size inadequate, not at self-cleaning slope or insufficient cover in many areas o Disjointing of old butt end pipes causes tomos to form. o Scouring of watertables due to high stormwater flows in roadside drains	• Provide adequate training to grader operators and NTA maintenance staff to avoid watertables being filled with gravel. • Provide drainage FWP and MIS. This is likely to require additional funding, particularly for watertable maintenance. • Develop processes and collect watertable condition data. • Provide subsoil drains for areas with no surface water drainage • Ensure that high risk culverts are inspected and cleaned before heavy rain events • Ensure that culverts are properly designed so that they have sufficient waterway, are at self-cleaning slopes and have sufficient cover. • Treat disjointed or butt end pipe culverts • Provide additional culverts or cut outs to reduce high flows in roadside drains

5. Option Assessment

The following sections analyse options for addressing the problems and issues identified in the Strategic Case. These options have been identified through the Root Cause Assessment.

For the assessment of the data, peer group analysis and option assessment, a five point “traffic light” rating system has been used as shown in the following schematic. This rating system is based on a qualitative assessment of the LOS and cost comparison data.

5-point traffic light rating system

Performance Rating	Symbol	For LOS this means:	For Costs & Achievement this means:	Trend Rating	Symbol	For LOS this means:
Very Good		Much Better than Peer Group Average	Much Less than Peer Group Average	Improving Trend		Positive Change towards a Very Good rating
Good		Better than Peer Group Average	Less than Peer Group Average	Worsening Trend		Negative Change away from a Very Good rating
Average/Moderate		Similar to the Peer Group Average	Similar to the Peer Group Average	Static Trend		No Change
Poor		Worse than Peer Group Average	Higher than Peer Group Average			
Very Poor		Much Worse than Peer Group Average	Much Higher than Peer Group Average			
No Data		No Data	No Data			

Work Categories:	WC 113 Routine Drainage Maintenance WC 213 Drainage Renewals WC 341 Low Cost / Low Risk Improvements

5.1 Links to Strategic Case

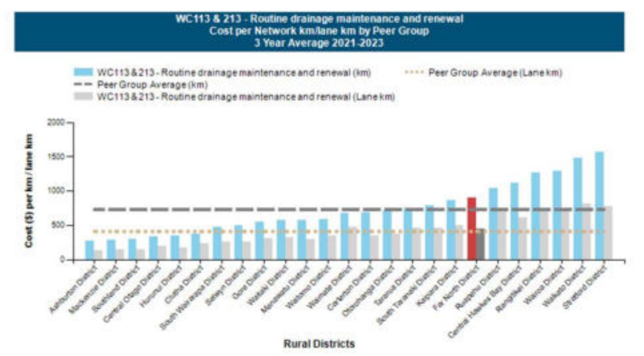
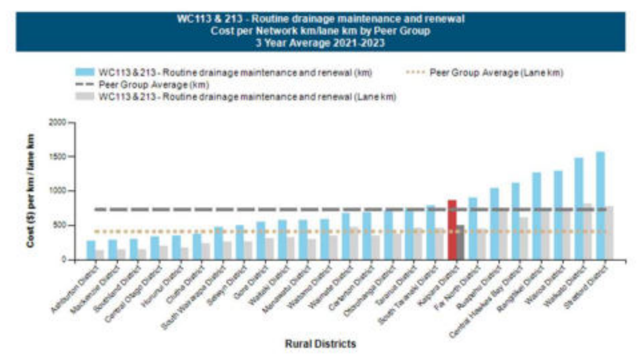
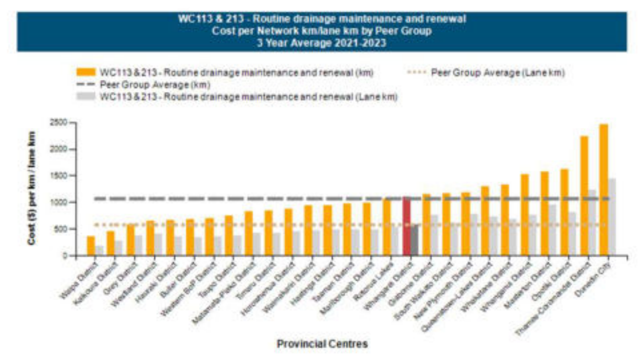
Problem Statement:	The procurement structure of the maintenance contract combined with the major events, such as COVID lockdowns, Cost Escalations, Limited resources and Compounding Storm Events are creating a large increase in drainage work, which in turn results in further deterioration on all roads.
Benefits of Addressing Problem:	A fit for purpose drainage system that minimises water ingress into pavements thus extending pavement life and reduces the likelihood of flooding and slips during heavy rain events.
Consequences of Not Addressing the Problem:	Pavements will continue to fail prematurely due to water ingress. Slips and flooding will continue to cause resilience issues on our roads during heavy rain events resulting in road closures that often affect freight, tourist and detour routes, key lifelines and isolated communities.

5.2 Levels of Service

ONRC Customer Outcomes:	ONRC Resilience CO1 – The number of journeys impacted by unplanned events (no data available) ONRC Resilience CO2 – The number of instances where road access is lost (no data available)
Customer Levels of Service:	LTP 1.1.X – Decreasing trend in resilience related faults on key routes (new measure, no data available)

5.3 Evidence and Gap Analysis

NZTA Peer Group Charts – 3yr Cost/km WC 113 & 213 Routine Drainage Maintenance and Drainage Renewals

FNDC	KDC	WDC
		
FNDC Drainage Maintenance and Renewals Cost – FNDC's drainage cost is in the top third of its peer group. This was partially caused the NZTA funded Forestry Road Strengthening programme. This level of drainage maintenance and renewal is probably reasonable given Far North's poor moisture sensitive soils and high levels of rainfall and high intensity rain events. A focus area going forward will be to carry out a cyclic programme of watertable maintenance to reduce water ingress into pavements. This should result in lower sealed and unsealed pavement maintenance costs in the future.	**KDC Drainage Maintenance and Renewals Cost** – The KDC drainage cost is in the top third of its peer group. Kaipara has poor moisture sensitive soils and high levels of rainfall and high intensity rain events. And reflects a lack of focus on drainage maintenance in the past. Kaipara is currently achieving watertable maintenance cycles at longer than desired intervals, where a 5-year cycle is considered optimum. A focus area going forward will be to carry out a cyclic programme of watertable maintenance to reduce water ingress into pavements. This should result in lower sealed and unsealed pavement maintenance costs in the future.	**WDC Drainage Maintenance and Renewals Cost** – The WDC drainage cost is near the average for their peer group. This is low given that Whangarei has poor moisture sensitive soils and high levels of rainfall and high intensity rain events. There has also been a lack of focus on drainage maintenance in the past. A focus area going forward will be to carry out a cyclic programme of watertable maintenance to reduce water ingress into pavements. This should result in lower sealed and unsealed pavement maintenance costs in the future.

5.4 Options to be Considered (S.6, P.337)

Based on the above data and the root cause analysis, the following options have been considered:

Option	Description
Option 1 – Provide drainage FWP and MIS.	Provide drainage Forward Works Programme and Maintenance Intervention Strategy with appropriate training of these systems with maintenance staff.
Option 2 – Improve watertable maintenance to avoid water ingress into pavements.	Improve drainage systems to reduce water ingress into pavements. This is likely to require additional funding, particularly for watertable maintenance. Develop processes and collect watertable condition data.
Option 3 – Improve grading with operator training to avoid watertables being filled with gravel.	Provide adequate training to grader operators and NTA maintenance staff to avoid watertables being filled with gravel. Also to train grader drivers to cut watertables when undertaking grading operations. Provide subsoil drains for areas with no surface water drainage.
Option 4 – Maintenance of drainage system where there is a high risk of flooding or slips.	Ensure that high risk culverts are inspected and cleaned before heavy rain events. Improve drainage systems where there is a high risk of slips.
Option 5 – Culverts to be properly designed. Replace culverts that are too flat, disjointed or have inadequate cover.	Ensure that culverts are properly designed so that they have sufficient waterway, are at self-cleaning slopes and have sufficient cover. Treat disjointed or butt end pipe culverts.
Option 6 – Provide additional culverts or cut-outs to reduce watertable flows.	Provide additional culverts or cut outs to reduce high flows in roadside drains which will reduce the likelihood of watertable scour and overtopping the drainage system.

PBC Multi Criteria Option Analysis, RCA: NTA

Activity/Work Categories: Drainage (WC 113, 213)

Short list up to 3 options from the following:

Option - Can we make	Yes/No	Rank	Reason
❑ Intervention response **timing** change			
❑ **LoS** adjustments	Yes	3	Provide subsoil drains for areas with no surface water drainage
❑ Use existing assets **differently**			
❑ **Blending** Work Categories differently			
❑ **Risk** - Hold Assets longer	Yes	4	Ensure that high risk culverts are inspected and cleaned before heavy rain events. Improve drainage systems where there is a high risk of slips
❑ Managing **demand**	Yes	6	Provide additional culverts or cut outs to reduce high flows in roadside drains
❑ **Route** Management	Yes	5	Ensure that culverts are properly designed so that they have sufficient waterway, are at self-cleaning slopes and have sufficient cover. Treat disjointed or butt end pipe culverts
❑ Alternative approaches – different **solutions/technology**			
❑ **Maintenance vs Renewal** adjustments	Yes	2	Improve drainage systems to reduce water ingress into pavements. This is likely to require additional funding, particularly for watertable maintenance
❑ **ONRC** Classification variance			
❑ Extended **temporary** management			
❑ **Supply chain** improvements			
❑ Improve **systems and capability**	Yes	A - 1 B - 3 C - 2	A - Provide drainage FWP and MIS. B - Provide adequate training to grader operators and NTA maintenance staff to avoid watertables being filled with gravel. C - Develop processes and collect watertable condition data

Criteria	Weighting (Importance) (Total to 100%)	How good is this option													
		Option 1 - Provide drainage FWP and MIS		Option 2 - Improve watertable maintenance to avoid water ingress into pavements		Option 3 - Improve grading with operator training to avoid watertables being filled with gravel		Option 4 - Maintenance of drainage system where there is a high risk of flooding or slips		Option 5 - Culverts to be properly designed. Replace culverts that are too flat, disjointed or have inadequate cover		Option 6 - Provide additional culverts or cut-outs to reduce watertable flows.		Option 7	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	10%	0	0	1	0.1	0	0	2	0.2	1	0.1	-1	-0.1		0
Problem solving effectiveness	10%	1	0.1	2	0.2	1	0.1	1	0.1	1	0.1	1	0.1		0
Benefits realised	10%	1	0.1	2	0.2	1	0.1	1	0.1	1	0.1	0	0		0
Good Environmental impacts	5%	1	0.05	1	0.05	1	0.05	1	0.05	1	0.05	1	0.05		0
Value for Money	10%	3	0.3	3	0.3	3	0.3	3	0.3	0	0	1	0.1		0
Closing Customer and Technical LoS gaps and impacts	10%	1	0.1	2	0.2	0	0	1	0.1	1	0.1	0	0		0
Closing ONRC Performance gaps	10%	1	0.1	2	0.2	1	0.1	1	0.1	0	0	0	0		0
Asset preservation and sustainability	10%	1	0.1	2	0.2	2	0.2	1	0.1	2	0.2	1	0.1		0
Total Cost of Ownership (whole of life Costs)	10%	1	0.1	1	0.1	1	0.1	1	0.1	1	0.1	1	0.1		0
Life Cycle Management	10%	1	0.1	2	0.2	1	0.1	1	0.1	1	0.1	1	0.1		0
COVID-19 Recovery	5%	0	0	2	0.1	0	0	0	0	0	0	0	0		0
Totals	**100%**		**1.05**		**1.85**		**1.05**		**1.3**		**0.85**		**0.45**		**0**

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

5.5 Option Assessment and Line of Sight

The options and the line of sight to the preferred strategic response and the problems they are addressing are shown in the table below. These options have been ranked in order of preference and then have been assessed through a multi-criteria assessment (MCA) to determine the highest scoring options that are preferred and are to be adopted. The MCA assessment is also provided as follows.

Work Activity	Problem Statements Addressing	Preferred Strategic Response	PBC Options to be Considered	Option Rank	MCA Score	Preferred Options
Drainage	The procurement structure of the maintenance contract combined with the major events, such as COVID lockdowns, cost escalations, limited resources and compounding storm events are creating a large increase in drainage work, which in turn results in further deterioration on all roads.	**Programme Adjustment** • Increase watertable maintenance and renewal programme. **Policy Approach** • Increase culvert sizes.	**Programme Adjustments** **Maintenance and Renewal Adjustments & Improve Systems and Capability** • Option 2 - Improve watertable maintenance to avoid water ingress into pavements.	2	1.85	Yes
			Route Management • Option 5 - Culverts to be properly designed. Replace culverts that are too flat, disjointed or have inadequate cover.	5	0.85	Yes
			Managing Demand • Option 6 - Provide additional culverts or cut-outs to reduce watertable flows.	6	0.45	Yes
			Policy Approach **Improve Systems and Capability** • Option 1 - Provide drainage FWP and MIS.	1	1.05	Yes
			LOS Adjustments & Improve Systems and Capability • Option 3 - Improve grading with operator training to avoid watertables being filled with gravel.	3	1.05	Yes
			Risk • Option 4 - Maintenance of drainage system where there is a high risk of flooding or slips.	4	1.3	Yes

Preferred Options: From the multi-criteria assessment the preferred options are:

- Option 1 – Provide drainage FWP and MIS.
- Option 2 – Improve watertable maintenance to avoid water ingress into pavements.
- Option 3 – Improve grading with operator training to avoid watertables being filled with gravel.
- Option 4 – Maintenance of drainage system where there is a high risk of flooding or slips.
- Option 5 – Culverts to be properly designed. Replace culverts that are too flat, disjointed or have inadequate cover.
- Option 6 – Provide additional culverts or cut-outs to reduce watertable flows.

5.6 Financial Impact

The following tables show the work categories and examples of the associated tasks. For full financial details for the work categories, refer to Section 08 (Financials):

5.6.1 Far North District Council

Work Category	Financial Impact
WC 113 Routine Drainage Maintenance	Additional funding for drainage maintenance to deal with backlog due to COVID, and storms.
WC 213 Drainage Renewals	Additional funding for drainage renewals to deal with backlog due to COVID, and storms.
WC 341 Low Cost / Low Risk Improvements	None programme.

5.6.2 Kaipara District Council

Description	Financial Impact
WC 113 Routine Drainage Maintenance	Additional funding for drainage maintenance to deal with backlog due to COVID, and storms
WC 213 Drainage Renewals	Additional funding for drainage renewals to deal with backlog due to COVID, and storms.
WC 341 Low Cost / Low Risk Improvements	No programme.

5.6.3 Whangarei District Council

Description	Financial Impact
WC 113 Routine Drainage Maintenance	Additional funding for drainage maintenance to deal with backlog due to COVID, and storms
WC 213 Drainage Renewals	Additional funding for drainage renewals to deal with backlog due to COVID, and storms.
WC 341 Low Cost / Low Risk Improvements	No Programme.

5.7 AMP Improvement

The following improvements will be considered:

- Create new drainage strategy with consistent approach across the three districts.
- Currently KDC add potential renewals & improvements from inspections and Customer Request Management (CRM) and add it to a list of dispatches, this work can be used by the asset management team to build a FWP. The same approach could be applied by FNDC & WDC.

Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendix 04

Structures

Overview and Management
Problems, Benefits, Consequences
Options Assessment

Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendix 04

Structures

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Appendix 04.A – Mechanical Bridges

Appendix 04.B – Kohu Ra Tuarua Hokianga Ferry

1 Overview

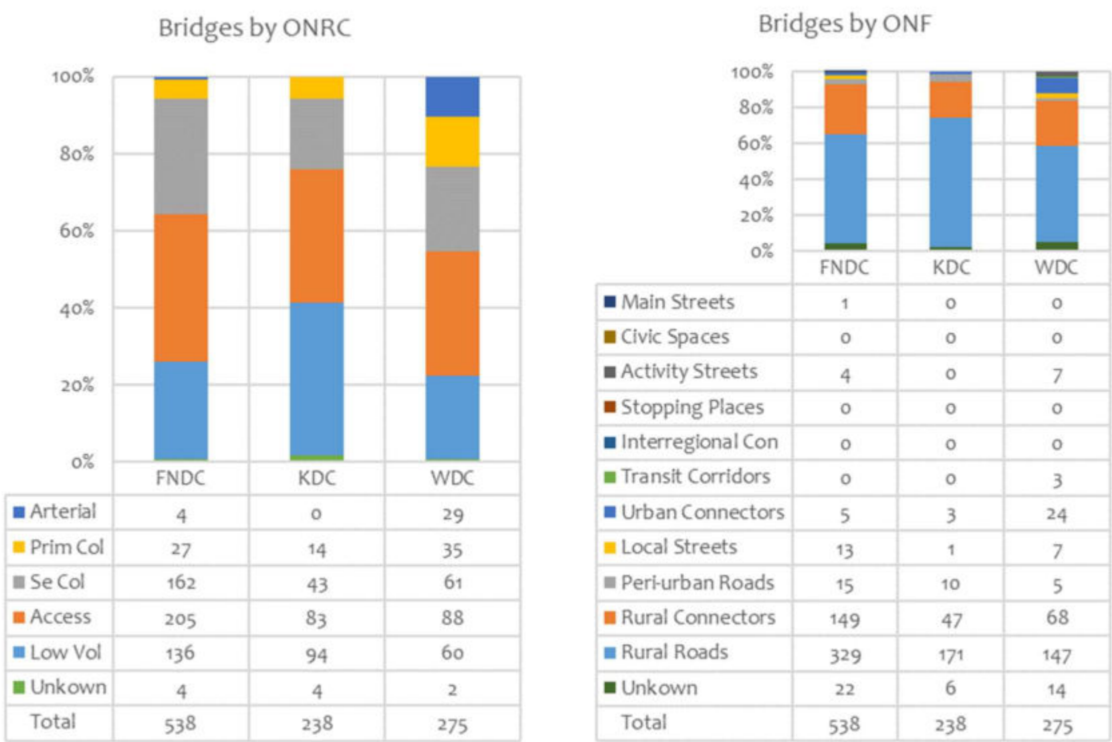
1.1 Description

The structure assets that make up this group are:

- Road bridges & Footbridges
- Major culverts (culvert area > 3.4m²)
- Fords
- Retaining walls including seawalls
- Rails and barriers
- Structural stairs
- Pedestrian Under/Overpasses – Council currently do not own any pedestrian under/overpasses
- Stock Underpasses – These assets are not owned by Council but are inspected by Council and recorded on the Councils database.

1.1.1 Bridges

Figure 1-1 below shows bridges distribution by ONRC (Left) and ONF (right).

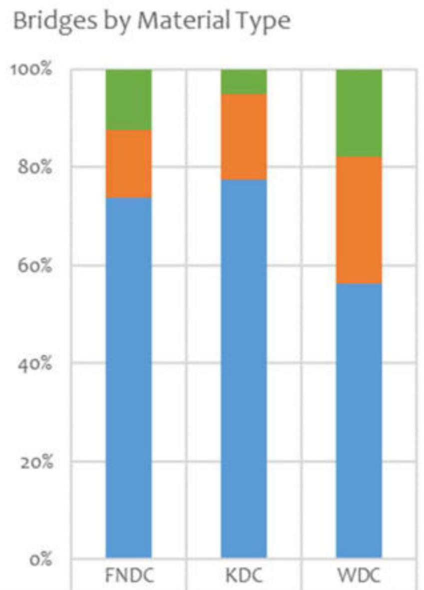


	FNDC	KDC	WDC
Arterial	4	0	29
Prim Col	27	14	35
Se Col	162	43	61
Access	205	83	88
Low Vol	136	94	60
Unkown	4	4	2
Total	538	238	275

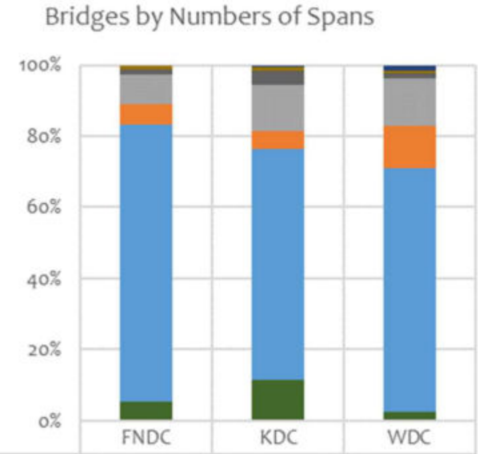
	FNDC	KDC	WDC
Main Streets	1	0	0
Civic Spaces	0	0	0
Activity Streets	4	0	7
Stopping Places	0	0	0
Interregional Con	0	0	0
Transit Corridors	0	0	3
Urban Connectors	5	3	24
Local Streets	13	1	7
Peri-urban Roads	15	10	5
Rural Connectors	149	47	68
Rural Roads	329	171	147
Unkown	22	6	14
Total	538	238	275

Figure 1-1: Bridges distribution by ONRC (Left) and ONF (right)

Figure 1-2 below shows bridges distribution by material type (left) and number of spans (right).



	FNDC	KDC	WDC
timber - steel	66	12	49
concrete - steel	75	42	71
concrete	397	184	155
Total	538	238	275

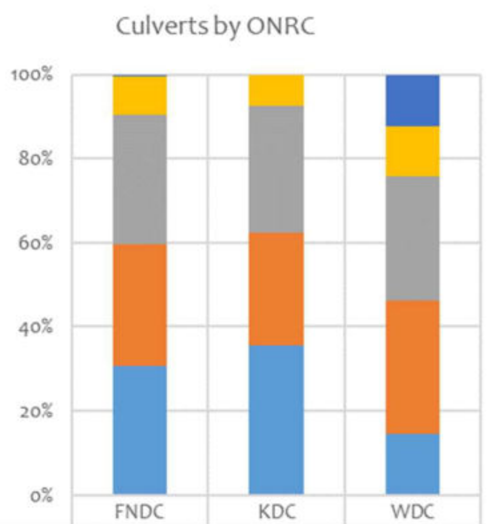


	FNDC	KDC	WDC
6 or more	0	1	4
5	6	3	2
4	9	9	4
3	45	31	37
2	30	12	33
1	420	155	188
Unkown	28	27	7
Total	538	238	275

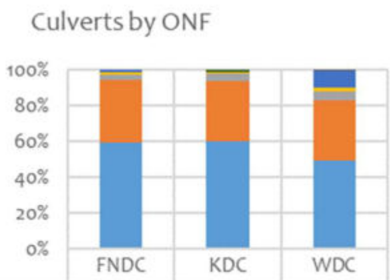
Figure 1-2: Bridges distribution material type (left) and (number of spans(right)

1.1.2 *Major Culverts*

Figure 1-3 below shows major culverts distribution by ONRC (Left) and ONF (right).



	FNDC	KDC	WDC
Arterial	1	0	22
Prim Col	16	7	21
Se Col	55	28	52
Access	52	25	56
Low Vol	55	33	26
Total	179	93	177

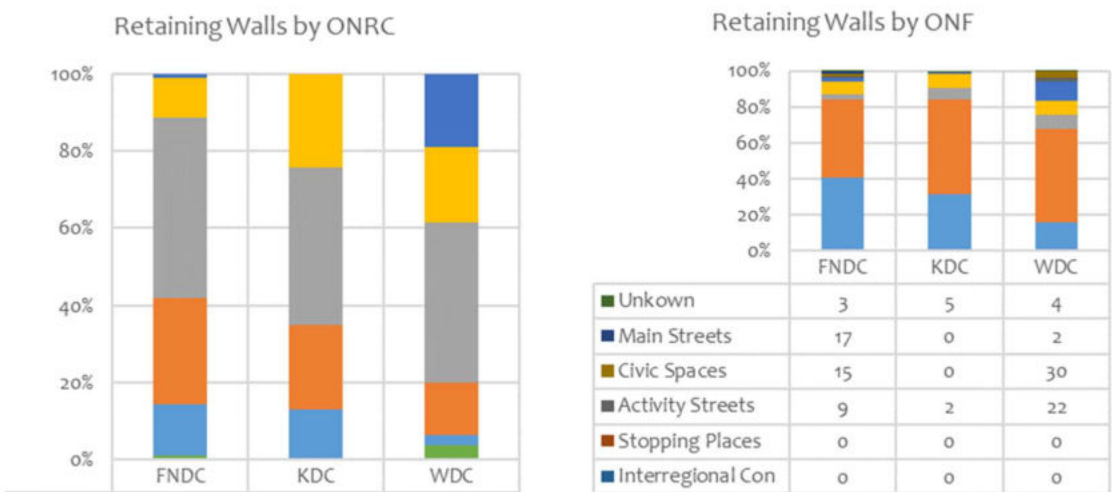


	FNDC	KDC	WDC
Unkown	0	1	0
Main Streets	0	0	0
Civic Spaces	0	0	0
Activity Streets	0	0	1
Stopping Places	0	0	0
Interregional Con	0	0	0
Transit Corridors	0	0	0
Urban Connectors	2	0	16
Local Streets	3	1	4
Peri-urban Roads	5	4	9
Rural Connectors	63	31	59
Rural Roads	106	56	88
Total	179	93	177

Figure 1-3: Major Culverts distribution by ONRC (Left) and ONF (right)

1.1.3 Retaining Walls

Figure 1-4 below shows retaining walls distribution by ONRC (Left) and ONF (right).



	FNDC	KDC	WDC
Arterial	12	0	180
Prim Col	114	138	187
Se Col	532	235	396
Access	310	125	128
Low Vol	151	72	26
Unkown	12	2	35
Total	1131	572	952

	FNDC	KDC	WDC
Unkown	3	5	4
Main Streets	17	0	2
Civic Spaces	15	0	30
Activity Streets	9	2	22
Stopping Places	0	0	0
Interregional Con	0	0	0
Transit Corridors	0	0	1
Urban Connectors	27	5	101
Local Streets	76	42	77
Peri-urban Roads	33	37	74
Rural Connectors	491	301	495
Rural Roads	460	180	146
Total	1131	572	952

Figure 1-4: Retaining Walls distribution by ONRC (Left) and ONF (right)

1.1.4 Ownership

- Footbridges: Many of these are attached to bridges and across estuaries. Some are located in parks and reserves which are owned and maintained by the Councils Parks Department and sometimes maintained by the NTA on their behalf.
- Rail Overbridges: These are owned, managed and maintained by the railway owner, mainly KiwiRail. The NTA is only responsible for the signage that is associated with the overbridges applicable to the road users.
- Stock Underpasses: Although council inspects these assets, they are all owned by the property owners who are responsible for any maintenance and improvements required.
- Road Overbridges and Underpasses: These are owned by Waka Kotahi if they are part of the State Highway network, otherwise they are owned by the NTA and are managed through the bridges, pavements and surfaces activities.

1.2 Monitoring and Condition

1.2.1 Inspections

Structural inspections of bridges and major culverts assets are currently undertaken by Consultants on behalf of the Councils. In the KDC and WDC, BECA conduct the inspections, and in FNDC, GRIT conduct the inspections. The inspections cover all assets associated with the bridges including railings and barriers.

Inspection of the retaining walls were conducted by WSP on behalf of the Councils during 2020. An assessment of their criticality with regard to the network was identified and those classified as 4 and 5 (criticality 1 were least critical and criticality 5 were those identified as most critical) were inspected and a forward works program created. Retaining Walls of Criticality 1 to 3 were not inspected due to time and cost constraints during 2020. The future inspections will follow the same process as the bridge inspections and incorporate all the retaining walls over time.

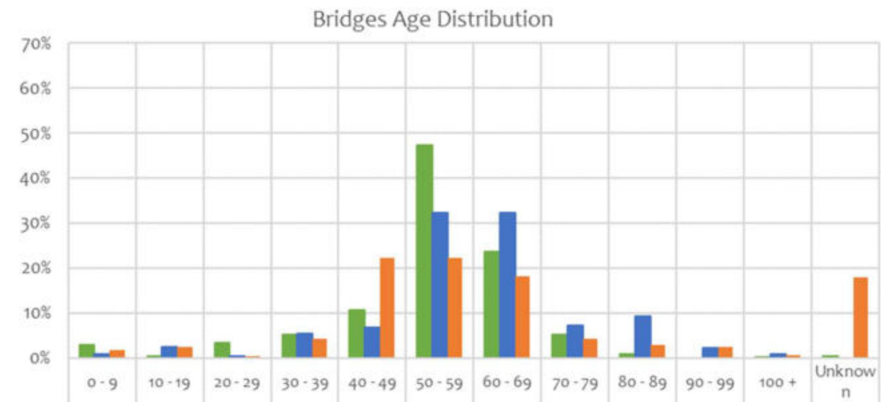
Inspection of all road safety barriers is undertaken as part of the Road Maintenance Contract and involves the inspection of the barriers, two weekly, monthly, or three monthlies based on ONRC. This inspection only involves the identification of defects. It does not consider the overall structural integrity of the barrier.

Road safety barriers associated with bridges are inspected for structural integrity during the bridge inspections that are conducted every year or every two years based on the bridges' criticality. These barriers are covered by the Bridge and Major Culvert Activity.

1.2.2 Age

Bridges

Figure 1-5 following shows the bridges age distribution. The KDC network has 19% of bridges more than 70 years old, followed by WDC 11% and FNDC 6%. These bridges will require components renewal and full renewal in the near future. WDC has 18% bridges with unknown age.

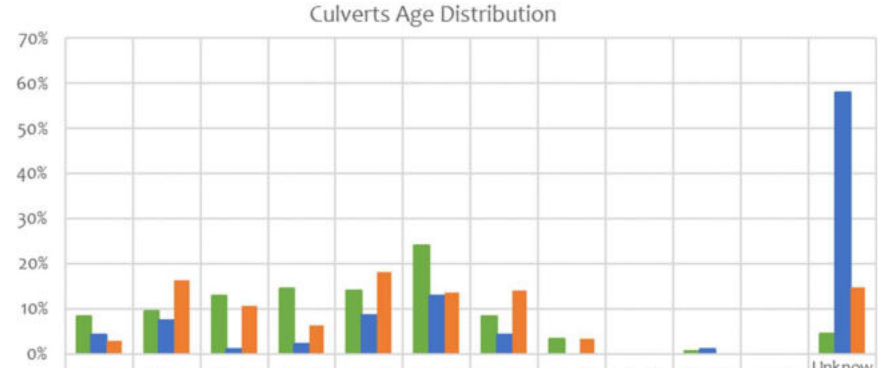


	0 - 9	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 - 79	80 - 89	90 - 99	100 +	Unknown
FNDC	3%	0%	3%	5%	11%	47%	24%	5%	1%	0%	0%	0%
KDC	1%	3%	0%	5%	7%	32%	32%	7%	9%	2%	1%	0%
WDC	2%	3%	0%	4%	22%	22%	18%	4%	3%	3%	1%	18%

Figure 1-5: Bridges age distribution

Culverts

Figure 1-6 following shows the major culverts age distribution. FNDC network has 36% of major culverts more than 50 years old, followed by WDC 31% and KDC 18%. KDC network has 58% culverts with unknown age.

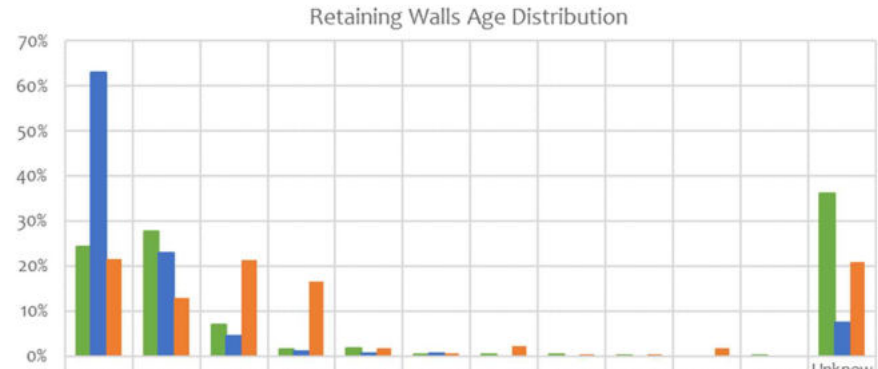


	0 - 9	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 - 79	80 - 89	90 - 99	100 +	Unknown
FNDC	8%	9%	13%	15%	14%	24%	8%	3%	0%	1%	0%	4%
KDC	4%	8%	1%	2%	9%	13%	4%	0%	0%	1%	0%	58%
WDC	3%	16%	11%	6%	18%	14%	14%	3%	0%	0%	0%	15%

Figure 1-6:Major Culverts age distribution

Retaining Walls

Figure 1-7 following shows the retaining walls age distribution. FNDC has 36% retaining walls with unknown age, followed by WDC 21%.



	0 - 9	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 - 79	80 - 89	90 - 99	100 +	Unknown
FNDC	24%	28%	7%	2%	2%	0%	0%	0%	0%	0%	0%	36%
KDC	63%	23%	5%	1%	1%	1%	0%	0%	0%	0%	0%	7%
WDC	22%	13%	21%	16%	2%	1%	2%	0%	0%	2%	0%	21%

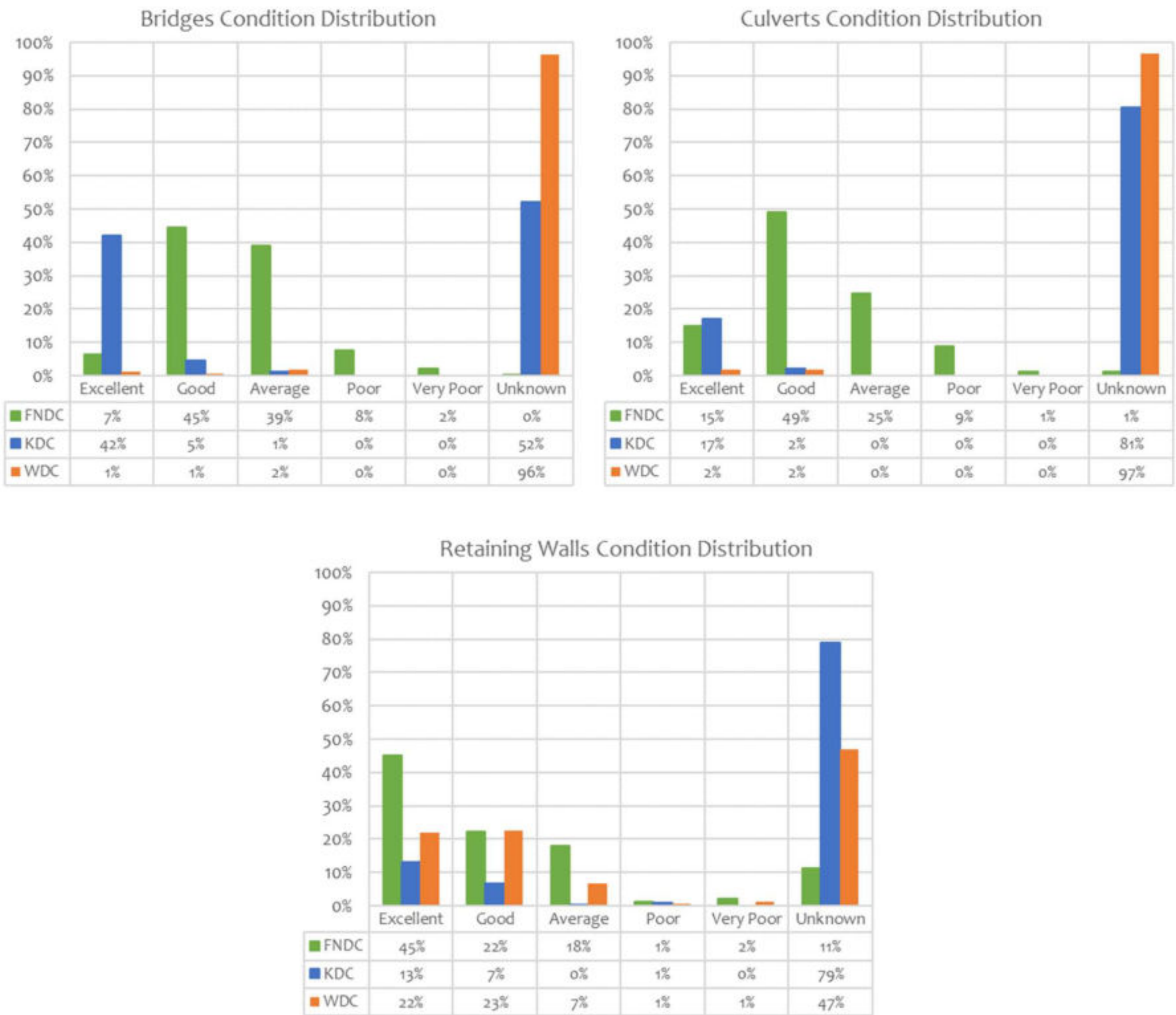
Figure 1-7: Retaining walls age distribution

1.2.3 Condition

Figure 1-8 following shows the condition distributions for bridges, culverts, and retaining walls for the three networks.

- Detailed inspections are used to assess conditions and prioritise component repair work. Due to an error with RAMM data processes a large amount of structures condition data is recorded as unknown.
- Condition rating 1-5 for all bridges and major culverts are currently stored in spreadsheet. However, this is not condition rated by components. Rating by Individual components and storing in RAMM is on the AMP improvement plan.

- All bridges and culverts have detailed spreadsheets with an overall condition rating 1-5, however this is not condition rated by components. The NTA is currently planning the following improvements:
    - Bridge and retaining wall asset data to be broken into their component parts in RAMM
    - Bridge and retaining wall condition, maintenance dispatches (including photos) and repairs to be stored in RAMM.
- Bridges – the majority of the WDC bridges and 52% of the KDC Bridges are recorded as unknown although inspections have been undertaken.
- Major Culverts – the majority of the WDC and KDC major culverts are recorded as unknown although inspections have been undertaken.
- Retaining Walls – the majority of the KDC retaining walls and 47% of the WDC retaining walls are recorded as unknown although inspections have been undertaken.



Bridges Condition Distribution

	Excellent	Good	Average	Poor	Very Poor	Unknown
FNDC	7%	45%	39%	8%	2%	0%
KDC	42%	5%	1%	0%	0%	52%
WDC	1%	1%	2%	0%	0%	96%

Culverts Condition Distribution

	Excellent	Good	Average	Poor	Very Poor	Unknown
FNDC	15%	49%	25%	9%	1%	1%
KDC	17%	2%	0%	0%	0%	81%
WDC	2%	2%	0%	0%	0%	97%

Retaining Walls Condition Distribution

	Excellent	Good	Average	Poor	Very Poor	Unknown
FNDC	45%	22%	18%	1%	2%	11%
KDC	13%	7%	0%	1%	0%	79%
WDC	22%	23%	7%	1%	1%	47%

Figure 1-8: Condition distribution – bridges, culverts and retaining walls

1.3 Overall Strategy

1.3.1 Bridges and Major Culverts

Bridges and major culverts are an important part of the transport network (major culverts are those with an area of over 3.4m², which corresponds to the NZTA asset category).

Because of their cost, importance to the network and the consequences of failure, bridges and major culverts are amongst Council's highest risk assets. Accordingly, Council regularly inspects all bridges and major culverts, and from these inspections determines the need for routine and planned maintenance (e.g. repairs). Higher frequency monitoring is carried out on timber structures and those that are sign posted with weight restrictions. There is also a process to identify appropriate routes for overweight vehicles to ensure that bridges and major culverts are not damaged.

The focus will be on trying to carry out lower cost heavy maintenance repairs or component replacements rather than replacing entire bridge structures. However, there are many steel Armco culverts which are rusting out under their concrete linings and will require replacement over the next 10 years.

HPMV/50Max: In 2010 the Vehicle Dimension and Mass (VDM) Rule Amendment came into force. This amendment allows vehicle operators to apply for High Productivity Motor Vehicle (HPMV) Permits for vehicles with divisible loads, provided their axle and gross weights are within specified limits. However, a nationwide State Highway bridge screening exercise revealed that older bridges in particular were not suitable for these heavier weights.

In 2013, a form of 'limited' HPMV was designated, which allowed for vehicles that would be heavier than conventional 44 tonne trucks (at the time, Class 1 designation) but not so heavy that they couldn't be driven over the current bridge stock. These were designated as 50MAX vehicles, and these vehicle combinations have one more axle than conventional 44-tonne vehicles combinations, meaning the overall truck load is spread further and there is no additional wear on roads/bridges per tonne of freight.

All councils have signed a MOU with NZTA to allow 50Max vehicles on the road network. There are 64 bridges on the FNDC network, 24 bridges on the KDC network, and 21 Bridges on the WDC network that have been assessed as not have the required strength to handle 50Max vehicles.

Seismic Capabilities: With the change in building requirements following the Christchurch earthquakes there may be a need to strengthen some of our structure to improve their seismic capabilities to preserve key lifelines.

Overweight/Dimension Vehicles: FNDC, KDC, and WDC currently manages this process through their bridge professional services consultants, the intent is to align with the NZTA processes.

FNDC – Kohu Ra Tuarua Hokianga Ferry vessel and the service are included under the structures maintenance and renewals funding categories. For further details, refer to Appendix 04.B (Kohu Ra Tuarua Hokianga Ferry).

WDC – The Te Matau ā Pohe bascule bridge is currently operated from a control room on site which requires this to be manned during daylight hours. WDC have improved the CCTV camera and communication technologies at the bridge with a view to allow this operation to be remotely operated which is likely to significantly reduce the operating costs.

WDC – The Kotuitui Whitinga Footbridge is a 100m long, 10 span walking and cycle bridge which spans the Waiarohia Stream from the Hihiaua peninsular to Port Road. The bridge has a 10m long opening section that swings sideways on a slew bearing. The Kotuitui Whitinga Footbridge is controlled by the bridge operator in the Te Matau ā Pohe control room and has the same response times as Te Matau ā Pohe.

1.3.2 Retaining Walls

A management program has been created to categorise the criticality of the retaining walls network and then to collect the relevant data and create a forward works program based on the higher risk structures.

1.3.3 Guardrails

New guard rail sites are identified through crash reduction studies and prioritised through the High-Risk Rural Roads and minor improvements programme. An inspection programme and rating system for guardrails will be developed targeting older assets and high-risk roads first and from this replacement programme developed.

2 Management Plan

2.1 Management

Maintenance Contract

Most of the maintenance and operations associated with this activity are conducted by the maintenance contractors and governed by the Road Maintenance Contract. This allows for minor maintenance of the structures (such as minor repairs, painting, clearing deck drainage etc.) that is found as part of the carriageway inspections.

Renewal Works Contracts

Any structural replacement work found as a result of the inspections is packaged into one off contracts and tendered out.

2.2 Acquisition

Structures are created through new construction projects and through assets vested to Council from subdivision developments. In addition:

- Retaining walls are also created through repairs to slips occurring either through emergency work repairs to storm damage or resilience improvements to long term instabilities.
- Road safety barriers are created through the low cost low risk and can be identified through high-risk rural road studies, crash reduction studies or through network inspections.

Council does not construct stock underpasses and a landowner wishing to install these under public roads must seek approval from Council to do so. The approval process works through a number of issues to do with placement of the underpass and drainage, as this relates to the transport corridor, and on-going operation and maintenance agreements are as set out in the maintenance plan below.

2.3 Maintenance

Structures maintenance is undertaken to ensure that the structural integrity of all structures is protected and that their load capacity is maintained.

2.3.1 Bridges and Major Culverts

Bridges and major culverts are inspected by two parties:

- The Road Maintenance Contractors inspect the carriageway when defect is found. These inspections are tracked through RAMM contractor and where work is undertaken a job is raised.
- The NTA also has two bridge consultants, GRIT for FNDC and BECA for KDC and WDC, who inspect the structural integrity of all bridges and major culverts once every year or two.

Both these inspections include the associated railings and barriers.

The priorities concerning the maintenance requirements identified through the Road Maintenance Contracts, while the structural inspections report splits the works required into four priorities based on when the works should be completed.

Both Te Matau ā Pohe bridge (opened July 2013) and the Kotuitui Whitinga Footbridge (opened September 2014) are now 10 years old. As the ten-year mark for both bridges is approached, it is apparent that operating a steel structure with electronic and electrical and mechanical controls in a coastal marine environment is challenging, particularly so with corrosion protection. As such preventive maintenance has become a crucial element of the bridge operations and the intensity of the maintenance is only anticipated to increase as the asset ages.

Issues with expansion, pavement settlement of east abutment, corrosion, confined space entry, lighting failures and hydraulic RAM & line works mean an increase maintenance and renewals cost. For further details, refer to Appendix 04.A (Mechanical bridges).

2.3.2 Stock Underpasses

The NTA does not own this asset although they are inspected as part of the structures inspection programme. Minor Maintenance is generally attended to by Council, but other maintenance issues are passed onto the owner to attend to. Where the maintenance issues are not attended to by the owner Council contractors undertake the repairs and pass costs onto the owner.

The justification for this process is that the stock underpasses are a critical component for the Transport Network and cannot fail for obvious reasons.

2.3.3 Retaining Walls

A Retaining Wall Maintenance intervention strategy has been developed, whereby the critical routes (criticality 4 & 5) have been prioritised and the condition of the retaining walls along those routes inspected. It is proposed that the remaining Retaining walls will be developed into routine inspection programmes similar to the existing programmes for the bridges and major culverts activity.

2.3.4 Road Safety Barriers

The inspection of all railings is undertaken as part of the entire network inspections that occur weekly, fortnightly, or monthly depending on the road hierarchy through the roading Maintenance Contracts.

2.4 Renewals

Structures requiring renewals will be prioritised based on their condition and the criticality of the route. They will be renewed in priority order, with the volume of renewals based on the funding available.

Bridges renewals are prioritised as part of the inspection process undertaken by the bridge consultant.

Similar to the maintenance plan, there are likely to be numerous retaining walls that have recently been identified, or are still to be identified, that require renewal.

The planned renewals are shown in Section 05 (Renewal Programme).

2.5 Improvement

The forms of improvement are:

- **Increasing one lane bridge to two lanes:** This would normally considered in conjunction with a bridge renewal.
- **Replacing bridge structure with major culvert structure:** In some instances, it is more efficient and effective to replace a bridge structure with a major culvert structure. This will be assessed at the design stage for bridge renewals.
- **Upgrading of ford to either a bridge or large drainage structure:** In general fords provide a stable crossing point in flood prone streams. Fords are an historical structure and are generally in place on low volume unsealed roads where the expense of a bridge or culvert structure is not viable or justified. It is rare for a ford to be replaced with either a bridge or major culvert structure unless there was a major development that would require it. If this was the case, then this would generally occur at the cost of the developer.
- **Replacing non-compliant terminal ends:** It is recognised that there is a significant amount of non-compliant terminal ends on the network, especially associated with bridge safety railing, however there is no current or future programme to attend to this issue.

The planned improvements/replacements are shown in Section 06 (Improvement Programme).

2.5.1 Bridge Strengthening for High Productivity Motor Vehicles (50Max & HPMV)

In 2010 the Vehicle Dimension and Mass Rule was introduced to allow the freight industry to move freight safely with fewer vehicles, within an appropriately regulated and permitted environment. This was proposed as part of the Government's direction to make the freight industry more efficient, free up capital for increased economic productivity, and create more jobs.

HPMV and 50Max means moving more freight with fewer trucks, reduced fuel consumption, vehicle operating costs and driver hours per unit of freight moved. Increased safety benefits from fewer truck trips means reduced crash risks, higher safety standards required on newer vehicles and advanced safety features like electronic stability control. The increased payloads of HPMV and 50Max can lead to economic benefits for producers, customers and our communities.

The NTA structures team met with the Northland Wood Council to discuss the most important routes with bridges that need strengthening to support the forestry operations, this will ultimately result in reduced vehicle kilometre travel (VKT) and reduced emission. Based on that selected bridges are added in the improvement programme.

2.5.2 50Max (50 tonne vehicles)

The 50Max is a new generation of truck that is slightly longer than the standard 44 tonne truck and has an additional axle (9 in total). The modified design means that these trucks can carry more load, but they perform on the road in a similar way to a standard 44 tonne truck.

The 50Max trucks are designed to have no greater pavement wear than that of the current 44 tonne vehicle fleet, however existing restricted bridges and bridges with spans greater than 25-30m in length may be subject to load restrictions.

All Councils have signed an MOU with NZTA to allow 50Max on their road network. This will release the economic efficiency available from 50Max to the districts.

There are 64 bridges on the FNDC network, 24bridges on the KDC network, and 21 bridges on the WDC network, that have been assessed as having the required strength to handle 50Max vehicles.

2.5.3 HPMV (62 tonne vehicles)

Full HPMV (62 tonne) vehicles are only permitted to run on two specific WDC roads – Cinder Way and Portland Road which are part of the Wilsonville Quarry to Portland Cement Works route along SH1. HPMV vehicles are not currently permitted on other NTA roads.

FNDC – NTA have carried out 50MAX detailed assessments on four bridges: Duncan Road E70 and E71, Owae Road T38 and Okaka Road M23.

KDC – NTA have not carried out 50MAX detailed assessments on any of the KDC bridges.

WDC – SH1 through Whangarei is a designated HPMV route and the Kamo Bypass on SH1 is often closed due to maintenance works or due to a vehicle crash or other emergency. The detour route for this section of state highway is along Great North Road and onto Kamo Road through Kamo Village. There were two bridges on this route that could not carry HPMV loads which result in HPMV vehicles having to park up whenever the Kamo Bypass is closed. A detailed structural assessment of these two bridges were undertaken in the 2018/21 period to determine whether they can carry HPMV loads and, if not, what works would be necessary to make them HPMV compliant. The Great North Rd bridge was found to be fine for 50MAX/HPMV and so was to be removed from the 50MAX register. The Kamo Rd Rail Overbridge needs to be strengthened to allow 50MAX or HPMV vehicles to use it.

NTA have also carried out 50MAX detailed assessments on Great North Road bridge and Walton Street bridge.

2.5.4 Seismic Strengthening

An investigation into Seismic strength of bridges that form critical lifelines should be undertaken to determine which bridges require strengthening. This will be considered in the future planned works.

2.6 Disposal

The disposal plan for any of the assets managed by the NTA generally consists of any recoverable items being returned to Council. Disposal of the transportation assets normally occurs due to renewal/rehabilitation works and assets are rarely sold.

Often during renewal works any surplus material (such as old bridge beams) becomes the property of the contractor carrying out the works for them to reuse or dispose of. Any scrap value from these assets is generally obtained through a reduction in the contractors tendered price. Where assets are recognised as being obsolete, surplus or uneconomic to continue to own, these are identified and disposed through an appropriate process.

3 Problems, Benefits, and Consequences

This section outlines problems affecting structures and details the benefits or consequences of doing or not doing something to address these problems.

3.1 Key Issues

3.1.1 Problem Description

Far North District Council (FNDC)

There has been an under investment in the FNDC bridge stock for many years and this is resulting in many bridges (22) having weight and speed restrictions which limits access for normal 44 tonne trucks.

There are 61 bridges (9%) that have deteriorated to poor or very poor condition and another 151 bridges (21%) that have significant scour. This is driving a larger demand for expensive bridge replacements and scour protection to avoid catastrophic bridge failure. The Far North also has 67 timber decked bridges which are subject to deck failure if trucks wander from the centre of the wheel tracks.

The spend on the FNDC structures over the past 10 years is summarised in Figure 3-1 below. It should be noted that a substantial part of the structures maintenance for FNDC is used to fund the maintenance and operations of the Kohu Ra Tuarua Hokianga Ferry service. If this funding was removed from Figure 3-1, it would show that until 2017/18 there has been a sustained period of underinvestment in structures.

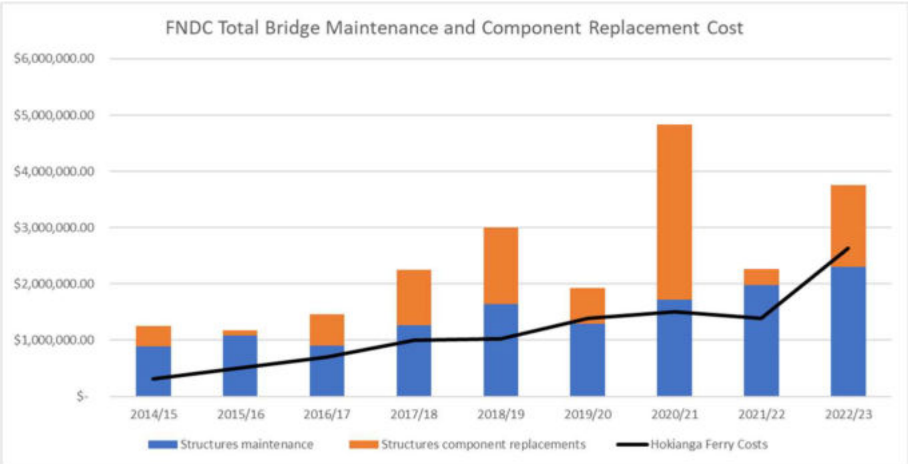


Figure 3-1: FNDC bridge maintenance and component replacement cost

The maintenance and operation of the Kohu Ra Tuarua Hokianga Ferry service has often used up most of the available structures maintenance budget which meant that bridge repairs have often been deferred leading to more expensive repairs or even full bridge replacements. The Kohu Ra

Tuarua Hokianga Ferry service second separable portion has just been awarded in April 2023 and the annual cost is now $2.025M/year. This is almost 75% of the current structures maintenance budget.

There are also a large number of bridges (64) that are restrictive for 50MAX vehicles which limits the use of these vehicles on the FNDC network with resulting loss of efficiency. This compares to 24 restrictive bridges for KDC and 21 for WDC. The current 50MAX restrictive bridges in Northland are shown in the Figure 10 below.

FNDC has by far and away the highest number of 50MAX restrictive bridges in the country for any district. Work is currently underway on carrying out detailed structural assessments on several of these bridges on critical routes. This work should be continued to identify bridges that can be removed from the register and a programme of strengthening work be undertaken to remove restrictions on critical freight routes. Figure 3-2 below shows locations of 50MAX restrictive bridges.

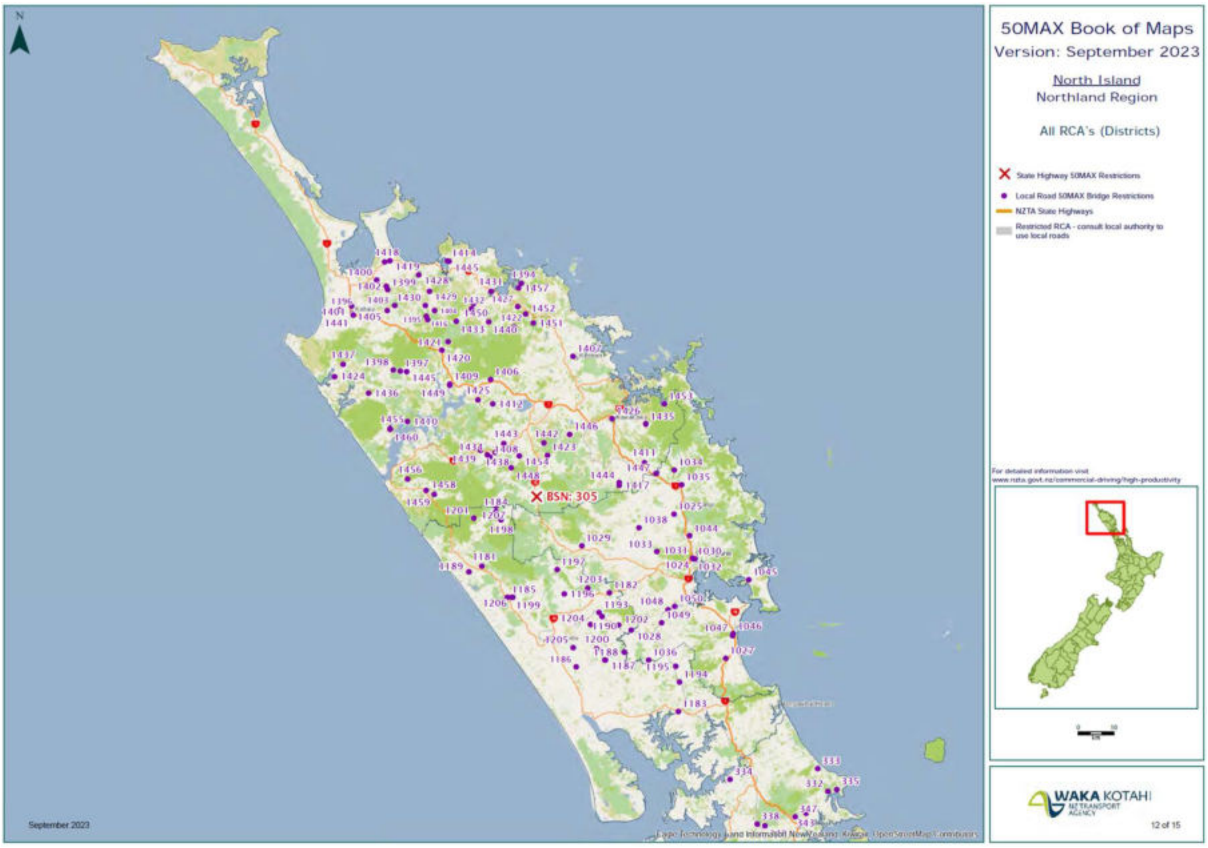


Figure 3-2: Map showing locations of 50 MAX restrictive bridges

It is also often hard to get contractors to price structural work in the Far North due to long travel distances as most contractors who undertake these works are based in Whangarei. This has resulted in some tenders only receiving one or no tenders, which often delays works and results in higher prices due to lack of competition. Options to package work or create a supplier panel are being considered to make work in the Far North more attractive to tenderers to increase competition.

Kaipara District (KDC)

The spend on the KDC structures over the past 10 years is summarised in Figure 3-3 following. Due to the effects of the rates strike in Kaipara between 2011/12 to 2013/14, in protest against the cost blowout for the Mangawhai Sewerage Scheme, there was a significant drop in the level of investment in bridge maintenance and renewals. This left a large hole in the bridge maintenance and component replacement programme which has resulted in several key structures deteriorating rapidly.

Figure 3-3: KDC bridge maintenance and component replacement cost

Whangarei District Council (WDC)

Many of WDC has 76 major culverts made of corrugated steel, 14 of these culverts are corroding quicker than anticipated, resulting in premature replacement of these culverts.

The spend on the WDC structures over the past 10 years is summarised in Figure 3-4 below, the figure shows steady increase in the component replacement cost.

Figure 3-4: WDC bridge maintenance and component replacement cost

Bridge Inspections

This has identified the need for more frequent bridge inspections for structures that are on critical routes or in coastal areas. These structures should also be inspected annually due to greater consequences if they fail and also the risk of rapid deterioration in the marine environment.

Retaining Walls

The NTA is also developing a Retaining Wall forward works programme and carrying out a large scale inspection of retaining walls on critical routes for the first time. This work is still underway but is identifying a need for retaining wall strengthening and replacement.

3.1.2 Key Issues and Actions

- There has been inadequate investment in the FNDC bridge stock for many years which has resulted in many structures having weight and speed restrictions.
- FNDC has 64 bridges which are 50MAX restrictive which is significantly higher than any other district in the country. This limits the productivity gains that could be achieved by the use of these vehicles. The detailed assessments of these bridges should be continued to identify bridges that can be removed from the register and a programme of strengthening work be undertaken to remove restrictions on critical freight routes.
- FNDC bridge tenders often have one or no tenderers which delays work and drives up prices due to lack of competition.
- Annual inspections of weight/speed restricted timber bridges, retaining walls should also be included in the inspection programme.
- The Kohu Ra Tuarua Hokianga Ferry service is also funded from the FNDC's structures maintenance budget and this currently uses a significant amount of the budget which leaves little funding left to carry out repair work on other structures. The Kohu Ra Tuarua Hokianga Ferry service second separable portion has just been awarded in April 2023 and the annual cost is now $2.025M/year putting further pressure on this budget.
- KDC had a period of low investment in its bridge stock due to the effects of the rates strike and this has resulted in expensive renewal work on two of its critical structures.
- We have limited data on the retaining walls inventory and condition. A programme of retaining wall identification and condition rating was commenced on critical 4 and 5 routes. This work needs to be completed for the balance of the network, along with continual routine inspections being undertaken. A robust forward works maintenance and renewals programme can be developed based on this data.

3.1.3 Benefits

- A fit for purpose bridge and retaining wall asset that provide access for freight and high productivity vehicles (50Max and HPMV) on arterial, freight and detour routes.
- The provision of adequate funding for structures maintenance and component replacement for FNDC and KDC will avoid expensive bridge repairs or replacements in the future. It will also help avoid the further weight restrictions being required. This investment should also account for the increasing costs of the Kohu Ra Tuarua Hokianga Ferry service;
- The removal of bridges from the 50MAX restriction register will enable more use of these higher productivity vehicles, will reduce freight costs and improve opportunities for investment.
- The packaging of structures work across the region or use of supplier panels will likely result in more competition and reduce tender prices.
- Carrying out annual inspections of critical and coastal structures, more frequent bridge inspections for FNDC and retaining walls inspections, will enable maintenance work to be identified in a timely manner and potentially reduce more expensive repairs in the future.

3.1.4 Consequences

- Our structures will deteriorate over time leading to further restrictions to freight and increasing risk of bridge or retaining wall failure resulting in safety issues and complete loss of access.
- Keeping funding at current levels is likely to lead to further deterioration of the FNDC and KDC bridge stock. This is particularly the case for the FNDC due to the increase in funding required to service the Kohu Ra Tuarua Hokianga Ferry.
- Without removing bridges from the 50MAX restriction register will result in Far North freight costs being higher than other areas which will reduce opportunities for investment.
- Without packaging structures work across the region, or the use of supplier panels, the current lack of competition and high tender prices for Far North structural work is likely to continue.
- Keeping the current bridge inspection regime may allow bridges to deteriorate before repairs are identified. Retaining walls will also deteriorate and potentially fail during storm events if inspections are not undertaken.

3.2 Strategic Case – Bottom-Up Assessment

During the development of the 2024/27 AMP, the NTA held a series of workshops to test and refine the problem statements and to determine the strategic response to address the problems. This is shown in the following table.

Draft Problem Statement
Aged assets and lack of historic maintenance and renewals of structures in FNDC and KDC is resulting in a large number of structures prematurely reaching the end of their life, which is adversely affecting freight access and increasing demand for expensive bridge replacement. Access restrictions are also impacting on greenhouse emissions and impairing freight routes. Gantries are aging and becoming more expensive to maintain. More funding is required to ensure that both the structure is safe, and the signage is maintained to standards.
Current AMP – Key responses outlined in Strategic Case:
• WDC & FNDC – Additional funding for retaining wall maintenance and renewal. Additional funding for steel arch culvert replacements (WDC issue). • FNDC – Large increase in bridge maintenance and renewal to retain current access for freight and 50MAX routes and reduce the likelihood of structural failure. • KDC – Increasing in maintenance funding to address increase in damage to narrow bridges from increased freight movements. Increase to catch up with damaged one lane bridge components. • NTA – Develop programme in conjunction with NZTA for structural upgrades on detour routes. Carry out detailed assessments of 50MAX restrictive bridges. Seismic assessments of structures on key lifelines, arterials and freight routes. Develop a Retaining Wall Plan and FWP. Retaining walls to be included in the annual bridge inspections.
Current Work that is being undertaken:
• Bridge inspections being undertaken, with all weight restricted and timber bridges inspected annually, and other bridges inspected on a cyclic basis (2 yearly cycle for FNDC, KDC, and WDC). • Bridge maintenance, renewals and replacements are identified through the bridge inspections. • Maintenance of bridges above the deck is undertaken by the maintenance contractors. All other maintenance and renewals are competitively tendered. • WDC has a large inventory of large steel pipe culverts which has progressively been concrete lined to extend their life. FNDC and KDC do not have many steel pipe culverts. • Meetings with Northland Wood Council and highlighted bridges for strengthening, as this will result in reduced VKT and emission.

- There is currently little information about the retaining wall assets. Therefore, a Retaining Wall Plan is being developed to identify the retaining wall assets and condition. This will be used to determine FWP of retaining wall work.
- FNDC fund the Kohu Ra Tuarua Hokianga Ferry Service through structures maintenance and renewals. This includes the operating costs of the service.
- WDC fund the maintenance of The Te Matau ā Pohe bascule bridge and The Kotuitui Whitinga Footbridge.

Aspects of the problem not being addressed, and benefits not being delivered?

- FNDC has a significant a backlog of structures renewals due to historic under investment. Many FNDC bridges are in need of replacement, renewals, and strengthening.
- Several critical KDC bridges have failed prematurely and need replacement due to lack of timely maintenance over the recent past due to cost cutting resulting from high council debt levels and Mangawhai rate strike;
- FNDC and KDC have a large number of weight restricted and 50Max restrictive bridges.
- FNDC also have a lack of as-built structural information about their bridges.
- Structures on critical routes or in high risk coastal environments are inspected as part of the planned inspection schedule, no special inspections are carried out unless if they are part of the posted restrictions for bridges.
- Lack of tenderers for structures work. Also, the time taken to get through the FNDC council procurement process often delays work by up to 6 months meaning work is late getting to the market which affects the number of tenderers and price.
- Retaining walls are currently not inspected frequently and there is little asset or condition data for these assets. This increases the likelihood of deterioration and premature failure.
- Strength of aged retaining walls is unknown.

Is the Problem Statement still relevant? If "No" what are the deficiencies? If "Yes" has priority changed?

Yes – this is a priority for all councils, and particularly FNDC and KDC.

If Problem is not being addressed by the current work, what is the strategic response?

Strategic response	Y/N	Rank	Detail
1 - Programme adjustment: example, Remove/reduce projects/activities.	Y Y	1 3	Increase programme of bridge maintenance and renewals on critical for FNDC and KDC to get on top of backlog and extend the life of these structures. Include a programme of bridge replacements targeting weight, speed and 50MAX restricted bridges on important freight routes.
2 - Policy approach: example, Adjust level of Service.	Y Y	2= 2=	Increase the frequency of bridge inspections to include an annual inspection of bridges of critical routes and in high risk coastal environments. Increase other FNDC bridge inspections to a 2-yearly cycle. Include retaining walls in the bridge inspections. Complete detailed structural inspection on 50MAX bridges on important freight routes. Develop a supplier panel to improve likelihood of receiving multiple tenders and competitive prices. Also look to review and change the FNDC procurement board process to reduce the time taken to let and approve tenders.
3 - Demand management: example, Manage use – up/down.	Y	–	Complete the Forestry Plans to better understand the demands of forestry on the network. This work is currently being undertaken – so this option has not been assessed further.
4 - Funding adjustment: example, Increase/decrease	Y	4	Change the funding of the Kohu Ra Tuarua Hokianga Ferry service operations to WC 123 Operational Traffic Management.

5 - Risk based: example, Hold Assets longer.	N	–	Structures assets are in poor condition in FNDC, are deteriorating in KDC and are fit for purpose for WDC. WDC has a large inventory of large steel pipe culverts which has already extended the life of via concrete lining the bases. It is therefore not considered practical to further "sweat the asset".

How effective are the options? (as per Multi Criteria Assessment below)

Option 1a – Increase structural maintenance and renewals programmes for FNDC and KDC - Score 1.65 out of 3 (Preferred).

Option 1b – Programme of 50MAX bridge strengthening on important freight routes - Score 0.85 out of 3 (Preferred).

Option 2a – Annual bridge inspections for critical and high-risk structures. Increase FNDC inspections cycle to 2 yearly. Carry out retaining wall inspections. Complete 50MAX detailed assessments on important freight routes – Score 1.2 out of 3 (Preferred).

Option 2b – Supplier panel and improved FNDC procurement processes – Score 1.6 out of 3 (Preferred).

Option 4 – FNDC Kohu Ra Tuarua Hokianga Ferry service operations charged to WC123 – Score 0.3 out of 3.

Draft an updated problem statement (if applicable)

Aged assets and lack of maintenance and renewals of structures in FNDC and KDC is resulting in a large number of structures prematurely reaching the end of their life, which is adversely affecting freight access and increasing demand for expensive bridge replacement.

Strategic Case Multi Criteria Option Analysis, RCA: NTA
Problem: Structures

Short list up to 3 options from the following - Can we make-----

Option	Yes/No	Reason	Rank
1 Programme adjustment eg, Remove/reduce projects/activities	1a - Yes	Increase programme of bridge maintenance and renewals on citical routes for FNDC and KDC to get on top of backlog and extend the life of these structures.	1
	1b - Yes	Include a programme of bridge replacements targeting weight, speed and 50MAX restricted bridges on important freight routes.	3
2 Policy approach eg, Adjust level of Service	Yes	Increase the frequency of bridge inspections to include an annual inspection of bridges of critical routes and in high risk coastal environments. Increase other FNDC bridge inspections to a 2 yearly cycle. Include retaining walls in the bridge inspections. Complete detailed structural inspection on 50MAX bridges on important freight routes.	2=
	Yes	Develop a supplier panel to improve likelihood of receiving multiple tenders and competitive prices. Also change the FNDC procurement board process to reduce the time taken to let and approve tenders.	2=
3 Demand management eg, Manage use – up/down	Yes	Complete the Forestry Plans to better understand the demands of forestry on the network. This work is already being undertaken - so this option hasn't been assessed further.	N/A
4 Funding adjustment. eg, Increase/decrease	Yes	Change the funding of the Hokianga Ferry Service operations to WC 123 Operational Traffic Management.	4
5 Risk based eg, Hold Assets longer	No	Structures assets are in poor condition in FNDC, are deteriorating in KDC and are fit for purpose for WDC. WDC has a large inventory of large steel pipe culverts which has already extended the life of via concrete lining the bases. It is therefore not considered practical to further "sweat the asset".	N/A

Criteria/Drivers to consider	Weighting (Importance) (Total to 100%)	How good is this option									
		Option 1a - Increase Maint & Renewal		Option 1b - 50Max Strengthening		Option 2 - Increase frequency of inspections		Option 2b - Supplier Panel & Improved FNDC Procurement Process		Option 4 - FNDC Hokianga Ferry Service Operations Charged to WC123	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score
Meets GPS	10%	1	0.1	1	0.1	2	0.2	2	0.2	0	0
Meets RLTP	10%	2	0.2	2	0.2	2	0.2	1	0.1	0	0
Addresses Problems	20%	2	0.4	1	0.2	1	0.2	2	0.4	1	0.2
Will realise Benefits	10%	2	0.2	1	0.1	1	0.1	2	0.2	0	0
Will meet Community Outcomes	10%	2	0.2	1	0.1	0	0	1	0.1	0	0
Will meet Customer Outcomes (CLOS)	10%	2	0.2	1	0.1	1	0.1	1	0.1	1	0.1
Provides high Performance impacts	10%	2	0.2	1	0.1	2	0.2	3	0.3	0	0
Provides high Environmental Impacts	5%	1	0.05	1	0.05	0	0	0	0	0	0
Provides Cultural Impacts	5%	0	0	0	0	0	0	0	0	0	0
How Costly	10%	1	0.1	-1	-0.1	2	0.2	2	0.2	0	0
Other 1											
Other 2											
Other 3											
Other 4											
Totals	100%		1.65		0.85		1.2		1.6		0.3

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

3.3 Strategic Case Summary (Line of Sight in Action)

Based on the assessment of the problem statement and the strategic responses undertaken in the previous section, a summary of the results and the affected work categories are shown in the table below:

Issue	Structures
Problem Statement	Aged assets and lack of maintenance and renewals of structures in FNDC and KDC is resulting in a large number of structures prematurely reaching the end of their life, which is adversely affecting freight access and increasing demand for expensive bridge replacement.
Benefits	• Provide adequate maintenance and renewals to keep the structures in a fit-for-purpose condition. • Prolong the life of structures. • Reduce restrictions to freight on the network.
Trend	Getting Worse
Strategic Response	**Programme Adjustment** • Increase structural maintenance and renewals programmes for FNDC and KDC. • Programme of 50MAX bridge strengthening on important freight routes. **Policy Approach** • Improve frequency of bridge inspections and carry out retaining wall inspections. • Complete 50MAX detailed assessments on important freight routes.
Activity/Work Category	WC 114 Structures Maintenance. WC 215 Structural Component Replacement. WC 216 Bridge and Structures Renewal. WC 322 Replacement of Bridges and Other Structures. WC 341 Low Cost / Low Risk Improvements.

4 Options, Assessment and Alternatives

4.1 Option Identification (Root Cause Analysis)

Following the identification of the problem statements, a root cause analysis was undertaken to identify the underlying causes of these problems. The root cause analysis was undertaken using the "5 Whys" type methodology in accordance with NZTA's Business Case Approach Practice Note No.3 – Root Cause Analysis in Business Case Development.

This process was undertaken through a series of workshops with the NTA Assets Team and NZTA local representative to determine the underlying causes of the identified problems. This was a bit of a deep dive into the myriad of issues that affect the transport network and a multitude of root causes were identified for each problem statement.

For each root cause, a possible solution (option or alternative) was identified to try and address this cause. These solutions ranged from high level interventions such as changing council policies and developing strategies to low level interventions such improving grader operator training.

The following tables includes the results of the root cause analysis and the possible solutions to address the problem statements.

Root Cause Analysis – Structures

<table>
<tr><td>Problem statement</td><td colspan="12">A large number of structures in FNDC and KDC are prematurely reaching the end of their life which is adversely affecting freight access and increasing demands for expensive replacement.</td></tr>
<tr><td>why 1</td><td colspan="4">Many bridges in FNDC are in poor condition and are vulnerable</td><td colspan="3">Heavy vehicles are putting more demands on the bridge stock</td><td colspan="3">Bridge maintenance not being undertaken soon enough to avoid expensive renewals/replacements</td><td>Accelerated Deterioration of assets due to storm events</td><td>Retaining wall maintenance and renewal is undertaken on an Ad-hoc basis</td></tr>
<tr><td>why 2</td><td>FNDC has a large number of timber decked bridges (68) which are vulnerable to damage.</td><td>FNDC has a large number (24) of speed and weight restricted bridges at the end of their life. There are also many other structures that are in poor condition.</td><td colspan="2">Delays in timely renewal and replacement work.</td><td>Heavy vehicles (particularly logging trucks) are overloading bridges.</td><td colspan="2">Heavy vehicle loads are increasing due to the change to 50Max loading.</td><td>Defects not being identified early enough.</td><td colspan="2">Budget constraints affecting the amount of bridge maintenance undertaken.</td><td>Increase in scour/soil erosion beneath structures.</td><td>There is no programme of retaining wall maintenance or renewals.</td></tr>
<tr><td>why 3</td><td>Timber bridges have greater risk from wheel loading (point loads).</td><td>The load carrying capacity of these bridges has reduced due to deterioration of the structure.</td><td colspan="2">FNDC has difficulty in procuring renewal and replacement work. Prices that are received are higher than expected.</td><td>Bridge renewals or replacements not undertaken in time to cope with forestry loads coming on stream.</td><td colspan="2">FNDC has a large number of 50Max restrictive bridges (70) and there is increasing demand for these bridges to take 50Max loads, particularly on forestry routes.</td><td>Inspections undertaken on a cyclic basis - timber & weight restricted bridges yearly, other bridges: FNDC 3 yearly, KDC & WDC 2 yearly.</td><td>There has been a historic lack of suitable KDC budget for bridge maintenance.</td><td>FNDC's bridge maintenance budget is insufficient to carry out the required bridge maintenance and fund the Hokianga Ferry service.</td><td>Increase in the frequency of storm events and intensity of the storms.</td><td>There is insufficient information on retaining wall condition to develop a programme of works.</td></tr>
<tr><td>why 4</td><td>Truck wheelpaths tracking off the supporting beams and onto the cantilevered deck.</td><td>Insufficient bridge renewals and replacements undertaken in the past.</td><td>Difficulty in getting bridge designs completed in a timely manner.</td><td>Difficulty in getting competitive prices for bridge renewal and replacement programmes due to lack of specialist bridging contractors (often one Whangarei based contractor pricing the work).</td><td>Insufficient knowledge of when forestry loadings are coming on stream.</td><td>50Max is more efficient to haul freight, particularly on long haul routes from the Far North District.</td><td>Many FNDC bridges have very little bridge information, and so have been conservatively assessed as being 50Max restrictive.</td><td>Inspection cycle insufficient to identify defects on critical life line bridges and structures in high risk areas (eg coastal).</td><td>KDC's spend on bridge maintenance was reduced during the 2012/15 period as a result of the rates strike, which has resulted in critical maintenance on some key bridges being delayed.</td><td>The Hokianga Ferry service maintenance and operations costs have been increasing which has limited the amount of bridge maintenance work that can be funded.</td><td>Climate change.</td><td>Retaining walls are not regularly inspected.</td></tr>
<tr><td>why 5</td><td>Wider and heavier trucks with wider swept paths.</td><td>Lack of programme of bridge renewals to justify investment in timely bridge renewals to retain the structural integrity.</td><td>Lack of specialist bridging consultant resource in Northland.</td><td>Insufficient work in the Far North to justify more specialist bridging contractors. One specialist bridge contractor no longer considered acceptable to use. This is exacerbated by the FNDC procurement board process which can take up to 6 months to get approvals.</td><td>Lack of a long term strategy to identify and address forestry loads.</td><td>Less trucks are required to carry the same load of freight.</td><td>The 50Max bridge screening was undertaken based on existing bridge data, with no detailed analysis to confirm whether or not these bridges could take 50Max loads. FNDC has a lack of historic geological and structural data (due to lack of as-built records).</td><td>The impacts of life line bridges deteriorating are more significant to network access. Bridges in high risk environments are likely to deteriorate more quickly.</td><td>Bridge maintenance in KDC was deferred due to other competing demand for very limited budgets during the rates strike.</td><td>Increases in ferry operating costs such as labour and fuel costs have been increasing, but this has not been matched by a similar increase in the bridge maintenance budget. The recent ferry service tender has also resulted in a large increase in costs.</td><td>No or low priority given to climate adaptation in the past.</td><td>No process has been established to carry out annual retaining wall inspections. Retaining walls are often not recorded in the RAMM database.</td></tr>
<tr><td>Potential Solutions</td><td>Realign bridge approaches where possible and position kerbs to channel trucks along the main structural beams wherever possible.</td><td>Develop a long term strategy and FWP for bridge renewals. Provide an adequate level of FNDC bridge renewal funding to preserve the structural integrity and reduce the need for expensive bridge replacement wherever possible.</td><td>Continue to work on releasing a NTA professional services contract to secure sufficient specialist bridge design resource in Northland.</td><td>Consider creating a supplier panel to encourage more competition by reducing barriers for contractors by prequalifying them. Continue to work on simplifying the FNDC procurement approval process.</td><td>Continue to develop and update the Forestry Plan and FWP.</td><td colspan="2">Continue to carry out detailed assessments of 50Max restrictive bridges to determine whether these can be removed. Where necessary, provide adequate funding for 50Max bridge strengthening on critical freight routes. Support initiatives to revitalise the Northland rail network to reduce long-haul freight cartage by road.</td><td>Change bridge inspection cycle to yearly for critical bridges and bridges in high risk areas (eg coastal, or age). Change FNDC default cycle to two yearly. Make sure process of checking on defects repaired is robust to ensure repairs are undertaken and that the quality of repairs is to the correct standard.</td><td>Continue to provide an adequate level of KDC bridge maintenance funding to ensure that the maintenance requirements of bridges can be met.</td><td>Increase the FNDC bridge maintenance programme to reflect the required level of bridge maintenance and the new Hokianga Ferry operating costs. By providing an adequate level of bridge maintenance funding this should see a reduction over time of bridge renewal work.</td><td>Invest more in scour protection and associated works that reduce the water level, below bridges.</td><td>Include inspections of retaining walls on critical routes in the annual bridge inspection programme. Continue to collect retaining wall RAMM data as part of the development of the retaining wall plan. Continue the development of the retaining wall plan and FWP.</td></tr>
</table>

4.2 Option Development

The following table was developed by the Roading Efficiency Group as part of a top-down assessment of options to address the identified problems. They summarise the responses in the existing AMP, the effectiveness of the existing programme and the proposed options which have been determined from the root cause analysis which should be considered as part of the option assessment.

Statement Problem	Key Responses In existing AMP	Summary of effectiveness of existing programme	Proposed Programme Business Case adjustments (from Root Cause Analysis)
Structures – Aged assets and lack of maintenance and renewals of structures in FNDC and KDC is resulting in a large number of structures prematurely reaching the end of their life, which is adversely affecting freight access and increasing demand for expensive bridge replacement.	• FNDC – Large increase in bridge maintenance and renewal to retain current access for freight and 50MAX routes and reduce the likelihood of structural failure. • KDC – Increasing in maintenance funding to address increase in damage to narrow bridges from increased freight movements. Increase to catch up with damaged one lane bridge components. • WDC & FNDC – Additional funding for retaining wall maintenance and renewal. Additional funding for steel arch culvert replacements (WDC issue). • NTA – Develop programme in conjunction with NZTA for structural upgrades on detour routes. Carry out detailed assessments of 50MAX restrictive bridges. Seismic assessments of structures on key lifelines, arterials and freight routes. Develop a Retaining Wall Plan and FWP. Retaining walls to be included in the annual bridge inspections.	• Bridge maintenance and component replacement for FNDC and, to a lesser extent KDC, is not enough to keep the asset in a stable condition. • Bridge replacements are slowly replacing the aging and poor condition bridge stock. • Key issues from Root Cause Analysis: o FNDC has a large number of timber decked bridges which are vulnerable to damage. o Insufficient bridge renewals in the past have left FNDC with a backlog of poor condition bridges, many with restrictions. o Lack of specialist bridging consultants and contractors, particularly in the Far North. FNDC procurement board also a constraint. o Bridge strengthening/replacement not carried out in time for forestry harvest. o 50MAX bridge restrictions are affecting productivity of HCV routes. o Bridge inspections are not frequent enough on critical and high-risk structures (eg coastal). o Bridge maintenance budgets insufficient to stop costly renewals and replacements. o FNDC Kohu Ra Tuarua Hokianga Ferry service cost increases have reduced available budget for bridge maintenance. o Retaining walls not being inspected.	• Develop a long-term bridge strategy and FWP. • Provide sufficient level of bridge maintenance and component replacement funding for FNDC and KDC, including adequate allowance for the FNDC Kohu Ra Tuarua Hokianga Ferry service. • Develop a professional service contract for the NTA to secure bridging design services. • Continue to develop and update the Forestry Plan and the Forward Work Plan. • Carry out annual inspections of retaining walls and develop a retaining wall FWP. • Continue to carry out detailed 50MAX assessments; • Develop a supplier panel to pre-qualify contractor for bridging (and other) works. • Simplify the FNDC procurement process. • Advocate for rail revitalisation to reduce road freight haulage distances. • Realign bridge approaches and move in kerbs on timber decked bridges to concentrate loads on the main structural beams (we are not doing this – maybe delete). • Increase the number of bridge inspections and carry out retaining wall inspections.

5 Option Assessment

The following sections analyse options for addressing the problems and issues identified in the Strategic Case. These options have been identified through the Root Cause Assessment.

For the assessment of the data, peer group analysis and option assessment, a five point "traffic light" rating system has been used as shown in the following schematic. This rating system is based on a qualitative assessment of the LOS and cost comparison data.

5-point traffic light rating system

Performance Rating	Symbol	For LOS this means:	For Costs & Achievement this means:	Trend Rating	Symbol	For LOS this means:
Very Good		Much Better than Peer Group Average	Much Less than Peer Group Average	Improving Trend		Positive Change towards a Very Good rating
Good		Better than Peer Group Average	Less than Peer Group Average	Worsening Trend		Negative Change away from a Very Good rating
Average/Moderate		Similar to the Peer Group Average	Similar to the Peer Group Average	Static Trend		No Change
Poor		Worse than Peer Group Average	Higher than Peer Group Average			
Very Poor		Much Worse than Peer Group Average	Much Higher than Peer Group Average			
No Data		No Data	No Data			

Work Categories:	WC 114 Structures Maintenance WC 215 Structural Component Replacement WC 216 Bridge and Structures Renewal WC 322 Replacement of Bridges and Other Structures WC 341 Low Cost / Low Risk Improvements

5.1 Links to Strategic Case

Problem Statement:	**Structures** – Aged assets and lack of maintenance and renewals of structures in FNDC and KDC is resulting in a large number of structures prematurely reaching the end of their life, which is adversely affecting freight access and increasing demand for expensive bridge replacement.
Benefits of Addressing Problem:	A fit for purpose bridge and retaining wall asset that provide access for freight and high productivity vehicles (50Max and HPMV) on arterial, freight and detour routes.
Consequences of Not Addressing the Problem:	Our structures will deteriorate over time leading to further restrictions to freight and increasing risk of bridge or retaining wall failure resulting in safety issues and complete loss of access.

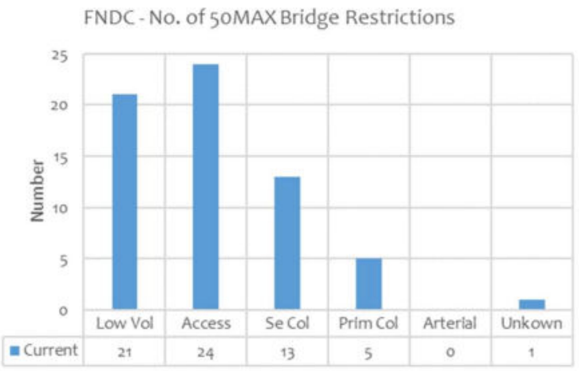
5.2 Levels of Service

ONRC Customer Outcomes:	ONRC Resilience CO1 – The number of journeys impacted by unplanned events (no data available) ONRC Resilience CO2 – The number of instances where road access is lost (no data available) ONRC Accessibility CO1 – Proportion of the network not available to Class 1 heavy vehicles and 50MAX vehicles
Customer Levels of Service:	ONRC Safety TO1 – Permanent hazards (no data available) LTP 1.1 – Decreasing trend in resilience related faults on key routes (no data available)

5.3 Evidence and Gap Analysis

Number of 50MAX Restrictions

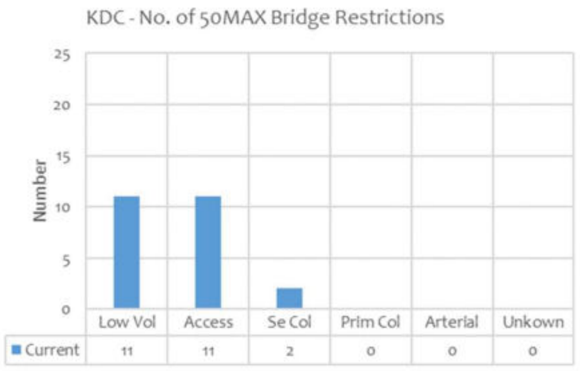
FNDC



FNDC Number of 50MAX Restrictions – FNDC has 64 bridges which have 50MAX restrictions which is the highest amount in the country. Far North also have 22 bridges which have restrictions for standard Class 1 (44 tonne) vehicles.

Most of the 50MAX bridge restrictions are on the Secondary Collector or lower road classes. However, many of these routes provide the only access to forestry blocks which limits the ability to cart the harvest from these blocks using more efficient 50MAX logging trucks. Given the long cartage distances to Northport or local sawmills, this substantially adds to the harvest cost.

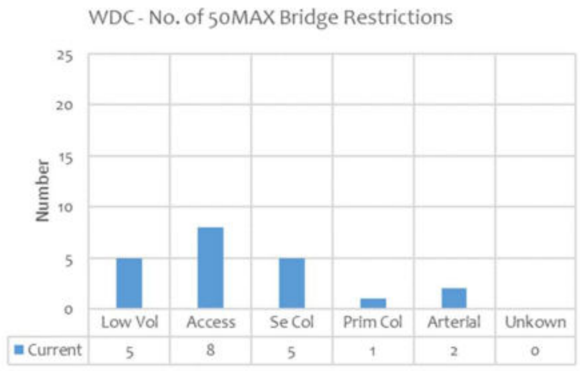
KDC



KDC Number of 50MAX Restrictions – KDC has 24 bridges which have 50MAX restrictions. Kaipara also have 7 bridges which have restrictions for standard Class 1 (44 tonne) vehicles.

All of Kaipara's 50MAX bridge restrictions are on the Secondary Collector or lower road classes. However, many of these routes provide the only access to forestry blocks or are located on dairy routes which limits the ability to cart the product from these areas using more efficient 50MAX vehicles. Given the long cartage distances involved, this substantially adds to the cost of getting the product to its destination (e.g. Northport, sawmill or dairy factory).

WDC



WDC Number of 50MAX Restrictions – WDC has 21 bridges which have 50MAX restrictions. Whangarei also have 5 bridges which have restrictions for standard Class 1 (44 tonne) vehicles.

Although Whangarei has fewer 50MAX restrictive bridges than FNDC and KDC, several of these bridges are located on Arterial and Primary Collector routes with significant heavy vehicle flows

Several of the 50MAX restrictive bridges are located on forestry, dairy or quarry routes which limits the ability to cart the product using more efficient 50MAX vehicles.

5.4 Options to be Considered

Based on the above data and the root cause analysis, the following options have been considered:

Option	Description
Option 1 – Develop long term bridge strategy and FWP in conjunction with Forestry Plan. Detailed 50MAX assessments to reduce restrictions.	Develop a long-term bridge strategy and FWP. Complete the Forestry Plan to proactively address structural constraints on forestry routes before logging commences. Continue to carry out detailed 50MAX assessments.
Option 2 – Increase number of bridge inspections and carry out retaining wall inspections.	Reduce inspection frequency for FNDC and for all councils on critical and high risk structures. Carry out annual inspections of retaining walls and develop a retaining wall FWP.
Option 3 – Provide sufficient bridge maintenance and renewal funding for FNDC and KDC, to avoid expensive bridge replacement.	Develop a professional service contract for the NTA to secure bridging design services. Develop a supplier panel to pre-qualify contractor for bridging (and other) works. Simplify the FNDC procurement process.
Option 4 – Secure professional services for bridge design, supplier panel for bridge contractors. Simplify FNDC procurement process.	Provide sufficient level of bridge maintenance and component replacement funding for FNDC and KDC, including adequate allowance for the FNDC Kohu Ra Tuarua Hokianga Ferry Service.
Option 5 – Realign bridge approaches and reduce kerb widths on timber decked bridges	Realign bridge approaches and move in kerbs on timber decked bridges to concentrate loads on the main structural beams.
Option 6 – Advocate for rail revitalisation to reduce freight haul distances.	Advocate for rail revitalisation to reduce road freight haulage distances.

PBC Multi Criteria Option Analysis, RCA: NTA

Activity/Work Categories: Structures (WC 114, 215)

Short list up to 3 options from the following:

Option - Can we make	Yes/No	Rank	Reason
❑ Intervention response **timing** change			
❑ **LoS** adjustments			
❑ Use existing assets **differently**			
❑ **Blending** Work Categories differently			
❑ **Risk** - Hold Assets longer	Yes	2	Reduce inspection frequency for FNDC and for all councils on critical and high risk structures. Carry out annual inspections of retaining walls and develop a retaining wall FWP.
❑ Managing **demand**	Yes	A - 1 B - 6	A - Complete the Forestry Plan to proactively address structural constraints on forestry routes before logging commences. Continue to carry out detailed 50MAX assessments. B - Advocate for rail revitalisation to reduce road freight haulage distances.
❑ **Route** Management	Yes	5	Realign bridge approaches and move in kerbs on timber decked bridges to concentrate loads on the main structural beams.
❑ Alternative approaches – different **solutions/technology**			
❑ **Maintenance vs Renewal** adjustments	Yes	3	Provide sufficient level of bridge maintenance and component replacement funding for FNDC and KDC, including adequate allowance for the FNDC Hokianga Ferry Service.
❑ **ONRC** Classification variance			
❑ Extended **temporary** management			
❑ **Supply chain** improvements	Yes	4	Develop a professional service contract for the NTA to secure bridging design services. Develop a supplier panel to pre-qualify contractor for bridging (and other) works. Simplify the FNDC procurement process.
❑ Improve **systems and capability**	Yes	1	Develop a long term bridge strategy and FWP.

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

Criteria	Weighting (Importance) (Total to 100%)	How good is this option: Option 1 - Develop long term bridge strategy and FWP in conjunction with Forestry Plan. Detailed 50MAX assessments to reduce restrictions.		Option 2 - Increase number of bridge inspections and carry out retaining wall inspections.		Option 3 - Provide sufficient bridge maintenance and renewal funding for FNDC and KDC, to avoid expensive bridge replacement		Option 4 - Secure professional services for bridge design, supplier panel for bridge contractors. Simplify FNDC procurement process		Option 5 - Realign bridge approaches and reduce kerb widths on timber decked bridges		Option 6 - Advocate for rail revitalisation to reduce freight haul distances	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	10%	1	0.1	1	0.1	2	0.2	1	0.1	0	0	2	0.2
Problem solving effectiveness	10%	2	0.2	1	0.1	2	0.2	1	0.1	1	0.1	1	0.1
Benefits realised	10%	2	0.2	1	0.1	2	0.2	1	0.1	0	0	1	0.1
Good Environmental impacts	5%	0	0	0	0	0	0	0	0	0	0	1	0.05
Value for Money	10%	3	0.3	3	0.3	1	0.1	3	0.3	-1	-0.1	-2	-0.2
Closing Customer and Technical LoS gaps and impacts	10%	2	0.2	1	0.1	2	0.2	0	0	0	0	0	0
Closing ONRC Performance gaps	10%	2	0.2	2	0.2	1	0.1	1	0.1	0	0	0	0
Asset preservation and sustainability	10%	2	0.2	3	0.3	2	0.2	0	0	1	0.1	1	0.1
Total Cost of Ownership (whole of life Costs)	10%	1	0.1	2	0.2	1	0.1	1	0.1	0	0	-2	-0.2
Life Cycle Management	10%	1	0.1	1	0.1	1	0.1	1	0.1	1	0.1	1	0.1
COVID-19 Recovery	5%	0	0	0	0	0	0	0	0	0	0	0	0
Totals	**100%**		**1.6**		**1.5**		**1.4**		**0.9**		**0.2**		**0.25**

5.5 Option Assessment and Line of Sight

The options and the line of sight to the preferred strategic response and the problems they are addressing are shown in the table below. These options have been ranked in order of preference and then have been assessed through a multi-criteria assessment (MCA) to determine the highest scoring options that are preferred and are to be adopted. The MCA assessment is also provided as follows.

Work Activity	Problem Statements Addressing	Preferred Strategic Response	PBC Options to be Considered	Option Rank	MCA Score	Preferred Options
Structures	Aged assets and lack of maintenance and renewals of structures in FNDC and KDC is resulting in a large number of structures prematurely reaching the end of their life, which is adversely affecting freight access and increasing demand for expensive bridge replacement.	**Programme Adjustment** • Increase structural maintenance and renewals programmes for FNDC and KDC. • Programme of 50MAX bridge strengthening on important freight routes. **Policy Approach** • Improve frequency of bridge inspections and carry out retaining wall inspections. • Complete 50MAX detailed assessments on important freight routes. • Supplier panel and improved FNDC procurement processes.	**Programme Adjustments** **Maintenance and Renewal Adjustments & Improve Systems and Capability** • Option 3 - Provide sufficient bridge maintenance and renewal funding for FNDC and KDC, to avoid expensive bridge replacement. **Route Management** • Option 5 - Realign bridge approaches and reduce kerb widths on timber decked bridges. **Policy Approach** **Improve Systems and Capability & Managing Demand** • Option 1 - Develop long term bridge strategy and FWP in conjunction with Forestry Plan. Detailed 50MAX assessments to reduce restrictions. **Risk** • Option 2 - Increase number of bridge inspections and carry out retaining wall inspections. **Supply Chain Improvements** • Option 4 - Secure professional services for bridge design, supplier panel for bridge contractors. Simplify FNDC procurement process. **Managing Demand** • Option 6 - Advocate for rail revitalisation to reduce freight haul distances.	3 5 1 2 4 6	1.4 0.2 1.6 1.5 0.9 0.25	Yes No Yes Yes Yes No

Preferred Options: From the multi-criteria assessment the preferred options are:

- Option 1 – Develop long term bridge strategy and FWP in conjunction with Forestry Plan. Detailed 50MAX assessments to reduce restrictions.
- Option 2 – Increase the number of bridge inspections and carry out retaining wall inspections.
- Option 3 – Provide sufficient bridge maintenance and renewal funding for FNDC and KDC, to avoid expensive bridge replacement.
- Option 4 – Secure professional services for bridge design, supplier panel for bridge contractors. Simplify FNDC procurement process.

5.6 Financial Impact

The following tables show the work categories and examples of the associated tasks. For full financial details for the work categories, refer to Section 08 (Financials).

5.6.1 *Far North District Council*

Work Category	Financial Impact
WC 114 Structures Maintenance	Funding for the increased Kohu Ra Tuarua Hokianga Ferry operations contract costs. Funding for additional retaining seawall maintenance. Funding to continue maintenance of bridges.
WC 215 Structural Component Replacement	Funding for additional bridge component replacement. Funding for a new programme of retaining wall renewals.
WC 216 Bridge and Structures Renewal	Funding for additional large diameter culvert replacements. Funding for a new programme of retaining wall replacements. Funding for major renewals works related to the Kohu Ra Tuarua Hokianga Ferry.
WC 341 Low Cost/Low Risk Improvements	Funding for 50MAX bridge strengthening upgrades.

5.6.2 *Kaipara District Council*

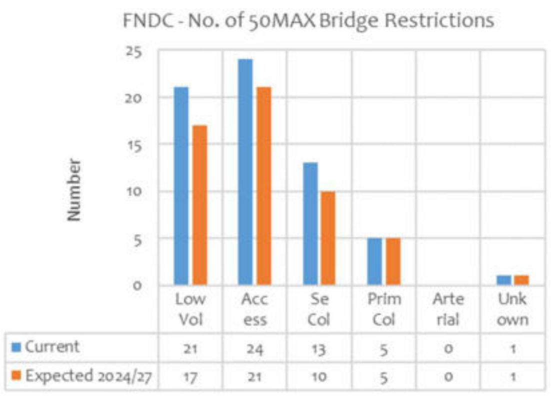
Work Category	Financial Impact
WC 114 Structures Maintenance	Funding additional bridge maintenance.
WC 215 Structural Component Replacement	Funding for additional bridge component replacement.
WC 216 Bridge and Structures Renewal	Funding for additional bridge replacement costs and a new programme of retaining wall replacements.
WC 341 Low Cost/Low Risk Improvements	Funding for 50MAX bridge strengthening upgrades.

5.6.3 Whangarei District Council

Work Category	Financial Impact
WC 114 Structures Maintenance	Funding for both Te Matau ā Pohe bridge and the Kotuitui Whitinga Footbridge. Funding to continue maintenance of bridges. Funding for items relating to confined space entry, pavement settlement, water ingress in W1 & bridge expansion.
WC 215 Structural Component Replacement	Funding for additional bridge component replacement to extend the life of the aging asset. Funding for programme of retaining wall renewals. Funding for the renewals relating to hydraulic & electrical components and corrosion mitigation of bridge handrails.
WC 216 Bridge and Structures Renewal	Funding for additional large diameter culvert replacements to address bow wave of heavily corroded structures. Funding for a new programme of retaining wall replacements.
WC 341 Low Cost/Low Risk Improvements	Funding for 50MAX bridge strengthening.

5.7 Level of Service Impact

The following table show the expected Level of Service impact of the options selected:

<table>
<tr><th>FNDC</th><th>KDC</th><th>WDC</th></tr>
<tr>
<td>
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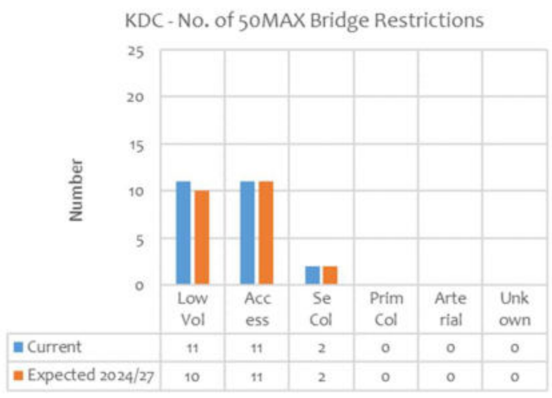
<td>
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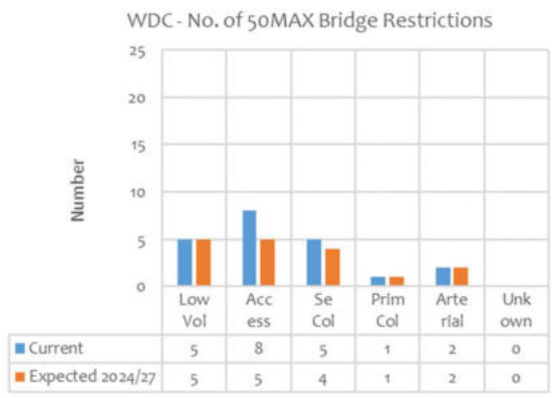
<td>
</td>
</tr>
<tr>
<td>ACCESSIBILITY – We expect that the number of 50MAX restrictive bridges on the FNDC network will reduce by (10) through investment in bridge strengthening and replacement as well as detailed bridge assessments.</td>
<td>ACCESSIBILITY – We expect that the number of 50MAX restrictive bridges on the KDC network will reduce by (1) through investment in bridge strengthening and replacement as well as detailed bridge assessments.</td>
<td>ACCESSIBILITY – We expect that the number of 50MAX restrictive bridges on the WDC network will reduce by (4) through investment in bridge strengthening and replacement as well as detailed bridge assessments. This includes both the two bridges on the Arterial Road network.</td>
</tr>
</table>

5.8 AMP Improvement

The following improvements will be considered:

- Continue to carry out full assessment on key bridges that have current 50Max restrictions to determine whether these restrictions are necessary.
- Seismic assessments to be carried out on structures on key lifelines, arterials and freight routes. Develop a programme of remedial work as required.
- Annual inspections of weight/speed restricted timber bridges, retaining walls should also be included in the inspection programme.
- Bridge and retaining wall asset data to be broken into their component parts in RAMM. Bridge and retaining wall condition, maintenance dispatches (including photos) and repairs to be stored in RAMM.
- Implement Bridges into Forward Works Programming software.
- Carry out an audit of existing guardrails to determine their condition and compliance with current safety standards.

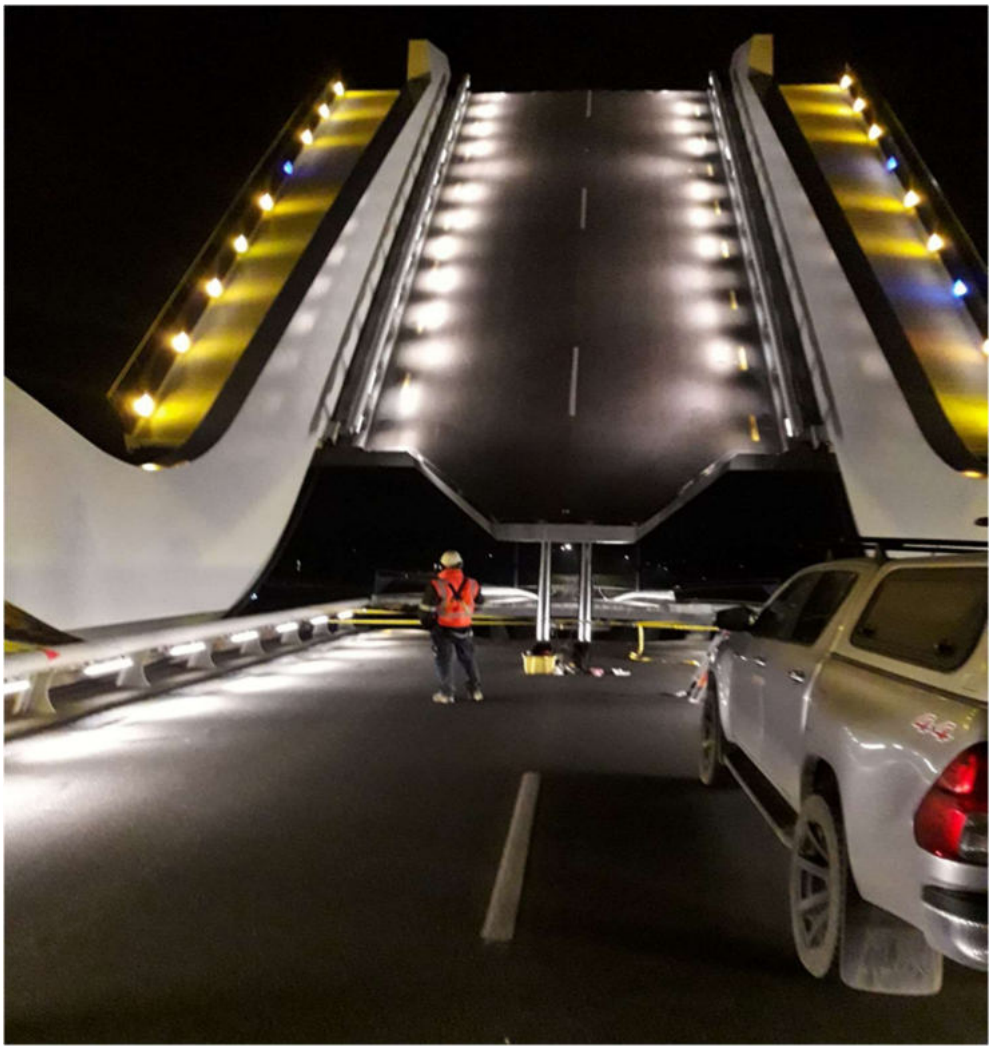
Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendix 04.A

Mechanical Bridges

Overview and Management



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Transportation Activity Management Plan 2024–2054

Appendix 04.A

Mechanical Bridges

Table of Contents

1 Overview

1.1 Description

The two mechanical bridges in Whangarei namely the Te Matua ā Pohe over the Hatea River and the Kotuitui Whitinga foot bridge over the Waiarohia Stream provide a key link to pedestrian and vehicular traffic in the town basin whilst also enabling a passage for marine traffic through the two water ways.

Figure 1-1 below illustrates the location of the two mechanical bridges.

Figure 1-1: Location of the two mechanical bridges

Whangārei's iconic harbour bridge, Te Matau ā Pohe was officially opened on Saturday 27 July 2013. This $32 million structure was the largest and most expensive WDC civil engineering project in the district back then. This year will see the ten-year anniversary of operation for this bridge.

Inspired by the design of Māori fishhooks crafted of bone, the sleek, pale structure provides a grand entrance and spectacular exit for those arriving at and departing the Town Basin. The bridge has 390 tonnes lifting bascule to allow safe navigation of marine traffic into the town basin marina. Since the start of its operation in 2013, the bridge has done 20,800 lifts to date with 11,000 vehicles crossing the bridge daily.

The Kotuitui Whitinga pedestrian and cycle bridge which spans the western half of the Waiarohia stream from Port Road, completes the Hatea Loop walkway between the Town Basin, Port Road, and Riverside Drive. Kotuitui Whitinga has a central rotating section that allows it to be opened for boats using the Waiarohia Stream. This bridge was completed in August 2014 and since its operation has done around 7,600 openings.

Figure 1-2 below shows the Te Matua ā Pohe bridge.

Figure 1-2: Te Matua ā Pohe bridge

The Te Matua ā Pohe bridge infrastructure is unique when compared to other bridges as it comprises of mechanical, hydraulic, and electrical control and communications systems to lift the bascule which is the lifting section of this bridge.

The two 8 tonne RAM's on Te Matua ā Pohe bridge have a lifting capacity of 125 tonnes each and when extended have a length of 18.4m. The counterweight on the bascule structure (J-beams) offsets the bascule weight from the lifting capacity of the two RAM's.

There are four 30kW electrical motors that drive the four hydraulic pumps to lift the bascule. The bridge has 600 metres of hydraulic pipes and more than 200 welds to join them.

Figure 1-3 following illustrate the equipment inside the hydraulic & electrical plant room.

Figure 1-3: Hydraulic & Electrical plant room

Table 1-1 below shows the details of the bridge lifting bascule.

Table 1-1: details of the bridge lifting bascule

Type	Bottom Driven Rolling Bascule
Length	25m
Width	17.7m
Weight	390 tonnes
Counterweight in Arms	67 tonnes each
Height of Arms above Deck	19m
Height of Bascule When Open	41m above mean high tide level (MHWS)
Lifting Time	140 seconds for full lift
Lifting Cycle (for One Vessel)	5 - 7 minutes to raise and lower bridge
Daily Lifts per Day	6 on average
Clear Navigational Width	16m
Clear Navigational Height (when closed)	7.5m above mean high tide level (MHWS)

Figure 1-4 following shows the 390-tonne bascule being lifted by the two hydraulic rams that are under the bridge.

Figure 1-4: - Bascule lifting and Hydraulic RAMs at W1

Apart from the electrical motors the bridge has 1,080 meters of strip light underneath the handrails for lighting the foot path and 52 feature lights for the J-beams, RAMs and underside of the bascule.

The RAMs on this bridge are only accessible by a watercraft and then entry into a confined space for maintenance purposes. The bridge can be lifted with one operational RAM due to its design and counterweight, but this would take longer. During an emergency or loss of power the bascule can be manually operated to lower it to allow the bridge to be closed.

There are around 850 meters of fibre optic cabling for CCTV and PA system and 7.5km of electrical power and control cables on the bridges that enable the operation and control of the two mechanical structures. Figure 1-5 below illustrates the Kotuitui Whitinga pedestrian and cycle bridge.

Figure 1-5: Kotuitui Whitinga Pedestrian Bridge

The Kotuitui Whitinga bridge infrastructure is distinctive when compared to other foot and cycle bridges in the region as it comprises of mechanical, hydraulic, and electrical control and communications systems to open the bridge deck carousel to enable marine traffic through the Waiaroha stream.

The hydraulic pressure to operate this bridge is supplied by a 5.5kW electrical motor that pumps oil from a reservoir to the valves via the piping system to the RAM. The hydraulic pressure extends the RAM to open the bridge carousel and retracts to close the same. Two position sensors on this bridge are used to signal and control the pedestrian gates.

Both the Kotuitui Whitinga and Te Matau ā Pohe bridges are monitored and controlled from a control room located near the west abutment of the Te Matau ā Pohe bridge. Operational monitoring is possible through the installed CCTV systems for both bridges whilst a Supervisory Control and Data Acquisition (SCADA) system enables the control functionality. The design of the control system can be upgraded to enable bridge control from a remote location.

Figure 1-6 below shows the control room for the mechanical bridges. The control room is manned during normal working ours.

Figure 1-6: Bridge Control Room

1.2 Monitoring and Condition

By 2017 after five years of operation of the two bridges it was clear the existing maintenance programme needed to be refined to reduce operational and preventative maintenance costs and streamline the operation of both bridges. This was achieved by 2022 which resulted in the five present specialised maintenance and operations contracts.

The bridge asset designs are bespoke and as such not an ‘off the shelf’ design. Specialised, purpose-built equipment is heavily used on both bridges. These assets are now ten years old, but both are still in relatively good condition, due to the application of preventative maintenance which included annual cleaning campaigns.

The structural steel components of Te Matau ā Pohe Bascule Bridge have been scheduled to be inspected by WSP (formerly OPUS) biennially as per the recommendation within the Lower Hatea River Crossing Bridge Maintenance Manual. Maintenance personnel inspect the external and internal surfaces of all steel beams and transoms (except permanently sealed sections).

In addition to a general visual inspection, the following items are checked and repaired as necessary:

- Corrosion of bolted connections
- Corrosion of structural steel members
- Damage to the deck soffit

- Excessive salt deposits inside the beams
- Excessive ponding of water inside the beams due to blocked drain holes.

Only super structure and part of the roading components of the bridges are included in this section of the AMP as this has been written from an operational point of view and focuses mainly on the hydraulic, mechanical, electrical & communications components of the bridge that include:

- Hydraulic & mechanical system
  - Pumps
  - RAMs
  - Pipes, hoses, valves, W1 sump pit
  - Oil reservoir
  - Actuators, sensors
- Electrical power & control system
  - Power reticulation switchboards
  - PLC SCADA
  - Control system network
  - Human machine Interface (HMI)
  - Electrical motors, transducers, sensors & switches.
  - Pedestrian & vehicle barrier arms
  - Uninterruptible Power Supply system
  - VMS signs
- Lighting system
  - Handrail lighting
  - Feature lighting
  - Crash rail lighting
- CCTV & PA system
  - PTZ & dome cameras
  - Totem public announcement system
  - CCTV server, switches & network

The mechanical bridges' construction projects were both completed with strict budget caps, this was particularly the case for Te Matau ā Pohe. As such, value engineering exercises were completed to assist with budget management. Some compromises have resulted from this practice which are:

- Fewer CCTV cameras of a lower specification than adequate for safe operation in all weather conditions were installed. Work on system upgrade is presently underway.
- Absence of the PA system on Kotuitui Whitinga and some areas with poor PA coverage on Te Matau ā Pohe. This is a significant problem for the operator when the control room is approximately 400m from the bridge.

2 Management Plan

2.1 Management and Operations

2.1.1 *Management*

The Kotuitui Whitinga and Te Matau ā Pohe bridges is owned by the Whangarei District Council and is maintained and operated on behalf of the Council through five maintenance and operations contracts. The five contracts are listed below:

- Hydraulics and Mechanical
- Electrical
- Operations
- Routine cleaning
- Minor Works.

Operations, maintenance, renewals, and any other works are managed by way of a project control group. This group consists of the 4 main contractors who look after maintenance and operations, with Scope Projects as the facility managers and two representatives from NTA.

When Te Matau ā Pohe was completed, it was realised that this was a unique asset with many systems that were new to many in the roading area. As such a new approach was required, and this led to the formation of the project control group.

The intent of the project control group is to:

- Ensure that the operation and maintenance of the bridge was to a high standard
- Take a leadership role in health and safety and create a template for others to follow
- Maintain the asset in the best, most presentable condition possible
- Ensure that activities on the mechanical bridges were well coordinated.

These five maintenance and operations contracts include but are not limited to the following key activities:

Hydraulics and Mechanical Contract

- Undertaking inspections of the bridge's mechanical and hydraulic systems.
- Undertaking routine maintenance, emergency repairs, and repair of accident damage.
- Equipment within the specified timeframe.
- Supply of all mechanical and hydraulic parts and critical spares as and when required.
- Recording and scheduling all inspections, maintenance and repair work undertaken.
- Providing a complete hydraulics & mechanical maintenance management service.
- Carrying out annual condition rating.
- Assisting Council in developing RAMM asset inventory and dispatch raising processes for Te Matau ā Pohe and Kotuitui Whitinga so that it can be incorporated into the RAMM Contractor system.
- The mechanical and hydraulic maintenance shall ensure the continuing efficient operation of the bridge.

Electrical Contract

- Undertaking inspections of the bridge's electrical & communications systems to identify any issues which may interfere with the operation of the bridge.
- Undertaking preventative maintenance, emergency repairs, and repair of accident damage within the times specified.
- Supply of all spare electrical parts and critical spares as and when required.
- Recording and scheduling all inspections, maintenance and repair work undertaken.
- Providing a complete electrical maintenance management service.
- Carrying out annual condition rating.
- Assisting Council in developing RAMM asset inventory and dispatch raising processes for Te Matau ā Pohe and Kotuitui Whitinga so that it can be incorporated into the RAMM Contractor system.
- The electrical maintenance shall ensure the continuing efficient operation of the bridge.

Cleaning & Minor Works Contracts

- Inspections and routine cleaning including graffiti removal.
- Undertaking preventative maintenance, emergency repairs, and repair of accident damage to the bridge structural systems within the times specified.
- Prompt emergency repair of any minor structural equipment that fails under normal working conditions.
- Prompt repair of structural equipment in case of accident damage or vandalism.
- Recording and scheduling all inspections, maintenance and repair work undertaken.

Operations Contract

- Management of the two mechanical bridges operations including monitoring and control of bridge lifts and opening during normal working hours as well as callouts.
- To provide a smooth, hazard free travel for motorists, pedestrians and marine traffic.
- Daily visual bridge inspection to detect and notify any maintenance activities that require attention, graffiti, oil spills, incidents or other concerns including H&S concerns.
- Liaise with marine users, Council, Contractors and public on bridge operations.
- On the first day of each month complete measurements of bridge gap and offsets, and report.
- Keeping bridge logbook and Monthly reporting of bridge operations.

2.1.2 Operations

The Te Matau ā Pohe diverts over 11,000 vehicles per day from the Town Basin waterfront. This has made a significant difference to the operation of the Town Basin and indeed had this additional link not been created the waterfront would experience ~20,000 vehicles per day, which is beyond its capacity to manage, particularly in peak periods.

Vessels over 6.5m in height (above water level) in the Hatea river need to phone or radio a request to bridge control to see if the bridge needs to be lifted. Whilst in the Waiaroha stream many boats will be able to pass under the bridge without requiring the bridge to be opened, skippers of boats over 2.5m in height are required to phone or radio bridge control to request the bridge to be opened. There is no charge to the marine users for the lifting or opening of the bridges.

During normal operating hours, the target response time is 5 minutes for the bridge to be raised from the time a request is received by bridge control. Outside of normal operating hours, the service is on-call and there is a response time of 30 minutes from the time a request is received.

Figure 2-1 following shows the bascule fully opened to allow marine traffic of heights over 6.5 meters through whilst the vehicular and pedestrian traffic are stopped on the bridge.

Figure 2-1: TMaP Bascule lifted

To balance the rights and needs of all users, but particularly to ensure that the rights of marine traffic to sail up-river are protected two non-opening periods, 7:00am to 9:00am and 4:00pm to 6:00pm Monday to Friday are scheduled.

Outside of these times there are normal Summer and Winter operating hours. The summer schedule begins when the daylight saving begins in September and finishes when daylight savings ends in April. Tabulated below are the bridge operating hours.

Summer operating hours:

- Monday – Friday: 9:00am to 4:00pm and 6:00pm to 7:00pm
- Saturday – Sunday: 7:00am to 7:00pm

Winter operating hours:

- Monday – Friday: 9:00am to 4:00pm
- Saturday – Sunday: 8:00am to 5:00pm

Apart from the schedule operating hours, both bridges open daily - Te Matau ā Pohe (TMaP) 12:00pm, Kotuitui Whitinga (KTTW) 11:30am. The level of interest from visitors to Whangarei is such that it became necessary to do this, so that the Information Centre could advise times for visitors to allow them to view the structures in operation.

The KTTW bridge does a monthly average of around 30 openings whilst the TMaP bridge does around 150 lifts per month.

Figure 2-2 below provides the 2022/2023 bridge opening data.

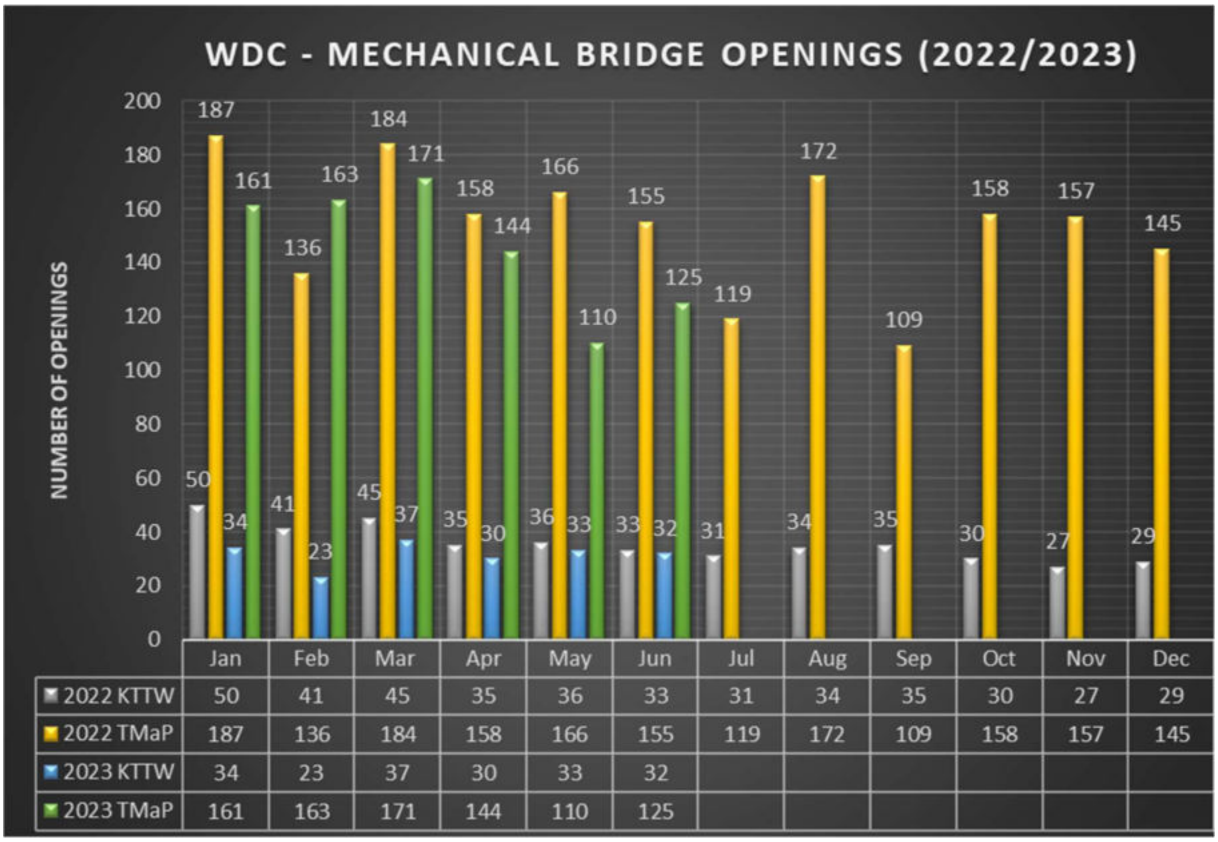

Figure 2-2: 2022/2023 bridge opening data

2.2 Maintenance

As the ten-year mark for both bridges is approached, it is apparent that operating a steel structure with electronic and electrical and mechanical controls in a coastal marine environment is challenging, particularly so with corrosion protection. As such preventive maintenance has become a crucial element of the bridge operations and the intensity of the maintenance is only anticipated to increase as the asset ages.

There are planned and refined routine preventive maintenance activities scheduled based on the bridge electrical and hydraulics manuals as well as input from the maintenance contractors. A summary of these is tabulated in Table 2-1 following.

Table 2-1: Bridge scheduled maintenance activities

Freq.	Inspections and Preventative Maintenance - Hydraulic & Mechanical	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
		2024				2025				2026				2027		
3 MONTHLY	**HYDRAULIC POWER UNIT**															
	Check all components and connections for leaks & damages	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
	Check finish on HPU tank, manifold and bund for any damage, breather bowls & filters for clogging.	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
	Inspect hoses for signs of chafing, damage to the outer cover, corrosion of the tails or ferrules or any loss of integrity	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
	HYDRAULIC SYSTEM CHECKS															
	Check working pressures, oil particle count.	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
	Check Pump/Motor assemblies for leaks, and mounting secure	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
ANNUAL	**CYLINDERS (W1)**															
	Inspect external finish of cylinder bodies and piping for paint damage		✔				✔				✔				✔	
	Inspect Port and manifold Connections for leaks		✔				✔				✔				✔	
	Wash cylinder assembly to clean off salt residue		✔				✔				✔				✔	
	CYLINDER MANIFOLD (W1)															
	Cylinder 1 and 2 - Inspect manifold, valves & connections for leaks & damage to finish		✔				✔				✔				✔	
	Cylinder 1 and 2 - Inspect transducers and electrical connections for security		✔				✔				✔				✔	
	Cylinder 1 and 2 - Inspect cover for paint damage & check counter valve adjustment.		✔				✔				✔				✔	
	CYLINDER HOSES (W1															
	Inspect W1 hoses for signs of chafing, damage to the outer cover, corrosion of the tails or ferrules or any loss of integrity & leaks.		✔				✔				✔				✔	
	MAIN CONTROL MANIFOLD (W1)															
	Inspect manifold, valves & connections for leaks & damage to the finish		✔				✔				✔				✔	
	Inspect transducers and electrical connections for security		✔				✔				✔				✔	
	Check relief and throttle valve adjustment		✔				✔				✔				✔	
	CYLINDER WELL/PIT (W1)															
	Remove silt from sump and base of W1 well/pit. Wash walls of the W1 well/pit. Wash sump pit.		✔				✔				✔				✔	
	HYDRAULIC POWER UNIT															
	Pump rebuild - Full service of pump and replace seals (5 year rolling cycle of 1 pump per annum including recirculation pump).			Pump 2				Pump 3				Pump 4				Recirc Pump
	Change filter elements			✔				✔				✔				✔
	HYDRAULIC SYSTEM CHECKS															
	Carry out full oil analysis and report			✔				✔				✔				✔
	Data log flow and pressure test on pumps			✔				✔				✔				✔
	MECHANICAL SYSTEMS - RACK & TRACK															
	Inspect Rack & Track bolts, shock absorbers, rubber bearing pads, rubber bearing pad bolts.			✔				✔				✔				✔
	Check Shock Absorbers for corrosion. Grease as necessary			✔				✔				✔				✔
	Check Telflon Pads for damage and security.			✔				✔				✔				✔
	GENERAL															
	Carry out a test drill of the emergency systems associated with the bridge. This shall include a test of the hydraulic emergency systems & manual lose of Te				✔				✔				✔			
3 YEARLY	**CYLINDERS (W1)**															
	Inspect cylinder rods for damage to chrome (Incremental Lift)						✔									
	Inspect gland seals for leaks and salt or contamination build up. Check bolt torque on clevis plate.						✔									
	Inspect cylinder bearings top and bottom.						✔									
	PIPEWORK															
	Inspect pipework for damage to the paint finish						✔									
	Inspect pipework for leaks						✔									
	Wash pipework to clean off salt residue						✔									
	Inspect concrete trench & pipe work between the western bridge abutment and the control room building.						✔									
	Remove the steel plates on the western bridge abutment. Inspect the pipework and other equipment.						✔									

These complex assets require both mechanical and electrical maintenance to ensure safe operations of the bridge. Table 2-2 following shows a summary of the scheduled electrical maintenance.

Table 2-2: Bridge scheduled electrical maintenance

Freq.	Inspections and Preventative Maintenance - Electrical	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
		2024				2025				2026				2027		
6 MONTHLY	**LIGHTING**															
	Visually inspect functional and feature lights for any faults and or signs of damage or reduced output (including	✔		✔		✔		✔		✔		✔		✔		✔
	EAST/WEST SWITCHBOARDS															
	Operate RCD test buttons and perform visual check on MCB's. Check switchboard for moisture/corrosion and	✔		✔		✔		✔		✔		✔		✔		✔
	SCADA PC															
	Clean interior of the PC enclosure, check all SCADA related equipment.	✔		✔		✔		✔		✔		✔		✔		✔
ANNUAL	**VEHICLE AND PEDESTRIAN BARRIER ARMS**															
	Clean and oil the levers and check the nuts, screws, manual release, limit switches & obstacle detection.			✔				✔				✔				✔
	Clean and grease the articulated joint and spring-post, check all electrical connections.															
	Check that all control and safety functions & bar balance are working correctly															
	ELECTRICAL CHANNEL LID - FOOTPATH															
	Check internal areas for any signs of corrosion/issues.			✔				✔				✔				✔
	Check drain holes clear.															
	TOTEM POLES															
	Check internals of totems for signs of corrosion of deterioration.			✔				✔				✔				✔
	Check condition of screws and hinges.															
	Carry out earth loop impedance test on each totem.															
	PA SYSTEM AND INTERCOMS															
	Test PA system and all intercoms check whether they are working properly.			✔				✔				✔				✔
	LIGHTING															
	Clean feature light Perspex covers and remove cobwebs etc.			✔				✔				✔				✔
	CAMERA LENS															
	Clean camera lens with clean rag (do not use Rain-X or similar cleaning agent).			✔				✔				✔				✔
	MAIN SWITCHBOARD AND EASTERN CABINET															
	Check batteries of both UPS's by cutting the power and monitoring the capacity on the front panel of the UPS.			✔				✔				✔				✔
	Carry out earth loop impedance test on each switchboard.															
	Check for hot spots via thermal imaging device.															
	CONTROL ROOM ELECTRICAL SYSTEMS															
	Check the control room electrical systems that includes lights, CCTV camera, heat pump, hot water cylinder, SCADA computer, computer monitors, master control panel.			✔				✔				✔				✔
	PUMP MOTORS															
	Remove & carry out electrical servicing of hydraulic pumps			Pump 2				Pump 3				Pump 4				Recirc Pump
	Check for unusual noises and lubricate as necessary.															
	W1 ELECTRICAL INSPECTION - CONFINED SPACE															
	Coordinate with the Hydraulic/Mechanical Contractor.		✔				✔				✔				✔	
	Inspect electrical junction boxes in Pier W1 & replace sump pump															
	Service any level sensors associated with the sump pump.															
	GENERAL															
	Carry out a test drill of the emergency electrical systems associated with the bridge.				✔				✔				✔			
2 YEARLY	**TEST LIFT**															
	Test of the bridge remote control. To be undertaken in conjunction with the annual emergency test drill.								✔							
3 YEARLY	**CLEVIS LIMIT SWITCHES**															
	Clean and lubricate both clevis limit switches in conjunction with Hydraulic/Mechanical Contractor 3 yearly check of hydraulic rams in Pier W1 well.						✔									
	WESTERN ABUTMENT PUMP															
	Coordinate with the Hydraulic/Mechanical Maintenance Contractor for the removal of the abutment panel.						✔									
	Inspect and service pump behind panel at western abutment.															
5 YEARLY	**UPS MAIN SWITCHBOARD AND EASTERN CABINET**															
	Replace battery in Main Switchboard UPS in Electrical Room		✔													
	Replace battery in UPS in the Eastern Cabinet										✔					

2.3 Improvement (Bridge Improvement Strategy)

The bridge improvement strategy has been derived from the findings of the condition monitoring and preventive maintenance activities. This has been split into three major components being the Hydraulic/Mechanical, Electrical and Civil works. Health and Safety is becoming increasingly complex and has also triggered an aspect of the bridge improvement strategy.

It has become necessary to initiate an independent Safety in Design review of the confined space access by maintenance crew on the bridge's W1 pier that is 7m deep and is accessible by water. Safety in Design was not mainstream for transportation projects of this type in 2011/12. Details of the proposed bridge improvements are discussed in the sections below.

2.3.1 Hydraulics and Mechanical

Confined space entry – Engineering Controls

The W1 pier on TMaP that houses the two hydraulic RAMs has mechanical and electrical components that are 7m inside a confined space and is only accessible by water. Figure 2-3 below illustrates the W1 pier RAMs.

Figure 2-3: W1 pier RAMs

The absence of engineering controls such as anchor points, access ladder, platform railing and additional hatch in the platform has made this confined space entry risky. An independent assessment of this is being carried out and implementation of the required engineering controls are proposed in this AMP-as bridge improvements.

Flange seal replacement – Hydraulic pipe

There are 600 meters of high pressure and return hydraulic pipes running along the TMaP bridge. Whilst the flexible hoses in the plant have been replaced, it has been noticed that the steel pipe flanges seals are now starting to leak. A major section of these pipes is over the water and can be accessed by a barge or a purpose-built man cage operated from the bridge deck. The number of flanges and the challenging environment means that this is going to be a major maintenance activity a such is proposed in this AMP.

Figure 2-4 following show the hydraulic pipe network under the bridge.

Figure 2-4: Hydraulic pipe network under the bridge

Hydraulic fluid replacement – biodegradable hydraulic oil

The bridge hydraulic system contains around 4,000 litres of oil in its reservoir and another 1,000 litres in the piping system making a total capacity of 5,000 litres. The leaking seals on the hydraulic pipe flanges possess a serious risk not only to the bridge operation but to the contamination in the Hatea river. The seals have lasted for 10 years and are now showing signs of deterioration. To mitigate against any future contamination, it is imperative to replace the type of hydraulic oil used in the bridge operation to biodegradable type.

TMaP RAM Cylinders – Oil Weeping & Spare

Inspection of the cylinder RAMs on W1 during maintenance revealed that there was some weeping of hydraulic fluid into the bunded area of W1. This indicates that the cylinders will need to be refurbished within the next 2 years, based on current assessments. Figure 2-5 below shows the Cylinder RAMs on W1 during maintenance.

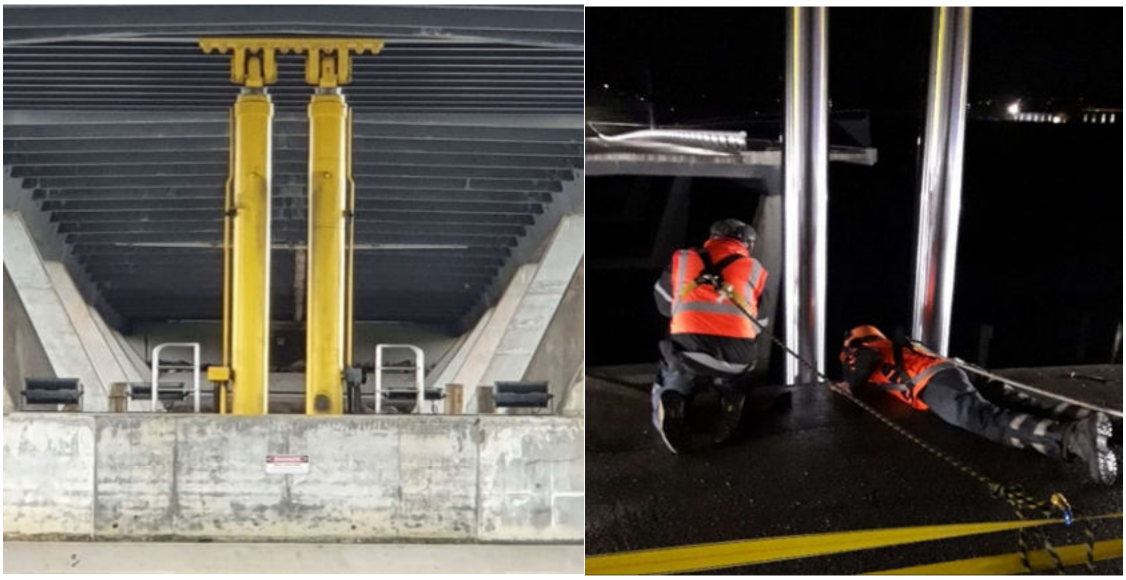

Figure 2-5: Cylinder RAMs on W1 during maintenance

The second issue noticed on the RAM is the pitting of the chrome on the cylinder rods (extendable section of RAM) although the design life was around 15yrs. Whilst the weeping is related to the cylinder seals and is something that can be done as a major maintenance work the chrome pitting is far more extensive work.

To preserve service will necessitate acquisition of a critical spare cylinder from overseas, as there is no known way to separate one cylinder from the hydraulic circuit without significantly increasing the bridge cycle time and halving its wind loading limit.

At this point in time the contractor understands that the cylinder's rod may not be able to be refurbished in New Zealand due to the type of coating and this is also a key reason why one cylinder at a time is proposed to be removed and sent for refurbishment. A spare RAM is being proposed in this AMP.

2.3.2 *Electrical (Power & control and lighting)*

Switchboards for KTTW - Upgrading

The electrical switchboards for KTTW bridge are now congested with wiring and are developing heating as well as access issues. Accessing the switchboard for maintenance & callouts is problematic as well during raining weather. Figure 2-6 below shows the internal space limitations.

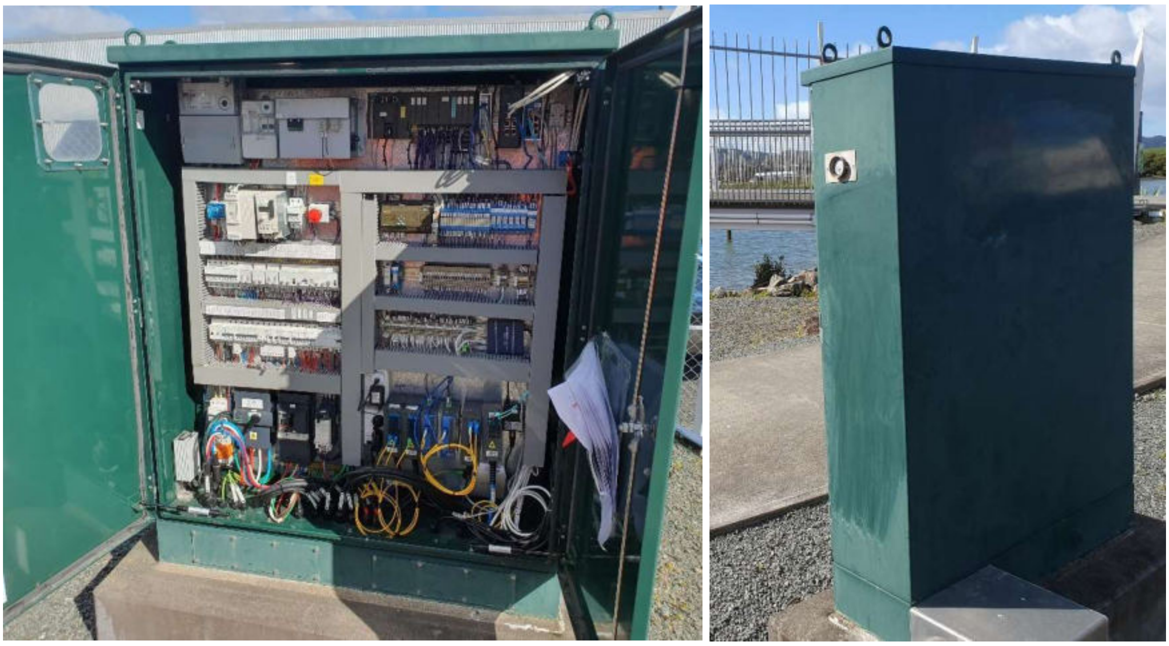

Figure 2-6: Electrical switchboard internal space limitations

There are two such switchboards on either side of the KTTW bridge and both are in similar condition. With the replacement of the handrail light on KTTW and the installation of more cameras and a PA system, an additional switchboard will be required. Furthermore, a covering of both switchboards is necessary to enable access during raining weather to improve the operational efficiency.

TMaP Marine VMS sign – Replacement

There are five road Variable Message Signs (VMS) and two marine VMS for the TMaP bridge operations. The five road VMS signs have been upgraded and are operational, but the two marine VMS signs are faulty and obsolete now. As such these are proposed to be replaced with compatible ones to connect the present VMS control system. Figure 2-7 following shows the marine VMS that has to be replaced (RHS) and the upgraded road VMS for TMaP bridge (LHS).

Figure 2-7: Marine VMS to be replaced (LHS) and upgraded road VMS for TMaP bridge (RHS)

TMaP feature, handrail & crash rail light – Replacement

There are 1,080 meters of strip light under the handrails, 52 feature lights for lighting the "J" beams, the RAMs and underside of the bascule and around 266 crash rail lights on the TMaP bridge. The strip bespoke handrails have begun to fail and sections of it are not operational. Figure 2-8 below shows the missing handrail lights.

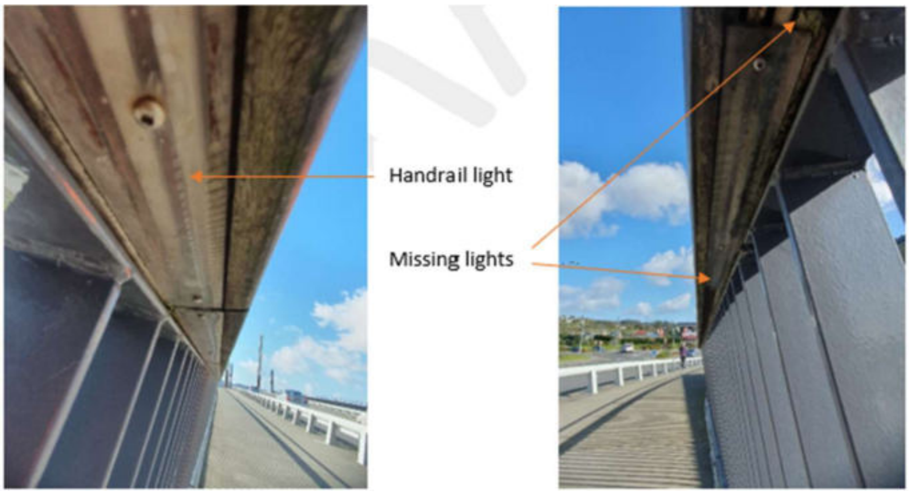

Figure 2-8: Missing handrail lights

The 52 obsolete feature lights for the TMaP bridge can change colour by adding removable gels in front of the feature light panel. The gels slide into the light panel's frame and this manual colour alteration task takes two people one day to do. The colours are also limited due to the type of gel and the fading of it over time. These lights have also deteriorated due to the harsh environment and the frames are becoming unusable. The fading of the gel and the manual task of changing colour is no longer feasible as there are now configurable RGB colour combinations available using LED lights and these can be changed remotely. Figure 2-9 following illustrates the condition of the feature lights.

Figure 2-9: Condition of the feature lights

The blue colour gels in the above photos are held by packaging tape as the frames have deteriorated beyond repair. The same is for all the feature lights.

The crash rail lights are also bespoke lights design to suit the TMaP bridge. Several of these lights have been failing over time and replaced by the contractor. The supplier has confirmed that similar lights are no longer available and only option now is modification or improvising by salvaging parts to keep them going. This has not proved to be a feasible option as there are a number of lights not operational and the contractor has been moving fittings around to ensure that some light is available on each span of the bridge. Figure 2-10 below shows the crash rail light.

Figure 2-10: Crash rail light

All the feature, handrail and crash rails lights are proposed to be replaced as part of this AMP.

2.3.3 Civil works

Pavement settlement – TMaP East abutment

Significant pavement settling has occurred at the eastern abutment, resulting in a depression and water ponding in this area. Ponding continually appears at the eastern abutment several meters away from the storm water drain, after deluges of rain. This settlement was expected as the eastern abutment area is on a former landfill. It appears the settlement of sub grade materials is ongoing and in the next 1-2 years will require remediation as the deformation is now starting to show on the structure's crash rail.

Figure 2-11 below show the water pooling and the pavement settlement visible on the carriage and the deformation of the crash rail structure.

Figure 2-11: Water pooling and the pavement settlement

The resultant water pooling due to the pavement settlement is becoming a hazard after deluges of rain for motorists as well as pedestrians.

The pavement settlement remedial is a major road rehabilitation work where the asphalt surface will be removed, and the road built up from the structural layer to align with the wearing course of the existing bridge surface. It is imperative that this corrective measure is taken within the next two years as such this work is proposed in this AMP.

Major corrosion – Handrail mounts

It is quite apparent that maintaining a steel structure in a coastal marine environment is challenging, particularly so with corrosion protection. Coating systems require renewal, particular on high wear areas such as the sides of the hook beams facing the footpaths, and the steelwork on the handrails for both bridges. Whilst the contractors have been maintaining the steel structures to some degree, it is now time for some intrusive and extensive maintenance to preserve the life of the asset.

Figure 2-12 following illustrate the level of deterioration on TMaP and KTTW handrail mounts.

Figure 2-12: Level of deterioration on TMaP and KTTW handrail mounts

To coat these properly on site and achieve the rated service life, requires the panels to be removed, prepared for coating, and then coated with marine grade paint system. This work is essential to maintain the integrity of the bridge handrail and its supporting structure. To mitigate against the rapid corrosion this work is proposed in this AMP.

Water ingress W1 sump – Investigation & Mitigation

Water ingress into the W1 sump after deluges of rain is becoming a constant problem. The runoff water into the sump from the bridge opening above W1 draws in silt and primarily clogs the sump.

In the initial design there was a gutter installed under the bridge bascule opening section but due to an expansion issue of the bridge this was removed and replaced with foam sealant. Figure 2-13 below shows the gap between the bridge lifting section and the fixed portion and water tracking marks on the piers.

Figure 2-13: Gap between the bridge lifting section and fixed portion and water tracking marks on the piers

The water issue has serious implications for the bridge operations, when the water pumps are clogged the water level in the W1 sump rises and comes in contact with the electrical junction box inside the sump and trips out the control circuit. When this happens the bridge control fails which causes traffic delays and reputation damage to the Council as TMaP is an iconic structure in the region. This was the root cause of the stoppage in April 2022. The location of the pump in the W1 sump which is a confined space with deficient engineering controls possess a significant challenge to repair and service.

As an interim measure a temporary submersible pump system has been setup just in case the main pump clogs and fails. Furthermore, the operators have been trained to monitor the water level alarm for W1 sump. Work is proposed in this AMP to investigate and mitigate the ingress of water in the W1 sump by redesigning the gutter to trap and divert the runoff water. This would improve the operational efficiency and bring the system back to its intended design.

Bascule deck epoxy surface – Renewals

The TMaP bridge bascule has a specialised epoxy coating to hold the thin asphaltic concrete surface that forms the carriageway. Replacement of the specialised epoxy decking surface and repainting has been allowed for every fifteen years with the first replacement being due in 2028. Replacement of the thin asphaltic concrete surfacing is to be undertaken using an oscillating roller.

This work is to be carried out through the Road Maintenance Contract and as part of this AMP proposal is made for the planning and implementation of this work in the 2027 financial year to ensure the specialised road surface on the bascule is maintained in good condition.

TMaP & KTTW Bridge expansion – Investigation & Mitigation

After construction and during the first year of operation the expansion issue was identified on TMaP bridge. As a result of this the gutter was removed and the concrete overhang on the bridge deck (fixed section) was cut back to create enough gap for the bridge to operate. The movement of the east bridge abutment has not only caused pavement settlement but also decreasing the expansion gap. As part of this AMP further specialised investigation and recommendation to mitigate the movement and settlement of the east abutment is being proposed.

Teflon pad KTTW - Replacement

The carousel opening section on KTTW slides over a Teflon pad which is designed to wear out over time. Inspections have revealed that the Teflon pad requires replacement and as such is proposed for replacement in this AMP.

2.3.4 Remote operation

The intended design of the bridge control system was to enable the bridge operation from either the control room located on the west abutment of TMaP or from a remote location in future. Due to the deficiencies in the CCTV and PA system it was deemed unsafe to venture into remote operation. With the CCTV and PA upgrade project underway in 2023, it is feasible to explore the remote operation of the bridges. With the remote operational capability, the bridge operations can be outsourced to the likes of ATOC (Auckland Transport Operation Centre) which is manned 24/7.

As part of this AMP investigation and planning for upgrade of the SCADA and communication network is proposed to set the platform for remote operations.

Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendix 04.B

Kohu Ra Tuarua – Hokianga Ferry

Overview and Management

Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendix 04.B

Kohu Ra Tuarua – Hokianga Ferry

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1 Overview

1.1.1 *Description*

The Hokianga Ferry service is a vital transport link in the Far North District's Road network. The service operates between the South Hokianga (Rawene) to North Hokianga (Rangiora). The Service provides the community of North Hokianga with access to healthcare at the Hospital in Rawene, this includes the provision of afterhours callouts for emergency services as well. The Ferry provides access to essential services such as food and fuel, access to education, employment, and social connections for residents from both sides of the harbour.

The Service also is a tourism enabler on the Twin Coast Discovery Highway providing economic benefits for local businesses. The tourist use provides an amenity to a much wider group of users who in turn make use of the commercial facilities in the district to the benefit of the residents.

Figure 1-1 below illustrates the Rawene-Kohukohu link that the Ferry provides in the absence of a road link.

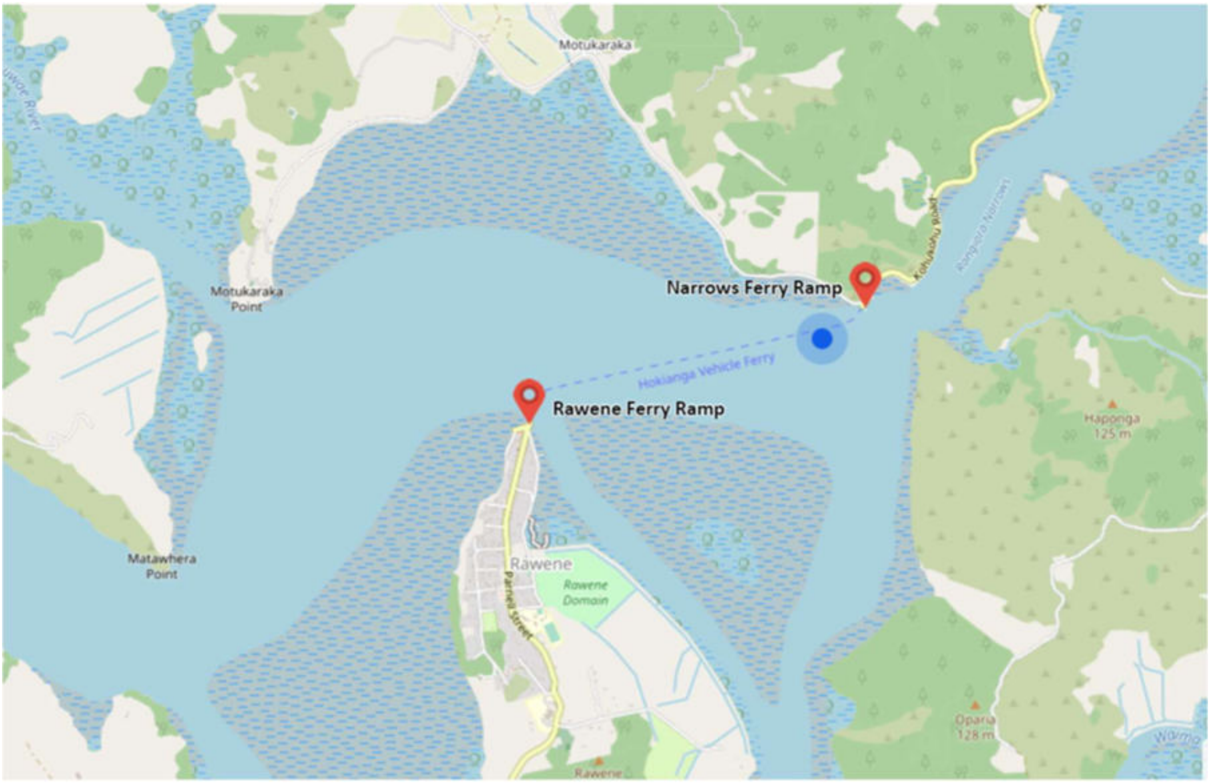


Figure 1-1: Ferry link

Without the Ferry operating the vehicle commuters would have to travel an additional 90km on SH12-SH1 driving at least 1hr 27min to get to Kohukohu from Rawene. This journey via the Ferry takes around 15mins only making it a feasible and an important link for the Hokianga community. The Ferry carries an average of 250 vehicles and 500 passengers across the harbour daily.

The Kohu Ra Tuarua is a double ended, monohull, flat-deck vehicle ferry, specifically designed and built for operating on the Hokianga Harbour. Boarding access to the vehicle deck is via hydraulically operated ramps at both ends of the vessel. The ferry has a carrying capacity of 20 cars or equivalent heavy vehicles.

The Ferry was built in 1999 by Shipco Ltd for the Far North District Council and has a design life of 30yrs.

The superstructure is located on the nominated port side and contains the wheelhouse, enclosed seating for pedestrian passengers, the ship's office, storage space and a toilet.

The hull is welded steel construction with the superstructure being aluminium. The ferry is maintained and operated under a Maritime Operator Safety System (MOSS) and has a Certificate of Survey issued by Robin Williams & Associates in compliance with Maritime New Zealand Rules, valid until May 2026, to operate within the Hokianga Harbour.

The Ferry is powered by four diesel MAN engines and has four sets of Schottel jet pump propulsion system to provide the thrust and manoeuvrability required to operate in the harbour. Table 1-1 below shows the details of the vessel.

Table 1-1: Vessel details

Length overall	33.6m
Waterline length	31.38m
Breadth	12.3m
Depth	2.0m
Draft	0.9m
Lightship displacement	146 tons
Deadweight capacity	131 tons
Capacities	Fuel 10,300 (Diesel) / Freshwater 3,000 / Lube Oil 500/
Engines	4 x MAN model 2866, TE each developing 186 kw
Propulsion	4 x Schottel model SPJ 57T Pump Jets with Co-pilot 2,000 integrated controls

1.2 Monitoring and Condition

Northland Ferries Ltd, as Council's contractor, operates the Hokianga Harbour Ferry Service, and is also contractually responsible for preparing and managing the agreed routine and periodic maintenance programmes for the ferry vessel; including all mechanical, electrical, hydraulic systems, re-painting, and anti-corrosive maintenance to all surfaces to maintain the vessel to a serviceable and presentable standard throughout the period of the contract.

The vessel has been gradually renewed over its operational life and over the last six years has had the following components replaced with new ones:

- 4 x new MAN diesel engines (2017-2019)
- 4 x new engine gearboxes (2023)
- 4 x new schottel jet pumps (2017-2021)
- 4 x new schottel control units (2023).

Table 1-2 below shows the engine running hours for five months this year. Each engine does an average of 3,900hrs per annum.

Table 1-2: Engine running hours – Jan – May 2023

Month	Engine 1 (Hrs)	Engine 2 (Hrs)	Engine 3 (Hrs)	Engine 4 (Hrs)
Jan-23	87,443	86,061	85,498	86,850
Feb-23	87,718	86,371	85,808	87,130
Mar-23	88,059	86,727	86,163	87,459
Apr-23	88,371	87,022	86,460	87,773
May-23	88,399	87,050	86,488	87,801

Figure 1-2 below shows the engines with the newly installed gearboxes units.

Figure 1-2: Newly installed gearboxes units

2 Management Plan

2.1 Management and Operations

2.1.1 Management

The Kohu Ra Tuarua Ferry is owned by Far North District Council and is operated on behalf of the Council by Northland Ferries Ltd. (formerly known as Fullers BOI Ltd) under a Management and Operations contract.

The contract has for an initial term of three years commencing on 1 May 2020 with three contract extension for a further 3 + 2 + 2years. At present the contract is running its second (3yr) separable portion which expires 30 April 2026.

The contract includes but is not limited to the following key activities:

Proactive

- Undertaking preventative & routine maintenance of the vessel.
- Undertake approved Major Maintenance and Renewals works.
- Asset inspection and condition assessment to ensure compliance with Maritime Operator Safety System (MOSS).
- Operating a Passenger only service to same timetable for service interruptions exceeding one day.
- Maintaining critical spares of parts and equipment for reactive maintenance.

Reactive

- Attendance and rectification of emergency repairs of any equipment that fails under normal working conditions.
- Prompt repair in case of crash damage or vandalism.
- Working with DHB and emergency services as required in emergency response events.

Management

- Operation of the Hokianga Ferry Service 365 a year to the scheduled timetable and to operate the vessel for Emergency Callouts.
- Management of fare collection.
- Compliance with relevant Maritime Transport requirements and to ensure the vessel has a current Certificate of Survey.
- Marketing and promotion of the Service, including collaborative working with key stakeholders.
- Managing and undertaking maintenance activities within budget allocations;
- Working collaboratively with stakeholders; District Councils, Hokianga Health Board, Tourism Operators, suppliers, and the community.
- Monthly reporting to FNDC on Contractual matters.

The Contractor is primarily responsible for continuous operation and necessary maintenance of the Kohu Ra Tuarua Ferry. The following high-level outcomes are sought from this contract model:

- To provide a smooth, hazard free travel for motorists and pedestrians.
- To provide on time daily scheduled sailings, on demand shuttling and afterhours callouts to support the needs of the community.
- To preserve the structural integrity of the vessel.
- To ensure maximum service life of the asset.
- To utilise resources in an efficient and cost-effective manner.
- To identify all maintenance, renewal and improvement needs of the vessel and its associated components managed under this contract.
- Increase customer satisfaction.

2.1.2 Operation

The Maintenance and Operation of the Hokianga Ferry Service is not self-sufficient as such is funded through a combination of fares collected, subsidy of the net position (operational expenditure less fares) from Waka Kotahi and the balance via FNDC general rates.

The Ferry service is well regarded in the district and its performance and future is a matter of vital interest in the community. The Ferry is operated by Northland Ferries seven days a week on a scheduled sailing timetable, Table 2-1 below shows the details.

Table 2-1: Hokianga Ferry timetable

North Terminal	Narrows	*0715 (Daily weekdays – excludes P/H)*	0745	0830	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
South Terminal	Rawene	*0700 (Daily weekdays – excludes P/H*	0730	0815	0845	0930	1030	1130	1230	1330	1430	1530	1630	1730	1830	1930

During the peak season, there can be a backlog of cars waiting to board the ferry but only for short periods of time, due to scheduled return trips that the ferry operates to. Due to high demands during peak season the Ferry shuttles to clear any queuing when necessary. The current timetable is sufficient for the present needs but there have been some requests to extend operational hours to meet the social needs of the community.

The Ferry fares have been set by the Far North District Council in accordance with the socio-economic factors of the Hokianga community. Table 2-2 below Illustrates various fares for the Ferry service valid through to July 23.

Table 2-2: Ferry fares valid through to July 23

LIGHT VEHICLES	HEAVY VEHICLES	CAMPERVANS	MOTORBIKES	PASSENGERS
$20 One-Way	$15* One-Way	$40 One-Way	$5 One-Way	$1 One-Way
Under 2500kg gross tare weight and maximum two axles	*Price is per axle	Vehicles with a bed weighing over 2500kg gross tare weight		Applies to foot, motorbike and vehicle passengers

The operator, Northland Ferries Ltd have a dedicated web page that provides real time information on the Hokianga Ferry service including the location of the vessel. The web page includes the ferry timetable and fares as well. Apart from this Northland Ferries have a social media page that provides information pertaining to the state of service and receives concerns and comments from customers which are addressed by their public relations team.

The Ferry service operates a CCTV system to monitor and most importantly to discourage unruly behaviour from service users. The CCTV system is also used as a mechanism to audit onboard ticket sales by Northland Ferries. The CCTV system operates under Entrada Travel Group's Privacy Policy and in compliance with the Privacy Act and the footage is only made available upon the request of the Council or Police.

Being a vital service-oriented link, the Ferry operation and management contract is designed to closely monitor the performance of the operator against set targets.

The six key results areas are Asset Management, Customer Responsiveness, Financial & non-financial Management, Health & Safety, Quality & Innovation and Community Engagement. Table 2-3 following shows the KPI's for the Operation and Management of the Ferry service.

Table 2-3: Ferry Service operations and management KPI's

	Key Performance Indicator	Measure	Evidence / Reporting	Target
ASSET MANAGEMENT	Ten-year maintenance plan	Submission of accurate information and maintenance plan	Updated 10-year Maintenance plan	100% by 31st March each year +/- 5 working days
	Delivery of annual major maintenance and renewals programme	All projects that make up the agreed annual programme are delivered.	Contractors claims and supporting documentation	100%
CUSTOMER SERVICES	Customer Care	Ferry service will run in accordance to advertised timetable.	Contractor detailed sailing data and Monthly report summarising details of trips departing more than five minutes late, trips not operated, and total trips operated (per clause 5.12.3).	Equal to and greater than 95%
		Timely response to Customer complaints.	Contractor Complaints Register and summary included in monthly report.	Within 3 working days
		Timely notification of Ferry service outage - temporary signs shall be erected.	Time/date stamped photographic evidence provided to FNDC	Within 1 hour
	Community Engagement	Regular interaction and participation with the Hokianga Ferry Liaison Group, Hokianga Health and the community.	Regular stakeholder engagement forums set up-participated in, and actions followed up on a minimum quarterly basis. Reporting of the same.	100%
CONTRACT MANAGEMENT	Quality and Innovation	Introduction of technology and improvements to provide better value for money and enhance community outcomes.	Innovation and improvement is put forward for Council consideration, if approved, is implemented within the agreed timeframe (prior to end of financial year).	At least one agreed initiative per annum to be agreed and implemented where confirmed budget is available.
	Transparency of information	Monthly report supplied to FNDC	Monthly Report	Within 5 working days of the following month
	Non-conformance notice (NCN	Number of NCN's issued	Notices issued	4 or less per year
		Number of NCN's resolved within stipulated timeframe	Resolutions completed	100%
	Revenue collection reporting	Accurate and transparent financial	Financial revenue information & monthly contract claim and monthly report (received by	100%

	Key Performance Indicator	Measure	Evidence / Reporting	Target
		figures for revenue collection.	5th working day of following month).	
HEALTH & SAFETY	Safety consciousness for ferry customers, staff and the environment	Prompt reporting of all accidents and incidents to requirements within Contract requirements.	Notifications & Reports are received within specified timeframes and are in accordance with Contract.	100%
		Safety audit of the service carried out by Contractors Rep or as delegated.	Completed audit received with Monthly report - Supplied together with monthly report and all required safety drills have been carried out and documented.	100%

2.2 Maintenance

The contractor is responsible for and carries several critical spares for the vessel including a complete second-hand engine. The Contractor's maintenance strategy is broken down into three categories below:

- Planned – Survey/Winter Maintenance
- Planned – Scheduled Maintenance
- Unplanned (reactive) Maintenance.

Planned – Survey/Winter Maintenance

This is planned by the Operator in Apr/May of the year specifically for the vessel to be executed over a 12-month period (July to June). The work is identified via number of sources such as but not limited to Survey requirements, Health and Safety matters from the Operator's H&S committee, vessel Planned – Scheduled Maintenance crew and mechanics suggestions.

Planned – Scheduled Maintenance

The operator has a vessel specific preventative maintenance schedule which is developed according to manufacturers' recommendations, past trends, and the operator's knowledge of the vessel. The hour-based servicing carried out on the vessel is shown in Table 2-4 below.

Table 2-4: Planned maintenance

250 hrs – Servicing	500 hrs – Servicing	1000 hrs – Servicing	3000 hrs – Servicing
Remove engine belts, check water pump, alternators & idler pulleys, check condition of belts & re-tension	Carry out service as for 250 hours plus;	Carry out service as for 500 hours plus;	Test strength of coolant in cooling systems, adjust if necessary
Supply & change engine oil & filters.	Supply & change fuel filters.	Supply & service air filter elements.	Check engine valve clearances
Check air induction system for damage, chaffing or leaks	Supply & change fuel pre-filter elements	Supply & change ZF gearbox oil & filters	Supply & change Schottel steering planetary gear unit oil.
Check engine for oil & coolant leaks	Turn ZF gearbox oil strainers to clean out if fitted	Grease cardan shaft universals & slip joints	Supply & change Schottel gearbox oil.

250 hrs – Servicing	500 hrs – Servicing	1000 hrs – Servicing	3000 hrs – Servicing
Check fuel system for leaks	Check engine idling speed & adjust if necessary	Check all gearbox & engine control cables	Check turbo charger radial & axial clearances
Check & clean centrifugal oil filter if fitted	Check all coolant hoses for signs of damage & deterioration	Check all valves for seizing & gl& leakage	Remove & service engine cooling water pumps
Check & clean engine rooms & centre void space	Check bilge / fire pump operation	Sample hydraulic oil & change filter	Carry out sampling & testing of steering hydraulic oil
Check visually for exhaust smoke	Carry out SOS scheduled oil sampling for engine oil & monitor results	Inspect ramp lift chains & connections	
Check all instruments, controls & warning systems	Grease ramp cable pulleys x 8	Check all battery acid levels where applicable. Health test all batteries	
Check ZF gearbox oil levels, top up if necessary		Carry out sampling & testing of gearbox oil	
Check pump jet gearbox oil levels, top up if necessary		Clean out pump jet vent pipes	
Check steering hydraulic oil reservoirs, top up if necessary		Clean out deck drain scuppers	
Check all Nav lights & deck lights are operative, repair or replace bulbs as necessary.			

To ensure the safety of the Public and the continued operations of the Ferry, the Contractor carries out a monthly vessel compliance audit that looks at the amenities, life preserving equipment, fire suppression system, vessel logbooks, Maritime Operators Plan, Northland Ferries Operational Manual, crews training, and vessel's maintenance records to name a few.

The vessel's out of water major maintenance was carried out in May 2023 and all works completed as recommended by the Marine Surveyor. The Vessel now has a new Certificate of Survey that is valid to 30th May 2026 in accordance with Maritime NZ requirements.

Figure 2-1 below shows the vessel on dry dock undergoing its major out of water maintenance in May 2023.

Figure 2-1: Out of water maintenance

During this year's out of water major maintenance works several repairs were carried out on the hull, bulwarks, tanks, deck, ramps, and vessel's void space. The out of water maintenance involved the following works that were completed with 4 weeks:

- Established a secure worksite at the Kohukohu ramp.
- Haul out and relaunch of the Ferry.
- Inspection, repair and painting of all voids and tanks.
- Replacement of second finger ramp.
- Repairs to both main ramps.
- Top end servicing of all four engines.
- Blasting and protective coating and painting of underwater hull, hull topsides, decks and bulwarks.
- Replacement of anchor and anchor chain.
- Inspection and repair of damage and deterioration of parts of the hull structure.
- Replacement of the inverter.

Figure 2-2 below illustrates the condition of the hull during inspection and the repairs carried out.

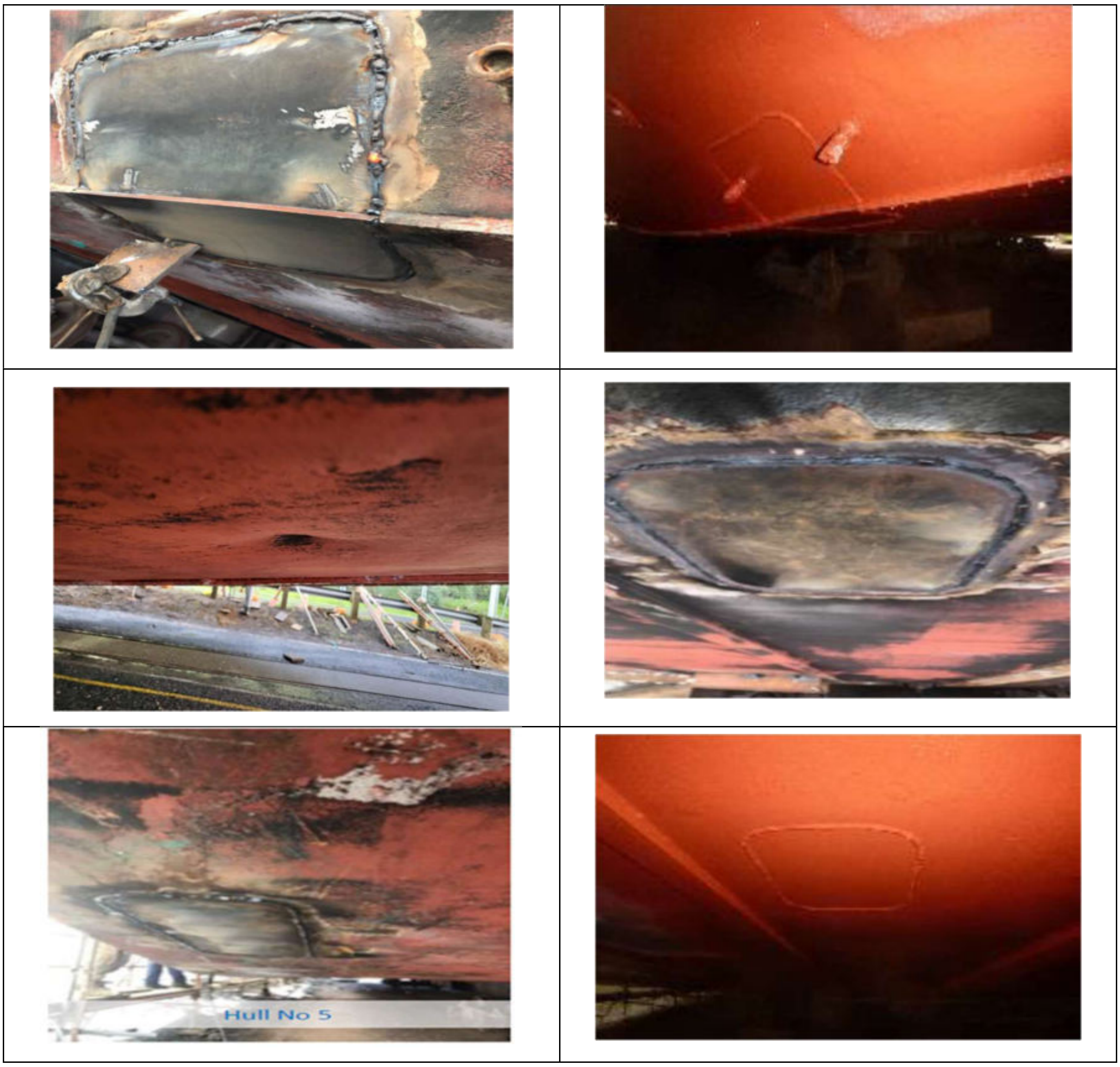


Figure 2-2: Condition of hull & Repairs

2.3 Improvement (Ferry Improvement Strategy)

The Ferry improvement strategy focuses on the three critical components namely the vessel itself, concrete loading and unloading ramps and the service. Whilst the vessel and ramp improvements are centred around the renewal of the asset, the service improvement focuses more on the needs of the community.

2.3.1 *Vessel's Improvement Plan*

After the vessel's major maintenance in May 2023, the vessel surveyor has outlined the plan for ongoing survey and inspection as shown in Table 2-5 following.

Table 2-5: Survey and inspection plan

Survey items group	Month	Calendar year	2024	2025	2025 & 2026	2027
	May	Age vessel,	26	27	28/29	30
	Items to be surveyed					
Hull exterior inspection	Hull exterior under the waterline by diver				x	x
	Hull external after water blasting.					
	Drive nozzles and housings				x	x
	All under water hull penetrations and fittings				x	x
Hull interior	Internal structural inspection		x			x
	Below deck watertight doors		x	x	x	x
Through hull fittings and valves	Sea cocks withdraw and strip					
Decks and superstructure	Decks and wheelhouse structural inspection				x	
	Deck and equipment inspection			x		x
	Doors, hatches and seals including water tightness (load line inspection)		x	x	x	x
	Ventilators shutdown		x	x	x	x
	Operation and condition of ramps				x	x
	Load line inspection		x	x	x	x
	Test loading of ramp		x	x	x	x
Fit out	Fire systems checked and serviced		x	x	x	x
	Fuel shut offs				x	x
Propulsion and steering	Control linkages				x	
	Testing propulsion system and steering system.				x	
	Note, drive system propeller shaft crack testing to be undertaken in line with manufacturers recommendations					
Auxiliary Systems & machinery	Fire pumps and bilge pumping.				x	
	Bilge alarms				x	
	Anchoring systems and chain				x	
	Electrical installation				x	
Safety (including navigation and coms equipment)	Lifesaving equipment inspected				x	
	Navigation equipment including lights and shapes				x	

Apart from this the following proposal has been made by the surveyor to enable forward works planning:

- Based on NDT testing of the hull undertaken during the previous out of water inspection and random NDT testing of the deck undertaken during the most recent inspection, shows the hull, below the deck and the internal structure to be in very good condition, particularly when you consider the age of this vessel.
- It was generally accepted that this vessel will require replacing within the next five or so years however previous NDT testing and this current inspection process shows the hull plating and internal structure to be in above average condition.
- The vessel's operational life could be prolonged for several years or longer if it was re- decked.

Based on the recommendation above and in line with the maintenance plan of the vessel the following are proposed in this AMP for vessel improvement:

- Vessel Deck – Full/Partial Replacement.
- Major Top End overhaul of all 4 engines.
- Refurbishment of Electrical and Interior spaces.
- Schottel Rebuild – New impellors and chambers.
- Schottel Rebuild – Jet pump gearbox.
- Non-destructive Testing of Deck and Hull.
- Modify Engine Room fire CO2 suppression system to the FirePro system as recommended by the surveyor.

2.3.2 *Ferry Ramp Improvement*

During the haul out of the vessel this year, a concern was raised by Northland Ferries on the structural integrity of the concrete ramp on the narrow's side. WSP had been engaged to inspect the same and made the following observations:

- ferry ramp had a slight lean to the left.
- some of the cast in-situ concrete panels had lifted – likely rotating.
- Sediment at the toe of the rock spall scour protection (supporting the ramp) was found to be scoured away, along with some minor damage to the profile of the rock spall scour protection.
- thrusters of the ferry discharged large volumes of turbulent water at the toe of the ramp.
- ferry was likely be resting on the toe of the ramp when docked, creating additional loading.

Figure 2-3 below shows photos of the ramp.

Figure 2-3: Ferry ramp

Preliminary assessment of the survey data suggested a longer-term pattern of movement likely being an anticlockwise rotation of the cast in-situ concrete panels. A longer-term survey monitoring and assessment of the vector movements associated with the ramp is required.

As such as part of this AMP strategy a detailed investigation into the structural integrity of the ramps at the Narrows and Rawene is planned to ascertain any physical works to remediate or partially reconstruct the same.

2.3.3 Service Improvement

Listed below are improvements to the service that are a result of proposals by the Hokianga liaison group and feedback from our operations contractor:

- Additional evening sailings. Particularly in summer months to enable social connections across the harbour.
- Electronic variable message signages on the road network to inform ferry users of service outages.
- Alternative ferry (electric or cable ferry) with ample space for passengers in the cabin rather than on the open deck. (study of options).

Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 05

Active Modes – Walking, Cycling and Micro-Mobility

Overview and Management
Problems, Benefits, Consequences
Options Assessment

Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 05

Active Modes – Walking, Cycling and Micro-Mobility

Table of Contents

1 Overview

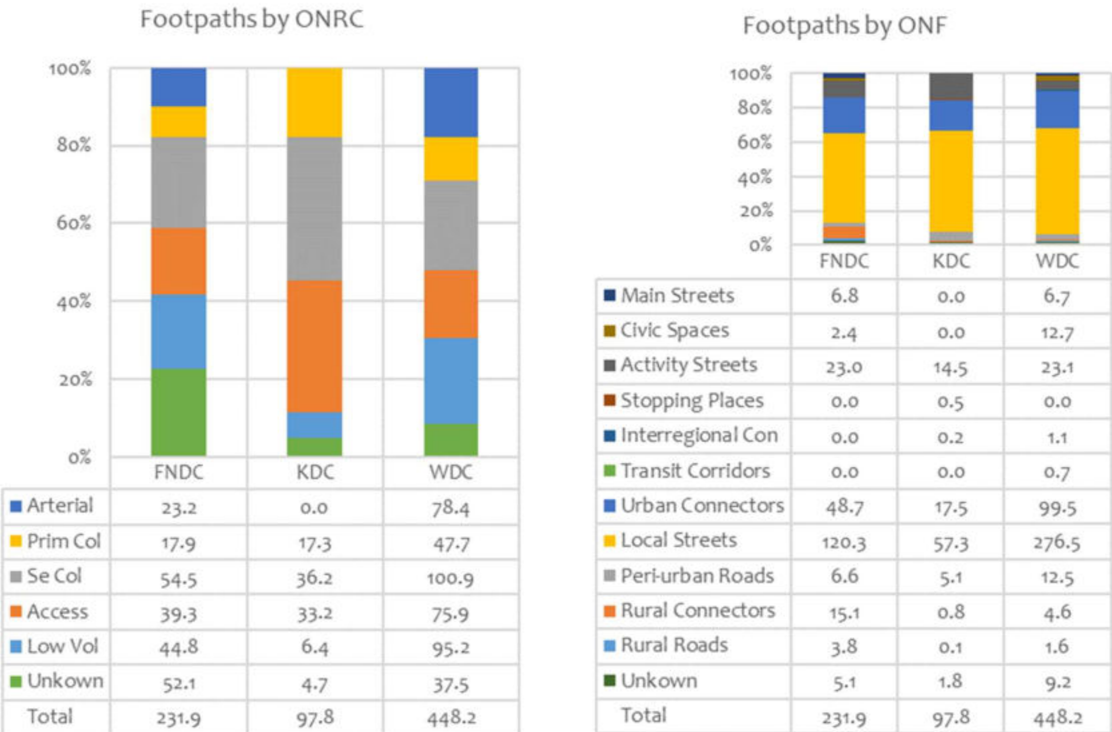
1.1 Description

This activity consists of assets relating to active modes (walking, cycling and micro-mobility) including:

- Shared use paths
- Footpaths and walkways attached to the roading network, including kerb dropdowns and crossing places
- Pedestrian barriers.

The three Councils maintains 778 km of footpaths and 16.9km of shared paths. Note the cycle trails are not included in this list. Over 95% of the paths are constructed from concrete, with a few others constructed from asphaltic concrete, interlocking blocks or timber.

Figure 1-1 below provides a breakdown by Council:



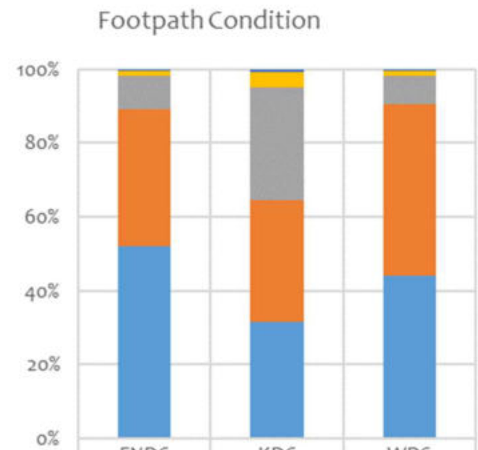
	FNDC	KDC	WDC
Arterial	23.2	0.0	78.4
Prim Col	17.9	17.3	47.7
Se Col	54.5	36.2	100.9
Access	39.3	33.2	75.9
Low Vol	44.8	6.4	95.2
Unkown	52.1	4.7	37.5
Total	231.9	97.8	448.2

	FNDC	KDC	WDC
Main Streets	6.8	0.0	6.7
Civic Spaces	2.4	0.0	12.7
Activity Streets	23.0	14.5	23.1
Stopping Places	0.0	0.5	0.0
Interregional Con	0.0	0.2	1.1
Transit Corridors	0.0	0.0	0.7
Urban Connectors	48.7	17.5	99.5
Local Streets	120.3	57.3	276.5
Peri-urban Roads	6.6	5.1	12.5
Rural Connectors	15.1	0.8	4.6
Rural Roads	3.8	0.1	1.6
Unkown	5.1	1.8	9.2
Total	231.9	97.8	448.2

Figure 1-1: Length of footpaths and cycleways by network by ONRC (left) and ONF (right)

1.2 Monitoring and Condition

The last rating for footpath condition was done in 2023. This data is held within RAMM footpath condition rating table and is used to programme footpath maintenance programmes. Figure 1-2 below shows the distribution of footpath condition.



	FNDC	KDC	WDC
Very poor	0.8	0.9	2.4
Poor	3.6	3.9	5.2
Average	20.7	29.9	35.6
Good	86.1	32.1	207.0
Excellent	120.8	31.0	197.5
Unknown	0.0	0.0	0.4
Total	231.9	97.8	448.2

Figure 1-2: Footpath condition distribution

Most of the footpaths are classified as Excellent, Good or Average.

There is no condition data for cycleways and shared paths. There is no formal condition rating programme at present. However, given most of these trails were built in the past 10 years, the condition rating is likely to be Excellent. Note – any on-road cycle lanes are assessed as part of traffic lanes.

1.3 Overall Strategy

Northland Regional Council has prepared a Northland Walking and Cycling Strategy (August 2018) in partnership with Far North, Kaipara and Whangarei District Councils. The Regional Strategy provides the overall framework for regional walking and cycling routes and aspirations of the Northland Region. It is consistent with the focus of the Whangarei District Walking and Cycling Strategy, The Kaipara Walking and Cycling Strategy and the FNDC draft Integrated Transport Strategy.

Table 1-1 below defines the linkages between the National, Regional, and District strategies on walking and cycling:

Table 1-1: Linkages between Strategies

National	Regional	District
• The Government Policy Statement for Land Transport Funding is produced by the Ministry of Transport. It sets the priorities for central government land transport funding. • The Waka Kotahi, the New Zealand Transport Agency (NZTA) is a key partner and funding agency for transport projects across Northland. • The Ministry of Business Innovation and Employment (MBIE) funds economic and regional development including cycle trail development. • The Department of Conservation (DOC) administers Great Walks, Short Walks and Day Hikes in its role as custodian for New Zealand's public conservation land. • The New Zealand Walking Access Commission (Herenga ā Nuku Aotearoa) is a Crown entity that protects and promotes free, certain, enduring and practical access to the outdoors. • Nga Haerenga, The New Zealand Cycle Trail Inc. is focused on growing New Zealand through outstanding cycling experiences. to promote connections between walking, cycling and public transport.	• The Northland Regional Land Transport Plan (2021-24) sets out the overall regional land transport priorities. This includes a strategic priority to increase travel choices and to improve participation in walking and cycling, and to promote connections between walking, cycling and public transport. • The Tai Tokerau Northland Economic Action Plan provides a strategic framework for regional economic and tourism development. • Northland Forward Together is the collective plan for all four Northland councils to work together to deliver better outcomes for Northland and its people.	• Whangarei District Council's Walking and Cycling Strategy 2018 (draft) provides the detail for a comprehensive set walking and cycling initiatives within the district and how these will link with other areas. • The Kaipara Walking and Cycling Strategy 2017 outlines plans for the district to become a walking and cycling destination. • Work is underway on a walking and cycling strategy for Far North District and an Experience and Product Development Plan for Pou Herenga Tai-Twin Coast Cycle Trail.

The strategy will assist in achieving the vision and responding to the issues and opportunities by delivering on four strategic focus areas.

1. Developing appealing and cohesive walking and cycling networks that connect Northland.
2. Growing walking and cycling participation and promoting Northland's coastal point of difference.
3. Improving community wellbeing including creating economic opportunities.
4. Ensuring walking and cycling infrastructure, and its use, is sustainable.

The first focus area emphasises the built infrastructure; the second concentrates on the promotion of that product; the third reflects the desire to see that the development bring benefits to Northlanders; and the fourth ensures that it is all done sustainably.

Figure 1-3 defines the cycle trails current and future.

Figure 1-3: cycle trails current and future

All districts have long lengths of footpaths that are too narrow compared to the minimum design width of 1.8m as per the current councils' standards. Figure 1-4 below shows that WDC has more than 200km of footpaths with width less than 1.5m, FNDC has about 100km and KDC has about 80km. There is a need for a plan to widen footpaths to the standard width taking in account usage and condition.

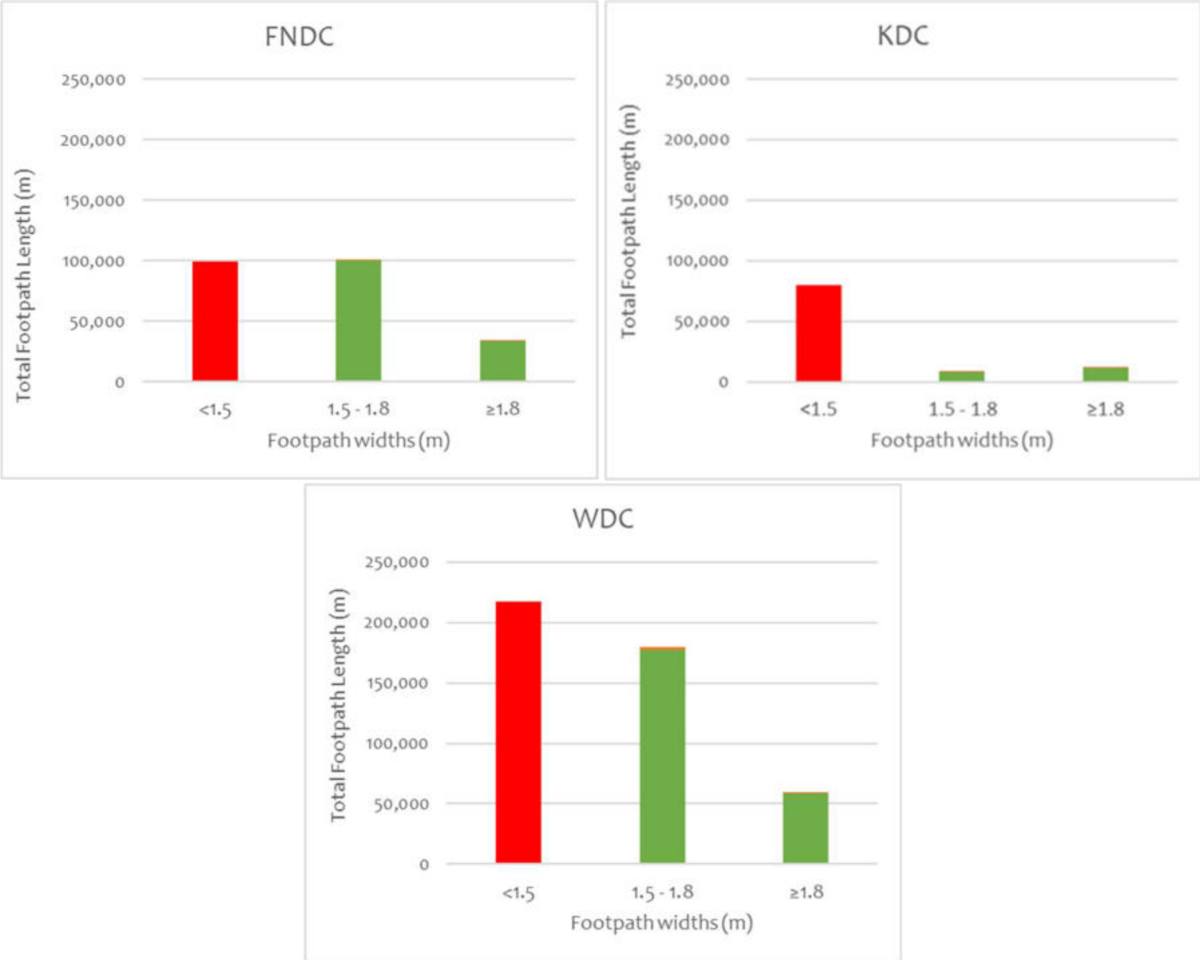


Figure 1-4: Footpath width distribution – All Districts

2 Management Plan

2.1 Management

2.1.1 *Maintenance Contract*

Most of the maintenance and operations associated with this activity are conducted by the maintenance contractors and governed by the Road Maintenance Contract.

2.1.2 *Ownership*

Some clarification is required as to which Council department owns, and is responsible for, some of the walkways and alleyways in the district. In general, any walkway/alleyway that links two roads is managed by the NTA. However, walkways/alleyways that link roads to parks or reserves could be deemed the property of the Parks Departments, but generally are the Parks Departments.

2.1.3 *NZTA*

As part of the MOU with NZTA and each Council the NTA is responsible for all school crossing controls (including those on the state highways), while NZTA is responsible for all other pedestrian crossing assets on State Highways.

All footpath maintenance is the responsibility of NTA, NZTA only reinstates the footpaths and only when they have been removed as part of State Highway works.

Cycleways are jointly funded by NZTA and Council where these are part of Council's approved Walking and Cycling strategy.

2.1.4 *Vehicle Crossing Applications*

All new vehicle crossings require consent from the Council to ensure that they are constructed to the appropriate standards and cause as little disruption as possible to roadside drainage and neighbouring properties.

The maintenance of driveways from the road edge to the property boundary is the responsibility of the property owner.

2.1.5 *Cycle Lanes*

On-road cycle lanes are managed as part of the carriageway so are covered by the sealed pavement and sealed surface activities.

2.2 Acquisition

Along with creating footpaths, the council also takes ownership of footpaths created by others. These acquisitions are generally aligned with the creation of new roads, either by Council, or by other parties such as developers creating a new subdivision. All assets vested to Council must comply with the EES.

The Deficiency Database and Prioritisation (DDP) holds the footpath requirements of the network, which have been identified from a number of sources. As noted earlier the DDP uses risk and benefit outcomes to determine the highest priority works to be completed.

Due to funding constraints and the fact the identified work far exceeds Councils ability to implement all the required footpaths, a strategy has been developed to gain the maximum benefit from any footpath work undertaken. The strategy recognises the importance of the link as set out in the following:

Footpath projects are assessed through the DDP selection process which allows assessment of risk benefits.

The top priority sites are then reviewed in terms of the importance of the link. This focuses on those links, in priority order, that:

- link schools to neighbouring communities
- link hospitals and health care centres with communities
- create access to neighbouring parks and recreation facilities
- provide general community to community links.

Once priority order is established a programme of footpath capital creation is developed to suit the funding available.

There are also certain issues regarding the type of assets vested to Council. For assets to be vested to Council they must comply with the Environmental Engineering Standards (EES). However, for footpaths and walkways there is no requirements regarding the materials that must be used to create these paths. This has resulted in the NTA acquiring assets that require higher levels of maintenance than most footpaths.

The footpath project list, based on the strategy above, is currently held within the DDP. Included in this programme is the development of Pedestrian Crossing points, Cycle Facilities and Pedestrian Facilities.

2.3 Maintenance

Footpath and off-road cycleway maintenance is completed as part of the Road Maintenance Contracts. As part of the contracts, they are inspected on a ‘best effort’ basis during the carriageway inspection round. Shared paths and road-to-road walkways in Whangarei City are on a program of cyclic inspections.

Cycle lanes in the roadway are maintained as part of the carriageway and hence are covered by the Road Maintenance Contracts.

Carriageways where detritus collects on the cycle ways require occasional sweeping.

In the event of the council being notified by the public of a dangerous defect in the footpath, this is attended to immediately by restoring an even surface on a temporary basis. The contractor then programs the permanent repair for the following month.

Several district roads are resealed annually and as each road is resealed, all footpaths’ defects are removed at the same time if possible.

Routine and minor reactive maintenance is based on the intervention levels and response times set out in the maintenance contracts. Any large maintenance that is identified is prioritised based on the risks posed by the defect and the criticality of the section of footpath or walkway.

2.4 Renewals

The majority of the footpaths in the district are assumed to have a useful life of 25 - 55 years depending on its material type. However, it has been found that many of the older assets were constructed to a lower standard than that is currently accepted. Due to these low standard footpaths the majority of the plan is focused on the renewal of these sections of footpaths.

Footpaths will be renewed based on the levels of funding, with priority going to the footpaths that are in worst condition and are considered critical links to community facilities such as schools and hospitals.

The shared paths are relatively new so there is no immediate requirement for their renewal.

The decision process for the renewal of existing pedestrian facilities is based on the asset use and purpose. Pedestrian facilities that link key community areas and access to community services, such as hospitals and schools are considered priority routes. Coupled with this are high volume areas, such as the CBD. Included then are mobility issues with appropriate widths and facilities to assist the physically disadvantaged portion of the community to have the same level of access on the network.

These projects are identified and managed through DDP system and prioritised accordingly.

2.5 Improvement

Footpaths and cycleways can be improved in the following ways:

2.5.1 Path Widening

The widening of both footpaths and cycleways is based on the level of demand (the quantity of people using the path) and the type of demand (pushbikes, prams, scooters etc.). However, we will aim for a minimum path width of 1.8m, where we a replacing a reasonable length (say >40m continuous length), constraints allow, and this area warrants a wider path (based on demand). For some lengths replacing like-for-like ~1.5m wide path maybe still appropriate

2.5.2 Kerb Drop-Downs and Crossing

Some kerb drop-downs and crossing places in the district are not adequate for use by mobility scooters and prams etc. The current programme will be developed based on complaints / requests by residents.

2.5.3 Handrails

Handrails may be improved based on any safety deficiencies identified. These will be prioritised based on the criticality of the route and the severity of the issue.

2.5.4 Cycle Facilities

Cycle facilities such as cycle parking spaces, lean rails and signage may be provided based on any deficiencies identified. These will be prioritised based on the criticality of the route and the severity of the matter.

3 Option Assessment

For the assessment of the data, peer group analysis and option assessment, a five point "traffic light" rating system has been used as shown in the following schematic. This rating system is based on a qualitative assessment of the LOS and cost comparison data.

5-point traffic light rating system

Performance Rating	Symbol	For LOS this means:	For Costs & Achievement this means:	Trend Rating	Symbol	For LOS this means:
Very Good		Much Better than Peer Group Average	Much Less than Peer Group Average	Improving Trend		Positive Change towards a Very Good rating
Good		Better than Peer Group Average	Less than Peer Group Average	Worsening Trend		Negative Change away from a Very Good rating
Average/Moderate		Similar to the Peer Group Average	Similar to the Peer Group Average	Static Trend		No Change
Poor		Worse than Peer Group Average	Higher than Peer Group Average			
Very Poor		Much Worse than Peer Group Average	Much Higher than Peer Group Average			
No Data		No Data	No Data			

Work Categories:

WC 124 Cycleway Maintenance
WC 125 Footpath Maintenance
WC 224 Cycleway Renewal
WC 225 Footpath Renewal
WC 341 Low Cost / Low Risk Improvements
WC 451 Walking Facilities
WC 452 Cycling Facilities

3.1 Links to Strategic Case

Problem Statement:

Growth and Demand – Rapid growth and lack of suitable mode shift options are causing congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods. Lack of mode shift options in the more remote communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation.

Lack of pathways connectivity and lack of appropriate pathway width (to current design standards).

Benefits of Addressing Problem:

Providing and maintaining cycleways and footpath with strong connections and in a fit for purpose condition will encourage active mode use and reduce private vehicle dependency.

Consequences of Not Addressing the Problem:

Without good pedestrian and cyclist facilities, there will be lower active mode use and more dependence on private vehicles with resulting increase in vehicles emission.

3.2 Levels of Service

ONRC Customer Outcomes:

None

Customer Levels of Service:

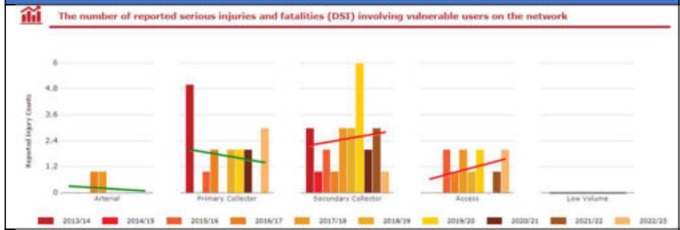
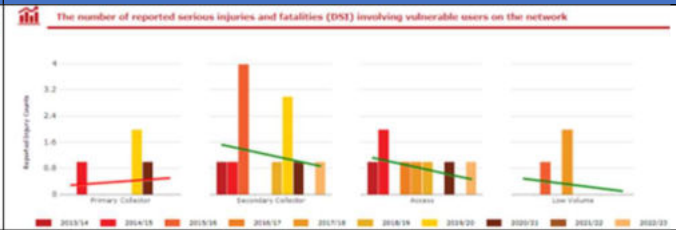
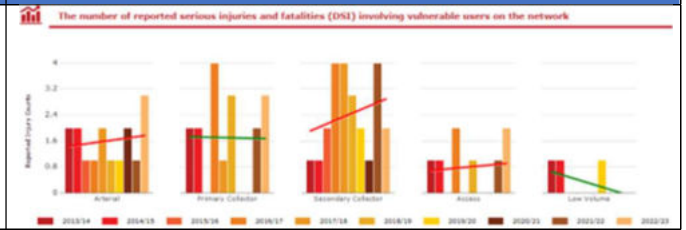
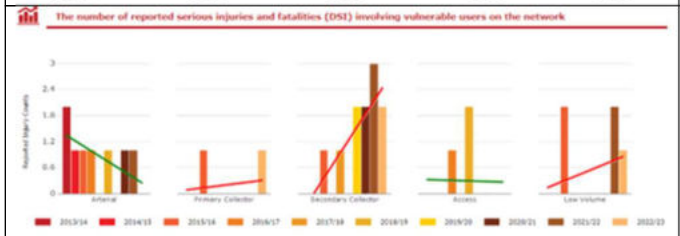
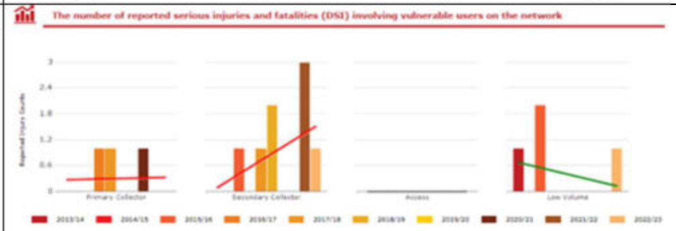
ONRC Safety TO8 – Cycle Path Faults (NO DATA AVAILABLE)

ONRC Safety TO9 – Vulnerable Users

LTP 1.2.1 – Percentage of footpaths in territorial authority that meet LOS standards (Current measure-DIA)

3.3 Evidence and Gap Analysis

ONRC Safety TO9 – Vulnerable Users – Rural roads (top graph) & Urban roads (bottom graph)

FNDC	KDC	WDC
 	 	
Arterial · Primary Collector · Secondary Collector · Access · Low Volume	Primary Collector · Secondary Collector · Access · Low Volume	Arterial · Primary Collector · Secondary Collector · Access · Low Volume
 	 	
Arterial · Primary Collector · Secondary Collector · Access · Low Volume	Primary Collector · Secondary Collector · Access · Low Volume	Arterial · Primary Collector · Secondary Collector · Access · Low Volume
FNDC Vulnerable User DSI – It should be noted there is little data for vulnerable user crashes for rural roads and less for urban roads on the FNDC network. This makes it difficult to determine any issues or trends. However, it appears there may be an increasing trend in vulnerable user crashes on urban Secondary Collector and Low Volume roads. During the last ten years, approximately 70% of vulnerable user crashes involved motorcyclists or mopeds, so it is unlikely these trends relate to pedestrians and cyclists.	**KDC Vulnerable User DSI** – It should be noted there is little data for vulnerable user crashes for rural roads and less for urban roads on the KDC network. This makes it difficult to determine any issues or trends. It appears there may be an increasing trend in crashes on urban Secondary Collector roads. During the last ten years, approximately 80% of vulnerable user crashes involved motorcyclists or mopeds, so it is unlikely these trends relate to pedestrians and cyclists.	**WDC Vulnerable User DSI** – It should be noted there is little data for vulnerable user crashes on many road classes for the WDC network. This makes it difficult to determine any issues or trends. However, it appears there could be an increasing trend in vulnerable user crashes on the rural Arterial and Secondary Collector roads. During the last ten years, approximately 50% of vulnerable user crashes involved motorcyclists or mopeds, so it is unlikely these trends relate to pedestrians and cyclists.

3.4 Options to be Considered

Based on the above data and the root cause analysis, the following options have been considered for footpaths and cycleways:

Option	Description
Option 1 – Widen footpaths that are too narrow for a mobility scooter. Increase minimum footpath width in Engineering Standards.	Widen footpaths that are too narrow for mobility scooters to pass. Consider increasing the minimum footpath width in the council engineering standards.
Option 2 – Continue the implementation of the Whangarei shared path network.	Continue the development of the shared path network including completing the Kamo, Raumanga and Onerahi paths, as well as extending to Maunu and Tikipunga and linking through the city centre.
Option 3 – Shared path networks for Kerikeri/Waipapa and Mangawhai.	Consider shared path network linking Kerikeri to Waipapa and implement the planned Mangawhai Shared Path network. This will encourage mode shift to active modes and reduce congestion during the summer peak period.
Option 4 – Construct rural Heartland rides identified in the Northland Integrated Cycle Business Case.	Construct the rural cycleways (ie Heartland Rides) identified in the Regional Walking and Cycling Strategy and the PGF funded Northland Integrated Cycling Plan.
Option 5 – Develop a network of safe cycleways between rural towns.	Develop a network of safe rural cycleways linking rural towns and communities, particularly in areas of high social deprivation and transport disadvantage.
Option 6 – Implement footpaths and cycleways identified through Township Improvement Plans and Council Spatial Plans.	Construct footpath linkages and cycleways identified through the PGF funded Township Improvement Plans and Council Spatial Plans to encourage growth and maximise tourism opportunities.

PBC Multi Criteria Option Analysis, RCA: NTA

Activity/Work Categories: Footpath and Cyclelanes (WC 124, 125, 451, 452)

Short list up to 3 options from the following:

Option - Can we make	Yes/No	Rank	Reason
❑ Intervention response **timing** change			
❑ **LoS** adjustments	Yes	1	Widen footpaths that are too narrow for mobility scooters.
❑ Use existing assets **differently**			
❑ **Blending** Work Categories differently			
❑ **Risk** - Hold Assets longer			
❑ Managing **demand**			
❑ **Route** Management	Yes	2 - A 3 - B 4 - C 5 - D 6 - E	A. Continue the development of the shared path network including completing the Kamo, Raumanga and Onerahi paths, as well as extending to Maunu and Tikipunga and linking through the city centre. B. Consider shared path network linking Kerikeri to Waipapa. Implement the planned Mangawhai Shared Path network. C. Construct the rural cycleways (ie Heartland Rides) identified in the Regional Walking and Cycling Strategy and the PGF funded Northland Integrated Cycling Plan. D. Develop a network of safe rural cycleways linking rural towns and communities. E. Construct footpath linkages and cycleways identified through the PGF funded Township Improvement Plans and Council Spatial Plans.
❑ Alternative approaches – different **solutions/technology**			
❑ **Maintenance vs Renewal** adjustments			
❑ **ONRC** Classification variance			
❑ Extended **temporary** management			
❑ **Supply chain** improvements			
❑ Improve **systems and capability**	Yes	1	Consider increasing the minimum footpath width in the council engineering

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

Criteria	Weighting (Importance) (Total to 100%)	How good is this option													
		Option 1 - Widen footpaths that are too narrow for a mobility scooter. Increase minimum footpath width in Engineering Standards		Option 2 - Continue the implementation of the Whangarei shared path network		Option 3 - Shared path networks for Kerikeri/Waipapa and Mangawhai		Option 4 - Construct rural Heartland rides identified in the Northland Integrated Cycle Business Case		Option 5 - Develop a network of safe cycleways between rural towns		Option 6 - Implement footpaths and cycleways identified through Township Improvement Plans and Council Spatial Plans		Option 7	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	10%	2	0.2	3	0.3	3	0.3	2	0.2	2	0.2	3	0.3		0
Problem solving effectiveness	10%	1	0.1	2	0.2	2	0.2	0	0	1	0.1	2	0.2		0
Benefits realised	10%	1	0.1	2	0.2	2	0.2	1	0.1	1	0.1	2	0.2		0
Good Environmental impacts	5%	0	0	2	0.1	1	0.05	1	0.05	1	0.05	1	0.05		0
Value for Money	10%	3	0.3	1	0.1	0	0	0	0	0	0	-2	-0.2		0
Closing Customer and Technical LoS gaps and impacts	10%	2	0.2	2	0.2	1	0.1	0	0	1	0.1	1	0.1		0
Closing ONRC Performance gaps	10%	1	0.1	2	0.2	1	0.1	0	0	1	0.1	1	0.1		0
Asset preservation and sustainability	10%	0	0	0	0	0	0	0	0	0	0	0	0		0
Total Cost of Ownership (whole of life Costs)	10%	0	0	0	0	0	0	-1	-0.1	-1	-0.1	0	0		0
Life Cycle Management	10%	0	0	0	0	0	0	0	0	0	0	0	0		0
COVID-19 Recovery	5%	1	0.05	1	0.05	1	0.05	3	0.15	1	0.05	1	0.05		0
Totals	100%		1.05		1.35		1.00		0.40		0.60		0.80		0

3.5 Option Assessment and Line of Sight

The options and the line of sight to the preferred strategic response and the problems they are addressing are shown in the table below. These options have been ranked in order of preference and then have been assessed through a multi-criteria assessment (MCA) to determine the highest scoring options that are preferred and are to be adopted. The MCA assessment is also provided as follows.

Work Activity	Problem Addressing Statements	Preferred Strategic Response	PBC Options to be Considered	Option Rank	MCA Score	Preferred Options
Walking and Cycling	**Growth and Alternative Transport** - Rapid growth and lack of suitable alternative transport modes are causing congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods. Lack of alternative transport modes in many communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation.	**Programme Adjustment** • Intersection and road upgrades including bus priority lanes, new link roads. • Shared path networks for Whangarei, Kerikeri/Waipapa and Mangawhai. **Policy Approach** • Increase bus frequency in Whangarei and expand rural services. **Demand Management** • Travel planning and mode shift promotion. • Increase all-day parking charges.	**Programme Adjustment** **Route Management** • Option 2 - Continue the implementation of the Whangarei shared path network. • Option 3 - Shared path networks for Kerikeri/Waipapa and Mangawhai. • Option 4 - Construct rural Heartland rides identified in the Northland Integrated Cycle Business Case. • Option 5 - Develop a network of safe cycleways between rural towns. • Option 6 - Implement footpaths and cycleways identified through Township Improvement Plans and Council Spatial Plans. **Policy Approach** **LOS Adjustments & Improve Systems and Capability** • Option 1 - Widen footpaths that are too narrow for a mobility scooter. Increase minimum footpath width in Engineering Standards.	2 3 4 5 6 1	1.4 1.0 0.4 0.6 0.8 1.05	Yes Yes Yes No Yes Yes

Preferred Options: From the multi-criteria assessment the preferred options are:

- Option 1 – Widen footpaths that are too narrow for a mobility scooter. Increase minimum footpath width in Engineering Standards.
- Option 2 – Continue the implementation of the Whangarei shared path network.
- Option 3 – Shared path networks for Kerikeri/Waipapa and Mangawhai.
- Option 4 – Construct rural Heartland rides identified in the Northland Integrated Cycle Business Case – through alternative funding (PGF etc).
- Option 6 – Implement footpaths and cycleways identified through Township Improvement Plans and Council Spatial Plans.

3.6 Financial Impact

The following tables show the work categories and examples of the associated tasks. For full financial details for the work categories, refer to Section 08 (Financials):

3.6.1 Far North District Council

Work Category	Financial Impact
WC 124 Cycleway Maintenance	No Programme.
WC 125Footpath Maintenance	Minor increase in funding for the increased footpath assets.
WC 224 Cycle path Renewals	No Programme.
WC 225 Footpath Renewals	Increased funding for renewals to fund programme of works.
WC 341 Low Cost/Low Risk Improvements	Funding for new footpaths to improve road safety and promote active modes. Funding for accessibility improvements and safe connections.
WC 451 Walking Facilities	No programme.
WC 452 Cycling Facilities	Funding for Twin Coast Cycle Trail Development.

3.6.2 Kaipara District Council

Work Category	Financial Impact
WC 124 Cycleway Maintenance	Funding for maintenance on Mangawhai Shared Path.
WC 125 Footpath Maintenance	Increased funding for footpath maintenance, mainly on the very poor condition sections.
WC 224 Cycle path Renewals	No programme.
WC 225Footpath Renewals	Funding to continue footpath renewal work.
WC 341 Low Cost/Low Risk Improvements	Funding for new footpaths to improve road safety and promote active modes. Funding for accessibility improvements (barrier removal). Funding for neighbourhood cycle connections.
WC 451 Walking Facilities	No programme.
WC 452 Cycling Facilities	Funding for the continued development of the Mangawahi Shared Path to promote walking and cycling in this rapidly growing town. Funding for the continued development of the Kaihu Valley Trail Cycleway which is part of the Twin Coast Discovery Route PBC. Funding for the development of the Dargaville River Path which is identified in the Twin Coast Discovery Route Dargaville Township Plan PBC. Funding for the KDC walking and cycling network improvements (10-Year programme).

3.6.3 Whangarei District Council

Work Category	Financial Impact
WC 124 Cycleway Maintenance	Minor increase in funding for to cover the increase in cycle track assets.
WC 125 Footpath Maintenance	Minor increase in funding to reinstate footpath maintenance back to required levels of service.
WC 224 Cycle path Renewals	No programme.
WC 225Footpath Renewals	Funding increase for deteriorating footpaths and backlog of needed works.
WC 341 Low Cost/Low Risk Improvements	Funding to continue to develop the footpath network to improve road safety and promote active modes. Funding to develop a network of on-road cycle lanes to connect to the shared path network.
WC 451 Walking Facilities	No programme.
WC 452 Cycling Facilities	The projects below are identified in the Northland Integrated Cycle Implementation Plan PBC, the Northland Regional Walking & Cycling Strategy or the Whangarei Walking & Cycling Strategy. They will improve walking and cycling safety, promoting active modes and improving tourism opportunities. Funding to complete the Kamo Shared Path. Funding to continue the development of the Tikipunga Shared Path. Funding for Tukukaka Coast Heartland Ride from Whangarei to Ngunguru. Funding for Beam Bay Coastal Trail Heartland Ride. Funding for Whangarei Heads Cycle Link Heartland Ride. Funding for on road cycle way connections.

3.7 AMP Improvement

The following improvements will be considered:

- Update the three District Councils Walking and Cycling Strategies.
- Develop business cases for urban active transport for Whangarei City and all large towns in Northland (over 5,000 population).
- Create assessment criteria for shared paths and cycleways, which considers a combination of asset condition rating and effective level of service (how fit for purpose), which would consider (among other criteria) connectivity, CPTED principles and width – i.e. current usage versus potential usage.

Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 06.A

Network Operations – Environmental

Overview and Management
Problems, Benefits, Consequences
Options Assessment

Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 06.A

Network Operations – Environmental

Table of Contents

1 Overview

1.1 Description

Activities undertaken in providing a transport network have the potential to result in adverse effects on the environment. These activities include:

- Sustainability.
- Vegetation control.
- Health and wellbeing of water bodies and freshwater ecosystems.
- Delivering good environmental and sustainability outcomes as part of the design, construction and operation of our infrastructure projects.
- Road maintenance and vegetation control practices to maintain the vegetation envelope as well as construction activities have the potential to damage surrounding flora as part of the works.
- Undertaking certain activities near kauri trees on an ongoing basis in a manner that it complies with the new provisions to manage Kauri Dieback disease.
- Provision of specialised storm water assets such as rain gardens and storm water quality devices.
- Managing roads and roadsides drainage affected by storm events.
- Action plans to support the achievement of the fish passage through road culverts.
- Roadside stock effluent disposal sites that allow stock trucks to dispose of their effluent.
- Operating clean-fill site involving the set-up, documentation and monitoring associated with these.

1.2 Quantity of Assets

1.2.1 *Vegetation*

The majority of this function is only quantifiable through records in RAMM gathered from inspections and through standards that exist within the Road Maintenance Contracts.

1.2.2 *Special Storm Water Devices*

The WDC maintains three Downstream Defenders which are hydrocarbon traps located within manhole type structures. Greater use of Enviropods installed in sumps is taking place in the urban area.

1.2.3 *Stock Effluent*

There is one stock effluent disposal facility within the Whangarei District. This is located on Saleyards Road in Kauri and was constructed in 2012. The operations and maintenance of the site is the responsibility of Council.

1.2.4 *Clean-fill sites*

There are several clean fill dumpsites that are managed by contractors on behalf of the NTA across Northland.

1.3 Monitoring and Condition

1.3.1 Vegetation Control

The maintenance needs of the network are primarily determined from regular inspections of the network with all observed defects logged into the maintenance defect pool within RAMM Contractor.

Inspections of the vegetation envelope is carried out as per the required frequencies, and any encroachment is recorded and is cut back under Routine maintenance.

Logging of pest plants sites in RAMM is ongoing through the year. As the contractor deals with them the dispatch is closed and the plot point disappears, but the record is not lost. Later if our inspector observes re-growth, it will be logged again.

The inventory of pest plants data can be plotted on a map which gives an instant visual representation of the deficiency in service level. This can be used to determine a programme to achieve the service level required.

Not all weeds logged will be treated in one year. The available budget, which can vary during the year, will dictate how much is carried out.

1.3.2 Clean-fill sites

Monitoring is carried out of environmental compliance on active clean-fill sites. Site audits are undertaken by suitable experienced employees in accordance with an audit schedule.

1.4 Overall Strategy

The overall strategy for this activity for the next five to 10 years includes the following.

1.4.1 Sustainability

Emissions reduction plan has three focus areas to support this:

1. Reduce reliance on cars and support people to walk, cycle and use public transport
2. Rapidly adopt low-emissions vehicles
3. Begin work now to decarbonise heavy transport and freight.

The Government is committed to four transport targets to support these three focus areas:

- Reduce total kilometres travelled by the light fleet by 20% by 2035 through improved urban form and providing better travel options, particularly in our largest cities (Focus area 1).
- Increase zero-emissions vehicles to 30% of the light fleet by 2035 (Focus area 2).
- Reduce emissions from freight transport by 35% by 2035 (Focus area 3 – this target is focused on emissions from trucks, rail and ships, it excludes light vehicles and aviation).
- Reduce the emissions intensity of transport fuel by 10% by 2035 (Focus area 3).

1.4.2 Vegetation control

The **Vegetation Envelope Maintenance strategy** includes the removal of vegetation such as shrubs and tree growth to the required envelope dimensions to ensure driver safety, visibility, unobstructed roadside furniture and roadside drainage. This includes the ongoing maintenance of that envelope for the duration of the awarded contracts, once the vegetation envelope is established.

All roads on the NTA network are maintained so that vegetation which encroaches within 1.5 metres from edge of seal or unsealed edge of trafficable carriageway (hinge point) or 4.5 metres above the roadway shall be cut back on Rural roads and within 1.5 metres from back of kerb, edge of seal on Urban roads.

Roadside herbicide spraying limited to areas where in the opinion of the NTA it is not practical or economical to carry out manual, mechanical or other methods of vegetation control. There is likely to be greater pressure to move away from the use of glyphosate herbicides.

The **Targeted Weed Control strategy** seeks to satisfy the requirements of the Northland Regional Pest and Marine Pathway Management Plan 2017 – 2027 for roading authorities to plan for progressively controlling plant pests within formed road corridors in the Region. The extent of the work is dependent on funding being allocated through the Council's Long-Term Plan and Annual Plan processes.

The NTA is committed to meeting its obligations under the Regional Pest Management Strategies (RPMS) but it has to do so in a financially sustainable way which is acceptable to the communities which it serves. The NTA believes the programme is achievable and seeks to make optimal use of the existing processes and resources available with which to meet its obligations under the RPMS. It also recognises the benefits of working with stakeholders, including individual communities, where resource efficiencies can be gained by working collaboratively to achieve the desired environmental outcomes.

The weed management strategy involves controlling a small number of widespread weeds that threaten biodiversity, economic, human health, and/or cultural values. These weeds commonly infest neglected sites including roadsides and are often spread by wind or birds along road corridors. These sites can become a seed source for infestations into adjoining land

The previous decade of funding has enabled the councils to initiate control of weeds on arterial and collector roads in the districts. These roads are high priority for pest plants control as they include many high visibility public spaces, including the city entranceways, and are high traffic volume roads. Local roads, whose main function is to provide access to properties, will be monitored on an on-going basis as resources allow, following public complaints and during regular network inspections. Roads will also be monitored and prioritised where they abut reserves, biodiversity sites or community partnership areas. The use of the RAMM database will enable integration across work programmes.

2 Management Plan

2.1 Management and Operations

2.1.1 *Sustainability*

- Implement management plans that take a 'whole-of-life' approach to resources considering the overall best opportunities for resource efficiency over the asset's lifetime.
- Promoting recycling initiatives such in-situ stabilising and recycling milled asphaltic concrete.
- The walking a cycling strategy have been embraced by the councils.
- The bus and T2 Priority Lane project in WDC is being investigated where a specific road lane is created by having a temporary clearway where there is usually parking. The priority lane is designated for buses and vehicles with two or more occupants.

2.1.2 *Clean-Fill Management Plan*

The earthworks in a clean fill should be managed in a similar way to any earthwork site. A plan is developed that details a number of key aspects of the clean-fill operation such as:

- Where the different types of fill will be placed - some fill will be unsuitable for engineering purposes or have potential low-levels of contamination such as asphalt, vegetation etc.
- What compaction standards are required in each area - in particular this relates to where wet, unsuitable material from slip repairs etc can be placed which may require sign placement to guide truck drivers if the site is to be unattended at dumping times.
- The final shape of the clean fill.
- Where possible there should be a dump face at the end of an area stabilised with aggregate so that trucks do not track mud onto the road. Salvaged aggregate or concrete can be used wherever possible to reduce costs.

2.1.3 *Fish passages*

The Resource Management, National Environmental Standards for Freshwater (NES-F) Regulations 2020, under the Resource Management Act 1991 (RMA), contains set rules that apply to installing or altering a culvert, weir, flap gate, dam or ford. The regulations require applicants to provide information about any new structures being planned with potential to block or impede fish passage to the regional council.

It is the structure's owner or occupier and/or the consent holder's responsibility to ensure fish passage is provided over the life of a structure.

A work programme in an action plan must, at a minimum:

- Identify instream structures in the region by recording each structure.
- Any other information about the structure.
- Evaluate the risks that instream structures present as an undesirable barrier to fish passage.
- Prioritise structures for remediation, applying the ecological criteria.
- Document the structures or locations that have been prioritised, the remediation that is required to achieve the desired outcome, and how and when this will be achieved.

- Identify the structures that have been remediated since the commencement date; and
- specify how the ongoing performance of remediated structures will be monitored and evaluated, including the effects of the structure on the abundance and diversity of desired fish species.

2.1.4 *Kauri Protection Plan*

The NTA contractors undertake a significant amount of maintenance and capital works to ensure the ongoing operation, maintenance and upgrade of the roading network. Below lists activities that may have elements of work that could involve the transferal of soil material alongside other activities that the NTA is typically responsible for.

Activities that are a higher risk with regards to soil disturbance include:

- The carting of slip material to clean fill dumpsites via heavy vehicles.
- Water-table, channel, sump and culvert cleaning, and disposal of material, usually to clean fill sites if substantial.
- New works including new footpaths/shared paths that involve excavation.
- Vegetation control / tree felling within the road environment.

Standard Operating Procedure associated with the Kauri Protection Plan are the minimum requirements that apply when undertaking activities or work in or near any land owned or managed by the councils where kauri are confirmed as present.

The Standard Operating Procedure must be complied with during all vegetation removal, earthworks, soil disturbance, or longer-term maintenance within Kauri Hygiene Area to meet the purpose of this Kauri Protection Plan. The exception to this is the management of these activities for emergency works and unplanned network outages which are subject to reduced requirements.

2.2 Acquisition (Growth)

There is no plan to create or acquire any storm water devices within the next ten years, although stormwater treatment devices may be vested to Council through land developments.

2.3 Maintenance

Environmental maintenance is made up of the following activities:

- Vegetation control
- Stock effluent maintenance and removal
- Specialised storm water devices
- Operating clean-fill sites.

2.3.1 *Vegetation Control*

The vegetation envelope is maintained by a combination of the following activities:

- **Routine Roadside Vegetation Envelope Maintenance** is defined as cutting, by appropriate means to remove vegetation such as scrub, shrubs and tree growth to the required envelope.
- **Footpath Vegetation Envelope Maintenance** is defined as cutting, by appropriate means to remove vegetation such as scrub, shrubs and tree growth to the required footpath envelope dimensions
- **Hydro-mowing:** This mowing is performed on scrub to ensure an obstruction free state of visibility and to keep the road envelope clear of encroaching vegetation. Areas for sight visibility are maintained at all intersections and bridges.
- **Pruning:** Selective limbing of trees in a horticultural trained manner is carried out so that they do not intrude or grow back within one year into the vegetation envelope of the road. This work only includes vegetation greater than 100mm diameter encroaching into the envelope.
- **Roadside boom spraying:** Spraying is carried out in three periods and repeated yearly at an average of 2.0 metres from edge of seal, or edge of formed road and includes watertable or side drains. These spray periods are adjusted to suit growth and climate conditions.
- **Gun spraying:** A noxious weed management plan for the NTA road reserves has been implemented which focuses the contractor on the spraying selected weed species growing in the watertable and vegetation envelope. The focus is on the NRC listed weeds which are broom, Taiwan cherry, cotoneaster, wilding conifers, privet and wild ginger. This focus is required to limit public expectations that all weed species growing in the road corridor will be treated.

2.3.2 *Stock effluent disposal*

The maintenance of the stock effluent disposal system is being carried out by the council Waste Water Department on behalf the NTA.

2.3.3 *Stormwater devices*

Storm water device maintenance occurs on a cyclic basis and also when a defect has been identified, usually by the public (e.g. catchpit overflowing)

2.3.4 *Clean-fill site Maintenance*

The additional cost to Council in maintaining the clean fill dumpsites has been included in the maintenance programme. Each of the clean fill sites are inspected annually. Any maintenance requirements identified from these inspections are undertaken as reactive maintenance.

2.4 Renewals

The stock effluent site and the majority of the storm water devices are reasonably new and therefore are not likely to require renewal in the near future.

2.5 Improvement

There is no plan to improve any of these assets as the majority are reasonably new.

3 Option Assessment

For the assessment of the data, peer group analysis and option assessment, a five point "traffic light" rating system has been used as shown in the following schematic. This rating system is based on a qualitative assessment of the LOS and cost comparison data.

5-point traffic light rating system

Performance Rating	Symbol	For LOS this means:	For Costs & Achievement this means:	Trend Rating	Symbol	For LOS this means:
Very Good		Much Better than Peer Group Average	Much Less than Peer Group Average	Improving Trend		Positive Change towards a Very Good rating
Good		Better than Peer Group Average	Less than Peer Group Average	Worsening Trend		Negative Change away from a Very Good rating
Average/Moderate		Similar to the Peer Group Average	Similar to the Peer Group Average	Static Trend		No Change
Poor		Worse than Peer Group Average	Higher than Peer Group Average			
Very Poor		Much Worse than Peer Group Average	Much Higher than Peer Group Average			
No Data		No Data	No Data			

Work Categories:

WC 121 – Environmental Maintenance
WC 221 – Environmental Renewals
WC 341 – Low Cost / Low Risk Improvements

3.1 Links to Strategic Case

Problem Statement:

Environmental – Activities undertaken in providing a transport network, has the potential to result in adverse effects on the environment.

- Clean-fill sites located around the network are possible pollution points.
- Roads and roadsides are subjected to excessive volumes of water arising from storm events
- Road maintenance and vegetation control practices to maintain the vegetation envelope as well as construction activities have the potential to damage surrounding flora as part of the works.
- Need to deliver good environmental and sustainability outcomes as part of the design, construction and operation of our roading network.

Safety – Northland has a narrow, winding and unforgiving rural road network which combined with poor driver behaviour has resulted in the region being a high Community at Risk for death and serious injury (DSI) crashes and the rate of DSI crashes is trending upward for FNDC and WDC. FNDC and KDC also have higher Collective Risks than their peer group.

Benefits of Addressing Problem:

Environmental – Delivering good environmental and sustainability outcomes on the network.

Safety – Sightlines and roadside tree hazards will be minimised improving road safety.

Consequences of Not Addressing the Problem:

Environmental – Probable adverse effects on the environment.

Safety – Sightlines will become blocked and tree hazards in the road corridor increased resulting in increased risk of fatal and serious injuries.

3.2 Levels of Service

ONRC Customer Outcomes: None

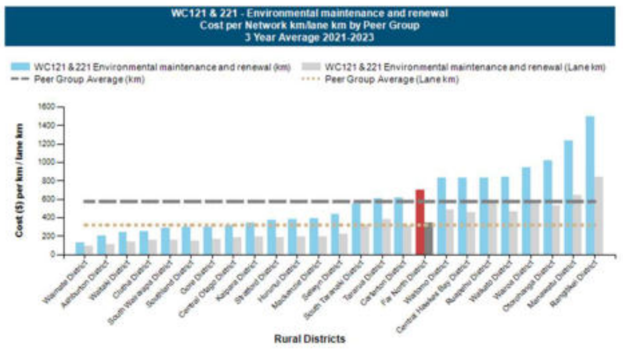
Customer Levels of Service:

ONRC Safety TO3 – Sight Distances (no data available)
ONRC Safety TO10 – Roadside Obstructions (no data available)
ONRC Amenity TO2 – Aesthetic Faults (no data available)

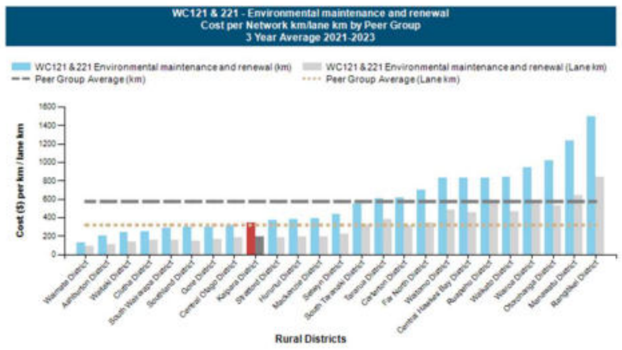
3.3 Evidence and Gap Analysis

NZTA Peer Group Charts – 3yr Cost/km WC 121 & 221 Environmental Maintenance and Renewals

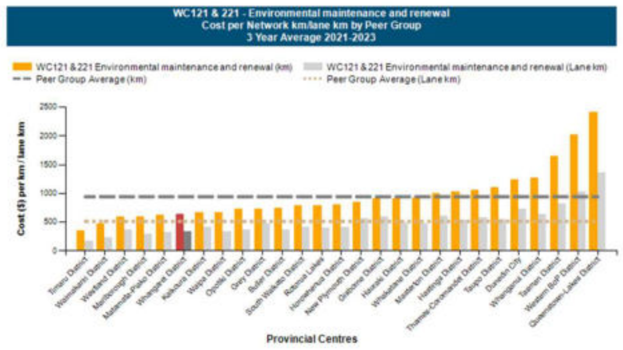
FNDC



KDC



WDC



FNDC	KDC	WDC
FNDC Environmental Maintenance and Renewal Cost – FNDC's environmental maintenance and renewal cost is slightly above the average of its peer group. This is lower than expected given Northland's rapid vegetation growth due to warm climate and high rainfall which increases the demand for envelope clearing and roadside mowing.	**KDC Environmental Maintenance and Renewal Cost** – The KDC environmental maintenance and renewal cost is lower than their peer group average. As for FNDC, this is lower than expected given Northland's rapid vegetation growth due to warm climate and high rainfall which increases the demand for envelope clearing and roadside spraying.	**WDC Environmental Maintenance and Renewal Cost** – The WDC environmental maintenance and renewal cost is lower than their peer group average. As for the other councils, this is lower than expected given Northland's rapid vegetation growth due to warm climate and high rainfall which increases the demand for envelope clearing and roadside spraying.

3.4 Options to be Considered

Based on the above data and the root cause analysis, the following options have been considered:

Analysed Options	Description
Option 1 – Remove hazardous trees on HRRR routes	Remove hazardous trees on high risk rural roads (HRRR) to make roadsides more forgiving and reduce death and serious injuries.
Option 2 – Replace roadside mowing with spraying in FNDC.	Replace roadside berm mowing with spraying in the Far North to reduce the costs of vegetation control.

PBC Multi Criteria Option Analysis, RCA: NTA

Activity/Work Categories: Environmental (WC 121, 221)

Short list up to 3 options from the following:

Option - Can we make	Yes/No	Rank	Reason
❑ Intervention response **timing** change			
❑ **LoS** adjustments			
❑ Use existing assets **differently**			
❑ **Blending** Work Categories differently			
❑ **Risk** - Hold Assets longer			
❑ Managing **demand**			
❑ **Route** Management	Yes	1	Remove hazardous trees
❑ Alternative approaches – different **solutions/technology**	Yes	2	Replace roadside mowing with spraying in the Far North.
❑ **Maintenance vs Renewal** adjustments			
❑ **ONRC** Classification variance			
❑ Extended **temporary** management			
❑ **Supply chain** improvements			
❑ Improve **systems and capability**			

Criteria	**Weighting** (Importance) (Total to 100%)	**How good is this option**					
		Option 1 - Remove hazardous trees on HRRR routes		**Option 2 - Replace roadside mowing with spraying in FNDC**			
		Raw	**Score**	**Raw**	**Score**		
Community Outcomes Achieved	10%	2	0.2	0	0		
Problem solving effectiveness	10%	2	0.2	0	0		
Benefits realised	10%	2	0.2	0	0		
Good Environmental impacts	5%	-1	-0.05	-2	-0.1		
Value for Money	10%	1	0.1	3	0.3		
Closing Customer and Technical LoS gaps and impacts	10%	1	0.1	0	0		
Closing ONRC Performance gaps	10%	0	0	1	0.1		
Asset preservation and sustainability	10%	0	0	0	0		
Total Cost of Ownership (whole of life Costs)	10%	0	0	2	0.2		
Life Cycle Management	10%	0	0	2	0.2		
COVID-19 Recovery	5%	2	0.1	0	0		
Totals	**100%**		**0.85**		**0.7**		

Scale of impact

Impact	**Score**
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

3.5 Option Assessment and Line of Sight

The options and the line of sight to the preferred strategic response and the problems they are addressing are shown in the table below. These options have been ranked in order of preference and then have been assessed through a multi-criteria assessment (MCA) to determine the highest scoring options that are preferred and are to be adopted. The MCA assessment is also provided as follows.

Work Activity	Problem Statements Addressing	Preferred Strategic Response	PBC Options to be Considered	Option Rank	MCA Score	Preferred Options
Environmental	**Safety** - **Proactive and reactive program of vegetation control to ensure motorist safety** Northland has a narrow, winding and unforgiving rural road network which combined with poor driver behaviour has resulted in the region being a high Community at Risk for death and serious injury (DSI) crashes and the rate of DSI crashes is trending upward for FNDC and WDC. FNDC and KDC also have higher Collective Risks than their peer group.	**Programme Adjustment** • Increase safety programme **Policy Approach** • Additional delineation **Demand Management** • Enhanced Road Safety Promotions with active in-house management.	**Programme Adjustments** **Route Management** • Option 1 - Remove hazardous trees on HRRR routes **Policy Approach** **Alternative Approaches – Different Solutions/Technology** • Option 2 - Replace roadside mowing with spraying in FNDC	1 2	0.85 0.7	Yes Yes

Preferred Options: From the multi-criteria assessment the preferred options are:

- Option 1 - Remove hazardous trees on HRRR routes.
- Option 2 - Replace roadside mowing with spraying in FNDC.

3.6 Financial Impact

The following tables show the work categories and examples of the associated tasks. For full financial details for the work categories, refer to Section 08 (Financials).

3.6.1 Far North District Council

Work Category	Financial Impact
WC 121 Environmental Maintenance	Funding due to increase in contract management costs from the maintenance contracts Funding due to increase in cyclic vegetation control costs through maintenance contracts Funding due to in-house staff costs being charged to WC 151
WC 221 Environmental Renewals	None programmed – No change.
WC 341 Low Cost Low Risk Improvements	Funding for the installation of two new stock effluent disposal facilities as identified in the FNDC Integrated Transport Plan.

3.6.2 Kaipara District Council

Work Category	Financial Impact
WC 121 Environmental Maintenance	Funding to match current expenditure
WC 221 Environmental Renewals	None programme
WC 341 Low Cost Low Risk Improvements	None programme

3.6.3 Whangarei District Council

Work Category	Financial Impact
WC 121 Environmental Maintenance	Funding to match current expenditure
WC 221 Environmental Renewals	None programme
WC 341 Low Cost Low Risk Improvements	None programme

3.7 AMP Improvement

The following improvements will be considered:

- Climate Change - Carry out a stock take of assets likely to impacted by climate change and include in RAMM and carry out Dynamic Adaptive Planning Pathway (DAPP) on these assets to determine adaptation strategies. This could be done as part of the Resilience Strategy.
- Climate Change - Develop a strategy to identify and implement initiatives that reduce the greenhouse gas emissions from transport related maintenance and construction activities.
- Investigate and develop a programme of sediment control measures for roadside drainage systems and maintenance practices to minimise sediment runoff into harbour catchments (particularly the Kaipara Harbour).
- Manage clean-fill sites according to best practices – there is a need to dispose of large quantities of soil in clean fill sites located around the network and they are possible pollution points that require close attention.
- Make use of arboriculturally best practice whilst removing vegetation – manage the removal of vegetation on roads whilst undertaking maintenance and construction works.
- Proactive and reactive programme of weed control funded and carried out annually – to ensure that weeds growth is controlled and comply with NRC requirements and to ensure that the functioning of assets is not compromised.
- Take a ‘whole-of-life’ approach to resources considering the overall best opportunities for resource efficiency over the asset’s lifetime – there is a need to drive sustainable sourcing and use of materials and waste minimisation.

Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 06.B

Network Operations – Traffic Services and Network Lighting

Overview and Management
Problems, Benefits, Consequences
Options Assessment

Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 06.B

Network Operations – Traffic Services and Network Lighting

Table of Contents

1 Overview

1.1 Description

1.1.1 Signs, Markings and Delineation Activity

The Signs, Markings and Delineation Activity include the following assets:

- Signs – there are more than 40,000 signs across the three NTA networks, the count of sign types within the networks are tallied in Table 1-1 as follows:

Table 1-1: Number of sign types within the NTA networks

Sign Type	FNDC	KDC	WDC	NTA
Advisory	3,393	3,115	4,099	10,607
Regulatory	5,115	2,569	5,344	13,028
Temporary Warning	15	9	29	53
Warning	9,192	5,018	8,392	22,602
Total	17,715	10,711	17,864	46,290

- Sight Rails (includes safety barriers, these are considered in the road safety barrier activity) – there is a total length of36.12 km of sight rails with the NTA networks (FNDC – 21.52km; KDC – 6.37km; WDC 8.22km).
- Edge Marker Posts (EMPs).
- Pavement Markings.
- Reflective Raised Pavement Markers (RRPMs).
- Audio Tactile Profiles (ATP).

1.1.2 Traffic Island & Calming Device Activity

The Traffic Island and Calming Devices Activity include the following assets:

- Rotary Islands – large central islands at an intersection.
- Channelized Islands – to guide traffic into the correct lanes or to slow the traffic through chicanes.
- Divisional Islands – dividing the highway into separate directional traffic thus eliminating head on collisions and reducing accidents.
- Speed Humps (includes pedestrian platforms, courtesy crossing, raised table zebra) – these are often constructed in conjunction with traffic islands.
- Pedestrian loading Islands – to protect pedestrians at bus stops or crossing points including schools.
- Kea Crossings – these are temporary crossings that are only in operation for a limited period before and after school hours. Outside these hours vehicles are not required to give way to pedestrians. Figure 1-1 following shows the crossings with foldout signs, generally outside schools (source: NZTA Kea Crossings: School Crossing Points – Factsheet 26).

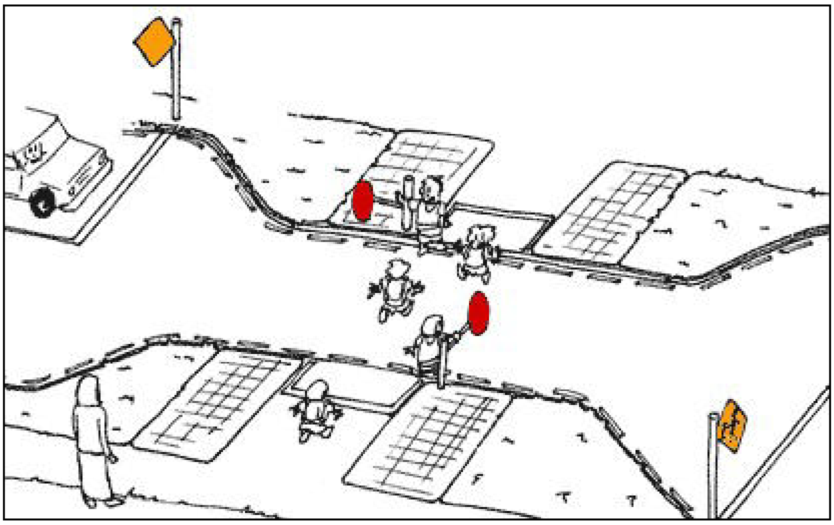


Figure 1-1: Kea Crossing arrangement

Many of these assets are unknown in quantity as there is little information in RAMM and no records regarding their creation. A program may be put in place to acquire this information, but what information we do have on record is shown in the Table 1-2 below:

Table 1-2: Number of Traffic Island and Calming Devices within the NTA networks [1]

Type	FNDC	KDC	WDC	NTA
Channelising	86	39	244	369
Divisional Island	34	9	28	71
Other	4	0	17	21
Pedestrian Loading Islands	40	22	218	280
Rotary Islands	21	5	24	50
Total	185	75	531	791

1.1.3 *Street Furniture & Bus Shelter Activity*

The Street Furniture and Bus Shelter Activity include the following assets:

- 66 seats (all located in CBD);
  - 4 bench seats with no backs
  - 23 bench seats with backs
- 38 timber fences at a total length of 4455m,
- An unknown quantity of bollards, and
- Approximately 39 bus shelters (glass, concrete and steel).

[1] Table 1-2: Number of Traffic Island and Calming Devices will be updated for the final document submission

1.1.4 Network Lighting

Streetlights are an important component of the Council's public lighting asset. The lighting network is required to be attractive, of good quality, easy to maintain, and cost effective. Public lighting is there to provide a safe environment for pedestrians and vehicles and to discourage illegal acts.

Although the primary function of public lighting is to provide illumination of public spaces within our cities, they require very different designs depending on what they illuminate to minimise spill light onto neighbouring properties as well as upward light (sky glow).

The main types of public lightings within the three Councils include:

- Street lighting for main roads where the vehicular traffic is predominant – "Category V" lighting;
- Lighting for local streets, shared path, public space, carparks, parks and reserves primarily for transport functions where pedestrian traffic is predominant – "Category P" lighting.
- Amenity lighting - associated with pedestrian areas to assist with all visual information and personal security in hours of darkness but not directly related to the operation of the road.
- Sports ground lighting - very powerful narrow beam specialised lights mounted on tall poles for sports arena.
- Decorative lighting – associated with special features of surroundings and or buildings.

The focus of this document is on the street lighting assets of the Council. The streetlighting system constitutes of the following components:

- Poles [steel or concrete].
- Luminaires (light) (LED or HPS (high-pressure sodium)).
- Brackets (steel pole outreach arms or concrete pole mount outreach brackets).
- Protection system – fuses, and earthing system.
- Control system – Decabit relay, Photocell or Central Management System (CMS).
- Power supply – Underground cabling or Overhead line.

These streetlighting components can be generally categorised as the luminaire, the mounting structure, the power supply and control system.

LED luminaires are widely used within the three Councils with supporting structures being either steel or concrete poles with an outreach arm. Majority of street lighting assets are entirely owned and operated by the three Councils with some hybrid ownership where the Council owns the luminaires with mounting brackets and the Electricity Utility's own the supporting structures and power supply system.

Figure 1-2, Figure 1-3, and Figure 1-4 following show the three key types of streetlight mounting structures in the region.

Figure 1-2: RCA owned steel streetlight pole

Figure 1-3: RCA owned concrete streetlight pole

Figure 1-4: RCA owned streetlight (bracket) on utility pole

1.2 Monitoring and Condition

1.2.1 Signs

Figure 1-5 below shows the condition ratings of the road signs across the region.

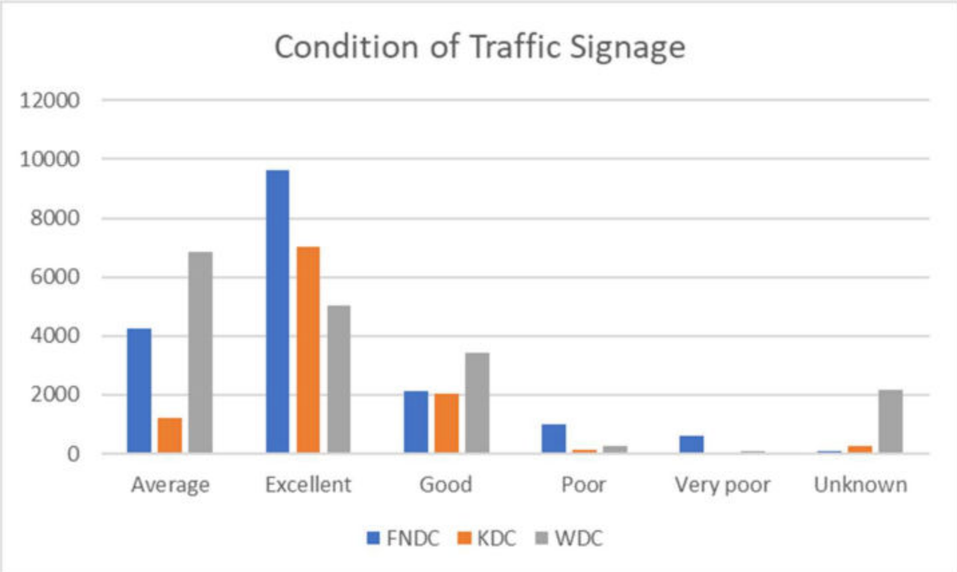


Figure 1-5:Condition distribution – signs

A proportion of the assets (5.4% for WDC) have unknown condition recorded in the RAMM database and this will require repopulating.

It can be seen from the condition ratings that the majority of the signs are in ‘average’ or above condition, however due to the small amount of data available on the age of the signs, the graph above is unlikely to be an accurate representation.

1.2.2 Traffic Island & Calming Device Activity

The majority of these assets are inspected as part of the Road Maintenance Contracts in terms of their markings, signs etc. However, no formal inspection or condition rating process is in place for these devices and very little is known about them in terms of type, age, location etc.

1.2.3 Street Furniture & Bus Shelter Activity

The data retained in RAMM for the condition of the Bus Shelters records are incomplete. Therefore, further update is required for reporting the condition of the bus shelters.

1.2.4 Network Lighting

As part of the day inspections, the Contractor carries out condition rating inspections of all assets and updates RAMM accordingly. The condition rating assessments are based on observations as well as non-destructive tests carried out by the contractor on site. The streetlight steel columns are tested using a Colchek method which is a non-destructive method to determine the thickness of the steel columns wall under the ground. Whilst the contractor relies purely on observation to rate the condition of the concrete streetlight poles and luminaires.

A number of Colchek tests on steel columns have been done across the network in this maintenance contract which will be discussed in the next section of this report. The condition rating allocates a number ranging from 1 through to 5 with 1 being 'excellent' and 5 being 'very poor'.

The condition rating of the asset in the streetlighting maintenance contract is in accordance with Table 1-3 below.

Table 1-3: Streetlighting Maintenance Contract – Condition Rating

Grade	Condition	Description of Condition
1	Excellent	Sound physical condition. Asset likely to perform adequately without major work for 15 - 25 years or more.
2	Good	Acceptable physical condition; showing minor wear or deterioration. Need to re-inspect in 1-2 years. minimal short-term failure risk but potential for deterioration in long-term (10 - 15 years). Minor work required.
3	Average	Deterioration evident; failure likely within the next 5 - 10 years. Minor components or isolated sections of the asset need replacement or repair now to improve appearance but asset still functionally sound.
4	Poor	Failure likely within 1 - 5 years (short-term). Need to replace most or all of assets within 5 years. Work required in the near future to ensuring asset remains safe. Substantial work required in short-term, asset barely serviceable.
5	Very Poor	Failed or failure imminent. Immediate need to replace most or all of asset. Health and safety hazards exist which present a possible risk to public safety or asset cannot be serviced/operated without risk to personnel. Major work or replacement required urgently.

The streetlight condition data for the luminaires, poles and brackets are held within the RAMM database based on the rating as per the above table and is used to program streetlight maintenance and renewals programs.

Ideally there ought to be a direct relationship between the age and usage of the asset to its condition. In case of the streetlight luminaires and poles this is somewhat different as there are factors such as their location, ground conditions, installation methodology, and workmanship that could contribute to any premature failure of the asset.

The main structure supporting the streetlights are the poles or columns which are either owned by the Council or the power utility. The Council is not responsible for assessing either the structural integrity of the poles or the suitability of the electrical system owned by the power Utility.

The composition and ownership of the streetlight supporting structures vary between Councils and the same is illustrated in Table 1-4 below for the three districts.

Table 1-4: Composition and ownership of streetlighting support structure

Pole Type	FNDC	KDC	WDC
Steel	74%	30%	46%
Concrete	5%	8%	14%
Concrete - Utility	21%	62%	40%

The three key components that are condition rated for the streetlighting system currently are the poles, brackets and the luminaire (light). The poles include both the steel and concrete poles owned by the Council; the brackets refer to the steel mounting installed on Utility poles to support the luminaire (light).

Figure 1-6 following illustrate some of the failures of steel and concrete streetlight columns identified during the condition rating assessment of the assets.

Figure 1-6: failures of steel and concrete streetlight columns

The LED luminaires installed in the region are fairly new as this date back to 2018 and have a design life of 20yrs and a LED warranty of 10yrs on them. The electronic drivers in the LED luminaires on the other hand have a 5yr warranty which is generally similar to any other electronic device.

The streetlight hot dipped galvanized steel poles designed in accordance with AS/NZS 4676 Structural Design Requirement for utility service poles and AS/NZS 4677 Steel Utility Service poles have a minimum design life of 50yrs when installed in accordance with the manufacturer's specifications.

An extensive asset condition assessment was carried out between 2021 and 2022 across the regions streetlighting network to ascertain the condition rating and to update the RAMM database accordingly. An objective analysis of all the components of the streetlight asset as previously mentioned is not possible as such some dependence on its age data is also important when planning renewals.

The streetlight asset age data quality in RAMM is not perfect as this is usually taken from the date of the construction of the road pavement and is some cases is incomplete. As such the validity of the remaining useful life data in RAMM will be compared against the design life of the asset and then used as a guidance to support discussion making related to asset renewals plan.

Figure 1-7 following depicts the condition of the streetlight poles, luminaires, and brackets as well as its age data from the RAMM database for the three Councils.

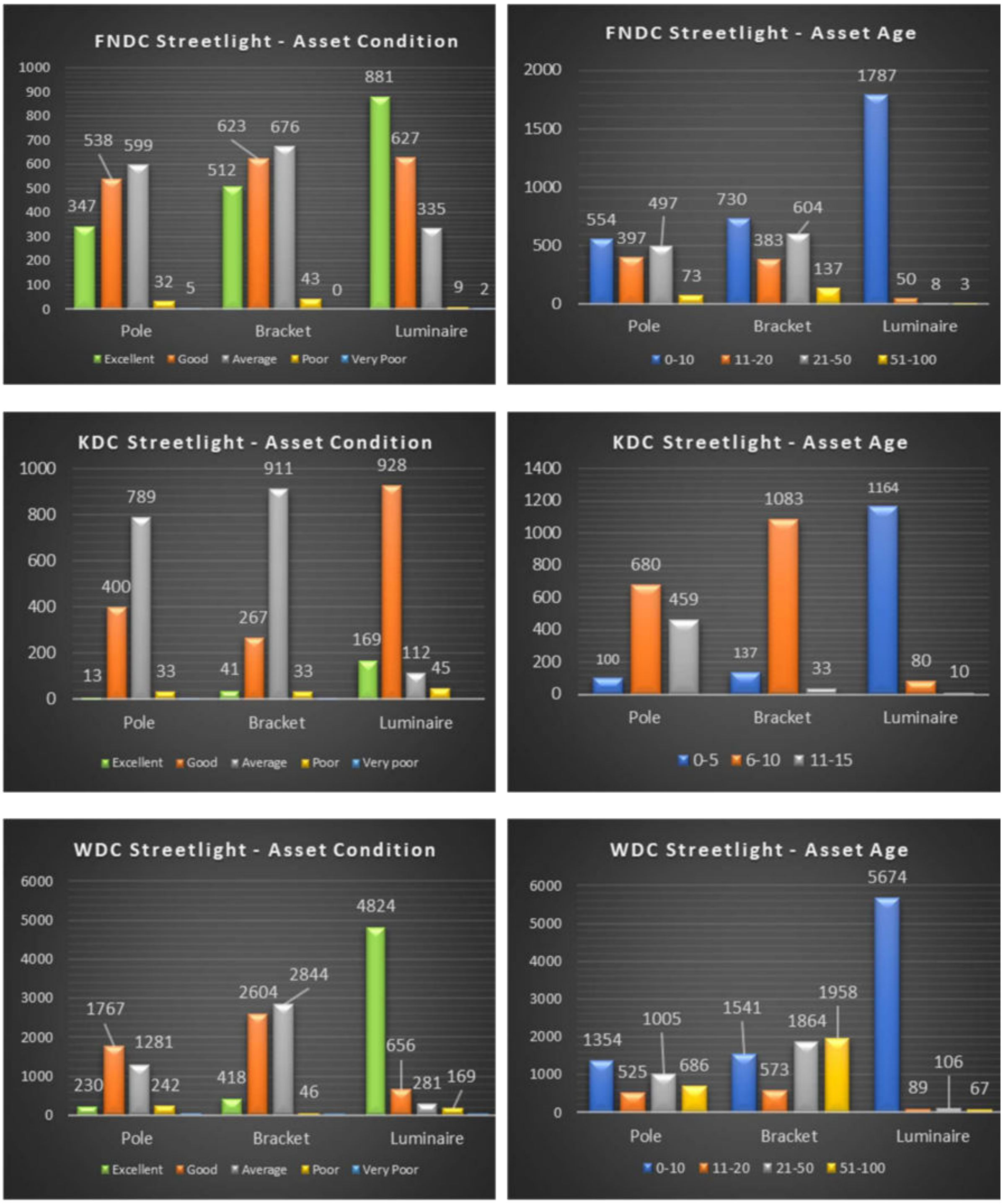


Figure 1-7: Streetlight condition and age distribution by district

1.3 Overall Strategy

1.3.1 Signs, Markings and Delineation Activity

The overall strategy for the next 5-10 years includes the following:

- Maintenance and Operations:
    - Signs: A small proportion of signage is replaced due to ageing. The bulk is due to accident damage and vandalism.
    - Sight Rails: These are either painted or cleaned annually. Sight Rails which are higher than 0.5 x eye height shall be modified to meet this requirement.
    - EMPs: to provide or maintain to meet NZTA standards for all arterial, collector and tourist routes.
    - Pavement markings: long life products will be used on high wear sites where the breakeven period will be achieved.
    - RRPMs: to provide or maintain to meet NZTA standards for all arterial, collector and tourist routes.
- Renewals – Usually done as part of reseals and pavement rehabilitation.
- Improvements – All improvements are identified through dispatches raised through RAMM Finance or road safety inspections. There is no set strategy for these improvements with the majority of improvements being implemented through the minor improvements programme.
- New Assets – Through capital works.

1.3.2 Street Furniture & Bus Shelter Activity

Summary of the overall strategy for the next 5-10 years including:

- Maintenance and Operations – When a shelter is vandalised on a regular basis it becomes too expensive to replace the glass (approximately $2,500 to re-glaze an entire shelter). The next step is that when a more appropriate/deserving site is identified the vandalised shelter may be refurbished and relocated.
- Renewals – The old steel shelters are becoming structurally unsafe. When these are removed, a decision on the replacement style of shelter will be made based on the track record of vandalism in the area.
- New Assets – This will be driven by customer requests and validated by the Northland Regional Council (NRC). Some sites do not lend themselves to be shelters due to the lack of space or resistance from property owners. Shelters are often perceived by locals to be venues of undesirable behaviour. New vandal proof shelters have been installed at some sites, replacing glass sided shelters as and when they are relocated.

The capital expenditure has historically been vulnerable to cost cutting. However, to achieve the proposed gains in public transport use that have been identified in the Whangarei Transportation Strategy, a budget increase is being proposed that enables five new shelters to be installed annually (up from the previous two per annum). An increase is also being proposed to provide additional seating.

1.3.3 Network Lighting

A Streetlight LED conversion project had been undertaken by the Councils and therefore majority of the streetlights are LEDs. The WDC has around 96% LED luminaires, KDC 89% LED's and FNDC around 97% LEDs as detailed in Table 1-5 below.

Table 1-5: Streetlight type by Council

Streetlight	FNDC	KDC	WDC
LED	97%	89%	96%
Other	3%	11%	4%

The NTA's streetlighting asset network strategic objectives are as follows:

- Enhance the safety by ensuring that public lighting provides adequate illumination for pedestrians, drivers, and other users of public spaces.
- Operate an integrated and responsive lighting network for the transportation system.
- Develop and implement a comprehensive maintenance program to ensure that public lighting is functioning properly and consistently, and to minimize the need for repairs and replacements.
- Reduce the Districts impact on the Environment by applying appropriate design practice and adapting new technologies.
- Implement street lighting solutions that are cost-effective and provide good value for money, while still meeting the needs of the wider community.

Figure 1-8 below illustrates the importance of road lighting to enhance safety for motorists and pedestrians alike.

Figure 1-8: LED intersection lighting - Category P Road

Historically, the focus was on the renewing of the streetlight luminaires from the conventional lower efficiency lamps to the higher efficiency LED luminaires. The region now has around 94% LED luminaires amongst the three districts. In addition to its higher efficiency the LED modules in the luminaires have a longer life of 20yrs as such the cyclic 5yr replacement of the conventional lamps are obliterated with the LED conversion of the streetlights.

Apart from the major streetlight LED conversion project some streetlight infills on the arterial as well as few local roads were also carried out over the past 2 years in the region to overcome some of the road lighting deficiencies.

With the luminaires been converted to LEDs, the asset renewal emphasis is now on the other key components of the streetlight infrastructure such as the streetlight poles, brackets, and the power supply system.

The overall strategy considered in this Activity Management Plan is around the maintenance and improvement of the existing streetlighting assets as well as improving the levels of service pertaining to the lighting of the road corridor in the region.

Therefore, the improvement strategy is broken down into a renewals plan and a lighting improvement plan. The lighting improvement plan is inclusive of the streetlight infills and new streetlighting schemes that expands the coverage of the road lighting network based on need.

2 Management Plan

2.1 Management and Operations

2.1.1 Signs, Markings and Delineation Activity

Maintenance Contract

The Road Maintenance Contracts incorporate all operation, maintenance and renewals of signs, sight rails, EMPs, markings, and RRPMs. The contract also covers the creation of new signage, markings and delineation as requested by the Engineer.

State Highways

As part of the MOU with NZTA, the NTA is responsible for certain markings on the State Highway network, such as; parking bays, taxi stands, fire hydrants, bus bays and loading zones. All other markings are the responsibility of NZTA. In addition, all marker posts are the responsibility of NZTA.

The NTA is responsible for certain signs on the state highways. These include the following:

- Road names
- Locality and services
- Some general information
- Tourist route
- School zone
- Parking
- Community facilities.

2.1.2 *Traffic Island & Calming Device Activity*

Maintenance Contract

The Road Maintenance Contract covers most of the maintenance of these devices. Although the contract does not identify them specifically as islands or calming devices, it does cover their components such as markings, signage, surfacing and pavements.

Parks Department

Garden in-fills on traffic islands, roundabouts etc. are the responsibility of the Councils Parks Department and maintained through their maintenance contracts.

2.1.3 *Street Furniture & Bus Shelter Activity*

Public Bus Stops & Shelters

NRC tender and manage the bus service in Whangarei and to surrounding areas including Bream Bay; Hikurangi and Hokianga. The NTA manages the associated bus service infrastructure on behalf of the NRC. This has been done on the basis that NTA have the resources and physical works contractors to put this infrastructure more effectively in place. NRC provides some subsidies regarding the creation and maintenance of the bus shelters.

School Bus Stops & Shelters

Rural and some urban school bus shelters and stops are not funded by the NTA. The creation and maintenance of these shelters is generally undertaken and funded by community groups.

Ownership

Some clarification is required as to which Council department owns and is responsible for some of the benches in the district. In general, any benches in the road reserve is owned by the NTA. However, those in walkways/alleyways that link roads to parks or reserves could be deemed the property of either the Roading or the Parks Departments.

NZTA

Street furniture on the urban highways is the responsibility of WDC, FNDC and KDC, while NZTA looks after all furniture on the rural highways.

Maintenance Contract

The maintenance and operations associated with the region's street furniture are conducted by the maintenance contractors and governed by the Road Maintenance Contracts. This excludes bus shelters which are maintained by small local operators.

2.1.4 *Network Lighting*

2.1.4.1 *Management*

The maintenance of the streetlight network is delivered through the Streetlight Maintenance & Renewals Contract. The Contract is for the management and maintenance of the road corridor and amenity lighting network assets within the districts.

The contract has three separable portions with an initial term of two years from August 2021 with two contract extension of two years and one year respectively (2 + 2 + 1) based on performance, and entirely at the discretion of the Principal. The contract includes but is not limited to the following key activities:

Proactive

- Maintenance, replacement and or retrofitting (luminaires, lighting columns, supports/fixings, control gear & wiring) for all street lighting and specified amenity areas;
- Streetlight LED Infills as necessary;
- Asset inspection and condition monitoring;
- Asset management; and
- Traffic management necessary to safely carry out work without unnecessarily delaying traffic movements.

Reactive

- Attendance and rectification of lighting outages within the prescribed contract response times for specific areas; and
- Working with NTA and emergency services as required in emergency response events.

Management

- Reporting;
- Accurate and complete provision of RAMM related asset information;
- Maintaining critical spares of parts and equipment for reactive maintenance;
- Managing and undertaking maintenance activities within budget allocations; and
- Working collaboratively with stakeholders; District Councils, Police, Energy supplier(s), to obtain best for community solutions to specific matters.

The Contractor is primarily responsible for continuously monitoring the lighting assets and carrying out the necessary maintenance. The following outcomes are sought from this contract model:

- Increase customer satisfaction;
- A safe and efficient lighting network for road users;
- Value for money and cost-effective asset maintenance management;
- Integrated asset inspection and condition monitoring; and
- Innovative work methods and materials.

2.1.4.2 *Operations*

In the absence of a Streetlight Central Management System (CMS), most lighting asset failures are reported by residents and recorded by the Council's service request system. Some failures are also detected because of the contractor's day and night inspections.

To maintain an agreed level of service (LoS), the response times start once the lighting asset failure has either been identified by the Contractor or the Contractor notified of the same. The failure is deemed rectified once the lighting asset is brought back into service.

The LoS considers the safety of all road users, the traffic and population density and the place value of the streetlighting assets within the District.

Table 2-1 following details the various LoS for the lighting maintenance and renewal contract.

Table 2-1: LOS for Lighting maintenance and renewal contract

SL	Item	Description
SL1	Pedestrian Crossings	Lighting for dedicated Pedestrian Crossings that are marked with alternative parallel bands of black and white, which may be reflectorized. Includes Belisha Beacons.
	Arterial Road - Urban	Road Carriageway lighting on roads classified as Arterial routes in an urban area.
	Primary & Secondary Collector and minor roads - Urban	Roads classified as Access, Low Volume, Primary and Secondary Collector roads in an urban area. (Urban residential setting)
	Intersection/ Flag Lighting	Road Carriageway lighting for the purpose of illuminating an intersection (intersection lighting scheme or flag lighting).
	Shared Path	Shared path used by pedestrians, cyclists and mobility vehicles
SL2	Arterial Road - Rural	Road Carriageway lighting on roads classified as Arterial routes in a rural area.
	Primary & Secondary Collector and minor roads - Rural	Roads classified as Access, Low Volume, Primary and Secondary Collector roads in a rural area. (Rural residential setting)
	Amenity Lighting - A	Walkways and footbridge
	RCA Carpark Lighting	Outdoor carparks lighting
SL3	Amenity Lighting - B	Amenity Lighting – such as but not limited to illuminated bollards, In-ground/ up-lighting

The repair and response times corresponding to the various levels of service above is tabulated in Table 2-2 below for the streetlight maintenance contract.

Table 2-2: Response times for lighting maintenance contract

Asset Issue	Repair Times			RFS Response Times
	SL1	SL2	SL3	
Emergency – (such as but not limited to: Asset Hanging (Luminaire or outreach arm detached from mounting), Lighting Column Gear Door Open/ Missing/ Unsecure/ and/ or wires exposed, lighting column knockdown due to motor vehicle accident)	3 hours	4 hours	4 hours	Contractor notified by RCA call center, Engineer, Customer or Emergency Services. Contractor to be on incident site within One and a half (1.5) hours in the urban area and within two and a half (2.5) hours elsewhere from the time of notification day or night.
Single light out whilst adjacent lights working	5 days	10 days	10 days	Contractor acknowledges RFS within 2 working days of notification & RFS closed within 10 working days.
Two or more consecutive lights out	2 days	5 days	5 days	

Asset Issue	Repair Times			RFS Response Times
	SL1	SL2	SL3	
Asset misalignment (Luminaire & Column & Outreach arm)	5 days	10 days	10 days	
Day Burning (Lights "ON" during the day)	1 day	5 days	5 days	
Glare and Obtrusive Light Control	10 days	10 days	10 days	
Pole or structure defect (non-emergency)	10 days	10 days	10 days	
Pole and luminaire replacement	5 days	10 days	10 days	
Removal of unauthorised banners attached to Lighting Columns	10 days	10 days	10 days	
Trimming foliage causing light distribution to be blocked	10 days	10 days	10 days	
Fixing approved signs/ banners/ flags to lighting columns	10 days	10 days	10 days	

Based on the present streetlight maintenance contract a high emphasis is placed on preventive maintenance as such the Contractor is required to undertake routine inspections using RAMM Patrols to ascertain the condition of the assets on the entire network. These routine inspections comprise of day and night inspections to ascertain any spot failures or degradation of the streetlighting assets.

During the night inspection the Contractor drives the road network taking note of all asset faults and defects including, but not limited to:

- Lighting not functioning
- Glare or obtrusive light spill
- Hanging or misaligned assets that constitute a hazard to the safety of public or are adversely affecting the lighting level
- Open or missing gear doors
- Trees, vegetation, or other obstructions obscuring the lighting.

Day inspections require a bit more work as such the frequency of this inspection varies from the night inspections. The nature of streetlighting assets is such that there are above ground and underground structures. During the day inspections apart from asset faults, the focus is on identifying the degradation of the assets that are not readily apparent during the hours of darkness. These include, but are not limited to:

- Day burners
- Hanging or misaligned assets that constitute a hazard to the safety of public
- Leaning lighting columns
- Open or missing gear door

- Trees, vegetation, or other obstructions obscuring the lighting
- Asset condition
- Shear base column torque (pole re-torque)
- Electrical safety of the installation (electrical tests).

All faults or defects discovered during the night and day inspections are recorded in RAMM at the time of the inspection. Table 2-3 below details the inspection frequencies.

Table 2-3: inspection frequencies

Item	Description	Inspection Frequency - Night	Inspection Frequency - Day
Pedestrian Crossings	Lighting for dedicated Pedestrian Crossings including Belisha Beacons	3 months	12 months
Arterial Road Lighting	Road Carriageway lighting on roads classified as Arterial routes.	6 Months	12 months
Intersection/ Flag Lighting	Road Carriageway lighting for the purpose of illuminating an intersection	6 Months	12 months
Primary & Secondary Collector and minor roads	Road carriageway lighting other than arterial roads.	6 Months	12 months
Amenity Lighting	Walkways, shared paths, and footbridge	6 Months	12 months
Carpark Lighting	Outdoor carparks lighting	6 Months	12 months
Lighting Column.	Shear base columns	-	6 months

2.2 Acquisition (Growth)

2.2.1 *Signs, Markings and Delineation Activity*

Creation of these assets is undertaken through minor improvement works as a result of any identified deficiencies or customer requests. New assets can also be created through major capital projects or roads being vested with council through subdivision development.

Sight rails are often installed due to storm damage. If any unsafe or major works cannot be repaired within a certain timeframe, a sight rail is installed as part of the minor safety works to advise road users of the hazard. Sight rails are not normally constructed as a result of minor safety studies as there is a move to use signage rather than railings.

2.2.2 *Traffic Island & Calming Device Activity*

The creation of these assets is generally undertaking either as part of a major project, such as the creation of a new road or a major seal renewal, or as minor improvement works through customer requests of identified safety deficiencies.

2.2.3 Street Furniture & Bus Shelter Activity

Street Furniture

It is anticipated that approximately five seats/benches per year are to be installed at a cost of around $10,000. These, along with bollards and fences are generally installed as part of street scaping projects.

Bus Shelters

The NRC operates the local buses in the district and works closely with the NTA to determine the most appropriate location for bus stops and shelters. The NRC Public Transport Infrastructure Strategy will help determine the current and long-term location of bus stops and their associated infrastructure (pull off bays, bus shelters, signage and seating).

The selection process for bus shelters is based upon a number of criteria such as:

- List of sites compiled from NRC, the bus company and the public. These sites can be influenced by changes in bus routes or extra routes being included.
- Passenger volumes are then considered – this can define the sort of shelter required.
- Pull off bays as part of the bus shelter – designed behind the whole bus pull off area.

2.2.4 Network Lighting

Along with installing new streetlights, the Council also takes ownership of streetlights designed and installed by others. These acquisitions are generally aligned with the creation of new subdivisions by other parties such as land developers. All assets vested to the Council now must comply with the NTA Design Manual – Streetlighting referenced in the Environmental Engineering Standards of the Council. This design manual was developed by NTA in 2020 and has been widely used from 2021.

The Councils' have also recognized the AS/NZS 1158 series of public lighting standards as the guiding specifications for assessment of the adequacy of road lighting in the district. These standards provide for two main categories: 'Category V' lighting, where the intent is to light the road carriageway for the benefit of road traffic such as for arterial roads and 'Category P' lighting where the intent is to light the road corridor as a whole for the benefit of all road users to deter crime and fear of crime such as local roads.

As part of the LED replacement project, the Category V intersections and major arterial roads on the Twin Coast Discovery Highway have been upgraded by infill streetlighting as necessary to meet the Category V standards and obliterate dark areas.

NTA has also undertake a HISLAT survey to identify any dark areas on the P Category (local) roads and has prioritized the deficiencies based on proximity to schools, community safety, traffic flows and crash history. Where funding allows, some P Category infill lighting will be programmed to address the worst of these dark areas.

There are also certain issues regarding the type of assets vested to the Council. For assets to be vested to Council they must comply with the EES and the NTA Design Manual -Streetlighting. However, every subdivision tends to use a different type of streetlight pole and LED luminaire to create a more modern concept. At present there are no specific requirements regarding the type of pole or LED luminaire that is to be used in new developments in the region, but the NTA Design Manual-Streetlight rather refers to a list of approved poles and LED luminaires used by Auckland

Transport. This simply means that the Council's streetlight maintenance contractor needs to either keep or have access to all these different types of assets should there be a need for replacement.

This is something that needs to be addressed through a wider consultation as it may not be sustainable for the Councils to maintain these various assets in future.

2.3 Maintenance

2.3.1 Signs, Markings and Delineation Activity

Faults with these assets are identified in the following ways;

- Customer Request Management (CRM)
- Client identifies
- Patrol for specific reasons e.g. storm, strong winds, spate of vandalism
- Changes requested WDC
- By our team when in the field
- By our routine maintenance patrol.

The maintenance plan is based on the outcomes of routine inspections and planned and reactive maintenance. Night inspections are required to be completed twice a year for T1 – T5 roads and once a year for others. These inspections are to ensure that all signs and markings are clearly visible at night. The only planned maintenance for this activity is the cleaning of all edge marker posts which is to occur annually. All other maintenance is reactive.

Maintenance Decision Processes

Faults are prioritised by their function, the more relevant to safety and enforcement, the higher the priority. Priority is assessed by field engineers and the area engineer. In practise, the work proceeds from identification, to ordering, to supply, to installation. Usually this happens quite smoothly so the jobs are done in the order they are identified.

Routine and minor reactive maintenance is based on the intervention levels and response times set out in the maintenance contracts. Any large maintenance that is identified is prioritised based on the risks posed by the defect and the criticality of the asset or associated road.

Reinstatement of Marking After Repairs

Apart from reseal sites as described below, all failure repairs are to have the markings reinstated within 5 working days irrespective of when the annual remarking is going to take place.

Repairs that are going to be sealed over in the current season may not have to marked ahead of the reseal. Temporary marking will be required if safety, compliance, or regulatory issues are likely to arise and/or the time lapse between the repair and reseal will span a few weeks. Reinstating rural roads centre lines, edge lines etc. are less of an issue.

2.3.2 Traffic Island & Calming Device Activity

As mentioned in the Management and Operations section, there is no maintenance contract or plan specific to these devices, however their components (such as markings, signage, surfacing and pavements) are covered by the Road Maintenance Contract.

The Parks Department maintenance contract is responsible for the maintenance of garden in-fills.

2.3.3 *Street Furniture & Bus Shelter Activity*

Maintenance of street furniture, including bus shelters, is conducted as part of the Road Maintenance Contract. The furniture is inspected during the inspections of the entire network. Bus stop maintenance is reactive only.

All bus shelters are cleaned monthly small local operators.

Fence maintenance is all reactive and is generally driven by customer complaints.

A large part of the maintenance of street furniture and bus shelters is due to vandalism and tagging. Glass bus shelters are the most susceptible to vandalism.

2.3.4 *Network Lighting*

The maintenance of the network lighting activity is delivered through the Streetlight Maintenance Contract. The maintenance plan is based on the routine inspections, some planned maintenance and reactive maintenance. The contract requires night-time inspections of arterial roads, car parks and recreational areas to be conducted at least four times per year.

Following the LED conversion project, the maintenance plan will be revised through the next version of the Streetlight Maintenance Contract to reflect the much reduced maintenance needs of the LED luminaires and the improved response times following the implementation of the central management system (CMS).

2.4 Renewals

2.4.1 *Signs, Markings and Delineation Activity*

Faults are identified either through the regular inspections of the entire network or through the night inspections conducted that focus on signs, markings and delineation.

The standards for the renewal of signs, markings and delineation are set out in the maintenance contract.

2.4.2 *Traffic Island & Calming Device Activity*

The majority of these assets are unknown in terms of their condition, age etc. This means the renewal of these assets generally only occurs as part of pavement or surface renewal projects or as Minor Improvement works identified.

2.4.3 *Street Furniture & Bus Shelter Activity*

Benches

Generally, around two seats per year are refurbished at a cost of approximately $1,000 each.

Bus Shelters

All the old steel bus shelters in the district require renewing and the glass shelters are to be phased out due to their susceptibility to vandalism. These may be replaced by perforated steel shelters. These renewals will occur at a rate of two replacements per year.

The assets that require renewal are generally identified either by the maintenance contractors during their inspections or by the public. There are no set intervention levels of defects that are used.

The renewal of both the steel and glass shelters is being undertaken due to the steel shelters reaching the end of their lifespan, and the glass shelters requiring a high level of maintenance.

2.4.4 Network Lighting

A key current focus area is the introduction of Light Emitting Diode (LED) streetlight lamps to replace the older less power efficient lamps on our network. LED lights are providing the same light output for about half the power demand so the savings will be significant. In addition, LED lights have long lives of approximately 20 years compared to a replacement cycle of 5 years for High Pressure Sodium lights which will reduce bulb replacement costs.

LED streetlights are currently providing between 30-60% power savings. Modelling by WSP shows that the pay-back period for LED lights on the Whangarei network is in the order of 8-10 years.

2.5 Improvement

2.5.1 Signs, Markings and Delineation Activity

It is proposed to continue with the following improvements:

- Provide RRPMs and edge marker posts to NZTA standards on all arterial, collector and tourist routes.
- Long life pavement markings shall be used on major intersections where there is a positive payback period.
- Sight rails are to be progressive lowered where necessary so that they meet the 0.5 x eye height standard.

2.5.2 Traffic Island & Calming Device Activity

Improvements of these assets will only be undertaken as part of Capital Improvement Projects such as pavement or surface improvements.

2.5.3 Street Furniture & Bus Shelter Activity

It is proposed that an accelerated programme of 5 new bus shelters and seats be provided on an annual basis to encourage uptake in public transport use.

2.5.4 Network Lighting

Street lighting is an essential public service that provides a safe environment for night-time travellers including motorists and pedestrians. Proper use of street lighting is considered as a protective method that also provides economic and social benefits to the people.

Lighting is planned to allow night traffic operations with maximum possible safety, comfort, and convenience. The driver should be able to see more clearly and explore all the important details of the driving environment.

Figure 2-1 following shows that street lighting can be improved in the following ways:

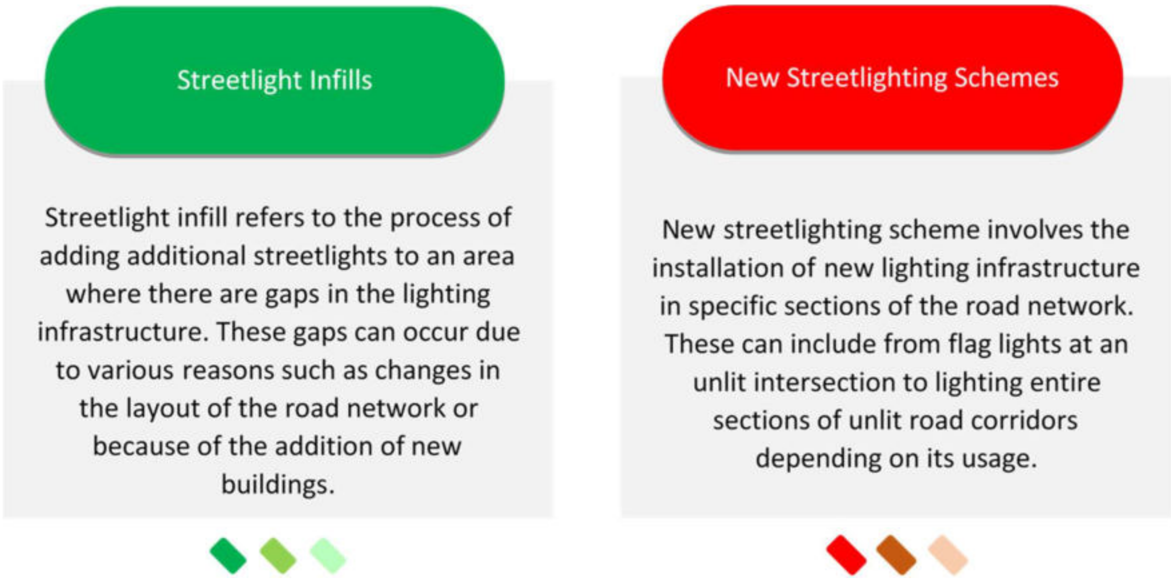


Figure 2-1: Ways streetlighting is improved

Streetlight infills can have a significant impact on the safety and security of an area, particularly in areas where there is high foot traffic or where there are concerns about crime. It can also improve the overall aesthetic of an area, making it more attractive and inviting for residents and visitors alike.

A new streetlighting scheme in the context of this Activity Management Plan refers to a strategy to install new lighting infrastructure in specific areas within the road corridor. The new scheme aims to improve the quality, efficiency, and effectiveness of the lighting in the area, with a focus on enhancing safety, security, and energy efficiency.

The goal of streetlight improvement is to improve visibility and safety for pedestrians, cyclists, and drivers in areas that may be poorly lit or completely dark.

The region is in good space when it comes to data related to lighting levels in urban areas. Post streetlight LED conversion a lighting survey was carried out by Odyssey Energy Ltd in 2019 that covered a total of 1,337 (423-FNDC, 207-KDC, 707-WDC) road sections across the region.

The survey was carried out to measure the illuminance level using Lux Mapping measuring system. The method of illumination data collection used an illuminance detector, mounted on top of a car at 1.5m height, and a GPS location device connected to a laptop that recorded simultaneously the illumination and vehicle GPS location.

The roads surveyed were predominantly: Residential (Pedestrian Priority P3 and P4) and High volume, mainly arterial roads (Vehicular Priority V3 and V4) roads. The lux survey data had been processed for sectional average values (average between two successive lights) and has been compared to see if they fall within the average lux target values for the selected lighting category and the percentage of the road length with substandard lighting levels.

Based on the above, Table 2-4 below had been established showing recommended upgrade priorities in relation to percentage of substandard sections:

Table 2-4: Recommended streetlight upgrade priorities

Critical Sections	Priority

Substandard / critical sections 80% - 100% (80% - 100% of the total road length has non-satisfactory lighting levels for selected lighting category)	1
Substandard / critical sections 60% - 79%	2
Substandard / critical sections 40% - 59%	3
Substandard / critical sections 20% - 39%	4
Substandard / critical sections 5% - 19%	5
Substandard / critical sections 0% - 4%	6

Figure 2-2 below depicts the percentage of the road length with substandard lighting for each district.

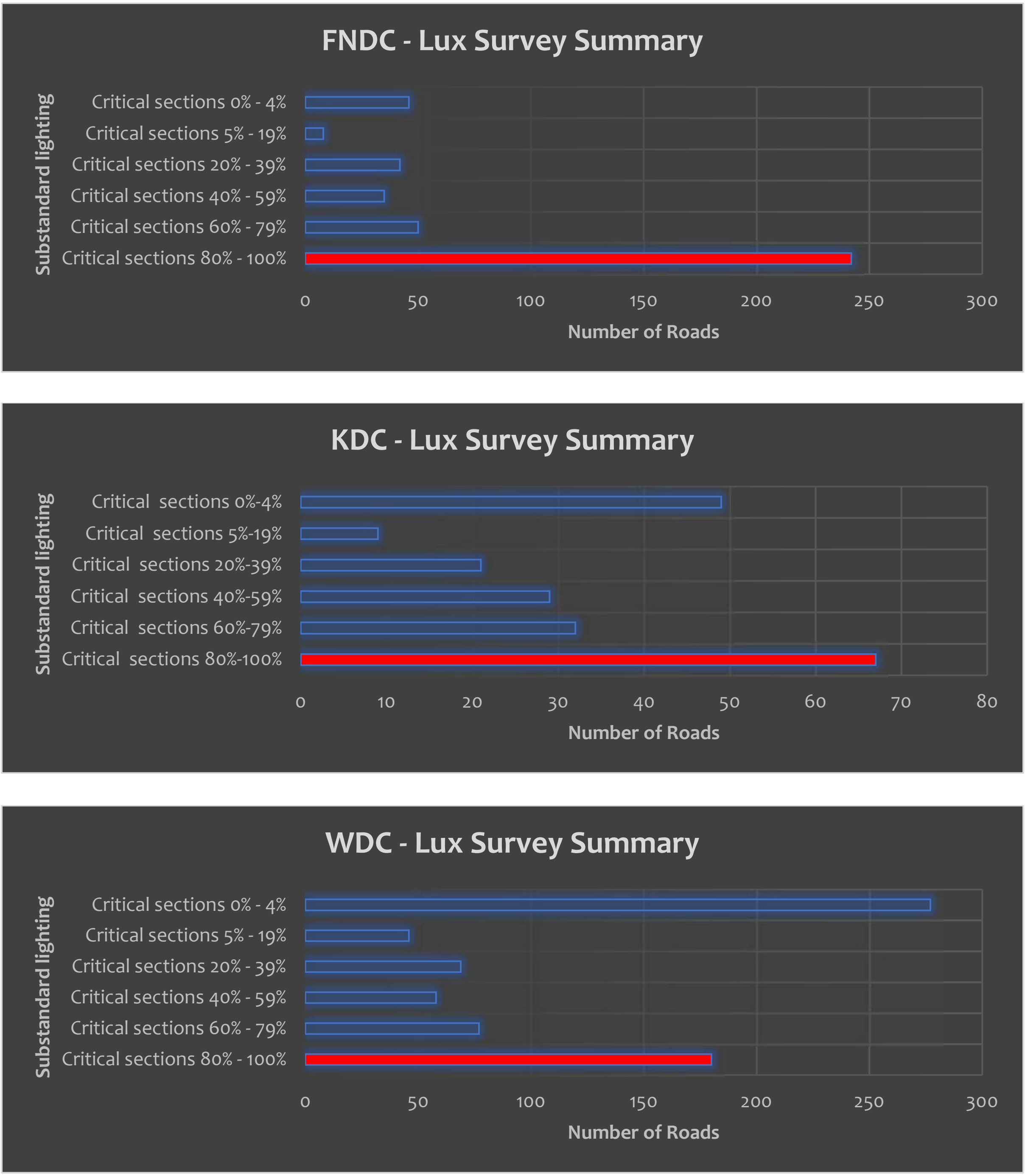


Figure 2-2: percentage of the road length with substandard lighting by district

An internal review of lux data including other factors such as presence of schools, public halls, commercial area, RAMM crash data, fear of crime, physical features of the roads, customer requests (CRM's) and access to electrical infrastructure (existing power poles) were considered to create an Infill lighting priority list.

3 Option Assessment

For the assessment of the data, peer group analysis and option assessment, a five point "traffic light" rating system has been used as shown in the following schematic. This rating system is based on a qualitative assessment of the LOS and cost comparison data.

5-point traffic light rating system

Performance Rating	Symbol	For LOS this means:	For Costs & Achievement this means:	Trend Rating	Symbol	For LOS this means:
Very Good		Much Better than Peer Group Average	Much Less than Peer Group Average	Improving Trend		Positive Change towards a Very Good rating
Good		Better than Peer Group Average	Less than Peer Group Average	Worsening Trend		Negative Change away from a Very Good rating
Average/Moderate		Similar to the Peer Group Average	Similar to the Peer Group Average	Static Trend		No Change
Poor		Worse than Peer Group Average	Higher than Peer Group Average			
Very Poor		Much Worse than Peer Group Average	Much Higher than Peer Group Average			
No Data		No Data	No Data			

Work Categories:	WC 122 Network Services Maintenance WC 222 Traffic Services Renewals WC 341 Low Cost/Low Risk Improvements

3.1 Links to Strategic Case

Problem Statement:	**Safety** Northland has a narrow, winding and unforgiving rural road network which combined with poor driver behaviour has resulted in the region being a high Community at Risk for death and serious injury (DSI) crashes and the rate of DSI crashes is trending upward for all three councils. FNDC and KDC also have higher Collective Risks than their peer group.
Benefits of Addressing Problem:	Delineation will be improved reducing the likelihood of loss of control crashes. Streetlights will provide adequate lighting levels that provide more confidence for people to walk and cycle after dark.
Consequences of Not Addressing the Problem:	Loss of control crashes will continue, increasing the risk of fatal and serious injury. Less people walking and cycling at night which will limit the number of commuters taking active modes, particularly in winter when the days are shorter

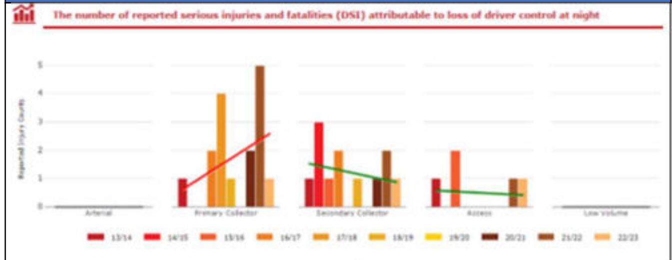
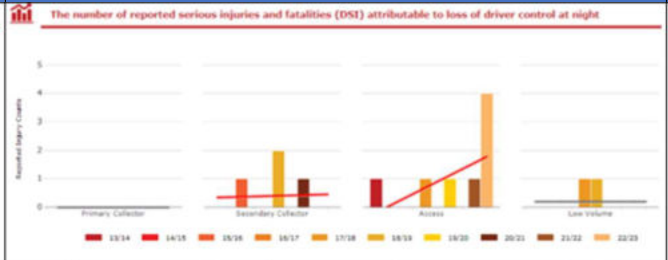
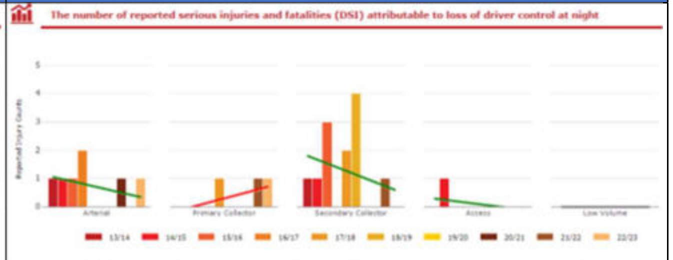
3.2 Levels of Service

ONRC Customer Outcomes:	None
Customer Levels of Service:	ONRC Safety TO1 – Permanent Hazards (no data available) ONRC Safety TO5 – Loss of driver control at night ONRC Accessibility TO1 – Accessibility (guide signage) (no data available)

NORTHLAND TRANSPORTATION ALLIANCE

3.3 Evidence and Gap Analysis

ONRC Safety TO5 – Loss of Driver Control at Night – Rural roads (top graph) & Urban roads (bottom graph)

<table>
<tr><th>FNDC</th><th>KDC</th><th>WDC</th></tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td>Arterial | Primary Collector | Secondary Collector | Access | Low Volume</td>
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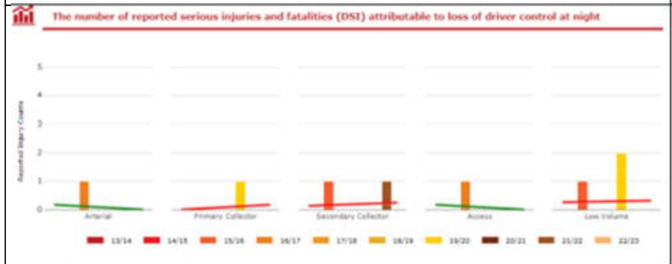
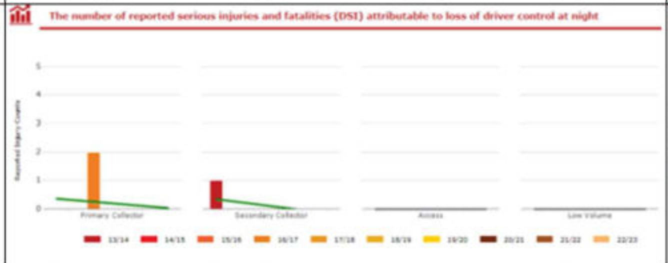
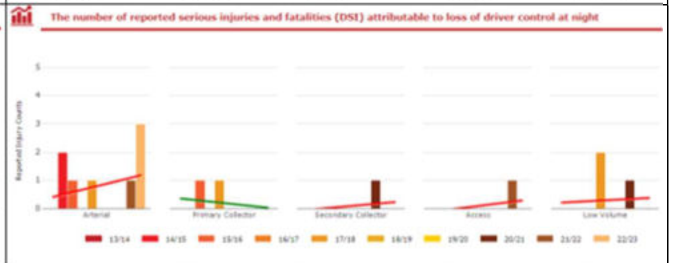
<td></td>
<td></td>
<td></td>
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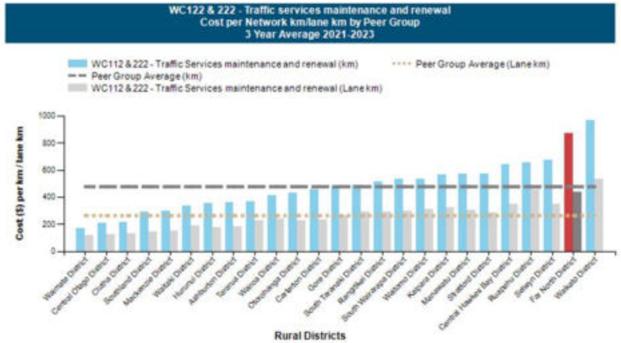
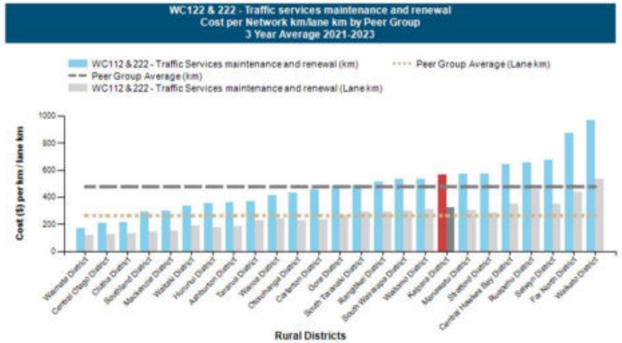
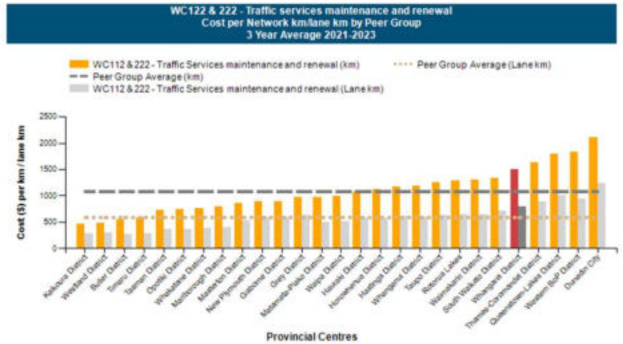
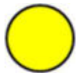
</tr>
<tr>
<td>FNDC Loss of Driver Control at Night DSI – It should be noted there is little data for night-time crashes for rural roads and almost none for urban roads on the FNDC network. This makes it difficult to determine any issues or trends.

However, it appears that there may be an increasing trend in night-time crashes on rural Primary Collector roads and urban Collector and Low Volume roads.</td>
<td>KDC Loss of Driver Control at Night DSI – It should be noted there is little data for night-time crashes for rural roads and almost none for urban roads on the KDC network. This makes it difficult to determine any issues or trends.

From the limited data available, there may be an increasing trend in night-time crashes on the rural Access roads.</td>
<td>WDC Loss of Driver Control at Night DSI – It should be noted there is little data for night-time crashes on the WDC network. This makes it difficult to determine any issues or trends.

However, it appears that there could be an increasing trend on most of the urban road classifications.</td>
</tr>
</table>

NZTA Peer Group Charts – 3yr Cost/km WC 122 & 222 Traffic Services Maintenance and Renewals

FNDC	KDC	WDC
		
		
FNDC Traffic Services Maintenance and Renewal Cost – FNDC's traffic services maintenance and renewal cost is the second highest in its peer group. This is mainly due to the high cost of line marking due to the establishment costs from Whangarei as well as high streetlight power costs. The maintenance contracts have resulted in line marking costs tripling for FNDC and this will further increase the cost on traffic services to achieve an annual line marking programme. The savings from the LED streetlight conversion programme will partially offset the increase in marking costs. Further savings from the LED streetlight conversion are possible if FNDC can negotiate a more reasonable power charge with their power authority (Top Energy).	**KDC Traffic Services Maintenance and Renewal Cost** – The KDC traffic services maintenance and renewal cost is near the average for their peer group. As for FNDC, the maintenance contracts have resulted in line marking costs doubling for KDC and this will further increase the cost on traffic services to achieve an annual line marking programme. The savings from the LED streetlight conversion programme will partially offset the increase in marking costs.	**WDC Traffic Services Maintenance and Renewal Cost** – WDC traffic services maintenance and renewal cost is in the top third of their peer group. The cost for traffic services has increased in recent years to enable WDC to achieve a full annual line marking programme. As for the other councils, the maintenance contracts have resulted in line marking costs doubling for WDC and this will further increase the cost on traffic services to achieve an annual line marking programme. The savings from the LED streetlight conversion programme will partially offset the increase in marking costs.

Summary

FNDC	KDC	WDC
It appears that there may be an increasing trend in night-time crashes on rural Primary Collector roads and urban Collector and Low Volume roads. However, there is limited data to support trend analysis. The maintenance contracts have resulted in line marking costs tripling for FNDC and this will further increase the cost on traffic services to achieve an annual line marking programme. The savings from the LED streetlight conversion programme will partially offset the increase in marking costs. Further savings from the LED streetlight conversion are possible if FNDC can negotiate a more reasonable power charge with their power authority (Top Energy).	There may be an increasing trend in night-time crashes on the rural Access roads. However, there is limited data to support trend analysis. The maintenance contracts have resulted in line marking costs doubling for KDC and this will further increase the cost on traffic services to achieve an annual line marking programme. The savings from the LED streetlight conversion programme will partially offset the increase in marking costs.	It appears that there could be an increasing trend on most of the urban road classifications. However, there is limited data to support trend analysis. The cost for traffic services has increased in recent years to enable WDC to achieve a full annual line marking programme. As for the other councils, the maintenance contracts have resulted in line marking costs doubling for WDC and this will further increase the cost on traffic services to achieve an annual line marking programme. The savings from the LED streetlight conversion programme will partially offset the increase in marking costs.

3.4 Options to be Considered

Based on the above data and the root cause analysis, the following options have been considered:

Option	Description
Option 1 – Temporary signing curves with insufficient skid resistance.	Temporarily sign curves with insufficient skid resistance to warn motorists of the hazard. This would be a temporary measure until a permanent treatment such as watercutting or a reseal is undertaken.
Option 2 – Increase funding to allow for a full annual remark also consider Long Life markings.	Increase funding to account for substantial cost increase for line marking (two to threefold increase) in new maintenance contract to enable a full line mark once per year.
Option 3 – Change power authority pricing structure for FNDC's streetlights.	Change the power authority pricing structure for FNDC's streetlights to reduce the cost of this service. The Far North is currently paying about double the amount per light for power than what KDC and WDC pay.

PBC Multi Criteria Option Analysis, RCA: NTA

Activity/Work Categories: Traffic Services (WC 122, 222)

Short list up to 3 options from the following:

Option - Can we make	Yes/No	Rank	Reason
❑ Intervention response **timing** change			
❑ **LoS** adjustments			
❑ Use existing assets **differently**			
❑ **Blending** Work Categories differently			
❑ **Risk** - Hold Assets longer			
❑ Managing **demand**	Yes	2	Increase funding to account for substantial cost increase for line marking (x 2-4 increase) in new maintenance contract to enable a full line mark once per year.
❑ **Route** Management			
❑ Alternative approaches – different **solutions/technology**			
❑ **Maintenance vs Renewal** adjustments			
❑ **ONRC** Classification variance			
❑ Extended **temporary** management	Yes	1	Temporarily sign curves with insufficient skid resistance.
❑ **Supply chain** improvements	Yes	3	Change the power authority pricing structure for FNDC's streetlights.
❑ Improve **systems and capability**			

Criteria	Weighting (Importance) (Total to 100%)	How good is this option					
		Option 1 - Temporary signing curves with insufficient skid resistance		Option 2 - Increase funding to allow for a full annual remark also consider Long Life markings		Option 3 - Change power authority pricing structure for FNDC's streetlights	
		Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	10%	1	0.1	2	0.2	1	0.1
Problem solving effectiveness	10%	2	0.2	2	0.2	0	0
Benefits realised	10%	2	0.2	2	0.2	0	0
Good Environmental impacts	5%	0	0	0	0	0	0
Value for Money	10%	3	0.3	2	0.2	3	0.3
Closing Customer and Technical LoS gaps and impacts	10%	1	0.1	2	0.2	0	0
Closing ONRC Performance gaps	10%	0	0	0	0	2	0.2
Asset preservation and sustainability	10%	0	0	0	0	0	0
Total Cost of Ownership (whole of life Costs)	10%	0	0	-1	-0.1	2	0.2
Life Cycle Management	10%	0	0	0	0	0	0
COVID-19 Recovery	5%	0	0	0	0	0	0
Totals	**100%**		**0.9**		**0.9**		**0.8**

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

3.5 Option Assessment and Line of Sight

The options and the line of sight to the preferred strategic response and the problems they are addressing are shown in the table below. These options have been ranked in order of preference and then have been assessed through a multi-criteria assessment (MCA) to determine the highest scoring options that are preferred and are to be adopted. The MCA assessment is also provided as follows.

Work Activity	Problem Statements Addressing	Preferred Strategic Response	PBC Options to be Considered	Option Rank	MCA Score	Preferred Options
Traffic Services	**Safety** - Northland has a narrow, winding and unforgiving rural road network which combined with poor driver behaviour has resulted in the region being a high Community at Risk for death and serious injury (DSI) crashes and the rate of DSI crashes is trending upward for all three councils. FNDC and KDC also have higher Collective Risks than their peer group.	**Programme Adjustment** • Increase safety programme **Policy Approach** • Additional delineation **Demand Management** • Enhanced Road Safety Promotions with active in-house management.	**Programme Adjustment** **Extended Temporary Management** • Option 1 - Temporary signing curves with insufficient skid resistance. **Policy Approach** **Managing Demand** • Option 2 - Increase funding to allow for a full annual remark also consider Long Life markings. **Supply Chain Improvements** • Option 3 - Change power authority pricing structure for FNDC's streetlights.	1 2 3	0.9 0.9 0.8	Yes Yes Yes

Preferred Options: From the multi-criteria assessment the preferred options are:

- Option 1 – Temporary signing curves with insufficient skid resistance.
- Option 2 – Increase funding to allow for a full annual remark also consider Long Life markings.
- Option 3 – Change power authority pricing structure for FNDC's streetlights.

3.6 Financial Impact

The following tables show the work categories and examples of the associated tasks. For full financial details for the work categories, refer to Section 08 (Financials).

3.6.1 *Far North District Council*

Description	Financial Impact
WC 122 Network Services Maintenance (was Traffic Services Maintenance)	Increase funding to enable FNDC to complete a full line mark of the network per annum. Increase is due to significantly higher line marking rates in the maintenance contracts Increase in streetlight maintenance contract costs and streetlight power costs
WC 222 Traffic Services Renewals	Funding for new streetlight contract renewals
WC 341 Low Cost/Low Risk Improvements	Funding to carry out infill lighting on P and V Category roads

3.6.2 *Kaipara District Council*

Description	Financial Impact
WC 122 Network Services Maintenance (was Traffic Services Maintenance)	Increase funding to enable KDC to complete a full line mark of the network per annum. Increase is due to significantly higher line marking rates in the maintenance contracts Increase in new streetlight maintenance contract costs
WC 222 Traffic Services Renewals	Funding for new streetlight contract renewals
WC 341 Low Cost/Low Risk Improvements	Funding to carry out infill lighting on V-Category roads.

3.6.3 *Whangarei District Council*

Description	Financial Impact
WC 122 Network Services Maintenance (was Traffic Services Maintenance)	Increase funding to enable WDC to complete a full line mark of the network per annum. Increase is due to higher line marking rates in the maintenance contracts
WC 222 Traffic Services Renewals	No change
WC 341 Low Cost/Low Risk Improvements	Funding to carry out infill lighting on V-Category roads and to install a Central Management System (CMS) to control/dim the streetlights

3.7 AMP Improvement

The following improvements will be considered:

- Collect data relevant to define policy for level of service for signs and road markings.
- Develop work programme to achieve specified levels of service.
- Undertake an assessment of long-life markings to determine where and when these should be used.
- Undertake cyclic night-time inspections with safety engineers to determine improvements to signs, markings, RRPMs and edge marker posts.
- Develop forward works programme of high priority “black” areas resulting from the lux mapping survey (HISLAT survey) of the P-Category (local road) lights.

Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 06.C

Network Operations – Traffic Signals and Intelligent Transport System

Overview and Management
Problems, Benefits, Consequences
Options Assessment

Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 06.C

Network Operations – Traffic Signals and Intelligent Transport System

Table of Contents

1 Overview

A modern city relies on predictable and reliable road transportation for its economic prosperity as well as other equally important issues such as user safety and protection of the environment (air quality/reduction of vehicle exhaust emissions).

The Intelligent Transport System (ITS) systems in Northland are generally infrastructure focused as these are embedded within the transport network. These include equipment such as traffic signals, dynamic signages (electronic school zone signs) and CCTV system.

The ITS technology employed in the region are mostly traffic signals, driver feedback and school zone signs as well as CCTV systems on our shared paths. These help to manage the traffic flow and ensure safety of the road users.

1.1 Description

1.1.1 Traffic Signals

Traffic signals play a critical role in managing traffic flow and improving safety on roads. Five key reasons for the importance of traffic signals include:

Safety
Traffic signals are designed to regulate the movement of vehicles, pedestrians, and cyclists at intersections, reducing the risk of accidents and improving safety for all road users. By providing clear instructions to drivers and pedestrians, traffic signals help prevent collisions, particularly at busy intersections.

Efficiency
Traffic signals are used to manage traffic flow by controlling the amount and timing of vehicles passing through an intersection. By reducing congestion and delays, traffic signals help improve travel time and reduce fuel consumption and emissions.

Pedestrian safety
Traffic signals are crucial for pedestrian safety, particularly at busy intersections where pedestrian traffic is high. By providing designated crossing times and signals, pedestrians can safely cross the road without interference from vehicles.

Accessibility
Traffic signals are also important for ensuring accessibility for people with disabilities. Audible and tactile signals, such as audible countdowns and tactile pads, can assist visually impaired pedestrians in navigating intersections safely.

Compliance with traffic laws
Traffic signals help enforce traffic laws by indicating when it is safe and legal to proceed through an intersection. By promoting compliance with traffic laws, traffic signals help improve overall safety on roads.

Traffic signals have been operating in Whangarei since the 1970s. In the 1990s a traffic signal central management system known as the Sydney Coordinated Adaptive Traffic System (SCATS) was introduced.

Since 2006 the traffic signals and SCATS network has grown to almost double its size, and changing dramatically with a changing cityscape, communications and control technology and a growing emphasis on multi-modal transport, disability equity of access and environmental impacts.

There has been significant investment in the SCATS systems ICT and communication infrastructure over the last two years to support the 24x7x365 operations and management of the traffic signals system in the region.

At the time of writing this document there are a total of 36 sets of traffic signals operated and managed by the Network Operations team as illustrated below. These comprise of 9 State Highway traffic signal sites, 23 WDC sites (includes 7 signalised pedestrian crossings) and 2 KDC sites located in Waipoua which have yet to be handed over formally to maintenance and operations.

Figure 1-1 following shows the traffic signals distribution across the networks (left) and a typical traffic signal controller box (right). Figure 1-2 following shows traffic signals mast arms and lanterns.

The NZTA traffic signals in the region are maintained by the Whangarei District Council under a delegated authority via a Memorandum of Understanding (MoU). The State Highway (SH) traffic signals are in WDC urban area and one in Pahia township.

The NZTA traffic signals in the region are maintained by the Whangarei District Council under a delegated authority via a Memorandum of Understanding (MoU). The State Highway (SH) traffic signals are in WDC urban area and one in Pahia township.

The traffic signal system in WDC comprise of the following major components:

- Signal controller
- Lanterns
- Poles & overhead mast arms
- Detection system (Camera, radar & induction loops)
- Underground cabling
- Communications network devices (switch, 4G router, serial-ethernet convertors)
- Communications link (wireless & fibre)
- SCATS Central Management system.

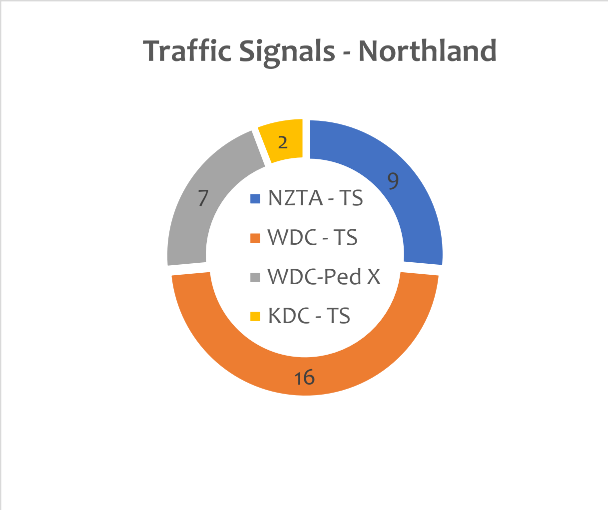


Figure 1-1: Traffic signal distribution (left) & typical traffic signal controller box (right)

Figure 1-2: Traffic Signal mast arms & lanterns

1.1.2 *Dynamic signs – Electronic School Zone Signs (SZS)*

There is also a large network of electronic school zone sign sites in the region for the three district Councils. Whangarei district has 31 schools with a total of 76 electronic sign units. Whilst KDC have 6 schools with a total of 13 electronic sign units. Electronic school zone signs for three schools on SH namely, Maungatapere School, Mangakahia Area School and Poroti School are also maintained by WDC.

Electronic school zone signs play a vital role in ensuring the safety of students, parents, and staff by alerting drivers to reduce their speed in designated school zones. They serve as a constant reminder for motorists to exercise caution and be more aware of their surroundings. The use of LED technology in electronic school zone signs enhances their visibility, especially in low light conditions or adverse weather.

Figure 1-3 below shows few different types of electronic school zone signs (SZS).

Figure 1-3: Fixed & variable school zone Signs (SZS)

Some electronic school zone signs are equipped with data collection capabilities via a digital telemetry platform, allowing gathering of information on traffic patterns, speed violations, and other relevant data. This data can be used for analysis and informed decision-making regarding traffic management strategies and future safety improvements in school zones. All these assets are managed on a "one network" basis with the intent being that all parties benefit from the economies of scale and prompt service from a local maintenance contractor.

1.1.3 Closed Circuit Television (CCTV) – Roading Shared paths

CCTV systems play a central role in the region, serving as an essential tool for surveillance and security along the roading shared paths in Kamo and Raumanga. These systems consist of cameras strategically placed in various locations to monitor and record activities in public spaces. The CCTV systems provide several benefits including but not limited to the following:

- Enable real-time monitoring, enabling authorities to detect and respond to incidents swiftly.
- Enhance public safety by allowing prompt responses to emergencies.
- Act as a deterrent, significantly reducing the occurrence of criminal activities such as theft, vandalism, and trespassing. CCTV systems aid in investigations by capturing valuable evidence.
- Provide peace of mind to individuals, organizations, and communities, creating a safer and more secure environment for all.

In summary, the importance of CCTV systems lies in their ability to deter crime, aid investigations, enhance public safety, and instil a sense of security in our daily lives. The Council, through the City Safe programme, manages the CCTV network situated in the:

- Central city
- Town Basin and Hātea Loop Walkway (including the Bascule and Pohe Island carparks, and the Pocket Park on Port Road),
- Kamo Shared Pathway from Rust Avenue.

The footage of the CCTV system is only accessible from the Whangarei Police station and is monitored by a volunteer group from there. Figure 1-4 below shows the Dahua CCTV cameras installed on streetlight poles in the Kamo shared path (KSP).

Figure 1-4: CCTV cameras installed in Kamo Shared Path (KSP) on streetlight poles

The visual information collected from the CCTV network cameras is stored at the Whangārei Police Station. All CCTV recordings are automatically deleted within four to six weeks, unless downloaded specifically for enforcement or community safety purposes.

The 53 CCTV cameras on the Kamo shared path (KSP) are connected through to the Police station via a fibre optic link that runs along the shared path. There are common connection points for the traffic signal and CCTV's on the KSP. The CCTV systems installed on the shared paths are considered roading asset as such are maintained by the traffic signal maintenance contractor.

The KSP CCTV's were inherited by the roading team, and it has been found that the manner of equipment selection, installation and configuration employed by the original CCTV contractor has made the network difficult to modify and upgrade to comply with best practices for ICT security. Critical items of information were not supplied in the original package of as-built information, this would be discussed as part of the maintenance strategy.

1.2 Monitoring and Condition

To ensure the safety of the Public and the continued security of the infrastructure, the Contractor carries out a close inspection of the full inventory at the time of routine inspection every three, six and twelve-monthly inspections. This includes but is not limited to the inspection and monitoring of the condition of all poles, brackets, switchboards, overhead mast arms, lanterns, audio tactile, push buttons, detection systems and wiring systems forming part of the traffic signal system.

An annual condition rating assessment is undertaken for assets maintained under this contract in accordance with the Auckland Traffic Management Units – Traffic Signal Condition Rating Definitions that provide a grading system for the condition. The assessment and report are required to be completed and loaded into RAMM by the 31st of March each year of the contract.

Table 1-1 below shows the generic grading system related to condition rating of the traffic signal assets.

Table 1-1: Traffic signals – condition rating grading system

Grade	Condition	Description of Condition
1	Excellent	Sound physical condition. Asset likely to perform adequately without major work for 15 - 25 years or more.
2	Good	Acceptable physical condition; showing minor wear or deterioration. Need to re-inspect in 1-2 years. minimal short-term failure risk. Minor work required.
3	Average	Deterioration evident but no critical yet. Consideration can be given to some parts of the components being better or worse than others. Some work required.
4	Poor	Failure likely within 1 year (short-term). Work required in the near future to ensuring asset remains safe. Substantial work required in short-term, asset barely serviceable.
5	Very Poor	Failed or failure imminent. Immediate need to replace most or all of asset. Health and safety hazards exist which present a possible risk to public safety or asset cannot be serviced/operated without risk to personnel. Major work or replacement required urgently.

An extensive asset condition assessment was carried out in early 2022 across the regions Traffic Signal & Electronic School zone sign network to ascertain the condition rating and to update the RAMM database accordingly. An objective analysis of all the components of the asset were not possible as such some dependence on its age data apart from the visual observation is to be used when planning renewals.

The asset age data quality in RAMM is not perfect and in some cases is incomplete. As such there is heavy reliance on the field inspections and condition rating of the asset by the contractor to make informed decisions related to asset renewals plan.

Figure 1-5 below shows the remaining useful life (RUL) of the traffic signal controllers presently in our network.

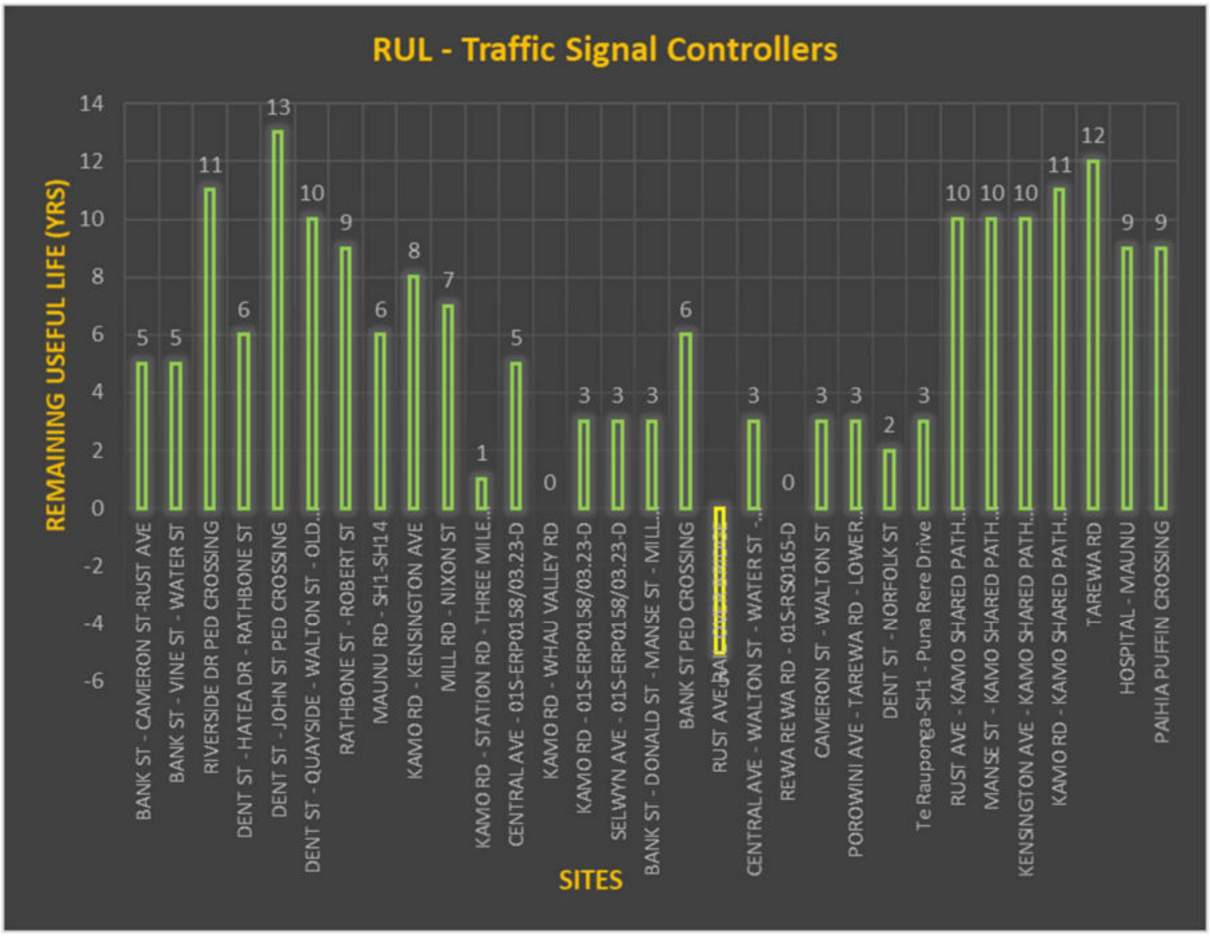


Figure 1-5: Remaining Useful Life (RUL) – traffic signal controllers

The traffic signal equipment usually has the following useful life:

- Controllers – 15yrs
- Lanterns – 10yrs
- Poles & mast arms – 25yrs
- Underground control cabling – 25yrs
- Underground ducting – 30yrs.

Figure 1-6 below shows the age and condition of the other Traffic signal components from the RAMM database.

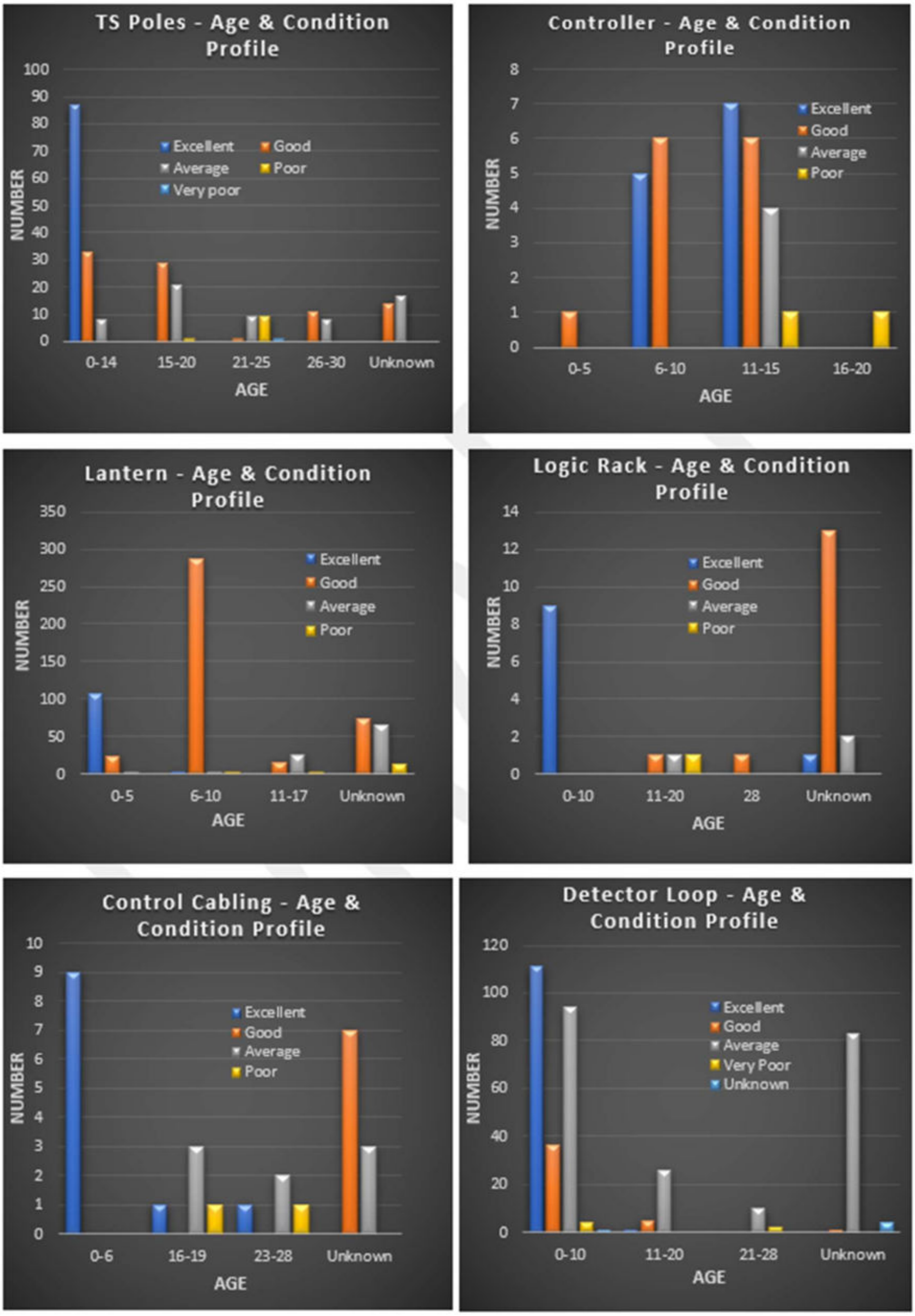


Figure 1-6: Age and condition of the other Traffic signal components

Based on a site investigation carried out by the regional operations team, there are around 88 electronic school zone signs. A significant number of these are old type HMI SCZ40 electronic school zone signs in the region. These are all due for replacement as they are all >10 years old. Apart from its age they have inadequate waterproofing, some are not configurable and uses old radio communications technology via a direct link to the school office for switching and cannot be remotely monitored via the digital telemetry.

Figure 1-7 below shows the web view of the radar speed data recorded by the electronic SZS and displayed by the Digital Telemetry platform.

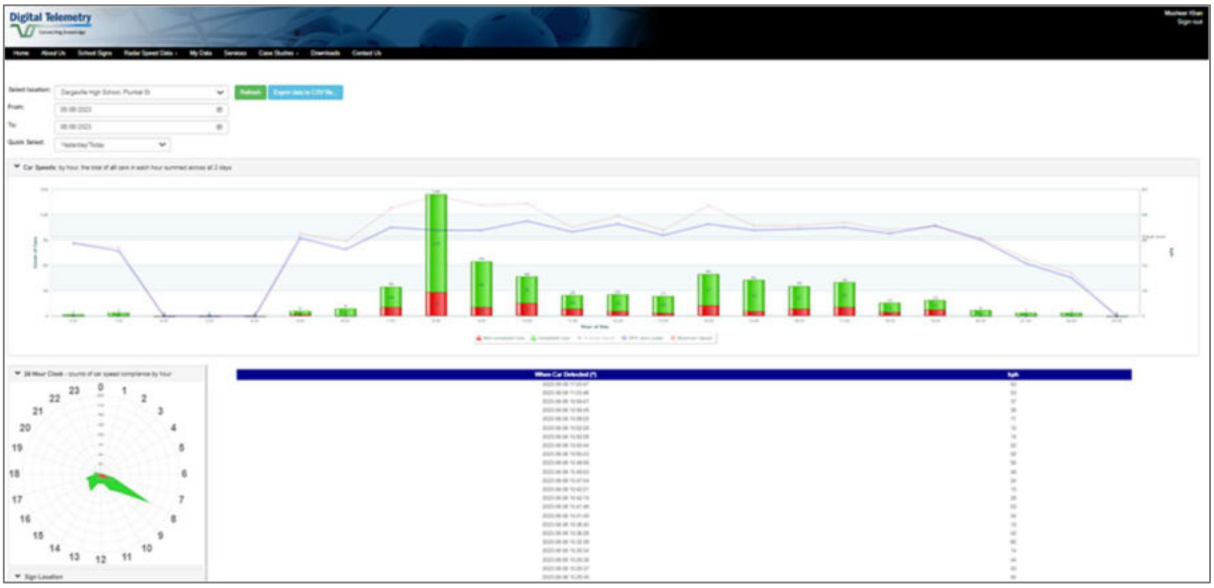


Figure 1-7: Web view of the radar speed data recorded by the electronic SZS

The inability of some electronic school zone signs to offer the advantage of flexibility and customization means that they cannot be programmed to display specific messages, such as speed limits, school hours, or cautionary messages during inclement weather or special events. This is another reason that they need to be replaced apart from its condition and age. The replacement of these is discussed in the asset improvement strategy section of this document.

Figure 1-8 below shows the age and condition of the school zone signs in the region.

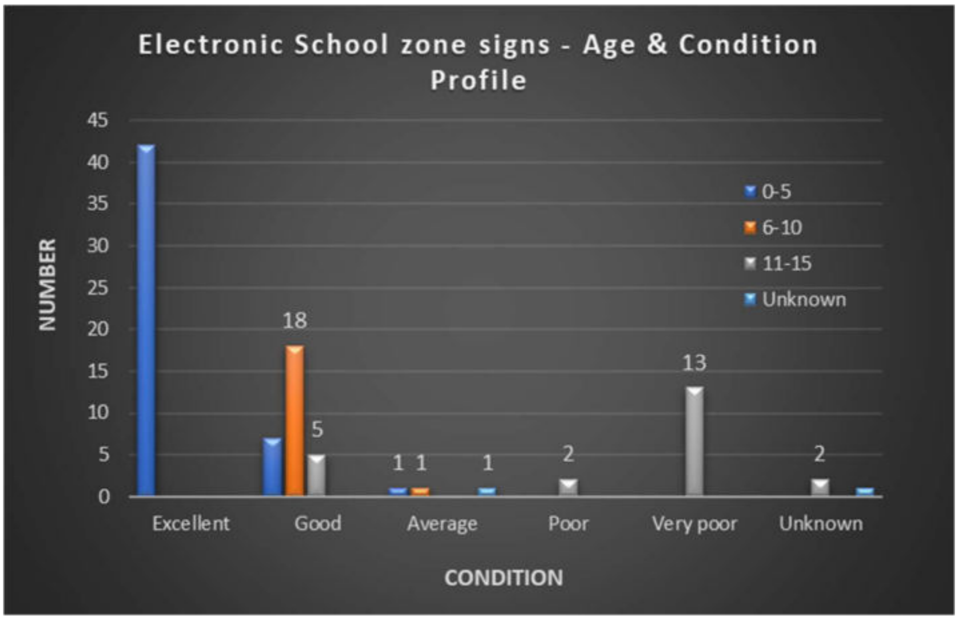


Figure 1-8: Age and condition of the school zone signs in the region

1.3 Overall Strategy

Previously the focus was on the renewing of the traffic signal controllers and lanterns based on its remaining useful life (RUL) and frequency of failures. As a result of this around 97% of the old traffic signal lanterns have been replaced with LED types. Apart from this traffic signal controllers have progressively been replaced and at present there are around 49% of traffic signal controllers that have a RUL of less than 6yrs.

The upgrade of the traffic signal central management system known as SCATS to 6.9.5.8 version in 2022 and the migration of the SCATS application to a virtualized environment hosted by NorthCloud in Whangarei as part of the Infrastructure as a Service (IaaS) arrangement has led to the significant improvement in the system administration, maintenance, and security.

Furthermore, whilst ten traffic signal sites had been converted to Internet Protocol (IP) based with fibre communications link, at the time of writing this AMP, another 22 sites have been upgraded to IP based with an interim 4G wireless communications. This conversion not only obliterates the redundant copper line links provided by Spark but prepares the infrastructure for addition of cameras and other intelligent devices for monitoring the operation of the traffic signal system. The wireless link is provided by NorthCloud as Network as a Service (NaaS).

The overall strategy now considered in this Activity Management Plan is around the maintenance and improvement of the entire ITS infrastructure to improve the levels of service and the useful life of the asset. Therefore, the improvement strategy focuses on the following key components of the ITS system in the region:

- Traffic signal system
  - Controller
  - Poles/mast arms
  - Underground ducting & control cabling
  - Communications link
  - Detection
  - Optimization - camera
  - Accessibility
  - Asset Information.

- CCTV system
  - Hardware
  - Security & Network
  - Asset Information.

- Electronic School Zone signs
  - Hardware
  - Control & power system
  - Asset Information.

2 Management Plan

2.1 Management and Operations

2.1.1 *Management*

The maintenance of the Intelligent Transport System (ITS) asset is delivered through the Traffic Signal & ITS Maintenance Contract. The Contract is for the routine maintenance of traffic signals including any zebra crossing lighting and beacons associated with traffic signals, electronic school zone signs, electronic speed indicator signs (driver feedback), and CCTV system on shared paths.

The contract has two Separable Portions and was for an initial term of two years with one contract extension for a further 3 years (2 + 3yr). The Contract extension will be based on various performance factors and entirely at the discretion of the Principal. The Contract commenced on 1st November 2021. The contract includes but is not limited to the following key activities:

Proactive

- Undertaking preventative maintenance, this includes the repair or replacement of all components associated with the lantern assemblies, posts, mast arms, controllers, cabinets, vehicle detection systems and all power, control and data cabling.
- Asset inspection and condition assessment
- Asset management
- Traffic management necessary to safely carry out work without unnecessarily delaying traffic movements.

Reactive

- Attendance and rectification of emergency repair of any equipment that fails under normal working conditions.
- Prompt repair in case of crash damage or vandalism
- Working with NTA and emergency services as required in emergency response events.

Management

- Reporting & recording all inspections and maintenance works undertaken.
- Accurate and complete provision of RAMM related asset information.
- Maintaining critical spares of parts and equipment for reactive maintenance.
- Managing and undertaking maintenance activities within budget allocations
- Working collaboratively with stakeholders; District Councils, Police, Energy supplier(s), to obtain best for community solutions to specific matters.

The Contractor is primarily responsible for continuously monitoring the ITS assets and carrying out the necessary maintenance. The following outcomes are sought from this contract model:

- To provide a smooth, hazard free travel for motorists and pedestrians.
- To preserve the structural integrity of the traffic signal system
- To ensure maximum service life of the asset
- To utilise resources in an efficient and cost-effective manner
- To identify all maintenance, renewal and improvement needs on the signals and other assets managed under this contract.
- To action rapid response to unsafe conditions and emergencies.
- Increase customer satisfaction.

2.1.2 Operations

The Sydney Coordinated Adaptive Traffic System (SCATS) system which is used to monitor various aspects of the traffic signals is available for NTA traffic operations team and the maintenance contractor. This allows the Contractor to use the system to monitor the maintenance elements of the contract, such as lanterns and detector loops.

Figure 2-1 below shows the high-level functionality of the traffic signal system.

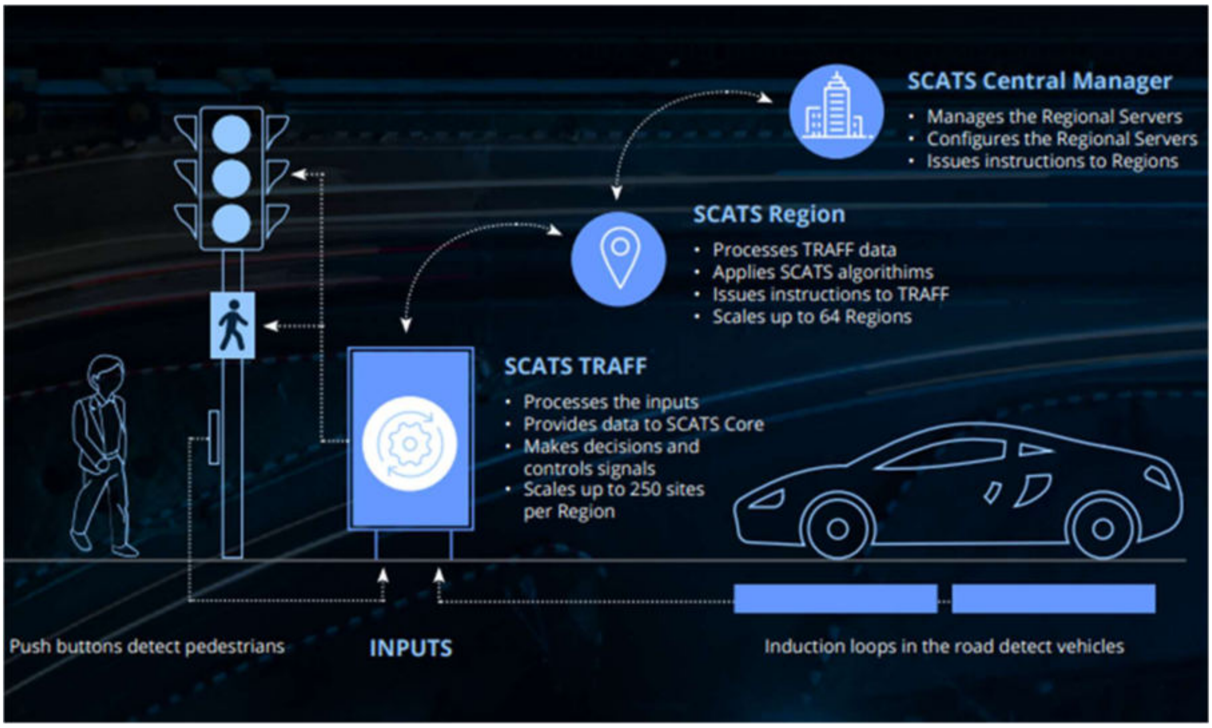


Figure 2-1: high-level functionality of the traffic signal system

SCATS is an intelligent real-time traffic management platform that monitors, controls, and optimises the movement of people and vehicles. The system also monitors for faults and alarms that is used by the ITS maintenance contractor to attend to necessary callouts for repairs. Some failures are reported by the road users especially those related to queues and delays. Others are picked up by the contractor's routine day and night inspections.

The Contractor attends to emergency Repairs and Crash Damage in Whangarei area within 1 hour and 2 hours outside of Whangarei of an Emergency call. Initial repair works are completed within 5 hours of the damage occurring. However, in the event of a controller being damaged, then all repair works are completed within 12 hours of the failure.

Apart from emergency repairs as part of the ITS maintenance contract the contractor is required to attend to faulty school zones signs within 24hrs and pedestrian Belisha beacon or floodlight and CCTV failures with 48hrs of notification.

To maintain an agreed level of service (LoS), the response times start once the ITS asset failure has either been identified by the Contractor or the Contractor notified of the same. The failure is deemed rectified once the asset is brought back into service.

The Contractor responds to other complaints, service requests, and logged incidents, within the times outlined in the table below.

Table 2-1 below shows the times be measured from the time that the Contractor receives notification.

Table 2-1: Contractor's response time from receiving notification

Complaints / Service Requests / Incidents - Response	
Acknowledgement of the Customer Request Management (CRM) request	The Contractor is to acknowledge receipt on the Tech 1 system within 2 days of notification.
Incident investigation and resolution	It is expected that the Contractor will complete works for all incidents within one (1) month, unless the works are subject to seasonal constraints, or the scope of the works is such that it requires programming.
Incident Closures / Resolution of request on the Tech 1 system	Investigations carried out, works physically completed or included in the programme of works and customer informed within 12 days of notification. The 12 days comprises of 2 days to acknowledge the service request and 10 days for complete resolution. The CRM call record is to be updated by the Contractor with planned action, extension of time or closed if completed.
Priority Requests from the Engineer or their representative	3 Working Days for completion of works on site, or as agreed with the Engineer.

2.2 Acquisition

Generally, traffic signals and electronic school zone signs are installed by the Council either as a result of a corridor management strategy or as part of a capital works project. These acquisitions are generally aligned with the creation of new shared paths or intersections where there is usually addition of traffic signals for pedestrian and vehicle movement control to enhance safety of road users. All new assets acquired by the Council must comply with the NZTA P43 Specification for Traffic Signal.

To assist traffic signal owners to capture the maximum benefits from newer technologies; the IPENZ group SNUG and the NZ Transport Agency has developed the P43 Specification for Traffic Signals.

The P43 standard is intended to provide asset owners, design consultants and suppliers guidance. It is not intended to be prescriptive or to hinder innovation. Each RCA is able to amend the specification should a particular clause not be appropriate. The guideline is based on both experience and international best practice.

The Whangarei District Council being the owner of most of the traffic signals in the regions as well as the traffic signal central management system has the delegated authority to manage and maintain the traffic signals on State Highways owned by the NZTA. The future addition of any traffic signal system in the region will inherently be vested to the WDC for operations and maintenance.

The CCTV system installed on the Kamo shared path was acquired by the roading department as part of the wider maintenance strategy for the KSP infrastructure. As a result of this all existing and new shared paths installed with CCTV cameras are to be maintained under the Traffic Signal & ITS maintenance contract.

2.3 Improvement

2.3.1 Traffic Signals

Controller

Managing the obsolescence of the electronic component like the controller is not only determined by the RUL but also the compatibility of the existing system to adopt new technologies & requirement for up-to-date communications & monitoring capability.

The existing TYCO/Johnson Controls Eclipse traffic signal controllers do have an upgrade board called the CPM5 which also allows direct ethernet connection. This is currently being evaluated with a view to implementing these in Eclipse controllers in good condition and with remaining useful life of at least 6 plus years, based on an expected lifespan of 15 years for a controller.

The 49% of controllers with a RUL of less than 6yrs poses an opportunity for these to be replaced with Aldridge ATSC4 controllers that have native ethernet connection as well as built in power backup system. This device has the advantage of on-board ethernet connection, allowing standard industrial grade ICT network components to be used, simplifying installation and troubleshooting.

A prudent approach is to replace traffic signal controllers that have <4years of remaining useful life with Aldridge ATSC4 controllers and upgrade the remaining ones to native IP.

Poles & Mast Arms

There are approximately 249 steel traffic signal poles in the region and of these there are around 26% of poles that are in average, poor, or very poor condition as per RAMM data. It's important to point out that around 28% of the poles are over 20yrs old as well. RAMM has reported that there are 11 poles in poor or very poor condition. This information has been validated on site and found to be true.

It is only since about 2015 that poles with serial number traceability to a formal design have been installed in the WDC network. As such there is a large stock of poles installed prior to 2015 that have no traceability for verifiable design criteria. Previously installed poles in some cases have been identified as being in sections welded together and painted. In the event of a crash, it is considered probable that these welds will fail, resulting in the lanterns striking the vehicle.

The approach here is to address the 26% of the poles rated as average, poor, and very poor as part of the activity management plan for next 3yrs to ensure the assets do not pose a safety risk to road users.

Underground Cabling & Chambers & Ducts

Assets that are underground are usually difficult to condition rate and maintain and the traffic signal underground assets are no different. There has been a record keeping problem with cabling in RAMM with no distinction made between 35 core multicore control cable or 29/19 core control cable (old type) and 2or 4 pair loop feeder cable types. This has led to assets being under-valued or overlooked.

Loop cables & feeders have been in the forefront of being damaged due to road repair works recently and a decision was taken to wherever possible newly installed loop cables were to be in the structural layer of the pavement. These can be easily tested by our contractors, and they have identified some older cables with degraded insulation as result of ingress of moisture. The maintenance contractor has recommended that all loop feeders that are not gel filled to repel moisture as per the current P43 Specification for Traffic Signals to be replaced.

Since 2015 traffic systems brand chambers have been installed in the network. These are nominally AS3996 Class B rated units, but it has been found that their lids can be damaged by sharp objects and the locking mechanisms can be broken by rough handling. Humes modular pits or similar are now recommended for new installations, this means that the older ones will need to be replaced as they fail.

Ducts have been installed during the initial installation of traffic signals at the sites and none have since been replaced. Few ducts have been identified as being blocked as they are suspected to have collapsed. Record keeping of the type, route and condition of the ducts have been a historical issue as such surveys had been carried out at few sites to build information around this asset. As part of the AMP all sites in the region will be surveyed and proper duct condition rating will be done and recorded in the asset database to plan remedial works.

Detection

The detection technology for traffic signals have changed considerably with radar, video, and thermal imaging. All three of these technological devices have been installed at a few sites in the region. Further standard detail work needs to be completed in relation to pedestrian detection, particularly the installation of thermal imaging cameras at crossing points, near side displays for PUFFIN/TOUCAN crossing, and other newer ITS hardware.

The ability of radar & video detection to count vehicle, cycle and pedestrian movements enhance our ability to make informed decisions. The strategic approach to take here is to install alternative less invasive and more intelligent detection systems at critical intersections and intersections where loop detection failure is imminent.

Communications

As outlined above, the transition to an IP based protocol using 4G wireless communications network is an interim solution to fulfil the needs of today. This does provide a more resilient, modern communication infrastructure to support a modern intelligent transportation system platform.

More investment and attention are needed over the next 3-year term to move to a fibre optic communications link. The bandwidth and lower on-going cost and resilience of the fibre link outweighs the capital investment in the same. The Council already has fibre links for CCTV's and some traffic signal sites. The migration to a fibre link provided by Northpower will enable the installation of traffic CCTV cameras & smart micro radars for monitoring the road network.

The ultimate aim is to have all traffic sites connected to the central management system via a fibre optic link.

Optimisation

There are problem areas developing in the signalised road network in the region, such as the lower section of Bank St, Whau Valley, Dent/Hatea, Maunu/Central Ave and SH14/Hospital Rd.

Whangarei aspires to be a city of the future where people can move freely around the city and district, and indeed the whole of Northland. To achieve this, and to help promote a multimodal transport and quality environment, we need to minimise the number and duration of traffic stops at intersections while ensuring that other users of non-motorized transport also can move safely and without undue delay.

Whilst the traffic team adjust traffic signal timings to mitigate complaints against delays and queuing, it's time for a structured approach to optimization of the signal operations in the region. A limitation of SCATS is that the advance detection will inform the operations staff of a queue but will give no indication how far that queue extends. This is where the traffic cameras come in to provide the valuable information to adjust traffic signal timings to suit traffic patterns.

The AADT on the state highway in the Northland has seen a 11% growth from 2015 to 2019 based on NZTA statistics. This growth translates to an increase in the traffic volumes on our local roads as well and the impact of the same can be seen during peak traffic hours in Whangarei now.

A traffic signal optimization analysis has not been done for the road network in the region in the last 5yrs and it is now time for this to be carried out. As such as part of the traffic signal improvement plan, an optimization for all sites including the coordinated sites will be carried out in this AMP cycle.

Accessibility

Historically the practice has been that disability facilities beyond audio-tactile pedestrian crossing devices were only provided in two cases namely, on major capital works upgrade and when respective Councils were made aware that there were users in the area that required them.

Currently there are three traffic signals sites in the CBD in Whangarei which lack any form of tactile ground surface indicators. These are:

- Site 1 Bank/Cameron/Rust
- Site 2 Bank/Water/Vine
- Site 21 Walton/Cameron

These are a key safety features for the visually impaired, particularly cane users. From a safety point of view and to standardize the traffic signal accessibility in the region its imperative that these are incorporated in the existing infrastructure as far as feasibility permits. As part of the improvement plan the above three sites will be looked at for upgrade.

Asset Information

The Utilities Access Act and the Code of Practice for Utilities' Access to the Transport Corridors require that Network Utility Operators can provide detailed, accurate information on their assets to other parties who have a need to work or install plant in the road corridor.

Historically this has not been done and it represents an operational risk apart from cost recovery in the event of damaged assets by a third party. As the RCA and the coordinator of the corridor access in the region it puts the WDC in a difficult situation when its own assets are not properly recorded. Some work has commenced on the survey of underground ducts to make CAD as-builts more work is required to capture all other remaining assets in the RAMM database.

A programme will be developed to address this compliance issue and improve the asset record and condition within this AMP cycle.

2.3.2 CCTV

Hardware

There are around 53 existing Dahua static and Pan Tilt Zoom (PTZ) cameras installed in the Kamo shared paths. Some of these cameras have been victims of vandalism and replaced in the last few years.

The major concern with the Dahua cameras has been security, where it had been identified as trying to connect with an IP address in Shanghai, PRC. It is not known for certain whether an undisclosed "backdoor" login capability exists to allow remote viewing of images in this way, but it cannot be ruled out.

The options would be to either replace all cameras or segregate the network physically as some of these are connected via the traffic signal fibre connection. The alternative cameras are around 2 or 3 times more expensive than the Dahua, so the all-out replacement at this stage is not feasible.

From experience the camera domes of the Dahua type seem to only have a life of about 5 years in an outdoor situation before optical clarity is impaired. Most of the stock was installed in 2018/19 and so a replacement programme is being considered as part of this AMP.

Security

As mentioned previously, the CCTV system was built on an ad hoc basis and lack the involvement from WDC ICT department meant that limited information was supplied as part of the as-builts. The dependency on the contractor has been challenging especially with the change of ownership. It is recommended that a full ICT security audit and discovery exercise is carried out to ensure the Kamo and Raumanga Shared Path network is properly and completely documented. This needs to include proper network diagrams, details of all hardware, and fibre routing/patching diagrams. This work is planned to be outsourced in this AMP cycle.

Asset Information

There are some significant gaps in RAMM and not only does the ITS table need to be fully populated but the way in which the shared path is visualized In RAMM needs attention. There is only a centreline shown and the assets being spread across multiple tables complicates day to day management for the contractor.

There is a scarcity of information regarding the configuration and details of the ICT equipment on Kamo Shared Path. There are some other gaps such as no drawing set that shows the location of all the ducts and chambers from start to finish on the path. Many of these chambers are in gardens and have plastic lids so are difficult to detect when overgrown.

Work is required on site to gather field information as well as in RAMM by the asset team to implementing a user defined table specifically designed for this type of composite asset, to simplify day-to-day operations and streamline permissions for the contractor. This needs resourcing from the maintenance contractor and the asset team which is planned as part of this AMP.

2.3.3 Electronic School Zone Signs

Hardware

The type and age of some of the electronic school zone signs (SZS) inhibit the flexibility and customization that is now required for the regions' needs. Of the 88 electronic SZS in the system, there are around 51% of these that are web-enabled type and have better monitoring and additional capabilities such as the ability to record and generate speed histograms via a digital telemetry platform to monitor compliance.

Around 14% of the SZS are over 10yrs old and their condition range from very poor to good. There is some work underway to change the school zone speed limits from 40km/h to 30km/h and the older signs in the network will not be able to be configured for the same.

This poses an opportunity to replace the 49% of the older ones in the region with more intelligent type to enable the following benefits:

- Newer electronic school zone signs offer the advantage of flexibility and customization. They can be programmed to display specific messages, such as speed limits, school hours, or cautionary messages during inclement weather or special events. This adaptability makes them more effective in conveying important information to drivers.
- With electronic school zone signs, updates and changes can be made quickly and efficiently. For example, if there is a schedule change due to early dismissal or a delayed opening, the signs can be updated accordingly, ensuring accurate information is communicated to drivers promptly.
- The use of LED technology in electronic school zone signs enhances their visibility, especially in low light conditions or adverse weather. This improved visibility makes it easier for drivers to notice and respond to the signs, reducing the likelihood of accidents or speeding violations.
- Electronic school zone signs can be integrated with other traffic control systems, such as flashing beacons or speed cameras, to further enhance safety measures. This integration allows for a comprehensive approach to traffic management in school zones, reducing the risk of accidents and improving overall traffic flow.
- Electronic school zone signs are equipped with data collection capabilities, allowing authorities to gather information on traffic patterns, speed violations, and other relevant data. This data can be used for analysis and informed decision-making regarding traffic management strategies and future safety improvements in school zones.

As part of this AMP a phased replacement programme for the older electronic SZS is being proposed to achieve the benefits mentioned above.

Control & Power System

The remote management of the system is only possible with the appropriate supporting infrastructure. In the case of the electronic SZS this is the telemetry platform, the communications link and the field hardware (display, pole, solar panels, backup battery). Several compatible electronic SZS are powered by solar panels and backup batteries to power the field device. The use of GSM SIM cards from cellular providers connects the system via modems to the Digital Telemetry platform.

Digital Telemetry specialises in the remote collection of business data and the remote control of equipment using cellular, local area, and wide area networks. Figure 2-2 below illustrates the remote monitoring of the backup battery voltage for the electronic SZS.

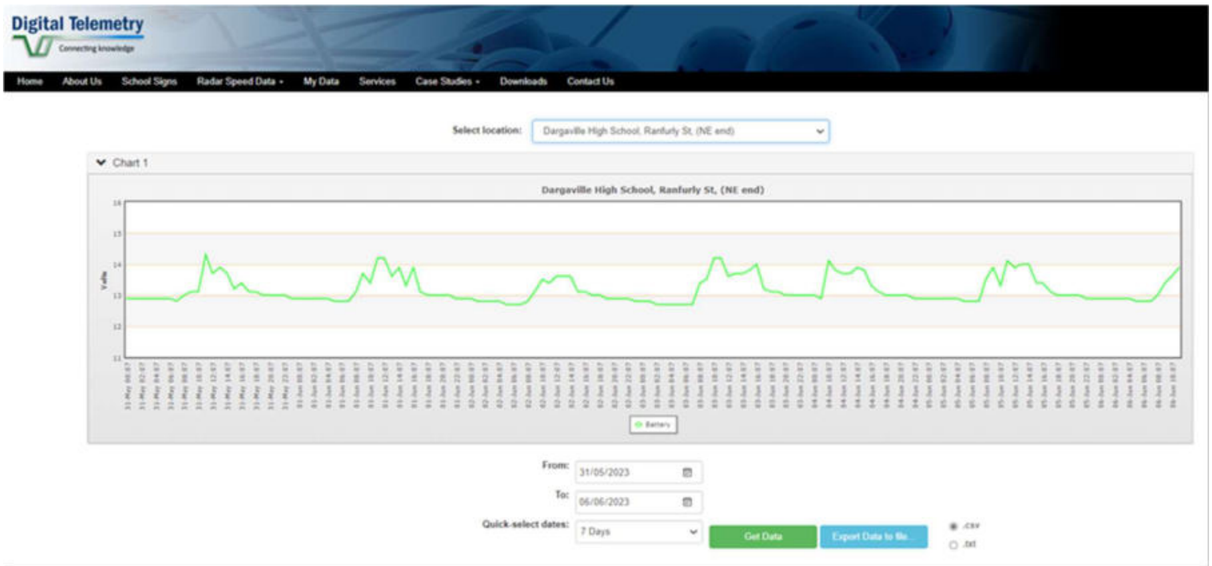


Figure 2-2: Remote monitoring of the backup battery voltage for the electronic SZS

The progressive replacement and routine maintenance of the backup batteries, solar panels, supporting structure and displays that are over 5yrs old are proposed as part of this AMP to ensure necessary roading network infrastructure are in operable state.

Asset Information

The absence of accurate and detailed information in the RAMM database has been a challenge and to site verification exercise had to be carried out to ascertain the type and location of some assets. The update of asset data is proposed to be addressed to improve the asset record and condition in RAMM within this AMP cycle.

3 Option Assessment

For the assessment of the data, peer group analysis and option assessment, a five point "traffic light" rating system has been used as shown in the following schematic. This rating system is based on a qualitative assessment of the LOS and cost comparison data.

5-point traffic light rating system

Performance Rating	Symbol	For LOS this means:	For Costs & Achievement this means:
Very Good		Much Better than Peer Group Average	Much Less than Peer Group Average
Good		Better than Peer Group Average	Less than Peer Group Average
Average/Moderate		Similar to the Peer Group Average	Similar to the Peer Group Average
Poor		Worse than Peer Group Average	Higher than Peer Group Average
Very Poor		Much Worse than Peer Group Average	Much Higher than Peer Group Average
No Data		No Data	No Data

Trend Rating	Symbol	For LOS this means:
Improving Trend		Positive Change towards a Very Good rating
Worsening Trend		Negative Change away from a Very Good rating
Static Trend		No Change

Work Categories: WC 123 – Operational Traffic Management

WC 222 – Traffic Services Renewals

WC 341 – Low Cost / Low Risk Improvements

3.1 Links to Strategic Case

Problem Statement

Growth and Demand – Rapid growth and lack of suitable mode shift options are causing congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods.

Benefits of Addressing Problem:

Upgrading the traffic signals will result in more efficient movement of traffic reducing congestion. The provision of cameras at each site will allow issues to be addressed more quickly and enable ATOC support potentially reducing operating costs.

Providing a remote operation for the Te Matua ā Pohe /Kotuitui Whitinga bridges would reduce ongoing operating costs.

Consequences of Not Addressing the Problem:

Inconsistent levels of service from our traffic signals will continue, leading to delays and driver frustration. Signal issues will need to be solved on site which leads to longer response times to resolve issues.

Continuing the manned operation of the Te Matua ā Pohe /Kotuitui Whitinga bridges will result in high ongoing operating costs.

3.2 Levels of Service

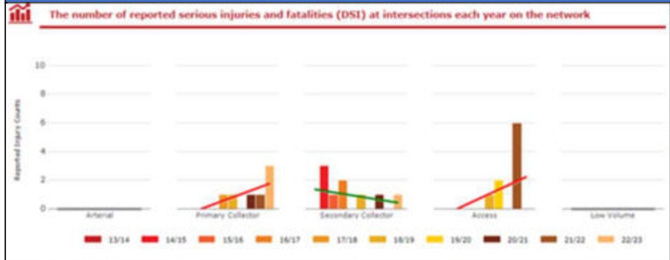
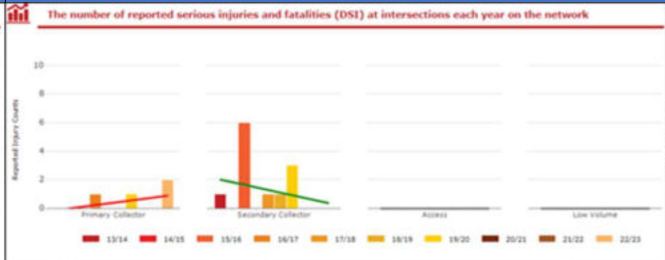
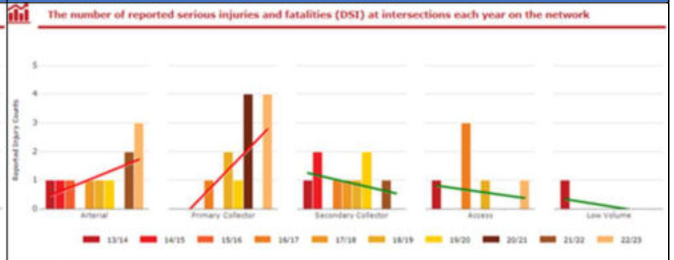
ONRC Customer Outcomes: ONRC Travel Time Reliability CO1 – Throughput at indicator sites (no data available)

Customer Levels of Service: ONRC Safety TO6 – Intersections

ONRC Cost Efficiency 5 – Overall network cost

3.3 Evidence and Gap Analysis

ONRC Safety TO6 – Intersection – Rural roads (top graph) & Urban roads (bottom graph)

<table>
<tr><th>FNDC</th><th>KDC</th><th>WDC</th></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Arterial, Primary Collector, Secondary Collector, Access, Low Volume
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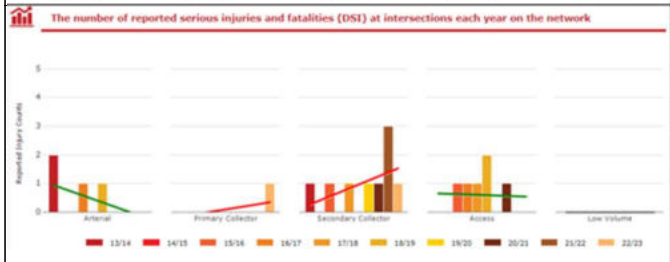
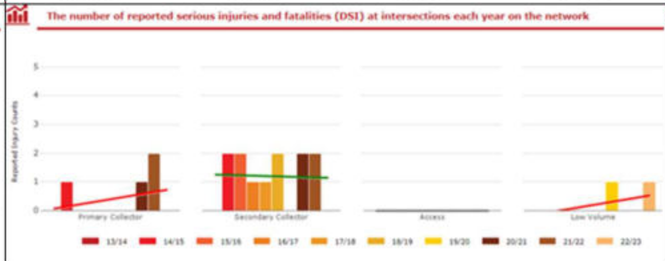
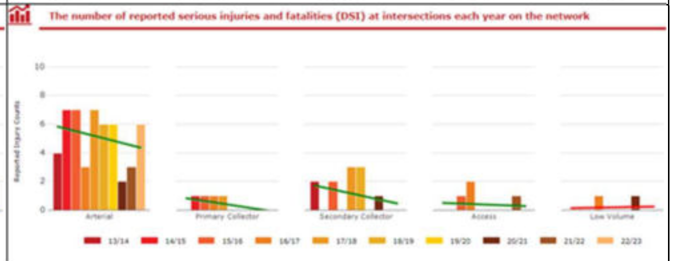
<tr><td></td><td></td><td></td></tr>
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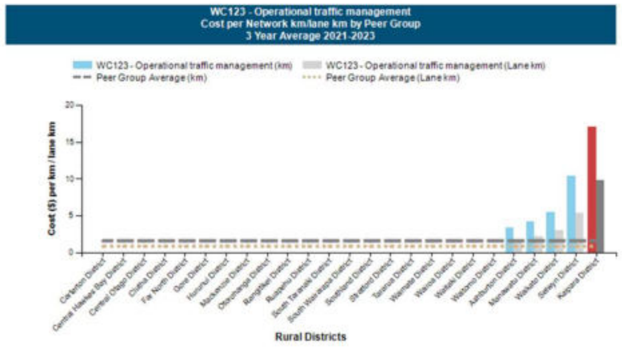
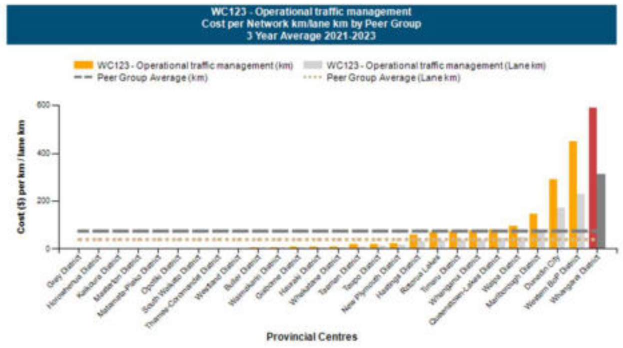
</td><td>Arterial, Primary Collector, Secondary Collector, Access, Low Volume
</td></tr>
<tr><td>FNDC Intersection DSI – It should be noted there is very little data for intersection crashes on the FNDC network. This makes it difficult to determine any issues or trends.
However, it appears that there may be an increasing trend in intersection crashes on the rural Primary Collector and Access roads and urban Collector roads.</td><td>KDC Intersection DSI - It should be noted there is very little data for intersection crashes on the KDC network. This makes it difficult to determine any issues or trends.
From the limited data available, there may be an increasing trend in rural Primary Collector roads and urban Primary Collector and Low Volume roads.</td><td>WDC Intersection DSI – It should be noted there is little data for intersection crashes on many road classes for the WDC network. This makes it difficult to determine any issues or trends.
It appears that there could be an increasing trend of intersection crashes on WDC's rural Arterial and Primary Collector roads.</td></tr>
</table>

NZTA Peer Group Charts – 3yr Cost/km WC 123 Operational Traffic Management

FNDC	KDC	WDC
		
FNDC Operational Traffic Management Cost – FNDC does not have any operational traffic management cost.	**KDC Operational Traffic Management Cost** – KDC has the highest operational traffic management cost in their peer group. This could be attributed to the operation of the recently acquired traffic signals and operating the school zones signs (SZS).	**WDC Operational Traffic Management Cost** – WDC has the highest operational traffic management cost in their peer group. This is not surprising as it spends a large portion of the budget operating the Te Matau a Pohe bascule bridge. If this amount was removed, Whangarei's cost/km would be similar to Dunedin's.

Summary

FNDC	KDC	WDC
FNDC Summary – From the limited crash data, it appears that there may be an increasing trend in intersection crashes on the rural Primary Collector and Access roads and urban Collector roads. However, this is likely to be addressed though other work activities because FNDC does not currently carry out any activity though WC 123 Operational Traffic Management and is unlikely to implement traffic signals of any of its urban intersections for the foreseeable future.	**KDC Summary** – From the limited data available, there may be an increasing trend in rural Primary Collector roads and urban Primary Collector and Low Volume roads.	**WDC Summary** - It appears that there could be an increasing trend of intersection crashes on WDC's rural Arterial and Primary Collector roads. WDC has the highest operational traffic management costs in their peer group. This is not surprising as it spends a large portion of the budget operating the Te Matau a Pohe bascule bridge. If this amount was removed, Whangarei's cost/km would be similar to Dunedin's.

3.4 Options to be Considered

Based on the above data and the root cause analysis, the following options have been considered:

Option	Description
Option 1 – Improve detection and operation of signals in Whangarei.	Improve detection and operation of signalised intersections in Whangarei to optimise their performance and reduce congestion. This would include CCTV cameras at key sites and improved signal phasing.
Option 2 – Remote operation of the opening bridges in Whangarei.	Remote operation of the Te Matau a Pohe and Kotuitui Whitinga opening bridges in Whangarei to reduce the cost of service which currently requires an operator to be based on site.

PBC Multi Criteria Option Analysis, RCA: NTA

Activity/Work Categories: Operational Traffic Mgt (WC 123)

Short list up to 3 options from the following:

Option - Can we make	Yes/No	Rank	Reason
❑ Intervention response **timing** change			
❑ **LoS** adjustments	Yes	1	Improve detection and operation of signalised intersections in Whangarei.
❑ Use existing assets **differently**			
❑ **Blending** Work Categories differently			
❑ **Risk** - Hold Assets longer			
❑ Managing **demand**			
❑ **Route** Management			
❑ Alternative approaches – different **solutions/technology**	Yes	2	Remote operation of the Te Matau a Pohe and Kotuitui Whitinga opening bridges in Whangarei.
❑ **Maintenance vs Renewal** adjustments			
❑ **ONRC** Classification variance			
❑ Extended **temporary** management			
❑ **Supply chain** improvements			
❑ Improve **systems and capability**			

Criteria	Weighting (Importance) (Total to 100%)	How good is this option					
		Option 1 - Improve detection and operation of signals in Whangarei		Option 2 - Remote operation of the opening bridges in Whangarei			
		Raw	Score	Raw	Score		
Community Outcomes Achieved	10%	2	0.2	1	0.1		
Problem solving effectiveness	10%	2	0.2	0	0		
Benefits realised	10%	2	0.2	0	0		
Good Environmental impacts	5%	1	0.05	0	0		
Value for Money	10%	2	0.2	3	0.3		
Closing Customer and Technical LoS gaps and impacts	10%	2	0.2	0	0		
Closing ONRC Performance gaps	10%	0	0	2	0.2		
Asset preservation and sustainability	10%	0	0	0	0		
Total Cost of Ownership (whole of life Costs)	10%	0	0	2	0.2		
Life Cycle Management	10%	0	0	0	0		
COVID-19 Recovery	5%	0	0	0	0		
Totals	100%		1.05		0.8		

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

3.5 Option Assessment and Line of Sight

The options and the line of sight to the preferred strategic response and the problems they are addressing are shown in the table below. These options have been ranked in order of preference and then have been assessed through a multi-criteria assessment (MCA) to determine the highest scoring options that are preferred and are to be adopted. The MCA assessment is also provided as follows.

Work Activity	Problem Statements Addressing	Preferred Strategic Response	PBC Options to be Considered	Option Rank	MCA Score	Preferred Options
Operational Traffic Management	**Growth and Demand**- Rapid growth and lack of suitable mode shift options are causing congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods. Lack of mode shift options in the more remote communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation.	**Programme Adjustment** • Intersection and road upgrades including bus priority lanes, new link roads. • Shared path networks for Whangarei, Kerikeri/Waipapa and Mangawhai. **Policy Approach** • Increase bus frequency in Whangarei and expand rural services. **Demand Management** • Travel planning and mode shift promotion. • Increase all-day parking charges.	**Policy Approach** **Alternative Approaches – Different Solutions/Technology** • Option 2 - Remote operation of the opening bridges in Whangarei. **Demand Management** **LOS Adjustments** • Option 1 - Improve detection and operation of signals in Whangarei.	2 1	0.8 1.05	Yes Yes

Preferred Options: From the multi-criteria assessment the preferred options are:

- Option 1 – Improve detection and operation of signals in Whangarei.
- Option 2 – Remote operation of the opening bridges in Whangarei.

3.6 Financial Impact

The following tables show the work categories and examples of the associated tasks. For full financial details for the work categories, refer to Section 08 (Financials).

3.6.1 *Far North District Council*

Work Category	Financial Impact
WC 123 Network Operations (was Operational Traffic Management)	No programme
WC 222 Traffic Services Renewals	No programme
WC 341 Low Cost/Low Risk Improvements	No programme

3.6.2 *Kaipara District Council*

Description	Financial Impact
WC 123 Network Operations (was Operational Traffic Management)	Funding to maintain and operate KDC's school zone signs
WC 222 Traffic Services Renewals	No programme
WC 341 Low Cost/Low Risk Improvements	No programme

3.6.3 *Whangarei District Council*

Description	Financial Impact
WC 123 Network Operations (was Operational Traffic Management)	No programme.
WC 222 Traffic Services Renewals	Funding for additional traffic signal renewals to improve detection and operation of signals to ensure these are as efficient as possible.
WC 341 Low Cost/Low Risk Improvements	Funding to continue to upgrade traffic signals to provide CCTV cameras, fibre connection, WiFi backup and central management to better control the signals Funding to upgrade the Te Matua ā Pohe Comms system to enable it to be remotely operated.

3.7 AMP Improvement

The following improvements will be considered:

- Determine the feasibility of carrying out signal and bridge operations remotely through a Northland regional control centre similar to Auckland Transport Operation Centre (ATOC) including assessment of ongoing operating costs.
- Determine a suitable central management system for streetlight control and other "smart" technologies.

Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 07

Network Safety – Safety, Education & Promotion, and Demand Management

Overview and Management
Problems, Benefits, Consequences
Options Assessment

Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 07

Network Safety – Safety, Education & Promotion, and Demand Management

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Appendix 07.A – Northland Road Safety Action Plan (RASP) 2023/24

1 Overview

1.1 Description

The following activities/assets are managed under safety in line with the framework provided by Austroads publication AP-R509-16 Safe System Assessment Framework. Below are some of the key interventions:

- Roadside and centreline barriers
- Bridge end treatment – guardrails
- Delineation devices
    - Line marking
    - Structured line markings
    - Edge maker posts
    - Reflective Raised Pavement Markers (RRPM)
- Curve Advisory signage
- Speed Limit signage and markings
- Intersection treatments; like roundabouts, buildouts, etc
- Other markings; zebra, kea, intersection markings, etc.

1.2 Monitoring and Condition

- Skid resistance prediction and intervention for high-risk curves Roadside Barrier (including bridges) condition assessment and 'length of need' assessment (is it actually protecting the hazard). This programme of assessment will be developed over the next three-year period.
- Pavement markings; waterborne, long life, audio tactile profiled (ATP) etc. – annual line mark is carried out subject to budget availability.
- The safety systems, tools and resources as set out in the following section; Safety Hazard Identification.

1.3 Overall Strategy

The overall strategy comprises the following plans and strategies:

- National Strategy – Road to Zero NZTA website and strategy
    - Vision
    - Goal
- Northland Road Safety Strategy – draft in development
- Regional Speed Management Plan (RSMP) 2024-27 – in development and will be published early to mid-2024
- Setting Speed Limits Rule 2022 – requires the RSMP
- Northland Road Safety Action Plan (RSAP) – regional cross-sector plan for road safety partners, copy attached in Appendix A07.A.

2 Management Plan

2.1 Management

Ensuring the road network is safe and efficient is a key role of Council and supports the Ministry of Transport's Safer Journeys and Government Policy Statement (GPS) objectives of reducing fatal and serious injury crashes. The NTA has a process to identify safety issues and to mitigate these through road improvements, maintenance activities or education.

2.2 Acquisition

Growing the region when acquiring new roads requires different users to be separated and/or manage the energy in the event of resulting crashes. Solutions for the elimination or mitigation of crashes are based on the following standards, guidelines and tools:

- Road to Zero programme, including:
  - Speed Management (speed limits and associated infrastructure)
  - Infrastructure (Standard Safety Intervention (SSI) Toolkit) – Waka Kotahi Pipeline Development Tool (sophisticated multi criteria analysis)
  - Bike Skills Training – National Programme Business Case strategic fit Medium
  - Road Safety Promotion – RSAP and Communities at Risk Register – Medium, High or Low strategic fit.
- Seal Extension requirements: Job Brief, Road Safety Audits, Design Reviews
- Vested roads (Private development):
  - Private Plan Change – Hearings, conditions of consent and Engineering Plan Approvals to meet District Plan Rules, Engineering Standards and National Policies and Standards.
  - Road Safety Audits following national standards.
  - Design Reviews
- Crash Reduction Studies and Pipeline Development Tool – assessment of crash outcome versus predicted outcome and assess previous investment.

2.3 Safety Hazard Identification

Table 2-1 below sets out the systems, tools and resources used to identify safety issues on the road network.

Table 2-1: Safety Systems, Tools and Resources

Resource	Description
Waka Kotahi Pipeline Development Tool	A tool to predict the death and serious injury reduction from standard safety interventions across every road and intersection in New Zealand that will help RCA's plan their road safety programme.
NTA Risk Map (Abley)	A GIS-based system developed by Abley that enables the easy identification of high-risk road and intersections, 10-year crash history and collective and personal risk.
CAS Database	The Crash Analysis System (CAS) is an NZTA-administered database which provides crash records that can be used to identify crash trends.
Fatal and Serious Crash Investigations	Investigate all fatal and some serious crashes. Identify the possibility of transport network contribution/ failure and propose recommendations.
Crash Reduction Studies	NTA carries out Crash Reduction Studies (CRS) on regular cycle. CRS use the CAS database to identify high risk roads and intersections and to identify possible treatments. It is desirable to complete a CRS on a 3 yearly cycle to pick up on any change in crash trends. The next CRS is currently programmed for early 2024.
Mega maps	A GIS-based system that enables the easy identification of high-risk roads and intersections.
NZTA Road Safety Reports	Annual reports on crash trends in each district and identifies crash types that are over-represented.
NZTA Communities at Risk Register	A register that identifies which causal crash factors (such as speed, alcohol, young drivers etc) are over-represented in each district.
Safety Audits	Audits of new projects to identify any safety issues and recommend treatments that can be undertaken in conjunction with the project.
Deficiency Database	Repository of untreated safety deficiencies identified previously through CRS, safety audits or through Council staff and public feedback. Although this database is still maintained, its usefulness in addressing fatal and serious crashes is questionable.
Safety Management System	Provides a central reference of safety standards and processes to be consulted when undertaking works.
Public Feedback	Safety issues identified through public feedback.

2.4 Safety Assessment

Figure 2-1 and Figure 2-2 following are screenshots from the Northland Risk Mapping 2020 - a risk mapping system which identifies high risk roads and intersections that should be further investigated for possible safety improvements.

Figure 2-1 shows the Collective Risk (crash density) of the rural road network. Apart from the State Highway network, the only High or Medium High collective risk rural roads in the region are:

- FNDC – two Medium High-Risk sections: Kerikeri Road (part) and Kerikeri Inlet Road
- WDC – one High Risk section: Riverside Drive and 6 of the Whangarei city centre road as well as the Whangarei Heads Road and the Marsden Point Road.

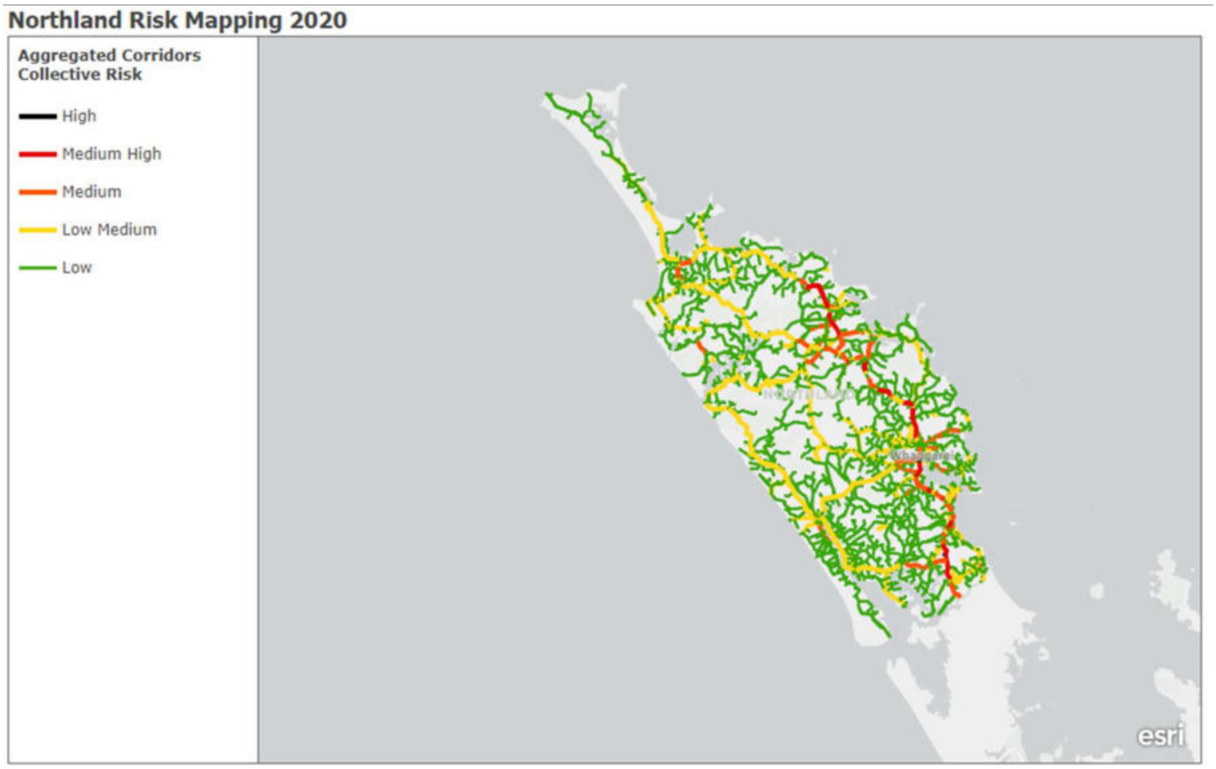


Figure 2-1: Northland Risk Mapping 2020 – Aggregated Corridors Collective Risk

Figure 2-2 below shows the Personal Risk (crash rate) of the rural road network. This shows that there are many roads with High and Medium High personal crash rates across the region.

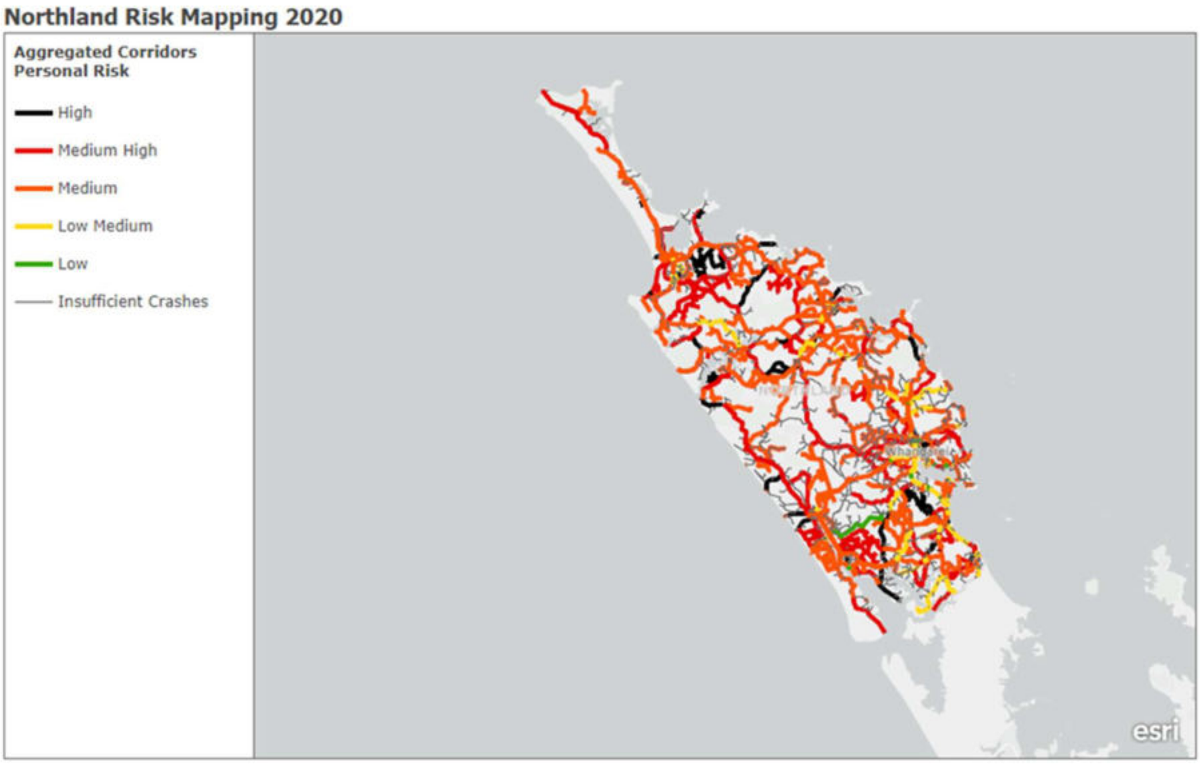


Figure 2-2: Northland Risk Mapping 2020 – Aggregated Corridors Personal Risk

2.5 Safety Programmes

2.5.1 Work Programmes

The NTA carries out numerous safety improvement projects to assist in improving the safety of the network through their annual programme. Improvement projects are listed in Table 2-2 below.

Table 2-2: Assets and their contribution to safety

Asset	Contribution to Safety
Road Safety Barriers	Barriers provide delineation to help drivers recognise road edges as well as offering protection in the event of an accident.
Signs, Markings and Delineation	Signs are used to warn drivers of dangerous sections of road and to help control vehicle speed. Marking and delineation provide guidance to drivers by clearly indicating centrelines and road edges.
Driver Feed-Back Signs	These signs are used to promote driver awareness and encourage drivers to be more aware of their speed and the speed limits.
School Zone Signs	These signs are used to encourage drivers to be aware of school children and encourage drivers to limit their speed and be extra vigilant in school areas.
Lighting	Lighting improves driver's vision at night and also offers protection to pedestrians by increasing the safety of the areas they use.
Vegetation Control & Sight Benching	Vegetation control is important in ensuring that signs and markings are visible, and that driver's sightlines are clear, particularly at intersections. Sight benching helps keep sightlines clear, particularly on blind corners.
Traffic Calming Devices	These devices are used to control the speed of drivers and encourage focus on the road in areas with vulnerable users such as pedestrians.
Traffic Signals	Controls the flow of traffic at intersections, reducing conflicts between traffic streams, hence reducing the likelihood of an accident.
Road Widening	Widening the carriageway provides more wander space for drivers before they enter the road should where they may lose control of their vehicle. This work is often undertaken in conjunction with pavement rehabilitation work.
Speed Limits	With the release of the NZTA Speed Management Guide, opportunities to change speed limits to better reflect the safe and appropriate speed of a road will be investigated and implemented where appropriate. This includes electronic speed signs, repeater signs, intersection speed signs and school zone signs.
Roundabouts	Reduces the speed of vehicles and provides a more favourable conflict angle. Therefore, reduces the likelihood and severity of an accident.

2.5.2 Road Safety Promotions

WDC and KDC have engaged Northland Road Safety Trust to undertake road safety promotion work on its behalf, while FNDC have engaged Far North Rural Education Activities Programme (REAP). These partnerships have been in place for many years and allows many road safety programmes promotions for a relatively small investment by way of NZTA subsidies and utilising contributions from the community (local share).

The original plan was developed by RoadSafe Northland in conjunction with the Road Safety Action Plan Group for the NTA. This group includes representatives from:

- Northland Transportation Alliance
- Waka Kotahi New Zealand Transport Agency
- Northland Road Safety Trust
- New Zealand Police
- ACC
- Far North REAP
- Bike Northland.

The RSAP group feeds back to RTC and other road safety forums such as:

- Northland Road Safety Forum
- Northland Freight Group
- Other interested parties such as AA Council, other Council appointed committees.

The plan sets out areas to be targeted and activities to promote road safety, and ultimately reduce fatal and serious injury crashes in Northland's transport network. This group develops a plan of safety initiatives across the district to focus on high-risk issues that have been identified through the Communities-at-Risk Register:

- Young Driver Education
- Alcohol and/or drugs
- Speed
- Rural road loss of control/head on
- Intersections
- Inattention and Fatigue
- Restraints (child restraints)
- Distractions.

The plan is updated every three years, with a full review undertaken every six years.

3 Problems, Benefits, and Consequences

This section outlines problems affecting the transportation network and details the benefits or consequences of doing or not doing something to address these problems.

3.1 Key Issues

3.1.1 Problem Description

The road network in Northland is often narrow and winding due to the rolling topography. Roads generally have little or no shoulders and hazardous roadsides with trees, ditches and service poles in close proximity to the road edge. This means the roads are often demanding to drive on, with little room for error which increases the likelihood of a crash and if a vehicle leaves the road the consequence of a high severity crash is increased.

The Infrastructural Risk Rating for most of Northland's road network is High or Medium-High which indicates the road network has a high level of crash risk. Figure 3-1 following shows the map of Northland's crash risk levels (Source: MegaMap).

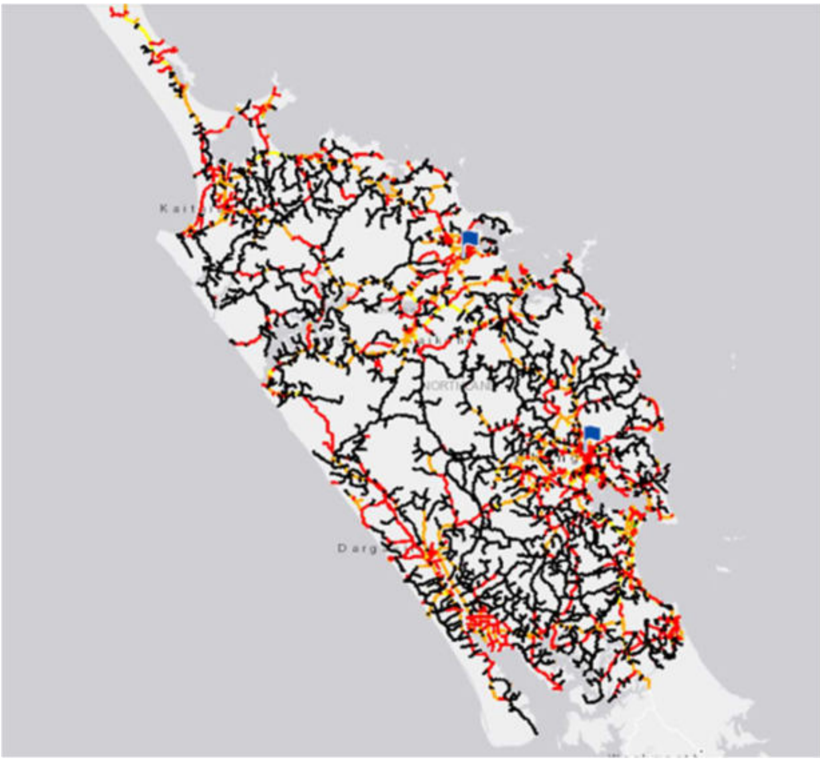
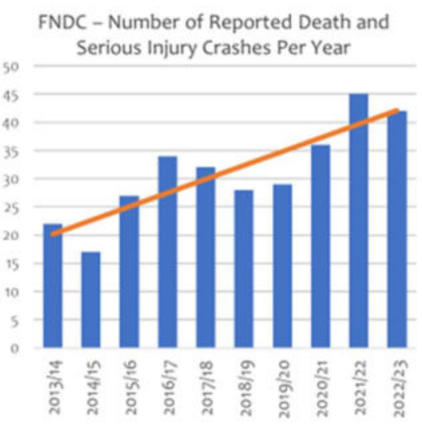
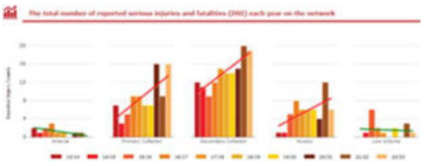
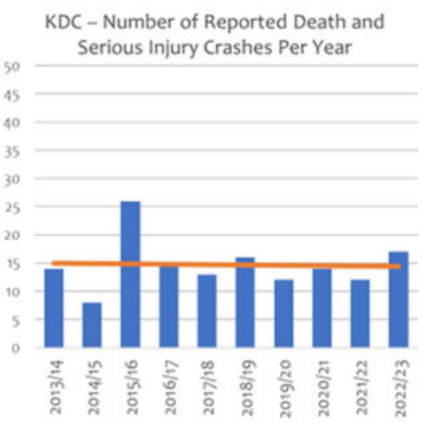
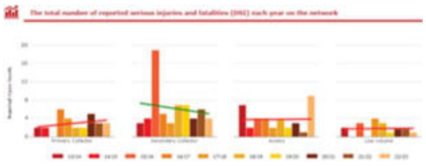
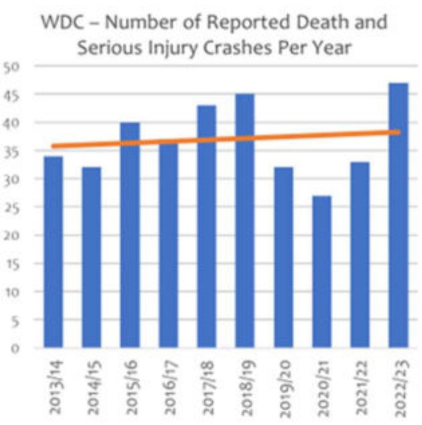


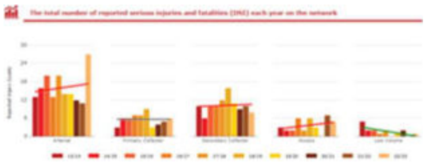
Figure 3-1 Northland crash risk level

The amount of fatal and serious injury crashes on the local road network have generally increased over the last 10 years in the Far North (most significant) and Whangarei districts. The Collective Risk in the Far North and Kaipara Districts are also higher than their peer group. In addition, each district has road classes having much greater Personal Risk than their peer group. This is shown in the following graphs.

<table>
<tr><th>FNDC</th><th>KDC</th><th>WDC</th></tr>
<tr><td colspan="3">Death and Serious Injury Crashes (per year)</td></tr>
<tr>
<td>

</td>
<td>

</td>
<td>

</td>
</tr>
<tr><td colspan="3">Collective Risk</td></tr>
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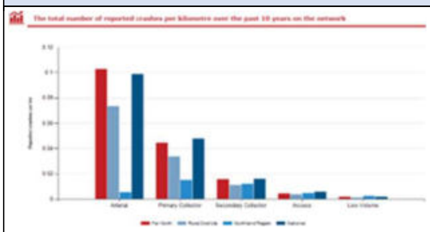
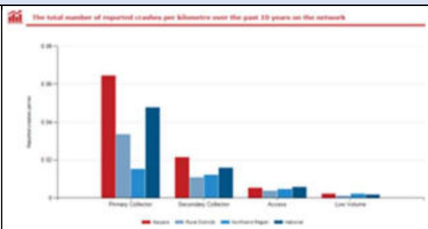
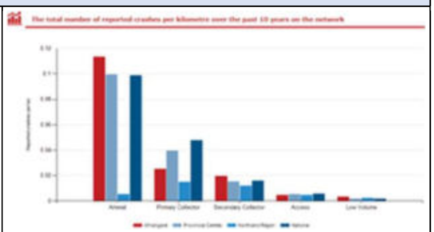
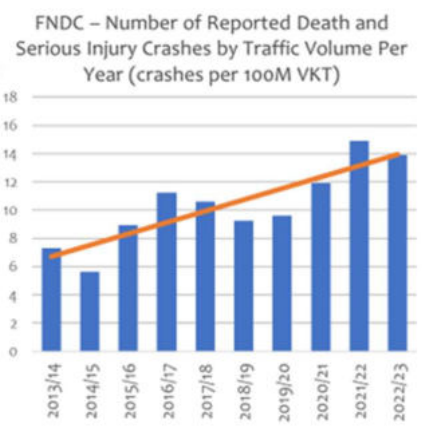
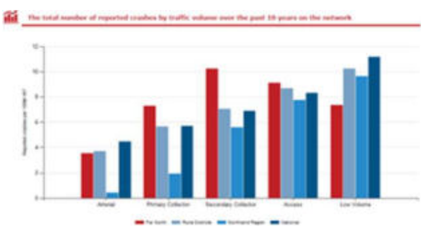
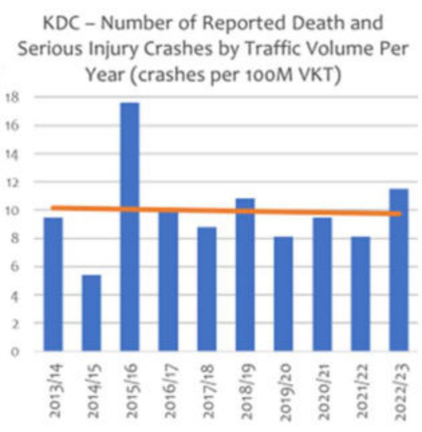
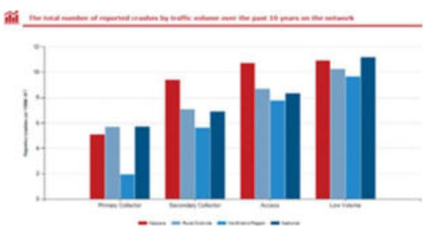
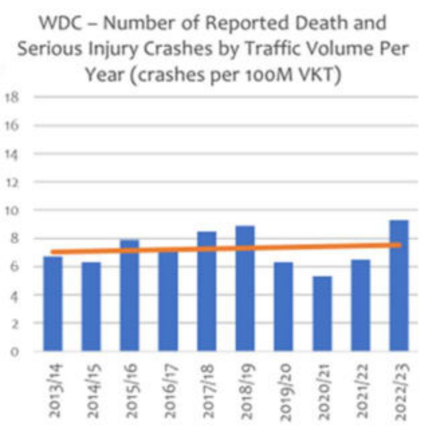
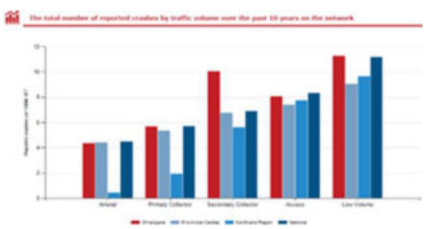
<td></td>
<td></td>
<td></td>
</tr>
<tr><td colspan="3">Personal Risk</td></tr>
<tr>
<td>

</td>
<td>

</td>
<td>

</td>
</tr>
</table>

These trends are likely to continue in the future due to growth demands increasing traffic and freight flows, unless significant investment in improving safety is made.

The Waka Kotahi Communities at Risk Register for 2022 identifies that Northland is a high risk for death and serious casualties. When broken into the individual districts, the Far North and Kaipara Districts are also high risk for death and serious casualties. This is shown in Figure 3-2 below, extract from the register.

All deaths and serious casualties

2022 Register

PERSONAL RISK DSI/100MVKT	Ranking Territorial Authority	Standard Deviation	COLLECTIVE RISK 5yr AVG DSI	PERSONAL RISK DSI/100MVKT	Road Safety Regions	COLLECTIVE RISK 5yr AVG DSI
15	Wairoa District		18	9	NORTHLAND	190
12	Gisborne District		49	5	AUCKLAND	642
12	Otorohanga District		15	8	WAIKATO	423
11	South Waikato District		43	7	BAY OF PLENTY	201
11	Waitomo District		24	7	TARANAKI	87
10	Far North District		86	8	MANAWATŪ-WHANGANUI	210
10	Kaipara District		33	12	GISBORNE	49
10	Horowhenua District		37	9	HAWKE'S BAY	122
10	Whanganui District		31	6	WELLINGTON	211
10	Masterton District		20	6	TASMAN NELSON MARLBOROUGH	95
10	Opotiki District	1 STDEV	13	7	WEST COAST	37
8	South Wairarapa District		11	5	CANTERBURY	328
8	Ruapehu District		18	6	OTAGO	158
8	Whakatane District	0.5 STDEV	35	7	SOUTHLAND	89
8	Taupo District		51			
8	Hauraki District		30	6	NATIONAL	2,842
8	Buller District		14			
8	Stratford District		11			

Figure 3-2: NZTA Communities at Risk Register (November 2022) – Northland death and serious casualties

A breakdown of specific issues identified in the Communities at Risk Register is provided in the Table 3-1 below.

Table 3-1: Communities Risk Register

Communities at Risk Register 2022 Issue	FNDC	KDC	WDC	Northland
All Deaths and Serious Casualty	High	High		High
Young Drivers (of light vehicles aged 16-24 yrs)	High	High		High
Alcohol and/or Drugs	High	High	Medium	High
Speed (too fast for conditions)	High	High		High
Urban Intersections				
Rural Intersections				
All Intersections				
Rural Road Loss of Control and/or Head On	High	High		High
Motorcyclist Involved	Medium	High		Medium
Cyclist Involved	High	Medium	High	High
Pedestrian Involved	High	High	High	High
Distraction (crash factor: attention diverted)	High			Medium
Fatigue				
Older Road Users (aged 75yrs or older)				
Restraints (seatbelts not worn)	High	High		High

Many of these High and Medium risk areas are driver behaviour or driver skill issues such as speed, alcohol/drugs, young drivers, rural road loss of control/head on and lack of seat belts worn. Continued education campaigns supported by police enforcement are required to help address these risk areas. The implementation of speed management through Waka Kotahi's Speed Management Guide will also help address speed as a factor in crashes.

High risk rural roads and intersections should be targeted for route treatment and intersection upgrade to help reduce crash rates in these high risk areas. In particular, loss of control on bends in rural areas should continue to be targeted.

Vulnerable road users such as pedestrians, cyclists and motorcyclists are at greater risk of injury in a crash and need to be catered for. The area of immediate focus is for pedestrian safety in Whangarei City where additional safe crossing points are required on major arterial roads which was raised as a major problem in the Whangarei City Transportation Network Strategy Investment Logic Mapping (ILM). Pedestrian safety is also a high risk in the Far North with most pedestrian crashes occurring in and around the rural towns in the district.

Following the release of the Safer Journeys 2016-2020 Action Plan, a Northland Road Safety Action Plan 2016/17 was developed, which targets the following areas:

- High Risk Rural Roads – to target interventions on the five highest risk rural roads and five highest risk rural intersections in each district.
- Alcohol – target police enforcement and community-based programmes in areas with high alcohol/drug related crashes.
- Motorcycles – Identifying high risk motorcycle routes and providing motorcycle training throughout Northland.
- Speed – apply the NZTA Speed Management Guide principles and countermeasures on all local roads, especially high risk roads.
- Young Drivers – increase driver education to identified communities to help young drivers attain their full licence. Restraints – Increase education on adult and child restraints.

The following has been identified as emerging issues:

- Vulnerable road users: Cyclists and Pedestrians
- Distraction
- Fatigue.

The Northland Road Safety Action Plan 2023/24 has been updated to reflect the new Road to Zero strategy.

3.1.2 Key Issues and Actions

- Prioritise treatments for high risk rural roads and high risk intersections.
- Target road safety promotion to address the issues identified in the Communities at Risk register and focus areas from the Northland Road Safety Action Plan.
- Ensuring that roads are widened to adequate widths and traversable shoulders provided when roads are rehabilitated, particularly for arterial/collector roads, freight routes and tourist routes. Where widening cannot be accommodated, consider roadside barrier treatment.
- Implement speed management across Northland to set speeds that are safe and appropriate in accordance with speed management guidelines
- Providing safe and convenient crossing points and routes for pedestrians and cyclists, particularly for Whangarei City and Far North rural towns and travel planning to encourage use of these routes.

3.1.3 Benefits

- Providing treatments on high-risk rural roads and high-risk intersections will target investment on the areas with the highest safety risk and have the greatest opportunity to reduce crash rates.
- The continuation of the road safety promotion programme will help reduce high risk areas identified in the Communities at Risk register.
- Widening and improving the general road network through the pavement rehabilitation programme will provide a recovery zone for vehicles, that is, providing an errant vehicle an opportunity to return to the roadway or to come to a safe stop thus making the network more forgiving in nature. The additional road space will also provide more space for cyclists and pedestrians.
- Speed management may also have significant impact on road safety, particularly in rural areas where the road network does not safely provide for an open road speed.
- Provision of safe walking and cycling routes and travel planning to encourage use of these routes will reduce crashes involving vulnerable active road users. In particular, safe crossing points in Whangarei City are required.

It should be noted that investment in the above safety measures will incrementally increase the maintenance, operations and renewals costs overtime due to the ongoing costs of maintaining and servicing new facilities and widened pavements.

3.1.4 Consequences

Fatal and serious injury crashes will continue increasing and will continue to cause significant harm to our customers and communities.

Without adequate investment into road safety measures, the increasing trend in fatal and serious injury crashes on the Northland local road network is likely to continue. This is contrary to the objectives of the GPS and the Road to Zero strategy which is to have "A New Zealand where no one is killed or seriously injured in road crashes".

3.2 Strategic Case – Bottom-Up Assessment

During the development of the AMP, the NTA held a series of workshops to test and refine the problem statements and to determine the strategic response to address the problems. This is shown in the following tables.

Draft Problem Statement :
Northland has a narrow, winding and unforgiving rural road network which combined with poor driver behaviour has resulted in the region being a high Community at Risk for death and serious injury (DSI) crashes and the rate of DSI crashes is trending upward for FNDC and WDC. FNDC and KDC also have higher Collective Risks than their peer group. There is inadequate funding available for installation of safety devices such as signage and barriers, there is also a need for funding to improve geometry at critical areas. Line Marking is becoming more expensive and more funding is required to comply with modern safety standards.
Current AMP - Key responses outlined in Strategic Case:
Speed FNDC – Focus on school zones and urban town centres. KDC – Focus on school zones, urban town centres and the northern rural roads of Kaipara. WDC – Focus on school zones, Whangarei City, and other town centres. NTA – Review and implement speed management across Northland to set speeds that are safe and appropriate in accordance with speed management guidelines. **Infrastructure** FNDC – Increase annual safety programme to $3.2M/year. KDC – Increase annual safety programme to $2.2M/year. WDC – Increase annual safety programme to $5M/year. NTA – Increase the intersection and safe pedestrian crossing upgrades in Northland. Boom mulching of roadside vegetation to clear sightlines. Edge lines for all Secondary Collector and above roads as well as tourist routes. Delineation and hazard protection on High-Risk Rural Road (HRRR) routes and CRS sites. LED light upgrades on arterial road routes to bring lighting up to the required standard. Develop programme of skid resistance seals/water cutting targeting high risk curves on HRRRs and tourism routes. **Road Safety Promotions** FNDC – Enhance road safety promotion using in-house resources and Far North Rural Education Activities Programme (REAP). Bike skills training (Grade 1 and Grade 2) delivered by Bike Northland. KDC – Enhance road safety promotions using in-house resources and Northland Road Safety Trust. WDC –- Enhance road safety promotions using in-house resources and Northland Road Safety Trust. Bike skills training (Grade 1 and Grade 2) delivered by Bike Northland. NTA – Targeted public road safety programme focussed on Restraints Impairment Distraction Speed (RIDS). **Travel Demand Management** Northland has a new programme for Travel demand management with WDC and FNDC requesting for $50k/year each and KDC requesting for $20k/year.
Current Work that is being undertaken:
Road safety is generally undertaken through the Low-Cost Low Risk programme. Programmes are developed based on HRRR and High-Risk Intersection criteria using the Waka Kotahi Pipeline Development Tool (PDT). Also includes pedestrian safety and traffic calming. Speed management programme is being slowly rolled out, but not enough budget for physical interventions on site to make speeds "self-explaining". Active school zone signs being installed in WDC and KDC. None yet in FNDC, although these will be installed through the speed management programme. Skid resistance being considered in the development of the reseal programme. Line marking – Delineation (audio tactile markings and long-life markings) has been improved through the new High Risk Rural Road (HRRR) projects, but it has been a challenge to carry out an annual remark due to the increase in cost two to four fold in the new maintenance contracts.

Boom mulching of roadside vegetation to keep sightlines clear.

WDC carry out 3 yearly crash reduction studies to identify problem areas. FNDC and KDC do not have a regular crash reduction study programme.

Road Safety Promotion is undertaken through Northland Road Safety Trust, Far North REAP, and Bike Northland. Review of Road Safety Promotion has been undertaken across the Northland councils as part of Northland RSAP and Bike skills training has been undertaken in FNDC and WDC

Mid-block pedestrian crossings, courtesy crossings, etc are being prioritised and delivered in accordance with Waka Kotahi's Standard Safety Intervention (SSI) Tool Kit criteria.

Aspects of the problem not being addressed and benefits not being delivered?

FNDC – Safety programme now generally targeting the high-risk areas that are likely to lead to the greatest safety outcomes. However, budget limitations are restricting what can actually be achieved on an annual basis for all three councils. This makes it difficult to carry out interventions in a timely manner.

KDC and WDC – Road Safety Promotion is not being driven as hard as it could be due to lack of in-house council resource. Funding constraints are also a limitation for both WDC and KDC, due to difficulties getting local share.

WDC – several hundred pedestrian crossing facilities do not meet minimum safety standards.

NTA – Additional edge lines on all secondary collectors, detour, tourist and freight routes not being undertaken due to high cost of line marking through new maintenance contracts.

NTA – Safety funding levels insufficient to meet national target of reducing death and serious injuries by 40% by 2030 from 2020 baseline.

Is the Problem Statement still relevant? If "No" what are the deficiencies? If "Yes" has priority changed?

Yes – the problem is still a high priority.

If Problem is not being addressed by the current work, what is the strategic response?

Strategic response	Y/N	Rank	Detail
1 Programme adjustment eg, Remove/reduce projects/activities	Y	2	Increase safety programmes focussed on high risk rural roads, vulnerable road user safety and speed management to enable more timely interventions by increasing the available safety budget (ties to Option 4). This may be achieved through rebalancing of the LCLR programme.
2 Policy approach eg, Adjust level of Service	Y	3	Increase programme of delineation improvements. This will enable a full annual line mark as well as providing adequate edge lines, curve warning signage, RRPMs and edge marker posts on arterials and collectors, detour, tourist and freight routes. Long Life and Audible Tactile Profile (ATP) markings should be installed on high risk sites.
3 Demand management eg, Manage use – up/down	Y	1	Enhance the road safety promotion activity by actively driving this through dedicated NTA resource to get the best outcome, targeting the risk areas identified in the NZTA Communities at Risk Register.
4 Funding adjustment. eg, Increase/decrease	Y	-	Increase funding for both the Low Cost / Low Risk Safety Programme (particularly for FNDC) and for Road Safety Promotion (for WDC and KDC) to enable better more timely interventions. Ties to Option 1.
5 Risk based eg, Hold Assets longer	N	N/A	Already taking a risk based approach to target the highest safety risks first (using Abley SafetyNet and other tools).

How effective are the options? (as per Multi Criteria Assessment below)

Option 1 – Increase safety programme - Score 1.6 out of 3 (Preferred)

Option 2 – Additional delineation - Score 1.4 out of 3 (Preferred)

Option 3 – Enhanced Road Safety Promotions with active in-house management – Score 1.6 out of 3 (Preferred)
Draft an updated problem statement (if applicable)
Northland has a narrow, winding and unforgiving rural road network which combined with poor driver behaviour has resulted in the region being a high Community at Risk for death and serious injury (DSI) crashes and the rate of DSI crashes is trending upward for FNDC and WDC. FNDC and KDC also have higher Collective Risks than their peer group. Line Marking is becoming more expensive and more funding is required to comply with modern safety standards. The future challenge will be the maintenance and renewal costs for remarking. Safety funding levels insufficient to meet national target of reducing death and serious injuries by 40% by 2030 from 2020 baseline. A step change in funding is required to meet this target.

Strategic Case Multi Criteria Option Analysis, RCA: NTA
Problem: Safety

Short list up to 3 options from the following - Can we make-----

Option	Yes/No	Reason	Rank
1 Programme adjustment eg, Remove/reduce projects/activities	Yes	Increase safety programmes focussed on high risk rural roads, vulnerable road user safety and speed management to enable more timely interventions by increasing the available safety budget (ties to Option 4). This may be achieved through rebalancing of the LCLR programme.	2
2 Policy approach eg, Adjust level of Service	Yes	Increase programme of delineation improvements. This will enable a full annual line mark as well as providing adequate edgelines, curve warning signage, RRPMs and edge marker posts on arterials and collectors, detour, tourist and freight routes. Long Life and Audible Tactile Profile (ATP) markings should be installed on high risk sites.	3
3 Demand management eg, Manage use – up/down	Yes	Enhance the road safety promotion activity by actively driving this through dedicated NTA resource to get the best outcome, targeting the risk areas identified in the NZTA Communities at Risk Register.	1
4 Funding adjustment. eg, Increase/decrease	Yes	Increase funding for both the Low Cost Low Risk Safety Programme (particularly for FNDC) and for Road Safety Promotion (for WDC and KDC) to enable better more timely interventions.	-
5 Risk based eg, Hold Assets longer	No	Already taking a risk based approach to target the highest safety risks first (using Abley SafetyNet and other tools).	N/A

Criteria/Drivers to consider	Weighting (Importance) (Total to 100%)	How good is this option					
		Option 1 - Increase Safety Programme		Option 2 - Additional Delineation		Option 3 - Enhanced Road Safety Promotions with active in-house management	
		Raw	Score	Raw	Score	Raw	Score
Meets GPS	10%	3	0.3	2	0.2	3	0.3
Meets RLTP	10%	3	0.3	2	0.2	2	0.2
Addresses Problems	20%	2	0.4	2	0.4	2	0.4
Will realise Benefits	10%	2	0.2	2	0.2	2	0.2
Will meet Community Outcomes	10%	2	0.2	2	0.2	1	0.1
Will meet Customer Outcomes (CLOS)	10%	2	0.2	1	0.1	2	0.2
Provides high Performance impacts	10%	2	0.2	2	0.2	2	0.2
Provides high Environmental Impacts	5%	0	0	0	0	0	0
Provides Cultural Impacts	5%	0	0	0	0	2	0.1
How Costly	10%	-2	-0.2	-1	-0.1	-1	-0.1
Other 1							
Other 2							
Other 3							
Other 4							
Totals	100%		1.6		1.4		1.6

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

3.3 Strategic Case Summary (Line of Sight in Action)

Based on the assessment of the problem statement and the strategic responses undertaken in the previous section, a summary of the results and the affected work categories are shown in the table below:

Issue	Problem Statement
Problem Statement	Northland has a narrow, winding and unforgiving rural road network which combined with poor driver behaviour has resulted in the region being a high Community at Risk for death and serious injury (DSI) crashes and the rate of DSI crashes is trending upward for FNDC and WDC. FNDC and KDC also have higher Collective Risks than their peer group. Line Marking is becoming more expensive and more funding is required to comply with modern safety standards. The future challenge will be the maintenance and renewal costs for remarking. Safety funding levels insufficient to meet national target of reducing death and serious injuries by 40% by 2030 from 2020 baseline. A step change in funding is required to meet this target.
Benefits	Reduced road trauma.
Trend	Static
Strategic Response	**Programme Adjustment** • Increase safety programme. **Policy Approach** • Additional delineation. **Demand Management** • Enhanced Road Safety Promotions with active in-house management.
Activity/Work Category	WC 151 Network and Asset Management (Network User Information). WC 341 Low Cost / Low Risk Improvements (Local Road Improvement, Walking and Cycling). WC 421 Travel Demand Management. WC 432 Safety Promotion, Education and Advertising.

4 Options, Assessment and Alternatives

4.1 Option Identification (Root Cause Analysis)

Following the identification of the problem statements, a root cause analysis was undertaken to identify the underlying causes of these problems. The root cause analysis was undertaken using the "5 Whys" type methodology in accordance with NZTA's Business Case Approach Practice Note No.3 – Root Cause Analysis in Business Case Development.

This process was undertaken through a series of workshops with the NTA Assets Team and NZTA local representative to determine the underlying causes of the identified problems. This was a bit of a deep dive into the myriad of issues that affect the transport network and a multitude of root causes were identified for each problem statement.

For each root cause, a possible solution (option or alternative) was identified to try and address this cause. These solutions ranged from high level interventions such as changing council policies and developing strategies to low level interventions such improving grader operator training.

The following table includes the results of the root cause analysis and the possible solutions to address the problem statements.

Root Cause Analysis – Safety

Problem statement	**Northland has a narrow, winding and unforgiving rural road network which combined with poor driver behaviour has resulted in the region being a high Community at Risk for death and serious injury (DSI) crashes and the rate of DSI crashes is trending upward for FNDC and WDC. FNDC and KDC also have higher Collective Risk than their peer group**																		
why 1	The road network is often narrow, winding and has unforgiving road sides						Driver speeds are often unsafe for the road environment (FNDC and KDC are High Risk for excessive speed on the Communities at Risk Register)			Pedestrian safety in Northland is poor (FNDC and WDC are High Risk for Pedestrian crashes on the Communities at Risk Register)			Poor driver behaviour contributes to many crashes in Northland					Unsafe vehicles are a contributing factor in many crashes and often result in high severity crashes	
why 2	Historically the local road network was often not designed and so has a poor alignment and width (ie based on the old "goat tracks")	There are numerous roadside hazards on our roadsides and Northland has a high rate of run off road crashes (FNDC and KDC are High Risk and WDC is Medium Risk for Rural Run-off Road and Head On Crashes on the Communities at Risk Register).					Roads are not self explaining resulting in unsafe speeds		Speed limits are often inappropriate for the road environment		Pedestrians are often in conflict with vehicles		Alcohol and drug impairment is a significant issue (FNDC is a High Risk for alcohol/ drugs on the Communities at Risk Register)	There is a lack of use of restraints (ie seat belts) (FNDC and KDC are High Risk for restraints on the Communities at Risk Register)	Young drivers are over-represented in crashes (FNDC and KDC are High Risk for young driver crashes on the Communities at Risk Register)	Drivers often speed and carry out poor overtaking manoeuvres (FNDC and KDC are High Risk for crashes involving excessive speed on the Communities at Risk Register)	Drivers are often fatigued resulting in crashes (KDC is a Medium Risk for crashes involving fatigue on the Communities at Risk Register)	There are many unwarranted vehicles, particularly in the Far North District were a culture of not having a warrant or registration is normal and acceptable	Most vehicles in Northland do not have high safety ratings, which results in higher severity crashes
why 3	The alignment was based on following Northland's rolling topography	Trees and service poles are often located close to road edges	Deep roadside drains at located against the road edge in some areas	Steep roadside batters are located against the road edge in many places	Guardrails, bridge rails and sight rails are often not to current standards	There are a higher rate of loss of control crashes at night (FNDC has an increasing rate of night time loss of control DSI crashes on Arterial and Primary Collectors Roads)	There are many out of context curves which are not in keeping with the general speed environment	There are roads with insufficient skid resistance for the road environment, particular on curves (FNDC has a generally increasing rate of wet rural road loss of control DSI crashes)	Most speed limits are based on 50km/h and 100km/h standard speeds which are often inappropriate		There is a lack of safe footpaths in rural areas linking communities to places of employment, education, recreation and social services	There is a lack of safe crossing points on busy urban roads (WDC has an increasing trend of vulnerable road user DSI crashes on urban arterials)	Insufficient drug and alcohol enforcement	Laziness, people thinking they are "bullet proof", and lack of understanding of consequences. Also lower socio-economic area, so less likely to be able to afford car seats for children	There are many unlicensed drivers, particularly in the Far North District	Driver impatience and arrogance (thinking they are "bullet proof"), being late for appointment/work	Lack of alertness and concentration	People cannot afford (cost) or do not want (culture) to keep their vehicles maintained and warranted.	We have an older vehicle fleet in Northland
why 4	Following the topography was the least expensive option with the available resources and was fit for purpose for the vehicles at the time.	Self seeded trees, and shelter belts allowed to grow within road reserve. Service poles allowed to be placed on outside of bends.	Land drainage systems often use roadside drains, particularly in the Kaipara District (eg Ruawai) and some parts of FNDC (eg Awanui) and WDC (eg Hikurangi and Ruakaka)	Rolling topography means that there are many unprotected and steep cut and fill batters	These barrier systems have insufficient length of need, unsafe and obsolete end terminals. Sight rails are a hazard because they are too high which results in the top rail acting as a spear.	There is insufficient delineation of curves at night, particular in FNDC	The roads are often based on historic alignments which have not been designed which results in excess speeds entering many curves	The reseal programmes do not always pick up roads which have insufficient skid resistance. There is also very little warning to drivers that the road surface has inadequate skid resistance	100km/h not often appropriate for Northland's narrow, winding rural roads. 50km/h is not appropriate for urban areas with numerous vulnerable road user conflicts		Footpaths have mainly been provided in urban areas	Safe crossing points such as zebra crossings, raised platforms and mid-block signals are an impediment to traffic flow	Lack of adequate police presence and only ad-hoc alcohol and drug roadside testing undertaken	Education programme not sufficient to get message through without back up from police enforcement. Costs of providing car seats is often prohibitive	Insufficient driver licence testing stations in Northland. Cost of obtaining a licence is also a barrier.	Inadequate knowledge of the consequences of speeding and poor overtaking.	Long travel distances, which are often monotonous, particularly on the long Kaipara straights between Dargaville and Brynderwyn	Lower socio-economic area which limits the ability to keep vehicle maintained. Difficulty in accessing vehicle testing stations and mechanics due to large dispersed rural area.	Northland is a lower socio-economic area, which means that people often can only afford cheaper, older vehicles
why 5	Lack of historic investment in Northland's local road network	Inadequate clearing of roadside trees and acceptance of poor placement of service poles in the past	Easy to provide land drainage using the road reserve as this is a public space.	Lack of historic investment has resulted in most cut and fill batters being unprotected	These barrier systems are often old and based on obsolete standards	Lack of coordinated delineation improvement on Far North roads	Insufficient curve warning signage	Identification of roads with skid resistance issues is mostly reactive, using wet road crashes that have occurred as a trigger	High speeds reduce the survivability of crashes, particularly where there are road side hazards and vulnerable road users		Higher demand for urban footpaths due to greater population density, but speeds less so risk of a high severity crash is less. Lack of Walking & Cycling strategy in the Far North	Car-centric view prioritises traffic flow over pedestrian safety	The "booze bus" is not being used in Northland due to the vehicle being too slow to use in the Far North and insufficient officers with appropriate licences	Lack of adequate police enforcement, particularly in the Far North District.	Testing stations were centralised by the government a few years ago, making these less accessible. The Far North is a lower socio-economic area, and people often cannot afford the cost of a licence	Lack of suitable local education programme focused on speed. Lack of suitable passing opportunities results in poor choices being made	There are few suitable rest stops with services, for drivers to rest and refresh themselves	Lack of knowledge of why a properly maintained vehicle is vital for safety	Lack of knowledge why a more expensive, but safer vehicle should be considered
Potential Solutions	Consider minor alignment improvements either in conjunction with road rehabilitations or as standalone safety projects on High Risk Rural Road (HRRR) routes. Identify problem areas through HRRR studies, crash reduction studies and Waka Kotahi Pipeline Tool.	Provide Audible Tactile Profile (ATP) markings on edgelines on High Risk Rural Road (HRRR) routes. Remove roadside trees where possible and relocate or protect service poles on the outsides of bends on high risk routes. Identify problem areas through HRRR studies and crash reduction studies	Provide Audible Tactile Profile (ATP) markings on edgelines on High Risk Rural Road (HRRR) routes. Relocate land drainage system into private property on HRRR routes wherever possible. Ensure future land drainage is undertaken on private land. Identify problem areas through HRRR studies and crash reduction studies	Provide Audible Tactile Profile (ATP) markings on edgelines on High Risk Rural Road (HRRR) routes. Provide adequate treatment or protection of hazardous cut and fill batters on high risk routes. Identify problem areas through HRRR studies and crash reduction studies	Consider an upgrade programme for old, obsolete guardrails and bridge rails to bring these to standard on High Risk Rural Road (HRRR) routes or possibly in conjunction with rehabilitations on other significant routes. Provide compliant sightrails (half eye-height). Identify problem areas through HRRR studies and crash reduction studies	Develop corridor curve warning and marking upgrades on High Risk Rural Roads (HRRR), through HRRR studies, crash reduction studies and Waka Kotahi Pipeline Tool.	Complete the assessment of out of context curves. Sign out of context curves. Where signage has already been provided and crashes are still occurring, consider curve realignment. Identify problem areas through HRRR studies, crash reduction studies and Waka Kotahi Pipeline Tool.	Carry out targeted skid resistance testing on at risk curves on High Risk Rural Road (HRRR) routes. Sign curves with inadequate skid resistance. Complete the risk assessment of wet road curves for WDC and roll this out for FNDC and KDC using best practice and apply appropriate surfacing treatment during the reseal cycle. Use Waka Kotahi intervention methodology for local roads.	Continue to progress the speed management programme (including school zone signs) to provide Safe and Appropriate speed limits for the road environment on all roads, but targeting High Risk Rural Road (HRRR) routes and high risk urban routes.		Develop a Walking and Cycling strategy for the Far North. Prioritise new footpath projects based on safety risk, particularly where there are greater potential for higher severity crashes such as rural areas which have greater vehicle speeds.	Place more focus on safe pedestrian and cyclist crossing points. Prioritise safe crossing points such as mid-block crossings, zebra crossings and raised platforms in urban areas with significant pedestrian demand.	Support the new impairment vehicles for the Far North and Kaipara/Whangarei, with adequate police officers to run these on a weekly basis. Continue road safety campaigns to educate on alcohol and drug impaired driving. Consider potential mobility options (eg Uber type service or pub courtesy vans) to help avoid impaired driving.	Continue road safety campaigns to educate on the use of restraints, backed up with adequate police enforcement. NTA to provide resource to better supervise road safety promotion activities to focus on achieving better outcomes. Consider advocating for schemes for government funded car seats for lower socio-economic families.	Continue providing a subsidised driver licence scheme through the road safety promotion programme. Continue with development/roll out of mobile driver licence testing station. NTA to provide resource to better supervise road safety promotion activities to focus on achieving better outcomes.	Enhance the current road safety programme for speeding, to get better impact. NTA to provide resource to better supervise road safety promotion activities to focus on achieving better outcomes. Advocate for more passing opportunities on State Highways where appropriate. Provide adequate pull off opportunities on high risk rural arterials where warranted	Develop safe rest areas at suitable locations with services such as toilets and refreshments in conjunction with the Twin Coast Discovery Route Rest Area business case	Promote the importance of vehicle maintenance through the road safety promotion programme. Advocate for schemes for government funded mobile mechanics and vehicle testing stations in conjunction with road safety promotion highlighting the risks of having a poor maintained vehicle	Promote safer, but affordable vehicles through the road safety promotion programme. Through Council procurement of vehicles target higher safety ratings

4.2 Option Development

The following table was developed by the Roading Efficiency Group as part of a top-down assessment of options to address the identified problems. They summarise the responses in the existing AMP, the effectiveness of the existing programme and the proposed options which have been determined from the root cause analysis which should be considered as part of the option assessment.

Statement Problem	Key Responses In existing AMP	Summary of effectiveness of existing programme	Proposed Programme Business Case adjustments (from Root Cause Analysis)
Northland has a narrow, winding and unforgiving rural road network which combined with poor driver behaviour has resulted in the region being a high Community at Risk for death and serious injury (DSI) crashes and the rate of DSI crashes is trending upward for FNDC and WDC. FNDC and KDC also have higher Collective Risks than their peer group. Line Marking is becoming more expensive and more funding is required to comply with modern safety standards. The future challenge will be the maintenance and renewal costs for remarking. Safety funding levels insufficient to meet national target of reducing death and serious injuries by 40% by 2030 from 2020 baseline. A step change in funding is required to meet this target.	**Speed** **FNDC** – Focus on school zones and urban town centres. **KDC** – Focus on school zones, urban town centres and the northern rural roads of Kaipara. **WDC** – Focus on school zones, Whangarei City, and other town centres. **NTA** – Review and implement speed management across Northland to set speeds that are safe and appropriate in accordance with speed management guidelines. **Infrastructure** **FNDC** – Increase annual safety programme from $3.2M/year. **KDC** – Increase annual safety programme to $2.2M/year. **WDC** – Increase annual safety programme to $5M/year. **NTA** – Increase the intersection and safe pedestrian crossing upgrades in Northland. Boom mulching of roadside vegetation to clear sightlines. Edge lines for all Secondary Collector and above roads as well as tourist routes. Delineation and hazard protection on High Risk Rural Road (HRRR) routes and CRS sites. LED light upgrades on arterial road routes to bring lighting up to the required standard. Develop programme of skid resistance seals/water cutting targeting high risk curves on HRRRs and tourism routes.	Environmental maintenance such as keeping sightlines clear is having a positive impact on safety. Maintenance and renewals of sealed and unsealed roads, traffic services and operational traffic management are keeping safety outcomes relatively stable. Road safety promotion is having a positive impact on communities, but Northland is still a High Community at Risk for DSI. For FNDC this programme is expensive. Safety improvements through the Road to Zero programme are resulting in positive safety outcomes. Key issues from Root Cause Analysis: Northlands roads are often winding, narrow and have unforgiving roadsides. Poor historic road alignments. High rate of run-off roads with high severity due to numerous roadside hazards including trees, deep drains, poorly located service poles and inadequate barriers. Insufficient night-time delineation and signage. Numerous out of context curves. There is a lack of skid resistance in some areas. Speed limits are often not suitable for the speed environment.	Minor alignment improvements on HRRR in conjunction with rehabilitations or as standalone projects. Identify high risk areas through HRRR studies and crash reduction studies. Provide audible tactile profile markings (ATP) on HRRR routes. Remove hazardous trees and protect or remove hazardous service poles. Relocate deep drains onto private land where possible and ensure future land drainage systems are on private lane. Provide adequate protection of hazardous cut and fill batters. Treat unsafe guard rails and sight rails. Develop corridor curve warning signage and delineation upgrades on HRRR routes. Complete the identification of out of context curves and carry out signage upgrades on these curves. Carry out targeted assessment of skid resistance on at risk curves on HRRR routes. Temporarily sign curves with insufficient skid resistance. Complete the risk assessment of high-risk curves for skid resistance issues and apply appropriate surfacing treatments. Continue the speed management programme to provide appropriate speed limits for the speed environment on HRRR routes and urban areas. Prioritise new pedestrian facilities and crossings where there is a high pedestrian demand or risk.

Statement Problem	Key Responses In existing AMP	Summary of effectiveness of existing programme	Proposed Programme Business Case adjustments (from Root Cause Analysis)
	Road Safety Promotions **FNDC** – Enhance road safety promotion using in-house resources and Far North Rural Education Activities Programme (REAP). Bike skills training (Grade 1 and Grade 2) delivered by Bike Northland. **KDC** – Enhance road safety promotions using in-house resources and Northland Road Safety Trust. **WDC** – Enhance road safety promotions using in-house resources and Northland Road Safety Trust. Bike skills training (Grade 1 and Grade 2) delivered by Bike Northland. **NTA** – Targeted public road safety programme focussed on Restraints Impermeant Distraction Speed (RIDS). **Travel Demand Management** Northland has a new programme for Travel demand management with WDC and FNDC requesting for $50k/year each and KDC requesting for $20k/year.		

5 Option Assessment

The following sections analyse options for addressing the problems and issues identified in the Strategic Case. These options have been identified through the Root Cause Assessment.

For the assessment of the data, peer group analysis and option assessment, a five point "traffic light" rating system has been used as shown in the following schematic. This rating system is based on a qualitative assessment of the LOS and cost comparison data.

5-point traffic light rating system schematic

Performance Rating	Symbol	For LOS this means:	For Costs & Achievement this means:	Trend Rating	Symbol	For LOS this means:
Very Good		Much Better than Peer Group Average	Much Less than Peer Group Average	Improving Trend		Positive Change towards a Very Good rating
Good		Better than Peer Group Average	Less than Peer Group Average	Worsening Trend		Negative Change away from a Very Good rating
Average/Moderate		Similar to the Peer Group Average	Similar to the Peer Group Average	Static Trend		No Change
Poor		Worse than Peer Group Average	Higher than Peer Group Average			
Very Poor		Much Worse than Peer Group Average	Much Higher than Peer Group Average			
No Data		No Data	No Data			

Work Categories:

WC 151 Network and Asset Management (Network User Information)

WC 341 Low Cost / Low Risk Improvements (Local Road Improvement, Walking and Cycling)

WC 421 Travel Demand Management

WC 432 Safety Promotion, Education and Advertising

5.1 Links to Strategic Case

Problem Statement:	**Safety** Northland has a narrow, winding and unforgiving rural road network which combined with poor driver behaviour has resulted in the region being a high Community at Risk for death and serious injury (DSI) crashes and the rate of DSI crashes is trending upward for FNDC and WDC. FNDC and KDC also have higher Collective Risks than their peer group. Line marking is becoming more expensive and more funding is required to comply with modern safety standards. The future challenge will be the maintenance and renewal costs for remarking. Safety funding levels insufficient to meet national target of reducing death and serious injuries by 40% by 2030 from 2020 baseline. A step change in funding is required to meet this target. **Growth and Demand** Rapid growth and lack of suitable mode shift options are causing congestion in Whangarei during commuter peaks and in Kerikeri / Waipapa and Mangawhai during peak holiday periods. Lack of mode shift options in the more remote communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation.
Benefits of Addressing Problem:	**Safety –** Fatal and serious injury crashes will decrease on our network, reducing the harm to our customers and communities. **Growth and Demand** – Increase in alternative mode use and less dependency on private vehicles resulting in lower levels of congestion and less vehicle emissions.
Consequences of Not Addressing the Problem:	**Safety –** Fatal and serious injury crashes will continue increasing and will continue to cause significant harm to our customers and communities. **Growth and Demand** – Continued dependency on private vehicle use with increasing levels of congestion and vehicle emissions.

5.2 Levels of Service

ONRC Customer Outcomes:	ONRC Safety CO1 – The Number of Fatal and Serious Injuries on the Network
	ONRC Safety CO2 – Collective Risk
	ONRC Safety CO3 – Personal Risk
Customer Levels of Service:	Waka Kotahi Communities at Risk Register
	ONRC Safety TO1 – Permanent Hazards (no data available)
	ONRC Safety TO3 – Sight Distances (no data available)
	ONRC Safety TO5 – Loss of driver control at night
	ONRC Safety TO6 – Intersections
	ONRC Safety TO9 – Vulnerable Users
	LTP 1.1.2 – The number change of fatal and serious crashes (current measure-DIA)

5.3 Evidence and Gap Analysis

ONRC Safety CO1 – Number of Fatal and Serious Injuries on the Network

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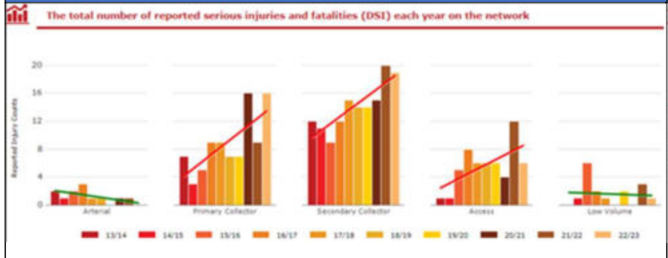
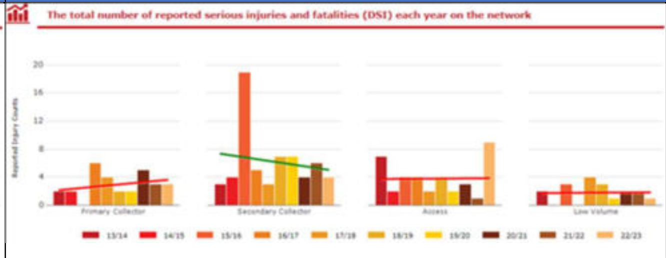
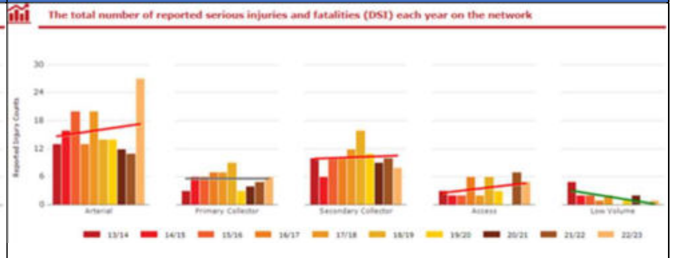
<tr><td>
</td><td>
</td><td>
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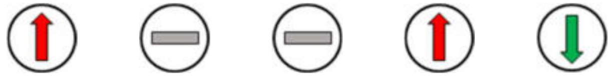
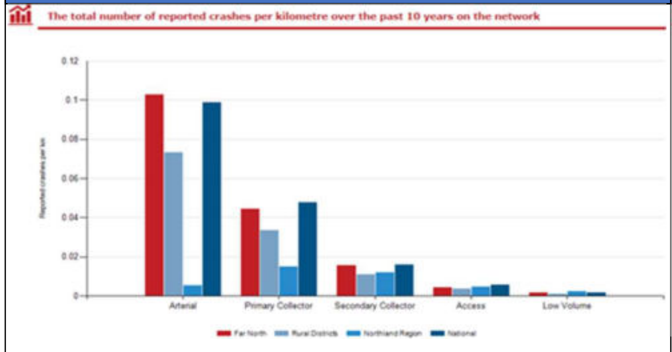
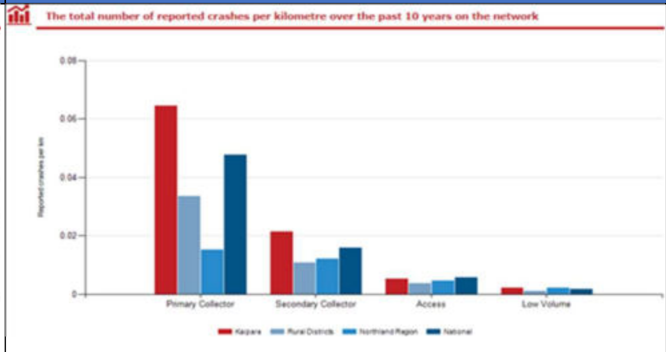
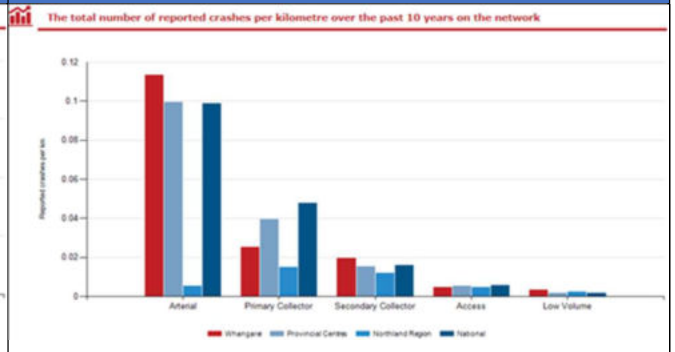
</td><td>Primary Collector | Secondary Collector | Access | Low Volume
</td><td>Arterial | Primary Collector | Secondary Collector | Access | Low Volume
</td></tr>
<tr><td>FNDC Number of DSI – There appears to be an increasing trend in death and serious injury (DSI) crashes on most of FNDC’s road classes, apart from the Arterial roads which are showing a decreasing trend.

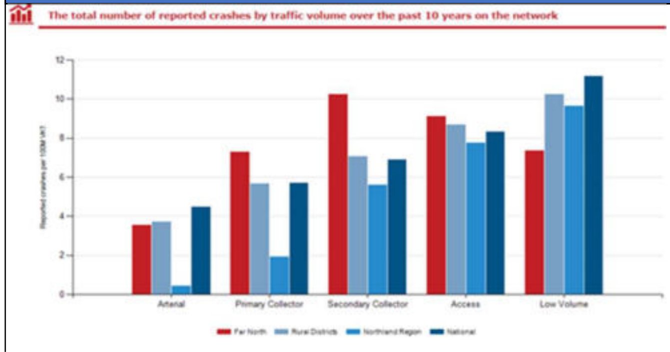
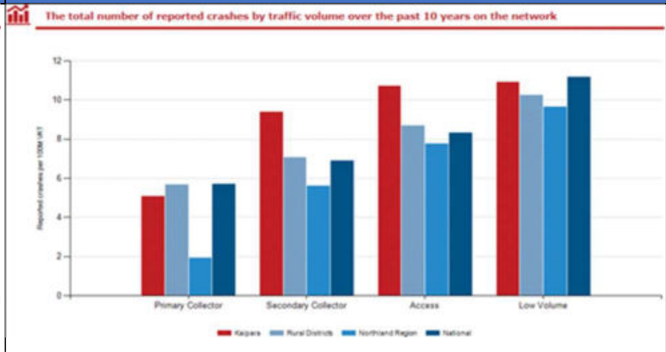
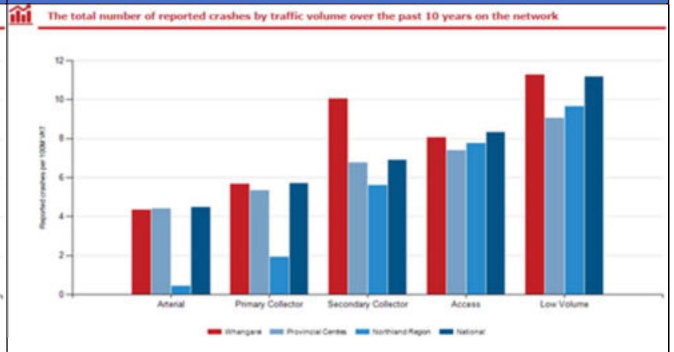
This increasing trend is a significant concern and reflects the unforgiving nature of the road network and often poor driver behaviour.</td><td>KDC Number of DSI – There appears to be a slightly increasing trend in death and serious injury (DSI) crashes on KDC’s Primary Collector and Access roads. The other road classes appear to be static or decreasing.</td><td>WDC Number of DSI - There appears to be an increasing or static trend in death and serious injury (DSI) crashes on all of WDC’s roads, apart from the Low Volume roads. The Arterial roads have a rapidly increase during the last year which is a significant concern.

As for Far North, this is likely to be a reflection of the unforgiving nature of the road network and growth in traffic volumes. The focus should be on addressing crashes on Arterials.</td></tr>
</table>

ONRC Safety CO2 – Collective Risk

<table>
<tr><th>FNDC</th><th>KDC</th><th>WDC</th></tr>
<tr><td>
</td><td>
</td><td>
</td></tr>
<tr><td>Arterial | Primary Collector | Secondary Collector | Access | Low Volume</td><td>Primary Collector | Secondary Collector | Access | Low Volume</td><td>Arterial | Primary Collector | Secondary Collector | Access | Low Volume</td></tr>
<tr><td> FNDC Collective Risk – The collective risk of the FNDC network is higher than its peer group for all road classes and is significantly higher for Arterial and Primary Collector roads. This is a strong indicator that FNDC have a higher number of DSI crashes/km (ie crash density) than its peer group and is a significant concern. In terms of the High-Risk Rural Roads (HRRR) classification, the collective risk of Arterial roads is Medium and is Low-Medium or Low for the other road classifications. This indicates the biggest benefit would be from addressing DSI crashes on the Arterial Road network </td><td> KDC Collective Risk - The collective risk of the KDC network is higher than its peer group for all road classes and is significantly higher for Primary and Secondary Collector roads. This is a strong indicator that KDC have a higher number of DSI crashes/km (ie crash density) than its peer group and is a significant concern. In terms of the High-Risk Rural Roads (HRRR) classification, the collective risk of Primary Collector roads is Medium and is Low for the other road classifications. This indicates the biggest benefit would be from addressing DSI crashes on the Primary Collector Road network. </td><td> WDC Collective Risk – The collective risk of the WDC network is generally equal to its peer group but slightly higher for its Arterial, Secondary Collector roads, and Low Volume roads. In terms of the High-Risk Rural Roads (HRRR) classification, the collective risk of Arterial roads is Medium-High and is Low for the other road classifications. This indicates the biggest benefit would be from addressing DSI crashes on the Arterial Road network. </td></tr>
</table>

ONRC Safety CO3 – Personal Risk

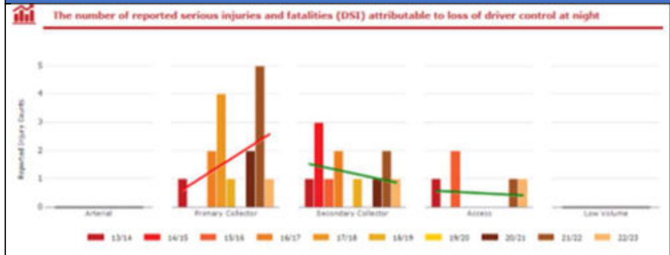
FNDC	KDC	WDC
		
Arterial, Primary Collector, Secondary Collector, Access, Low Volume	Primary Collector, Secondary Collector, Access, Low Volume	Arterial, Primary Collector, Secondary Collector, Access, Low Volume
FNDC Personal Risk – The personal risk of the FNDC network is significantly higher for Primary and Secondary Collector roads and higher for its Access roads. The Arterial and Low Volume roads are lower than the peer group. This is a strong indicator that FNDC have a higher number of DSI crashes/VKT (ie crash exposure) than its peer group on its collector and Access roads which is a significant concern given the amount of travel on these road classes. In terms of the High-Risk Rural Roads (HRRR) classification, the personal risk is High for all road classes apart from Primary Collectors which is Medium-High and Arterial roads which is Low-Medium	**KDC Personal Risk** - The personal risk of the KDC network is higher than the peer group for its Secondary Collector and Access roads but is comparable for the other road classes. This indicates that KDC have a higher number of DSI crashes/VKT (ie crash exposure) than its peer group on its Secondary Collector and Access roads which is a concern. In terms of the High-Risk Rural Roads (HRRR) classification, the personal risk is High for Secondary Collector, Access and Low Volume roads and Low-Medium for Primary Collector roads	**WDC Personal Risk** - The personal risk of the WDC network is higher than the peer group for most road classes, with exception for the Arterial roads, which is comparable. This indicates that WDC have a higher number of DSI crashes/VKT (ie crash exposure) than its peer group on its Collector, Access, and Low Volume roads which is a concern. In terms of the High-Risk Rural Roads (HRRR) classification, the personal risk is High for Secondary Collectors, Access and Low Volume roads, Medium-High for Primary Collector roads and Low-Medium for Arterial roads.

NZTA Communities at Risk Register

Communities at Risk Register 2022 Issue	FNDC	KDC	WDC	Northland
All Deaths and Serious Casualty	High	High		High
Young Drivers (of light vehicles aged 16-24 yrs)	High	High		High
Alcohol and/or Drugs	High	High	Medium	High
Speed (too fast for conditions)	High	High		High
Urban Intersections				
Rural Intersections				
All Intersections				
Rural Road Loss of Control and/or Head On	High	High		High
Motorcyclist Involved	Medium	High		Medium
Cyclist Involved	High	Medium	High	High
Pedestrian Involved	High	High	High	High
Distraction (crash factor: attention diverted)	High			Medium
Fatigue				
Older Road Users (aged 75yrs or older)				
Restraints (seatbelts not worn)	High	High		High

FNDC	KDC	WDC
FNDC Communities at Risk Register – FNDC has many areas of High Risk on the Communities at Risk Register including Death and Serious injury, Young Drivers, Alcohol/Drugs, Speed, Rural Road Loss of Control/Head On, Cyclists. Pedestrians, and Restraints. This indicates that there is significant need for on-going road safety improvement and effective road safety promotion in the Far North District.	**KDC Communities at Risk Register** – KDC has many areas of High Risk on the Communities at Risk Register including Death and Serious injury, Young Drivers, Alcohol/Drugs, Speed, Rural Road Loss of Control/Head On, Motorcyclist, Pedestrians, and Restraints. As for FNDC, this indicates that there is significant need for on-going improvement in safety in the Kaipara District.	**WDC Communities at Risk Register** – WDC has two areas of High Risk on the Communities at Risk Register, which is Cyclists and Pedestrians. Alcohol/Drugs also presents as Medium Risk. While the need for road safety promotion is less in Whangarei than for the other two districts, there is still a need for a sustained road safety programme to address these issues.

ONRC Safety TO5 – Loss of Driver Control at Night – Rural roads (top graph) & Urban roads (bottom graph)

<table>
<tr><th>FNDC</th><th>KDC</th><th>WDC</th></tr>
<tr>
<td>
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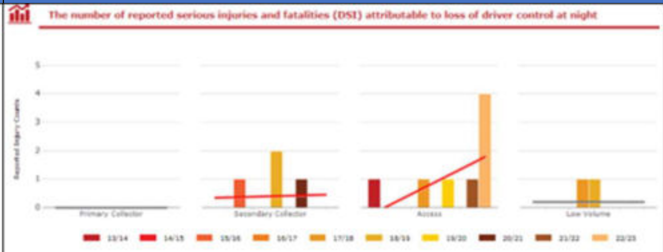
<td>
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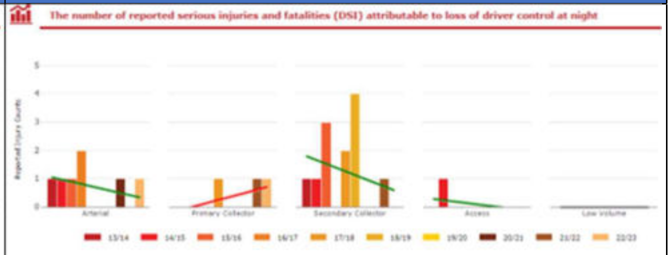
<td>
</td>
</tr>
<tr>
<td>Arterial | Primary Collector | Secondary Collector | Access | Low Volume</td>
<td>Primary Collector | Secondary Collector | Access | Low Volume</td>
<td>Arterial | Primary Collector | Secondary Collector | Access | Low Volume</td>
</tr>
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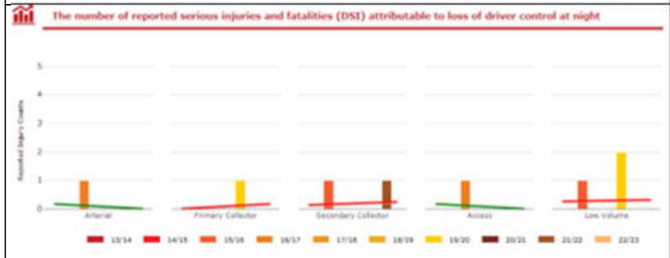
<td>
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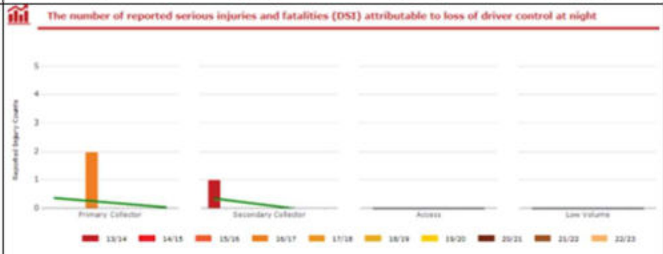
<td>
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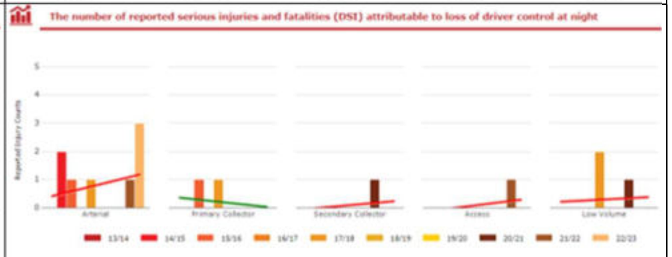
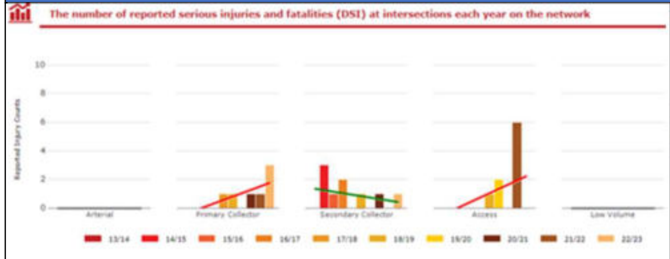
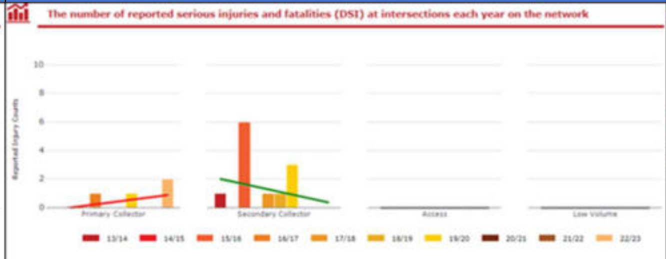
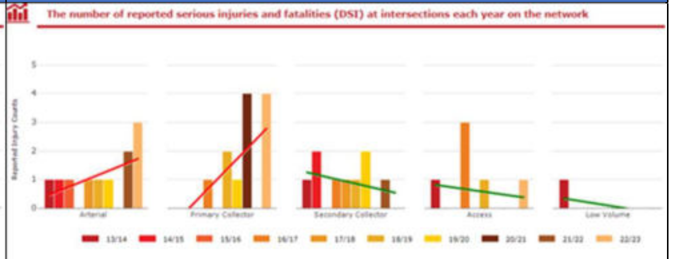
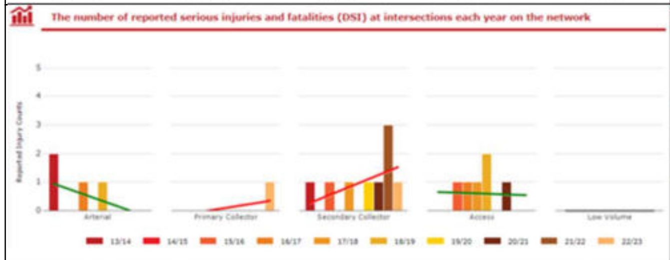
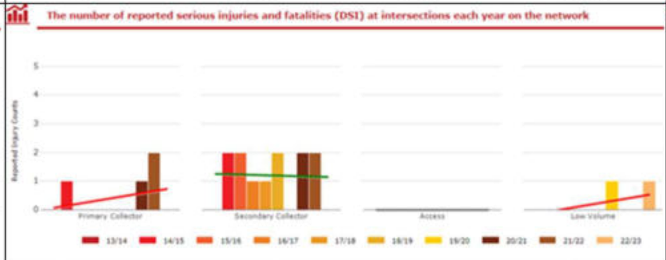
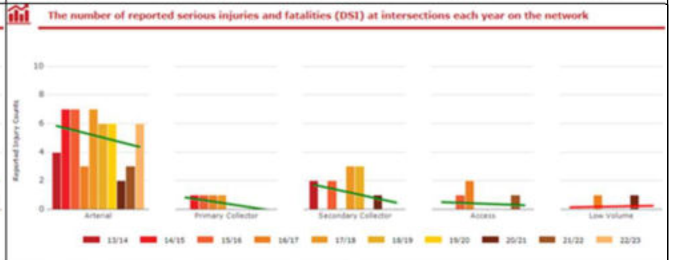
<td>
</td>
</tr>
<tr>
<td>Arterial | Primary Collector | Secondary Collector | Access | Low Volume</td>
<td>Primary Collector | Secondary Collector | Access | Low Volume</td>
<td>Arterial | Primary Collector | Secondary Collector | Access | Low Volume</td>
</tr>
<tr>
<td>FNDC Loss of Driver Control at Night DSI – It should be noted there is little data for nighttime crashes for rural roads and almost none for urban roads on the FNDC network. This makes it difficult to determine any issues or trends.

However, it appears that there may be an increasing trend in nighttime crashes on rural Primary Collector roads and urban Collector and Low Volume roads.</td>
<td>KDC Loss of Driver Control at Night DSI – It should be noted there is little data for nighttime crashes for rural roads and almost none for urban roads on the KDC network. This makes it difficult to determine any issues or trends.

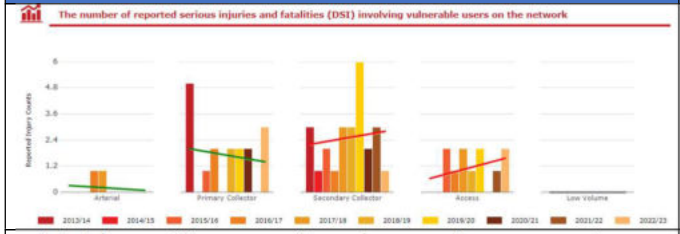
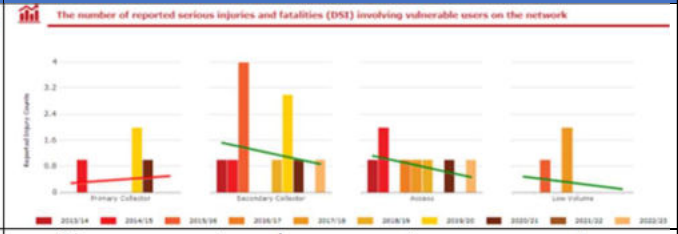
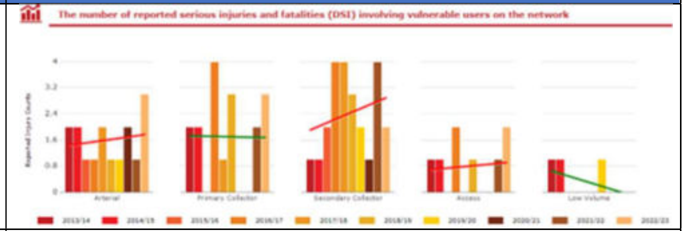
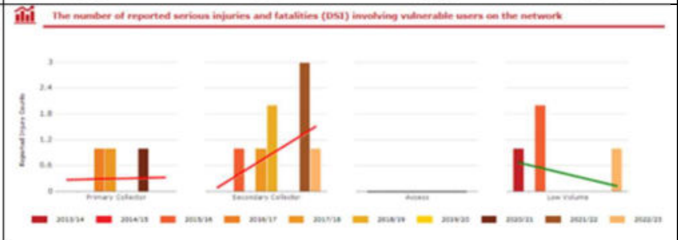
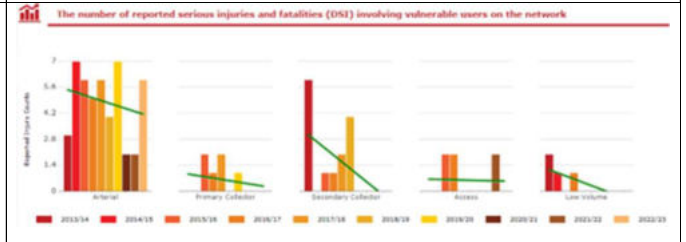
From the limited data available, there may be an increasing trend in nighttime crashes on the rural Access roads.</td>
<td>WDC Loss of Driver Control at Night DSI – It should be noted there is little data for nighttime crashes on the WDC network. This makes it difficult to determine any issues or trends.

However, it appears that there could be an increasing trend on most of the urban road classifications.</td>
</tr>
</table>

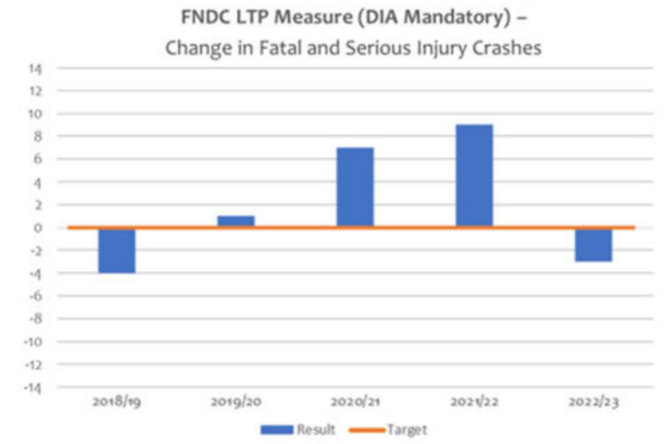
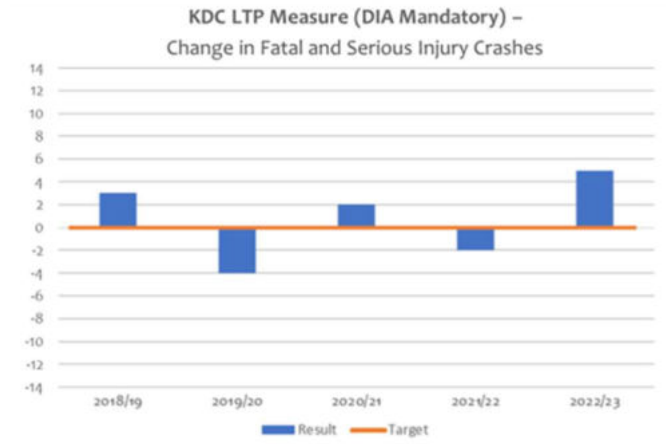
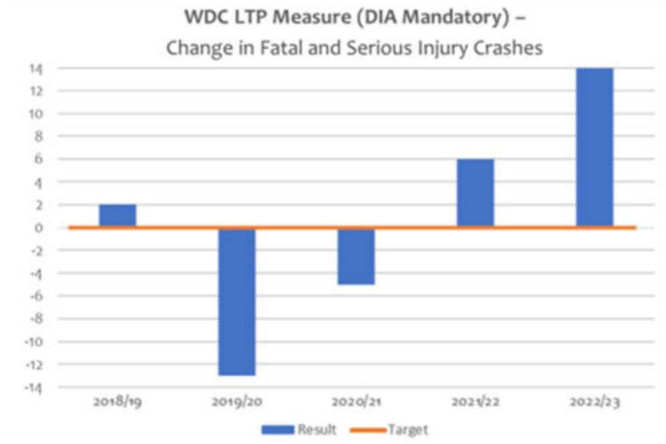
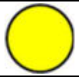
ONRC Safety TO6 – Intersection – Rural roads (top graph) & Urban roads (bottom graph)

FNDC	KDC	WDC
		
Arterial, Primary Collector, Secondary Collector, Access, Low Volume	Primary Collector, Secondary Collector, Access, Low Volume	Arterial, Primary Collector, Secondary Collector, Access, Low Volume
		
Arterial, Primary Collector, Secondary Collector, Access, Low Volume	Primary Collector, Secondary Collector, Access, Low Volume	Arterial, Primary Collector, Secondary Collector, Access, Low Volume
FNDC Intersection DSI – It should be noted there is very little data for intersection crashes on the FNDC network. This makes it difficult to determine any issues or trends. However, it appears that there may be an increasing trend in intersection crashes on the rural Primary Collector and Access roads and urban Collector roads.	**KDC Intersection DSI** - It should be noted there is very little data for intersection crashes on the KDC network. This makes it difficult to determine any issues or trends. From the limited data available, there may be an increasing trend in rural Primary Collector roads and urban Primary Collector and Low Volume roads.	**WDC Intersection DSI** – It should be noted there is little data for intersection crashes on many road classes for the WDC network. This makes it difficult to determine any issues or trends. It appears that there could be an increasing trend of intersection crashes on WDC's rural Arterial and Primary Collector roads.

ONRC Safety TO9 – Vulnerable Users – Rural roads (top graph) & Urban roads (bottom graph)

FNDC	KDC	WDC
		
Arterial · Primary Collector · Secondary Collector · Access · Low Volume	Primary Collector · Secondary Collector · Access · Low Volume	Arterial · Primary Collector · Secondary Collector · Access · Low Volume
		
Arterial · Primary Collector · Secondary Collector · Access · Low Volume	Primary Collector · Secondary Collector · Access · Low Volume	Arterial · Primary Collector · Secondary Collector · Access · Low Volume
FNDC Vulnerable User DSI – It should be noted there is little data for vulnerable user crashes for rural roads and less for urban roads on the FNDC network. This makes it difficult to determine any issues or trends. However, it appears there may be an increasing trend in vulnerable user crashes on urban Secondary Collector and Low Volume roads. During the last ten years, approximately 70% of vulnerable user crashes involved motorcyclists or mopeds.	**KDC Vulnerable User DSI** – It should be noted there is little data for vulnerable user crashes for rural roads and less for urban roads on the KDC network. This makes it difficult to determine any issues or trends. It appears there may be an increasing trend in crashes on urban Secondary Collector roads. During the last ten years, approximately 80% of vulnerable user crashes involved motorcyclists or mopeds.	**WDC Vulnerable User DSI** – It should be noted there is little data for vulnerable user crashes on many road classes for the WDC network. This makes it difficult to determine any issues or trends. However, it appears there could be an increasing trend in vulnerable user crashes on the rural Arterial and Secondary Collector roads. During the last ten years, approximately 50% of vulnerable user crashes involved motorcyclists or mopeds.

LTP Measure – Change in Number of Fatal and Serious Injury Crashes (DIA)

FNDC	KDC	WDC
		
		
FNDC Change in Fatal and Serious Injury Crashes – The number of fatal and serious injury crashes has increased on FNDC's network over the past five years by an average of 2.0 per year. The average rate of increase is similar over a longer, 10-year, period. The long term period of sustained and high rate of increase is a serious concern.	**KDC Change in Fatal and Serious Injury Crashes** – The number of fatal and serious injury crashes has increased on KDC's network over the past five years by an average of 0.8 per year. The average change is flatter over a longer, 10-year, period and the trend over this longer term indicates that change is near static. However, taking in account the latest five years, the result is not optimistic and the trends remain a cause for concern.	**WDC Change in Fatal and Serious Injury Crashes** – The number of fatal and serious injury crashes has increased on WDC's network over the past five years by an average of 0.8 per year. The changes over a longer, 10-year, period indicate there is a generally increasing trend and there is a greater rate of increase during the past five years. The long term period of sustained increase along with the recent changes during the past two years are a significant concern.

Summary

FNDC	KDC	WDC
Far North's Collective Risk is higher than its peer group for all road classes, and its Personal Risk is higher for the Primary and Secondary Collector and Access roads. FNDC has many areas of High Risk on the Communities at Risk Register including Death and Serious injury, Young Drivers, Alcohol/Drugs, Speed, Rural Road Loss of Control/Head On, Cyclists, Pedestrians, and Restraints. This indicates that there is significant need for on-going road safety improvement and effective road safety promotion in the Far North District. Night time crashes appear to be increasing on FNDC's rural Primary Collector roads and urban Collector roads. Intersection crashes appear to be increasing on the rural Primary Collector and Access roads and urban Collector roads. Vulnerable user crashes appear to be increasing on FNDC's urban Secondary Collector and Low Volume roads. During the last ten years, approximately 70% of vulnerable user crashes involved motorcyclists or mopeds. There is an increasing trend in death and serious injury (DSI) crashes on all of FNDC's road classes, apart from the Arterial roads. The number of fatal and serious injury crashes has increased on FNDC's network over the past five years by an average of 2.0 per year. The average rate of increase is similar over a longer, 10-year, period. The long term period of sustained and high rate of increase is a serious concern.	Kaipara's Collective Risk is higher than its peer group for all road classes and is significantly higher for Primary and Secondary Collector roads. The Personal Risk of the KDC network is higher than the peer group for its Secondary Collector and Access roads. KDC has many areas of High Risk on the Communities at Risk Register including Death and Serious injury, Young Drivers, Alcohol/Drugs, Speed, Rural Road Loss of Control/Head On, Motorcyclist, Pedestrians, and Restraints. This indicates that there is significant need for on-going road safety improvement and effective road safety promotion in the Kaipara District. Night time crashes appear to be increasing on KDC's rural Access roads. Intersection crashes appear to be increasing on the rural Primary Collector roads and urban Primary Collector and Low Volume roads. Vulnerable user crashes appear to be increasing on KDC's urban Secondary Collector roads. During the last ten years, approximately 80% of vulnerable user crashes involved motorcyclists or mopeds. There appears to be a slightly increasing trend in death and serious injury (DSI) crashes on KDC's Primary Collector and Access roads. The other road classes appear to be static or decreasing. The number of fatal and serious injury crashes has increased on KDC's network over the past five years by an average of 0.8 per year. The average change is flatter over a longer, 10-year, period and the trend over this longer term indicates that change is near static. However, taking in account the latest five years, the result is not optimistic, and the trends remain a cause for concern.	Whangarei's Collective Risk is generally equal to its peer group but slightly higher for its Arterial, Secondary Collector roads, and Low Volume roads. However, the personal risk is higher than the peer group for most road classes, with exception for the Arterial roads, which is comparable. WDC has two areas of High Risk on the Communities at Risk Register, which is Cyclists and Pedestrians. Alcohol/Drugs also presents as Medium Risk. While the need for road safety promotion is less in Whangarei than for the other two districts, there is still a need for a sustained road safety programme to address these issues. Night time crashes appear to be increasing on most of WDC's urban road classifications. Intersection crashes appear to be increasing on the rural Arterial and Primary Collector roads Vulnerable user crashes appear to be increasing on KDC's urban Secondary Collector roads. During the last ten years, approximately 80% of vulnerable user crashes involved motorcyclists or mopeds. There appears to be an increasing or static trend in death and serious injury (DSI) crashes on all WDC's roads, apart from the Low Volume roads. The Arterial roads have a rapidly increase during the last year which is a significant concern. The number of fatal and serious injury crashes has increased on WDC's network over the past five years by an average of 0.8 per year. The changes over a longer, 10-year, period indicate there is a generally increasing trend and there is a greater rate of increase during the past five years. The long term period of sustained increase along with the recent changes during the past two years are a significant concern.

5.4 Options to be Considered

Based on the above data and the root cause analysis, the following options have been considered:

Safety – Improvements

Option	Description
Option 1 – Speed management programme	Continue to progress the speed management programme (including school zone signs) to provide speed limits appropriate for the road environment on High Risk Rural Road (HRRR) routes or urban areas
Option 2 – Curve warning signage and marking upgrades on HRRR.	Develop corridor curve warning and marking upgrades on HRRR routes. Sign out of context curves.
Option 3 – Audible Tactile Profile (ATP) markings on HRRR	Provide Audible Tactile Profile (ATP) markings on edgelines on HRRR routes.
Option 4 – Prioritise safe pedestrian and cyclist crossing points	Prioritise safe crossing points such as mid-block crossings, zebra crossings and raised platforms.
Option 5 – Hazard removal or protection on HRRR. Provide compliant sight rails	Hazard removal or protection on HRRR routes. This includes service poles, deep roadside drains and steep cut and fill batters. Provide compliant sight rails (half eye-height).
Option 6 – Minor alignment improvements on HRRR	Consider minor alignment improvements on High Risk Rural Road (HRRR) routes to address high risk curves.
Option 7 – Upgrade programme for old, obsolete or non-compliant guardrails	Consider an upgrade programme for old, obsolete guardrails and bridge rails to bring these to standard on HRRR routes or possibly in conjunction with rehabilitations on other significant routes.

PBC Multi Criteria Option Analysis, RCA: NTA

Activity/Work Categories: Safety (WC 341)

Short list up to 3 options from the following:

Option - Can we make	Yes/No	Rank	Reason
❑ Intervention response **timing** change			
❑ **LoS** adjustments			
❑ Use existing assets **differently**			
❑ **Blending** Work Categories differently			
❑ **Risk** - Hold Assets longer	Yes	1	Continue to progress the speed management programme (including school zone signs) to provide speed limits appropriate for the road environment on High Risk Rural Road (HRRR) routes or urban areas
❑ Managing **demand**			
❑ **Route** Management	Yes	6 - A 3 - B 5 - C 7 - D 2 - E 4 - F	A. Consider minor alignment improvements on High Risk Rural Road (HRRR) routes. B. Provide Audible Tactile Profile (ATP) markings on edgelines on HRRR routes. C. Hazard removal or protection on HRRR routes. This includes service poles, deep roadside drains and steep cut and fill batters. Provide compliant sightrails (half eye-height). D. Consider an upgrade programme for old, obsolete guardrails and bridge rails to bring these to standard on HRRR routes or possibly in conjunction with rehabilitations on other significant routes. E. Develop corridor curve warning and marking upgrades on HRRR routes. Sign out of context curves. F. Prioritise safe crossing points such as mid-block crossings, zebra crossings and raised platforms.
❑ Alternative approaches – different **solutions/technology**			
❑ **Maintenance vs Renewal** adjustments			
❑ **ONRC** Classification variance			
❑ Extended **temporary** management			
❑ **Supply chain** improvements			
❑ Improve **systems and capability**			

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

Criteria	Weighting (Importance) (Total to 100%)	How good is this option													
		Option 1 - Speed management programme		Option 2 - Curve warning signage and marking upgrades on HRRR.		Option 3 - Audible Tactile Profile (ATP) markings on HRRR		Option 4 - Prioritise safe pedestrian and cyclist crossing points		Option 5 - Hazard removal or protection on HRRR. Provide compliant sight rails		Option 6 - Minor alignment improvements on HRRR		Option 7 - Upgrade programme for old, obsolete or non-compliant guardrails	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	10%	2	0.2	1	0.1	0	0	3	0.3	2	0.2	2	0.2	0	0
Problem solving effectiveness	10%	3	0.3	3	0.3	3	0.3	2	0.2	2	0.2	2	0.2	1	0.1
Benefits realised	10%	3	0.3	3	0.3	3	0.3	2	0.2	2	0.2	1	0.1	1	0.1
Good Environmental impacts	5%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Value for Money	10%	2	0.2	3	0.3	2	0.2	1	0.1	1	0.1	1	0.1	0	0
Closing Customer and Technical LoS gaps and impacts	10%	2	0.2	2	0.2	2	0.2	1	0.1	1	0.1	1	0.1	1	0.1
Closing ONRC Performance gaps	10%	1	0.1	1	0.1	1	0.1	1	0.1	1	0.1	1	0.1	0	0
Asset preservation and sustainability	10%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Cost of Ownership (whole of life Costs)	10%	0	0	0	0	-1	-0.1	0	0	0	0	0	0	0	0
Life Cycle Management	10%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COVID-19 Recovery	5%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	**100%**		**1.3**		**1.3**		**1.0**		**1.0**		**0.9**		**0.8**		**0.3**

Safety Promotion and Demand Management

Option	Description
Option 1 - NTA inhouse road safety coordinator	NTA to provide resource to better supervise road safety promotion activities to focus on achieving better driver behaviour change outcomes.
Option 2 – Continue existing road safety promotion campaigns	Continue existing road safety campaigns to educate on the use of alcohol/drugs, restraints, fatigue, young drivers, subsidised driver licence scheme (FNDC). Continue with development/roll out of mobile driver licence testing station (FNDC).
Option 3 – Enhance the speed education programme	Enhance the current road safety programme for speeding, to get better impact.
Option 4 – Implement travel planning such as New Plymouth's LetsGo programme	Implement travel planning campaigns such as New Plymouth's LetsGo to promote active modes and bus use which will result in better health impacts, reduced emissions and less congestion. These campaigns will target schools, businesses and the general public.
Option 5 – Promote vehicle maintenance and safer vehicles	Promote the importance of vehicle maintenance and safer, but affordable vehicles through the road safety promotion programme.
Option 6 – Travel demand management in Kerikeri and Mangawhai during summer peak traffic	Implement travel demand management to reduce summer peak traffic in Kerikeri and Mangwhai. This could include summer bus services (such as the Mangawhai seasonal service trialled in 2019/20).

PBC Multi Criteria Option Analysis, RCA: NTA

Activity/Work Categories: Safety Promotion & Demand Management (WC 421, WC 432)

Short list up to 3 options from the following:

Option - Can we make	Yes/No	Rank	Reason
❑ Intervention response **timing** change			
❑ **LoS** adjustments			
❑ Use existing assets **differently**			
❑ **Blending** Work Categories differently			
❑ **Risk** - Hold Assets longer			
❑ Managing **demand**	Yes	2 - A 3 - B 5 - C 6 - D 4 - E	A. Continue existing road safety campaigns to educate on the use of alcohol/drugs, restraints, fatigue, young drivers, subsidised driver licence scheme (FNDC). Continue with development/roll out of mobile driver licence testing station (FNDC). B. Enhance the current road safety programme for speeding, to get better impact. C. Promote the importance of vehicle maintenance and safer, but affordable vehicles through the road safety promotion programme. D. Implement travel demand management to reduce summer peak traffic in Kerikeri and Mangwhai. This could include summer bus services (such as the Mangawhai seasonal service trialled in 2019/20). E. Implement travel planning campaigns such as New Plymouth's LetsGo to promote active modes and bus use.
❑ **Route** Management			
❑ Alternative approaches – different **solutions/technology**			
❑ **Maintenance vs Renewal** adjustments			
❑ **ONRC** Classification variance			
❑ Extended **temporary** management			
❑ **Supply chain** improvements			
❑ Improve **systems and capability**	Yes	1	NTA to provide resource to better supervise road safety promotion activities to focus on achieving better outcomes.

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

Criteria	Weighting (Importance) (Total to 100%)	How good is this option											
		Option 1 - NTA inhouse road safety coordinator		Option 2 - Continue existing road safety promotion campaigns		Option 3 - Enhance the speed education programme		Option 4 - Implement travel planning such as New Plymouth's LetsGo programme		Option 5 - Promote vehicle maintenance and safer vehicles		Option 6 - Travel demand management in Kerikeri and Mangawhai during summer peak traffic	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	10%	1	0.1	2	0.2	2	0.2	2	0.2	1	0.1	2	0.2
Problem solving effectiveness	10%	2	0.2	2	0.2	2	0.2	2	0.2	1	0.1	1	0.1
Benefits realised	10%	2	0.2	2	0.2	2	0.2	2	0.2	1	0.1	1	0.1
Good Environmental impacts	5%	0	0	0	0	0	0	1	0.05	0	0	0	0
Value for Money	10%	2	0.2	1	0.1	2	0.2	3	0.3	1	0.1	1	0.1
Closing Customer and Technical LoS gaps and impacts	10%	1	0.1	1	0.1	1	0.1	1	0.1	1	0.1	1	0.1
Closing ONRC Performance gaps	10%	0	0	0	0	0	0	0	0	0	0	0	0
Asset preservation and sustainability	10%	0	0	0	0	0	0	0	0	0	0	0	0
Total Cost of Ownership (whole of life Costs)	10%	0	0	0	0	0	0	0	0	0	0	0	0
Life Cycle Management	10%	0	0	0	0	0	0	0	0	0	0	0	0
COVID-19 Recovery	5%	1	0.05	0	0	0	0	0	0	0	0	0	0
Totals	**100%**		**0.85**		**0.8**		**0.9**		**1.1**		**0.5**		**0.6**

5.5 Option Assessment and Line of Sight

The options and the line of sight to the preferred strategic response and the problems they are addressing are shown in the table below. These options have been ranked in order of preference and then have been assessed through a multi-criteria assessment (MCA) to determine the highest scoring options that are preferred and are to be adopted. The MCA assessment is also provided as follows.

Safety – Improvements

Work Activity	Problem Statements Addressing	Preferred Strategic Response	PBC Options to be Considered	Option Rank	MCA Score	Preferred Options
Improvements	Northland has a narrow, winding and unforgiving rural road network which combined with poor driver behaviour has resulted in the region being a high Community at Risk for death and serious injury (DSI) crashes and the rate of DSI crashes is trending upward for FNDC and WDC. FNDC and KDC also have higher Collective Risks than their peer group. Line Marking is becoming more expensive and more funding is required to comply with modern safety standards. The future challenge will be the maintenance and renewal costs for remarking. Safety funding levels insufficient to meet national target of reducing death and serious injuries by 40% by 2030 from 2020 baseline. A step change in funding is required to meet this target.	**Programme Adjustment** • Increase safety programme. **Policy Approach** • Additional delineation. **Demand Management** • Enhanced Road Safety Promotions with active in-house management.	**Programme Adjustment**			
			Route Management			
			• Option 2 - Curve warning signage and marking upgrades on HRRR.	2	1.3	Yes
			• Option 4 - Prioritise safe pedestrian and cyclist crossing points.	4	1.0	Yes
			• Option 5 - Hazard removal or protection on HRRR. Provide compliant sight rails	5	0.9	Yes
			• Option 6 - Minor alignment improvements on HRRR.	6	0.8	Yes
			• Option 7 - Upgrade programme for old, obsolete or non-compliant guardrails.	7	0.3	No
			Policy Approach			
			Risk			
			• Option 1 - Speed management programme.	1	1.3	Yes
			Route Management			
			• Option 3 - Audible Tactile Profile (ATP) markings on HRRR.	3	1.0	Yes

Safety Promotion and Demand Management

Work Activity	Problem Statements Addressing	Preferred Strategic Response	PBC Options to be Considered	Option Rank	MCA Score	Preferred Options
Safety Promotion	**Safety** – Northland has a narrow, winding and unforgiving rural road network which combined with poor driver behaviour has resulted in the region being a high Community at Risk for death and serious injury (DSI) crashes and the rate of DSI crashes is trending upward for FNDC and WDC. FNDC and KDC also have higher Collective Risks than their peer group. Line Marking is becoming more expensive and more funding is required to comply with modern safety standards. The future challenge will be the maintenance and renewal costs for remarking. Safety funding levels insufficient to meet national target of reducing death and serious injuries by 40% by 2030 from 2020 baseline. A step change in funding is required to meet this target.	**Programme Adjustment** • Increase safety programme. **Policy Approach** • Additional delineation. **Demand Management** • Enhanced Road Safety Promotions with active in-house management.	**Policy Approach** **Improve Systems and Capability** • Option 1 - NTA inhouse road safety coordinator. **Demand Management** **Managing Demand** • Option 2 - Continue existing road safety promotion campaigns. • Option 3 - Enhance the speed education programme. • Option 5 - Promote vehicle maintenance and safer vehicles.	1 2 3 5	0.85 0.8 0.9 0.5	Yes Yes Yes Yes
Travel Demand Management	**Growth and Alternative Transport:** – Rapid growth and lack of suitable mode shift options are causing congestion in Whangarei during commuter peaks and in Kerikeri / Waipapa and Mangawhai during peak holiday periods. Lack of mode shift options in the more remote communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation.	**Programme Adjustment** • Intersection and road upgrades including bus priority lanes, new link roads • Shared path networks for Whangarei, Kerikeri/Waipapa and Mangawhai **Policy Approach** • Increase bus frequency in Whangarei and expand rural services **Demand Management** • Travel planning and mode shift promotion. • Increase all-day parking charges	**Demand Management** **Managing Demand** • Option 4 - Implement travel planning such as New Plymouth's LetsGo programme. • Option 6 - Travel demand management in Kerikeri and Mangawhai during summer peak traffic.c	4 6	1.1 0.6	Yes Yes

Preferred Options

From the multi-criteria assessment the preferred options are:

Safety – Improvements

- Option 1 – Speed management programme.
- Option 2 – Curve warning signage and marking upgrades on HRRR.
- Option 3 – Audible Tactile Profile (ATP) markings on HRRR.
- Option 4 – Prioritise safe pedestrian and cyclist crossing points.
- Option 5 – Hazard removal or protection on HRRR. Provide compliant sight rails.
- Option 6 – Minor alignment improvements on HRRR.

Safety Promotion and Demand Management

- Option 1 – NTA inhouse road safety coordinator.
- Option 2 – Continue existing road safety promotion campaigns.
- Option 3 – Enhance the speed education programme.
- Option 4 – Implement travel planning such as New Plymouth's LetsGo programme.
- Option 5 – Promote vehicle maintenance and safer vehicles.
- Option 6 – Travel demand management in Kerikeri and Mangawhai during summer peak traffic.

5.6 Financial Impact

The following tables show the work categories and examples of the associated tasks. For full financial details for the work categories, refer to Section 08 (Financials).

5.6.1 Far North District Council

Work Category	Financial Impact
WC 341 Low Cost / Low Risk Improvements	Substantial increase in safety funding, interventions include corridor treatments such as signs and markings, guardrails, speed management and pedestrian safety. Funding for a resilience programme to address ongoing slips on critical routes. Funding for associated improvements on pavement rehabilitation projects. Funding to provide new detour routes and improved resilience of existing detour routes identified through the Integrated Transport Plan. Funding for new roading upgrades to improve access to communities as identified in the Twin Coast Discovery Route PBC and incorporated into the Integrated Transport Plan. Funding for new wayfinding signage as identified in the Twin Coast Discovery Route PBC. Funding for township upgrades as identified in the Twin Coast Discovery Route PBC and Integrated Transport Plan. Funding for behaviour change initiatives including the removal of barriers for mobility impaired. Programme identified through the Integrated Transport Plan.
WC 421 Travel Demand Management	Funding to create travel demand management for the District.
WC 432 Safety Promotion, Education and Advertising	Funding for continuation of the existing road safety programmes as well as to set up a Kerikeri REAP and provide an NTA in-house coordinator to drive the regional safety outcomes. Funding for Bikes Skills Training to provide the skills to safely use the new cycle lanes and paths identified through the Principle Cycle Network and Integrated Transport Plan.

5.6.2 Kaipara District Council

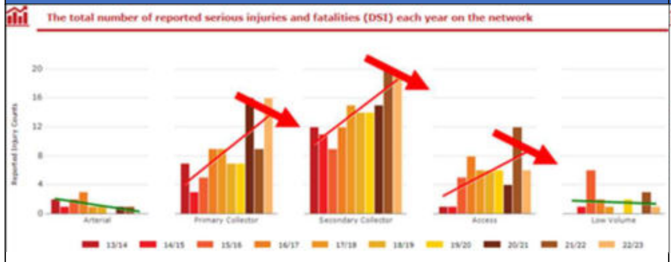
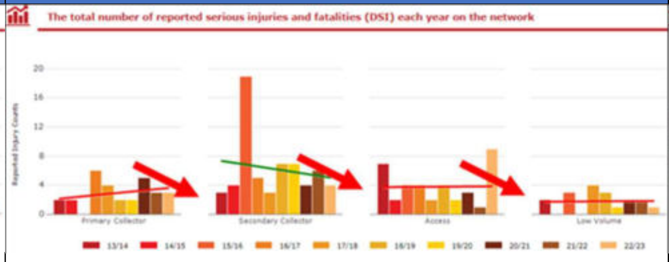
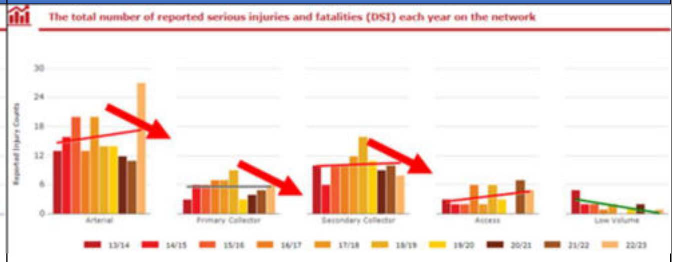
Work Category	Financial Impact
WC 341 Low Cost / Low Risk Improvements	Substantial increase in safety funding, interventions include corridor treatments such as signs and markings, speed management and pedestrian safety. Funding for a resilience programme to address ongoing slips on critical routes. Funding for associated improvements on pavement rehabilitation projects.
WC 432 Road Safety Promotion	Funding for continuation of the existing road safety programmes as well as to provide an NTA in-house coordinator to drive the regional safety outcomes. Funding for Bikes Skills Training to provide the skills to safely use the new cycle lanes and paths identified through the Principle Cycle Network and Integrated Transport Plan.
WC 421 Travel Demand Management	Funding to create travel demand management for the District.

5.6.3 Whangarei District Council

Work Category	Financial Impact
WC 341 Low Cost / Low Risk Improvements	Substantial increase in safety funding, interventions include corridor treatments such as signs and markings, guardrails, speed management and pedestrian safety. Funding for a resilience programme to address ongoing slips on critical routes. Funding for associated improvements on pavement rehabilitation projects.
WC 432 Road Safety Promotion	Funding for continuation of the existing road safety programmes as well as to provide an NTA in-house coordinator to drive the regional safety outcomes. Funding for Bikes Skills Training to provide the skills to safely use the new on-road cycle lanes and shared paths identified through the Principle Cycle Network and Walking and Cycling Strategy.
WC 421 Travel Demand Management	Funding to create travel demand management for the District.

5.7 Level of Service Impact

The following table shows the expected Level of Service impact of the options selected:

FNDC	KDC	WDC
		
Safety – We expect the crash trend on Collector roads and Access roads to decrease. This will be achieved through investment in: • corridor treatments on these routes, such as: speed management, signs and markings, hazard protection, and pedestrian safety in urban areas. • continued implementation and improvement in road safety education and promotion.	**Safety** – We expect the crash trend on Collector roads and Access roads to decrease. This will be achieved through investment in: • corridor treatments on these routes, such as: speed management, signs and markings, hazard protection, and pedestrian safety in urban areas. • continued implementation and improvement in road safety education and promotion.	**Safety** – We expect the crash trend on Arterial roads and Collector roads to decrease. This will be achieved through investment in: • corridor treatments on these routes, such as: speed management, signs and markings, hazard protection, and pedestrian safety in urban areas. • continued implementation and improvement in road safety education and promotion.

5.8 AMP Improvement

The following improvements should be considered:

- Complete the NTA Regional Speed Management Plan
  - Incorporate Northland Road Safety Management Strategy
  - Wet Road Curve Strategy.
- Guardrail end terminal and length of need assessment.
- Road safety promotion measures.

Northland Road Safety Action Plan 2023/24

Kaipara District, Whangarei District, and Far North District, July 2023 – June 2024

Date: 31/08/2023

Author: Nicole Cauty and Kayla Gunson

Northland
REGIONAL COUNCIL
Te Kaunihera ā rohe o Te Taitokerau

Introduction to Road Safety

Everyone should expect to travel safely regardless of how they choose to use our roads. A safe and accessible transport system is essential for a vibrant, healthy society and allows everyone to fully participate in the economic and social life of our region.

As a country, our road safety record is poor. New Zealand currently ranks 29th out of 33 OECD countries for road deaths. The road death rate in New Zealand is 7.9 per 100,000 population, while comparative countries with good safety performances have rates between 2 and 4 per 100,000 population.

Transport safety remains a persistent, ongoing problem for Northland as a region. In fact, Northland's death rate has exceeded the national average for the last 20 years. There is no doubt we need to improve our road safety records; this is a major issue we cannot ignore. Without strong action, more lives will be lost, and society will suffer the economic and social consequences.

In response, the government has developed a road safety strategy using international research to prevent serious and fatal crashes on New Zealand roads.

The Northland Road Safety Action Plan (RSAP) is an integrated, evidence-based plan, incorporating the national road safety directive, which is backed up by the latest international research. It identifies priority areas of action based on evidence-based data from the Crash Analysis System (CAS), Hospitalisation and Injury related data from both the Northland DHB & ACC partners. It is available to assist and guide our partners regarding local action plans in tackling the identified local & regional issues. RSAP shows where investments will be allocated over the following year to improve road safety on Northland roads. The Plan also demonstrates how road safety targets from the Regional Land Transport Plan for Northland (RLTP) will be achieved. Achieving Northland's Road to Zero will take collaboration, focus, funding, and proper management across all sectors.

Far too many road deaths and serious injuries occur each year on our roads. It is understood that safety is not a stand-alone activity, it is a direct result of transport policies, practices, and land use planning. Our road safety goals can only be achieved by consistently working closely with our regional road safety partners who are equally committed to creating and maintaining safer roads. Our plan is guided by Vision Zero – a world leading safety response that has been successful in reducing road trauma worldwide.

This plan outlines Northland's commitment to reduce road trauma through the implementation of regionally specific and relevant measures that align with Vision Zero. This document is reviewed annually.

Why a Safe Transport System Matters

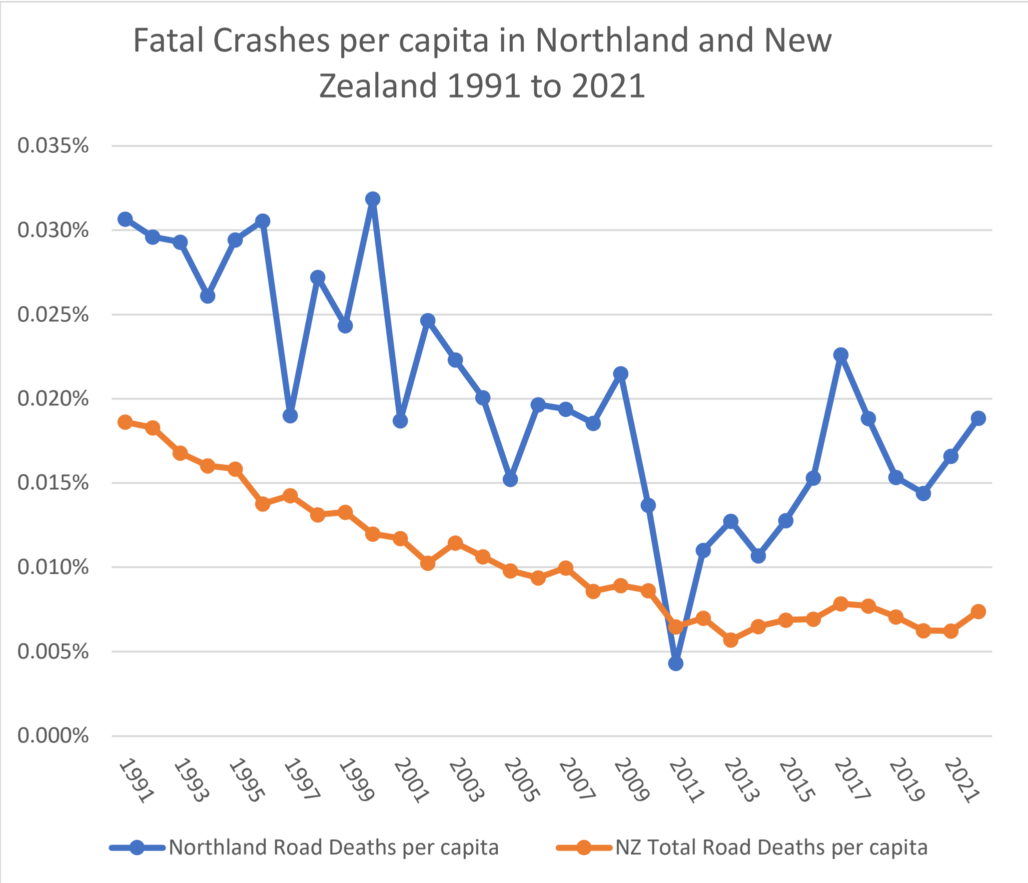
In 2022, 378 people were killed on New Zealand's transport network and thousands more were seriously injured. This level of trauma happens every year. In the Northland region, 38 people were killed and 173 were seriously injured, making it the deadliest year in 22 years. Our region's road fatalities are nearly 3x* what the region might expect based on our population numbers. These numbers are unacceptable, in fact no road deaths are acceptable.

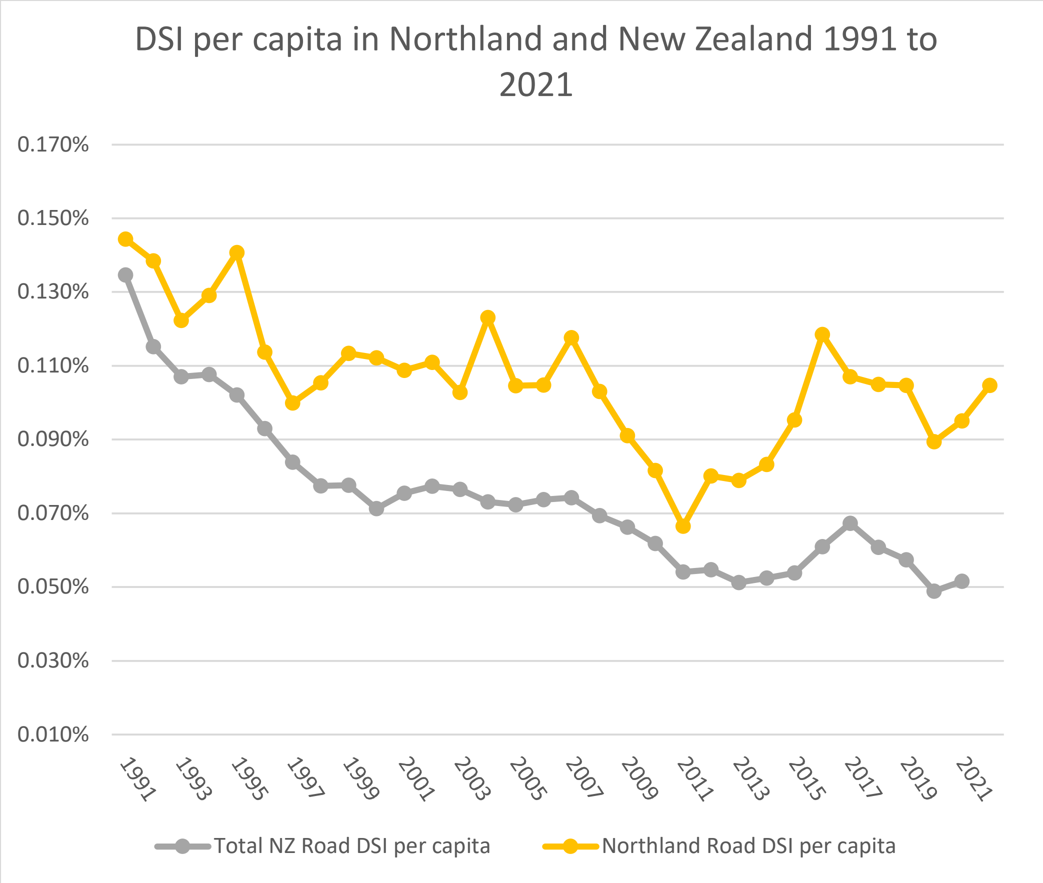
*https://www.transport.govt.nz/area-of-interest/safety/road-to-zero/#:~:text=New%20Zealand%20has%20committed%20to,by%2040%20percent%20by%202030.

Beyond direct injuries or death, the social impacts and costs include reduced quality of life and productivity, medical and legal costs, property damage costs, and impacts on family, workmates, and loss of social connection. The total social cost of $377 million is **4% of Northland's GDP**.

"Crashes are inevitable. Death or serious injuries as a result should not be."

With a long-term consistent downward trend, during the last 10 years there has been an increasing trend in road casualties. The past three years have been steadily worsening and immediate actions need to be taken to reverse this trend.



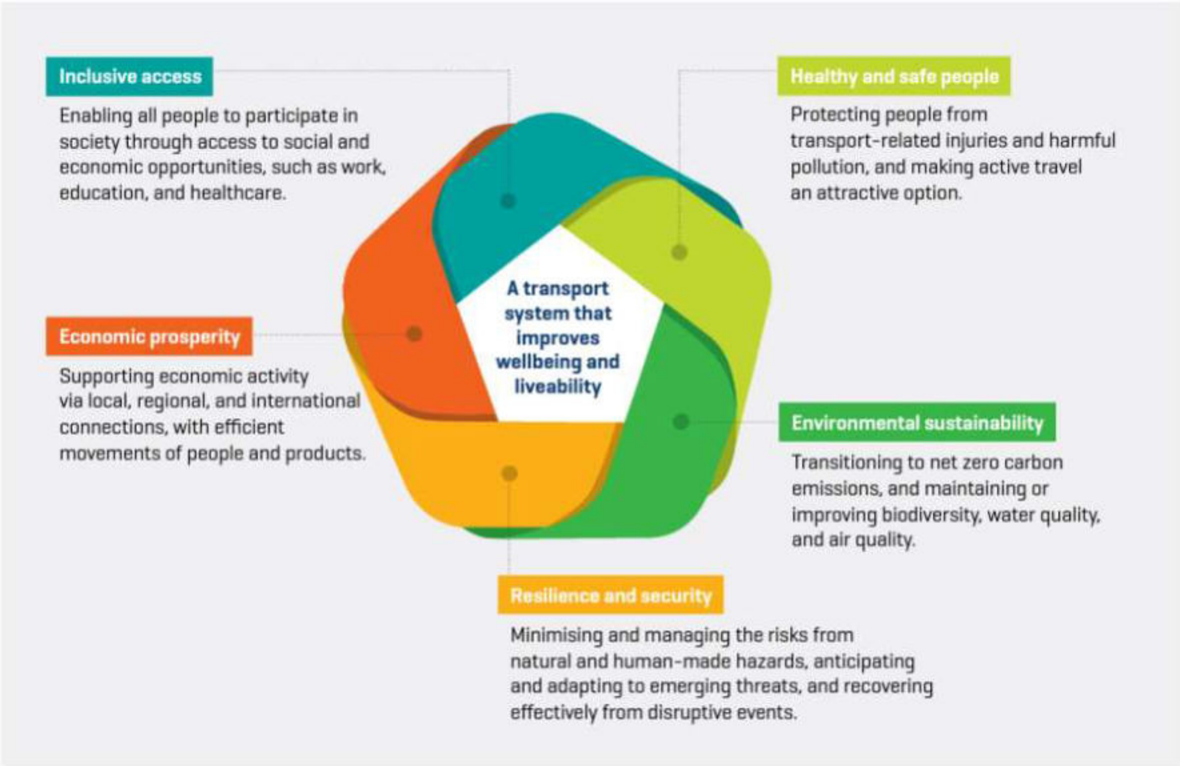


Policy Framework

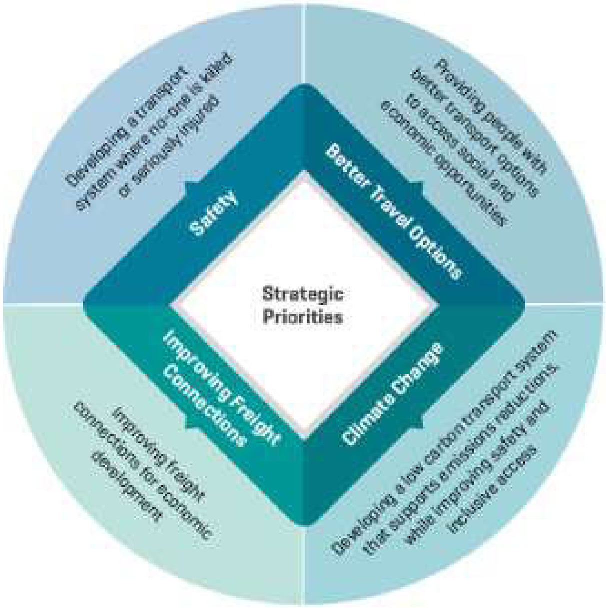
National Policy Framework

The Government Policy Statement on land transport (GPS) sets the Government's priorities for land transport investment over the next 10-year period. For more information, visit: Government Policy Statement on Land Transport 2021, in particular section 2.2 Strategic Priority: Safety.
The GPS guides the national programme of transport related projects and activities that receive funding from the National Land Transport Fund, local communities, and the Crown. The Government has identified five key outcomes in the Transport Outcomes Framework, shown below.

Transport Outcomes Framework



The Ministry of Transport's has set four strategic priorities for land transport investment:



Road to Zero, New Zealand's Road Safety Strategy 2020-2030

Road to Zero is a strategy from the Ministry of Transport with a vision where no one is killed or seriously injured in road crashes. Based on Vision Zero, an ethics-based safety approach, places responsibility on the people who design and operate the transport system to protect all road users. Using this world-leading approach, the government has set an ambitious goal of reducing deaths and serious injuries on New Zealand's roads, cycle lanes and footpaths by 40 per cent over the next 10 years. The Road to Zero strategy is guided by seven principles and will be achieved through action in five key focus areas, shown in the image below.

National Road to Zero Action Plan 2020-2022

The Ministry of Transport has released a Road to Zero Action Plan 2020-2022 with guiding principles for improving the road network and sets safety targets for 2030. It defines five areas of focus for the next decade and includes a framework to achieve the safety targets.
The Road to Zero approach will utilize the most effective road safety improvements, achieved by investment in infrastructure improvements and effective enforcement, along with safer speeds, safer vehicles, and encouraging safe driving behaviours. The target is to reduce road user deaths and serious injuries by 40% by 2030. Detail on the strategy and the current action plan can be found at transport.govt.nz/zero.

With only a 5 percent decrease in DSI compared to 2018, Northland is underperforming so far during the Road to Zero program.

The Road to Zero target of reducing deaths and serious injuries from road crashes by 40% requires strong national direction, support, and regional and local collaboration.

The three-year action plan shows the Road to Zero strategy can achieve much of New Zealand's safety targets through a combination of infrastructure improvements, speed limit changes and increased levels of enforcement. The primary projects currently underway nationwide include:

- median barriers and intersection treatments,
- speed limit changes in urban areas and on the highest risk parts of the road network, and
- increased levels of enforcement, both by safety cameras and police officers.

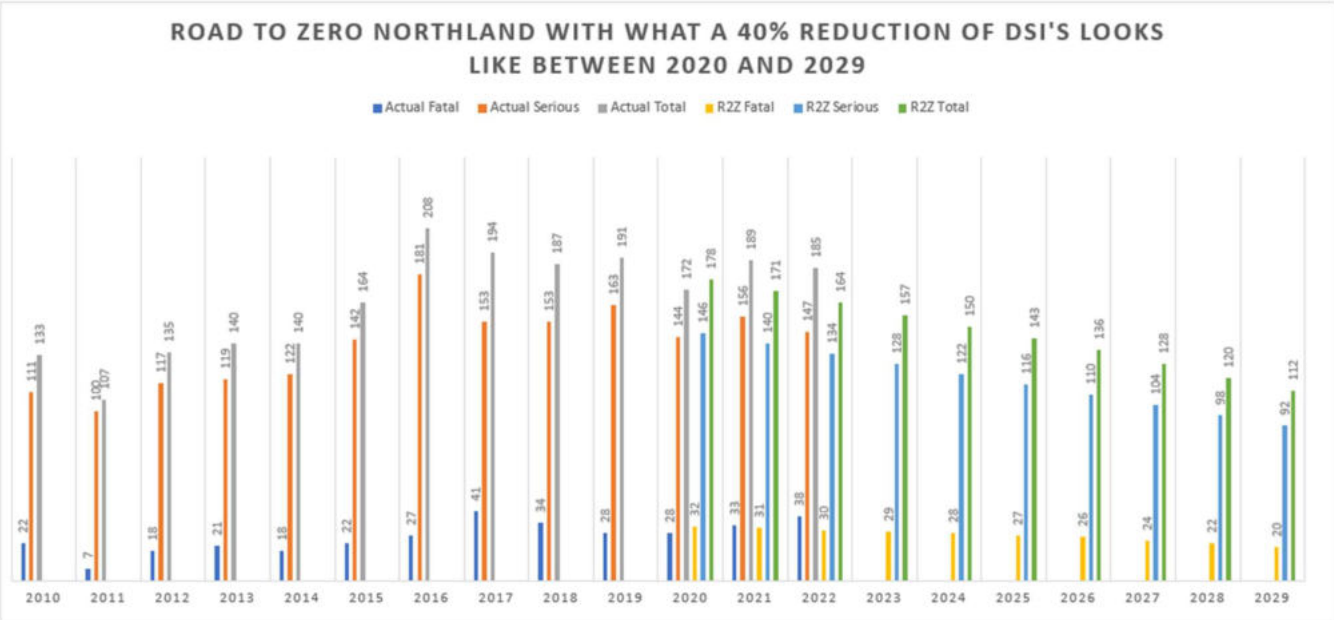
Other national focus areas include:

- improving safety of the vehicle fleet
- mandating ABS for motorcycles.

- improvements to driver licensing and increases to penalties for safety offences
- uptake of public transport
- changes in vehicle technology.

Government funding will be directed towards infrastructure improvements on roads with the highest concentration of deaths and serious injuries. In addition, the Road to Zero model also signals a potential transport mode shift with increased government spending on public transport and rail infrastructure.

Northland is currently making progress on these nationally directed safely improvements, along with region specific road safety measures specified on page 19 of this plan.



Northland’s Vision for Road Safety

The long-term goal for road safety in Northland reflects the vision of the national Road to Zero strategy - 'A safe road system increasingly free of death and serious injury'. This challenges us to see road deaths and serious injuries as preventable.

We will need a significant shift in the way we think about and manage road safety if we are to realise our aspirational vision. Our current approach could maintain our existing level of road safety, but it will not deliver further reductions in the number of deaths and serious injuries.

To achieve this goal, we will take a Safe System Approach to road safety. The Safe System differs from traditional approaches to road safety- rather than always blaming the road user for causing a crash, it acknowledges that even responsible people sometimes make mistakes in their use of the roads.

What is the Safe System approach?

The Safe System approach focuses on creating safe roads, safe speeds, safe vehicles, and safe road use. By designing a transport network that accommodates human mistakes and injury tolerances, we can address the safety of all road users. This includes those who walk, bike, drive, ride transit, and travel by other modes. The safe system recognized that all people make mistakes, but those mistakes shouldn't lead to deaths or serious injuries. Human vulnerability is considered a top priority, with the goal of minimizing crash severity on our roads.

The Safe System approach aims to create a forgiving road system based on four principles:

1 People make mistakes
We need to recognise that people make mistakes and some crashes are inevitable. But what we don't accept is that death or serious injury from crashes is inevitable.

2 People are vulnerable
Our bodies have a limited ability to withstand crash forces without being seriously injured or killed. Crash forces need to be kept to survivable levels.

3 We need to share responsibility
System designers and people who use the roads must all share responsibility for creating a road system where crash forces do no result in death or serious injury.

4 We need to strengthen all parts of the system
We need to improve the safety of all parts of the system – roads and roadsides, speeds, vehicles, and road use so that if one part fails, other parts will still protect the people involved.

Visit the Safe System Approach for more information.

Why do we need a Regional Response to Road Safety?

While the national Road to Zero safety strategy directs our long-term road safety initiatives, Northland must have its own response to road safety due to our challenging terrain, population distribution, and a variety of other factors unique to our region.
The Northland region is a large area with a mix of paved and unpaved roads, as described in the Regional Land Transport Plan for Northland (RLTP). There are many stakeholders, many of them small, with limited capacity and funding. If we work together, our efforts will provide faster and better outcomes for our communities and visitors. Collaboration is the only way to gain central government support and funding for road safety projects in Northland.

A regional approach provides leadership at a scale that local and regional organisations can respond to and elevates issues to a national level. Strong regional leadership allows for effective implementation. While government provides strong policy signals and funding support, it is the actual implementation at a local level which determines how safe our roads are. Northland's investments include improving local infrastructure, the safety of our vehicles and our driving behaviours to achieving our road safety goals. These investments align with the national Road to Zero strategy.

What is the purpose the Northland Road Safety Action Plan?

This plan supports a unified response to improve the safety of our roads and deliver the priorities of the Regional Land Transport Plan for Northland. The purpose of a shared regional approach is to:

- Identify key regional road safety issues and find solutions
- Identify priorities and actions which will collectively deliver our regional targets.

- Support partners in securing funds to deliver the appropriate interventions
- Provide guidance to the Regional Transport Committee in their development of the Regional Land Transport Plan
- Serve as a resource for regional and local road safety statistics
- Support stakeholders develop planning and policy priorities, projects, and direction.

Northland's regional partners are working on a measurement framework, but specifically is about reducing deaths and serious injuries on Northland roads. The regional policy framework will identify regionally specific and relevant measures that align with Road to Zero reporting.

Managing the road transport system involves a range of organisations and people. Our current partners and roles are summarised below.

Governance

The Regional Transport Committee (RTC), assisted by the Northland Regional Council, oversees, and signs off the Regional Land Transport Programme (RLTP). The RLTP drives regional policies, priorities, funding support and advocacy for road controlling authorities (these include territorial authorities, Waka Kotahi NZ Transport Agency, Department of Conservation, and a small number of other agencies.

Strategy and Collaboration

The Road Safety Action Planning (RSAP) group meet quarterly throughout the year as well as smaller group collaboration. Collectively, it supports a range of evidence-based road safety activities under successive Regional Land Transport Programmes. Northland Road Safety action planning meetings enable the following:

- Sharing data and networking between professionals, advocates, and community providers,
- Updating the Northland Road Safety Issues & Crash Data reports,
- Sharing regularly completed crash reduction studies and audits, best practice and research, monitoring, and reporting,
- Submitting bi-monthly road safety reports to the Regional Transport Committee,
- Creating opportunities for collaborative planning, consultation, and engagement,
- National updates of programmes impacting safety activities and investment.

The RSAP group is made up of:

- Northland Transportation Alliance (WDC, KDC, FNDC, NRC)
- Waka Kotahi New Zealand Transport Agency
- New Zealand Police
- ACC
- Far North REAP
- Northland Road Safety Trust
- Bike Northland

The RSAP group feeds back to RTC and other road safety forums such as:

- Northland Road Safety Forum
- Northland Freight Group
- Other interested parties such as AA Council, other Council appointed committees.

Implementation

Implementation can occur at a local level, at a regional level, and inter-regionally. Waka Kotahi NZTA manage the State Highway Network for maintenance, safety, and infrastructure upgrades. The

Territorial Local Authority (WDC, KDC, FNDC) manage the local, non-state highway roads for the same activities.

Regional Policy Framework

Northland shares the government's Road to Zero vision where no one is killed or seriously injured on our roads. Northland Transportation Alliance in conjunction with Waka Kotahi have developed a comprehensive multifaceted program of capital improvements and road safety promotion activities to meet the expectations of the Governments 10-year Road to Zero strategy. The strategic plan outlines our short-term actions and will be reviewed and updated regularly.

What is the evidence telling us?

There are multiple sources of data that are used to identify the key issues in Northland which is what the programme of works is derived from.

- The communities at risk register
- The crash analysis system
- ACC data
- District health board data
- Feedback from communities

Communities at Risk Register

This document provides a ranking of different communities around New Zealand with regard to selected road safety risks. The below tables are a summary of the risks identified in 2021 and 2022:

Table 1: Communities at Risk Register 2021

2021 Communities at Risk Register		2021 Fatals and Serious Injuries:	
Northland High Risks	**Northland Medium Risks**	**Northland Fatals**	**Northland SI**
1. All deaths and serious casualties 2. Young drivers (of light vehicles aged 16-24yrs) 3. Alcohol & drugs 4. Speed (too fast for the conditions) 5. Rural road loss of control and/or head-on (speed zones >70km/hr) 6. Cyclist involved 7. Restraints (seatbelt not worn)	1. Motorcyclist involved 2. Pedestrian involved	28	144
Kaipara High Risks	**Kaipara Medium Risks**	**Kaipara Fatals**	**Kaipara SI**
1. All deaths and serious casualties 2. Young drivers (of light vehicles aged 16-24yrs) 3. Alcohol and/or drugs 4. Speed (too fast for the conditions) 5. Rural road loss of control and/or head-on (speed zones >70km/hr) 6. Motorcyclist involved 7. Cyclist involved 7. Restraints (seatbelt not worn)	1. Fatigue	1	27
Whangarei High Risks	**Whangarei Medium Risks**	**Whangarei Fatals**	**Whangarei SI**
1. Cyclist involved 2. Pedestrian involved	1. Alcohol and/or drugs	12	49
Far North High Risks	**Far North Medium Risks**	**Far North Fatals**	**Far North SI**
1. All deaths and serious casualties 2. Young drivers (of light vehicles aged 16-24yrs) 3. Alcohol and/or drugs 4. Speed (too fast for the conditions) 5. Rural road loss of control and/or head-on (speed zones >70km/hr) 6. Cyclist involved 7. Pedestrian involved 8. Restraints (seatbelt not worn)	1. Motorcyclist involved	15	68

Table 3: Communities at Risk Register 2022

2022 Communities at Risk Register		2022 Fatal and Serious Injuries:	
Northland High Risks	**Northland Medium Risks**	**Northland Fatals**	**Northland SI**
1. All deaths and serious casualties 2. Young drivers (of light vehicles aged 16-24yrs) 3. Alcohol and/or drugs 4. Speed (too fast for conditions) 5. Rural road loss of control and/or head-on (speed zones >70km/hr) 6. Cyclist involved 7. Pedestrian involved 8. Restraints (seatbelts not worn)	1. Motorcyclist involved 2. Distraction	35	174
Kaipara High Risks	**Kaipara Medium Risks**	**Kaipara Fatals**	**Kaipara SI**
1. All deaths and serious casualties 2. Young drivers (of light vehicles aged 16-24yrs) 3. Alcohol and/or drugs 4. Speed (too fast for conditions) 5. Rural road loss of control and/or head-on (speed zones >70km/hr) 6. Motorcyclist involved 7. Pedestrian involved 7. Restraints (seatbelts not worn)	1. Cyclist involved	4	21
Whangarei High Risks	**Whangarei Medium Risks**	**Whangarei Fatals**	**Whangarei SI**
1. Pedestrian involved 2. Cyclist involved	1. Alcohol and/or drugs	15	60
Far North High Risks	**Far North Medium Risks**	**Far North Fatals**	**Far North SI**
1. All deaths and serious casualties 2. Young drivers (of light vehicles aged 16-24yrs) 3. Alcohol and/or drugs 4. Speed (too fast for conditions) 5. Rural road loss of control and/or head-on (speed zones >70km/hr) 6. Restraints (seatbelts not worn) 7. Cyclist involved 8. Pedestrian involved 9. Distraction (crash factor: attention diverted)	1. Motorcyclist involved	16	93

Northland Road Safety Issues Report – 2017 to 2021 Crash Data:

The Northland road safety issues report summarises the key issues relating to road safety faced by road users in Northland. The purpose of the document is to present the factual data only. There were 23 issues identified for Northland using the 2017 to 2021 crash data.

The rankings and the crash proportions from the table from the previous Road Safety Issues Report have been updated for the current crash data period (2017 – 2021), with the crash proportions for the previous period (2015 – 2019) included in brackets below. The colour of the current number indicates a positive (**green**) or negative (**red**) change from the previous period (**orange** is no change). Issues 1 to 21 are ranked in the order of percentage of injury crashes in Northland. Issues 22 and 23 are more general and not ranked.

The issues summarise the region as a whole and compare each District Council within the region, broken down between local roads (LR) and State Highways (SH):

Table 3: Issues Summary of Regions

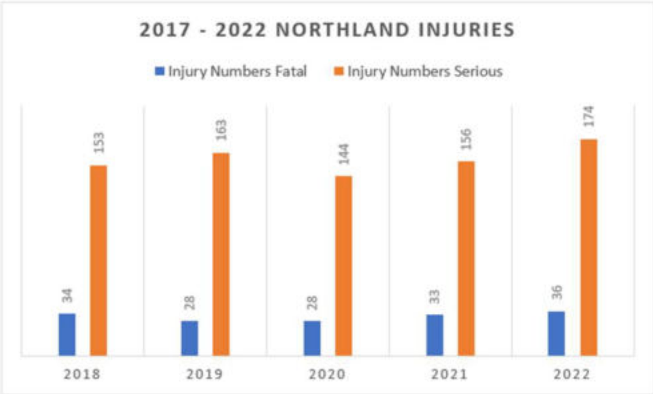
ROAD SAFETY ISSUE		NORTHLAND		FAR NORTH		KAIPARA		WHANGAREI	
		LR	SH	LR	SH	LR	SH	LR	SH
Total injury crashes		*1588* (1458)	*1276* (1197)	*584* (503)	*636* (611)	*205* (191)	*205* (185)	*799* (764)	*435* (401)
1	Open road crashes	56% (57%)	81% (84%)	70% (72%)	87% (89%)	78% (81%)	79% (84%)	41% (41%)	71% (76%)
2	Alcohol	69% (49%)	73% (51%)	69% (51%)	70% (49%)	74% (51%)	78% (54%)	67% (46%)	76% (53%)
	Drugs	1% (0%)	2% (0%)	4% (0%)	7% (1%)	4% (1%)	8% (3%)	6% (0%)	10% (1%)
3	Loss of control on bends	43% (41%)	37% (41%)	49% (46%)	42% (46%)	47% (47%)	42% (45%)	38% (37%)	26% (30%)
4	Young drivers (aged 15 to 24) at or part at fault	38% (36%)	36% (37%)	40% (37%)	37% (39%)	38% (38%)	35% (37%)	37% (35%)	36% (34%)
5	Hitting roadside objects (ditch, cliff / bank, tree)	28% (27%)	31% (31%)	33% (31%)	15% (36%)	31% (31%)	34% (37%)	24% (22%)	23% (22%)
6	Fatal and serious crashes	24% (28%)	28% (31%)	27% (28%)	29% (30%)	31% (36%)	33% (34%)	21% (25%)	26% (31%)

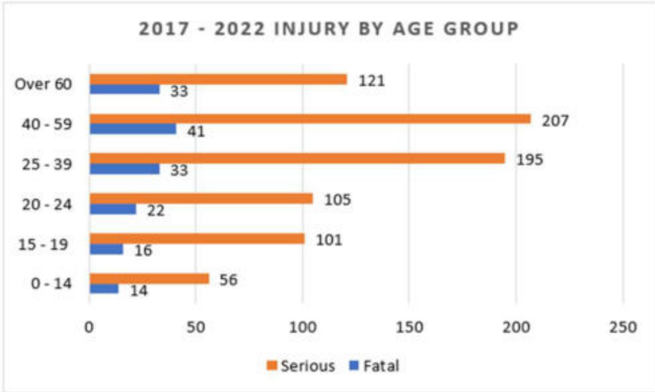
ROAD SAFETY ISSUE		NORTHLAND		FAR NORTH		KAIPARA		WHANGAREI	
		LR	SH	LR	SH	LR	SH	LR	SH
7	Crashes during the summer season	29% (29%)	28% (29%)	30% (29%)	27% (28%)	31% (29%)	26% (30%)	29% (28%)	30% (31%)
8	Poor observation	24% (25%)	24% (24%)	21% (22%)	21% (24%)	21% (22%)	25% (24%)	27% (28%)	29% (29%)
9	Travel Speed	30% (30%)	25% (26%)	32% (31%)	25% (27%)	27% (34%)	24% (29%)	29% (28%)	24% (24%)
10	Road factors	15% (14%)	15% (15%)	18% (18%)	16% (18%)	17% (17%)	16% (16%)	12% (11%)	13% (11%)
11	Motorcycles, total	10% (12%)	10% (9%)	11% (12%)	10% (10%)	12% (16%)	12% (11%)	9% (11%)	9% (7%)
12	Unsealed roads	15% (15%)	1% (1%)	24% (27%)	1% (1%)	23% (25%)	1% (2%)	5% (6%)	1% (2%)
13	Not using restraints	12% (11%)	8% (7%)	17% (16%)	9% (9%)	15% (12%)	7% (8%)	9% (7%)	7% (6%)
14	Fatigue	4% (4%)	11% (13%)	4% (4%)	11% (11%)	5% (5%)	11% (17%)	3% (3%)	11% (14%)
15	Pedestrians	8% (10%)	4% (4%)	7% (7%)	5% (5%)	2% (3%)	3% (2%)	11% (13%)	4% (4%)
16	Trucks, total	5% (4%)	9% (9%)	11% (2%)	4% (4%)	8% (7%)	12% (11%)	5% (5%)	14% (15%)
17	All Pole Crashes	7% (6%)	4% (5%)	3% (4%)	4% (5%)	9% (6%)	2% (3%)	8% (7%)	6% (7%)
18	Overseas drivers, total	2% (4%)	4% (7%)	2% (5%)	5% (9%)	1% (4%)	4% (5%)	2% (3%)	3% (5%)
19	Weather factors	2% (3%)	4% (4%)	3% (4%)	4% (4%)	1% (1%)	8% (7%)	3% (3%)	3% (4%)
20	Cyclists	3% (3%)	1% (2%)	2% (2%)	1% (2%)	3% (3%)	1% (1%)	4% (4%)	2% (2%)
21	Wandering stock	0% (0%)	1% (1%)	1% (1%)	2% (2%)	0% (0%)	0% (1%)	0% (0%)	0% (1%)

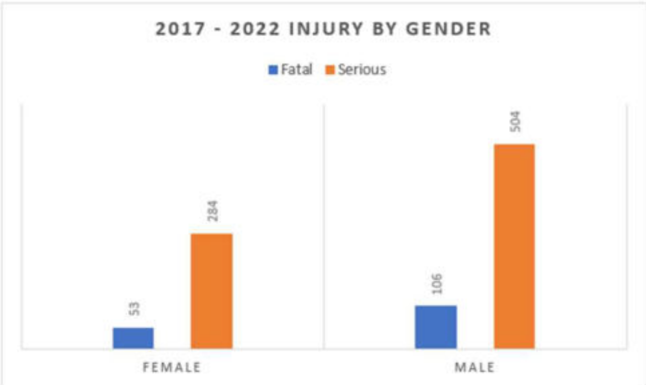
ROAD SAFETY ISSUE		NORTHLAND		FAR NORTH		KAIPARA		WHANGAREI	
		LR	SH	LR	SH	LR	SH	LR	SH
22	Vehicles from 1990 to 1999	32% (41%)	31% (40%)	36% (45%)	31% (41%)	35% (42%)	31% (37%)	28% (39%)	30% (39%)
23	Wet Road Bend Loss of Control / Head On	25% (15%)	30% (18%)	21% (15%)	29% (19%)	20% (13%)	31% (19%)	28% (16%)	32% (15%)

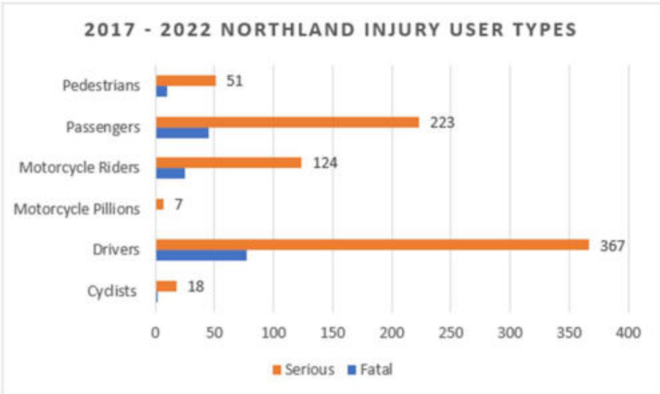
Waka Kotahi NZTA Crash Analysis System 2018 to 2022 Data:

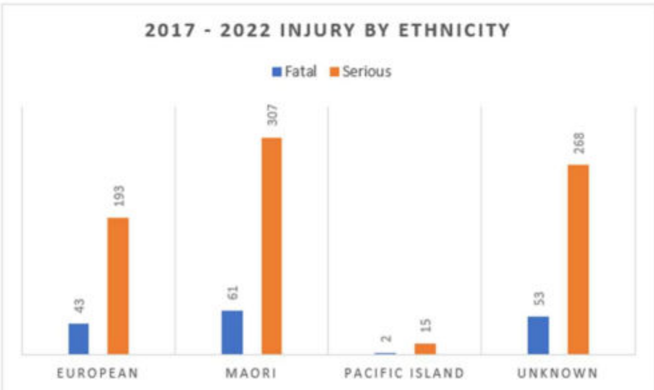
A profile of who is getting seriously injured or dying on Northland roads:

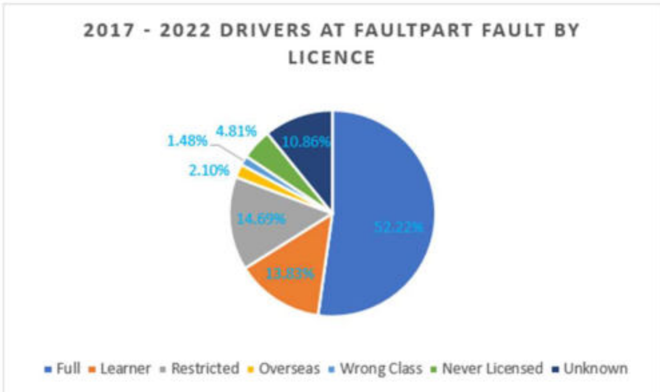












Northland Road Safety Action Plan

The road safety action planning partners have identified 6 areas of concern to focus on:

- High risk rural roads
- Alcohol
- Motorcycles
- Speed
- Young drives
- Restraints

Emerging issues have also been identified to continue monitoring:

- Vulnerable road users
    - Cyclists
    - Pedestrians
- Distraction
- Fatigue

The activities and monitoring of the areas of concern can be seen in the table below. The action pan is monitored quarterly at the road safety action planning meeting and updated annually.

The delivery of the action plan is done by providers within the three districts of Northland:

- Waka Kotahi NZTA covers the State Highway Network for infrastructure, safety, and speed improvements.
- NTA covers the local road infrastructure, safety, and speed improvements.
- New Zealand Police are the enforcement partner as well as supporting in education and promotion activities.
- Far North REAP provides road safety education and promotion activities in the Far North district.
- Northland Road Safety Trust provides road safety education and promotion activities in the Whangarei and Kaipara districts.
- Bike Northland provides bike skills and education to schools and communities in the Far North and Whangarei districts.
- ACC supports all initiatives and manages the motorcycle Ride Forever programme and promotes Motorcycle Awareness month.

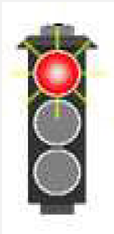
There are regional campaigns as well which each partner contributes too, particularly around speed, restraints and motorcycles.

Each partner has their own measures of success with the overarching goal of reducing deaths and serious injuries on Northland roads.

Progress Monitoring

NORTHLAND Road Safety Action Plan 2023/24

To be reviewed quarterly at RSAP meetings and updated annually.

	Safe System Theme	Interventions by Response		Expected Outcomes	Measure of Success	Progress	Delivery	Outcome/ Achieved
		Action	Response					
Extra Focus	High Risk Rural Roads	Identify the 2 highest (high risk) rural road sections across each Northland district. Identify the 2 highest (high risk) rural intersections across each Northland district.	Investigate and deliver improved safety through infrastructure improvements targeting high risk. Develop and implement a programme of lower cost safety improvements such as rumble strips, wide centrelines and paint treatments on high-risk local rural roads. Targeted Police deployment to high-risk rural locations as identified.	Pro-active network route improvement programmes to achieve safer roads and roadsides.	Reduction of loss of control on bends crashes and open road crashes by 5% (from xx%), contributing to a reduction in overall DSI. Reducing the number of high-risk intersections in Northland.		• Targeted & evidence driven • Improvement programmes • Police tasking • Intersection Campaign – urban and rural	

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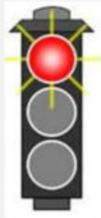
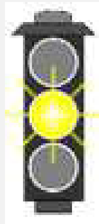
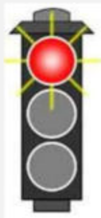
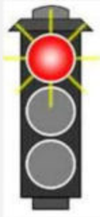
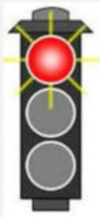
	Alcohol	Identify high risk locations with alcohol/drug related crashes per Northland District.	Targeted CBT operations and drug impairment testing activities. Work with affected communities through community-based programmes.	Community culture of reduced tolerance of driving while impaired. Reduced alcohol related crash results at identified high risk locations.	Reduction in alcohol related crashes by 5% (from xx%), contributing to a reduction in overall DSI.		• Targeted & evidence driven. • Police tasking • Targeted community interventions	
	Motorcycles	Identification of high-risk motorcycle routes. Improve availability of motorcycle training.	Apply proven countermeasures as recommended by "Safer Journeys for Motorcycling" (December 2016) guidance. Motorcyclists develop the necessary skills.	Treatments recommended in the Safer Journeys for Motorcycling guide are increasingly applied to high-risk motorcycling routes.	Reduced number of motorcyclist deaths and serious injuries. Reduced severity of injuries (as measured by ACC claims data). Increased uptake of training.		• National focus opportunities (ACC) Spring Campaign and Gear competition to increase rider training uptake.	
	Speed	Introduce best-practice speed management across Northland based around the road and risk. Identify high risk locations of loss of control	Apply Speed Management Guide principles that prioritise high benefit areas that improve both safety and economic productivity.	Consistent approach to speed management practice based on identified risk. Reduced loss of control on bends crashes at identified	Reduction of speed related crashes, contributing to a reduction in overall DSI.		• Targeted & evidence driven. • Network approach • Engagement profile • Local speed programme trial	

		on bends crashes across the Northland region.	Implement a programme of countermeasures for identified locations.	high risk locations.				
	Young Drivers	Increase young driver education opportunities and uptake through targeted engagement.	Work with identified communities through community-based programmes to progress through to attaining their full licence.	Young drivers are better equipped both in maturity and experience when driving.	Reduction of young driver related crashes contributing to a reduction in overall DSI. Reduce the road fatality rate of our young People. Increased number of young drivers progressing through to attaining a full licence.		• Targeted & evidence driven. • Improvement programmes • Targeted community interventions • Optimised partnerships	
	Restraints	Build on the NZTA research and campaign to develop messaging appropriate to a Northland audience.	Work with police to align operational focus.	Northland communities are more aware of the crash risk of not wearing a seatbelt.	Reduced number of DSI non-seatbelt wearing crashes. Increased wearing rate.		• Increased awareness to risk • Targeted and aligned response	

	Emerging issues	Actions

	• Vulnerable road users
	  ○ Cyclists
	  ○ Pedestrians
	• Distraction
	• Fatigue
		• Regular monitoring to track progress of issue.
		• Incorporate activity for issue in current activities.

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Northern Transport Alliance

Asset Management Plan 2024–2054

Appendix 08

Climate Change – Mitigation and Adaptation

Overview and Management
Problems, Benefits, Consequences
Options Assessment

Northern Transport Alliance

Asset Management Plan 2024–2054

Appendix 08

Climate Change – Mitigation and Adaptation

Table of Contents

1 Overview

1.1 Description

Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. But since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas.

Climate scientists have showed that humans are responsible for virtually all global heating over the last 200 years. Human activities like the ones mentioned above are causing greenhouse gases that are warming the world faster now than any time.

The average temperature of the Earth's surface is now about 1.1°C warmer than it was in the late 1800s (before the industrial revolution) and warmer than at any time. The last decade (2011-2020) was the warmest on record, and each of the last four decades has been warmer than any previous decade since 1850.

Many people think climate change mainly means warmer temperatures. But temperature rise is only the beginning of the story. Because the Earth is a system, where everything is connected, changes in one area can influence changes in all others.

The consequences of climate change now include, among others, intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms, and declining biodiversity.

Climate Change is being addressed in two major ways:

- Climatic Mitigations – How to reduce future CO^2 emissions. Mitigation actions will take decades to affect rising temperatures, so we must also consider.
- Climatic Adaptations – How to deal with the impacts being evidenced from Climatic events, along with being resilient and reliable to withstand and recover quicker with minimal effects after a climatic event.

Although we are at the initial stages of planning for climatic change impacts through this Transportation AMP, we have considered the following:

- Climate Change Mitigation:
  - Mode shift
  - Emissions reduction plans/actions

- Climate Change Adaptation:
  - Land instability slips
  - Flood zones
  - Resilience & Reliability for diversion routes for State Highways and local roads.

1.1.1 *Climate Mitigation – Mode Shift*

The primary focus of mode shift is such that we can move easily around our cities in ways that help us to protect our climate. We need to transition to a low-emissions and climate-resilient future for the benefit of all New Zealanders. Under the government's programme of Transport Choices, the aim is to demonstrate what's possible for communities across Aotearoa New Zealand, by providing people with more transport options, and making it easier to travel in ways that are good for all of us and our environment. The Climate Emergency Response Fund (CERF) Transport Choices are focused packages of work to:

- deliver strategic cycling/micro mobility networks
- create walkable neighbourhoods
- support safe, green, and healthy school travel
- make public transport more reliable and easier to use.

Currently a lot of infrastructure to support active transport modes is not safe enough for majority of the people and is often disconnected. Having greater transport choices will ensure people can access all their needs, while creating safer and healthier environments for communities across Aotearoa, New Zealand.

The programme of Transport choices is about making small, visible changes to our streets and the way people use them, quickly – and helping people embrace cycling, walking or public transport as a means of travel. There are many small-scale improvements we can make to our urban public transport system that will have a strong impact on improving the reliability of our public transport system and improve the experience of people who use the networks which, in turn will make public transport a more attractive option for people.

The following packages of work were submitted during the 2021-24 LTP period and are waiting for final funding approval under the Transport Choices Programme:

Kaipara District Council – Kaipara Cycle Network Connections. $7.2M
The community of Dargaville currently have very limited travel choice. There are missing sections of footpath, and no cycle facilities or public transport options. The Transport Choices Package developed for Kaipara District Council primarily focuses on providing walking and cycling connections between the residential areas to local schools and town centre. The aim is to provide a well-connected and safe neighbourhood to encourage walking and cycling for school and intra-community travel.

Far North District Council – Kerikeri Active Mode Network Connections. $1.85M
Enabling safe travel for both the schools and the wider community by creating a slow street environment and intersection improvements on Hone Heke Road between Cobham Lane and Kerikeri Road. Additionally, we will provide connections for walking and cycling across the quiet streets of Kerikeri through route connection and wayfinding.

Far North District Council – Far North Bus Services. $1.05M
The Far North bus routes were originally set up on a trial basis over 10 years ago with no infrastructure being put in place. There are currently no formal stops, not even bus stop signs, so public only know the locations by word-of-mouth / experience or have to guess and take the risk that they are in the right place at the right time. The absence of any infrastructure for these bus

stops is a significant barrier to residence use and further expansion of public transport in the Far North.

The three projects comprise of providing bus shelters and formalising the bus stops with road markings and signs for stops on the Kaitaia around town bus service loops and Mangonui - Kaitaia bus service and formalise the remaining Far North bus stops with signs and markings.

The Far North bus services were started by Community Business & Environment Centre (CBEC) as "a community enterprise which operates a range of businesses and environmental programmes as part of an overall effort to build sustainable local economies in the communities we live within." The services are now funded by the Northland Regional Council and Waka Kotahi but are still operated by CBEC.

The following packages of work have secured funding under the Transport Choices Programme:

Whangarei District Council - Kamo Shared Path Connections. $4.65M
A package of new and improved connections to the existing Kamo Shared Path. The project creates better connections to adjacent schools and remove barriers to active travel. The improvements leverage and support investment made by Waka Kotahi and WDC in constructing the Kamo Shared Path to improve access to and quality of the strategic cycle network. This will significantly improve the attractiveness of walking and cycling, including providing safer active modes for school travel to four schools within the path's catchment (Kamo High, Kamo Intermediate, Kamo Primary, and Whau Valley Primary). Included in this package, are several slow streets projects to promote more walkable neighbourhoods that connect to the Kamo Shared Path.

Whangarei District Council - Raumanga Shared Path Extension and CBD Cycle Parking. $3.45M
A package of new or improved shared path connections to the Raumanga Shared Path better connecting adjacent schools and removing barriers to active travel. The improvements leverage and support investment made by Waka Kotahi and WDC in constructing the Raumanga Shared Path to improve access to, and quality of, the strategic cycle network. This will significantly improve the attractiveness of walking and cycling, including providing safer active modes for school travel to 3 schools within the path's catchment (Manaia View, Horahora and Whangarei Intermediate) and the NorthTec-Te Pukenga Whangarei Campus.

The projects include a shared path standard connection to the new LTP funded Lovers Lane footpath bridge replacement. This is a critical connection joining the Kamo and Raumanga Shared Paths through the new civic centre precinct.

The Stage 4 upgrade of the Raumanga Shared path provides a fit for purpose connection to a new LTP funded playground project at Raumanga Reserve.

Included in this package is the provision of a secure bike parking network in the CBD, and at key village centres within the city. This has been promoted by Council's Walking and Cycling Reference Group, demonstrating a community demand for such facilities in key locations. The absence of a secure bike parking in the CBD is frequently raised as a barrier to cycling to the CBD as a destination.

Whangarei District Council - Whangārei City Bus Improvements. $4.5M
A package of public transport projects to upgrade public transport facilities in Whangārei city centre to improve journey time reliability, accessibility, and quality for all users.

WDC completed Stage 1 of the upgrade of the Rose Street Bus Terminal (CBD) in June 2022. Stage 2 of the upgrade includes the replacement of existing shelters, footpaths, public toilet facilities, and bus driver office/kiosk along with providing better real-time bus information signage and personal security improvements. It will make public transport more attractive, safer, reliable, and easier to use. Personal security concerns, unreliable, and infrequent bus times have hampered update of public transport in Whangārei, whereas, the terminal upgrade will provide for greater number of passengers using the terminal, and a more comfortable and secure environment that will contribute to moving more people to use the bus service.

With supporting a step change in public transport, the package includes a dedicated bus priority lane on Kamo Road making public transport more reliable and easier to use by reducing bus travel times and enabling an increase in bus frequency. In addition, upgrading bus shelters across Whangarei's bus network that are in poor condition will make bus use more attractive and safer for users.

1.1.2 Climate Mitigation – Emissions Reduction Plan

When the Government released Te hau mārohi ki anamata, its first ever Emissions reduction plan (ERP) for Aotearoa New Zealand in May 2022, it set out actions needed across every sector of the economy to reduce emissions.

The transport sector has an important role to play in delivering the ERP that calls for a 41% reduction in emissions from the transport sector by 2035 (from 2019 levels). Three focus areas will support this and VKT reduction specifically targets point 1:

- Reduce reliance on cars and support people to walk, cycle and use public transport.
- Rapidly adopt low-emissions vehicles.
- Begin work now to decarbonise heavy transport and freight.

The Ministry for the Environment's map defines some of the planned actions relating to the emission reductions. This is shown in Figure 1-1 following:

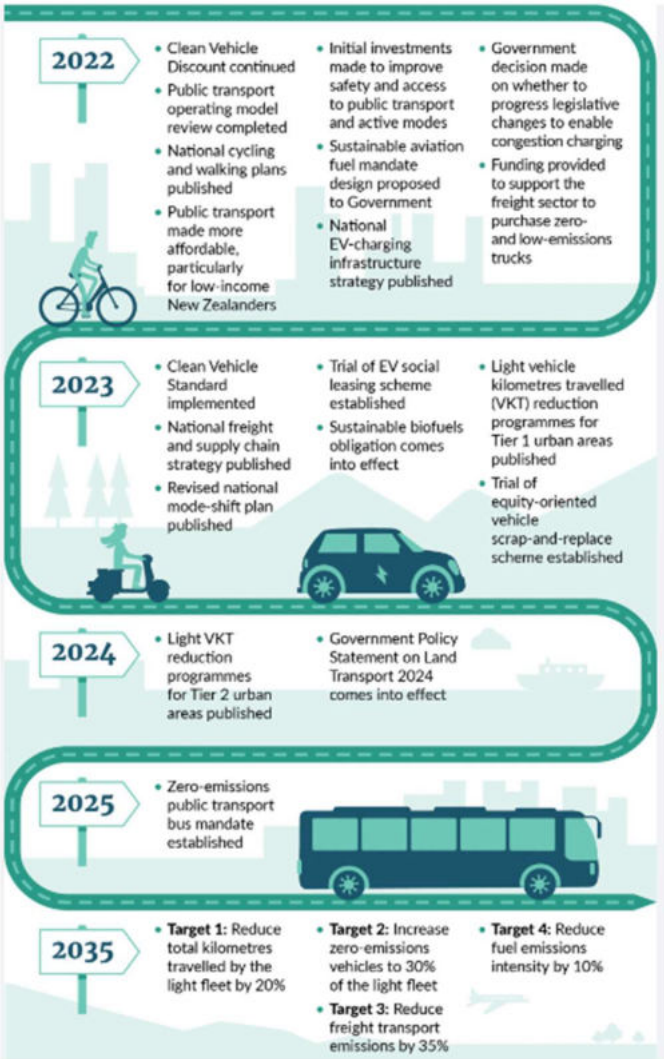

Figure 1-1 - Ministry for the Environment - Road map for emissions reduction

Whangarei as a Tier 2 city has to prepare a light VKT reduction programme by December 2024. The current target is a 14% reduction for 2019 figures by 2035. The target for KDC and FNDC is an 8% reduction for 2019 figures for 2035.

These actions will be considered in the AMP improvements

1.1.3 Climate Change Adaptation

Adaptation is how we act now due to the impacts of Climate Change. We have considered this is three major ways:

- Land instability slips are structural failures and slips which have a huge impact on the roading network.
- Flood zones are areas affected through river flooding and tidal flooding, including coastal erosions and Tsunamis.
- Resilience & Reliability is about being prepared, preserving, and quickly restoring access to the transport network for our customers, including Lifelines Utilities, in the face of unplanned events. Our focus is on the primary diversion routes for State Highways and key critical local roads.

With the three significant pieces of work relating to adaptation we have four approaches. Our first approach has been to develop a database of known land instability slips along our roading network with a view to undertake regular assessments and then prioritise which slips can be proactively targeted with a design solution to unsure the road network has increased reliability and resilience against potential future storm events. The second part is the emergency repairs for land instability slips that have caused structural failures. We have developed a process to assess the structural consequences and cross referenced this against the criticality of the road networks section to prioritise works and technical solutions.

Roads that are subjected to flooding have a reduced life capacity, require more maintenance and renewals and disrupt the network accessibility for the public. The NTA's future plan is to develop a database and record all of the known and potential flood sites that impact our roading assets and based upon the data develop strategic response and plan to strengthen and make our network more reliable and resilient.

Our fourth action has been to review and identify an upgrade programme for increasing the reliability and resilience of State Highway and critical local road diversions. In brief the network critical issues which impact our local network are:

- There is only one state highway into and out of Northland from Auckland
    - The only alternative diversion is through Kaipara local roads via Mangawhai – Langs Beach – Cove Road
- There is a high-risk potential of closures of SH1 at Brynderwyn due to traffic accidents and land instability slips
    - Diverted traffic is posted via Dargaville adding 61km onto the trip and thus many vehicles cut across the Paparoa-Oakleigh local road which is not suitable for large volumes of diversion traffic nor heavy vehicles.
- There are long term closures of SH1 at Mangamuka gorge (Aug 2022 till Dec 2024 – current estimate)
    - Diverted traffic is posted via SH10, but many vehicles select to use the local roads between Brentwood – Herekino – Ahipara – Kaitia, which is not suitable for large volumes of diversion traffic nor heavy vehicles.
- There are recurring flooding risks on both SH1 just north of Hikurangi, SH10 at Kaeo and SH15, which often result in traffic being diverted onto the local road networks.

1.2 Monitoring and Condition

With reference to the first three Climate Adaptation actions defined above (and hereafter termed "Resilience improvements" the following is the monitoring and action plan we have adopted. Implementing improved network and asset resilience require a phased approach. In summary, this consists of the following five phases:

- Phase 1: Data: Identify and consolidate risk site data
  - Collate existing data
  - Cleanse data and apply master data specification
  - Establish the Preliminary Slips Inventory & Risk Register.

- Phase 2: Initial Network Inspections
  - Conduct prioritised inspections on critical lifeline corridors and critical roads (approximately 1,300km of road network).

- Phase 3: Resilience Risk Assessment
  - Assess sites in risk management system
  - Load data into RAMM
  - Identify high risk sites
  - Develop a Power BI dashboard.

- Phase 4: Resilience Management Plan
  - Emergency response plan / process
  - Resilience asset management framework
  - Forward capital work programme
  - Business cases for capital works
  - Maintenance and inspection regime for risk sites.

1.3 Overall Strategy

Implementing improved resilience asset management will enable NTA to:

- Build upon network asset criticality information and resilience planning work already done;
- Identify vulnerability of the network where access to the road network could be lost;
- Assess, monitor and manage the specific risk locations within a consolidated database with accurate data;
- Develop an emergency response plan / process;
- Align maintenance tactics so they do not increase risks;
- Align resilience plans between NZTA and NTA for whole inter-connected Northland network;
- Enable improved risk prioritised future capital and asset maintenance expenditure for the road network; and
- Enhance the road network reliance.

2 Management Plan

2.1 Threats to resilience

Because of the topography and geological terrain of some parts of the network, the threats to resilience include:

Overslips/landslides
The soil and soft rocks on the coast do not need much rain to cause a slip, also called a landslide. An overslip is when material comes down onto the road from a bank or hill.

Underslips/dropouts
Underslips occur on the downhill side of the road. They do not always directly affect the road's surface but pose a risk if unaddressed. When a section of the road's surface and foundation has dropped away either from an underslip or other erosion, we call this a dropout. These issues usually occur in hill country with weak geology, or in areas near the coast or rivers. They often happen suddenly during a storm event, though there are some known slow moving sites that we continue to monitor.

Subsidence
Slumps in the surface of the road called subsidence. Sometimes we can't see that subsidence is happening until it has already created a hazard on the road. Causes include too much water in the ground, weak underlying soil and rock or lack of shoulder support. Subsidence is a major problem in this region.

Flooding
Flooding occurs when water cannot drain away and flows on to the road. High tides, heavy rain, blocked drains, steep banks, and limited vegetation can contribute to the effects of flooding.

Bridges are shown to have a high-risk profile with respect to coastal and fluvial flooding. This is largely due to them being physically located within floodplains (which they have specifically been designed for).

Floodwater flowing across the sealed surface with a high velocity scours and erodes the downstream roadside until it begins to erode underneath the road surface. Eventually, the leading edge of the asphalt crumbles and the erosion continues backward in this pattern until the road is completely washed away.

2.2 Treatments to improve resilience

Soil stabilisation
A method already used on the Whangarei Heads Road to treat subsidence sites with Colmix. This involves using a specialised drill rig to mix a small amount of lime and cement into the soil to create a solid column, which improves the strength of the soil. Steel shafts can also sometimes be used to achieve the same goal.

Drainage improvements
Soft rock and soil that can absorb a large amount of water and become unstable. By reducing the amount of water reaching the ground and removing water from under the surface, we can improve soil strength so that both overslips and subsidence become less likely.

Retaining walls
Where a reasonable foundation under the soil exists, a retaining wall can be used to reform an area of road. Retaining walls can be made from various materials: commonly iron or wooden posts and wooden boards, mass blocks of concrete or rocks, or rock baskets (Gabion walls).

Retreats
Sometimes the best thing to do is relocate the road away from the issue. This could include moving the road onto more stable ground or away from a river.

Rock protection
Rock protection (known as a rock revetment) is a rock barrier to protect against erosion. Where erosion is occurring, a revetment can remedy the situation by placing fill at the site and then building a thick layer of large rocks to absorb the wave or river energy.

Site monitoring
There are several site monitoring techniques that can be used such as camera and drone surveillance to monitor slopes. More recent technologies include sensors and comparison of 3D ground surface models generated from drones.

Rockfall fence
Low rock fall fences are effective for holding back small quantities of rock and are easy to maintain.

Mesh fence and anchors
A mesh system (or slope retention system) consists of nets anchored to the slope to secure and retain the material in place.

Groynes
A groyne is a physical barrier that intercepts sediment that would otherwise erode a particular area. It is used to 'river train' and deflect flowing water away from high erosion-risk zones.

2.3 Treatments to mitigate the effects of flooding

These treatments include:

- Stop-banks to protect the roads
- Raising the level of the road
- Debris interceptors to ensure that drainage assets such as bridges, culverts and sumps can function properly
- Concrete capping and rock spalls boulders to protect road shoulders from scour.

3 Problems, Benefits, and Consequences

This section outlines problems affecting resilience of the transportation network and details the benefits or consequences of doing or not doing something to address these problems.

3.1 Key Issues

3.1.1 Problem Description

Northland's road network has been subject to many slips over the years due to its weak predominantly clayey soils and high rainfall events. There are numerous slips on the road network that are either "slow creeps" or are in the road shoulder and have therefore not been eligible for emergency works funding. These slips are vulnerable to failure during storm events and should be repaired proactively to avoid catastrophic failure. Flooding is also an issue on roads in river valleys or flat coastal plains and will only get worse as a result of climate change, particularly in low-lying coastal areas that may face inundation through sea level rise.

Security of access is a key issue for Northland because there is no warehousing and so often essential supplies are freighted up multiple times a week to stock shelves etc. There are also several products produced in Northland that require same day delivery, such as fresh cut flowers and some live aquaculture, which require secure access. Also, when a flood event occurs, it normally affects the whole region putting many key routes at risk of slips and flooding at the same time. This was demonstrated clearly during the 2022 and 2023 storm events where Northland was effectively cut off from the rest of the country resulting in severe shortages of food, fuel and medical supplies.

The NTA has undertaken an exercise to define the individual road criticality across Northland's local roading network. Roads are categorised according to several criteria, such as: forestry, quarries, schools, marae/churches, living zones, the width rating, remoteness (if detour route), and land use. Based upon all the criteria, an overall rating was defined, and that rating was then validated by staff who are familiar with the network.

Figure 3-1 following shows the Resilience Management Dashboard which provides a snapshot of all identified existing slips on category 5 (most critical) and category 4 roads prior to the Cyclone Gabrielle event. As part of a Resilience Strategy undertaken by the NTA, 1,000km of critical routes were inspected and 1,073 slips were identified on these routes. This is an average of one slip per kilometre. Figure 3-1 shows that much of the network is subject to slips which pose a threat to closure of these critical routes, particularly with the growing risk of more intense storms and cyclones.

Figure 3-1: Slips on category 4 and 5 roads prior to Cyclone Gabrielle

Pre-Cyclone Gabrielle

- There was an average of one recorded slip per km (1,073 live slips across 1,110 km) along these category 4 and 5 routes
- 557 slips requiring a single lane closure;
- Estimated on-going maintenance cost of $7.25M per annum requiring usage of existing routine maintenance budgets;
- Current approved 2021/24 Northland Land Transport Fund (NLTF) Low Cost Low Risk funding of approximately $11.4M is estimated to be able to address 32 slip sites (2.8%) over the 2021/24 period; and
- To date recommended repair options have been determined for 116 of the total 1,073 recorded slips with an estimated cost for these 116 sites of $36.28M.

2022/23 significant weather events

During the 2022/23 financial year, the Northland roading network suffered approximately $75M of damage from at least ten discrete significant weather events listed below:

- July 2022 (x 2 extreme rainfall events)
- August 2022
- November 2022
- January 2023 (Cyclone Hale + Auckland Anniversary weekend)
- February 2023 (Cyclone Gabrielle + 24 February Mangawhai rainfall event)
- May 2023 (x 2 Orange rain warning events)
- June 2023.

2022/23 extreme weather events Pre-Cyclone Gabrielle

The values below are a summary of previously approved Emergency Funding (estimate totalling $23.7M) related to multiple extreme weather events that occurred during the 2022/23 financial year (since July 2022) summarised as:

- Far North District Council – $18.4M (includes $2.7M local share)
- Kaipara District Council – $1.8M (includes $0.68M local share)
- Whangarei District Council – $3.5M (includes $1.6M local share).

Cyclone Gabrielle and the Initial Response

Table 3-1 following provides a summary of the total number of individual roads identified as having issues responded to, which impacted on the network usage (slips, fallen trees, flooding, damaged bridges etc). There are many other roads with issues identified that did not impact on the network usage such as drainage asset issues, trees fallen onto berm areas, footpath obstructions, seawall damages, etc.

Table 3-1: Initial impacts

Council	Individual (#) roads closed	Individual (#) network (roads) impacted (minus closures)	Total (#) roads impacted
Whangārei	68	99	167
Kaipara	60	44	104
Far North	55	124	179
Regionally	183	267	450

Multiple incidents on a single road are reported as a single incident

Figure 3-2 following illustrates the impact of Cyclone Gabrielle on the road network. The figure shows the effect is widespread across the region and severely limits access both during the event, for months, and sometimes years afterwards.

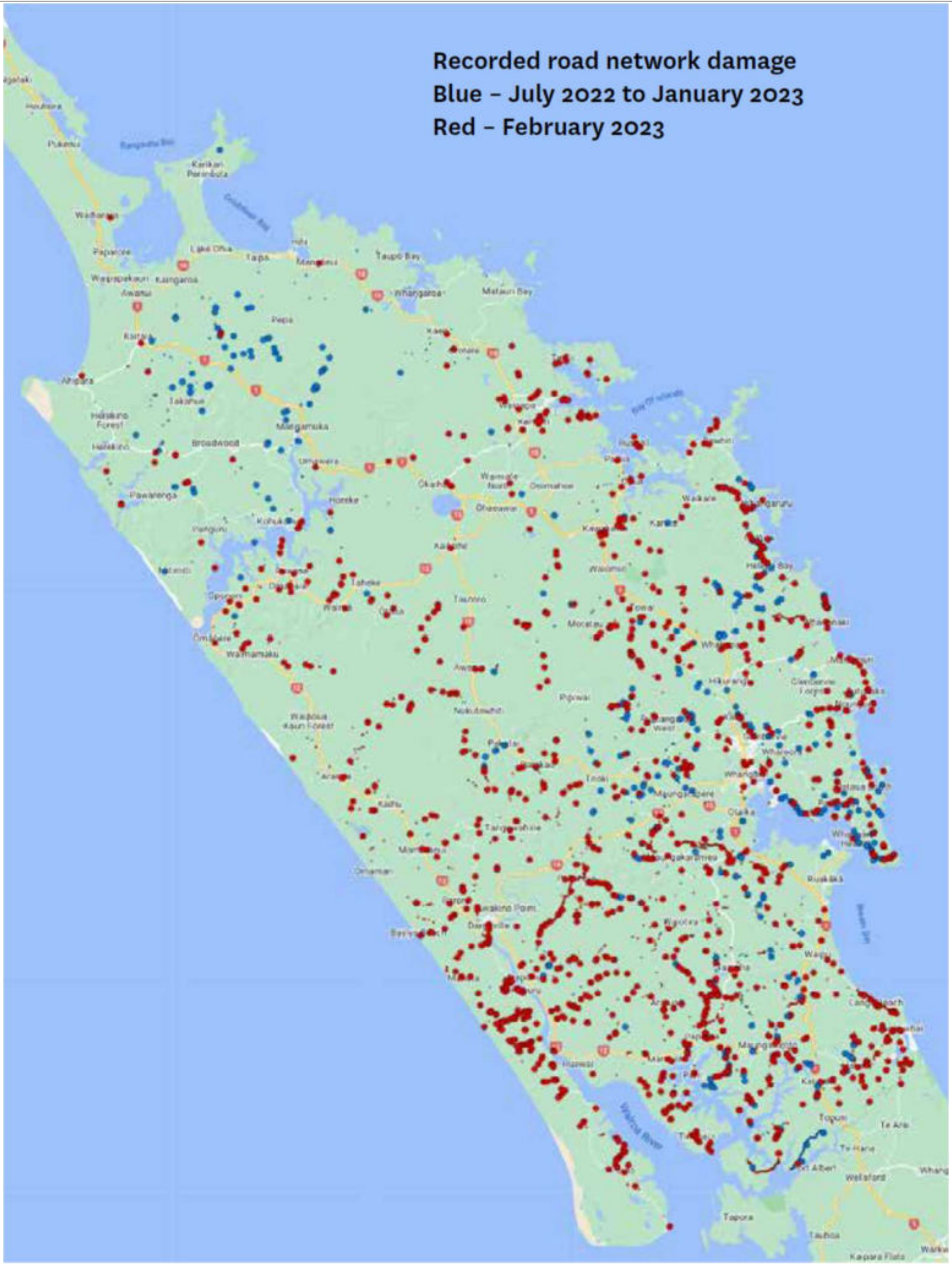

Figure 3-2: Damage to road network due to Cyclone Gabrielle

Council's increased financial assistance requirements

The normal Funding Assistance Rate (FAR) for the Northland District Councils are:

- Far North District Council – 69%
- Kaipara District Council – 62%
- Whangarei District Council – 53%.

When funding request for the year exceeds 10% of approved Maintenance, Operations, and Renewals (MOR) budget the FAR is increased by 20%, where Councils are required to contribute the cost balance (Local Share) which generally is provided for through Emergency Response Reserve Fund provisions.

Given the extent of the damage, the anticipated local share will exceed the total presently held in reserves and if further funding is not provided it will require re-prioritisation of existing maintenance programmes and budgets. This will result in significant negative long-term impacts and deterioration of the quality of Northland's already strained local road networks.

A one-off special funding assistance rate increase of 40% above the normal FAR has been provided for initial response and minor works that can be executed through to 30th June 2023 for the Cyclone Gabrielle and associated storm events.

Northland's District Councils are requesting Government Funding support for the anticipated $17M total local share component of the 2022/23 Extreme Event repair works that continue through into 2023/2024 and beyond, made up detailed in Table 3-2 below:

Table 3-2: Central Government Cyclone Gabrielle Support

2022/23 events	Current repair estimates	Remaining works for 2023/24	Base FAR	Local share required at base FAR	Local share required at base FAR +20%
Far North	$29.10M	$25.20M	69%	$7.81M	$2.77M
Kaipara	$25.10M	$14.40M	62%	$5.47M	$2.59M
Whangārei	$17.20M	$8.30M	53%	$3.90M	$2.24M
Total	**$71.40M**	**$47.90M**		**$17.18M**	**$7.60M**

Historic Financial Impact of Emergency Events

The scale of historic emergency events on the network during storm events is shown in Figure 3-3 below. These charts demonstrate the last 10 years of emergency events have averaged at $3.5M/year for FNDC, and $1.0M/year for KDC and $1.8M/year for WDC. The investment in planned preventative maintenance and resilience improvements had been very small compared to the reactive emergency works spend.

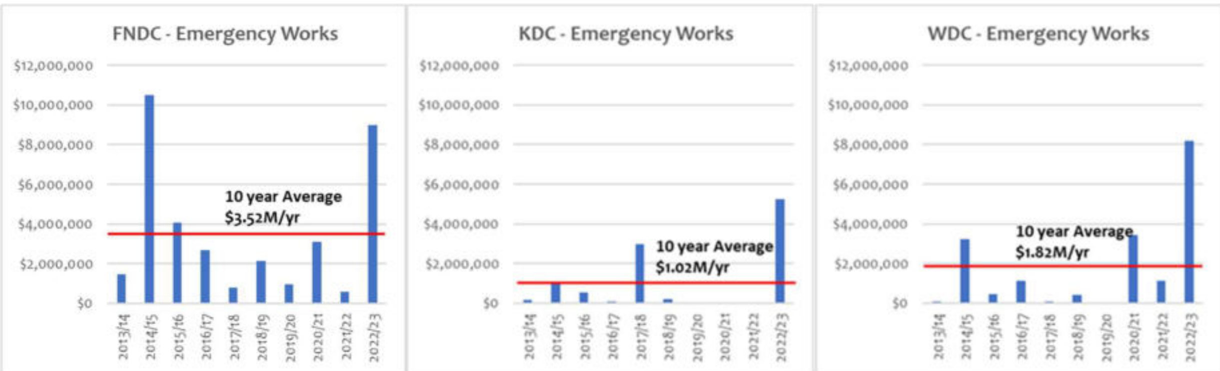

Figure 3-3: Historic cost of emergency works

One of the key issues identified by the freight industry is having suitable detours for main freight routes, particularly SH1 which is the main freight route to Auckland. Most of these routes are not yet fit for purpose to carry state highway and freight traffic due to being slip and flood prone, having one-lane bridges, tight corners which cannot be negotiated by heavy vehicles without crossing the centreline, and bridges incapable of carrying 50Max or HPMV loads. Currently there are nominated detour routes where 50Max and HPMV trucks need to park up until the state highway is cleared because the detour route is not capable of carrying these loads. Even road closures for emergency events such as a vehicle crash, can result in significant delay and disruption for heavy vehicles due to hilighted issues with the detour routes.

For the local road network, there are no identified detour routes for some key arterials (such as Whangarei Heads Road and Pouto Road) which carry equivalent amounts of traffic to the SH network and are critical for the safe and efficient operation of the network.

The NTA is currently developing a Resilience Plan to identify critical routes and the threats to these routes through slips, flooding or coastal inundation. A key part of this plan is to develop a forward works programme to carry out treatment on these critical routes in a planned manner. This should focus effort on addressing the highest need areas first which will result in the biggest gains to improving the security of the network and reduce unplanned road closures over time.

3.1.2 Key Issues and Actions

Develop FWP

Through the Resilience Improvement Plan, develop a prioritised programme of slip repairs and flood mitigation required on key arterial routes, tourist routes and on roads that form the only vehicle access to isolated communities.

Diversion Routes

The State Highway network in Northland forms the key means of access within the Northland region. This was recognised in the Northland Lifelines Group Infrastructure Resilience Plan. This plan identified that the State Highway networks were critical lifelines that provide access for people and emergency vehicles as well as for food and fuel to Northland communities. The Resilience Plan identified the top 5 risks for the transport network as:

- Flooding
- Land instability
- Tsunami/Surge
- High Winds
- Chemical Spills.

In addition to these top 5 risks, State Highway closure due to a vehicle accident is a very real risk. Maps from the Northland Lifelines Group Infrastructure Resilience Plan are included in Appendix 08.A (Northland Lifelines Maps).

Because of the criticality of these highways, bypass routes have been agreed should an emergency event require the highway to be closed. Figure 3-4 following shows the major State Highway and local roads diversion routes. These diversion roads were used during the 2022/2023 storm events when SH1 was closed.

These routes are not designed to carry highway loading and can deteriorate rapidly when diversion traffic uses these roads for extended periods. In addition, often when a State Highway is closed due to storm damage, the local diversion roads are often also flooded or damaged, and this can create safety risks for traffic detoured onto these routes.

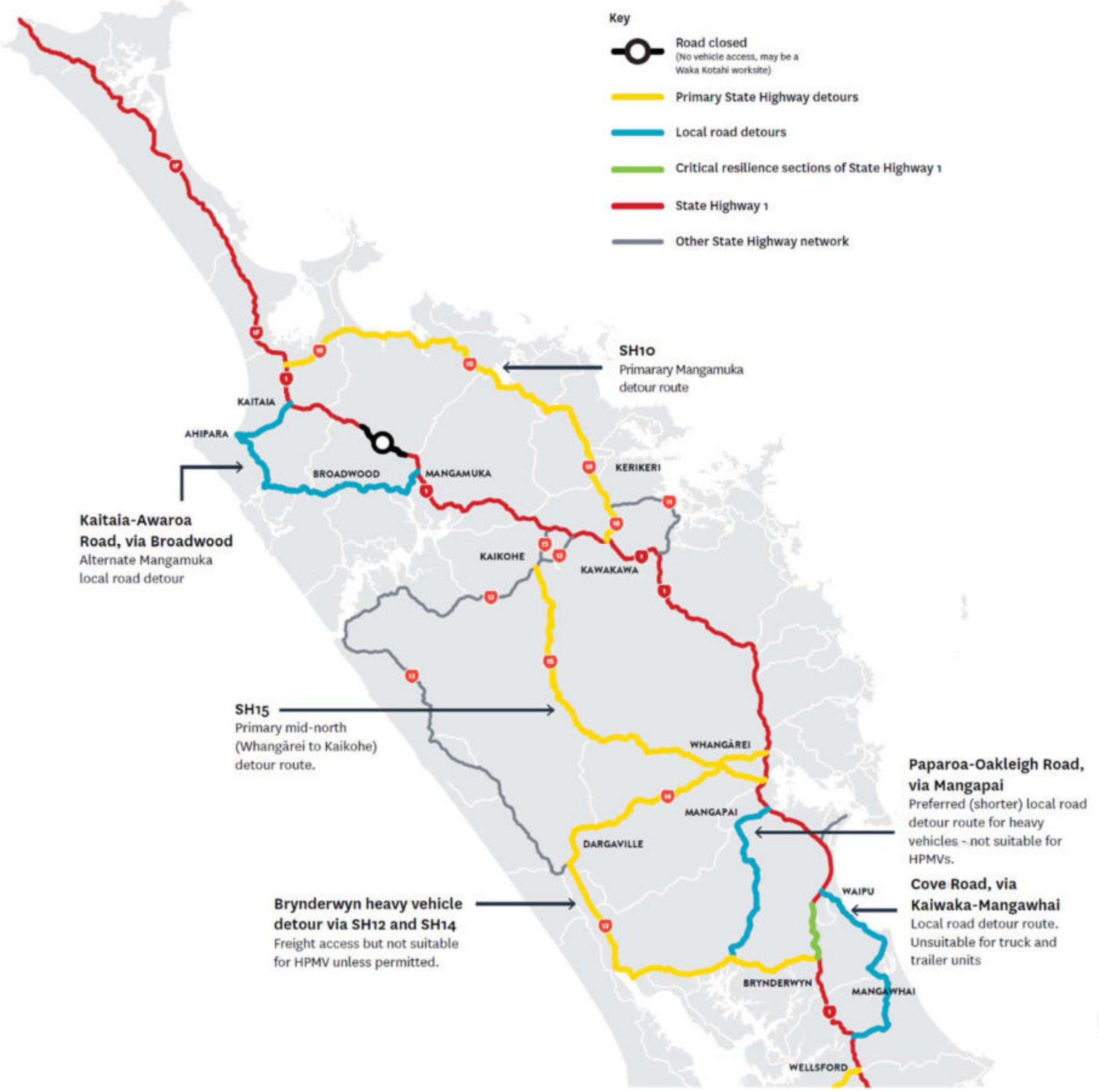

Figure 3-4: SH and NTA network diversion routes

3.1.3 Benefits

Our road network will be more robust during emergency events with reduced likelihood of delay and travel disruption due to road closures on freight, tourist, and detour routes and key lifelines. Access to isolated communities will be safeguarded.

A resilient transport system (that proactively addresses current and emergent risks) that is available for customers to use is fundamental to economic and social resilience of communities. Disruptions undermine economic growth and social well-being of communities and businesses. Resilience is critical for the availability of the national and regional transport system that carries freight, supports tourism, and that links regions to the wider transport system and markets. Poor resilience can impede critical and emergency services providing response and recovery support after significant events.

The following activities would make for a more resilient transport system:

- Addressing slips and flood mitigation in a proactive manner will reduce the likelihood of catastrophic failure and will reduce ongoing maintenance costs. This will minimise delay and disruption on key arterials, tourist routes and will provide security of access for isolated coastal communities. It will help ensure that access for essential supplies such as food, fuel, and medical supplies can be maintained. The proactive treatment of known slips and flood susceptible areas will also help mitigate the increased intensity of storm events in the future that are expected to occur due to the effects of climate change.
- Providing fit for purpose detour routes for the state highway network and key local arterials would enable traffic and freight flows to negotiate the detour efficiently and safely.
- Considering the impacts of climate change in low-lying coastal areas will help planning of new roads and coastal protection in these areas. This will help future proof the road network from potential sea level rise.
- Use maintenance and renewal opportunities to implement improvements to prevent reoccurrence of failures at sites and carry out a programme preventative maintenance on assets that contribute to road failures.
- Understand where the quick fix to make passable, versus permanent reinstatement principles apply. Advocate to build back better where economically justified.

3.1.4 Consequences

Road closures during emergency events, such as heavy rain events, will continue jeopardising key freight and tourist routes, lifelines and access to isolated communities. When a road is closed due to poor resilience, diversions can be long with a lower level of service and diverted traffic loading can accelerate deterioration on the diversion routes. In addition, VKT (Vehicle Kilometres travelled) increase.

Without a proactive resilience programme, historic slips and flood susceptible areas will continue to be at risk of premature failure or flooding and will require ongoing costly maintenance to repair during storm events. Access on key supply routes and to isolated coastal communities may be cut-off during significant storm events which may result in shortages of essential supplies such as food, fuel, and medical supplies. Also access on key tourist routes could be blocked resulting in tourists unfamiliar with the area being sent down back roads and getting lost leading to potential safety concerns.

Detour routes will continue to be below the required standard for state highway and arterial traffic flows and will be a major constraint for 50Max and HPMV freight movements when detours are in place resulting in delays, safety concerns and increased freight costs.

Slips and flooding will become more of an issue in the future with climate change likely to result in more significant rainfall events. It is also likely to result in inundation of low-lying coastal communities.

3.2 Strategic Case – Bottom-Up Assessment

During the development of the AMP, the NTA held a series of workshops to test and refine the problem statements and to determine the strategic response to address the problems. This is shown in the following tables.

Draft Problem Statement:
Due to poor geology and flood risk, the network is vulnerable in many sections which highlights the importance of identifying and managing the response priority and proactive works for lifeline routes to ensure community connectivity.
Current AMP - Key responses outlined in Strategic Case:
• Increase in drainage renewals to replace undersized culverts on primary and secondary collector roads. • Carry out a programme of resilience upgrades through the Low-Cost Low Risk programme. • Develop a Resilience Plan and FWP of resilience works on critical routes. • Develop a Retaining Wall Plan and FWP.
Current Work that is being undertaken:
Currently repairing the extensive damage caused by the recent storm events during 2022 and 2023. Historic slips and flooding issues are being progressively addressed through the Low-Cost Low Risk programme. These are being prioritised to suit rehabilitations (WDC approach) or based on prioritisation matrices (for KDC and FNDC). Overslips are addressed when they fall onto the road. Culverts are being inspected annually, and culvert inlets and outlet cleared. These inspections are also resulting in a programme of culvert barrel cleaning. Work being programmed to change the alignment and grade of the culvert where necessary. Some culverts are being upsized in conjunction with the realignment/regrading work. Crack sealing of roads during dry spells being identified and undertaken on ad-hoc basis. Diversion of stormwater away from known slips. WDC has an emergency response plan.
Aspects of the problem not being addressed and benefits not being delivered?
• The current prioritisation of resilience work does not adequately take into account a corridor approach to target the most important corridors and address the resilience issue on these routes. The Resilience Plan and FWP which is currently under development will target these critical corridors (e.g. detour routes, lifeline routes, arterials, isolated communities etc). • Overslips should be managed to reduce likelihood of them impacting the road network. This could include hydroseeding and/or active regrading of slopes. • Crack sealing needs to be carried out as a programme of work during dry spells. • Drainage facilities installed for historic slips, such as horizontal drains and subsoils, are not being actively maintained. • Emergency works and historic slips/flooding areas not being captured adequately in RAMM and not identifying the impact on the road network, e.g. time to reopen lane or road. • Need to develop a standard NTA response plan so that there is a consistent approach to dealing with emergencies, particularly when the detour routes cross between councils and the state highways. • Detour routes of major/critical local road routes are not identified or planned.
Is the Problem Statement still relevant? If "No" what are the deficiencies? If "Yes" has priority changed?
Yes – this is a high priority, and will increase overtime with predicted climate change impacts
If Problem is not being addressed by the current work, what is the strategic response?

Strategic response	Y/N	Rank	Detail
1 - Programme adjustment: example, Remove/reduce projects/activities.	Y	3	Increase the programme of resilience work to reduce the risk of road closures during emergency events on the FNDC, KDC, and WDC. networks.
2 - Policy approach: example, Adjust level of Service.	Y	1	Accept more frequent and longer road closures on non-critical routes, to prioritise effort on more critical routes to reduce the likelihood of closures on these routes.
3 - Demand management: example, Manage use – up/down.	Y	2	Develop programme of preventative maintenance such as: Culvert barrel cleaning from annual inspections and replace undersized culverts. Cyclic slip drainage maintenance to target horizontal and subsoil drains. Crack sealing of slip scarps. Hydroseeding and regrading of overslips. Proactive management of drainage systems in known flooding areas.
4 - Funding adjustment: example, Increase/decrease	Y	N/A	A funding adjustment would likely to be required with all of the other options.
5 - Risk based: example, Hold Assets longer.	Y	N/A	Same as Option 2.

How effective are the options? (as per Multi Criteria Assessment below)

Option 1 – Increase programme of resilience work on the FNDC, KDC and WDC networks – Score 1.4 out of 3 (Preferred)

Option 2 – Prioritise critical routes at the expense of lower priority routes – Score 1.65 out of 3 (Preferred)

Option 3 – Preventative maintenance programme – Score 1.45 out of 3 (Preferred)

Draft an updated problem statement (if applicable)

Poor geology, a subtropical climate and poor drainage systems make our roads susceptible to slips and flooding during heavy rain events, resulting in road closures that often affect critical routes. This is only expected to get worse over time due to the effects of climate change.

Strategic Case Multi Criteria Option Analysis, RCA: NTA
Problem: Resilience

Short list up to 3 options from the following - Can we make-----

Option	Yes/No	Reason	Rank
1 Programme adjustment eg, Remove/reduce projects/activities	Yes	Increase the programme of resilience work to reduce the risk of road closures during emergency events on the FNDC, KDC, and WDCnetworks.	3
2 Policy approach eg, Adjust level of Service	Yes	Accept more frequent and longer road closures on non-critical routes, to prioritise effort on more critical routes to reduce the likelihood of closures on these routes.	1
3 Demand management eg, Manage use – up/down	Yes	Develop programme of preventative maintenance such as: - Culvert barrel cleaning from annual inspections and replace undersized culverts. - Cyclic slip drainage maintenance to target horizontal and subsoil drains. - Crack sealing of slip scarps. - Hydroseeding and regrading of overslips.	2
4 Funding adjustment. eg, Increase/decrease	Yes	A funding adjustment would likely to be required with all of the other options.	N/A
5 Risk based eg, Hold Assets longer	Yes	Same as Option 2.	N/A

Criteria/Drivers to consider	Weighting (Importance) (Total to 100%)	How good is this option					
		Option 1 - Increase programme of resilience work on the WDC and KDC		Option 2 - Prioritise critical routes at the expense of lower priority routes		Option 3 - Preventative maintenance programme	
		Raw	Score	Raw	Score	Raw	Score
Meets GPS	10%	2	0.2	3	0.3	3	0.3
Meets RLTP	10%	2	0.2	2	0.2	2	0.2
Addresses Problems	20%	2	0.4	2	0.4	2	0.4
Will realise Benefits	10%	2	0.2	2	0.2	2	0.2
Will meet Community Outcomes	10%	2	0.2	1	0.1	1	0.1
Will meet Customer Outcomes (CLOS)	10%	1	0.1	2	0.2	1	0.1
Provides high Performance impacts	10%	2	0.2	2	0.2	2	0.2
Provides high Environmental Impacts	5%	1	0.05	1	0.05	1	0.05
Provides Cultural Impacts	5%	1	0.05	0	0	0	0
How Costly	10%	-2	-0.2	0	0	-1	-0.1
Other 1							
Other 2							
Other 3							
Other 4							
Totals	100%		1.4		1.65		1.45

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

3.3 Strategic Case Summary (Line of Sight in Action)

Based on the assessment of the problem statement and the strategic responses undertaken in the previous section, a summary of the results and the affected work categories are shown in the table below:

Issue	Resilience
Problem Statement	Poor geology, a subtropical climate and poor drainage systems make our roads susceptible to slips and flooding during heavy rain events, resulting in road closures that often affect critical routes. This is only expected to get worse over time due to the effects of climate change.
Benefits	• Improve resilience of the network • Reduce unplanned road closures • Reduce long term emergency work costs
Trend	Getting Worse
Strategic Response	**Programme Adjustment** • Increase programme of resilience work on the FNDC, KDC and WDC networks **Policy Approach** • Prioritise critical routes at the expense of lower priority routes **Demand Management** • Preventative maintenance programme
Activity/Work Category	WC 140 Minor Events WC 141 Emergency Events WC 215 Structural Component Replacement Programme WC 216 Bridge and Structures Renewals Programme WC 341 Low Cost / Low Risk Improvements WC 357 Resilience Improvements

4 Options, Assessment and Alternatives

4.1 Option Identification (Root Cause Analysis)

Following the identification of the problem statements, a root cause analysis was undertaken to identify the underlying causes of these problems. The root cause analysis was undertaken using the "5 Whys" type methodology in accordance with NZTA's Business Case Approach Practice Note No.3 – Root Cause Analysis in Business Case Development.

This process was undertaken through a series of workshops with the NTA Assets Team and NZTA local representative to determine the underlying causes of the identified problems. This was a bit of a deep dive into the myriad of issues that affect the transport network and a multitude of root causes were identified for each problem statement.

For each root cause, a possible solution (option or alternative) was identified to try and address this cause. These solutions ranged from high level interventions such as changing council policies and developing strategies to low level interventions such improving grader operator training.

The following table includes the results of the root cause analysis and the possible solutions to address the problem statement.

Root Cause Analysis – Resilience

Problem statement	Our Road Network resilience is poor in Northland							
why 1	Poor geology and soil conditions in Northland result in road over and under slips.	Northland has over a thousand active slips.	When an unplanned closure occurs there is often no suitable detour routes.			Climate change is predicted to worsen weather impacts.		
why 2	Soils in many locations are prone to slips even on gentle slopes.	There is a historic legacy of active slips.	State Highway detour routes are often not fit for purpose for taking these traffic flows, particularly heavy vehicles.	Critical local roads do not have dedicated detour routes established.	Northland have many isolated communities.	Climate change is likely to cause more droughts which will impact on the road network.	Climate change is likely to cause higher intensity storms which will impact on the road network.	Climate change is likely to cause sea level rise which will impact on the road network.
why 3	Many areas have Northland Allochthon (as known as Onerahi Chaos).	Insufficient investment in the past to address active slips.	The alignment and width of local roads is not designed to take state highway traffic.	Lack of planning of local road detour routes.	Historic development of the road network has often provided only one route to communities.	Droughts open up cracks in pavements which makes these more susceptible to slips.	Storms are more likely to overwhelm the drainage systems.	There is likely to be inundation of low lying coastal areas.
why 4	Northland Allochthon is a very weak and moisture sensitive soil.	Slip repairs were not prioritised in the past.	Local roads are designed for local road traffic flows.	Focus has been on providing State Highway detours.	Many communities are located on the coastal fringe with one access road.	Cracks in the pavement surface allow water in which can soften the underlying soil and increase the pavement weight, increasing the likelihood of slips.	Drainage systems often have not been designed. Where these have been designed, they have been designed for historic stormwater flows.	Access to many communities is via low lying coastal areas.
why 5	Poor drainage systems allow water to saturate and soften Northland Allochthon resulting in slips.	Other more pressing demands due to limited funding and funding policies at the time.	Insufficient funding to provide a higher level of service (alignment and width) on these detour routes.	Lack of determination of critical routes and recognition of the need to consider detours of these routes.	Northlands historic access was by sea and many of these communities are located on peninsulars or harbours where access is difficult to provide by road.	Northland's soils are sensitive to moisture and slip prone when saturated.	Stormwater design is typically based on historic rainfall rates.	Road network not designed for predicted sea level rise.
Potential Solutions	Improve drainage systems to control storm flows in areas that are a high risk for slips.	Continue to allocate funding to resilience works to get on top of historic slips on high priority routes.	Continue to discuss with NZTA opportunities for State Highway funding of detour routes to lift these to a fit for purpose standard. Develop a strategic approach to detour routes through the Resilience Strategy.	Continue to develop critical route map and Resilience Strategy to prioritise resilience works on these routes and to consider local road detours of these routes where possible.	Strengthen routes to isolated communities to reduce the risk of unplanned closures. This is being considered and prioritised through the Resilience Strategy.	Carry out a programme of crack sealing during dry summers.	Upgrade critical culverts in at risk areas to cater for predicted storm flows. Carry out stormwater designs for critical culverts allowing for increased stormwater flows due to climate change.	Consider options to Raise/Protect/Retreat roads in low lying coastal areas. Utilise the NZTA risk matrix in NZTA Knowledge Base and Resilience Strategy being developed to assess the appropriate treatment.

4.2 Option Development

The following table was developed by the Roading Efficiency Group as part of a top-down assessment of options to address the identified problems. They summarise the responses in the existing AMP, the effectiveness of the existing programme and the proposed options which have been determined from the root cause analysis which should be considered as part of the option assessment.

Statement Problem 1	Key Responses In existing AMP	Summary of effectiveness of existing programme	Proposed Programme Business Case adjustments (from Root Cause Analysis)
Resilience - Poor geology, a subtropical climate and poor drainage systems make our roads susceptible to slips and flooding during heavy rain events, resulting in road closures that often affect critical routes. This is only expected to get worse over time due to the effects of climate change.	• Increase in drainage renewals to replace undersized culverts on primary and secondary collector roads. • Carry out a programme of resilience upgrades through the Low-Cost Low Risk programme. Develop a Resilience Plan and FWP of resilience works on critical routes. Develop a Retaining Wall Plan and FWP.	• Drainage activity is insufficient to properly maintain the drainage system and is resulting in localised flooding and slips. • Bridge activity in FNDC and, to a lesser extent, KDC and WDC is struggling to keep detour routes viable for HCVs, particularly 50Max vehicles. • Resilience improvements (through LCLR) are starting to address historic slips. • Key issues from Root Cause Analysis: o Drainage systems allowing water to saturate Northland's poor soils resulting in slips and ground creep. o Historic underinvestment in slip repairs has resulted in a large backlog, particularly in FNDC and KDC. o Detour routes not often in a fit for purpose condition for SH traffic flows. o Critical routes not identified or protected. o Pavement cracks open up in summer, making them more susceptible to slips. o Culverts not designed for current storm flows. o Sea level rise likely to affected low lying access to communities	• Improve drainage systems where there is a high risk of slips. • Prioritise investment in resilience improvements. • Develop a strategic approach to managing the resilience of detour routes. Discuss with NZTA opportunities for State Highway funding of SH detour routes on local roads. • Continue the development of the Resilience Strategy and FWP, targeting critical routes. • Strengthen the resilience of routes serving isolated communities. • Carry out a programme of crack sealing in summer to target high risk areas. • Upgrade culverts sizes in areas that are high risk for slips or flooding. • Consider options to raise/protect/retreat roads that are subject to coastal inundation.

5 Option Assessment

The following sections analyse options for addressing the problems and issues identified in the Strategic Case. These options have been identified through the Root Cause Assessment.

Work Categories:	WC 140 Minor Events (small emergency events of less than $100,000 per event)
	WC 141 Emergency Events
	WC 215 Structural Component Replacement Programme
	WC 216 Bridge and Structures Renewals Programme
	WC 341 Low Cost / Low Risk Improvements
	WC 357 Resilience Improvements

5.1 Links to Strategic Case

Problem Statement:	Poor geology, a subtropical climate and poor drainage systems make our roads susceptible to slips and flooding during heavy rain events, resulting in road closures that often affect critical routes. This is only expected to get worse over time due to the effects of climate change.
Benefits of Addressing Problem:	Our road network will be more robust during emergency events with reduced likelihood of delay and travel disruption due to road closures on freight tourist and detour routes and key lifelines. Access to isolated communities will be safeguarded.
Consequences of Not Addressing the Problem:	Road closures during emergency events, such as heavy rain events, will continue to cause road closures, jeopardising key freight and tourist routes, lifelines and access to isolated communities. When a road is closed due to poor resilience, diversions can be long with a lower level of service and diverted traffic loading can accelerate deterioration on the diversion routes. In addition, VKT (Vehicle Kilometres travelled) increase.

5.2 Levels of Service

ONRC Customer Outcomes:	ONRC Resilience CO1 – The number of journeys impacted by unplanned events (NO DATA AVAILABLE)
	ONRC Resilience CO2 – The number of instances where road access is lost (NO DATA AVAILABLE)
Customer Levels of Service:	LTP 1.1 – Decreasing trend in resilience related faults on key routes (New measure) (NO DATA AVAILABLE)

5.3 Options to be Considered

Based on the above data and the root cause analysis, the following options have been considered:

Option	Description
Option 1 – Programme of crack sealing on slip sites	Carry out a programme of crack sealing in summer to target areas that are high risk for slips. The crack sealing will prevent water ingress into the slip scarp and reduce the likelihood of a slip occurring.
Option 2 – Upgrade the culvert sizes in areas that are high risk for flooding or slips.	Upgrade culverts sizes to provide adequate capacity in areas that are high risk for slips or flooding to minimise potential overtopping and washout.
Option 3 – Repair historic slips on high priority routes.	Continue to allocate funding to resilience works to get on top of historic slips on high priority routes. This will improve the resilience of key routes over time.
Option 4 – Strengthen the resilience of routes serving isolated communities**.**	Strengthen the resilience of routes serving isolated communities to help minimise loss of access to these communities during emergency events such as storm events.
Option 5 – Raise/Protect/ Retreat roads subject to coastal inundation.	Consider options to raise/protect/retreat roads that are subject to coastal inundation to minimise instances of closure and damage. Need to consider the effects of climate change and resulting sea level rise.

PBC Multi Criteria Option Analysis, RCA: NTA

Activity/Work Categories: Low Cost Low Risk - Resilience (WC 341)

Short list up to 3 options from the following:

Option - Can we make	Yes/No	Rank	Reason
❑ Intervention response **timing** change			
❑ **LoS** adjustments	Yes	2	Upgrade culverts sizes in areas that are high risk for slips or flooding
❑ Use existing assets **differently**			
❑ **Blending** Work Categories differently			
❑ **Risk** - Hold Assets longer	Yes	3 - A 1 - B	A. Continue to allocate funding to resilience works to get on top of historic slips on high priority routes. B. Carry out a programme of crack sealing in summer to target high risk areas.
❑ Managing **demand**			
❑ **Route** Management	Yes	4 - A 5 - B	A. Strengthen the resilience of routes serving isolated communities. B. Consider options to raise/protect/retreat roads that are subject to coastal inundation.
❑ Alternative approaches – different **solutions/technology**			
❑ **Maintenance vs Renewal** adjustments			
❑ **ONRC** Classification variance			
❑ Extended **temporary** management			
❑ **Supply chain** improvements			
❑ Improve **systems and capability**			

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

Criteria	Weighting (Importance) (Total to 100%)	How good is this option									
		Option 1 - Programme of crack sealing on slip sites		Option 2 - Upgrade the culvert sizes in areas that are high risk for flooding or slips		Option 3 - Repair historic slips on high priority routes		Option 4 - Strengthen the resilience of routes serving isolated communities		Option 5 - Raise/Protect/ Retreat roads subject to coastal inundation	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	10%	1	0.1	1	0.1	2	0.2	3	0.3	2	0.2
Problem solving effectiveness	10%	2	0.2	2	0.2	2	0.2	2	0.2	1	0.1
Benefits realised	10%	2	0.2	2	0.2	2	0.2	2	0.2	1	0.1
Good Environmental impacts	5%	1	0.05	1	0.05	1	0.05	1	0.05	1	0.05
Value for Money	10%	3	0.3	2	0.2	1	0.1	0	0	0	0
Closing Customer and Technical LoS gaps and impacts	10%	1	0.1	1	0.1	1	0.1	1	0.1	1	0.1
Closing ONRC Performance gaps	10%	0	0	0	0	0	0	0	0	0	0
Asset preservation and sustainability	10%	2	0.2	1	0.1	1	0.1	1	0.1	2	0.2
Total Cost of Ownership (whole of life Costs)	10%	1	0.1	1	0.1	1	0.1	0	0	0	0
Life Cycle Management	10%	1	0.1	0	0	0	0	0	0	1	0.1
COVID-19 Recovery	5%	0	0	0	0	0	0	0	0	0	0
Totals	**100%**		**1.35**		**1.05**		**1.05**		**1.0**		**0.85**

5.4 Option Assessment and Line of Sight

The options and the line of sight to the preferred strategic response and the problems they are addressing are shown in the table below. These options have been ranked in order of preference and then have been assessed through a multi-criteria assessment (MCA) to determine the highest scoring options that are preferred and are to be adopted. The MCA assessment is also provided as follows.

Work Activity	Problem Statements Addressing	Preferred Strategic Response	PBC Options to be Considered	Option Rank	MCA Score	Preferred Options
Low Cost Low Risk Improvements	**Resilience** - Poor geology, a subtropical climate and poor drainage systems make our roads susceptible to slips and flooding during heavy rain events, resulting in road closures that often affect critical routes. This is only expected to get worse over time due to the effects of climate change.	**Programme Adjustment** • Increase programme of resilience work on the FNDC, KDC and WDC networks **Policy Approach** • Prioritise critical routes at the expense of lower priority routes **Demand Management** • Preventative maintenance programme	**Programme Adjustment** **Route Management**			
			• Option 4 - Strengthen the resilience of routes serving isolated communities	4	1.0	Yes
			• Option 5 - Raise/Protect/ Retreat roads subject to coastal inundation	5	0.85	Yes
			Policy Approach **LOS Adjustments**			
			• Option 2 - Upgrade the culvert sizes in areas that are high risk for flooding or slips	2	1.05	Yes
			Demand Management **Risk**			
			• Option 1 - Programme of crack sealing on slip sites	1	1.35	Yes
			• Option 3 - Repair historic slips on high priority routes	3	1.05	Yes

Preferred Options: From the multi-criteria assessment the preferred options are:

- Option 1 – Programme of crack sealing on slip sites.
- Option 2 – Upgrade the culvert sizes in areas that are high risk for flooding or slips.
- Option 3 – Repair historic slips on high priority routes.
- Option 4 – Strengthen the resilience of routes serving isolated communities.
- Option 5 – Raise/Protect/ Retreat roads subject to coastal inundation.

5.5 Financial Impact

The following tables show the work categories and examples of the associated tasks. For full financial details for the work categories, refer to Section 08 (Financials).

5.5.1 *Far North District Council*

Work Category	Financial Impact
WC 341 Low Cost/Low Risk Improvements	Funding for a resilience programme to address ongoing slips on critical routes Funding for associated improvements on pavement rehabilitation projects Funding to provide new detour routes and improved resilience of existing detour routes identified through the Integrated Transport Plan Funding for new roading upgrades to improve access to communities as identified in the Twin Coast Discovery Route PBC and incorporated into the Integrated Transport Plan

5.5.2 *Kaipara District Council*

Work Category	Financial Impact
WC 341 Low Cost/Low Risk Improvements	Funding for a resilience programme to address ongoing slips on critical routes Funding for associated improvements on pavement rehabilitation projects
Road Improvements	Funding for a business case to investigate the feasibility of a new connection from Cove Road to the Mangawhai Central development as identified in the Mangawhai Network Operating Framework

5.5.3 *Whangarei District Council*

Work Category	Financial Impact
WC 341 Low Cost/Low Risk Improvements	Funding for a resilience programme to address ongoing slips on critical routes Funding for associated improvements on pavement rehabilitation projects

5.6 AMP Improvement

The following improvements will be considered:

- Database of vulnerable sites.
- Link Resilience database to RAMM.
- Implement Standard Operating Procedure for emergency response.

Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 09

Growth and Demand

Overview and Management
Problems, Benefits, Consequences
Options Assessment

Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 09

Growth and Demand

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Appendix 09.A – Public Transport

Appendix 09.B – Parking

1 Overview

1.1 Description

Demand and growth on the transport network is generally caused through one of the following mechanisms:

- Economic growth and increased productivity – business growth can affect traffic flows, and in particular heavy vehicle flows. This can affect road capacity and road renewal cycles.
- Population growth – increase in population will create demand for more trips and new infrastructure through subdivision development.
- Asset growth or change – this often follows business and population growth or can be from revocation of state highways or increased use of new technology, e.g. variable school zone signs. Growth in transport assets results in increased maintenance and renewals costs.
- Mode share change – change in mode share can create demand for new or improved infrastructure, e.g. increased number of cyclists could create demand for safer cycleways.
- Level of service change – changes to levels of service will change the amount of maintenance, renewals, and capital funding to achieve the required service.

These demands will be discussed in the following sections.

1.1.1 GDP and Productivity (continuing economic growth and productivity)

As at 2022, the Gross Domestic Product (GDP) in the Northland Region was $9,485 million with a growth of 4.7% which has continued a steady increase averaged at 3.2%pa over the last 10 years and trends similar to the national GDP of 5.3%. (source Infometrics):

Figure 1-1 – GDP Comparison New Zealand/Northland Region (Source Infometrics)

Figure 1-1 above summarises the top five contributors to economic growth in Northland as March 2022. The largest contribution to change in growth are:

- Professional, scientific, and technical services
- Construction
- Retail trade
- Wholesale trade, and
- Healthcare and social assistance.

The biggest contributors to growth in GDP over the last 10 years have been Manufacturing and Agriculture, Forestry and Fishing, Health Care and Social Assistance, Construction, and the Retail Trade.

Table 1-1 lists all the ANZSIC Level 1 industries and their contribution to growth for 2021 and 2022.

Table 1-1: summary of ANZSIC Level 1 Northland industries ranked by contribution to growth 2021-22

ANZSIC Level 1 industries ranked by contribution to growth, 2021-2022

March years, 2022 prices

ANZSIC Level 1 industries		Northland Region				
Code	Name	2021	2022	Absolute growth	% point contribution to growth	Annual growth
M	Professional, scientific and technical services	$436.1m	$512.3m	$76.2m	0.84%	17.5%
E	Construction	$682.2m	$755.5m	$73.3m	0.81%	10.7%
G	Retail trade	$566.0m	$612.2m	$46.2m	0.51%	8.2%
F	Wholesale trade	$238.3m	$276.1m	$37.8m	0.42%	15.9%
Q	Health care and social assistance	$729.9m	$753.6m	$23.7m	0.26%	3.2%
I	Transport, postal and warehousing	$274.4m	$294.8m	$20.4m	0.22%	7.4%
O	Public administration and safety	$378.3m	$398.6m	$20.3m	0.22%	5.4%
C	Manufacturing	$1,261.7m	$1,281.4m	$19.7m	0.22%	1.6%
H	Accommodation and food services	$188.7m	$205.7m	$17.0m	0.19%	9.0%
L	Rental, hiring and real estate services	$654.2m	$670.0m	$15.8m	0.17%	2.4%
N	Administrative and support services	$122.0m	$136.0m	$14.0m	0.15%	11.5%
S	Other services	$128.3m	$140.6m	$12.3m	0.14%	9.6%
P	Education and training	$337.3m	$339.7m	$2.4m	0.03%	0.7%
J	Information media and telecommunications	$68.7m	$70.3m	$1.6m	0.02%	2.3%
B	Mining	$12.7m	$13.2m	$0.5m	0.01%	3.9%
R	Arts and recreation services	$75.2m	$75.6m	$0.4m	0.00%	0.5%
A	Agriculture, forestry and fishing	$932.9m	$928.7m	-$4.2m	-0.05%	-0.5%
D	Electricity, gas, water and waste services	$180.8m	$174.8m	-$6.0m	-0.07%	-3.3%
K	Financial and insurance services	$153.2m	$140.6m	-$12.6m	-0.14%	-8.2%
	Total	**$9,057.8m**	**$9,485.0m**	**$427.2m**	**4.70%**	**4.7%**

As at March 2022, unemployment in Northland has trended downwards to virtually match the New Zealand average of 3.5%, although technically still higher than the national average over the past 10 years the difference of 2-3% has diminished. This is shown in the figure 2 below (Source: Infometrics).

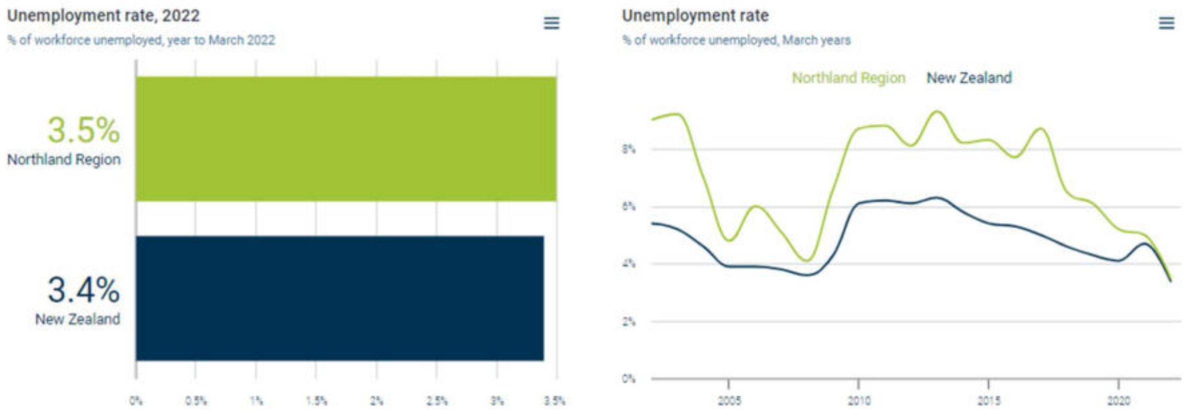


Figure 1-2 - unemployment rate comparison New Zealand/Northland

In addition, mean annual earnings in 2019 for Northland are $61,483 which is lower than the national average of $69,585.

1.1.2 Social Deprivation

Northland is one of the most socially deprived regions of New Zealand with only the Gisborne region having similar levels of deprivation. This is shown in the maps below from the University of Otago 2018 Interim Index of Deprivations. Of particular note are that large areas of the Far North (particularly the Aupouri Peninsular, Hokainga, Doubtless Bay and Mid North) and many areas of Kaipara (Kaihu Valley, West Coast, Pouto and Tinopai) and are in the top 20% of most deprived. Many suburbs of Whangarei City are also in highly deprived areas.

This is a result of Northland having higher rates of unemployment, lower household incomes, lower home ownership rates and poorer housing, more single parent families and lower levels of access to services than the rest of the country.

Economic growth opportunities and better access to jobs and social opportunities will help improve household incomes and reduce unemployment which will in turn lead to better home ownership rates, access to services and improve family well-being. Transport initiatives that will support growth and improve access, particularly for the transport disadvantaged (such as walking and cycling facilities and bus services), will play a part in helping to reduce the social deprivation in Northland over the long term.

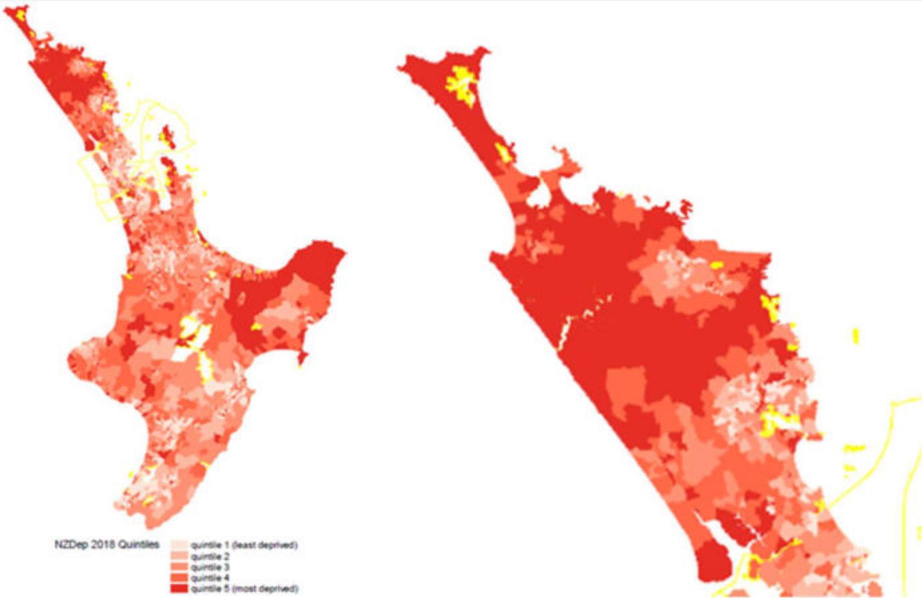


Figure 1-3 - University of Otago 2018 Interim Index of Deprivations

1.1.3 Freight Demand

Northland is responsible for about 6% of the national road freight, much of which is generated by its primary industries. Most of the freight movements are within the region but limited quantities are also transported to and from Auckland and to the Bay of Plenty and Canterbury. In 2017/18, 16.6 million tonnes of freight were transported in Northland by road. Most of the freight flows in the region consist of logs and wood products, petroleum (from the Marsden Point Refinery), lime, cement and fertiliser, aggregates, and dairy products. This is shown in the following graph.

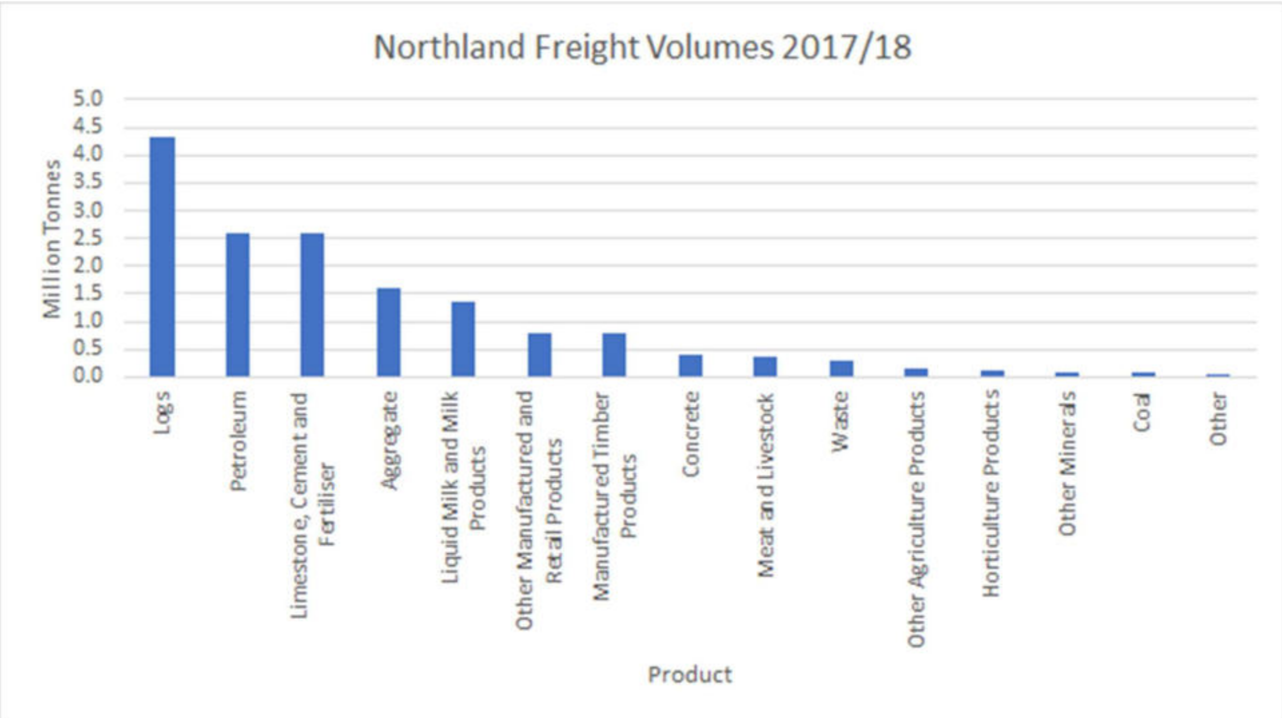


Figure 1-4: Freights Volume from Northland (Source: MOT National Freight Demand Study 2017/18)

Of the above Northland freight volumes, some are nationally significant as described in the table below:

Product	% of Total National Freight Volume
Petroleum	28.3%
Limestone, Cement and Fertiliser	25.4%
Logs	11.8%

(Source: MOT National Freight Demand Study 2017/18)

Estimated total freight to, from and within Northland has increased by almost 1.8 million tonnes between 2012 and 2017/2018. This represents steady growth of around 2 percent per annum.

According to the Ministry of Transport National Freight Demand Study 2017/18, freight in the country is expected to stay largely static over the next 30 years, with a dip around 2042/43 due to lower logging harvest. This is shown in the figure below. The study also predicts that Northland freight volumes are also expected to follow this trend and be largely static over the next 30 years. However, the recent reports recommending the potential for freight from Ports of Auckland to go through Northport at Marsden Point would see a significant increase in freight in Northland. Also, the investment from the Provincial Growth Fund on tourism and water storage projects to support horticulture are likely to result in increased freight movements to support these industries. This is described in more detail in Section 1.2.3.

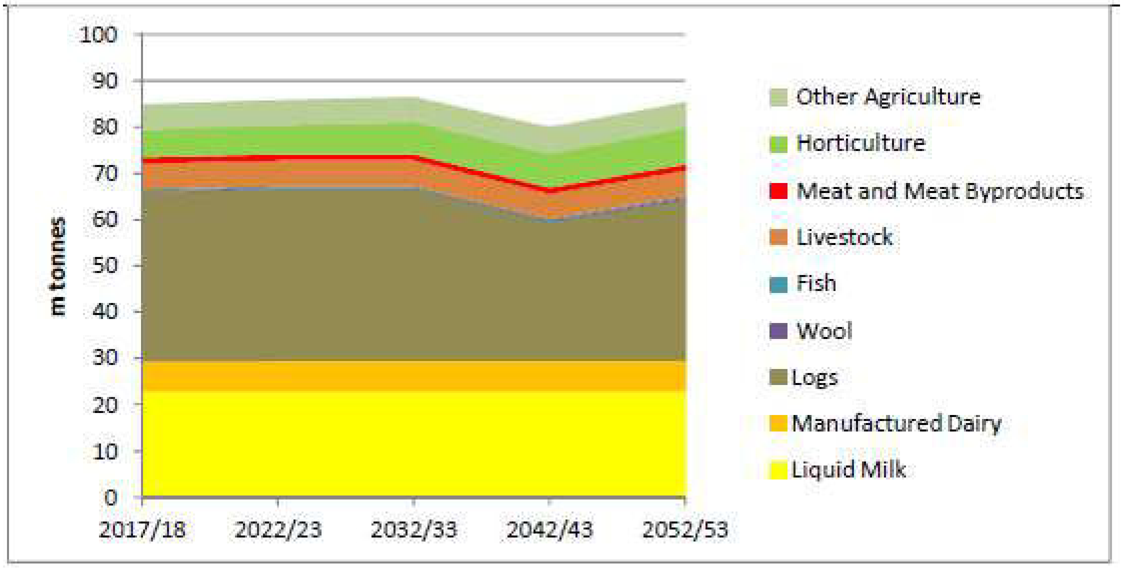


Figure 1-5: Estimates and forecasts of movements of supply-driven commodities 2017/18 to 2052/53 (m tonnes)

With a significant proportion of freight being logs, there is an increasing demand for the use of high productivity motor vehicles (HPMVs) and 50Max vehicles, which are road vehicles capable of carrying payloads of up to 62 tonnes and 50 tonnes respectively which is higher than the standard limit of 44 tonnes.

The increase in heavy vehicle flows and the use of 50Max vehicles is likely to result in increased requirements for maintenance and servicing of the road network. Low resilience and quality of roads has real effects on the efficiency of freight movements in the region. For example, Fonterra has noted that the standard of roads has impacts on the cost of maintaining their tankers – up to three times the cost experienced in other regions (Winder, 2014).

In addition, the increasing use of heavy vehicles causes dust problems on unsealed roads impacting on households, crops, and water quality. The Northland Regional Council has found that, at times, dust breached national environmental standards on some roads. Communities in Northland have been quite vocal about the problem and are looking for remedies, although dust suppressants are costly.

The rail line in Northland only has limited freight flows (only 0.6% of the freight volume in 2017/18) and the standard of the line restricts rail freight growth. A reduction in rail freight has occurred over the last decade with the closure of Port Whangarei and the opening of Northport at Marsden Point, which has no rail link. The decline in rail usage over the past 15 years has seen the mothballing of the Dargaville branch line and the suspension of rail traffic on the main line north of Kauri. This has placed increased demand on road transport as the main means of freight transport in Northland. To reverse this trend, $95M of investment from the Provincial Growth Fund (PGF) in the North Auckland Rail Line was allocated in the past two years to address deficiencies in the line between Whangarei and Auckland including bridge strengthening and lowering the rail line through several tunnels to allow high-cube containers. This also includes establishing a rail freight hub at Otiria near Morewa in the Far North.

A branch line to link Marsden Point with the rail network has been proposed and considered several times in the past. The preferred route for this rail link to Marsden Point was designated in 2009 to protect it from future development. In 2020, $40M of funding was allocated through the PGF to purchase the properties on the Marsden Point Rail Link route. Until recently this link was seen as a long-term option, and its viability is subject to greatly increased freight demands and the potential role of Northport to handle container freight. However, with recent reports recommending some of Ports of Auckland freight be moved to Northport, there is renewed interest in establishing this rail link.

The key port in Northland is the Marsden Point deep water port otherwise known as Northport. The port serves as the major export and import hub for forestry, fuels, dairy, and fertiliser. Most of this freight comes into and out of the port by road. Port traffic has grown rapidly in recent years due mainly to the increase in forestry exports.

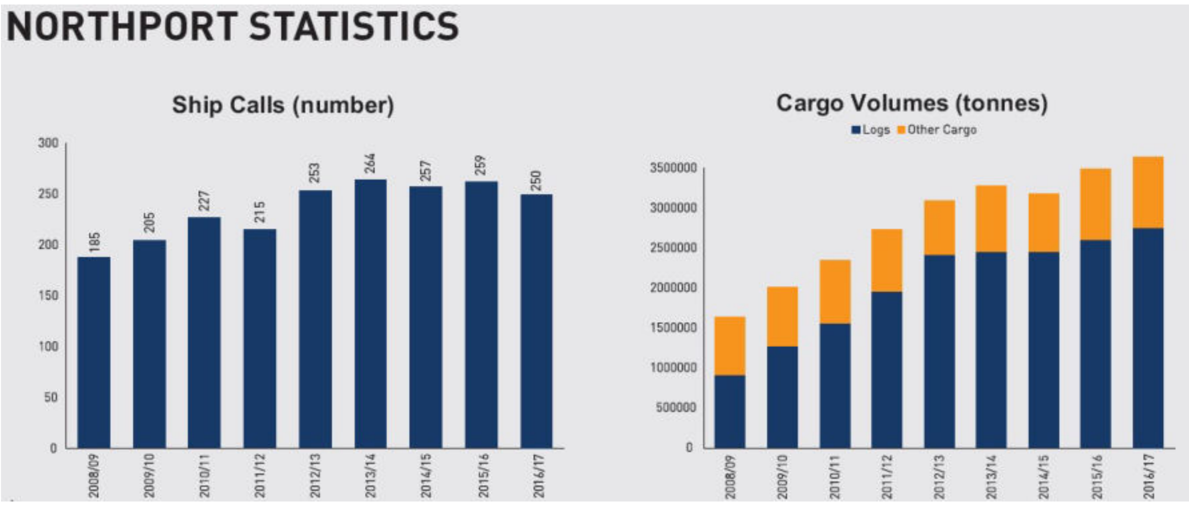


Figure 1-6: Marsden Point Export Growth (Ship Numbers and Freight Tonnages) – (Source: Marsden Maritime Holdings)

Export volumes have increased from around 1.2 million tonnes in 2004 to 3.4 million tonnes in 2017/18, an average increase of 13 percent per annum. This large increase in freight is largely due to increased log and wood product exports which make up over 75% of all exports.

In the long term, it is possible that Northport could develop as a container port and support container freight to and from Auckland as the Port of Auckland grows to capacity. A container crane has been installed at the port for this purpose. As mentioned above, there have been government reports prepared recommending that some of Ports of Auckland's freight be channelled through Northport. However, for this to succeed, road and rail links to Auckland would need to be upgraded and the Marsden Point rail link will be required.

1.1.4 Tourism

Aotearoa New Zealand's tourism industry has been greatly impacted by the Covid-19 pandemic. Closure of the border in early 2020 has made forecasting challenging and given the lack of data and uncertainty around international travel, Ministry of Business, Innovation & Employment (MBIE) decided to halt forecasting, but when reliable data is readily available, they plan to resume.

1.2 Growth Opportunities

1.2.1 Tai Tokerau Regional Growth Study and Action Plan

The Tai Tokerau Regional Growth Study published in February 2015 is a whole of government study which provides a road map for the economic growth in Northland. Following the release of the study, the Tai Tokerau Economic Action Plan was first published in February 2016 and refreshed in 2019 which identifies key work areas to realise the economic growth opportunities in Northland.

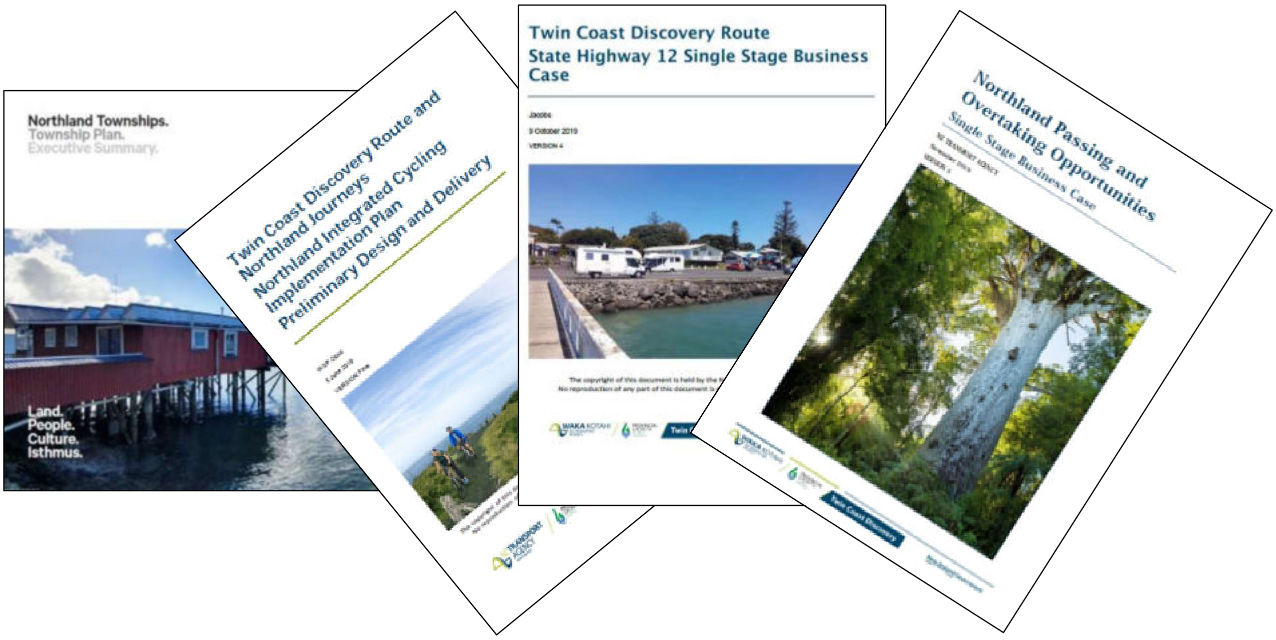
The key work areas where the Northland transportation network could play a role in realising this economic growth are detailed as follows:

- Revitalise the Twin Coast Discovery Route – including improvements to SH10, SH11 and SH12, byway signage, layover improvements and two-laning bridges where required. Programme business cases (PBC) for these initiatives have been developed to determine what upgrades are necessary on the local road network that is on this route or the associated byways. These business cases are described in more detail in Section 1.2.2.
- Improvements to SH1 to improve the connection from Whangarei to Auckland and the rest of the country.
- The revitalisation of the rail line in Northland to Whangarei and Otiria, including a new freight hub at Otiria. This should see a gradual shift in freight movements from road to rail.
- Development of Northport to grow the region's main port to its full potential, which is likely to significantly increase freight movements to and from the port. In the short to medium term, these freight movements would be by road. In the long term, the development of the planned rail spur to connect the Northport to the rail network would result in a shift in freight to rail.
- Upgrades to the Bay of Islands Airport near Kerikeri, which has now been completed, will increase visitor trips to and from the airport.
- Investigating the options for the relocation of the Whangarei Airport. This is a medium/long term project which is likely to occur in the next 10-15 years and may require new or upgraded road links to the new location (sites are currently being investigated). In addition, there may be re-development opportunities for the existing airport in Onerahi which could increase traffic demands.

- Investment in upgrades to key tourism initiatives such as the Māori Battalion upgrade of the Waitangi Museum, the Manea, Kupe's Footprints visitor centre in Opononi and Hundertwasser Art Centre in Whangarei are likely to result in more visitor trips in Northland.
- Development of regional cycle trails to create a network of trails around Northland will again increase the number of visitor trips to Northland to utilise these facilities.
- Providing improved water storage in Far North and Kaipara districts to enable more high-value horticultural development.
- Re-investment in replanting forest blocks that have recently been harvested as part of the 'One Billion Trees' programme to ensure the sustainability of the forestry industry and to capture greenhouse gases.

Many of these projects have already been funded through the Provincial Growth Fund (PGF).

1.2.2 *Twin Coast Discovery Route – Programme Business Cases (PBC)*



The Twin Coat Discovery Route is a sign posted tourist route that traverses across Northland in a loop using SH1, SH10, SH11 and SH12 as well as several local roads as described earlier in Section 1.1.4.

As part of the Tai Tokerau Economic Action Plan, it was identified that the revitalisation of this route was necessary to increase visitor numbers, to encourage visitors to spend more time in Northland (to "stop, stay and spend"), to make the tourist industry less seasonal (high numbers in summer but low in winter months). This would be achieved by improving the route and providing more experiences along the way to visit.

A series of business cases were developed by NZTA with funding from the Provincial Growth Fund to achieve this goal. These business cases were focused on the following:

- SH11 & SH12 – These two business cases were focused on improving the safety, access connections and resilience as well as increasing the economic and social opportunities on SH11 and on SH12 between Rawene and Katui Rd, north of Dargaville. Key initiatives identified included SH1/SH11 roundabout at Kawakawa, SH11 Tirohanga Bridge replacement, a shared path between Paihia and Waitangi, Paihia Town Centre upgrades, improved access to the Waitangi Treaty Grounds, SH12/Rawene Rd intersection upgrade, Opononi Township improvements and safety improvement projects on both routes.

- Northland Integrated Cycling Implementation Plan – This business case assesses and prioritises tourist cycle trails across Northland to provide a connected network to build off the Twin Coast Cycle Trail (Great Ride) and other Heartland Rides that have been developed to date. The routes assessed align with those in the Northland Walking and Cycling Strategy.
- Township Improvement Plans – Plans developed to improve the amenity, facilities, walking and cycling and place making of towns on the route. Townships that were included were Awanui, Dargaville, Horeke, Kaikohe, Kawakawa, Kohukohu, Moerewa and Rawene.
- Passing Opportunities and Rest Areas – These two business cases identified the need for additional passing opportunities and rest areas on SH11 and on SH12 between Rawene and Katui Rd, north of Dargaville. The passing opportunities would enable slower moving visitors and campervans to allow traffic to overtake safely. The rest areas would enable visitors a place to pull over to rest (and reduce the likelihood of fatigue related crashes) as well as to provide places to stop in tourist areas to improve their experience (by providing photo opportunities and improved storey telling).
- Wayfinding – This business case identified the need to improve the road signage to direct visitors along the route and to tourist destinations and facilities along the way. This would be supported by developing special purpose phone apps.

Initially the Provincial Growth Fund (PGF) was intending to fund the projects resulting from these business cases. However, due to other demands on the PGF, the funding of most of these projects is now likely to come from through the National Land Transport Fund (NLTF) with councils providing their local share.

1.2.3 *Provincial Growth Fund (PGF)*

The Provincial Growth Fund (PGF) was a $3 billion dollar fund created as part of a coalition agreement following the 2017 central government election. This fund has been administered by the Ministry of Business, Innovation and Employment (MBIE). Since the fund was created, $712M (as of August 2020) has been allocated to a range of projects within Northland. It is expected that this investment will result in 3,231 new jobs being created.

PROVINCIAL GROWTH FUND TUAWHENUA

FUNDING BY SECTOR

	Approved ($m)
Rail	$221.23
Forestry	$120.78
Tourism	$85.95
Road	$71.91
Water Storage / Management	$68.96
Training Skills / Employment	$30.37
Regional Projects	$27.68
Other	$20.40
Ports	$19.70
Aquaculture	$17.00
Agriculture / Horticulture	$14.98
ICT & Digital Connectivity	$10.27
Airports	$1.75
Manufacturing / Engineering	$0.80
Waste / Recycling	$0.51
Grand Total	$712.28

The breakdown of these projects by sector is shown in the figure to the right. The most significant funding allocations have been to the following areas:

- Rail ($221M) – Revitalisation of the North Auckland rail line from Whangarei to Auckland. This includes bridge strengthening and lowering the rail line through several tunnels to allow high-cube containers. This also includes establishing a rail freight hub at Otiria near Morewa in the Far North. In addition, this work includes purchasing land for the proposed rail link to Marsden Point. The result of this investment is likely to result in a minor shift in freight movements from road to rail. However, until the rail line to Northport (Marsden Point) is built any freight shift to rail is likely to be minor.
- Forestry ($121M) – Reinvestment in the Northland forestry industry to replant harvested areas, particularly on Māori owned land. This is part of the One Billion Trees programme and will help ensure a sustainable forestry industry in Northland. This will result in a minor increase in road traffic during the planting phase, particularly on forestry access roads. Over the long term, it will mean that logging traffic will continue to be a significant source of road freight for the foreseeable future.
- Tourism ($86M) – Investment in the following significant tourist attractions:
  - Hundertwasser Art Centre and Wairau Māori Art Gallery in Whangarei
  - Kawakawa Visitor Centre
  - Kupe Waka Centre in Opononi (Manea – Footprints of Kupe)
  - Māori Battalion Museum in Waitangi

  As described in the Tourism section, these projects will help result in continued growth in tourism in Northland and may result in local transport issues such as additional demands on traffic flows, pedestrian facilities and parking which will need to be catered for.
- Roads ($72M) – Investment in the following significant roading projects:
  - SH10/Waipapa Road Roundabout
  - Far North Strategic Road Sealing
  - Kaipara Kick-Start
- The SH10/Waipapa Road roundabout is complete and has improved access from Waipapa Road onto the highway. It also included a new link road via Klinac Lane which connects the highway to the Waipapa commercial area to the west.

The last two projects were of particular interest for the local road network. The Far North Strategic Road sealing project completed the sealing of 5km of Ngapipito Road (a forestry route), sealing 4.7km of Ruapekapeka Rd (a tourist route) and sealing of 6.3km of Peria Road (a state highway detour route). The Kaipara Kick-Start project completed the last 20km of seal on Pouto Rd (a forestry and tourist route) as well as the investment of $8M in upgrading significant unsealed roads in the Kaipara District ($5M of which is coming from the CIP "Shovel Ready" projects). These projects have resulted in significant improvements of the local road network on these routes.

- Water Storage/Management ($69M) – This includes water storage (dams) for irrigation and drinking water in the Kaitaia, Kaikohe and Kaipara areas. As a result of these projects, it is expected that there will be an increase in horticulture and food production in these areas. This will result in more traffic flows both during the development and operation of these businesses, and in particular freight carrying crops to market.
- Other – In addition, there are other business ventures that have been supported through the PGF. These include:
  - Ngawha Innovation & Enterprise Park – development of a business park near Kaikohe utilising surplus power from the Ngawha power station expansion.
  - Oceania 560 tonne Travel Lift in Whangarei – for haul out and servicing of large boats.
  - Marsden Point Kingfish Recirculating Aquaculture System – Expansion of the kingfish hatchery in Whangarei to grow kingfish fingerlings which can then be transported to other aquaculture facilities to mature.

1.2.4 Crown Infrastructure Partners (CIP), "Shovel Ready" Projects

In April 2020, the government announced a $6.8 billion fund to upgrade infrastructure around the country. This funding was specifically targeted at projects that were "shovel ready" to stimulate the economy and provide jobs following the COVID-19 lockdowns.

The projects listed below are completed / partially completed / or on HOLD that are transport related or likely to have a significant impact on the transport network:

Far North

- Te Hiku o te Ika Revitalisation – Providing shared paths, walkways and facilities between Kaitaia, Awanui, Ahipara and Ninety Mile Beach as well as between Pukenui and Houhora. It also includes the redevelopment of the Kaitaia town centre. (on HOLD)
- Paihia Waterfront Development – Beach replenishment, construction of a breakwater and the provision for a future shared path between Paihia and Waitangi. (on HOLD)

Kaipara

- Kaiwaka Footbridges – The construction of footbridges in Kaiwaka to connect the residential areas around Oneriri Road and Marshall Road to the town centre and school. (Completed)
- Ancient Kauri Trail – Development of a 36km cycle trail from Dargaville to Donnelly's Crossing (near the Waipoua Forest) using the old railway embankment. Also known as the Kaihu Rail Trail and is part of the Northland Integrated Cycle Network business case. (Partially complete)
- Sealing Kaipara Roads – Part of the $8M PGF funded work to strengthen unsealed roads in Kaipara (described above). (Completed)

Whangarei

- Active Modes Urban Shared Path Programme – This project includes the completion of the Raumanga Shared Path and the widening of the Port Road bridge across Limeburners Creek to 4-lanes including a shared path. Both projects are located in Whangarei City. (Completed)
- Pohe Island Bike Park – The development of a bike training park on Pohe Island, Whangarei to enable children and novice riders to develop skills to safely cycle in a road environment. (Completed)
- Oruku Landing Conference and Events Centre – The development of a 4-star hotel and 750 seat conference centre on the Hatea River in Whangarei. This development would also include an electric public ferry/water taxi and ferry terminal as well as a footbridge. (on HOLD)

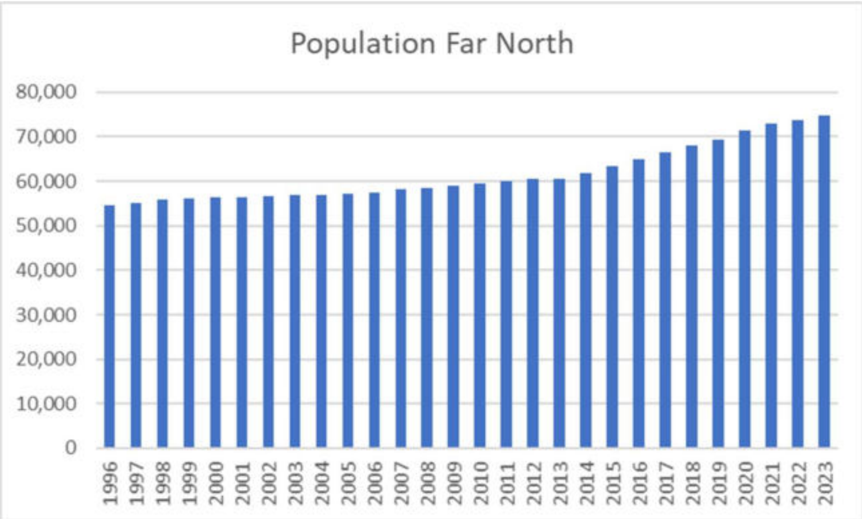
1.3 Population Growth

Northland population has steadily grown over the last twenty years, but the percentage growth has reduced to 1.3% against the New Zealand average of 2.1% the first time 10 years the growth has been less than the national growth. The average for Northland for the last five years was 1.9%Pa against New Zealand with 1.3%pa. the population totals are 203,900 for Northland in 2023 and 5,223,100 for New Zealand.

The growth is expected to continue into the future with strong growth opportunities through its proximity to Auckland, potential growth in Northport, and future government investment.

Each council has developed its own growth projections for the future are these are detailed as follows.

1.3.1 Far North District Growth

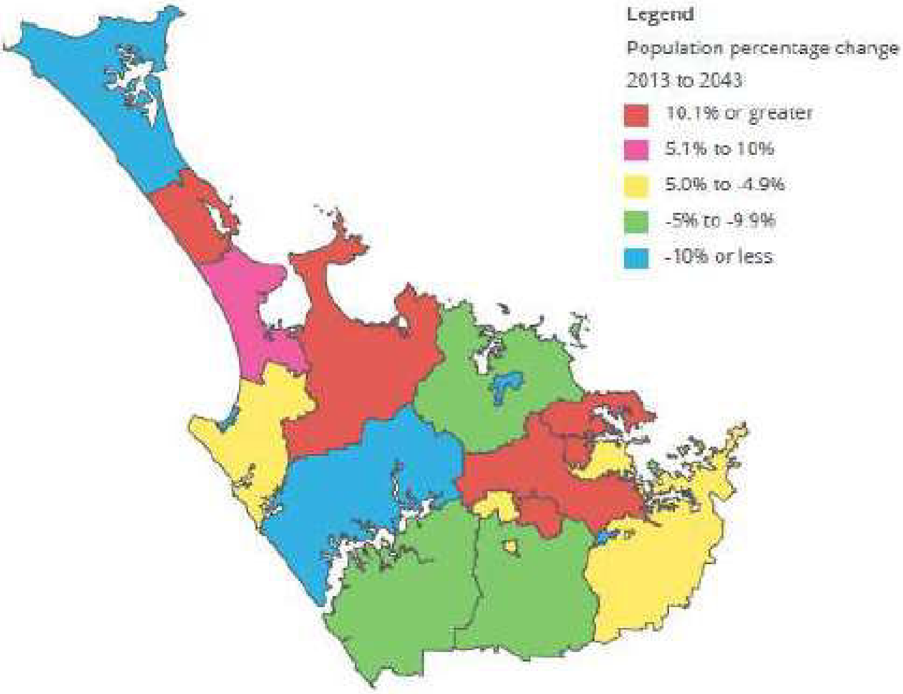


The usually resident population of the Far North District grew by 1.4% from the 2022 to 2023, reaching a population of 74,700 in 2023.

The majority of this population increase has been focused in urban areas located throughout the District, with 85% of growth occurring in and around Kerikeri. Along with Kerikeri, larger urban areas such as Paihia, Kaitaia and Kaikohe cater for around half of the population within the Far North. Most growth is expected to be focused in and around Kerikeri, followed by Mangonui, Coopers Beach and Cable Bay areas, offsetting the ongoing population decline to the north end and west of the District.

The following figure shows the projected population change between 2013 and 2043 for different areas in the Far North District.

Figure 6. Projected population change between 2013 to 2043 within Far North area units



Source: Statistics New Zealand. Projections based on Statistics New Zealand median projections (2016 release)

The Far North District has a high dependency ratio (proportion of people aged under 17 and over 65 years to the working age population) of any New Zealand region indicating a low proportion of working age people as shown to the right, with 41.5% compared to 35% for New Zealand.

Looking to the future, this trend is anticipated to be further emphasised, with the proportion of residents aged 65 years or older forecasted to have the highest population growth between 2028 and 2043.

Future demographic projections indicate that "between 2021 and 2028, the age structure forecasts for Far North District indicate an 8.6% decrease in population under working age, a 16.9% increase in population of retirement age, and a 2.1% decrease in population of working age."

Furthermore, evidence indicates that the largest population increase (in terms of age group) between 2021 and 2028 will be ages 75-79, which is anticipated to grow by 600 persons and account for 5.3% of the total Far North population. By 2028, the largest 5-year age group is expected to be 65-69 years, with a total of 4,611 persons. This will result in different demands on the transport network such as alternative transport options for those that cannot drive or demand for basic infrastructure to accommodate modes such as mobility scooters.

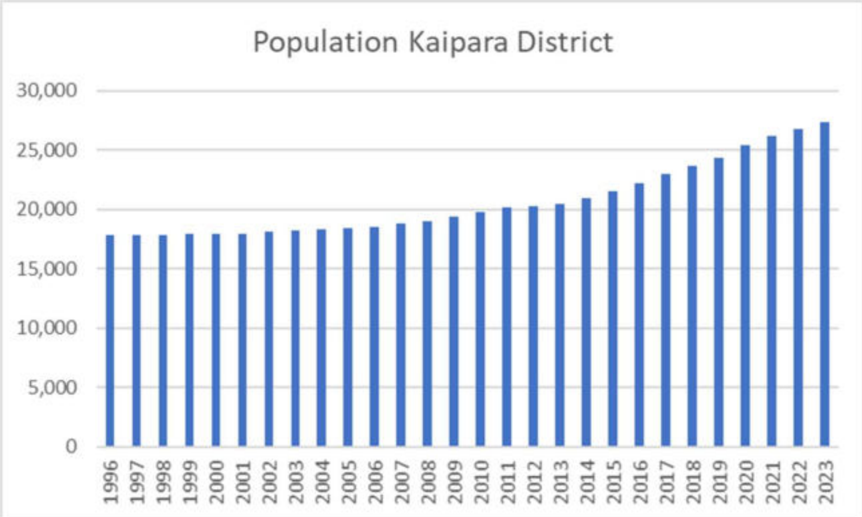
According to the Census 2013, the District's population comprised the following predominant ethnic groups:

- European 66%
- Māori 45%
- Pacific peoples 3.8%
- Asian 2.2%

Anecdotal evidence suggested by Far North elected members indicated that there is an increasing population returning to the Iwi and Hapu residing in the Far North. This is confirmed by Statistics NZ projections from the 2013 census which indicate that the total Māori population in the Far North is expected to grow by approximately 1.2% between the years 2018 and 2038.

1.3.2 Kaipara District Growth

The Kaipara District's population has grown strongly over the 20 years to 2023, reaching a population of 27,300 in 2023. The usually resident population of the Kaipara District grew by 15.2% from the 2018 to 2023 census and 15.6% from the 2013 to 2018 census, making it the fastest growing district in the country. Most of this growth occurred in the Mangawhai area.



The population growth did not slow as predicted over 2020 and 2021 but continued to grow particularly with net migration through more and more individual working from home.

Mangawhai is projected to continue growing rapidly and will soon become the Kaipara District's largest centre. It was the fastest growing town in New Zealand in the past five years with 60% growth between the 2013 and 2018 census. It is attracting retirees and people who can commute back to Auckland for work.

By comparison, Northwest Kaipara and Dargaville is projected to grow slowly with employment growth being the key driver. Dargaville's 2019 population is estimated at 5,027 and is projected to stay largely static, reaching 5,105 by 2031 and 5,097 by 2051.

Much of Dargaville's future growth will be outside the boundary of the Dargaville area and is therefore reported as occurring in Kaipara Coastal and Maungaru.

Central Kaipara will grow both because of employment growth and reducing travel times to Auckland. Most of this growth will be in Kaiwaka and Maungaturoto.

Slight population decline is projected for Otamatea and the Ruawai-Matakohe area due to less local employment and the aging population. However, the number of households in both these areas

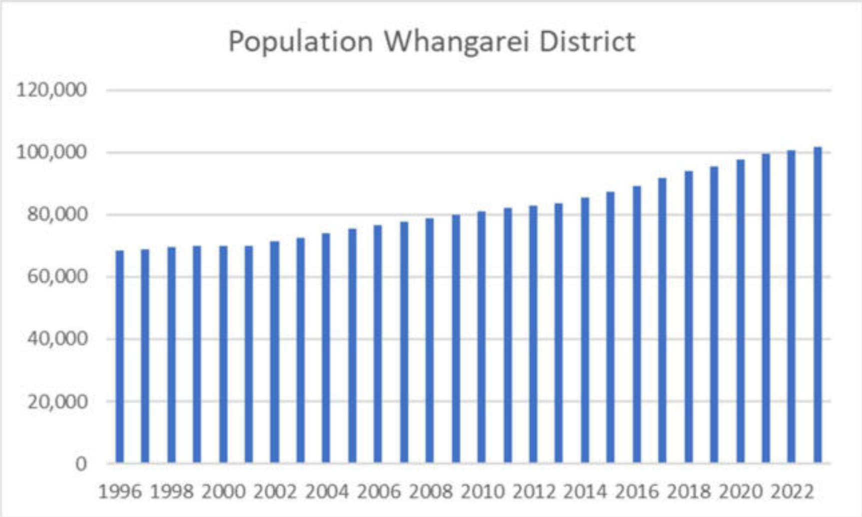
The Kaipara District's population is projected to age rapidly over the next 30 years. The number of residents aged 65 years and over will grow from 6,800 in 2023 to 12,200 in 2051.

The population 15 to 64 years of age will grow slightly. The population under the age of 15 is projected remain steady.

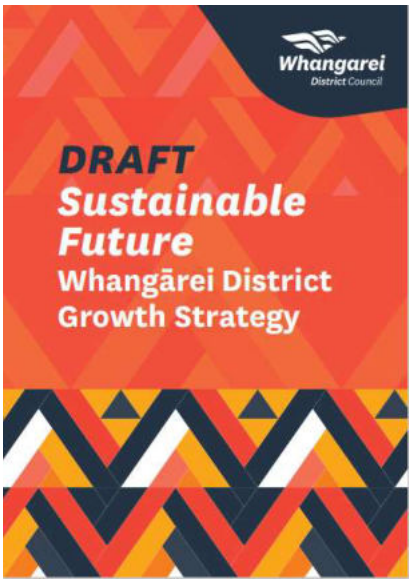
Population aging in the Kaipara District is exacerbated by the popularity of parts of the district as retirement destinations, resulting in an influx of migrants in the early retirement age group.

1.3.3 Whangarei District Growth

The usually resident population of the Whangarei District grew to 101,9100 by 2023, an 8.3% increase on the previous census growth.



In response to the continued growth, the Whangarei District Council developed a new draft Growth Strategy in 2020.



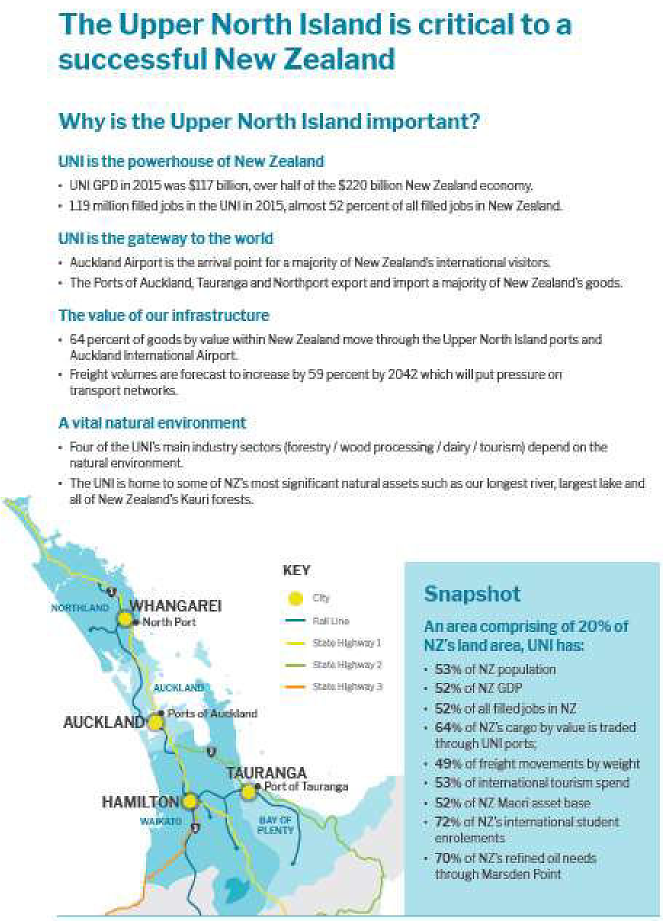
Whangarei is a hub for Northland. The District contains the only city north of Auckland as well several thriving rural and coastal communities.

Whangarei District has experienced a rapid rise in population over the past 10 years. The recent population surge is largely due to fewer people leaving New Zealand, larger numbers of returning New Zealanders, and strong inter-regional migration (i.e. people moving from other places in New Zealand, particularly from Auckland).

Sustained growth is likely to continue. Even if net international migration slows, inter-regional migration has been an ongoing source of growth for the District over the last 10-15 years.

Why is Whangarei a hot spot for growth?

- It is the only city in Northland and home to major businesses, services and employers
- It has a range of lifestyle choices from urban living to coastal and rural environments
- It has quality and pristine natural environments with world class beaches
- It is only a two-hour drive from Auckland
- It is well connected to international and national markets through Northport and Whangarei Airport
- It has a strong cultural identity and heritage shown through Māori business, innovation, and arts.



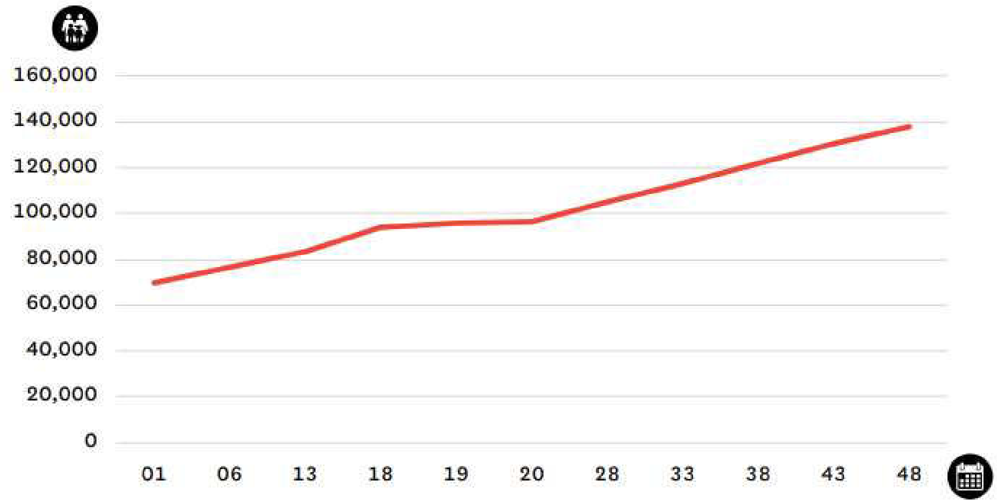
Whangarei and Northland fall within the Upper North Island of New Zealand. The Upper North Island is an economic powerhouse of New Zealand. Despite being 20 percent of New Zealand's land area, it contains over half of New Zealand's population and economic activity and includes nationally significant infrastructure. Significant growth across the Upper North Island is putting pressure on housing, infrastructure, the labour market and environment. Being part of the Upper North Island is a key driver for the growth of Whangarei, particularly through inter-regional movement of people and goods.

In response to the challenges of providing housing and land for business activities central government has developed a National Policy Statement on Urban Development Capacity (NPS-UDC).

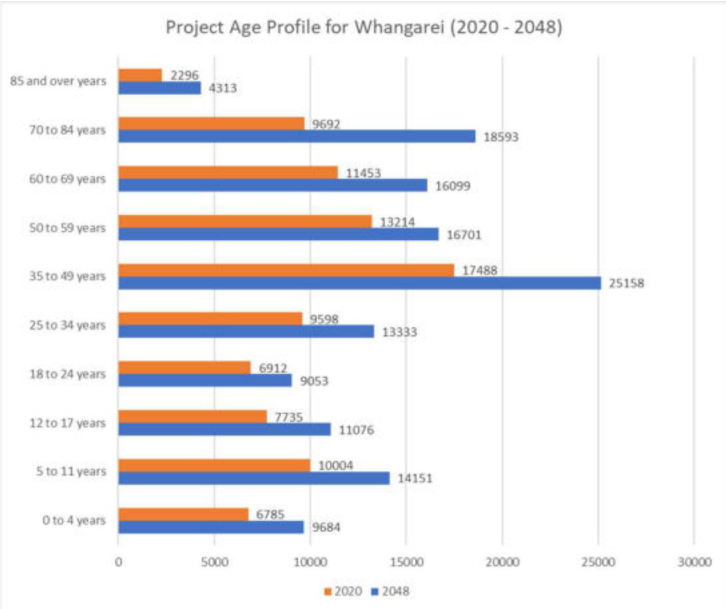
Under the NPS-UDC, the urban area of Whangarei was identified as "high growth" on the basis that our population is projected to increase by over 10 percent over a 10-year period.

The Whangarei District Council has developed a growth model to predict the amount of future growth. The following graphs show an overview of the model's findings for total population and age profile. Over the period of the model, it continues to tell a story of growth, but also of a changing community with more older people as well as a growing younger cohort.

FUTURE POPULATION GROWTH PROJECTIONS



The growth model forecasts that Whangarei will grow by almost 43,000 by 2048 or by 45%, at an average growth rate of 1.6% per annum as shown above.



The model considers anticipated growth related to continued Northport expansion as well as longer term investment in key projects to stimulate the local economy, such as transport improvements and connections.

The model is informed by Stats New Zealand population data, immigration data as well as data on building consents and subdivision consents. This gives a more robust picture of future growth, compared to using just Stats New Zealand data, noting the issues that the 2018 Census has faced.

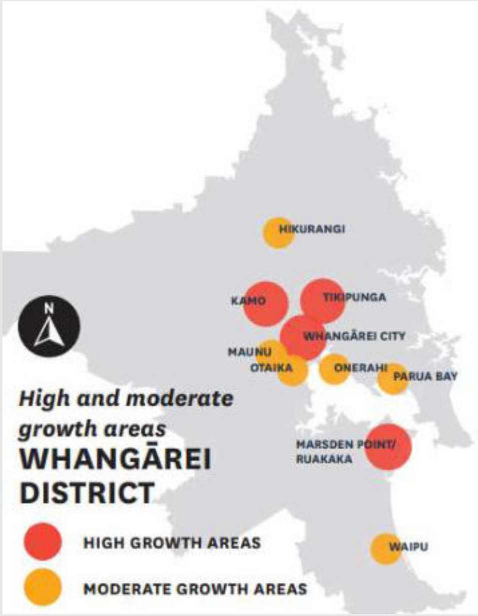
The age profile of the district is also going to change with a much greater population of elderly population over 70 years of age, although all age groups are expected to increase by 2048.

The strategy identified that growth will continue to occur in the main growth nodes that were identified in the previous Sustainable Futures 30/50 Growth Strategy developed in 2010.

These growth nodes are shown in the following figure and are summarised below:

- Around the fringe of the Whangarei City (Tikipunga, Kamo, Maunu, Onerahi, Port Nikau and Otaika)
- Hikurangi
- Parua Bay/Whangarei Heads
- Marsden Point – Ruakaka
- Waipu/Waipu Cove/Lang Beach

The strategy recognises that as the District grows increasing pressure will be placed on the transport network. Growth in traffic volumes is a reality of a growing District and we need a response that looks at ways to reduce these volumes and provide choice in the way we travel around our District.



The strategy identified three key issues with the transport network:

- The means of travel is dominated by cars, rather than public transport or active modes
- Many of the growth areas are serviced by a single arterial road.
- Topographical constraints limit alternative routes
- The responses to these challenges are to:
  - Ensure that the location for future development does not exacerbate existing problems
  - Invest in transport improvements that can support public transport as well as private vehicles
  - Build on the success of the urban cycleways to get greater coverage across the District
  - Investigate alternative transport including passenger transport and light rail.

1.4 Strategic Transport Planning

1.4.1 *Far North District Strategic Transport Plans*

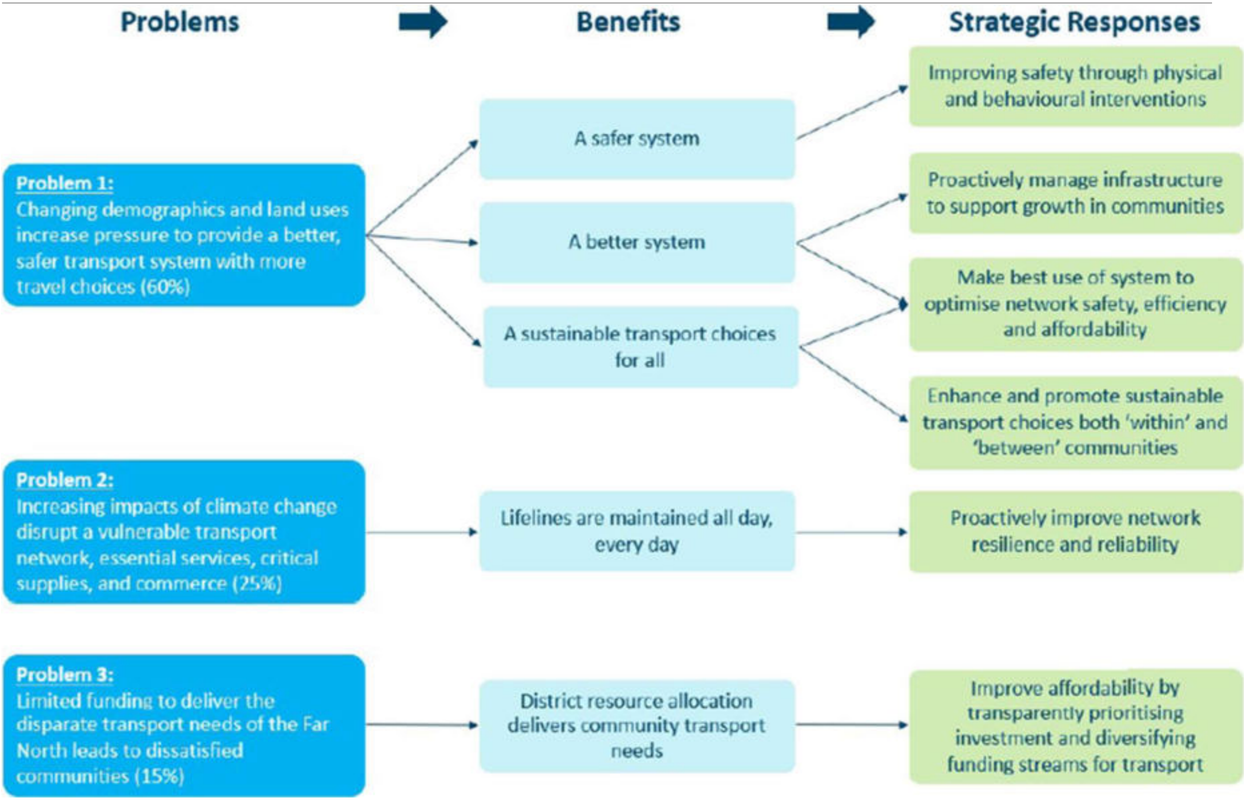
1.4.1.1 *Far North District Integrated Transport Strategy*

Far North District Council (FNDC) has developed an Integrated Transport Strategy (ITS) to address the key transport problems faced by the District. It is a holistic strategy that focuses on improving the "now" as well as providing direction to allow the District to respond in a consistent manner to address future challenges faced by growth, changing land use and new technology.

The Integrated Transport Strategy will focus on addressing three key problems through six strategic responses. By doing these things, the Far North will benefit from:

- A better, safer transport system with more transport choice
- The lifelines will be maintained
- Community transport needs will be met.

The problems, benefits, and strategic responses to achieve these benefits were identified through a series of workshops and an Investment Logic Mapping (ILM) exercise during the development of the strategy. These are described below:



The problem statements are:

- **Problem 1:** Changing demographics and land uses increase pressure to provide a better, safer transport system with more travel choices (60%)
- **Problem 2**: Increasing impacts of climate change disrupt a vulnerable transport network, essential services, critical supplies, and commerce (25%)
- **Problem 3:** Limited funding to deliver disparate transport needs to the Far North leads to dissatisfied communities (15%)

The Far North District Integrated Transport Strategy was finalised in 2020. The Far North District Council is currently seeking the endorsement of the strategy by the NZ Transport Agency.

1.4.1.2 *Far North District Integrated Transport Plan*

Following on from the development of the Integrated Transport Strategy, the Far North District Council has developed a Programme Business Case (PBC) in conjunction with key stakeholders. This business case is called the Far North District Integrated Transport Plan (ITP) and considers the case for investment to support communities and business in the Far North by providing a safer, more resilient and reliable transport system.

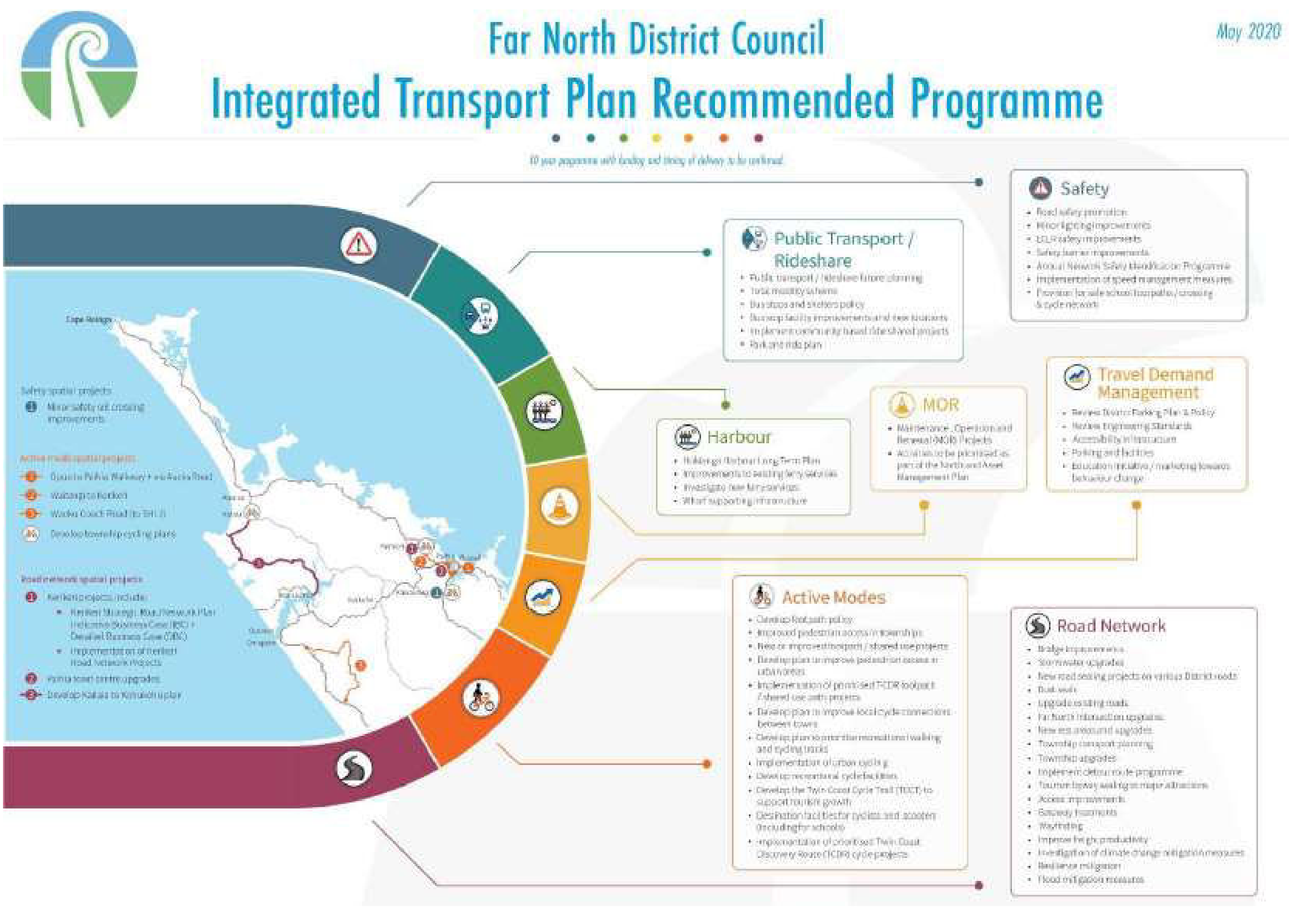
The ITP is still in draft form and is yet to be approved by Council or endorsed by the NZ Transport Agency.

This ITP PBC is intended to be a transport investment map to provide details on the type of options that will holistically provide the greatest benefits to the District. The ITP develops six action plans to deliver the outcomes identified in the ITS. These action plans are described in the diagram below.

A series of workshops were undertaken in 2020 to identify a long list of options and develop programmes to short list the options into realistic programmes of work. Multi-criteria assessments were undertaken to prioritise the individual options and the programmes.

The ITP Recommended Programme is shown in the figure below and includes 62 activities which represents an investment value of $464-$479M over a proposed 10-year implementation plan. The BCR for the programme is calculated to be 0.9.

Many activities are considered ‘business as usual’ for transport and focus on general maintenance, operation, and renewal activities as well as physical improvements to the network such as safety, road upgrades, improved resilience and enhanced connectivity / condition of walking and cycling networks.



Key projects that were specifically identified in the preferred programme are listed below:

Safety

- Minor safety rail crossing improvements

Active Modes (Walking and Cycling)

- Opua to Paihia Walkway via Aucks Road
- Waitangi to Kerikeri
- Waoku Coach Road (to SH12)
- Develop township cycling plans (for Kaitaia, Kerikeri and Kawakawa)

Road Network

- Kerikeri projects, include:
  - Kerikeri Strategic Road Network Plan, Indicative Business Case (IBC) and Detailed Business Case (DBC)
  - Implementation of Kerikeri Road Network Projects
- Paihia town centre upgrade
- Develop Kaitaia to Kohukohu plan

The programme includes packaged transport activities (as identified above), which in some cases, are broad and overarching and are therefore supported by a list of potential individual projects to be further prioritised within this activity. This list contains specific projects / locations identified to date and its purpose is to provide a starting point for the prioritisation of activities. It should be noted that other projects / locations can be considered within each transport activity during this process. This will retain flexibility for FNDC to respond to changes in the future. Some of these packages of projects and their benefits for each of the action plans is shown in the diagram below.

Action Plan	Benefit for the recommended programme
Road Network	Activities in the Road Network action plan include: • Roading / infrastructure improvements • Township planning and upgrades • Access improvements • Resilience improvements and response to climate change These options address network condition, connectivity, resilience and access: • Improve the <u>quality of the journey</u> through infrastructure upgrades and resilience mitigation measures • <u>Enhance connectivity</u> of the transport network by improving access via new roads and township upgrades • <u>Keep the road open</u> addressing journey reliability, disruption to businesses and community severance
Safety	Activities in the Safety action plan include: • Road Safety Promotion • Safety projects (planning and implementation options such as Annual network safety identification programme, speed management, LCLR safety improvements) • Schools These options improve safety through a <u>safe system approach</u> through physical safety interventions, education and safety reviews.
Travel Demand Management (TDM)	Activities in the TDM action plan include: • Parking and facilities • General TDM projects (i.e. Review Engineering Standards, Accessibility infrastructure, Education initiatives) These options aim to <u>integrate, implement and coordinate travel behaviour changes</u>
Active Modes	Activities in the Active Modes action plan include: • Pedestrian / shared paths planning and implementation activities • Cycling planning and implementation activities These options focus on <u>improved access to walking and cycling</u> in the district through enhancements of existing facilities and the provision of new facilities to ensure the <u>safety of vulnerable users</u>, <u>improve connectivity</u> within and between communities for <u>regional and commuter customers</u> and promote <u>recreational and tourist</u> activities.
Public Transport / Ride Share	Activities in the Public transport / Ride share action plan include: • Total mobility scheme • Public transport / ride share future planning and implementation • Bus stops / facilities The programme recognises the importance of public transport and community transport options as well as improving public transport facilities and provision for mobility impaired users.
Harbour	Activities in the Harbour action plan include: • Hokianga Harbour Long Term Plan • New / improved ferry services • Wharf supporting infrastructure These options enhance <u>community access</u> through improvement of existing ferry services, provision of new services and wharf supporting infrastructure.
Maintenance, operations & renewals	This category captures all <u>business as usual activities</u> that focus on maintenance, operations and renewals. Investment in this action plan will occur on an annual basis, where activities will be further prioritised for implementation within the FNDC Activity Management Plan (2021-24).

1.4.2 *Kaipara District Strategic Transport Plans*

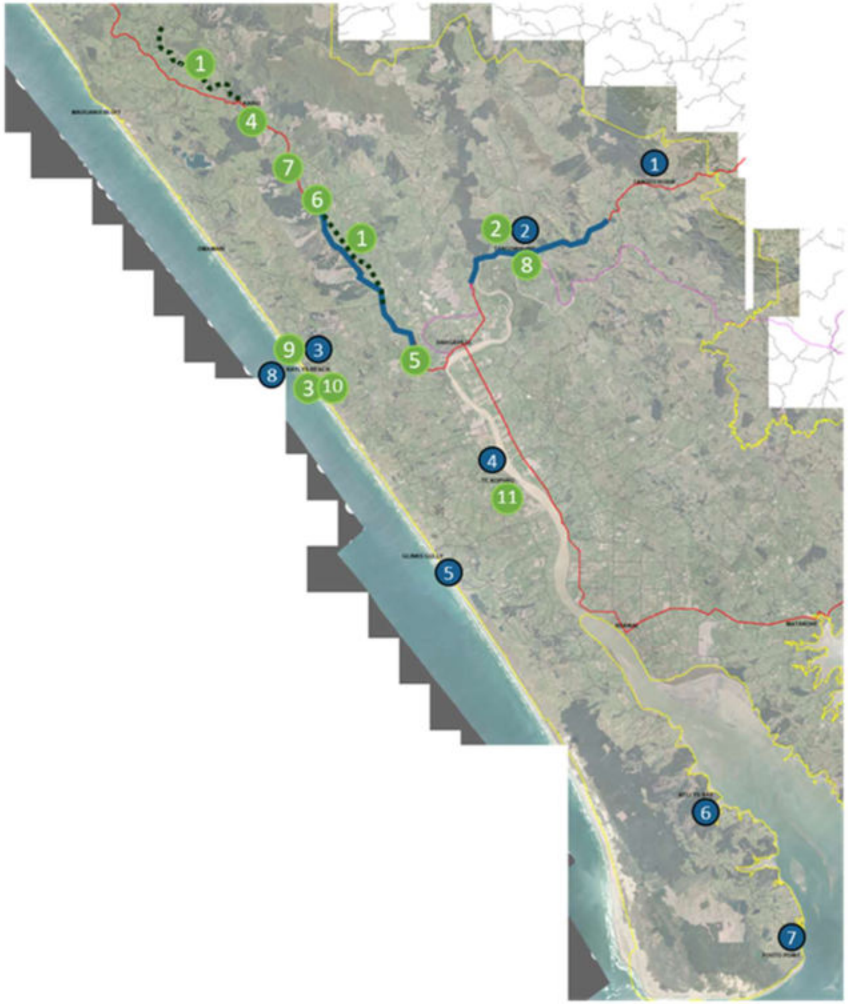
A draft Kaipara area Programme Business Case (PBC) has been prepared between 2021 and 2023 for the district. Workshops, Investment Logistics, and several consultation sessions around the district were conducted. With the economic case an options and assessment approach was adopted as indicated in Figure 1-7 to develop a recommended programme.

Figure 1-7 - Option and programme assessment approach

The following five pages identify the recommended 30-year programmes:

Kaipara District Council PBC

WEST COAST / CENTRAL RECOMMENDED PROGRAMME



PHASE

FIRST DECADE

Walking & Cycling

- 1 Kaihu Valley Trail Stage 2
- 2 SH14 Tangowahine improvements
- 3 Baylys Beach walking and cycling loop

SH & Local Rd Intersection upgrades

- 4 SH12 / Kaihu Wood Rd
- 5 SH12 / Baylys Coast Rd
- 6 SH12 / Waihue Rd / Mamaranui Rd
- 7 SH12 / Omamari Rd
- 8 SH14 / Tangowahine Valley Rd
- 9 Bayly Street / Kelly Street
- 10 Seaview Rd / Ripiro Rd / Baylys Coast Rd

Safety and Urbanisation

- 11 Te Kopuru School Crossing Upgrade

Resilience

- Road Sealing Programme

SECOND DECADE

Safety and Urbanisation

Gateway and slow speed zones

- 1 Tangiterōria
- 2 Tangowahine
- 3 Baylys Beach
- 4 Te Kopuru
- 5 Glinks Gully
- 6 Kellys Bay
- 7 Poutō Point
- 8 Seaview Road Upgrades (including carpark and handrail)

Resilience

- Flood resilience improvements (Includes assessment of alternative routes)
- One Lane Bridge reviews
- Pouto Point Access Road Upgrade

THIRD DECADE

Safety and Urbanisation

- Wayfinding Programme (including to cultural centres)

Figure 1-8 - West Coast / Central recommended 30yr programme

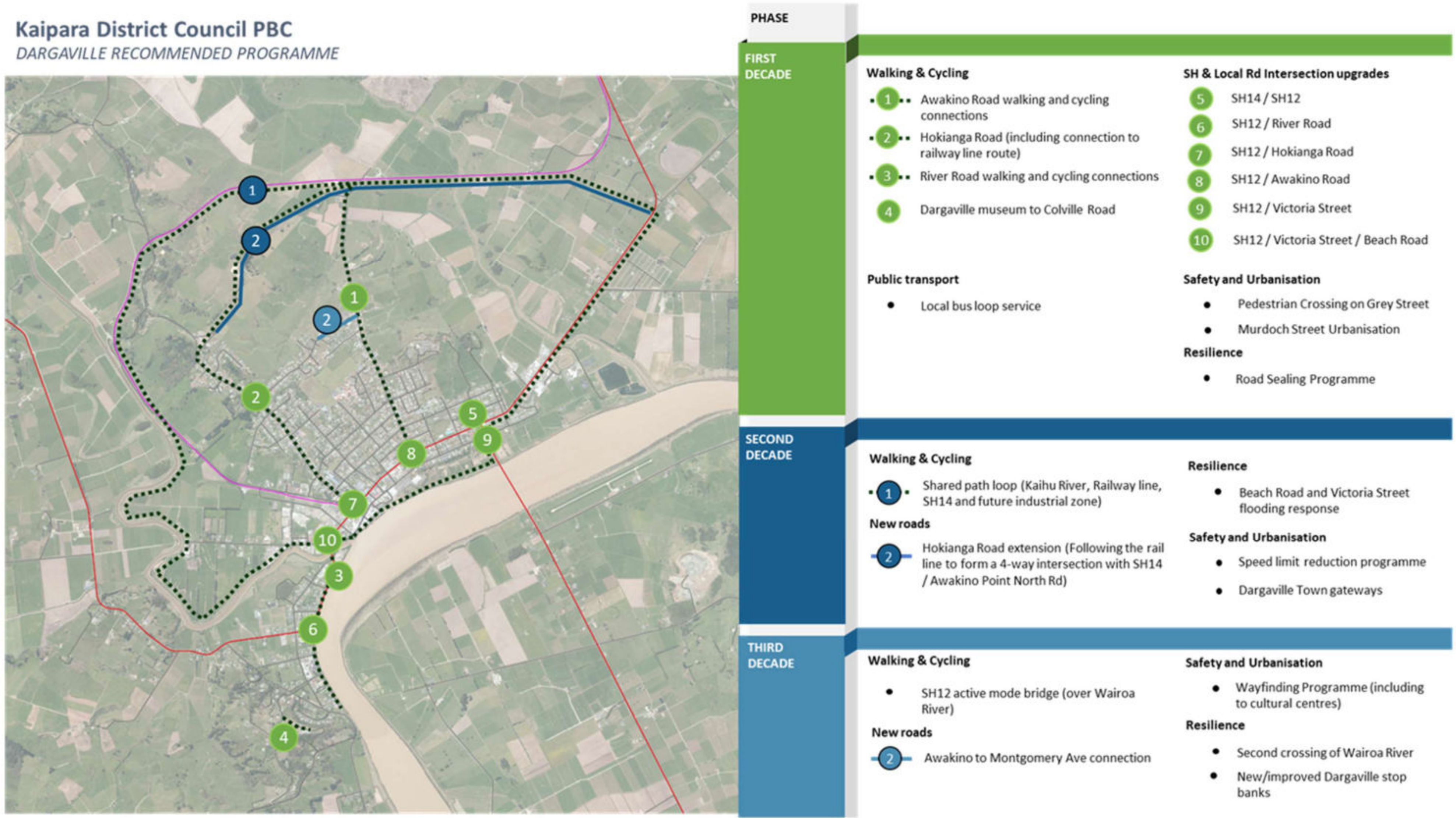


Figure 1-9 - Dargaville 30yr recommended programme

Kaipara District Council PBC

OTAMATEA RECOMMENDED PROGRAMME

PHASE

FIRST DECADE

Walking & Cycling

1. Bickerstaffe Road (SH12 to Otamatea High School) W/C improvements

SH Intersection upgrades

2. SH12 / Ruawai Wharf Road / Bledisloe Street
3. SH12 / Pahi Road
4. SH12 / Franklin Road
5. Sandy Beach Road / Komiti Road

SH Intersection upgrades

6. SH12 / Whaka Street
7. SH12 / Bickerstaffe Road

Resilience

- Road Sealing Programme

Public transport

- Paparoa, Maungaturoto, Kaiwaka, Mangawhai loop

SECOND DECADE

Walking & Cycling (W/C)

1. Ruawai W/C connections
2. Maungatūroto W/C connections

Local Intersection upgrades

3. Tinopai Road / Ngatoto Road
4. Gorge Road / Woodland Road intersection safety upgrades

Resilience

- One Lane Bridge reviews

Safety and Urbanisation - Gateway and slow speed zone

- Ruawai
- Paparoa
- Matakohe
- Tinopai
- Whakapirau

THIRD DECADE

New roads

- Maungatūroto town centre bypass
- Whakapirau Road to Whaka Street in Maungaturoto
- SH12 to Bickerstaffe Road

Safety and Urbanisation

- Wayfinding Programme (including to cultural centres)

Resilience

- SH12 stop banks – north of Ruawai

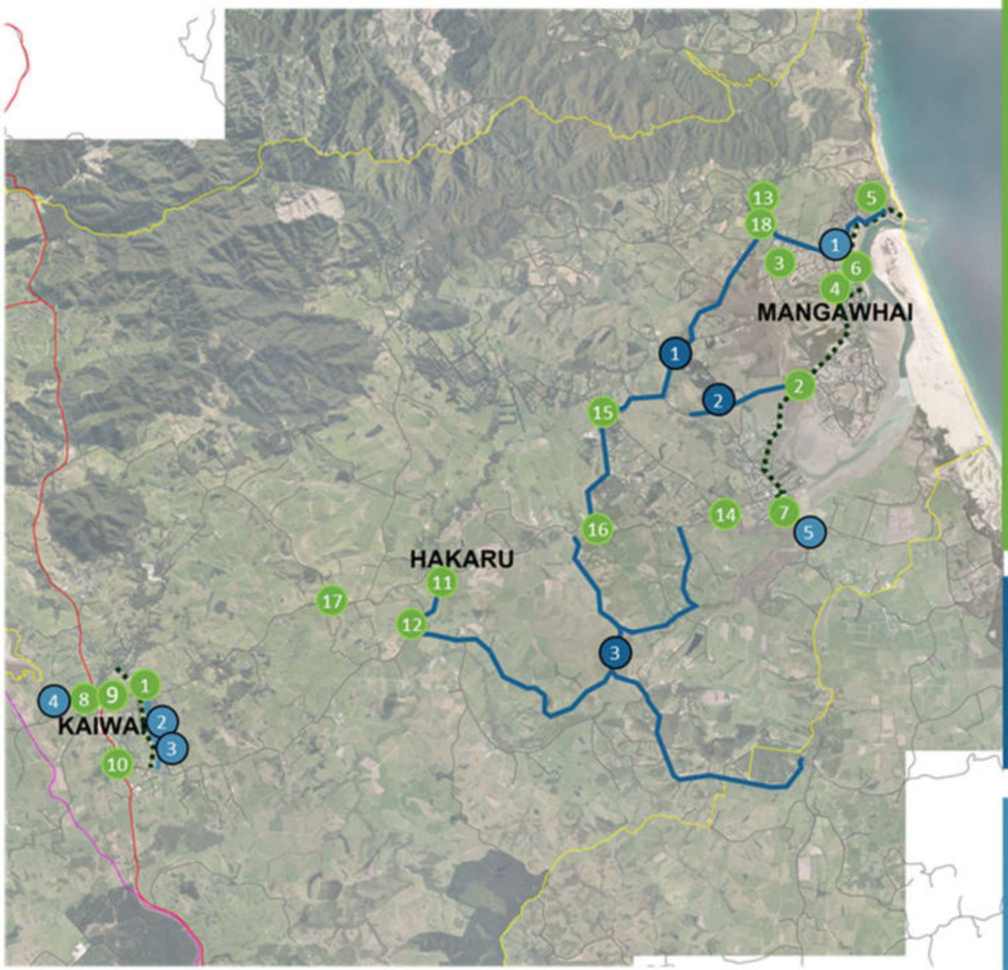
Wharf Upgrade

1. Ruawai
2. Paparoa
3. Matakohe

Figure 1-10 - Otamatea 30yr Recommended Programme

Kaipara District Council PBC

KAIWAKA MANGAWHAI RECOMMENDED PROGRAMME



PHASE

FIRST DECADE

Walking & Cycling

1. Kaiwaka walking and cycling connections (Gibbons Road to Settlement Road)
2. Mangawhai Shared Path
3. Jack Boyd Drive to Thelma North/South track
4. Wood Street Upgrade
5. Mangawhai Heads walking improvements on harbour/wharf area

- Footpath completion routes e.g. Jack Boyd Dr

Safety and Urbanisation

- Down tuning of Molesworth Drive for general traffic and freight

6. Alamar Crescent/Olsen Ave connectivity
7. Mangawhai School crossing and safety improvements

Public transport

- Mangawhai Internal loop service

Resilience

- Road Sealing Programme
- One Lane Bridge reviews

SH Intersection upgrades

8. SH1 / Oneriri Rd
9. SH1 / Kaiwaka Mangawhai Rd
10. SH1 / Settlement Rd / Hastie Lane

Local Intersection upgrades

11. Kaiwaka Mangawhai Rd / Settlement Rd
12. Settlement Rd / Valley Rd
13. Robert Hastie Dr / Pigeonwood Pl
14. Kaiwaka Mangawhai Rd / Tara Rd
15. Tara Road / Cove Rd / Garbolino Rd
16. Garbolino Rd / Kaiwaka Mangawhai Rd
17. Kaiwaka Mangawhai Rd / Baldrock Rd
18. Cove Road / Mangawhai Heads Rd

SECOND DECADE

Resilience

1. Mangawhai Heads Access – Cove Road and Garbolino Road upgrades

New Roads

2. Link between Mangawhai central to Old Waipu Road North
3. Upgrade Lawrence Rd, Cames Rd, Devich Rd

Safety and Urbanisation - Gateway and slow speed zone

- Hakaru
- Kaiwaka
- Mangawhai
- Wayfinding Programme (including to cultural centres)

THIRD DECADE

New Road connections

1. Mangawhai Heads Road to Olsen Avenue
2. Kaiwaka Mangawhai Rd to Settlement Rd
3. Dolly Lane to Wattle Lane
4. Kaiwaka Mangawhai Rd to Oneriri Rd

Resilience

5. Tomarata Bridge Upgrade (Mangawhai Rd, Mangawhai-Kaiwaka Rd)

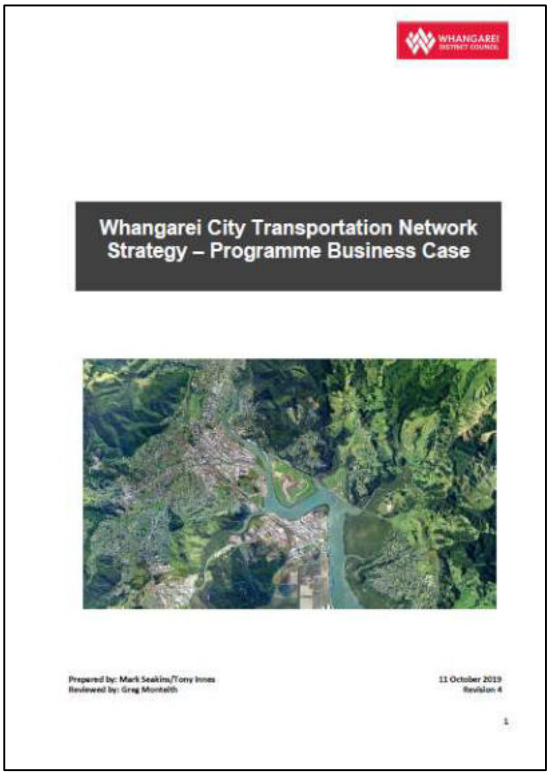
Wharf Upgrades

- Upgrade wharf and services at Mangawhai
- Second Harbour Access

Figure 1-11 - Kaiwaka / Mangawhai 30yr recommended programme

1.4.3 Whangarei District Strategic Transport Plans

1.4.3.1 Whangarei Transportation Network Strategy



Whangarei City Transportation Network Strategy – Programme Business Case

Prepared by: Mark Seakins/Tony Innes
Reviewed by: Greg Monteith

11 October 2019
Revision 4

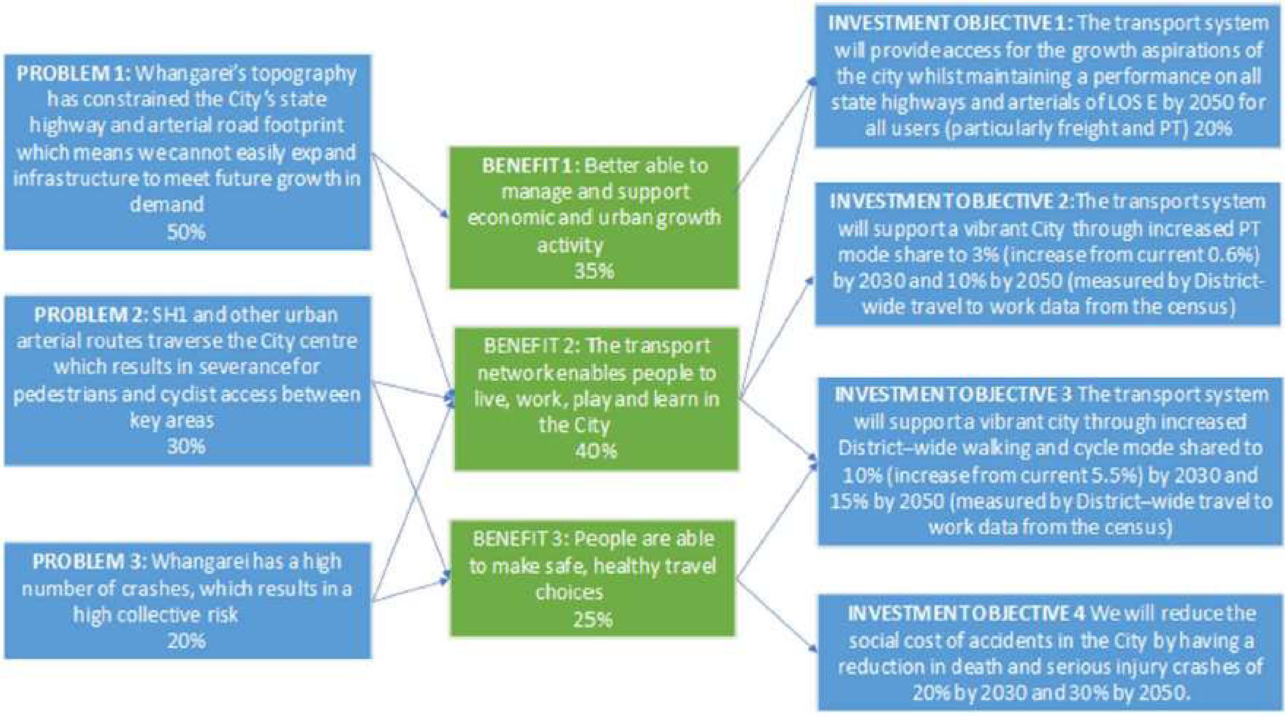
1

The Whangarei City Transportation Network Strategy – Programme Business Case (PBC) was developed by Council to identify a clear strategy to address capacity issues in Whangarei City. This strategy used data from the Whangarei Transportation Model and was completed in December 2018. The Whangarei model was approved by council in June 2019 and was endorsed by NZTA in December 2019.

The strategy identified that future increases in private vehicle use due to population growth is likely to create further pressure on the existing transport network given that Whangarei is a High Growth Urban Area. Uncontrolled growth in private vehicle use is likely to negatively affect access to economic and social opportunities within the city by creating significant delays on state highway and arterial routes. This indicates the need to promote and provide for other transport modes such as public transport and walking and cycling to reduce private vehicle usage and ease pressure on the transport network.

Fatal and serious injury crashes involving pedestrians or cyclists on arterial roads in Whangarei City have also been increasing steadily over the last 10 years.

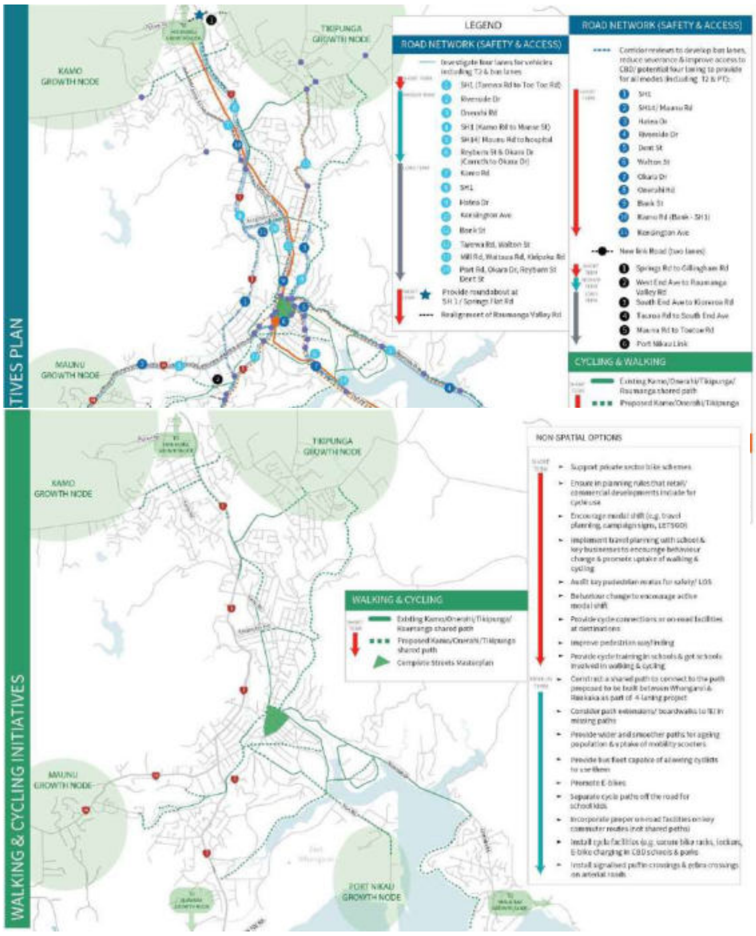
A series of stakeholder workshops including Investment Logic Mapping (ILM) were undertaken during the development of this Programme Business Case. This collaborative approach has resulted in alignment in the problems, benefits and investment objectives for the network as outlined in the diagram below.



During the stakeholder workshops 138 options and alternatives were identified to address these problems and achieve the benefits, ranging from lower-cost interventions to significant capital projects. From these, seven programmes were developed and analysed using a multi-criteria assessment.

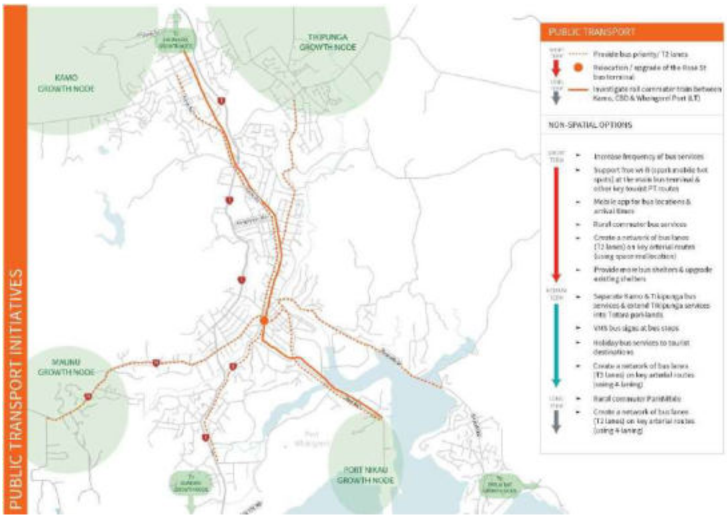
The stakeholders identified that the preferred programme should include the following:

- Investment in improvements that will improve access on State Highway 1 through the city will make this key freight route more efficient and reduce transport costs for freight being taken to markets south of Whangarei such as Northport or Auckland.
- Investment in improved pedestrian facilities, safe crossing points and provision of pedestrian malls and shared spaces such as those proposed through the Draft Complete Streets Masterplan will improve walkability in and around the CBD which would enable economic growth to build upon the previous investment in Whangarei such as the Town Basin and Cameron Street Mall. This will reinforce the CBD as the heart of the city and will improve livability in Whangarei. It will also enable a better pedestrian connection between the CBD and the Hundertwasser Art Centre



improving the ability for tourists to walk around the city which will stimulate more tourist spending on retail in the CBD.

- Investment in public transport, walking and cycling and intersection upgrades on routes serving high urban growth areas such as Kamo, Tikipunga, Whareora, Maunu, Raumanga and Port Nikau will help provide multi-modal access for growth in the city. In addition, rural commuter bus services will enable access to rural and coastal growth nodes such as Hikurangi, Parua Bay, Ruakaka and Waipu. This is important to meet the growth need of Whangarei which is a High Growth Urban Area.

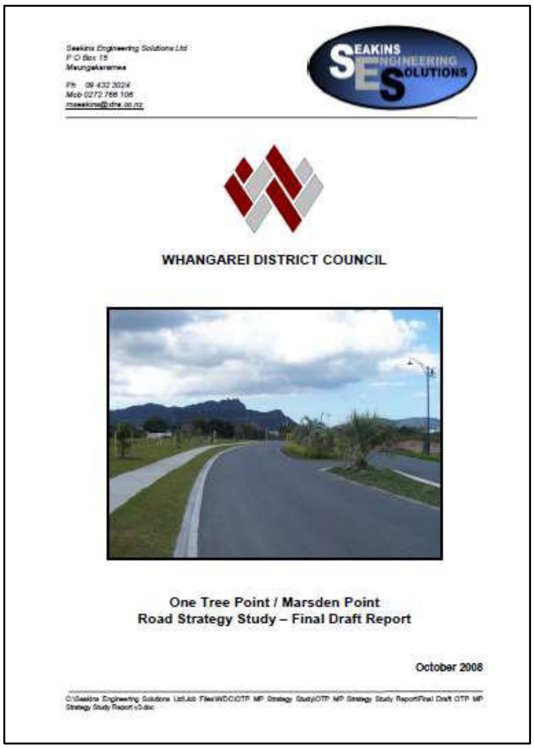


- Specific areas of focus should be to improve the mode share using public transport and using active modes where there is the greatest potential for benefit gains. This will provide a wider range of transport modes that will be less reliant on private vehicle use and will provide access for the transport disadvantaged. The public transport and walking and cycling networks should be linked to places of employment, retail centres, education, and recreation as well as the hospital and airport to provide a comprehensive transport system that serves all users.

- The stakeholders also focused on investment that would have a positive effect on road safety by targeting improvements on high-risk arterial roads, reducing driver frustration in congested areas and providing safe walking and cycling linkages and crossing points. This is consistent with the Safe System approach and will help reduce the increasing trend in fatal and serious injury crashes from occurring in the future.

The estimated cost of the preferred programme is $460-750M over a 30-year period with a Benefit Cost Ratio (BCR) of between 0.9 and 1.4.

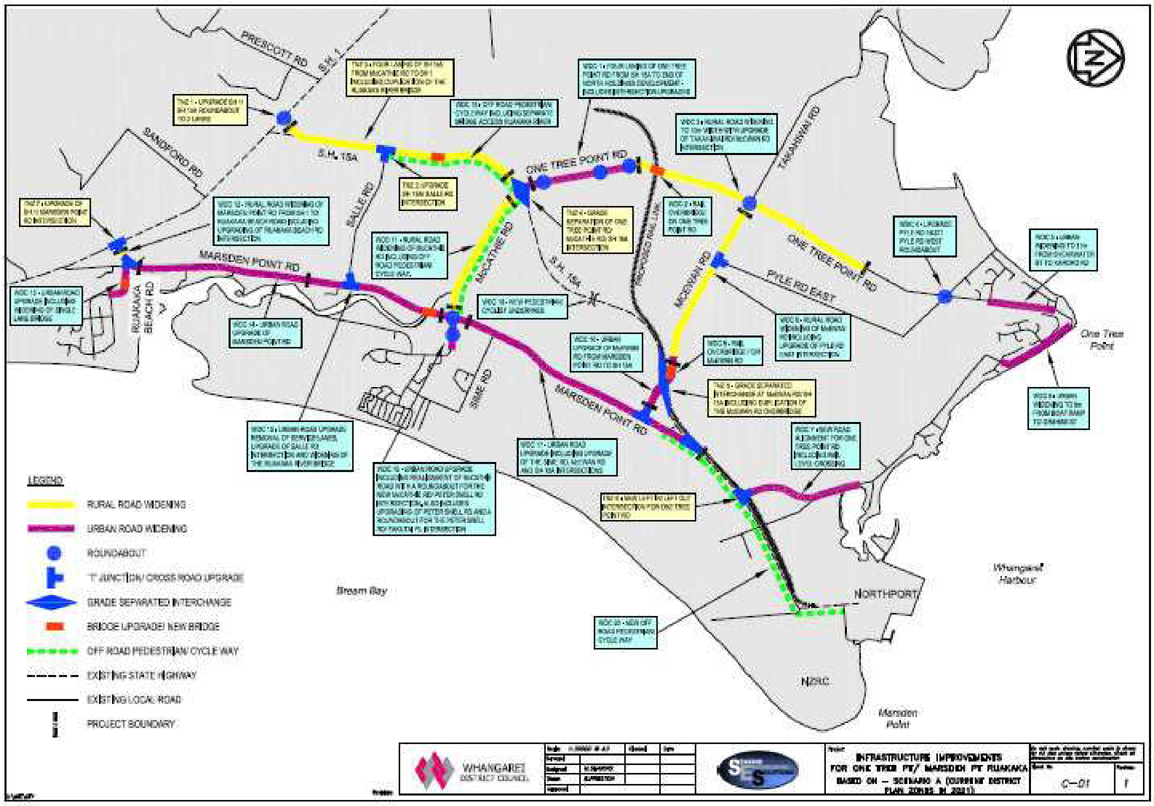
1.4.3.2 One Tree Point / Marsden Point Road Strategy Study



The Marsden Point/Ruakaka area seen rapid growth over the past 15 years due to its large areas of flat land, growth in Port Marsden and the Marsden Point Oil Refinery and its proximity to Whangarei. This area has been identified as a future satellite town of Whangarei and a structure plan has been adopted to urbanise this area. The current population of the Marsden Point/Ruakaka area is 4,300 from the 2013 census. The Whangarei Growth Strategy and 2019 Growth Model predicts that the population is to rise to approximately 12,900 by 2048.

A strategy study was prepared for this area in October 2008 to assess the transportation requirements to cater for the predicted population growth in this area. The growth model at that time expected that the population of this area would reach about 20,000 by 2021. To cater for this rapid growth a significant plan of road upgrades were predicted both on WDC roads and on the State Highways. The WDC portion of the road upgrades was estimated as having a cost between $50M – $72M.

Due to the effects of the global financial crisis in 2008, the growth has been much slower than predicted. The planned road upgrades (shown in the plan below) are now expected to be required within 2025 to 2060 period. Upgrades required in the next 10 years will mainly consist of road widening of narrow sections, or urbanisation of Marsden Point Road to reinforce the speed management programme currently being rolled-out.



1.5 Network Growth

There is also an increase in demand through growth of the transport network. To better understand the drivers of network growth, a number of factors are outlined below.

- Roads being vested to council through subdivision activities or revocation/declaration of the State Highway network (e.g. from the SH1 Kamo Bypass project or SH15 handover).
- The length of the sealed pavement network has grown through seal extension programmes.
- New roads being built to address capacity or access issues (e.g. several important new road links have been built in the past 10 years such as the Kerikeri Heritage Bypass and the Lower Hatea River Crossing in Whangarei).
- New cycleways being built (such as the Shared path network in Whangarei).
- New assets created as part of safety of other improvement works such as permanent warning signs, active signs (such as school zone signs), guardrails, streetlights, retaining walls, additional line markings or long-life markings etc.

This increase in the network will result in increased maintenance/operation costs and, over time, increased renewal demands.

1.6 Traffic Flows

Traffic data in the districts is monitored through a designed traffic counting strategy. The strategy uses catchments and series of related traffic count sites to capture and determine the traffic patterns within each catchment across the districts. These sites are also related to the state highway counting sites to provide an integrated traffic counting programme across the network.

This strategy classifies all traffic and can provide, speed, flow and time data as required. This counting strategy has been in place for many years for KDC and WDC and is continually revised each year to ensure the catchments and count sites are current and reflect the network traffic patterns as the network grows and changes.

Traffic estimates are derived for every road using the relationship formed between the counting sites. From this a Traffic Estimate file is produced annually and loaded into the RAMM database.

In November 2020 two new traffic counting contracts were awarded for the Far north District and Whangārei and Kaipara districts combined.

1.6.1 FNDC summary of Key Traffic trends

Traffic Trends: Overall, a network-wide negative growth of 1% in Average Daily Traffic (ADT) has been observed over the past year. Notable exceptions include the Kerikeri and Kawakawa catchments, which have experienced significant increases in ADT, likely attributed to residential developments.

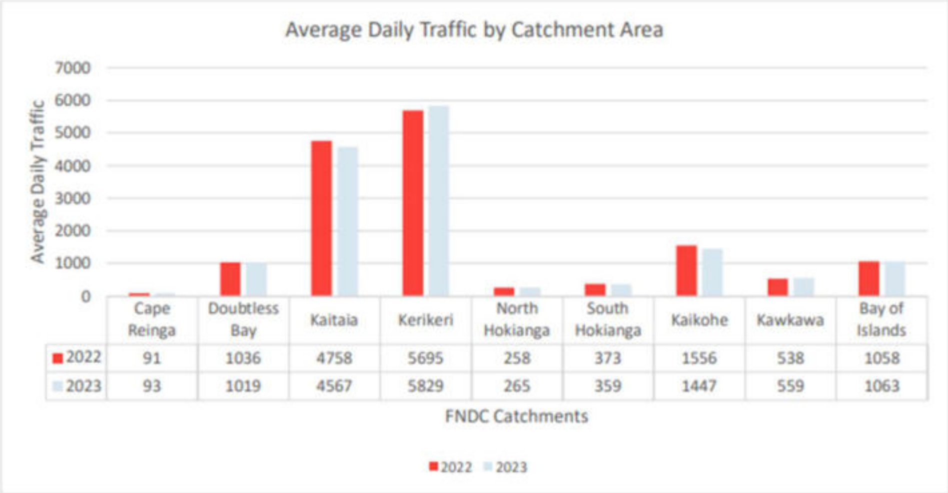


Figure 1-12 - FNDC Average Daily Traffic by Catchment Area

Heavy Commercial Vehicles (HCVs): The percentage of HCVs across the network has seen a slight decrease of 0.2%, except for the North Hokianga Catchment, where HCV numbers dropped by 2.1%.

85th Percentile Speeds: The 85th percentile speed, which represents the speed at or below which 85% of vehicles travel, remains relatively stable across the district. Notable exceptions include Doubtless Bay, which saw a 4 km/h decrease, and Kaikohe, which experienced a 3 km/h increase.

Holiday Traffic Analysis: Summer holiday traffic counts in 2022/23 show an average 46% increase compared to off-season traffic counts at the same sites. This emphasizes the importance of seasonal variation in traffic volumes.

Annual Vehicle Kilometres Travelled (VKT): The total annual VKT within the district is 308 million kilometres, with Kerikeri having the highest annual VKT due to its road length and ADT.

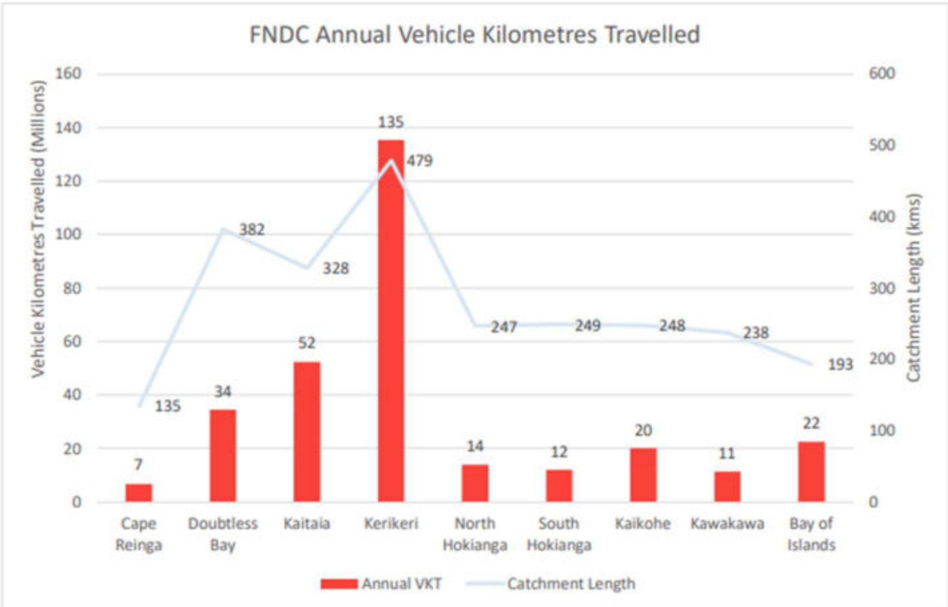


Figure 1-13 - FNDC Annual Vehicle Kilometres Travelled

Post COVID-19 Traffic Trends: Most monitoring sites have observed an increase in ADT postCOVID-19, indicating a return to normal traffic levels.

1.6.2 WDC summary of Key Traffic trends

Traffic Trends: A moderate overall growth of 2% in Average Daily Traffic (ADT) across the district has been observed from 2021/22 to 2022/23. Notable increases were observed in the One Tree Point and Russell catchments, while minor declines were seen in Mangakahia, Maungakaramea, and Waipu catchments.

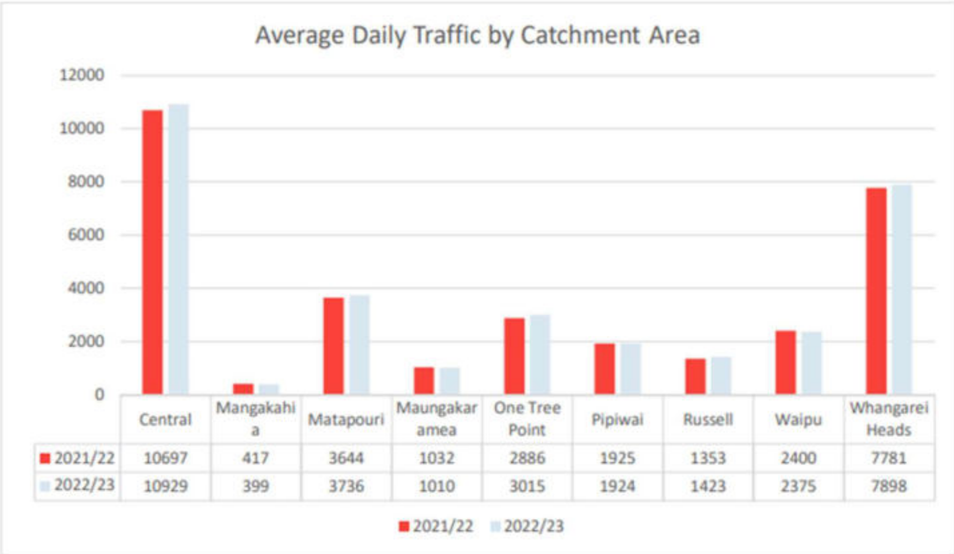


Figure 1-14 - WDC Average Daily Traffic by Catchment Area

Heavy Commercial Vehicles (HCVs): The percentage of Heavy Commercial Vehicles (HCVs) across the network remained relatively stable, with a significant decrease noted in the Mangakahia catchment, suggesting shifts in forestry operations on the network.

Speed Trends: The 85th percentile speeds across the district showed minimal changes over the past two years, indicating consistent traffic flow.

Holiday Traffic: Holiday traffic counts revealed an average increase of 29% compared to offseason counts, except for Marua Rd, which saw a decrease. Overall, holiday traffic decreased by 13% in 2022/23 compared to the previous year.

Annual Vehicle Kilometres Travelled (VKT): The report estimated the total Annual Vehicle Kilometres Travelled for 2022/23 to be 509 million kilometres, highlighting the substantial vehicular activity within the district.

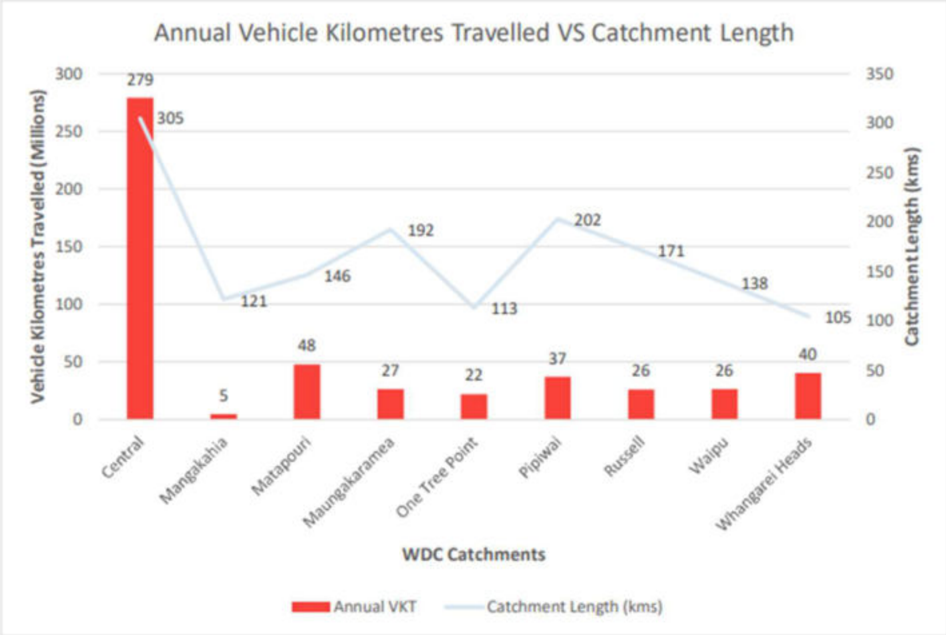
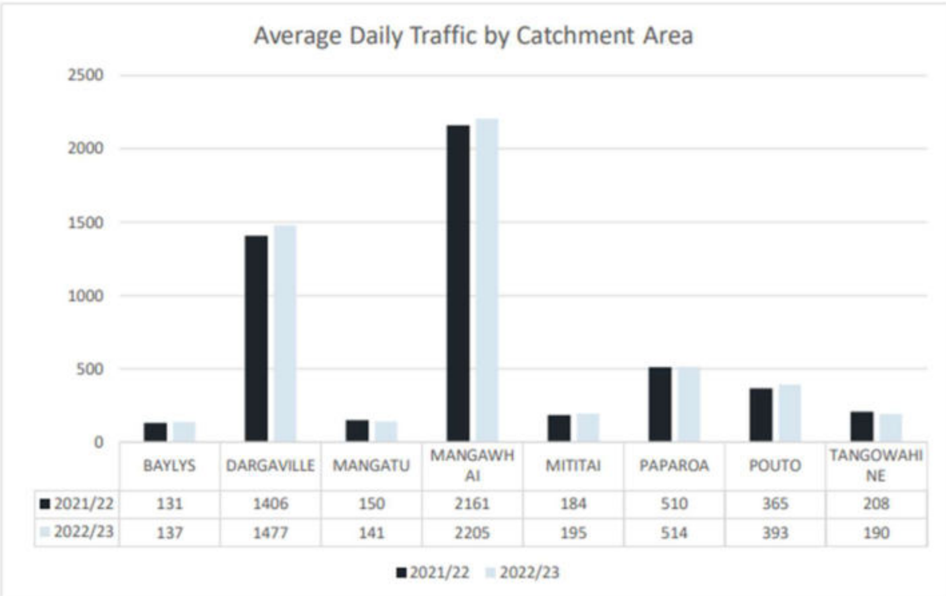


Figure 1-15 - WDC Annual Vehicle Kilometres Travelled

Post-COVID-19 Trends: The traffic trends post-COVID-19 showcased an overall increase in ADT at monitoring sites, indicating a return to normal traffic patterns.

1.6.3 KDC summary of Key Traffic trends

Traffic Trends: The analysis reveals a network-wide increase in traffic compared to the previous year, with only the Mangatu and Tangowahine catchments experiencing slight decreases in traffic volume.



	BAYLYS	DARGAVILLE	MANGATU	MANGAWHAI	MITITAI	PAPAROA	POUTO	TANGOWAHINE
2021/22	131	1406	150	2161	184	510	365	208
2022/23	137	1477	141	2205	195	514	393	190

Figure 1-16 - KDC Average Daily Traffic by Catchment Area

Heavy Commercial Vehicles (HCVs): HCVs, known to accelerate pavement deterioration, were carefully monitored. There was a 1.9% decrease in HCV percentages network-wide, with the Pouto catchment showing the highest HCV percentage.

Traffic Speed: The 85th percentile speed remained relatively stable across most catchments, with a 2 km/hr increase in the network's average 85th percentile speed since the previous year.

Holiday Traffic: Holiday traffic analysis showed a 9% increase compared to off-season traffic surveys. However, there was an overall 2% decrease in holiday traffic in 2022/23 compared to the previous year.

Annual Vehicle Kilometres Travelled (VKT): The report estimates the total annual VKT within the KDC catchments, with the Mangawhai catchment accounting for 42% of the total VKT despite constituting only 13% of the network length.

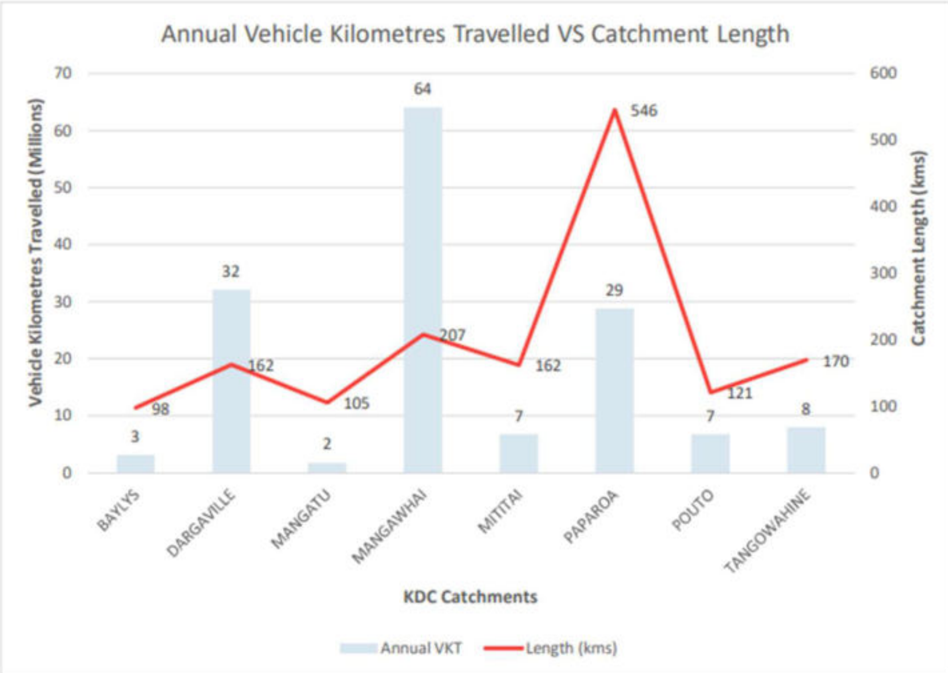


Figure 1-17 - KDC Annual Vehicle Kilometres Travelled

Post COVID-19 Traffic Trends: Traffic trends over the past three years were impacted by COVID-19 lockdowns. Most monitoring sites saw an increase in traffic, signifying a return to normal traffic patterns.

1.7 Parking Strategy

The Whangarei District Council has a parking strategy to manage the many parking demands in the central city area. FNDC and KDC do not currently have parking strategies, because parking demand is lower in these more rural districts.

WDC undertook a review of its existing Parking Strategy in 2017 and has reviewed the strategy in 2022. This review identified that there are currently sufficient car parks in the Whangarei CBD. Some parking sites are popular such as Cameron St and the Town Basin and have high occupancy rates of up to 90%, while others have occupancy rates of only 40-60%.

The intention of the parking strategy is to:

- Ensure availability of parking at desirable sites.
- Better utilise the available parking at underutilised major CBD sites

- Encourage commuter parking to shift from highly used parks, near the popular areas to the less used carparks on the CBD fringe.

The strategy also took into account the impacts of the proposed Hundertwasser Arts Centre and green space currently being constructed in the Town Basin area.

The tools to manage these car parks is to charge for previously "free" parking, increase charges at high occupancy car parks and lower charges on underutilised car parks. WDC has undertaken changes to the paid and time limited parking in the Whangarei CBD as a result of this strategy. Additional carparking has also been provided near the Town Basin at the James St (ex-Wilsons) carpark and a leased carpark on the old Toyota Site on Carruth St to replace parking removed for the new greenspace being created beside the Hundertwasser Art Centre.

Variable message board signs have also been erected at some underutilised carparks to advise the public of the number of remaining parks to encourage uptake in parking in those areas.

1.8 Walking and Cycling Strategies

There is a Northland walking and cycling strategy for the region. The Kaipara and Whangarei District Council's also have developed walking and cycling strategies. These strategies are described below.

There is currently no strategy for the Far North, although walking and cycling was a key consideration in the development of their Integrated Transport Plan, which is described in Section 1.4.1.2.

1.8.1 Northland Walking and Cycling Strategy, 2018

This strategy was developed by the Northland Regional Council in close collaboration with the district councils, Department of Conservation, Walking Access Commission and NZ Transport Agency. The aim of the document is to present a coherent overarching strategy for the development of walking and cycling in the region, drawing together district walking and cycling strategies. The document contains:

- A vision, namely: 'For Northland to be one of the world's best coastal walking and cycling destinations where the journeys and stories are as impressive and memorable as the scenery'.
- Four strategic focus areas:
    - Developing appealing and cohesive walking and cycling networks that connect Northland.
    - Growing walking and cycling participation and promoting Northland's coastal point of difference.
    - Improving community wellbeing including creating economic opportunities.
    - Ensuring walking and cycling infrastructure, and its use, is sustainable.
- Under each focus area are short term and long-term priorities for the strategy to address.
- A list of priority projects which collectively form part of a cohesive network that provides a route around Northland and connect with the Auckland region. The projects are made up of 'easy' and more challenging walking and cycling routes that will appeal to a broad range of visitors.

The projects identified in the strategy have been assessed through the PGF Northland Integrated Cycle Implementation plan which is described in Section 1.2.3.

1.8.2 *Kaipara Walking and Cycling Strategy, 2017*

This strategy has been prepared to provide a framework to increase walking and cycling participation in the Kaipara district. It includes initiatives to develop and expand walking and cycling networks, for both local journeys as well as long distance touring routes to support economic growth. The Strategy also identifies opportunities for the district to collaborate with key partners to jointly fund and connect key linkages and develop behaviour change initiatives to change attitudes to walking and cycling.

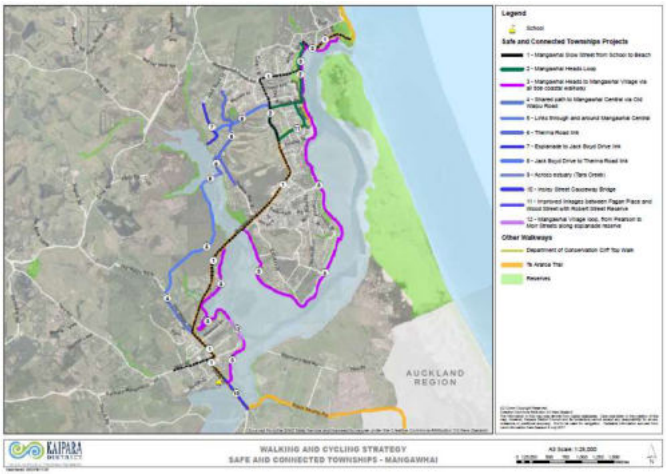
The vision of the Kaipara Walking and Cycling Strategy is: 'Working together to enhance walking and cycling in Kaipara'.

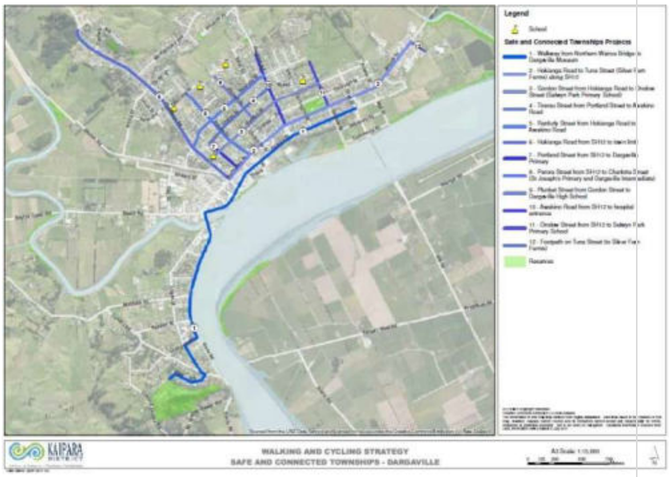
Council aims to work towards this vision by focusing its efforts on the following three objectives:

- Become a walking and cycling destination to support economic growth and provide transport and lifestyle choices.
- Partner with key stakeholders and community to deliver walking and cycling projects and behaviour change initiatives.
- Develop district-wide and township walking and cycling networks that are safe, enduring and connect with nature.

The strategy has identified many projects to improve walking and cycling opportunities in the Kaipara District and the most significant of these are shown in the following maps. This includes the:

- Mangawhai Shared Path
- Kaihu Valley Rail Trail
- Waoku Coach Trail
- Dargaville riverside path (connects to Kaihu Valley Rail Trail and existing Missing Link Cycleway Heartland Ride)
- Dargaville to Maungaturoto





1.8.3 *Whangarei Walking and Cycling Strategy, 2018*

This strategy provides a framework for increasing participation in walking and cycling as a principle transport mode, and for recreational purposes, contributing to a healthy and vibrant community and growing economy. Many facilities for walking and cycling will also provide opportunities for mobility scooter and for small wheeled recreational vehicles, including skateboards and scooters. This Strategy updates the Walking and Cycling Strategy for Whangarei City 2012.

The vision for the strategy is: 'A walking and cycling destination that provides safe, integrated, attractive and viable networks for commuters as well as lifestyle and economic opportunities for residents and visitors.'

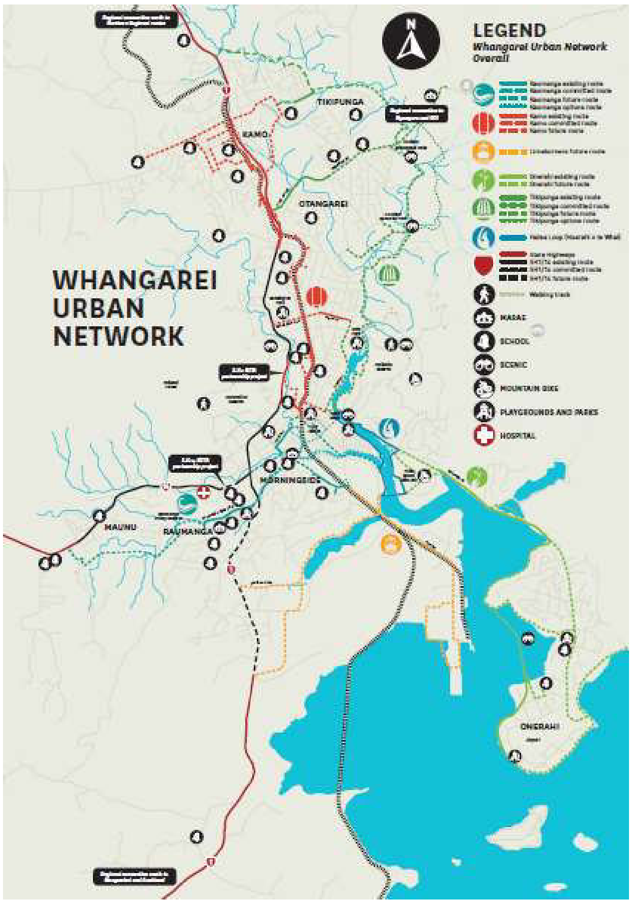
The goals of the walking and cycling strategy are:

- A safe connected urban walking and cycling environment
- More people walking and cycling, more often
- A destination where walking and cycling is a lifestyle

- A walking and cycling network that connects with other districts and significant locations in our district.

The projects identified in the strategy are shown in the following maps. The most significant of these are:

- Completing the shared path network in Whangarei city including the extension of the Kamo path to Kamo Village, the extension of the Raumanga path to Maunu, and the new Tikipunga shared path.
- The completion of the Bream Bay Cycle Trail and connection to the path being provided as part of the Whangarei to Port Marsden 4-laning project.
- The Whangarei to Ngunguru cycle trail.
- The Whangarei Heads cycle trail.



1.9 Forestry Strategy

The Northland Region has a long history of forestry-related activities. Maturing forest estates planted in the 1970s and 1980s are resulting in significant harvesting activities right across the Northland Region. Northport and six processing operations (mills and timber products) are located in Northland. In 2015, approximately 4.8 million cubic metres of harvest volume was processed and/or exported through mills and the port facilities located in the region. These volumes have been sustained for the last 5 years and current forecasts are that 4-4.5 million cubic metres of harvest will continue until 2019 when they are predicted to reduce to 3 million cubic metres per annum until 2034.

The forecast forestry harvest for Northland is shown in the figure below (source: Ministry of Primary Industries, Wood Availability Forecast – Northland 2014, Scenario 3).

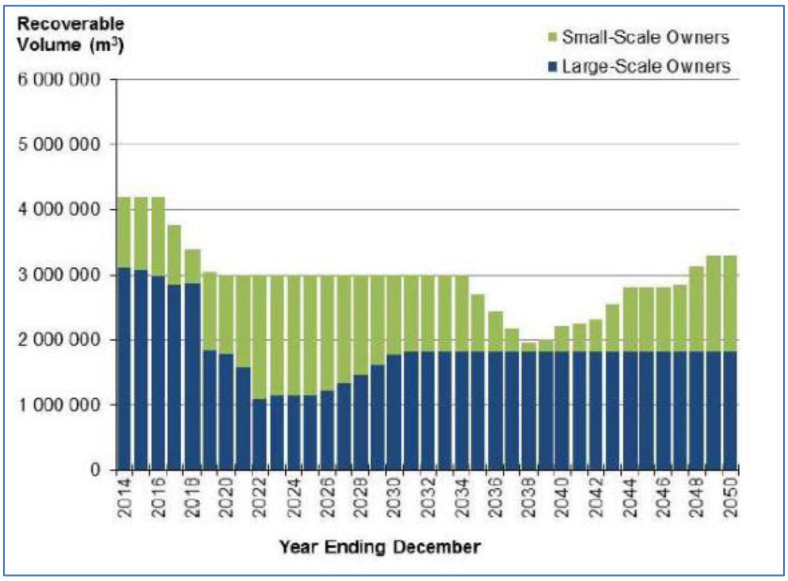
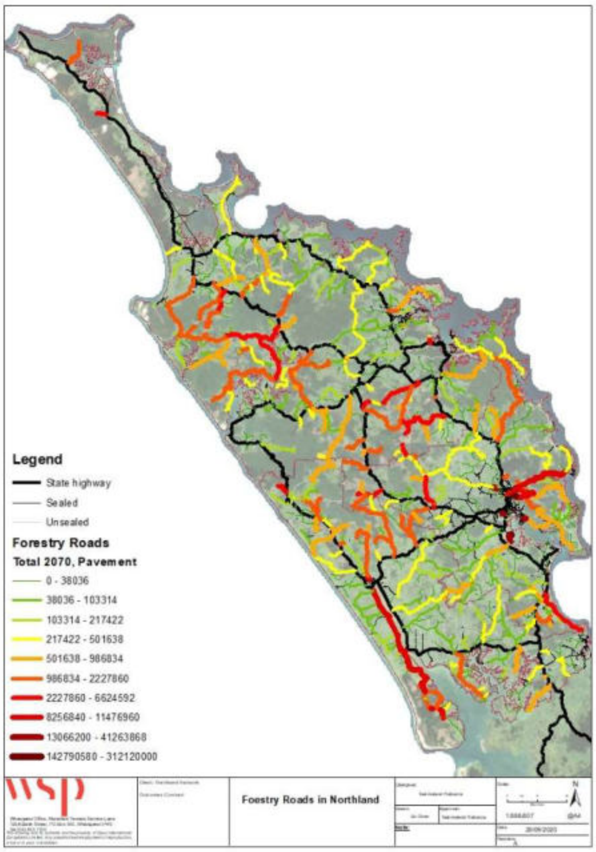


Figure 1-18: Forecast Wood Availability

During the 2013-2015 period a forestry strategy was developed by each council with an overarching strategy across the region and this resulted in additional funding being approved for each council during the 2015/2018 period to address the impacts of forestry on the local road network.

In preparation for the 2021/2051 AMP development, a new forestry strategy was developed in 2019-2020 to understand the ongoing impacts of forestry on the network and to account for this in the long-term planning for each council. FORME forestry consultants were used to determine the forestry harvest from the next two harvest cycles (out to 2070) and map these onto the road network to determine the forestry loadings.



The forestry harvest data was gathered in consultation with forestry owners. Wood processors were also consulted to determine the likely harvest intentions of small woodlot owners. Over the next 5 years, the major forestry blocks will have been mostly logged out and small woodlots are likely to make up 50% of the harvest. FORME estimated that 93% of all forestry blocks harvested in Northland will be replanted which will result in a sustained long term forestry harvest cycle.

The predicted total harvest (in tonnes) to 2070 is shown on the map to the right.

The harvest information was used by WSP consultants to determine the loading impact on the affected forestry routes. This information was then incorporated into the unsealed road model and dTIMS sealed road model to determine the long-term impact on the road network and to build the required treatments into the forward works programme for each council. In this way, forestry impacts will be considered as part of the business-as-usual development of the long-term planning for reseals, rehabilitations and heavy metalling programmes going forward.

1.10 Demand Summary

As described in this section, the demands on the Northland transport network can be summarised as follows:

- The effects of the COVID-19 pandemic to date have impacted international tourism, but growth in Northland has been strong since the lockdowns, due to a buoyant housing market fuelled by ex-pat New Zealander's returning home from overseas as well as strong domestic tourism.
- Growth in GDP in Northland was 4.6% in 2023 which is similar to the national average of 5.3%, and unemployment is at a low of 3.5%, but household incomes are less than the national average.
- Northland is one of the most socially deprived regions in the country and so supporting growth opportunities, and providing alternative transport opportunities such as walking, cycling and public transport are important.
- The freight task in Northland has grown by 2% per annum over the past 5 years to 16.6M tonnes being carried by road (in 2017/18). This is forecast to remain at these levels for the next 30 years due mainly to a drop in forestry harvest over the next few years from the current 4 million cubic metres to 3 million cubic metres. However, recent developments such as the potential for Northport to grow into a container port and the investment in water storage projects to support expansion of horticulture activities may increase freight movements. The recent investment in the North Auckland rail line may slowly reduce the current reliance on the road network for most freight movements (currently 99% of freight is carried by road).

- The population in Northland increased by 1.9% per annum over the five years to 2023. Much of this growth occurred in the Mangawhai, Kerikeri/Waipapa and Whangarei areas. This growth is expected to continue into the future with strong growth opportunities through Northland's proximity to Auckland, potential growth in Northport, the motorway extension to Warkworth and government investment such as through the Provincial Growth Fund.
- Overall growth in traffic volumes in Northland is between 1-2% for Kaipara and Whangarei, but dropping 1% in the Far North The percentage of HCVs has dropped across all districts between 0.2% and 1.9%
- The investment in walking and cycling projects across Northland, through the implementation of the Walking and Cycling Strategies, is likely to create a mode shift and partially mitigate the growth effects on traffic demand in urban areas. In addition, the proposed upgrade to the Whangarei CityLink bus service is also likely to result in a shift to public transport in the city. These initiatives will also help mitigate transports impact on greenhouse gas emissions.
- The impacts of climate change are likely to create more extreme weather events, sea level rise and more droughts. These impacts will create further demands on the transport system, particularly increased likelihood of slips, flooding, and inundation of low-lying coastal roads.

Overall, the impacts of these demands on the maintenance, operations and renewals programme is to increase the volume of traffic and freight on the network. Population growth will also result in growth of the road network through roads being vested to Council. These impacts will result in more wear and tear and a larger network which will require increasing levels of funding to maintain.

2 Problems, Benefits, and Consequences

2.1 Key Issues

2.1.1 *Key Issues and Actions*

- The constrained road network in Whangarei City and high dependence on private vehicle use results in higher traffic volumes on its arterial road network and is resulting in congestion in the commuter peaks. The high traffic growth rate in Whangarei is expected to continue for the near future due to high population, freight and tourism growth.
- There is also low uptake in public transport and walking and cycling in Whangarei City which is increasing the reliance on private vehicles.
- The Kerikeri/Waipapa area has grown rapidly for many years and the road network is under pressure from increasing traffic flows. These traffic flows increase in summer due to an influx of visitors and tourists. There are few bus services, cycle paths or pedestrian links between Kerikeri and Waipapa and this increases private vehicle use.
- Mangawhai is one of the fastest growing towns in the country and is a summer holiday destination which swells the population by up to 3 times normal. During summer holiday periods, there is congestion in several areas. Mangawhai also has few bus services, cycle paths or pedestrian links between Mangawhai Village and Mangawhai Heads, which again increases the reliance on private vehicle use.
- Rural towns are often located on State Highways or other arterial routes which result in severance of the community. There are also few bus services and cycleways linking these communities which reduce access to employment, education and social opportunities.
- Traffic congestion at known problem areas should be addressed.
- Improvements to the public transport and walking and cycling infrastructure should be made to encourage mode shift from private vehicle use. This should be supported by education and promotion campaigns.

2.1.2 *Benefits*

- Addressing capacity issues at known problem areas identified through the Whangarei City Transportation Network Strategy PBC will minimise delays to freight and improve access during peak periods.
- Improving the attractiveness of the bus service and infrastructure in Whangarei will encourage higher passenger numbers and would reduce private vehicle use and congestion. Rural bus services would reduce rural commuter traffic on key arterials servicing the city.
- Providing cycleway connections in Whangarei with good infrastructure and supported by travel plans to schools, parks and businesses will encourage cycle use and maximise the full potential of the current cycleway network.
- Developing and implementing the Kerikeri/Waipapa Strategic Road Network and the Mangawhai Network Operating Framework would remove current pinch points in these areas, would cater for long term growth and would provide pedestrian and cyclist links which will reduce reliance on private vehicles and improve active mode use.
- Improved walking and cycling connections in rural towns and the potential for rural bus services will provide transport choice to the transport disadvantaged in these communities, which will reduce severance, improve safety and lower social deprivation.

2.1.3 Consequences

- Without addressing capacity issues at know problem areas in Whangarei, there will continue to cause delays to freight and frustration to road users due to lack of access on these arterial routes. These delays will continue to grow as the city increases in population.
- Without change to improve the current bus service in Whangarei, public transport will have limited impact on reducing private vehicle use and congestion in Whangarei.
- Without adequate cycleway connections in Whangarei, potential cyclists may be put off from using the cycleway network which will result in lower uptake of users and less health and congestion relief benefits being achieved.
- Without developing and implementing the Kerikeri/Waipapa Strategic Road Network and the Mangawhai Network Operating Framework congestion in peak holiday periods will continue, growth will continue to exacerbate existing pinch points, and there will be a continued high reliance on private vehicle use due to lack of alternative transport choices.
- Without improving walking and cycling links and bus services to rural towns, these communities will continue to suffer from community severance, safety issues and lack of access to employment, education and social opportunities which will result in continuing high levels of social deprivation.

2.2 Strategic Case – Bottom-Up Assessment

During the development of the AMP, the NTA held a series of workshops to test and refine the problem statements and to determine the strategic response to address the problems. This is shown in the following tables.

Draft Problem Statement: Growth and Demand
Rapid growth and lack of suitable mode shift options are causing congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods. Lack of mode shift options in the more remote communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation. Funding is required to improve accessibility for built up urban areas and within townships and neighbourhoods.
Current AMP - Key responses outlined in Strategic Case:
• FNDC – Carry out an Integrated Transport Strategy and Plan to identify projects in the Kerikeri/Waipapa area to address summer congestion. • KDC – Carry out a Transport Strategy for Mangawhai to build on the work undertaken through the Mangawhai Community Plan. This will confirm the projects in Mangawhai area to address summer congestion. Upgrade the intersections at Moir/Insley and Moir/Molesworth. • WDC – Implementation of the Whangarei City Transportation Network Strategy PBC. Specifically, this includes: o Carry out corridor management plans of key arterial routes. o Improve traffic signal reliability and operation by providing Fibre/Wi-Fi Connection, CCTV Coverage, Remote Operation and Improved Detection Technology. o Carry out a programme of Signal Detector Renewals and SCATS Computer Replacement to ensure that the traffic signals are operating efficiently and will reduce the risk of the SCATS computer failing. o Consider the feasibility of carrying out signal and bridge operations through a Northland transport operations centre (similar to ATOC). o Travel planning to encourage mode shift to walking, cycling and public transport and will help reduce congestion. o Upgrade the Tarewa/Porowini and Maunu/Porowini intersections to address rapid growth on Porowini Ave o Construct a new roundabout at SH1/Springs Flat to help address growth in Tikipunga.

Current Work that is being undertaken:

- WDC – Tarewa/Porowini intersection has been completed and Maunu/Porowini intersection nearing completion. Corridor management plans have been replaced by a detailed Inner CBD transport model which is being finalised and will identify short and long term actions to reduce congestion in the CBD. Signal upgrades including improved communications are being progressively rolled out.
- FNDC – Nearing the completion of the Integrated Transport Strategy and Plan.
- KDC – Starting work on developing a Network Operating Framework for Mangawhai (agreed approach with NZTA). The intersections at Moir/Insley and Moir/Molesworth were upgraded in 2020/21.

- WDC – Tarewa/Porowini intersection has been completed and Maunu/Porowini intersection nearing completion. Corridor management plans have been replaced by a detailed Inner CBD transport model which is being finalised and will identify short and long term actions to reduce congestion in the CBD. Signal upgrades including improved communications are being progressively rolled out.

Aspects of the problem not being addressed and benefits not being delivered?

- Congestion is still building in Whangarei during the morning and evening peaks. This is increasing due to high growth in the city and lack of use of alternative transport modes. Uptake in walking and cycling is improving but is currently limited by the shared path network still being completed. Public transport is not seen as a viable mode by many commuters because it isn't frequent enough (30 minutes frequency in peak periods), it gets stuck in the same queues as private vehicles and costs more than all-day parking in the CBD (e.g. no time or cost advantage in taking public transport).
- Kerikeri, Waipapa and Mangawhai growth areas becoming more congested at peak holiday periods. Mangawhai was one of the highest growth regions in NZ in the past 5 years.

Is the Problem Statement still relevant? If "No" what are the deficiencies? If "Yes" has priority changed?

Yes – higher priority now with growth effects over the past 5 years.

If Problem is not being addressed by the current work, what is the strategic response?

Strategic response	Y/N	Rank	Detail
1 Programme adjustment eg, Remove/reduce projects/activities	Y	2	Increased programme of intersection improvements to address pinch points. Widening of arterial road links to 4-lanes in Whangarei in line with transport strategy to provide bus priority lanes. Bypass of Kerikeri town centre in line with Far North ITP. Upgrade Garbolino and Cove Rd routes to provide improved access to Mangawhai Centre and SH detour route in line with Mangawhai NOF.
2 Policy approach eg, Adjust level of Service	Y	3	Allow levels of service to decline and accept more congestion during peak periods, to help drive mode shift.
3 Demand management eg, Manage use – up/down	Y	1	Develop network of shared paths and provide improved bus services during peak periods to encourage mode shift.
4 Funding adjustment. eg, Increase/decrease	Y	-	In conjunction with Options 1 – 3.
5 Risk based eg, Hold Assets longer	N	-	Not applicable.

How effective are the options? (as per Multi Criteria Assessment below)

Option 1 – Intersection and road upgrades including bus priority lanes, new link roads – Score 1.5 out of 3. (Preferred).

Option 2 – Allow more congestion to drive mode shift – Score -1.0 out of 3.

Option 3 – Network of shared paths and improved bus services – Score 1.65 out of 3. (Preferred).

Draft an updated problem statement (if applicable)
Rapid growth and lack of suitable mode shift options are causing congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods. Lack of mode shift options in the more remote communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation.

Strategic Case Multi Criteria Option Analysis, RCA: NTA
Problem: Traffic Congestion and Growth

Short list up to 3 options from the following - Can we make-----

Option	Yes/No	Reason	Rank
1 Programme adjustment eg, Remove/reduce projects/activities	Yes	Increased programme of intersection improvements to address pinch points. Widening of arterial road links to 4-lanes in Whanagrei in line with transport strategy to provide bus priority lanes. Bypass of Kerikeri town centre in line with Far North ITP. Upgrade Garbalino and Cove Rd routes to provide improved access to Mangawhai Centre and SH detour route in line with Mangawhai NOF	2
2 Policy approach eg, Adjust level of Service	Yes	Allow levels of service to decline and accept more congestion during peak periods, to help drive mode shift.	3
3 Demand management eg, Manage use – up/down	Yes	Develop network of shared paths and provide improved bus services during peak periods to encourage mode shift.	1
4 Funding adjustment. eg, Increase/decrease	Yes	In conjunction with Options 1 – 3.	-
5 Risk based eg, Hold Assets longer	No	Not applicable.	-

Criteria/Drivers to consider	Weighting (Importance) (Total to 100%)	How good is this option					
		Option 1 - Intersection upgrades, road upgrades including bus priority lanes and new road links		Option 2 - Allow congestion to increase, to help drive mode shift		Option 3 - Network of shared paths and improved public transport services to promote mode shift	
		Raw	Score	Raw	Score	Raw	Score
Meets GPS	10%	2	0.2	2	0.2	3	0.3
Meets RLTP	10%	3	0.3	-2	-0.2	2	0.2
Addresses Problems	20%	2	0.4	-1	-0.2	3	0.6
Will realise Benefits	10%	2	0.2	-1	-0.1	2	0.2
Will meet Community Outcomes	10%	3	0.3	-3	-0.3	2	0.2
Will meet Customer Outcomes (CLOS)	10%	2	0.2	-2	-0.2	2	0.2
Provides high Performance impacts	10%	1	0.1	-3	-0.3	1	0.1
Provides high Environmental Impacts	5%	1	0.05	-2	-0.1	2	0.1
Provides Cultural Impacts	5%	1	0.05	-2	-0.1	1	0.05
How Costly	10%	-3	-0.3	3	0.3	-3	-0.3
Other 1							
Other 2							
Other 3							
Other 4							
Totals	100%		1.5		-1.0		1.7

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

Draft Problem Statement – Alternative Transport Modes
Rapid growth and lack of suitable mode shift options are causing congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods. Lack of mode shift options in the more remote communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation. Funding is required to improve accessibility for built up urban areas and within townships and neighbourhoods.
Current AMP - Key responses outlined in Strategic Case:

• FNDC – Development of Heartland Rides will provide cycling facilities aimed at visitors and tourists and is supported by the Twin Coast Discovery Highway.
• KDC – Construct a shared path and coastal walkway in Mangawhai. Develop the Kaihu Valley Rail Trail and other heartland rides connecting townships. Construct walking and cycling networks in Dargaville, Kaiwaka, Maungaturoto and Ruawai. Development of a ferry service in the Kaipara Harbour.
• WDC – Implement the Whangarei City Transportation Strategy PBC. Specifically the following activities were to be implemented through the AMP:
  o Improved traffic signal detection technology will further improve efficiency during pedestrian phases and by providing priority for public transport vehicles.
  o Complete the shared path network. Construct a bike training facility on Pohe Island.
  o Travel planning to encourage mode shift to walking, cycling and public transport and will help reduce congestion.
  o Provide Bike Skills training to improve cyclist confidence and safety.
  o Increase parking charges in the CBD.
• NTA – Carry out regular footpath condition rating and develop a footpath hierarchy and prioritisation tool for determining footpath renewals. Pedestrian crossing upgrades to improve the safety of pedestrians crossing busy roads.

Current Work that is being undertaken:
• Kamo Shared Path being built in Whangarei which is encouraging school children to walk and cycle to school. • Footpath condition rating undertaken, footpath hierarchy developed, and prioritisation tool developed for determining footpath renewals. Footpaths now subsidised by NZTA and are receiving more focus. • New footpaths being built through the Low-Cost Low Risk programme. • Pedestrian crossing upgrades are being undertaken in high risk areas. • CityLink bus service in Whangarei. • BusAbout Kaitaia, Far North Link, Mid North Link and Hokianga Link and Bream Bay Link providing some public bus services to the wider region.
Aspects of the problem not being addressed and benefits not being delivered?
In Whangarei, uptake in walking and cycling is improving but is currently limited by the shared path network still being completed. Public transport is not seen as a viable mode by many commuters because it isn't frequent enough (30 minutes frequency in peak periods), it gets stuck in the same queues as private vehicles and costs more than all-day parking in the CBD (e.g. no time or cost advantage in taking public transport). While there are several bus services outside of Whangarei that service many towns and villages, these services are often have very limited services (some are one, two or three trips per week) due to lack of demand. There are still other towns and villages that have no public bus service (such as Dargaville, Ruawai, Maungaturoto, Hikurangi, Ngunguru, Maungatapere and Parua Bay). Footpaths in urban areas are often incomplete or too narrow for the demands of an aging population (such as mobility scooters). Apart from Heartland Rides for tourists, there is a lack of cycling facilities outside of Whangarei.
Is the Problem Statement still relevant? If "No" what are the deficiencies? If "Yes" has priority changed?
Yes - priority is increasing through rapid growth and aging population requiring better paths and bus services.

If Problem is not being addressed by the current work, what is the strategic response?			
Strategic response	**Y/N**	**Rank**	**Detail**
1 Programme adjustment e.g. Remove/reduce projects/activities	Y	2	Complete the shared path network in Whangarei and provide walking and cycling opportunities in Kerikeri/Waipapa and Mangawhai.
2 Policy approach e.g. Adjust level of Service	Y	1	Increase frequency of bus services in conjunction with the development of bus priority lanes in Whangarei. Expand rural bus services to connect to all rural towns and increase services in line with demand.
	Y	4	Widen footpaths to meet current standards when undertaking renewals or new paths.
3 Demand management e.g. Manage use – up/down	Y	3	Carry out travel planning with schools and business and develop a promotional tool such as New Plymouth's LetsGo programme to encourage mode shift to active modes and public transport. All-day commuter parking charges to be increased to support mode shift where alternative modes exist.
4 Funding adjustment. e.g. Increase/decrease	Y	-	In conjunction with Options 1 – 3.
5 Risk based e.g. Hold Assets longer	N	-	Not applicable.

How effective are the options? (as per Multi Criteria Assessment below)
Option 1 – Shared path networks for Whangarei, Kerikeri/Waipapa and Mangawhai – Score **1.55** out of 3. (Preferred) Option 2a – Increase bus frequency in Whangarei and expand rural services – Score 1.75 out of 3. (Preferred) Option 2b – Widen footpaths in conjunction with footpath renewals – Score 0.75 out of 3. (Preferred) Option 3 – Travel planning and mode shift promotion. Increase all-day parking charges – Score 1.55 out of 3. (Preferred)

Draft an updated problem statement (if applicable)
Rapid growth and lack of suitable mode shift options are causing congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods. Lack of mode shift options in the more remote communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation.

Strategic Case Multi Criteria Option Analysis, RCA: NTA
Problem: Alternative Transport Modes

Short list up to 3 options from the following - Can we make-----

Option	Yes/No	Reason	Rank
1 Programme adjustment eg, Remove/reduce projects/activities	Yes	Complete the shared path network in Whangarei and provide walking and cycling opportunities in Kerikeri/Waipapa and Mangawhai.	2
2 Policy approach eg, Adjust level of Service	Yes	Increase frequency of bus services in conjunction with the development of bus priority lanes in Whangarei. Expand rural bus services to connect to all rural towns and increase services in line with demand.	1
	Yes	Widen footpaths when undertaking renewals or new paths.	4
3 Demand management eg, Manage use – up/down	Yes	Carry out travel planning with schools and business and develop a promotional tool such as New Plymouth's LetsGo programme to encourage mode shift to active modes and public transport. All-day commuter parking charges to be increased to support mode shift where alternative modes exist.	3
4 Funding adjustment. eg, Increase/decrease	Yes	In conjunction with Options 1 – 3.	-
5 Risk based eg, Hold Assets longer	No	Not applicable.	-

Criteria/Drivers to consider	Weighting (Importance) (Total to 100%)	How good is this option							
		Option 1 - Shared Path Networks in Whangrei, Kerikeri/ Waipapa and Mangawhai		Option 2a - Increase Bus frequencies in Whangarei. Expanded Rural Bus Services.		Option 2b - Widen Footpaths in Conjunction with Renewals		Option 3 - Travel Planning and Mode Shift Promotional Programme. Increase All-day Parking Charges.	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score
Meets GPS	10%	3	0.3	3	0.3	1	0.1	3	0.3
Meets RLTP	10%	2	0.2	3	0.3	1	0.1	1	0.1
Addresses Problems	20%	2	0.4	2	0.4	1	0.2	2	0.4
Will realise Benefits	10%	2	0.2	2	0.2	1	0.1	2	0.2
Will meet Community Outcomes	10%	3	0.3	2	0.2	1	0.1	1	0.1
Will meet Customer Outcomes (CLOS)	10%	2	0.2	2	0.2	0	0	1	0.1
Provides high Performance impacts	10%	1	0.1	2	0.2	2	0.2	3	0.3
Provides high Environmental Impacts	5%	2	0.1	1	0.05	0	0	2	0.1
Provides Cultural Impacts	5%	1	0.05	2	0.1	1	0.05	1	0.05
How Costly	10%	-3	-0.3	-2	-0.2	-1	-0.1	-1	-0.1
Other 1									
Other 2									
Other 3									
Other 4									
Totals	100%		1.55		1.75		0.75		1.55

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

2.3 Strategic Case Summary (Line of Sight in Action)

Based on the assessment of the problem statement and the strategic responses undertaken in the previous section, a summary of the results and the affected work categories are shown in the table below:

Issue	Problem Statement
Problem Statement	Rapid growth and lack of suitable mode shift options are causing congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods. Lack of mode shift options in the more remote communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation.
Benefits	• Reduce congestion at bottle necks • Provide for growth in a sustainable manner • Provide or improve access to alternative transport modes • Improve access to employment, education and social opportunities • Reduce community severance and social deprivation • Improve health benefits through active modes
Trend	Getting Worse
Strategic Response	**Programme Adjustment** • Intersection and road upgrades including bus priority lanes, new link roads • Shared path networks for Whangarei, Kerikeri/Waipapa and Mangawhai **Policy Approach** • Increase bus frequency in Whangarei and expand rural services **Demand Management** • Travel planning and mode shift promotion. • Increase all-day parking charges
Activity/Work Category	WC 324 – Road Improvements WC 341 – Low Cost / Low Risk Improvements WC 452 – Cycling Facilities WC 511 – Passenger Services - bus WC 531 – Public Transport Facilities and Major Renewals

3 Options, Assessment and Alternatives

3.1 Option Identification (Root Cause Analysis)

Following the identification of the problem statements, a root cause analysis was undertaken to identify the underlying causes of these problems. The root cause analysis was undertaken using the "5 Whys" type methodology in accordance with NZTA's Business Case Approach Practice Note No.3 – Root Cause Analysis in Business Case Development.

This process was undertaken through a series of workshops with the NTA Assets Team and NZTA local representative to determine the underlying causes of the identified problems. This was a bit of a deep dive into the myriad of issues that affect the transport network and a multitude of root causes were identified for each problem statement.

For each root cause, a possible solution (option or alternative) was identified to try and address this cause. These solutions ranged from high level interventions such as changing council policies and developing strategies to low level interventions such improving grader operator training.

The following table includes the results of the root cause analysis and the possible solutions to address the problem statements.

Root Cause Analysis – Growth and Demand

Problem statement	**Congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods. Many communities have restricted access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation**													
why 1	The road network does not have sufficient capacity to cope with the peak demands.										Rural towns and communities have a lack of transport choice, which is particularly a constraint for the transport disadvantaged who do not have access to a private vehicle.			
why 2	Many intersections and road sections on key routes are old and are reaching the limits of what they were designed for.										Lack of alternative modes available.			
why 3	Increase in the number of private vehicles.										Walking and cycling unsafe due to conflicts with higher vehicle speeds.			Limited or no public transport available.
why 4	Rapid population growth in the outer suburbs, and rural towns of Whangarei over the past 5-10 years.		Rapid population growth in Kerikeri/Waipapa and Mangawhai over the past 5-10 years, combined with summer holiday traffic.	Lack of suitable alternative transport modes.							Lack of safe, connected walking and cycling paths.		Limited shoulder or berm for walking and cycling.	Insufficient population to support bus services.
why 5	Lack of available land in the central area of Whangarei City has resulted in growth of the outlying areas.	Overflow population from Auckland due to sustained period of record immigration into NZ.	Kerikeri and Mangawhai are summer holiday destinations.	Whangarei's City Link bus service is not convenient or attractive for most commuters.				Walking and cycling paths in Whangarei, Kerikeri/Waipapa and Mangawhai are either incomplete, non-existent or unsafe.			Footpaths in rural towns and communities are either incomplete, non-existent or unsafe.	There are few safe cycleways between rural towns and communities.	Narrow rural roads designed primarily for vehicles.	Traditional bus services often not feasible due to lack of passengers and high cost of service.
	The Whangarei City centre is constrained by the surrounding hills and Hatea River.	Lack of available capacity in Auckland resulting in housing shortages.	Peak holiday traffic is significantly higher than normal traffic flows.	The buses get caught in the same traffic queues as private vehicles.	The buses are not frequent enough (most peak services are 30 minutes apart).	All-day parking is cheap ($2/day) compared to bus fares (currently $2/trip each way).	There are no suitable services for commuters in rural areas.	Whangarei shared path network to be completed and there is no on-road cycleway network.	There is no cycleway network for Kerikeri/Waipapa or Mangawhai.	The footpath network has missing and has unsafe crossing points. There are also many narrow sections that are unsuitable for mobility scooters and wheel chairs, which is likely to become more of an issue with an aging population.		Lack of focus and investment on rural cyclepaths in the past. Heavy reliance on private vehicle use between rural communities.	Lack of available funding to widen roads sufficiently to provide for safe shoulders/berms for walking and cycling.	Passengers in rural areas with high levels of social deprivation cannot afford high bus fares.
Potential Solutions	Implement the City Centre Plan and Complete Streets Masterplan to encourage more inner city living in Whangarei.	Upgrade intersections and road links as they reach capacity to remove pinch points on the network. Improve detection and operation of signalised intersections in Whangarei. Develop and implement the Kerikeri/Waipapa Strategic Road Network. Implement the improvements from the Mangawhai Network Operating Framework.	Implement travel demand management to reduce summer peak traffic in Kerikeri and Mangwhai. This could include summer bus services (such as the Mangawhai seasonal service trialled in 2019/20).	Provide bus priority lanes on key bus routes to enable buses to "beat the queue" and to get a time advantage over private vehicles.	Increase the frequency of the bus services to reduce the time that users are waiting for the bus. This should be implemented in conjunction with the bus priority lanes. Implement travel planning campaigns such as New Plymouth's LetsGo to promote bus use.	Increase the parking fees for all-day parking so that these are at least as expensive as a return bus fare (price advantage). Implement travel planning campaigns such as New Plymouth's LetsGo to promote bus use.	Provide rural bus services suitable for commuters in Whangarei's outlying towns and villages	Develop and implement a Principal Cycleway Network Plan for on-road cyclelanes in Whangarei. Continue the development of the shared path network including completing the Kamo, Raumanga and Onerahi paths, as well as extending to Maunu and Tikipunga and linking through the city centre. Implement travel planning campaigns such as New Plymouth's LetsGo	Develop and implement a Principal Cycleway Network Plan for on-road cyclelanes in Kerikeri/Waipapa. Also consider shared path network linking Kerikeri to Waipapa. Implement the planned Mangawhai Shared Path network. Complete missing sections of footpath to complete pedestrian networks. Implement travel	Complete missing sections of footpath to provide pedestrian networks linking residential areas with schools, places of employment and recreation etc. Widen footpaths that are too narrow for mobility scooters. Consider increasing the minimum footpath width in the council engineering standards to 1.6m. Provide safe pedestrian crossing points across busy roads. Construct footpath linkages identified through the PGF funded Township Improvement Plans and Council Spatial Plans.		Construct the rural cycleways (ie Heartland Rides) identified in the Regional Walking and Cycling Strategy and the PGF funded Northland Integrated Cycling Plan. Develop a network of safe rural cycleways linking rural towns and communities. Construct cycleways identified through the PGF funded Township Improvement Plans and Council Spatial Plans	Where suitable, provide additional shoulder or berm width on rural roads to enable safer walking and cycling opportunities.	Provide lower cost shuttle bus type services where feasible between rural towns. Support the development of low-cost ride share services to provide access to communities where bus services are not feasible.

3.2 Option Development

The following table was developed by the Roading Efficiency Group as part of a top-down assessment of options to address the identified problems. They summarise the responses in the existing AMP, the effectiveness of the existing programme and the proposed options which have been determined from the root cause analysis which should be considered as part of the option assessment.

Statement Problem 6	Key Responses In existing AMP	Summary of effectiveness of existing programme	Proposed Programme Business Case adjustments (from Root Cause Analysis)
Rapid growth and lack of suitable mode shift options are causing congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods. Lack of mode shift options in the more remote communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation.	• WDC – Implementation of the Whangarei City Transportation Network Strategy PBC. Specifically, this includes: ○ Carry out corridor management plans of key arterial routes. ○ Improve traffic signal reliability and operation by providing Fibre/Wi-Fi Connection, CCTV Coverage, Remote Operation and Improved Detection Technology. ○ Carry out a programme of Signal Detector Renewals and SCATS Computer Replacement to ensure that the traffic signals are operating efficiently and will reduce the risk of the SCATS computer failing. ○ Consider the feasibility of carrying out signal and bridge operations through a Northland transport operations centre (similar to ATOC). ○ Travel planning to encourage mode shift to walking, cycling and public transport and will help reduce congestion. ○ Upgrade the Tarewa/Porowini and Maunu/Porowini intersections to address rapid growth on Porowini Ave ○ Construct a new roundabout at SH1/Springs Flat to help address growth in Tikipunga. ○ Improved traffic signal detection technology will further improve efficiency during pedestrian phases and by providing priority for public transport vehicles.	• Traffic signals MOR are keeping signals in a relatively stable condition but is not keeping up with demand. • Footpath and cycleway maintenance is keeping these paths in a relatively stable condition. There are a lot of renewals required. • Traffic signal improvements and new footpaths undertaken through the Low-Cost Low Risk programme are starting to improve traffic flows and pedestrian linkages. • Footpath maintenance and renewals are potential COVID-19 stimulus works. • Key issues from Root Cause Analysis: ○ Rapid growth in Whangarei is causing congestion during workday peaks. ○ Rapid growth in Kerikeri/Waipapa and Mangawhai combined with summer holiday traffic is causing congestion. ○ The bus service in Whangarei is inconvenient for most commuters (stuck in same queue, 30 min frequency during peaks, all-day parking cheaper than return bus fare, lack of rural services). This places more reliance on private vehicle use.	• Implement the City Centre Plan and Complete Streets Masterplan to encourage more inner city living in Whangarei. • Upgrade intersections and road links as they reach capacity to remove pinch points on the network. • Improve detection and operation of signalised intersections in Whangarei. • Develop and implement the Kerikeri/Waipapa Strategic Road Network. • Implement the improvements from the Mangawhai Network Operating Framework. • Implement travel demand management to reduce summer peak traffic in Kerikeri and Mangwhai. This could include summer bus services (such as the Mangawhai seasonal service trialled in 2019/20). • Provide bus priority lanes on key bus routes to enable buses to "beat the queue" and to get a time advantage over private vehicles. • Increase the frequency of the bus services to reduce the time that users are waiting for the bus. This should be implemented in conjunction with the bus priority lanes. • Increase the parking fees for all-day parking so that these are at least as expensive as a return bus fare (price advantage). • Provide rural bus services suitable for commuters in Whangarei's outlying towns and villages. • Develop and implement a Principal Cycleway Network Plan for on-road cycle lanes in Whangarei. • Continue the development of the shared path network including completing the Kamo, Raumanga and Onerahi paths, as well as extending to Maunu and Tikipunga and linking through the city centre.

Statement Problem 6	Key Responses In existing AMP	Summary of effectiveness of existing programme	Proposed Programme Business Case adjustments (from Root Cause Analysis)
Rapid growth and lack of suitable mode shift options are causing congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods. Lack of mode shift options in the more remote communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation.	○ Complete the shared path network. Construct a bike training facility on Pohe Island. ○ Travel planning to encourage mode shift to walking, cycling and public transport and will help reduce congestion. ○ Provide Bike Skills training to improve cyclist confidence and safety. ○ Increase parking charges in the CBD. • FNDC – Carry out an Integrated Transport Strategy and Plan to identify projects in the Kerikeri/Waipapa area to address summer congestion. Development of Heartland Rides will provide cycling facilities aimed at visitors and tourists and is supported by the Twin Coast Discovery Highway. • KDC – Carry out a Transport Strategy for Mangawhai to build on the work undertaken through the Mangawhai Community Plan. This will confirm the projects in Mangawhai area to address summer congestion. Upgrade the intersections at Moir/Insley and Moir/Molesworth. Construct a shared path and coastal walkway in Mangawhai. Develop the Kiahu Valley Rail Trail and other heartland rides connecting townships. Construct walking and cycling networks in Dargaville, Kaiwaka, Maungaturoto and Ruawai. Development of a ferry service in the Kaipara Harbour. • NTA - Carry out regular footpath condition rating and develop a footpath hierarchy and prioritisation tool for determining footpath renewals. Pedestrian crossing upgrades to improve the safety of pedestrians crossing busy roads.	○ The shared path network in Whangarei is incomplete and not fully connected. ○ There is no safe path for pedestrians or cyclists linking Kerikeri to Waipapa, or Mangawhai Heads to the Mangawhai Village. ○ The footpath network is incomplete, narrow in places and has unsafe crossing points in many areas. ○ There are few safe facilities for cyclists to travel between towns and communities in rural area, placing more reliance on private vehicle use. ○ Road shoulders and berms are often narrow in rural areas making it unsafe for cyclists and pedestrians. ○ Lack of public transport in rural areas across Northland.	• Develop and implement a Principal Cycleway Network Plan for on-road cycle lanes in Kerikeri/Waipapa. • Also consider shared path network linking Kerikeri to Waipapa. • Implement the planned Mangawhai Shared Path network. • Implement travel planning campaigns such as New Plymouth's LetsGo to promote walking and cycling and bus use. • Complete missing sections of footpath to provide pedestrian networks linking residential areas with schools, places of employment and recreation etc. • Widen footpaths that are too narrow for mobility scooters. • Consider increasing the minimum footpath width in the council engineering standards to 1.6m. • Provide safe pedestrian crossing points across busy roads. • Construct footpath linkages and cycleways identified through the PGF funded Township Improvement Plans and Council Spatial Plans. • Construct the rural cycleways (ie Heartland Rides) identified in the Regional Walking and Cycling Strategy and the PGF funded Northland Integrated Cycling Plan. • Develop a network of safe rural cycleways linking rural towns and communities. • Where suitable, provide additional shoulder or berm width on rural roads to enable safer walking and cycling opportunities. • Provide lower cost shuttle bus type services where feasible between rural towns. • Support the development of low-cost ride share services to provide access to communities where bus services are not feasible.

4 Option Assessment

The Options Assessment sections in the following appendices analyse the options for addressing the problems and issues identified in the Strategic Case:

- Appendix 05 – Active Modes – Walking, Cycling, and Micro-Mobility.
- Appendix 06 – Network Operations.
- Appendix 07 – Network Safety – Safety, Education & Promotion, and Demand Management.

Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendix 09.A

Growth and Demand – Public Transport

Overview and Management
Problems, Benefits, Consequences
Options Assessment

Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendix 09.A

Growth and Demand – Public Transport

Table of Contents

1 Overview

1.1 Description

The subsidised public transport services presently contracted by the Northland Regional Council in Northland comprises:

CityLink Whāngārei
The key feature of the region's public transport system is the Whāngārei bus network, (branded as CityLink). It is a contracted bus network operating entirely within urban Whāngārei.

Bream Bay Link
This once a week bus service operates between Kaiwaka via Mangawhai and Waipu.

Hikurangi Link
This a twice a week bus service operates between Hikurangi and Whangarei via Kamo.

Far North Link
This service formerly known as BusAbout Kaitāia operates a twice weekly bus service that covers the Far North around Kaitāia, including Doubtless Bay, Ahipara and Pukenui.

Mid North Link
This bus service operates two routes from Kaikohe to Waipapa, one via Opua, Paihia and Waitangi and the second via Okaihau. The service runs three days a week: Tuesday, Thursday and Saturday.

Hokianga Link
The bus service operates three days a week: Tuesday, Thursday and Saturday from Opononi/Omparere to access services in Kaikohe and Kerikeri.

Total Mobility Scheme
The Total Mobility Scheme provides subsidized licensed taxi services to people who have an impairment that prevents them from undertaking any one or more of the following five components of a journey unaccompanied, on a bus, train or ferry in a safe and dignified manner:

- getting to the place from where the transport departs
- getting onto the transport
- riding securely
- getting off the transport
- getting to the destination

The Total Mobility Scheme presently operates in Whangarei with new services opening up in the Far North.

Non-contracted transport services
There are a number of other services in Northland that are not contracted by Northland Regional Council. Although the council has no direct involvement in these services, it does have an interest in ensuring they are maintained as they contribute towards the core objectives of the council's Long-Term Plan and the Regional Land Transport Plan. These are:

- Commercial operators –operate scheduled intercity coach services into and around the region from Auckland.

- School bus operators – currently run either on a commercial basis or are subsidised by the Ministry of Education. There may also be opportunities for other fare paying passengers to be accommodated on these services at the discretion of the school and/or operator.
- Tour operators – catering for tourists, these services are non-scheduled and are concentrated around peak season.
- The following ferry services operate in Northland:
  - Commercial passenger ferry in the Bay of Islands between Paihia and Russell;
  - Commercial passenger/vehicular ferry in the Bay of Islands between Opua and Okiato; and
  - Subsidised passenger/vehicular ferry (Kohu Ra TuaRua) in the Hokianga between Rawene and Kohukohu (this service is partially subsidized by Far North District Council).

Kohu Ra Tuarua – Hokianga Ferry

The Hokianga ferry (Kohu Ra TuaRua) provides a strategic link from South Hokianga (Rawene) to North Hokianga (Rangiora) within the roading network. The vehicular ferry is a critical asset and provides a vital connection for the local communities of Rawene and Kohukohu in the Far North, enabling access to community facilities such as health care. It is also an important tourist link in the western leg of the Twin Coast Discovery route, which is of strategic importance on a national level. The service has 14 scheduled return trips/day, 7 days/week.

During the peak season, there can be a backlog of cars waiting to board the ferry but only for short periods of time, due to scheduled return trips that the ferry operates to. With the current timetable there is no need to introduce additional sailings.

Table 1-1 below is the scheduled ferry timetable and Figure 1-1 show the ferry route from Rawene to the Narrows.

Table 1-1: Ferry timetable

South Terminal	North Terminal (4 km South of Kohukohu)
Rawene	Narrows
0700 (weekdays only – excludes Public Holiday’s)	0715 (weekdays only – excludes Public Holiday’s)
0730 – 7 days	0745 – 7 days
0815 – 7 days	0830 – 7 days
0845 – 7 days	0900 – 7 days
0930 – 7 days	1000 – 7 days
1030 – 7 days	1100 – 7 days
1130 – 7 days	1200 – 7 days
1230 – 7 days	1300 – 7 days
1330 – 7 days	1400 – 7 days
1430 – 7 days	1500 – 7 days
1530 – 7 days	1600 – 7 days
1630 – 7 days	1700 – 7 days
1730 – 7 days	1800 – 7 days
1830 – 7 days	1900 – 7 days
1930 – 7 days	2000 – 7 days

Figure 1-1: Hokianga Ferry Route

Kohu Ra TuaRua is a double ended, monohull, flat-deck vehicle ferry with an overall length of 33.6m. It is specifically designed and built for operating on the Hokianga Harbour. The ferry has a carrying capacity of 20 cars or equivalent heavy vehicles. Boarding access to the vehicle deck is via hydraulically operated ramps at both ends of the vessel.

Kohu Ra TuaRua is maintained under Maritime Operator Safety System (MOSS) programme. For further detail about the ferry operation, refer to Appendix 04.B Kohu Ra Tuarua – Hokianga Ferry.

Figure 1-2 below shows Kohu Ra TuaRua Ferry.

Figure 1-2: Kohu Ra TuaRua Ferry

1.2 Monitoring and Condition

The monitoring plan for the public transport network will be undertaken using the following key service delivery performance indictors:

- Patronage – total public transport boardings and by category
- Passenger km – total passenger kilometres travelled
- Fare box revenue – fare box revenue by time period
- Service reliability – scheduled trips completed in full
- Service punctuality – trip start, en route and at destination
- Customer satisfaction – for public transport users
- Disability access - proportion of services with disability access
- Patronage growth – total patronage growth on all services.

1.3 Overall Strategy

Strategic objectives to support public transport in the region are designed to support relevant outcomes from the 30 Year Transport Strategy for Northland 'incorporating' the Regional Land Transport Plan 2015-2021. They are as follows:

- An effective and efficient bus network in main centres
- People have access to shared transport options
- Reliable travel times and transport choice for communities servicing
- employment areas, retail and public services
- Public transport opportunities on appropriate corridors
- Transport management is effectively incorporated into land use planning
- A procurement system that supports the efficient delivery of public transport services.

2 Management Plan

2.1 Management

As the bus and total mobility operations are contracted out the management of the operation is undertaken through contract management.

Fullers Great Sights, as Council's contractor, operates the Hokianga Harbour Ferry Service, and is responsible for preparing and managing the agreed routine and periodic maintenance programmes for the ferry vessel; including all mechanical, electrical, hydraulic systems, re-painting and anti-corrosive maintenance to all surfaces to maintain the vessel to a serviceable and presentable standard throughout the period of the contract.

The piles and ramps at both ferry terminals are owned by FNDC and are maintained as part of the ferry operation by the Contractor.

2.2 Acquisition

In order to expand the current bus network there are guidelines on establishing a trial bus service prior to implementing a permanent service. The fundamental requirement is to establish a need through:

- Established demand
- Reviewing potential fares and routes
- Establishing a willingness to pay (via survey)
- Reviewing social and economic factors in the applicable areas.

3 Option Assessment

For the assessment of the data, peer group analysis and option assessment, a five point "traffic light" rating system has been used as shown in the following schematic. This rating system is based on a qualitative assessment of the LOS and cost comparison data.

5-point traffic light rating system

Performance Rating	Symbol	For LOS this means:	For Costs & Achievement this means:	Trend Rating	Symbol	For LOS this means:
Very Good		Much Better than Peer Group Average	Much Less than Peer Group Average	Improving Trend	↑	Positive Change towards a Very Good rating
Good		Better than Peer Group Average	Less than Peer Group Average	Worsening Trend	↓	Negative Change away from a Very Good rating
Average/Moderate		Similar to the Peer Group Average	Similar to the Peer Group Average	Static Trend	▬	No Change
Poor		Worse than Peer Group Average	Higher than Peer Group Average			
Very Poor		Much Worse than Peer Group Average	Much Higher than Peer Group Average			
No Data		No Data	No Data			

Work Categories:	WC 341 Low Cost / Low Risk Improvements WC 531 Public Transport Improvements, Major Renewals and Minor Improvements

3.1 Links to Strategic Case

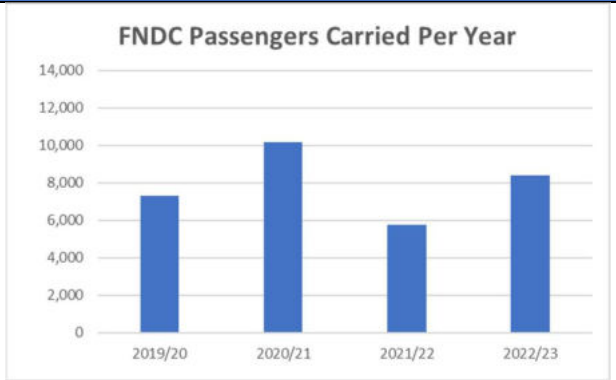
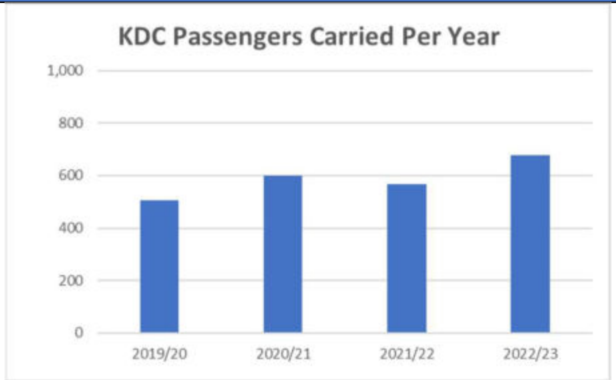
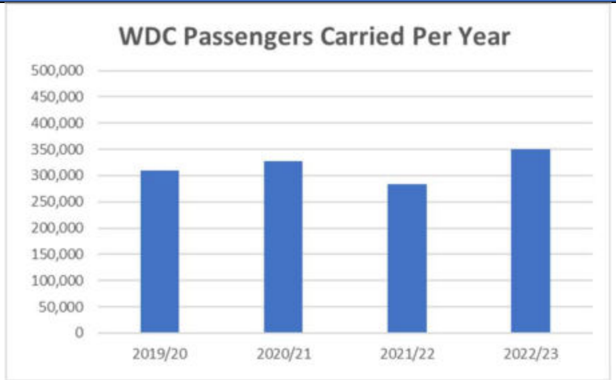
Problem Statement:	**Growth and Demand** – Rapid growth and lack of suitable mode shift options are causing congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods. Lack of mode shift options in the more remote communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation.
Benefits of Addressing Problem:	Increase in public transport use and less dependency on private vehicles resulting in lower levels of congestion and less vehicle emissions.
Consequences of Not Addressing the Problem:	Continued dependency on private vehicle use with increasing levels of congestion and vehicle emissions.

3.2 Levels of Service

ONRC Customer Outcomes:	None
Customer Levels of Service:	None

3.3 Evidence and Gap Analysis

Public Transport – Bus Patronage

FNDC	KDC	WDC
		
FNDC Bus Patronage – The number of passengers using the Far services in 2018/19 was approximately 7,000. This had decreased from a high of 8,000 per annum in 2012/13. There are signs of weak growth since 2018/19 and patronage has averaged at approximately 8,000 per annum again over the last three years. Given the population of the Far North District has grown over the past four years, this indicates that the patronage of this service is not keeping up with population growth.	**KDC Bus Patronage** – The Bream Bay Link service has been in operation for less than five years. There are signs of growth during the last four years but patronage numbers remain low.	**WDC Bus Patronage** – The number of bus passengers using the CityLink bus service in Whangarei in 2018/19 was 323,000. This has largely remained static for the last four years and has been influenced to some degree by the 2020 pandemic. 2022/23 was a strong year, having near 350,000 and the greatest patronage to date, and may be a signal that patronage will increase. Given the population of Whangarei has increased over the past four years, this indicates the patronage of the bus service in Whangarei is not keeping up with population growth.

3.4 Options to be Considered

Based on the above data and the root cause analysis, the following options have been considered:

Option	Description
Option 1 – Provide bus priority lanes in Whangarei	Provide bus priority lanes on key bus routes in Whangarei. This would initially be through lane reallocation to provide bus priority lanes during peak periods. The routes to be targeted in the next 3 years are Bank St/Kamo Rd, Riverside Dr and SH14/Maunu Rd.
Option 2 – Increase the frequency of bus services in Whangarei	Increase the frequency of the bus services to reduce the time that users are waiting for the bus. This would ideally be done in conjunction with bus priority lanes (Option 1) to ensure that buses can meet the timetable. This option would provide 15 minute buses during peak periods and 30 minute buses at other times (compared to the current service of 30-60 minutes during peak and 1-2 hours at other times).
Option 3 – Provide rural commuter bus services in Whangarei	Provide rural bus services suitable for commuters in Whangarei's outlying towns and villages to reduce commuter trips into the city. This would target the towns of Hikurangi, Tutukaka, Maungatapere, Parua Bay, Ruakaka and Waipu.
Option 4 – Develop shuttle bus services or ride share schemes in rural towns.	Provide lower cost shuttle bus type services where feasible between rural towns across Northland. Support the development of low-cost ride share services to provide access to communities where bus services are not feasible.
Option 5 – Consider mobility options (e.g. Uber/pub taxi) to avoid impaired driving	Consider potential mobility options (e.g. Uber type service or pub courtesy vans) to help avoid impaired driving.

PBC Multi Criteria Option Analysis, RCA: NTA

Activity/Work Categories: Public Transport (WC 511, 532)

Short list up to 3 options from the following:

Option - Can we make	Yes/No	Rank	Reason
❑ Intervention response **timing** change			
❑ **LoS** adjustments	Yes	2 - A 3 - B 4 - C	A. Increase the frequency of the bus services to reduce the time that users are waiting for the bus. B - Provide rural bus services suitable for commuters in Whangarei's outlying towns and villages. C - Provide lower cost shuttle bus type services where feasible between rural towns. Support the development of low-cost ride share services to provide access to communities where bus services are not feasible.
❑ Use existing assets **differently**			
❑ **Blending** Work Categories differently			
❑ **Risk** - Hold Assets longer			
❑ Managing **demand**	Yes	5	Consider potential mobility options (eg Uber type service or pub courtesy vans) to help avoid impaired driving.
❑ **Route** Management	Yes	1	Provide bus priority lanes on key bus routes in Whangarei
❑ Alternative approaches – different **solutions/technology**			
❑ **Maintenance vs Renewal** adjustments			
❑ **ONRC** Classification variance			
❑ Extended **temporary** management			
❑ **Supply chain** improvements			
❑ Improve **systems and capability**			

Scale of impact

Impact	Score
Significantly Positive	3
Moderately Positive	2
Slightly Positive	1
Neutral	0
Slightly Negative	-1
Moderately Negative	-2
Significantly Negative	-3

Criteria	Weighting (Importance) (Total to 100%)	How good is this option									
		Option 1 - Provide bus priority lanes in Whangarei		Option 2 - Increase the frequency of bus services		Option 3 - Provide rural commuter bus services in Whangarei		Option 4 - Develop shuttle bus services or ride share schemes in rural towns.		Option 5 - Consider mobility options (eg Uber/pub taxi) to avoid impaired driving	
		Raw	Score	Raw	Score	Raw	Score	Raw	Score	Raw	Score
Community Outcomes Achieved	10%	2	0.2	2	0.2	3	0.3	3	0.3	1	0.1
Problem solving effectiveness	10%	2	0.2	2	0.2	1	0.1	1	0.1	1	0.1
Benefits realised	10%	2	0.2	2	0.2	1	0.1	1	0.1	1	0.1
Good Environmental impacts	5%	1	0.05	2	0.1	2	0.1	1	0.05	0	0
Value for Money	10%	2	0.2	2	0.2	1	0.1	0	0	-1	-0.1
Closing Customer and Technical LoS gaps and impacts	10%	1	0.1	1	0.1	2	0.2	1	0.1	1	0.1
Closing ONRC Performance gaps	10%	0	0	0	0	0	0	0	0	0	0
Asset preservation and sustainability	10%	0	0	0	0	0	0	0	0	0	0
Total Cost of Ownership (whole of life Costs)	10%	0	0	-1	-0.1	-1	-0.1	-1	-0.1	0	0
Life Cycle Management	10%	0	0	0	0	0	0	0	0	0	0
COVID-19 Recovery	5%	0	0	0	0	0	0	0	0	0	0
Totals	**100%**		**0.95**		**0.9**		**0.8**		**0.6**		**0.3**

3.5 Option Assessment and Line of Sight

The options and the line of sight to the preferred strategic response and the problems they are addressing are shown in the table below. These options have been ranked in order of preference and then have been assessed through a multi-criteria assessment (MCA) to determine the highest scoring options that are preferred and are to be adopted. The MCA assessment is also provided as follows.

Work Activity	Problem Addressing Statements	Preferred Strategic Response	PBC Options to be Considered	Option Rank	MCA Score	Preferred Options
Public Transport	**Growth and Alternative Transport** - Rapid growth and lack of suitable alternative transport modes are causing congestion in Whangarei during commuter peaks and in Kerikeri/Waipapa and Mangawhai during peak holiday periods. Lack of alternative transport modes in many communities restricts access to places of employment, education and social opportunities which is leading to severance, safety issues and higher levels of social deprivation.	**Programme Adjustment** • Intersection and road upgrades including bus priority lanes, new link roads • Shared path networks for Whangarei, Kerikeri/Waipapa and Mangawhai **Policy Approach** • Increase bus frequency in Whangarei and expand rural services **Demand Management** • Travel planning and mode shift promotion. • Increase all-day parking charges	**Programme Adjustment** **Route Management** • Option 1 - Provide bus priority lanes in Whangarei. **Policy Approach** **LOS Adjustments** • Option 2 - Increase the frequency of bus services in Whangarei. • Option 3 - Provide rural commuter bus services in Whangarei. • Option 4 - Develop shuttle bus services or ride share schemes in rural towns. **Demand Management** **Managing Demand** • Option 5 - Consider mobility options (e.g. Uber/pub taxi) to avoid impaired driving.	1 2 3 4 5	0.95 0.9 0.8 0.6 0.3	**Yes** **Yes** **Yes** **Yes** No

PREFFERED OPTIONS: From the multi-criteria assessment the preferred options are:

- Option 1 – Provide bus priority lanes in Whangarei.
- Option 2 – Increase the frequency of bus services in Whangarei.
- Option 3 –- Provide rural commuter bus services in Whangarei.
- Option 4 – Develop shuttle bus services or ride share schemes in rural towns.

3.6 Financial Impact

The following tables show the work categories and examples of the associated tasks. For full financial details for the work categories, refer to Section 8 (Financials)

3.6.1 Far North District Council

Work Category	Financial Impact
WC 341 Low Cost/Low Risk Improvements	New wharf upgrades as identified in the Twin Coast Discovery Route PBCs and in the Integrated Transport Plan. Provide bus stops and shelters for users on bus routes as identified in the Integrated Transport Plan. Support Public Transport and Ride Sharing.
WC 531 Public Transport Infrastructure Improvements and Major Renewals	None programmed – No change.
WC 004 Investment Management	Develop a long-term plan for ferry operations on the Hokianga Harbour. Develop a Total Mobility Scheme for the Far North. Develop a Public Transport / Ride Share implementation plan for the Far North. Develop a plan for implementing Park and Ride facilities on public transport routes.

3.6.2 Kaipara District Council

Description	Financial Impact
WC 341 Low Cost/Low Risk Improvements	No programme.
WC 531 Public Transport Infrastructure Improvements and Major Renewals	No programme.

3.6.3 *Whangarei District Council*

Description	Financial Impact
WC 341 Low Cost/Low Risk Improvements	Develop bus priority lanes in Whangarei to improve the bus service and promote mode shift.
WC 531 Public Transport Infrastructure Improvements and Major Renewals	None programmed – No change
WC Unsubsidised (Note subsidy for these activities is recovered through NRC's WC 531 activity)	Rose St Bus Terminal upgrade in Whangarei to improve uptake in bus use. Upgrade bus shelters on stops on the bus priority lanes to improve uptake in bus use. Maintenance of existing bus shelters.

3.7 AMP Improvement

The following improvements will be considered:

- Determine the feasibility of rural commuter bus services to rural towns in the Whangarei District.

Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendix 09.B

Growth and Demand – Parking

Overview and Management
Problems, Benefits, Consequences
Options Assessment

Northland Transportation Alliance

Transportation Activity Management Plan 2024–2054

Appendix 09.B

Growth and Demand – Parking

Table of Contents

1 Overview

1.1 Description

The car park activity consists of the following categories:

- 88 Parking Meters: Pay and Display Units – of which there are two types;
  - Classics – 1st generation green units
  - Globals – 2nd generation silver units
  - Metropolis – silver units with credit card slots.

- 152 Single Electronic Head Machines – service a single parking spot
  - Car Park Surfaces
  - Car Park Footpaths
  - Car Park Pavements
  - Car Park Drainage
  - Car Park Markings
  - Car Park Amenity Lighting
  - Car Park Structures.

There are total of 27 off street carparking sites throughout the district. The maintenance, renewals and improvements associated with the Carparking Activity are generally undertaken as part of other activities.

The Whangarei District Council currently operates 84 Pay and Display Units and 128 Electronic Head Machines in and around the CBD.

1.2 Monitoring and Condition

1.2.1 Age

There is currently no age data for any of the parking meters recorded in RAMM.

1.2.2 Condition

All the parking meters in the district have been assigned a condition rating. The majority of the meters are in either 'good' or excellent' condition. Only 1.5% of the meters are in 'poor' condition, indicating the need for replacement of renewal in the near future. These are mainly the 2 Global model units.

Condition and age data associated with the other components of carparks (e.g. pavement, surfacing, lighting etc.) can be found in the sections relevant to that activity.

1.3 Overall Strategy

The Parking Strategy for WDC was due for review in 2021 and neither FNDC nor KDC have a structured parking strategy, but they do have bylaws regarding Parking.

Regarding WDC, the following is a summary of the current strategy:

Acquisition

New assets will only occur as new parking areas are developed. At this time no new parking facilities are known to be planned.

Maintenance & Operations

- Due to the lack of replacement parts the maintenance of the old generation pay & display machines has become problematic. Some cascading of parts has been taking place as newer machines are commissioned.
- The meter heads can still function well until they eventually get phased out.
- As a result of high pedestrian use of footpaths around carparks, there will be a greater focus on these areas.
- A number of carparks are considered as temporary, and a lower standard of surface on these are accepted.
- Markings are allowed to deteriorate extensively before remarking.

Renewals

- Replacement parts for the Classic pay and display machine are increasingly more difficult to obtain. With some parts (printers) no longer being available. It is proposed to phase out the old classic machines over several years replacing approximately 10 machines a year. Following on from this the Global machines will be replaced in a similar fashion. The exact programme will be dependent on the availability of parts and possibly changes in technology.
- No plan exists for the replacement of the metre heads at this time. It is envisaged these will continue to remain in use until parts are discontinued.
- Replacement of car park signs will be undertaken to replace old parking station and charging signs with new signs reflecting the new parking charges.

Improvement

Improvements will be achieved through the Renewals. Additional improvements will be considered with the development of new technologies and new machines. For example, Tap n Go payment facilities will be installed in the new Metro machines.

2 Management Plan

2.1 Management

2.1.1 Maintenance Contract

The maintenance and operations associated with the car parking is governed by the Parking Meter Maintenance Contract, Road Maintenance Contract, Streetlight Maintenance Contract and Road Marking Contract.

2.1.2 Parking Fees Collection

The collection of parking fees from the machines is completed under a separate money collection contract administer directly by the Roading Department.

2.1.3 Funding

The Parking Meters and Car Parking Activities have their own 'ring-fenced' account. This means that all funding for the activities comes from the fees collected by the meters and the fines given to customers that over-stay or do not pay.

2.2 Acquisition

As a result of regular attempts to break into the meter heads, these were all replaced with older cast-iron heads that are more robust. The original heads are held in the Roading storeroom. An exercise to dispose of these units needs to be undertaken.

The replacement of old machines provides additional spare parts to keep the existing stock operational. All useful parts are stored, and the remaining parts are usually just sold for scrap.

No other new carparks are intended on being constructed or purchased in the next 10 years.

2.3 Maintenance

Car park pavement and surfacing maintenance is completed as part of the Road Maintenance Contract for each area. The maintenance plan is based on routine inspections and programmed maintenance. In general, the maintenance requirement for these facilities is identified as part of the pre-seal repair contract. This includes any concrete works that might be required.

The maintenance plan is based on routine inspections conducted daily by the contractors and reactive maintenance undertaken when a member of the public informs the Roading Department that a meter requires work.

Many of the current pay and display meters are based on old technology which is now obsolete. This is an identified issue and the funding is being provided to continue to replace these old meters.

Any minor maintenance is undertaken as routine, while any other maintenance over and above these defect levels is termed 'major maintenance' and becomes programmed work. The programme is based on the severity of the fault and the criticality of the meter.

2.3.1 Repercussions of meters being out of order

Using the average monthly calls logged, the number of motorists inconvenienced as a result of meters being out of order was at least 90 people. One can assume that at least triple that amount experienced the problem, i.e. 270. Some of these faults results in money paid but no ticket issued.

The costs to council as a result of meters being out of order include the lost revenue due to machines not working and motorist not paying for parking and the lost revenue due to inability to impose fines if the time had been exceeded on the meter.

2.3.2 *Alternatives if a P&D machine is not working*

In all our larger carparks there are at least two units at each location that provides an alternative if one is not working.

In most of the CBD there are other units in the vicinity, either on the opposite side of the road or further along the road.

2.4 Renewals

The parking meter renewal plan covers the replacement of old pay and display meters, as well as the replacement of any meters that are no longer functional.

A small selection of parking meters will be replaced based on the network performance measures and the priority of the meter. The Roading Department manages the renewal of these assets through a stock of old meters that have been sourced from other Councils, as WDC is running older parking meter technology compared to some other Councils.

Within the next five years the plan has identified that a technology upgrade is required as the current stocks of technology are either receding or are no longer supported in terms of hardware manufacture. This has been allowed for within the renewal plan.

When funding is available, we will try and replace the oldest machines first and try to undertake an replacements in a whole area rather than spread this out over the city. The identification of these replacements is completed in discussion with the parking metre maintenance contractor.

2.5 Improvement

2.5.1 *Pay & Display Units*

Replacing all the machines with the latest state of the art machines will not necessarily eliminate all faults. The maintenance contractor advises that there is not much difference between the older and the newer machines, regarding the vulnerability to faults. The majority of the faults relate to vandalism, faulty or incorrect coins and the manner in which coins are fed into the machines.

The current issue is that the smaller coins (10c and 20c) are very light weight and with a little moisture or dirt they will hold up inside the coin race. This suggestion is given weight by the fact that very seldom does the heavier $1 and $2 coins give this problem.

Ideally if we could install machines that have the ability to communicate their status to a central point then a proactive response can be made to faults.

2.5.2 *Parking Meter Heads*

Currently there are 152 single head machines of which some are vulnerable to vandalism & theft. Most of these have been replaced by older versions that cannot be broken into. These meters are in low usage areas or parking bays that are remote. There is no intention to replace these in the near future.

2.5.3 *Replacement Machines*

The latest P&D unit that has become available since late 2006 is the Metro.

These machines offer various options for payment and service, pay by plate, pay by space, credit card payments and texting.

New metro machines will have payment options of credit card, coin and Tap n Go Eftpos payment. Text parking was not invested in as the Council has developed Mpark for electronic payments.

2.5.4 *Central Management System*

EziCom is a communications and management system (CMS) available for parking meter fleet management with remote monitoring in real time via a dual GPRS/GSM Modem fitted to CHS Pay and Display Parking Meters.

Text messages or email notifications automatically notify the meter technicians of machines with errors or warnings allowing them to respond immediately.

A variety of reports are available. Revenue, Audits, Cash Clearances, Maintenance and Asset Management information can be viewed easily from the simple to read screen layouts.

2.5.5 *VMS Signs*

VMS signs to advise motorists of the number of carparks available were installed at the Forum North carpark off Rust Ave, Vine St carpark and Farmers Carpark off Robert St. These have had several teething problems with not accurately picking up car numbers. It is not proposed to install more of these VMS signs until these signs have proved successful.

VMS signs on the main arterials leading into the City to advise motorists of each carpark and the number of available parks may also be considered in the future.

2.5.6 *Suggested Programme of Improvements*

The Roading Department manages the upgrade of these assets through a stock of old meters that have been sourced from other Councils, as WDC is running older parking meter technology compared to some other Councils.

Within the next five years the plan has identified that a technology upgrade is required as the stocks of current technology are either receding or are no longer supported in terms of hardware manufacture.

A contract for the management and upgrade of the parking assets is being assessed versus the council directly undertaking this works.

2.6 Disposal Plan

No removal of current car parks is currently envisaged.

3 Option Assessment

Problem Statement

There is no active signage to advise customers where parking is available which leads to people aimlessly driving around looking for a park in the CBD. Many of the parking meters use old technology which will soon be obsolete. Tension between providing sufficient parking with new developments and encouraging public transport use. Also demand for free parking in the CBD to compete with other "big box" developments which offer free parking.

Benefits of Addressing Problem

Advising where parking is available in real-time will reduce vehicle circulation in the CBD. Replacement of old parking machines will avoid problems with replacement parts etc when these become obsolete

Consequences of Not Addressing the Problem

Without carrying out any changes to the parking in the CBD, customers will still be frustrated in driving around looking for a park. Obsolete parking machines will result in difficulty maintaining these machines, lowering the level of service and potentially increasing costs.

Preferred Options

As per the preferred options for Appendix A09-A Public Transport:

- Option 1 – Provide bus priority lanes in Whangarei.
- Option 2 – Increase the frequency of bus services in Whangarei.
- Option 3 –- Provide rural commuter bus services in Whangarei.
- Option 4 – Develop shuttle bus services or ride share schemes in rural towns.

The promotion of bus use will result in reduced demand on day parking in the Whangarei City centre.

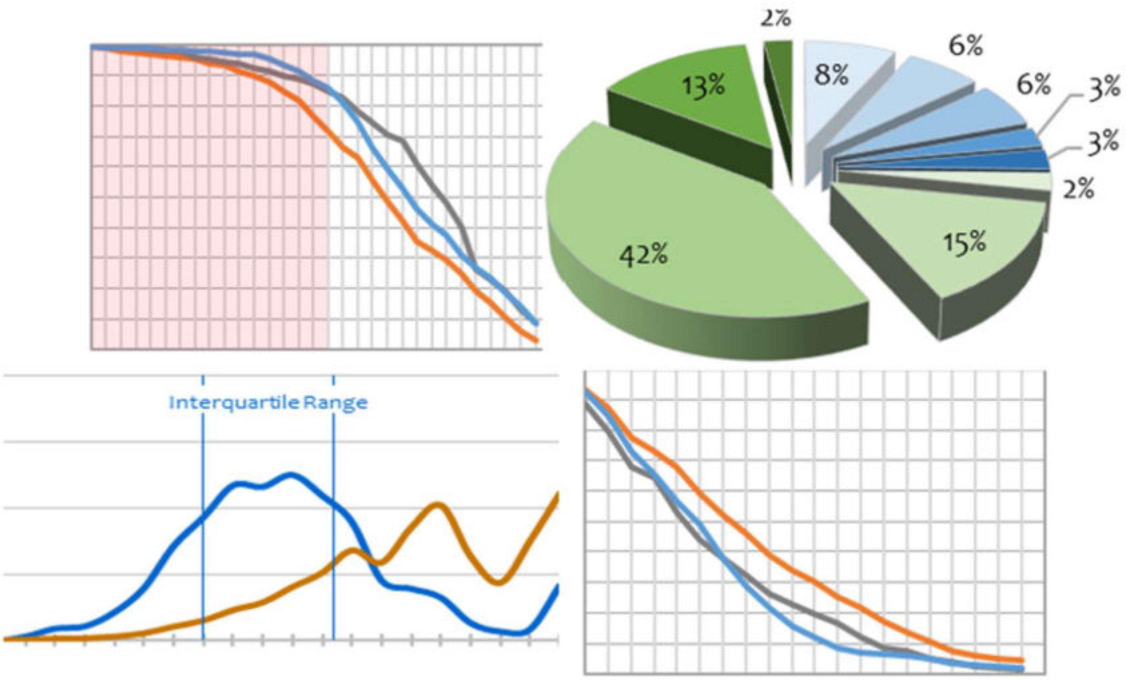
Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 10

Network Asset Management

Overview and Management
Problems, Benefits, Consequences
Options Assessment



Northland Transportation Alliance

Asset Management Plan 2024–2054

Appendix 10

Network Asset Management

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1 Overview

1.1 Introduction

This section is primarily about the people, processes, systems, tools and management activities that the Northland Transportation Alliance (NTA) (an alliance of the Roading divisions of the four Councils: Far North District Council (FNDC); Kaipara District Council (KDC); Whangarei District Council (WDC) and Northland Regional Council (NRC)) uses to provide a safe, efficient and effective Transport Network. Table 1-1 below defines all activities detailed in this section.

Table 1-1: Network Management and Administration Activities

Activity	Sub – Activities
Operations & Quality Control	Human resource management Financial management and monitoring • Funding acquisition • Budget control Processes to ensure quality of work and assets Stakeholder liaison
Asset Management & Strategy	Life Cycle management and planning for all assets • Creation • Maintenance • Renewal • Improvement • Disposal Acquisition, storage and analysis of asset information
Transportation Planning	Traffic Modes Transport / Network Strategy Studies Projects Identification & Prioritisation Developer / Subdivision Liaison
Safety Management	Strategies Plans Community Programmes
Corridor Management	Corridor Access Requests Temporary Traffic Management Other Corridor Permits
Customer Management	Customer Requests Elected Member Requests
Capital Projects	Project development Project prioritisation Project management
Maintenance Management	Maintenance of all assets • Decision process • Management of works
Renewals Management	Renewal of all assets • Decision process • Management of works
Emergency Management	Flood Damage Lifelines Group Contractor call out Response Civil Defence

1.2 NTA Operations and Structure

The activities described in this Transportation Activity Management Plan are delivered by the NTA's Asset Management and Strategy Team, Maintenance, Operations and Renewals Team and the Capital Team.

The organisation structure of the NTA comprises staff from the Far North District Council, Kaipara District Council, Whangarei District Council and the Northland Regional Council.

The NTA delivers the majority of the professional services required for this Transportation AMP with in-house resources, supported by consultants as and when required.

The NTA team participate in each of their respective Council's wider training and development processes including; performance reviews, IT training, inductions, health and safety etc

The following Figures show the organisation charts for the NTA staff.

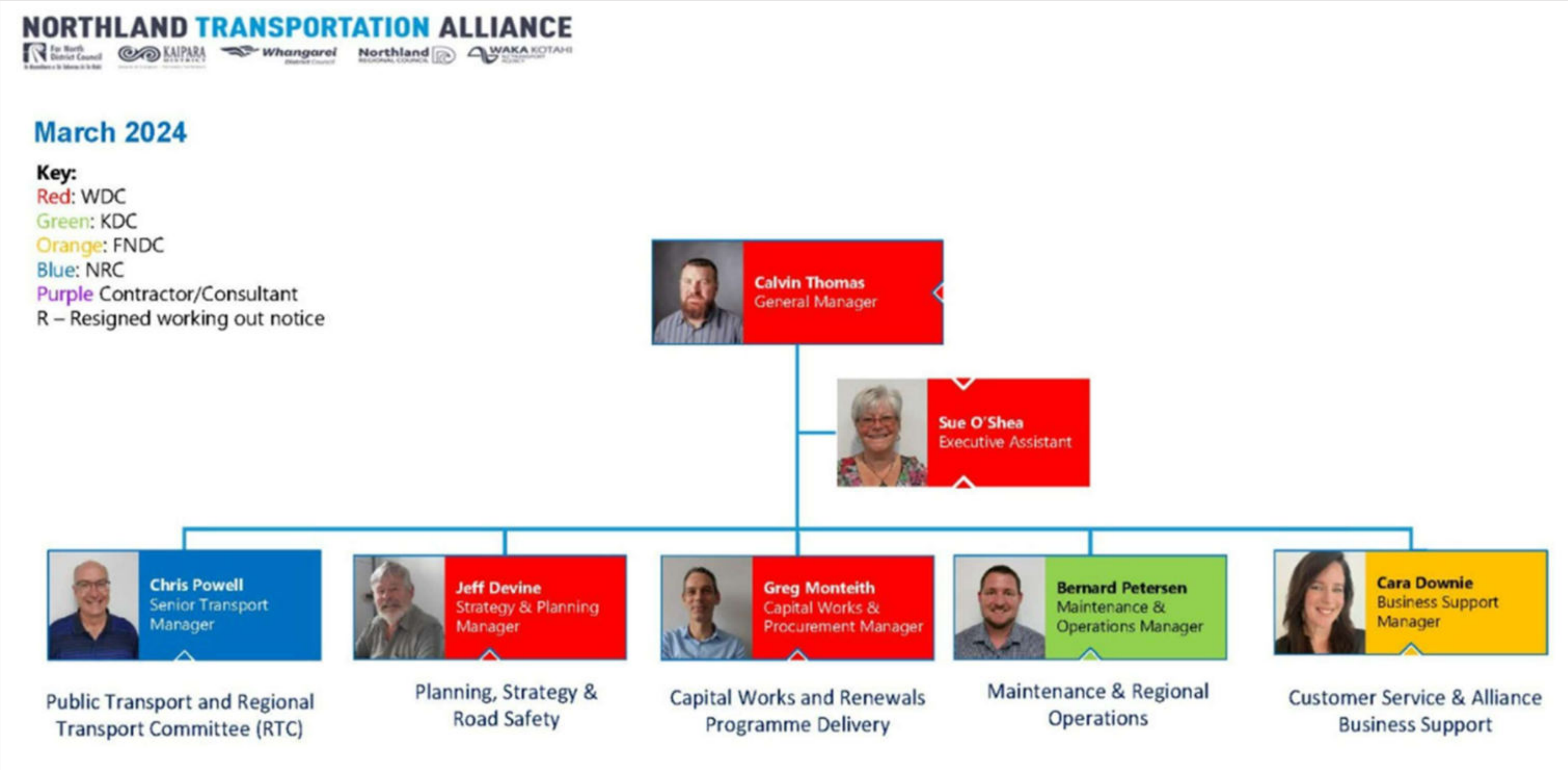


Figure 1-1: Organization chart for NTA staff – Management (March 2024)

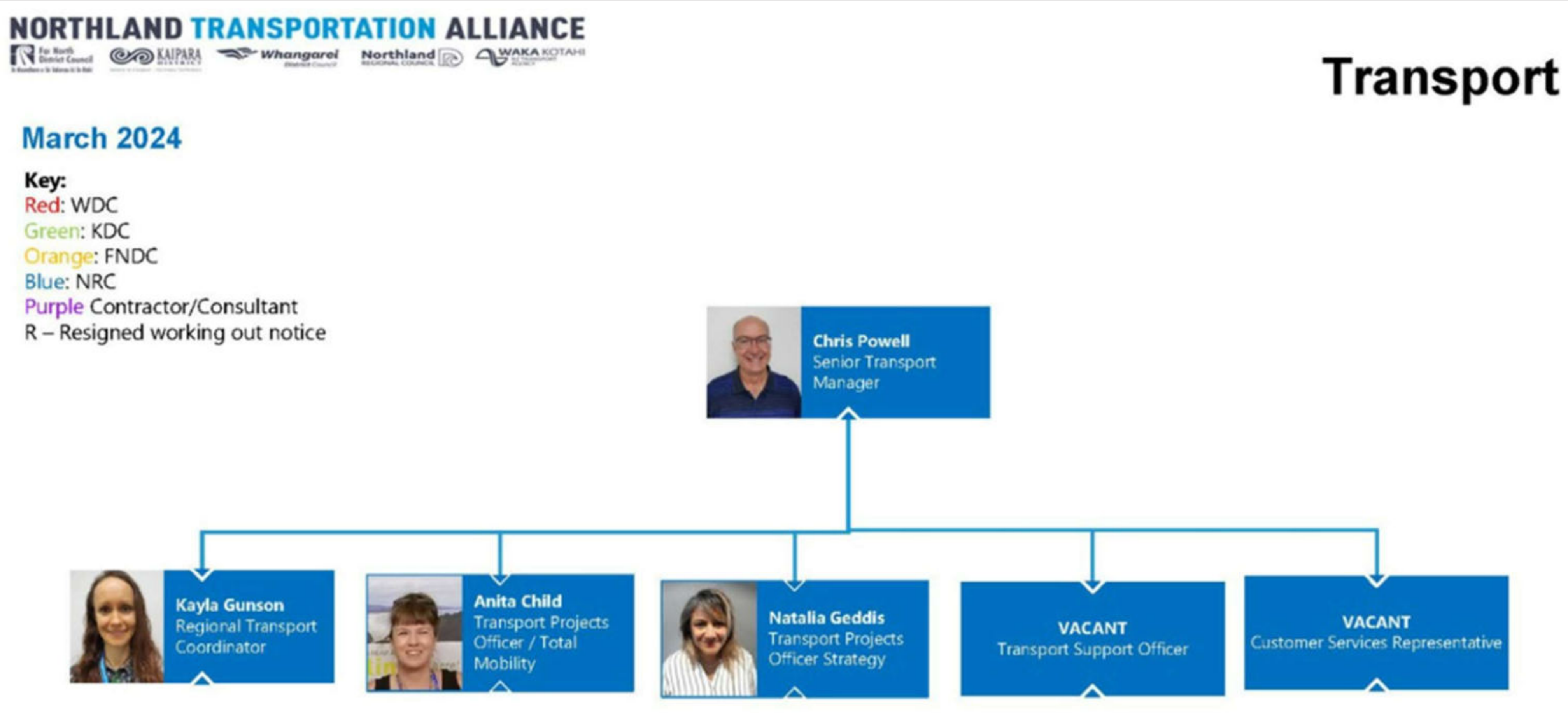


Figure 1-2: Organization chart for NTA staff –Transport (March 2024)

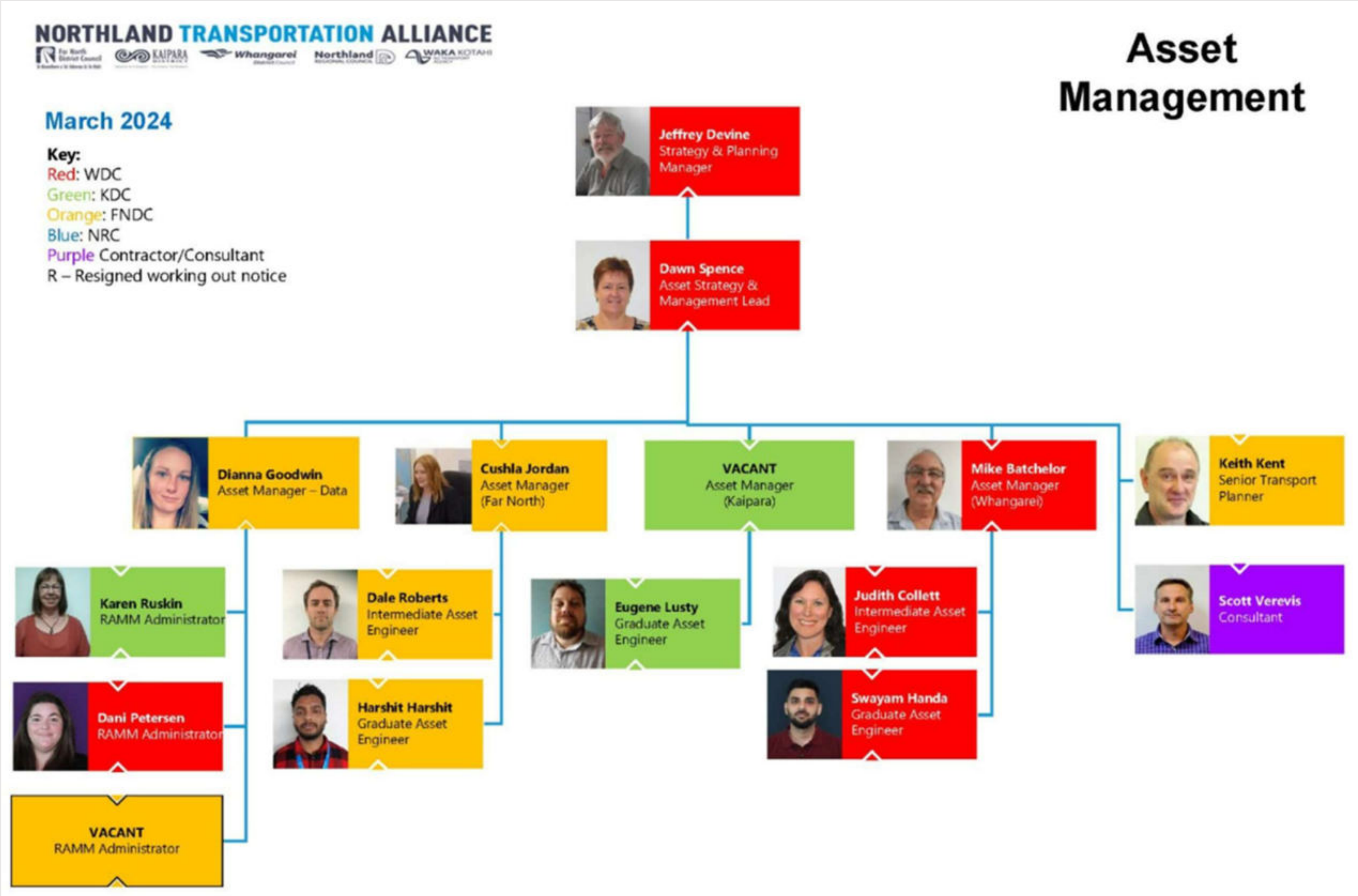


Figure 1-3: Organization chart for NTA staff – Asset Management (March 2024)

Figure 1-4: Organization chart for NTA staff – Corridor Access (March 2024)

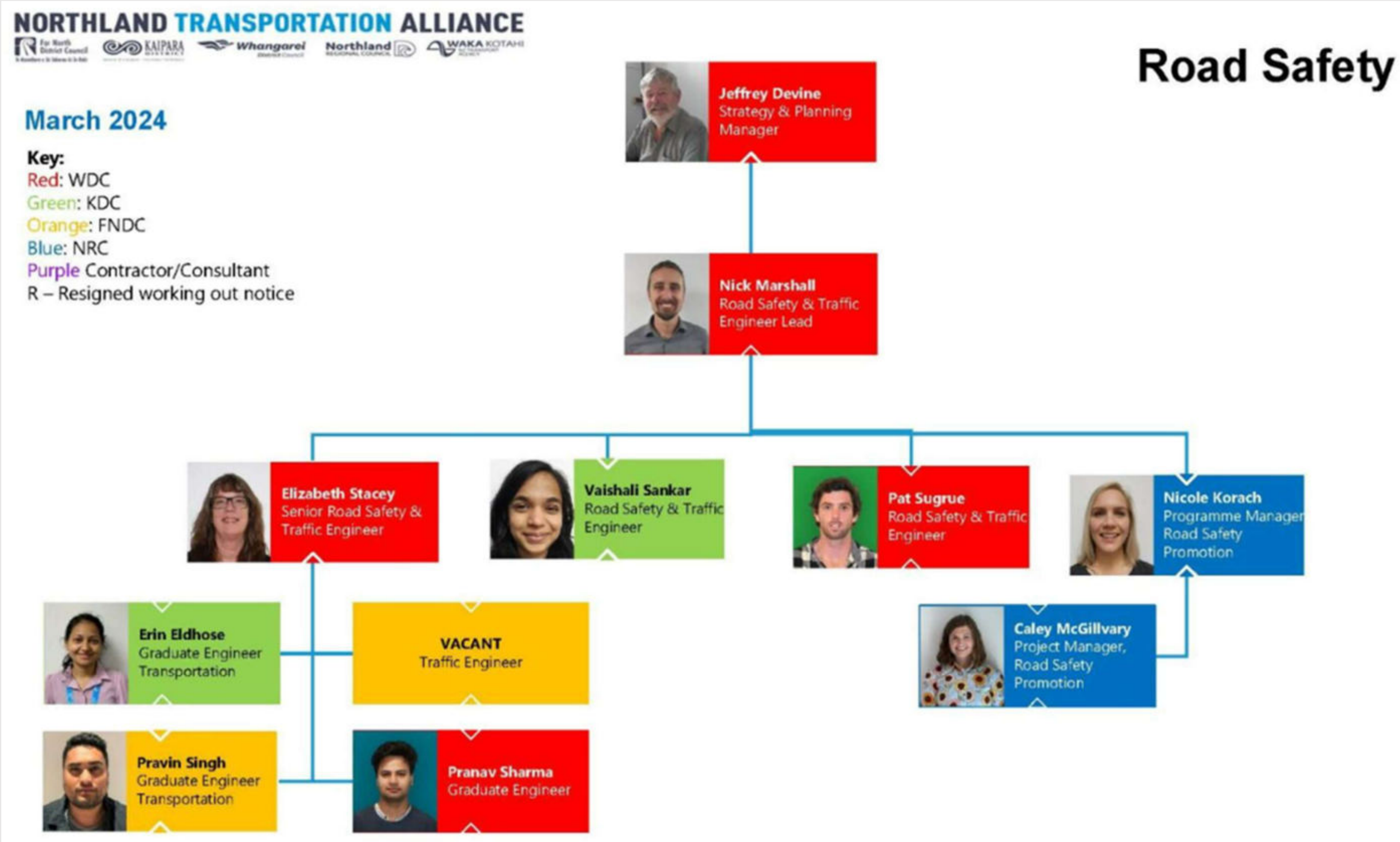


Figure 1-5: Organization chart for NTA staff – Road Safety (March 2024)

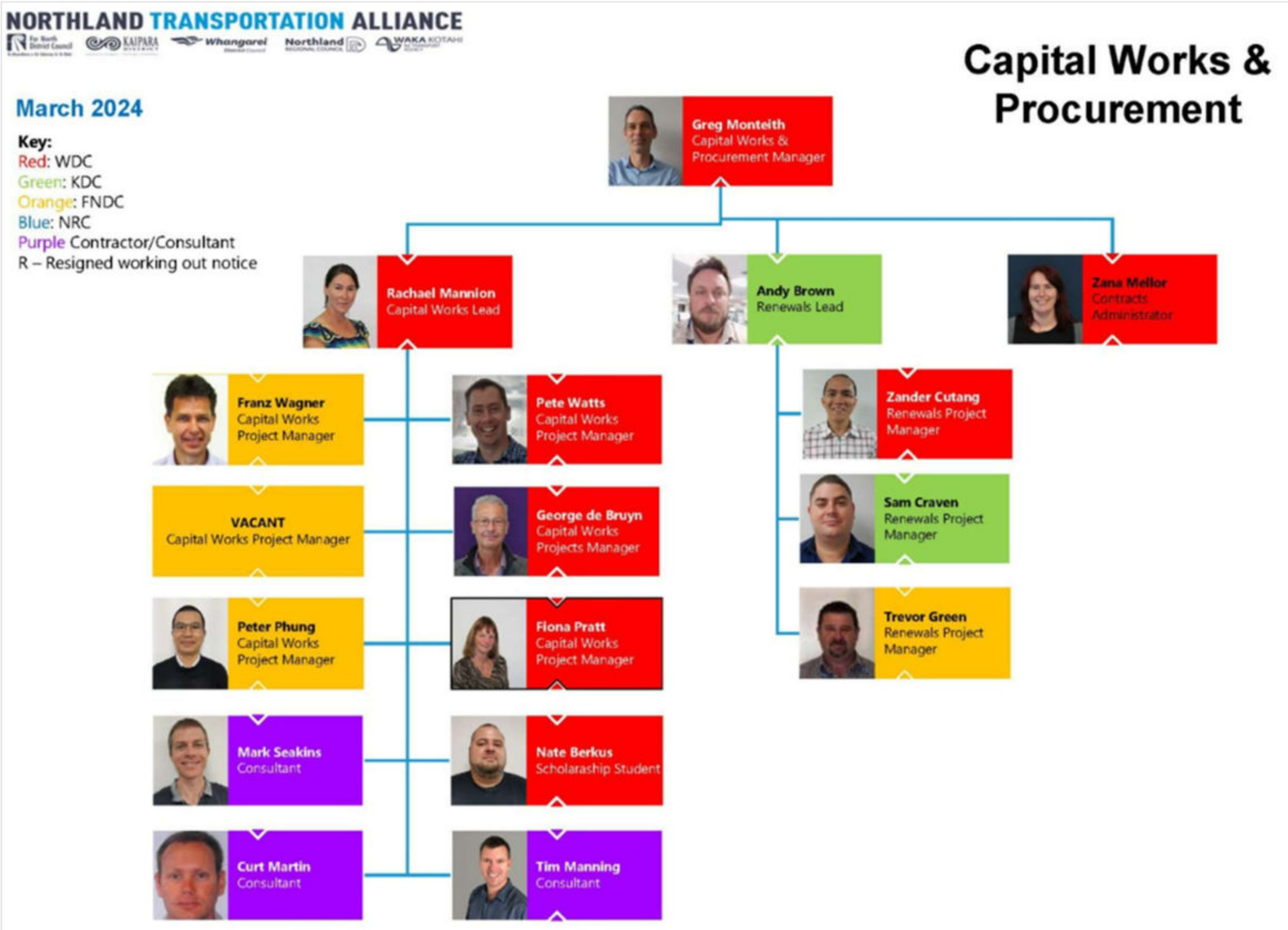


Figure 1-6: Organization chart for NTA staff – Capital Works and Procurment (March 2024)

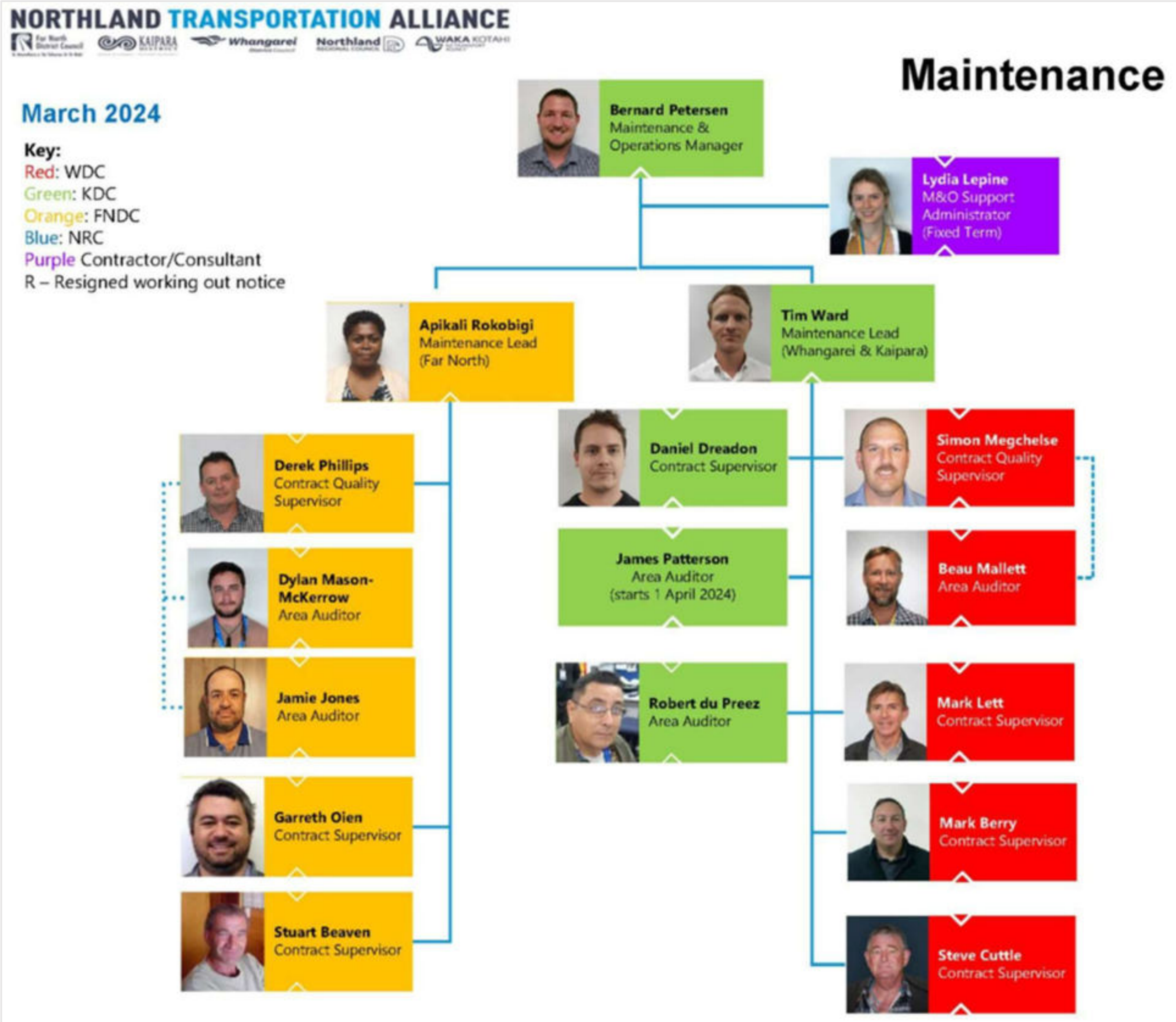


Figure 1-7: Organization chart for NTA staff – Maintenance (March 2024)

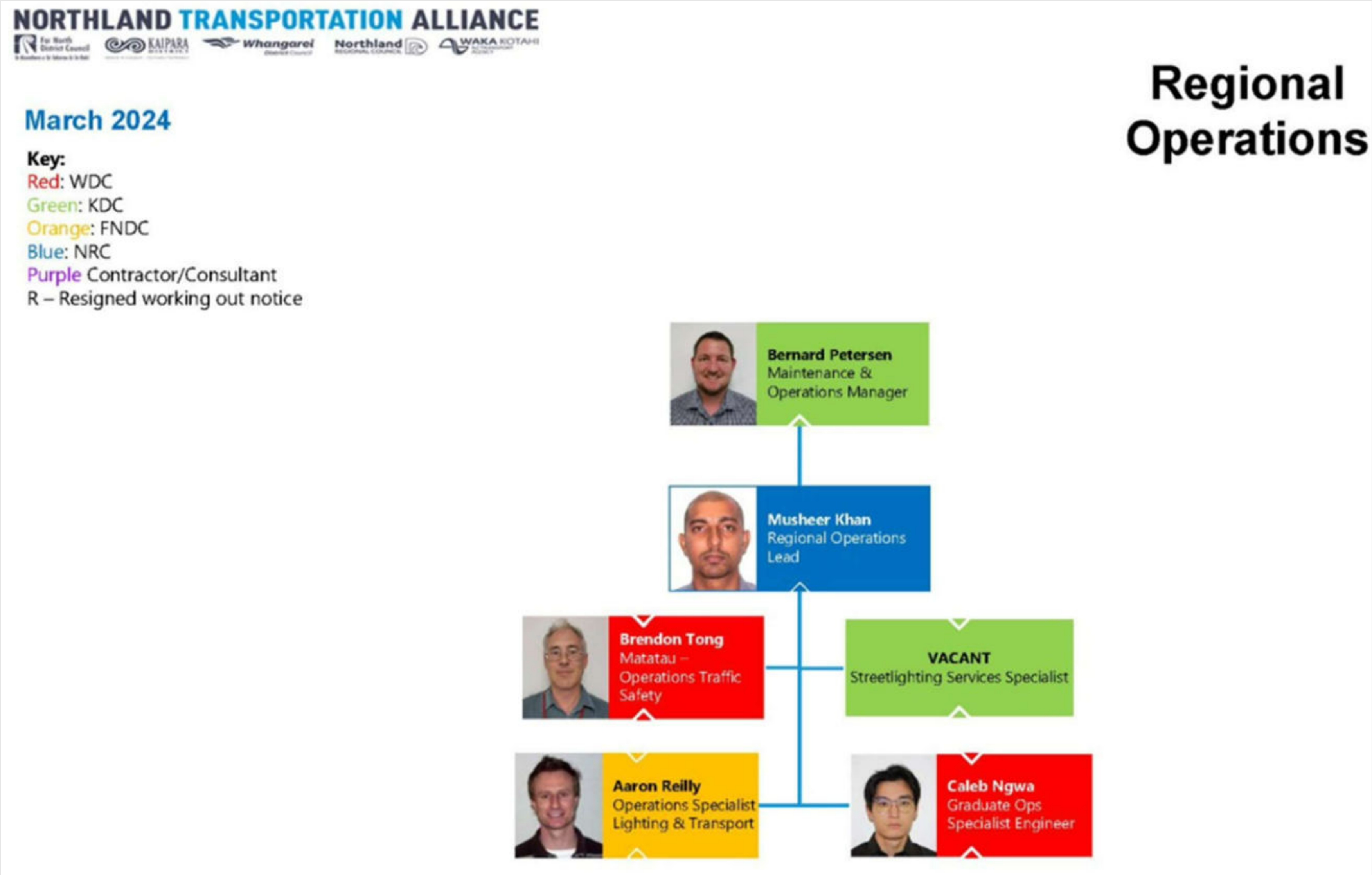


Figure 1-8: Organization chart for NTA staff –Regional Operations (March 2024)

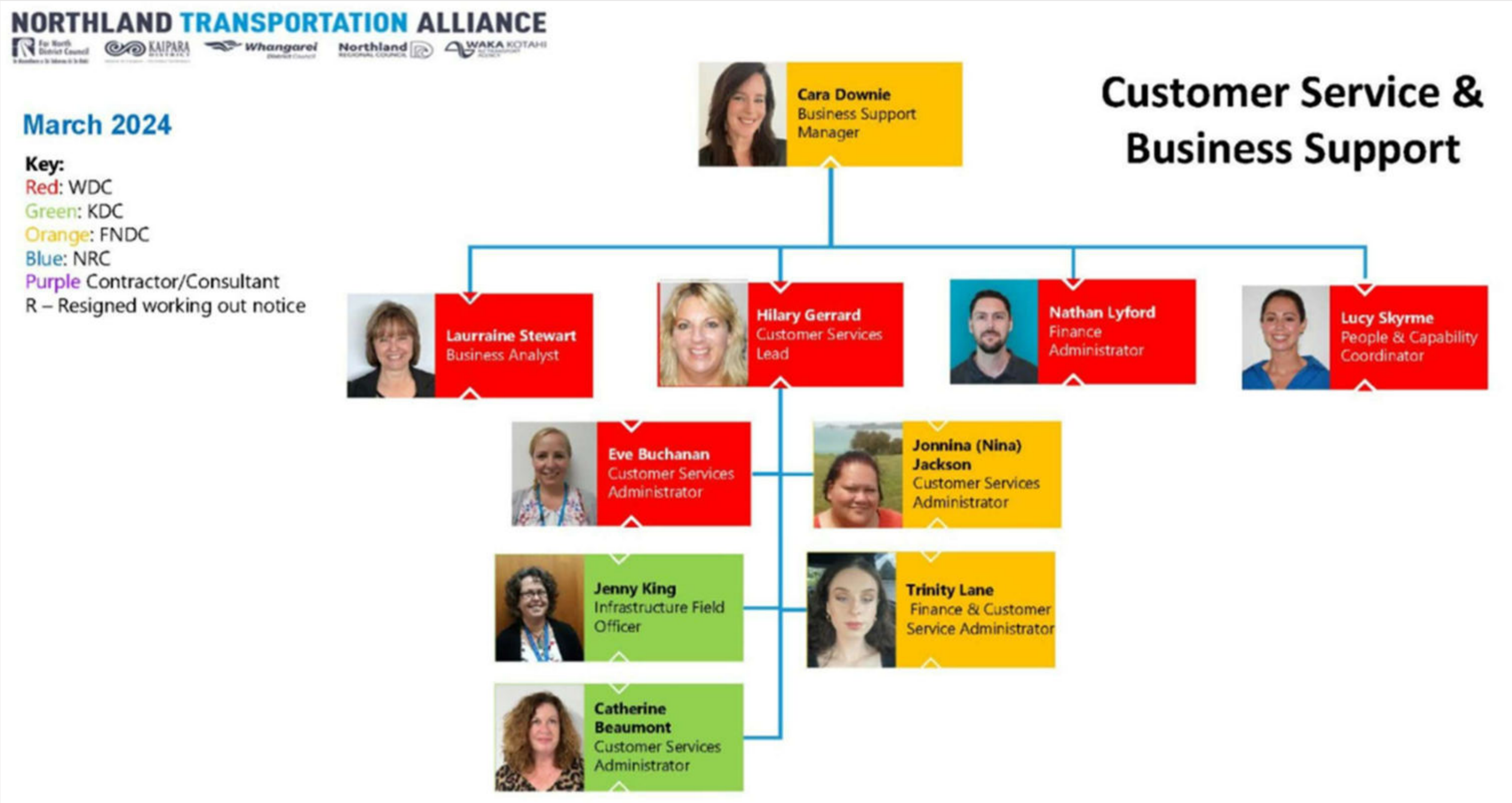


Figure 1-9: Organization chart for NTA staff –Customer Service & Business Support (March 2024)

1.3 Financial and Funding Management

Financial Management processes are carried out through the respective Council's Financial Management and job costing systems. The Council records costs against specific funding categories, such as being incurred through external contractual arrangements or through Council's internal payroll structure.

The accounting system Council uses is an Accrual Accounting System, which backdates the expenditure to the financial year in which it is undertaken even if payment occurs in the next financial year.

Budgetary funding for the transportation programme is managed by the Asset Strategy and Management team through applications to NZTA to mirror the share of funds available through Council's LTP. These applications are made through NZTA's Transport Investment Online (TIO) website.

The Land Transport Management Act 2003 requires Council to prepare a three-year Land Transport Programme. The programme is a summary of the work required to provide an effective Transport Network. It is prepared by the NTA Asset Strategy and Management Team, approved by Council, and then forwarded to NZTA to gain funding through the National Land Transport Programme (NLTP). This AMP is the business case to support the budgetary funding application.

NZTA provides funding assistance to Council for works that comply with NZTA's policies. Currently NZTA provides Financial Assistance Rates (FAR) as summarised below:

- FNDC – 69% 2021-24 and 71% 2024-27
- KDC – 62% 2021-24 and 2024-27
- WDC – 53% 2021-24 and 2024-27

1.4 Asset & Information Management

1.4.1 Description

The transportation network has a vast amount of asset data and information which relates directly to the asset (e.g. Road Asset Management and Maintenance data, or RAMM data) as well as information from within the corporate business and from customers and stakeholders (such as customer requests etc).

RAMM Finance/ Pocket RAMM has been implemented to manage the maintenance, operations and renewal works, and for compiling claims. The introduction of RAMM Finance has significantly improved the quality and timeliness of data available for asset maintenance decisions and management.

The core data systems that are relevant to operating and delivering the transport activity are the RAMM database, as well as the following:

- Forward Work Programme
- TechOne Customer Request Management (CRM) Module
- Pathway Request for Service (RFS) Module
- TechOne Corporate Management System (Finance)
- Trifecta T3 for Road Corridor Management
- Balanced Score Card Performance Measure Management System
- Transportation Activity Management Plan
- Bridge Database.

Figure 1-10 below outlines the information flow and how each system within Council fits together.

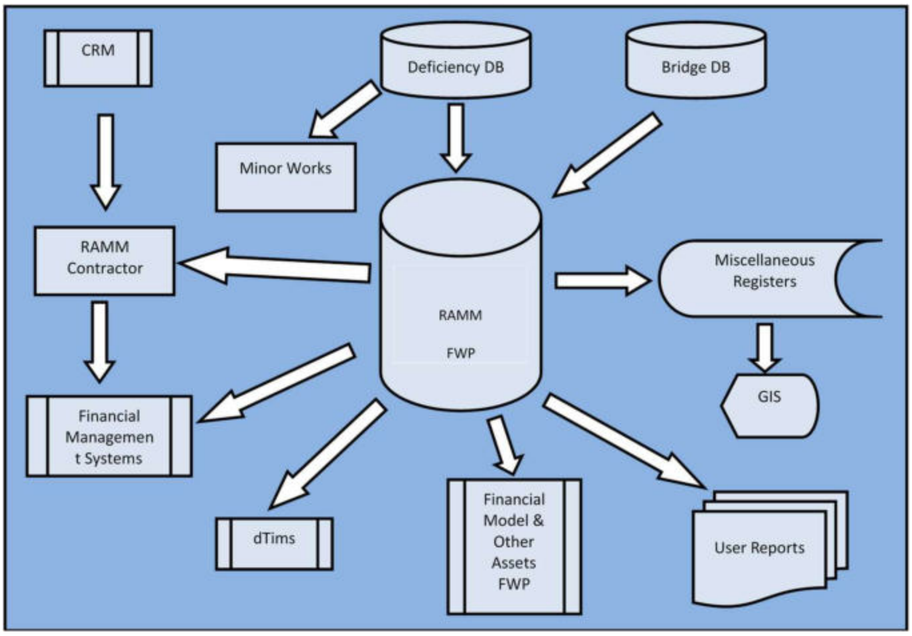


Figure 1-10: Information Flow between Council Systems

1.4.2 Management and Operations

Table 1-2 below summaries how the NTA records and stores all the information associated with the Transport Network.

Table 1-2: Data Information

Data Type	Location/System	Comments
Asset Inventory	RAMM Asset Register	Maintained in house. Provides data for LoS measures. Also used by NZTA for national benchmarking.
Scheme Descriptions	Hardcopy/As Built/RAMM (attributes and condition)	As built stripped and loaded to RAMM.
Condition	RAMM	Condition Assessments, roughness, rating.
	External Service Providers	Performance Records.
Operations Data	RAMM	Historical maintenance cost data.
	Contract Management System	Current approved programmes of work. Tracking and management of tasks on the network.
	SCATS	Stores operational information.
Customer Enquiries	Service Requests Register	Held in TechOne/Pathway systems, also used as input to LoS measures.
	Asset Managers Files Finance and Records (Historical)	Hard copies all work orders and invoices raised through TechOne.
Asset Valuations	RAMM Valuation Module	Data integration with asset inventory and condition
Finances Economics	Council financial systems	TechOne.
Development Data	RAMM – NOMAD Forward Planning Tool	Data integration with asset inventory and condition data
Forward Forecast	Urban Traffic Model	Provides future demand and capacity modelling allowing the identification of future works.
	dTIMS Pavement Performance Model	Allows the performance of the pavement and surfacing assets to be modelled providing a tool on which to determine future renewal and maintenance programmes.
Levels of Service	Transportation Activity Management Plan – Bulk of source data for LoS held in RAMM system and TechOne.	Also held in Balanced score card system

The NTA has created a Road Asset Database Operations Manual that provides clear guidelines on how the asset data is managed.

1.4.3 Community Consultation

The LGA 2002 requires Council to consult with affected and interested parties in making decisions. Before implementing level of service changes, options analysis and the selection of the best practicable and preferred options must be done using a coherent and transparent process.

All Councils recognise there is a wide range of customers and stakeholders with an interest in how the land transport activity is managed, including road users, the resident communities, visitors, specific interest groups within the community and regional and central government agencies.

The procedure for all consultation is set out in each council's online web pages.

1.4.4 LTP and Annual Plan

The majority of the NTA's public consultation is undertaken during Council's consultative process integral to development of the Long-Term Plans and Annual Plans. This process also includes consultation with local authority elected members.

1.4.5 Council Meetings

A senior NTA manager/engineer attends community meetings that are applicable to roading. Other relevant staff members are also asked to attend when appropriate (e.g. Safety Engineer if the topic is road safety).

1.4.6 General Public

The Local Government Act requires that the Council must consult the public in regard to the Long-Term Plan and the Annual Plan and sets the procedures for the consultation process that must be followed. This process covers all aspects of the plans, including roading, and is the main process used by the NTA to inform the public of the works they are planning to undertake.

The NTA also informs the public of significant upcoming works through press-releases in the Council News section of the local newspaper and on the Council's websites, Facebook page and Twitter account. Prior to commencing construction works, roading contractors are required to notify residents of the works via letter drops.

1.4.7 Iwi

The Act states that a local authority must 'establish and maintain processes to provide opportunities for Māori to contribute to the decision-making processes'. Council has established a Māori Liaison Committee to notify iwi of upcoming projects including roading works. The NTA also consults with iwi on projects that require resource consents.

1.4.8 Communitrak Surveys

Council also undertakes surveys of the community. These surveys are undertaken annually and provide a benchmark of how Council is performing on a range of areas including transport. Council uses this information to set appropriate Levels of Service.

1.5 Corridor Management

Corridor management involves the management of any person or party that wishes to occupy the road in such a way that the normal usage will be disrupted. This includes road inspections and work or events that will involve road closures or traffic flow disruption.

1.5.1 Corridor Access Requests (CAR) & Traffic Management Plans (TMP)

Any party that wish to occupy or work on a Council owned road must have approval from the NTA before commencing. The applicant must submit a Corridor Access Request Form accompanied by:

- Hazard Management Plan
- Traffic Management Plan
- Works Plan
- Copy of any public notification, if applicable.

The application process is based on the National Code of Practice for Utility Operators' Access to Transport Corridors.

The NTA has acquired a programme called 'Trifecta T3' that was designed by Global Infrastructure Solutions. The module is used to automate the process for Corridor Access Requests (CARs) and Traffic Management Plans (TMPs) and is based on the National Code for Practice for Utilities' Access to the Transport Corridor and covers all steps of the process.

1.5.2 Stock Control

Each of the Council Compliance Departments are responsible for all wandering stock on the districts roads as well as on the State Highway network in the district. All wandering stock requirements are dealt with by the Road Maintenance Contractors in line with the respective Council bylaw.

1.5.3 Vehicle Crossings

The maintenance of vehicle crossings from the road edge to the property boundary is the responsibility of the property owner. All new crossings require consent from the Councils Building Department to ensure that they are built to the Councils requirements, as set out in the Environmental Engineering Standards (EES).

1.6 Procurement Management

The Councils through the NTA currently have several term contracts to carry out maintenance, operations and renewals on the road network. These contracts are shown in Table 1-3 below:

Table 1-3: Term Contracts

Contract	Description
FNDC: CON7/18/100(North) / CON7/18/101(South) KDC: CON888 WDC: CON17085(North) / CON17086(South)	Maintenance and operations management for the road network for the five areas across Northland. These contracts include: • Sealed pavements • Unsealed pavements • Drainage • Signs • Structures • Vegetation control • Traffic Facilities • Paths • Clean-fill site management • Street Furniture • Traffic Delineation • Standby Service & Incident Response
FNDC: CON 7.21.185 – Streetlight Renewals and Maintenance contract KDC & WDC: CON20071 – Streetlight Renewals and Maintenance contract	Streetlight Upgrade, Infill and Maintenance Ongoing maintenance and renewal contracts
07041 Parking Meter Maintenance	This contract covers the inspection and maintenance of all the NTA's parking meters as well as the collection of money from the meters.
17038 Lower Hatea River Crossing – Bridge Operations	This contract covers the general operation of the Te Matau ā Pohe and Kotuitui Whitinga bridges as well as inspections and maintenance of the electrical systems.
17039 Te Matau ā Pohe & Kotuitui Whitinga – Hydraulic & Mechanical Maintenance	This contract covers the inspection and maintenance of the hydraulic and mechanical systems associated with the Te Matau ā Pohe and Kotuitui Whitinga opening bridge.

1.7 Management & Operations

Maintenance management covers the inspection of assets and the prioritisation, budgeting and completion of the maintenance required for all assets within the network.

Asset renewal is the process of restoring the level of service delivered by an asset to its original design level, or close to it, by repairing or replacing the worn components. The purpose of the renewal strategy is to maintain the levels of service by identifying the most cost-effective time to renew the asset.

1.7.1 Maintenance Intervention Strategy (Corridor Management Strategy)

This strategy is used to assist in the development of maintenance programmes for different assets. The strategy was developed as a way to ensure that the maintenance programmes are an effective, co-ordinated approach to maintenance over time.

Maintenance strategies determine how the local transportation network will be operated and maintained on a day-to-day basis in order to achieve the optimum use of the asset. Table 1-4 below shows describes the maintenance activities.

Table 1-4: Maintenance Categories

Maintenance Activity	Description
Routine Maintenance	Routine maintenance is the regular ongoing day-to-day work that is necessary to keep assets operating, including instances where portions of the asset fail and need immediate repair to make the asset operational again. This work falls into two broad categories as follows:
Proactive	Proactive inspection and maintenance works planned to prevent asset failure.
Reactive	Reactive action to correct asset malfunctions and failures on an as required basis.

A key element of asset management planning is determining the most cost-effective blend of planned and unplanned maintenance as illustrated in Figure 1-11 below.

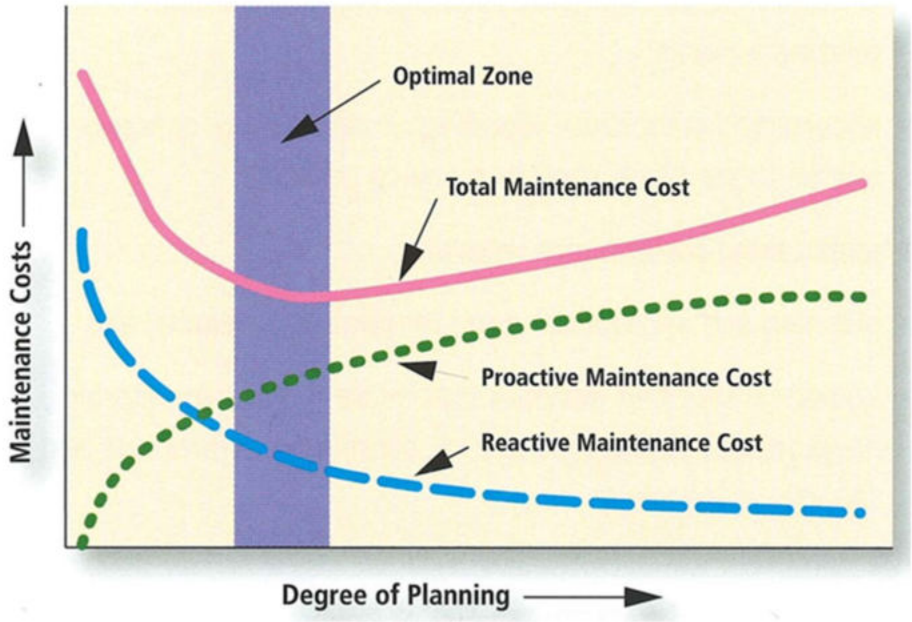


Figure 1-11: Maintenance Decision Making Process

1.7.2 Pavement Performance Modelling (dTIMS)

dTIMS is a pavement modelling system used to predict pavement deterioration and thus develop forward expenditure profiles for various user defined scenarios. This system has been adopted by the National Roading Information Management System (RIMS) group.

The NTA has been running the dTIMS model and uses this to optimise its pavement maintenance and renewal programmes. This information is then validated by site inspections to refine the programmes before they are entered in the Forward Work Programmes.

The main objective of this PPM analysis is to:

- Check whether current funding levels are appropriate for each of the road networks managed by the NTA; and
- Determine the optimal funding split between resurfacing and rehabilitation renewal treatments within each network.

The NZ - dTIMS CT V8 Enterprise software was utilised to perform the pavement modelling for these networks. The use of dTIMS in New Zealand is guided by Infrastructure Decision Support (IDS) Ltd.

The dTIMS software package is designed to enable infrastructure owners and managers to identify maintenance needs and plan forward work and associated budgets in the long term. It is a useful tool in testing the implication of different funding strategies and, as part of a pavement management system, ensures that the maximum return is derived from the road infrastructure investment.

There are three types of model analysis within the software:

- Trigger Model – defines the programme and cost required to meet a performance standard and specified level of service through the utilisation of a decision tree approach and applies treatments when certain triggers have been met without any budget constraint;
- Optimal Model – provides an optimal maintenance strategy to fit a given budget; and
- Specified Model – uses the current Forward Work Programme (FWP), calculates how much it will cost and predicts the condition based on the given treatments.

1.7.3 Recent Innovations

Incorporation of innovative data sets to enhance forecast for funding requirements using pavement modelling:

1.7.3.1 Forestry Strategy Study and Model Updates

The forestry strategy gathered information on forestry related heavy vehicle trips on the road network for the current use and make a forecast for the future demands. The forestry strategy then used pavement performance model analyses to predict future pavement condition and assess the associated financial impact from forestry trucks.

The IDS-NZdTIMS rutting progression model is a function of ESA and SNP. The SNP is a value that represents pavement strength in the model and may be seen as a proxy for the consumption of the pavement life. Figure 1-12 below shows rutting is much more sensitive to strength than loading. Rutting is 10% sensitive to loading. However, the curve becomes increasingly flat with increased loading, therefore sensitively will be less than 10% at higher loadings. Rutting is roughly 120% sensitive to SNP.

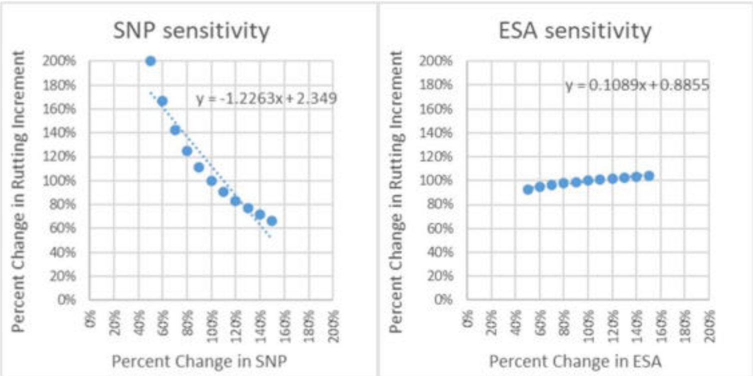


Figure 1-12: SNP and ESA sensitivity analysis (LTPP study)

The following Model setup updates were completed to accommodate the assessment of forestry impacts:

- SNP model – had historically developed with in intention be used for 10-year analyses rather than 30-year analyses. Therefore, the consumption of pavement strength has historically never needed to be addressed and has no performance model, to overcome this SNP was placed on a performance curve as a function of ESA, this means pavement consumption caused by loading is acknowledged. This will a have feedback into the rutting progression as it is a function of SNP.

- Cracking Model – substitution of AADT with ESA in to better represent the impact of the types of vehicles used.

The impact of forestry was assessed using combined financial and performance (rutting) outcomes which was between 6% to 15% increase in funding.

1.7.3.2 Long Term Pavement Performance (LTPP) Sites Data Analysis

The aim of this study was to analyse the data from the Northland WDC and state highway LTPP sites and explore the options of using the analysis results for refinement of pavement performance modelling and the use of high-speed cracking data.

This review's focus is on the conditions that have an impact on pavement performance modelling and in relation to the use of high-speed cracking data.

The conditions that are considered important for analysis and explore are rutting, roughness, alligator cracking, L&T cracking, and flushing as a potential model development.

Trend outcomes for each of the conditions have been analysed and summarised in tables that show initialisation points, condition progression, and reset condition after treatment. There are key differences in performance depending upon site parameters.

The outcome will be useful for calibrating pavement performance models and will assist with transitioning pavement performance modelling from using visual condition crack rating to using high-speed data crack condition rating.

The review of data correlations and strength of relationships between parameters and conditions has highlighted areas where further analysis can be directed, to explore the cause and effect of meaningful correlated parameters and conditions.

1.7.3.3 High Speed Data (HSD) Crack Data Analysis Models

The NTA has a strategic approach to data acquisition. Two recent innovations have been the adoption of high-speed crack data (Laser Crack Measuring System - LCMS) and studies of heavy vehicle forestry truck movements around the network. Data is important to the asset management decision making and this data has also been incorporated into the pavement performance model to provide optimised forecasts of future pavement conditions and likely impacts to funding requirements for renewals and maintenance.

The NTA has completed a comprehensive study of high-speed crack data and implemented this into the annual modelling processes. The NTA recognised the need to embrace this new technology as the potential advantages that could improve the understanding of the network pavement performance and long-term trends.

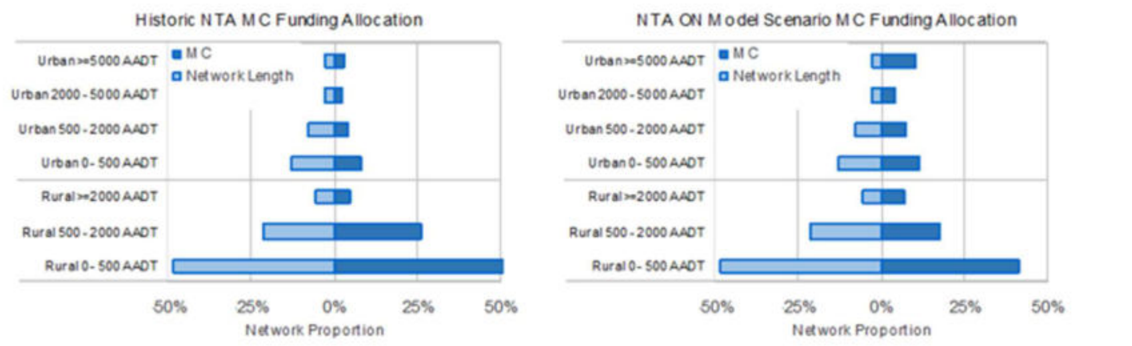
1.7.3.4 Maintenance Cost Data and Model Calibration

A review of this historic data was done in 2022 to ensure the model is suitably set up and calibrated. Historic maintenance cost (MC) is the recorded cost of routine maintenance over the past four years for each contract area within the NTA.

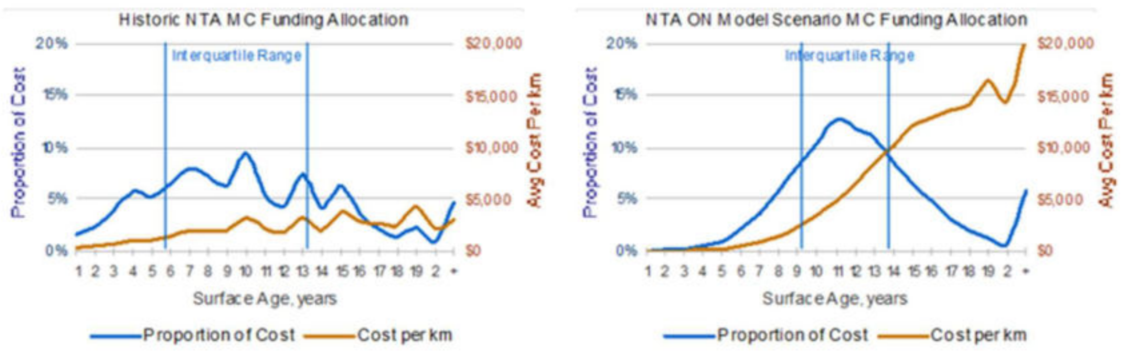
The following figure shows how maintenance cost is distributed across different road categories by the historic data set and by the optimal model normal scenario (OM-NS). Historically, the expenditure distribution has approximated the same proportion as the length distribution within the rural and urban road categories but having more emphasis toward the rural road categories.

In contrast, the OM-NS has greater bias toward traffic volume, which is highlighted by the urban roads with greater than 5000AADT. Calibration was adjusted to put more emphasis on the rural roads, these changes have resulted in increased maintenance cost overall relative to the previous model setup and better alignment to where maintenance activity is done.

Figure 1-13 below show maintenance cost distribution across the surface ages by the historic data set and by the Optimal Model Normal Scenario (OM-NS).



Proportion of maintenance cost relative to length of traffic use categories for historic cost data (LHS) and as forecast by optimal model normal scenario (RHS)



Proportion of maintenance cost relative to surface age for historic cost data (LHS) and as forecast by optimal model normal scenario (RHS)

Figure 1-13: Maintenance cost analysis (historc compared to Model forecast)

Historic Maintenance Cost Funding Allocation	Optimal model Forecast Funding Allocation
maintenance expenditure is relatively uniformly distributed across a wide range of surface ages.	peaked distribution across the surface ages.
50% of the expenditure is spent at surfaces that are between 6 and 13 years of age.	50% of the expenditure is spent at surfaces that are between 9 and 14 years of age, which is a narrower range then the historic data.
25% of expenditure is at surfaces that are less than 6 years old. These include surfaces that are over poor pavement and consume a disproportion of amount of maintenance and renewal budget	There is less maintenance expenditure on young surfaces by the model. This highlights the challenge of identifying sites that may have early surface life failure in the future.
25% of expenditure is at surfaces that are greater than 13 years. Older surfaces are scarce on the network, just 11% of the NTA network is greater than 13 years old. Older surfaces may either be aging well and have no requirement for maintenance at all, or are overdue for renewal and require maintenance. Older surfaces that require maintenance tend to have more expenditure on $/km basis than younger surfaces.	Similar to the historic data, the older surfaces receive a smaller portion of the network maintenance spend but individual sites become more costly.
The average cost per km that is spent at the different surface ages is a nearly straight line curve starting from 1 years age up to around 10 years of age, where the average maintenance costs plateaus at around $3000/km. The average values masks the amount of skew in the data, since the majority of length at any age has either no or very little maintenance expenditure while a small length has significantly large values.	The network average cost per km spent on older surfaces is greater than the historical data. This is because there is less skew in the distribution of cost at any given age. The model is more likely to assign a maintenance cost to an older site. The value of the cost per site is not normally significantly greater than the historic data but there is a greater likelihood of having a cost assigned by the model when the surface is becoming due for renewal.

1.7.3.5 Unsealed Roads Centre of Excellence

The NTA has been in developing a Centre of Excellence (CoE) for Unsealed Roads and this includes a draft regional unsealed road strategy Maintenance Management Plan (MMP, attached Appendix 02.A). The vision for the Centre of Excellence for Unsealed Roads and the MMP is an asset management led proactive approach to all unsealed road maintenance work. It is the intention that all work undertaken will be programmed, planned and have the appropriate intervention that is weighed up against all other programmes and activities to achieve the best value for money investment decisions and the optimum life cycle return on a given asset.

An asset management led structured approach to maintenance work will enable the district councils to invest in renewals work along with any required operational maintenance work. Councils will be able to systematically work through the networks and build an appropriate level of service that meets the needs of all road users. This will be achieved by focusing capital (Capex) investment in granular pavements, Paige-Green compliant bound wearing courses and culvert & drainage renewals while focusing operational (Opex) investment on appropriate drainage maintenance and keeping unsealed carriageways within the specification of the maintenance contract through better grading/blading frequencies.

Included in this work are the activities like forestry and dairy freight which from vehicle kilometres travelled (VKT) affect small portions of the network, but, if not included and the appropriate level of service catered for, lead to significant damage and maintenance expenditure. However, it is the intent that, rather than catering specifically to industry, the wider needs of all the community will be met through improved and sometimes decreased levels of service that will be a direct outcome of appropriately timed Interventions and treatment types led by asset management strategy.

1.7.4 Forward Work Programmes

The forward work programs contain all the required renewals that have been identified. The plan is used to prioritise the renewals, with the volume of works undertaken being based on the funding available.

1.7.4.1 FWP and Future Prediction Models – Unsealed Roads

The unsealed roads Centre of Excellence work enables model forecast programmes to be implemented. To date, the unsealed road programme has been validated for the majority of higher volume roads. An outcome of this validation was the realisation of the need to use a model framework to help manage the field work and forecast subsequent treatments based on the validated first treatment and using decision tree logic. Therefore, the team is currently trialling JunoViewer forward work programme and prediction software.

1.7.5 Life Cycle Management Plan (LCMP)

This plan contains details on the volume of maintenance and renewal activities to be undertaken. It covers the next 30 years and is reasonably flexible in terms of the type and volume of maintenance that will be undertaken.

1.7.6 MOU with NZTA

The Memorandum of Understanding (MOU) between the Councils via the NTA and NZTA sets the NTA's maintenance responsibilities regarding assets associated with the state highways in the district. The maintenance associated with each asset group is detailed in the relevant section of the Life Cycle Management part of this plan.

1.7.7 Cost Recording

The system of maintenance cost recording is specified within the maintenance contracts. The maintenance contractors record this data directly into RAMM Finance. At the end of each month the payment to the contract is made on value that is presented to FNDC, KDC and WDC from RAMM Finance. The following process outlines how this is managed.

Figure 1-14 following shows the Maintenance Cost Flow Process.

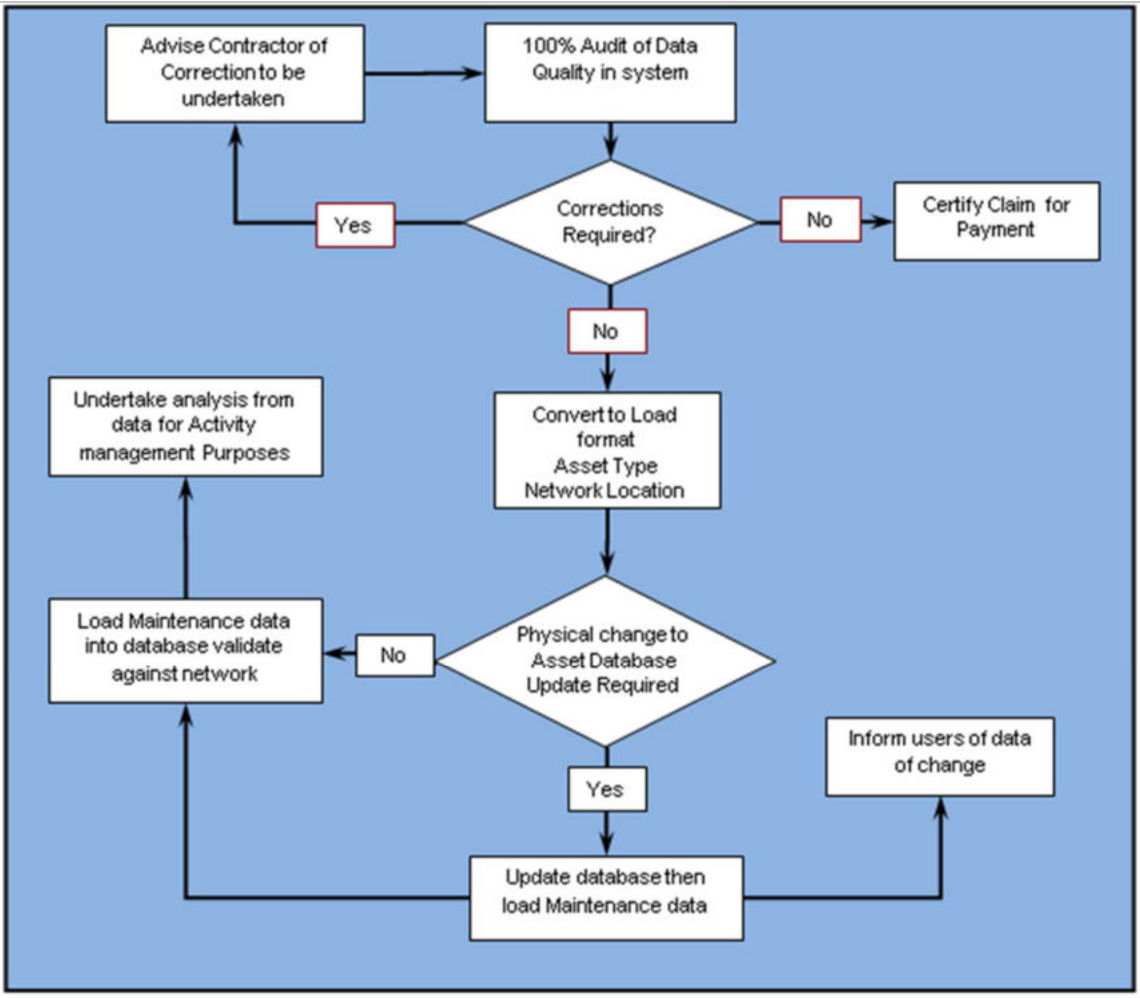


Figure 1-14: Maintenance Cost Flow Process

1.8 Emergency Management

An emergency event is a risk that is inherent with the management of all infrastructure networks. It is therefore a requirement of the plan to identify this as a risk, and to plan accordingly. Management plans are based on recognition of triggers that indicate the broad nature of event occurring, and in turn which process to follow as the event unfolds.

There are a number of levels within emergency management framework, and these are defined in Table 1-5 below.

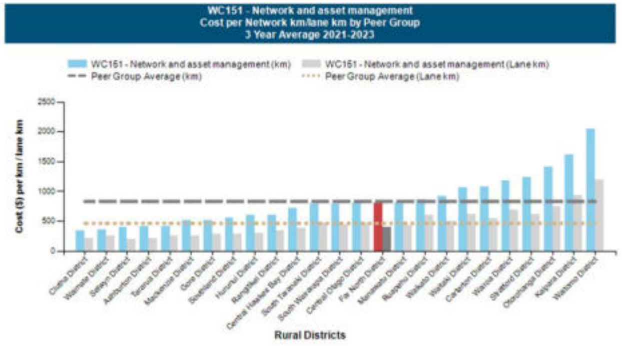
Table 1-5: Emergency Management Framework

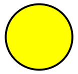
Scale	Description	Responsibility/Plan
Internally Coordinated Emergency Events	Managed by each District Council operations team with little co-ordination with external authorities apart from advising of current status of the event. This might take the form of storms events, road closures etc.	NTA respective council's Maintenance Contracts Team Lead,
Externally Coordinated Emergency Events	These are events that require co-ordination with external authority to manage the event, e.g. a crash on the state highway where a local roads detour route is required	NTA respective council's Maintenance Team Lead, Maintenance Contract documents and Quality Assurance Plans, State Highway Detour Maps etc.
Civil Defence Emergency	These are events where Civil Defence Emergency Management Plans are enacted. At this stage all Council's operation teams work to these plans to support the district or region in the state of emergency	Regional Civil Defence Co-ordinator Northland Civil Defence Emergency Plan 2010

1.9 Evidence and Gap Analysis

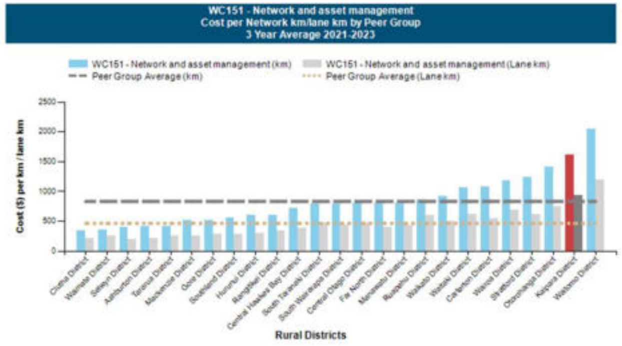
NZTA Peer Group Charts – 3yr Cost/km WC 151 Network and Asset Management

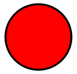
FNDC



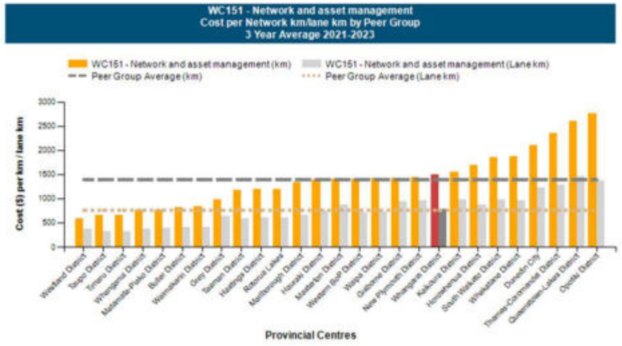


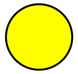
KDC





WDC





FNDC	KDC	WDC
FNDC Network and Asset Management Cost – FNDC's network and asset management cost is near the average for its peer group. The development of NTA, has improved the level of management being undertaken for FNDC in the past five years which will pay benefits in terms of better management of the network's assets.	**KDC Network and Asset Management Cost** – The KDC network and asset management cost is in the top third of their peer group. This is higher than expected, particularly given that KDC charging its in-house professional services for maintenance to the individual maintenance work categories, rather than to WC151. The development of NTA, has improved the level of management being undertaken for FNDC in the past five years which will pay benefits in terms of better management of the network's assets.	**WDC Network and Asset Management Cost** – The WDC network and asset management cost is near the average for their peer group. This is lower than expected due to Whangarei having a relatively complex network compared to most of its peer group and its high level of investment in asset management strategies and processes. The development of NTA, has improved the level of management being undertaken for FNDC in the past five years which will pay benefits in terms of better management of the network's assets.

1.10 Financial Impact

The following tables show the work categories and examples of the associated tasks. For full financial details for the work categories, refer to Section 08 (Financials).

1.10.1 Far North District Council

Description	Financial Impact
WC151 Network Asset Management	Increase in in-house staff and NTA on-charging of costs which has led to better planning, more focus on safety and asset management, and better delivery. Travel demand management activity to develop travel plans and support mode shift including the development of a web-based programme similar to New Plymouth's "LET'S GO" programme Increase in traffic counting costs through the traffic counting contract. Significant increase in costs for the new Bridge Professional Services contract. Safety programme management. 3-yearly crash reduction studies and safety project identification and scoping. Was previously being charged to WC 341 and WC 003.AMP Improvement activities.
WC 003 Activity Management Planning Improvement	To continue to develop Activity Management Planning activities – includes ONF development.

1.10.2 Kaipara District Council

Description	Financial Impact
WC151 Network and Asset Management	Funding for travel demand management activity to promote alternative modes such as walking and cycling.
WC003 Activity Management Planning Improvement	To continue to develop Activity Management Planning activities – includes ONF development.

1.10.3 *Whangarei District Council*

Description	Financial Impact
W 151 Network and Asset Management	Safety programme management 3-yearly crash reduction studies and safety project identification and scoping. Was previously being charged to WC 341 and WC 003. Travel Demand Management. New programme to develop travel plans and support mode shift including the development of a web-based programme similar to New Plymouth's "LET'S GO" programme
WC003 Activity Management Planning Improvement	To continue to develop Activity Management Planning activities – includes ONF development.

1.11 AMP Improvement

The following improvements will be considered:

Sealed Roads

- Investigate alternative seal designs such as: Emulsion seals to reduce the health and safety risk to workers; Fibredek-type seals to extend the life of cracked surfaces; the use of plastic in asphalt mix design; and seal rejuvenation techniques to extend the seal life.
- Development of AI video analysis to assist in the capture of pavement defects and asset capture/Validation.

Unsealed Roads

- Air monitoring of adjoining unsealed sections with and without Paige-Green compliant material to determine the reduction in PM10 dust emissions.
- Change unsealed Lump Sum items for pothole patching and grading in Maintenance Contracts to measure and value items to realise the savings through the Unsealed Centre of Excellence.
- Improve unsealed road data collection including implementing regular roughness monitoring through RoadRoid or similar, and visual dust assessment tool that can determine likely PM10 dust emission.
- Continue with the project level GPR testing and plan to do the testing work for the first two years of the FWP, this will allow adequate time to cost and plan the renewals work.
- Continued development of a Centre of Excellence for Unsealed Roads and the FWP.
- Development of an Unsealed Road Maintenance Intervention Strategy (MIS) and visual guide.

- Finalise development of a standardised dust matrix scoring system that will build upon NZTA General Circular 16/04 Assessment.
- The planning rules in the FNDC and KDC districts should be reviewed and rules developed similar to WDC to either limit the development of houses on unsealed roads or to require new dwellings to be located well back (ideally greater than 80m) from unsealed road frontages.

Drainage

- Create new drainage strategy with consistent approach across the three districts.
- Currently KDC add potential renewals & improvements from inspections and Customer Request Management (CRM) and add it to a list of dispatches, this work can be used by the asset management team to build a FWP. The same approach could be applied by FNDC & WDC.

Structures

- Continue to carry out full assessment on key bridges that have current 50Max restrictions to determine whether these restrictions are necessary.
- Seismic assessments to be carried out on structures on key lifelines, arterials and freight routes. Develop a programme of remedial work as required.
- All bridges on critical routes and in coastal areas should be inspected annually. Retaining walls should also be included in the annual inspection.
- Bridge and retaining wall asset data to be broken into their component parts in RAMM. Bridge and retaining wall condition, maintenance dispatches (including photos) and repairs to be stored in RAMM.
- Implement Bridges into Forward Works Programming software.
- Carry out an audit of existing guardrails to determine their condition and compliance with current safety standards.

Active Modes – Walking, Cycling and Micro-Mobility

- Update the three District Councils Walking and Cycling Strategies.
- Develop business cases for urban active transport for Whangarei City and all large towns in Northland (over 5,000 population).

Network Operations – Environmental

- Climate Change - Carry out a stock take of assets likely to impacted by climate change and include in RAMM and carry out Dynamic Adaptive Planning Pathway (DAPP) on these assets to determine adaptation strategies. This could be done as part of the Resilience Strategy.
- Climate Change - Develop a strategy to identify and implement initiatives that reduce the greenhouse gas emissions from transport related maintenance and construction activities.
- Investigate and develop a programme of sediment control measures for roadside drainage systems and maintenance practices to minimise sediment runoff into harbour catchments (particularly the Kaipara Harbour).

- Manage clean-fill sites according to best practices – there is a need to dispose of large quantities of soil in clean fill sites located around the network and they are possible pollution points that require close attention.
- Make use of arboriculturally best practice whilst removing vegetation – manage the removal of vegetation on roads whilst undertaking maintenance and construction works.
- Proactive and reactive programme of weed control funded and carried out annually – to ensure that weeds growth is controlled and comply with NRC requirements and to ensure that the functioning of assets is not compromised.
- Take a ‘whole-of-life’ approach to resources considering the overall best opportunities for resource efficiency over the asset’s lifetime – there is a need to drive sustainable sourcing and use of materials and waste minimisation.

Network Operations – Traffic Services and Network Lighting

- Collect data relevant to define policy for level of service for signs and road markings.
- Develop work programme to achieve specified levels of service.
- Undertake an assessment of long-life markings to determine where and when these should be used.
- Undertake cyclic night-time inspections with safety engineers to determine improvements to signs, markings, RRPMs and edge marker posts.
- Develop forward works programme of high priority “black” areas resulting from the lux mapping survey (HISLAT survey) of the P-Category (local road) lights.

Network Operations – Traffic Signals and Intelligent Transport System

- Determine the feasibility of carrying out signal and bridge operations remotely through a Northland regional control centre similar to Auckland Transport Operation Centre (ATOC) including assessment of ongoing operating costs.
- Determine a suitable central management system for streetlight control and other “smart” technologies.

Network Safety – Safety, Education & Promotion, and Demand Management

- Complete the NTA Regional Speed Management Plan
  - Incorporate Northland Road Safety Management Strategy
  - Wet Road Curve Strategy.
- Guardrail end terminal and length of need assessment.
- Road safety promotion measures.

Climate Change – Mitigation and Adaptation

- Database of vulnerable sites.
- Link Resilience database to RAMM.
- Implement Standard Operating Procedure for emergency response.

Growth and Demand – Public Transport

- Determine the feasibility of rural commuter bus services to rural towns in the Whangarei District.

Growth and Demand – Parking

- Continue to monitor parking meters condition data.
- Collect/ estimate parking meters age data and update RAMM.

Network Asset Management

- Determine which Council department has ownership and maintenance responsibilities for the Council-owned assets such as carparks, street furniture, shared paths, amenity lighting etc.
- Standardise the Annual Achievement Return reporting process using RAMM data, TIO data and council financial accounts.
- Implement the Asset Data Management System (ADMS).
- Improve KDC customer request (CRM) data to include asset type which will enable year-on-year tracking of trends.
- Carry out annual assessment of customer requests (CRMs) and requests for service (RFS) to determine trends.
- Procurement Strategy – Update the NTA Procurement Strategy.
- Application of the One Network Framework (ONF) including implementation of the ONF performance measures and levels of service into the AMP and maintenance contracts.
- Continue innovation work within the asset management innovation within the asset management practice, there are still tasks remaining others that are ongoing that need to be done to keep abreast with technological developments. We need to keep up to date in order to maintain current best practice.

Appendix 11 Self-assessment

No	Focus Area	Questions	Guidance	NTA AMP - Self-assessment
STRATEGIC CASE - Is there compelling case for investment?				
1	**Strategic Alignment**	What consideration has been given to progressing Government priorities, regional priorities, the One Network Framework (ONF) outcomes and measures? How do the strategic drivers align to Waka Kotahi's planning documents?	Briefly describe the information that demonstrates how the business case: • Supports and aligns to government priorities • Takes account of regional priorities • Is informed by Waka Kotahi planning documents • Responds to the One Network Framework	Section 2 (Instruction) highlights the relationship and the strategic linkages of the AMP with: - Local Government Act 2002 amendment act 2019. - Transport Outcomes Framework. - Government Policy Statement on Land Transport 2024/25 -2033/34 (GPS 2024). - Waka Kotahi (NZTA) Arataki 2023. - Draft Northland RLTP (2021-2027). - The three districts Community Outcomes - LTP (2018-2028). Strategic Mapping chart was created to illustrate the linkages between the strategic document. Refer to Section 2 (Introduction). The NTA has undertaken an exercise to define a network criticality system which defines the criticality of individual roads criticality across Northland's local roading network. This system considers regional priorities, prioritise, and optimises maintenance and renewal needs when using various Waka Kotahi (NZTA) funding work categories.
2	**Strategic Direction**	What issues additional to the national (GPS) and regional priorities need to be addressed in managing the network	Briefly describe the information that identifies issues such as: • Long term trends that impact on the network's customer levels of service • Acceptable levels of service gaps • Risks to the reliability and continuity of the network • Other priorities identified in the business case	Key issues for the assets and functions are detailed, they included historical funding analysis, state of the assets and or levels of service, identified risks, This included, identifying key issues and actions, consequences of not addressing the issues, benefits of addressing the issues. All assets and functions appendices have key issues identified under a specific section named Problems, Benefits and Consequences. These are also summarised in Section 4 (Problems, Benefits, Consequences and Preferred Options). Risk Management guidelines and Resilience planning is integrated into asset management decision making and criticality analysis has been undertaken.
3	**Problem identification (current state)**	For the issues identified above, does the business case documentation provide evidence (trends) to indicate the scale of the problem, or opportunity, and give some indication of the relative importance and urgency of the issues	Briefly describe the information that provides: • A clear statement of the current state problem or problems, or opportunities being addressed • What would be the consequences of not addressing the problem(s) or opportunity and the urgency e.g. 0-3 years, 3-10 years, 10 years +	Team workshops and review of the key issues resulted in well-defined problem statements. Problems identified are not just asset focused as they consider the needs of customers and stakeholders. All assets and functions appendices have key issues identified under a specific section named Problems, Benefits and Consequences. These are also summarised in Section 4 (Problems, Benefits, Consequences and Preferred Options).

No	Focus Area	Questions	Guidance	NTA AMP - Self-assessment
4	**Objectives (benefits, outcomes) identified and reasonable**	What benefits and measures, at a network level related to the programme, have been selected and are they reasonable	Briefly describe information provided on: • The benefits and measures selected and whether they are achievable • The traceability of the benefits and measures, and whether adequate evidence (trends) is available to confirm the benefits have been achieved • How well the programme responds to the customer levels of service (current and future state) and the relationship with the benefits • How well the benefits and measure will address the problem/s identified • The flow between benefits and measures in the AMP, the benefits and measures in the MOR, and whether there is an appropriate level of continuity. • If new benefits and measures are selected, and they are not part of the ONF or Waka Kotahi's Benefits Framework, assess whether they whether they add value.	Benefits and measures are summarised in the strategic case summary for all assets types and functions. For example, for sealed roads – benefits include: reduce whole of life cost, improved surface and pavement base life, and improved ride quality. For this case, the measures are: utilise model outputs and validated FWP to select the right treatment at the right time to maintain or improve network health measures such as surface and remaining life, maintenance cost, and condition data such as roughness. Most of assets appendices have a description section where most the traceability elements are described, for sealed roads as an example: the overview and description section have analysis of the surface life, pavement age, and network conditions. Most of assets appendices have a level of service impact section, for structures as an example: levels of service impact for accessibility is presented, in this case reducing restrictions to freight on the network. Most assets appendices have key issues and problems identified and linked to the consequences of not addressing the issues and the benefits of addressing them. Benefits and measures are generally based on the ONRC and network criticality system, they add value as they are used to prioritise the programme to respond to funding and resource availability.
ECONOMIC CASE - Is the programme optimising value for money?				
5	**Programme**	For the programme as a whole and for each of the work category bids, is there sufficient evidence to show the programme has been optimised for both the mix and timing of interventions, and is there an appropriate procurement approach to deliver value for money in the short, medium and long term?	The business case and supporting information must demonstrate and you need to be satisfied that: • A sufficient range of alternatives and options have been identified and explored, and that the preferred maintenance programme, within the AO's total transport programme, as set out in the AMP is the best way to respond to the problems and to deliver the expected benefits • The programme has been optimised effectively for scope, quantity, timing and deliverables • What consideration was given to addressing the problems/opportunities through maintenance and/or additional improvement activities (funded through the relevant Improvements Activity Classes) and/or enhanced delivery arrangements • Cost and level of service performance benchmarking compared to national, regional and local peers • Has the programme been assessed for emissions impact?	The NTA held a series of workshops around Multi Criteria Analysis (MCA) to determine the strategic response to address the problems. - Critical issues are addressed through root cause analysis using the '5 Whys' methodology. - Options were developed based on the assessment of the proposed options determined from the root cause analysis. - Options were assessed using the five-point rating system based on qualitative assessment of the Levels of Service (LoS) and cost comparison data. - The considered options have been analysed and ranked using the Project Business Case (PBC) MCA. The PBC links each activity to the strategic case and LoS assessment and identifies evidence and gaps. Most of the asset groups and functions appendices include: - Levels of Service Analysis - example: refer to Appendix A01 Sealed Roads, 5.7 Level of Service Impact. - Evidence and Gap Analysis - for each district, provide a five point "traffic light" rating system and commentary notes for the NZTA peer group cost charts for the relevant Asset group work categories. Example: refer to Appendix A02 Unsealed Roads, 5.3 Evidence and Gap Analysis, (NZTA Peer Group Charts – 3yr Cost/km WC 112 - Unsealed Pavement Maintenance) and (NZTA Peer Group Charts – 3yr Cost/km WC 211 - Unsealed Road Metalling). The programmes are created to consider and minimise emissions impact through: - operational efficiencies, clustering various work activities to reduce number of mobilisations. - consider using existing materials where possible to minimise waste, transport costs, and emissions. - using local materials where possible to reduce transport costs and emissions. - meetings held with Northland Wood Council highlighted bridges requiring strengthening, which will result in reduced VKT and emissions.

No	Focus Area	Questions	Guidance	NTA AMP - Self-assessment
6	**Evidence**	Is there sufficient evidence to underpin the problems, benefits and the response?	The business case and supporting information must demonstrate and you need to be satisfied that: • Sufficient evidence has been provided to supports the proposed programme. This includes evidence such as modelling, benchmarking, incremental analysis & sensitivity analysis and is of sufficient granularity to support any assertions made.	Sealed roads pavement performance modelling (PPM) was utilised in the decision making for both network and project levels to ensure that short to medium programmes will not impact on the network health over the long term. In this case, the model analysis shows the field validated programme maintained and or improved network condition over the next 10-year period. Unsealed roads Centre of Excellence (CoE) and network modelling provides inputs for the 2024-27 programme management and implementation. Refer to: Appendix A Sealed Roads Appendix A01-A Pavement Performance Analysis – 2023/24, October 2023 Appendix A02 Unsealed Roads Appendix A02- A Maintenance Management Plan: Unsealed Pavement Activities
7	**Alignment of programme expenditure**	How well are planning documents aligned to the core programme (and any associated funding applications) in TIO?	Review documentation/references provided and provide assurance that there is: • An alignment between the planning documentation and the TIO funding application for the total core programme (including any service improvement(s)) in relation to other documents including the RLTP and councils LTPs • Any gaps are identified	The programmes for the three district councils have been identified, collated, and presented to each Council for inclusion in their respective Long Term Plans (LTP's). The major project originally identified have been include din the Regional Land Transport Plans (RLTP) and these programmes and projects are also submitted into TIO for subsidy funding application. In this manner all planning is aligned to the core programme and with all funding applications. Any potential gaps will occur where the RLTP or LTP funding approval is moderated differently to that of the NLTP, but the risk of this is low as the core programme algins with the recently released draft Government Policy Statement (GPS) on Land Transport 2024-27.
FINANCIAL CASE - Is the programme affordable?				
8	**Affordability**	"Affordability should be considered in the context of the size of the problem. What is the confidence that funding will be available to support the proposed programme?	Briefly describe: • If the proposed programme is feasible and sustainable. • Has local funding availability confirmed? (Councils Only) • Have all funding options been considered? • How will any cost increases be managed?	The proposed programmes are considered to be adequate to achieve the proposed benefits, programme costs are presented using the NZTA funding categories with detailed justification notes. The programmes for the three districts councils have been identified, collated, and presented to each Council for inclusion in their respective Long-Term Plans (LTP's) Briefings and moderation with elected council members is a process which is currently ongoing prior to their public consultation on the Long-Term Plans in early 2024. For this reason, the programmes of works listed are DRAFT and will be amended following feedback from the Councils. The NTA prepared a detailed Funding Request 2024-2027 for maintenance, operations and renewal (MOR) using the NZTA work categories for each Council. Refer to Section 5 (Continuous Maintenance Programme) and Section 6 (Improvement Programme). NTA prepared detailed supporting information relating to the changes or the increase above the escalated figures of the previous 2021-24 funding request, by NZTA work categories. Refer to Section 3 (Setting The Scene) and Section 5 (Continuous Maintenance Programme of works).

No	Focus Area	Questions	Guidance	NTA AMP - Self-assessment
COMMERCIAL CASE - Is the programme commercially viable?				
9	**Procurement**	What is the status of Council's procurement strategy?	Briefly identify & describe: • Does the AO have an endorsed Procurement Strategy • Whether there is a procurement assessment consistent with the Smart Procurement evaluation guide published by the Road Efficiency Group (REG) procurement group • Any emerging risks or opportunities related to procurement that need to be addressed or accommodated in future • If there are any issues or risks identified in the procurement strategy where further mitigation is required	The NTA has an endorsed Procurement Strategy published on the AO's website and assessed with the Smart Procurement evaluation guide. All AOs have their own procurement processes which are combined into an NTA endorsed Procurment policy (expires in 2024 and due for a review). Each of the AO polcies include compliance with the principals of the Governemnt Procurement Rules (NZTA). Regular NZTA Audits are conducted to ensure the procurement policies and processes are adhered to.
MANAGEMENT CASE - Can the programme be delivered successfully?				
10	**Integration / Partnering**	How well is the delivery of the proposed programme and related activities aligned and integrated?	Briefly describe: • How the programme takes account of other agencies programmes/activities (such as Regional Public Transport Plans) highlighting areas that may affect and/or be critical to delivering the necessary outputs to achieve the desired outcomes? • Does the proposal ensure optimal programme delivery efficiency and co-ordination with suppliers and partner organisations? • How has integration with other classes been managed? • How Build back better considerations will be managed?	The programmes are optimised to maximise network health and take advantage of any opportunity to achieve operational efficiencies by combining different work activities (cross asset optimisation) within the same site or programming adjacent sites to be done at the same time. The programmes are shared with stakeholders and suppliers at an early stage to enable early planning and coordination. The NTA advocates to build back better where it is economically justified. Such as where the quick fix to make passable versus permanent reinstatement principles apply. Use maintenance and renewal opportunities to implement improvements to prevent reoccurrence of failures at sites and carry out a programme preventative maintenance on assets that contribute to road failures.

No	Focus Area	Questions	Guidance	NTA AMP - Self-assessment
11	**Performance Management**	How will suppliers and the programme be monitored and managed?	The business case and supporting information must demonstrate and you need to be satisfied that: • Key milestones outlined and are traceable • Key Quality measures • Key parties involved in managing & delivering the Maintenance, Operations & Renewals programme are identified, and their role outlined • Programme delivery is described and will be monitored	The key deliverables are the propsed programmes and these have to be competed within the LTP period to be achieved. All work activities are delivered to required specifications, such material properties, designs, testing, practical and final completion, and performance measures. The NTA organisational charts are attached in Appendix 10 (Network Asset Management) teams included, Asset Management and Stratey, Safety, Capital Works and Procurement, Maintenance and Operations are working closely together internally and with other stakeholder and suppliers. Annual renewal programmes are identified at project level and managed using monthly and quarterly Key performance Measures (KPI)
12	**Confidence in delivery / Risk management**	What is the confidence that the programme can be delivered, and risks managed?	Briefly describe: • How findings from previous Transport Agency audits have been, or will addressed, and your confidence in the programme owner to deliver on the planned approach • Identify, if any, concerns related to delivery of the maintenance programme such as work quality, timeliness of responses, and ability to detect and respond to changes in conditions or circumstances • The proven track record of sound delivery with previous investments in the continuous programme and related activities (particularly in terms of timing and alignment/management of the funding allocation) • The capability and capacity of the organisation to deliver and manage the future programme and related activities, particularly in terms of adequacy of resourcing and skillsets available • The extent to which risks have been adequately identified for the type / complexity of the network (and/or related activities) and whether there is a sound risk mitigation strategy in place • The organisation's self-assessment and/or its independent assessment result from the application of the Te Ringa Maimoa Excellence Framework	Agreed with NZTA investment advisor to be completed by NZTA.