NLTP Pavement and Surfacing Business Case

Gordon Hart and Roger Bailey

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NZ TRANSPORT AGENCY
WAKA KOTAHI

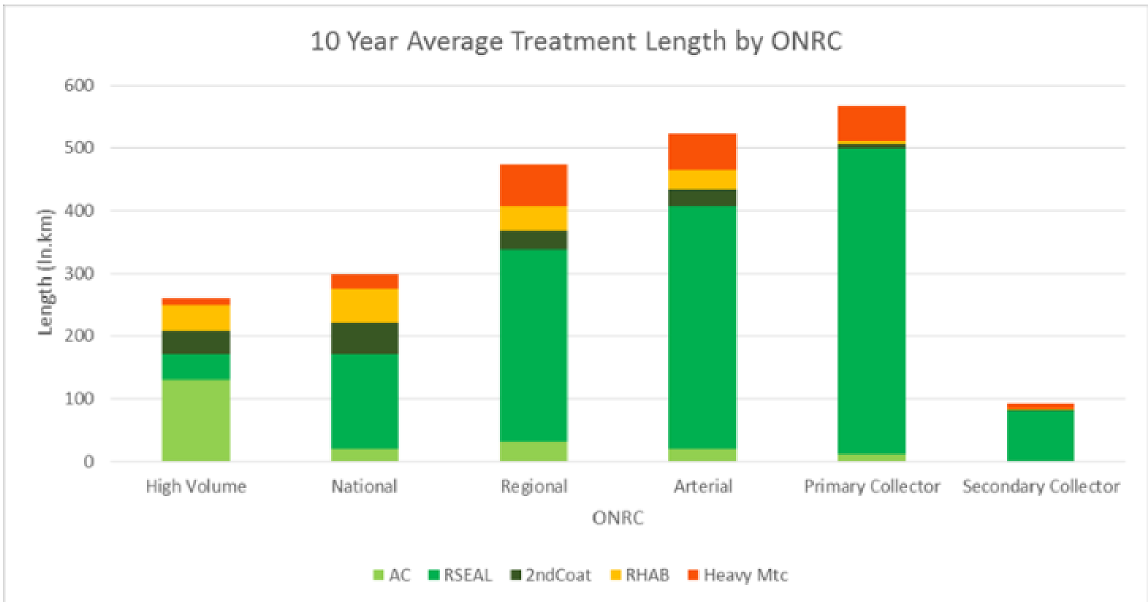
New Zealand Government

Executive Summary

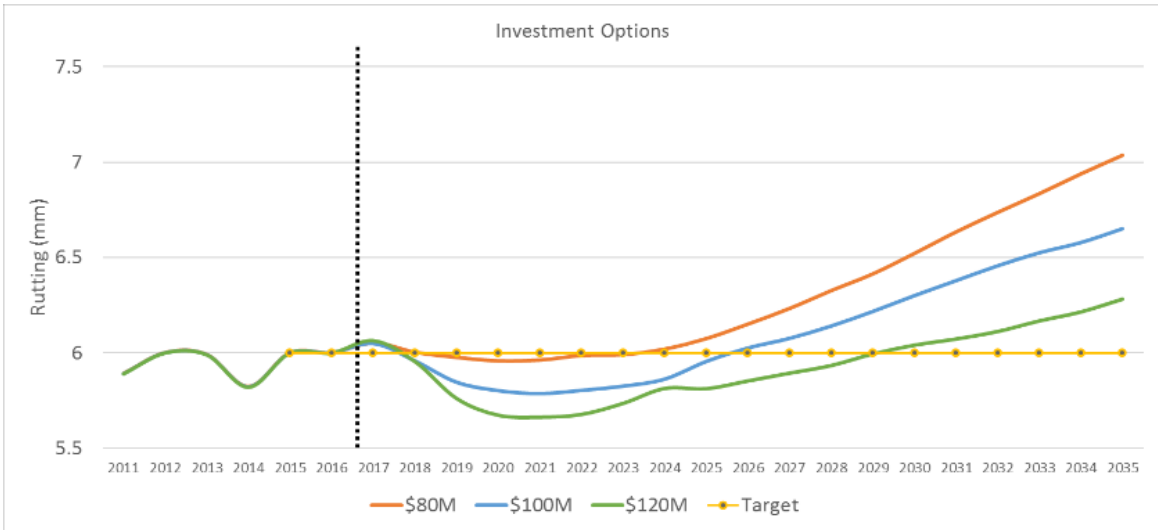
This business case recommends the optimal pavement renewal and maintenance investment in State Highways to meet long term sustainable customer needs over the next ten years. The investment recommendations are to be included in the 2018-2021 National Land Transport Programme (NLTP). Currently, the State Highway network is in good condition, however there is a lag effect of approximately six years before there is a noticeable change in performance if the level of investment changes.

Lower volume roads currently have a higher level of service and performance than is required. The NZ Transport Agency (NZTA), with the introduction of the Network Outcome Contract model, has started to take more risks by reducing the maintenance required for lower classification roads and providing more investment on high classifications. This business case recommends a programme that will continue to shift renewal and maintenance priority towards higher volume roads, while allowing lower volume roads to deteriorate to an acceptable minimum level over time.

The recommended outcome is a resurfacing and rehabilitation budget of $100m (1856 lane km per annum) over the next 6 to 7 years and routine maintenance at current levels of approximately $30m per annum for work categories 111, 212 and 214. This level of investment will maintain the state highway network to the levels of service required by customers and in accordance with the One Network Road Classification (ONRC) targets. The 1856 lane km proposed equates to 8.1% of the state highway length renewed each year, which is lower than the 14.3% annual surface depreciation rate (NZTA 2015 Annual Report). The ten-year average treatment length by type and by ONRC classification are shown below:



The Investment Options graph below shows that lower levels of renewal expenditure don't meet the target level of performance, as the network deteriorates rapidly from 2023. Average condition can be maintained in the short term at an $80m level expenditure, but the deterioration on higher volume roads would be unacceptable.



Rutting on the state highways is used as an indicator of pavement performance and expected life. As rutting deepens, other symptoms of deterioration are commonly present which signal that intervention treatments are required. Robust renewal and maintenance modelling has been undertaken on the state highway network. The modelled process has tested many different levels of investment to determine the optimum level, and the results have been verified.

Lifecycle modelling is not an exact science, and there is always a risk that in spite of the research and effort that goes into building a model, it can never be completely accurate. Key environmental inputs may change and invalidate the outputs. The modelling team has considered the sensitivity of inputs is understood and taken several measures to validate the results to address the question "how do we know it is right". The key validation was to roll the database back 5 years, apply the interventions since then, and use the model to predict the current condition and compare the results with the current network condition. The results of this validation work give us sufficient confidence to carry forward the forecast into our business plan.

The safety modelling forecasts that over the 10 year period 292 lane-km per annum will have to be resealed at a cost of $7.4m pa to address skid resistance issues brought about by aggregate polishing, loss of surface texture and flushing. This accounts for 1.2% of the total network lane length per annum. Combining the safety treatments with the pavement surfacing programme will require only 178 lane km per annum at a cost of $6m pa for safety needs in addition to the recommended resurfacing and rehabilitation budgets.

This business case summarises the technical lifecycle modelling outputs from dTIMS software, which is widely used in many countries in the world. dTIMS is a sophisticated network modelling tool that has been developed and customised for NZ pavements over the past 20 years. The business case is supported by the "2016 NZ Transport Agency Strategic Maintenance Investment Model Report" and the "Incorporating Safety Management Modelling in NZ:dTIMS" report.

Recommendations:

1. NZTA accepts the findings of the state highway pavement and surface modelling
2. For the 2018-2021 NLTP, a sealed road resurfacing and rehabilitation budget of $100m per annum (pa) is proposed over the next 6 to 7 years and routine maintenance to be held at current levels of approximately $30m per annum (work categories 111, 212 and 214).

3. In addition, a further budget of $6m pa is funded for safety to improve skid resistance at high risk sites.
4. The outcomes of the lifecycle modelling are used as the basis for the next network outcome contract agreements.

More information

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If you have further queries, call our contact centre on 0800 699 000 or write to us:

NZ Transport Agency
Private Bag 6995
Wellington 6141

This document is available on the NZ Transport Agency's website at www.nzta.govt.nz

BUSINESS CASE

Introduction

This business case recommends NZTA's preferred option for the pavement and surface renewals and maintenance for the 2018-2021 National Land Transport Programme (NLTP). A team of New Zealand's most experienced pavement management modelling specialists have been brought together to improve the way NZTA determines the sustainable long term customer investment needs for state highways (SH) pavement renewals and maintenance.

The business case explains the pavement surface and safety modelling, the outcomes, validations and recommendations. It is supported by the 2016 NZ Transport Agency Strategic Maintenance Investment Model Report and the Opus Research Report, "Incorporating Safety Management Modelling in NZ:dTIMS", May 2016).

Pavement modelling was required to determine the quantity of renewal work required using the One Road Network Classification (ONRC). The outcomes of the modelling are used in the National Outcome Contracts with road contractors to set the level of work required, assist in understanding the modes of failure and in developing forward works programmes. The investment levels and outcomes by corridor are presented in Appendix 1. The final cost of planned works is agreed with road contractors, so costs presented in this business case are based on average national planning rates.

The process to model the level of state highway investment was to:

- Assess the minimum sustainable investment profile for the respective road classes on the SH network
- Quantify the condition outcomes in data and chart form. Recommend the preferred sustainable investment and the consequences, in terms of condition outcomes, of not investing at that level
- Run scenarios either side of the minimum preservation need profile to assess associated risks with adopted investment profile
- Assess the minimum funding to sustain safety from slippery road surfaces over the NLTP period. Identify the portion of safety need that is mitigated by preservation treatments, ensuring no double dipping
- Forecast predicted performance in terms of condition outcomes for the 'optimal' scenario
- Validate and challenge the model outputs by:
    - Developing and running a second model, built on entirely different framework, and comparing the outcomes
    - perform retrospective analysis on a sample network
    - comparing to 'birthday' analysis
    - Asset Integrators completing small sample validation in the field

For the purposes of this business case the term “renewals” refers to asphaltic concrete and chip seal surfacing, rehabilitation and heavy maintenance work intended to extend the life of the pavement. “Maintenance” is defined as reactive maintenance only and is characterised by short term actions such as potholes and patching.

Current State

New Zealand has a good quality state highway network. However, there has been an over investment in maintaining the quality of state highway pavements. The 2013 network modelling recommended the quantity of pavement at about two thirds of previous levels. The lower levels modelled were equivalent to levels of renewal on the Australian highway networks.

The current performance of the different ONRC classes of road are generally similar, as they are designed with similar specifications.

Desired State

What is acceptable?

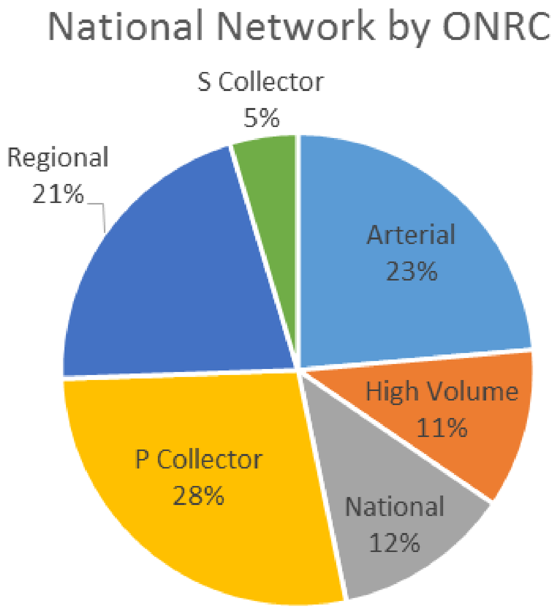
NZTA requires a network that fulfils the customer level of service expectations over the long term at the least sustainable cost. Rutting of the road surface as shown in the photos below, is used as the indicator that the pavement surface is reaching the end of its useful life.


A number of factors are known to lead to pavement end of life including but not limited to:

- Construction quality
- Material quality
- Saturation of pavement material
- Strength of pavement
- Traffic/loading

NZTA has adopted the Road Efficiency Group's One Road Network Classification (ONRC) in order to differentiate the level of service between different types of road. Targeted investment is required in order to obtain the desired performance differentiation between ONRC classes.

The total length of the state highway network is 23,085 lane km. The proportion of state highway road length by ONRC class is presented in the pie chart below:



The different classifications of road are designed for different performance levels. Many of the customer level of service measures specified in the One Road Network Classification have not yet been translated into technical measures. In future, measures other than rutting may be able to be used to indicate the end of pavement life.

For modelling purposes, the classes of roads in the ONRC have been grouped as follows, with rut target levels lower (i.e. less rutting) for higher class roads:

ONRC groups				
Group	**ONRC class**	**Modelling Outcome**	**Percentage of Network Length**	**Rutting Target**
High	National High Volume and National	Maintain condition profile	23%	4.9 mm
Medium	Regional and Arterial	Deteriorate slightly	44%	6 mm
Low	Primary and secondary Collectors	Deteriorate significantly	33%	7.2 mm

Average targets are used in this business case to illustrate the outputs. The lifecycle model uses a more technical measure of deeper rutting at the 75th percentile. As the rutting target levels shown in the table above are reached on the State Highway, portions of the road experience deeper, more extreme rutting beyond exceedance levels. These sections of road with deeper ruts often display other visible defects, which indicate the end of life, such as:

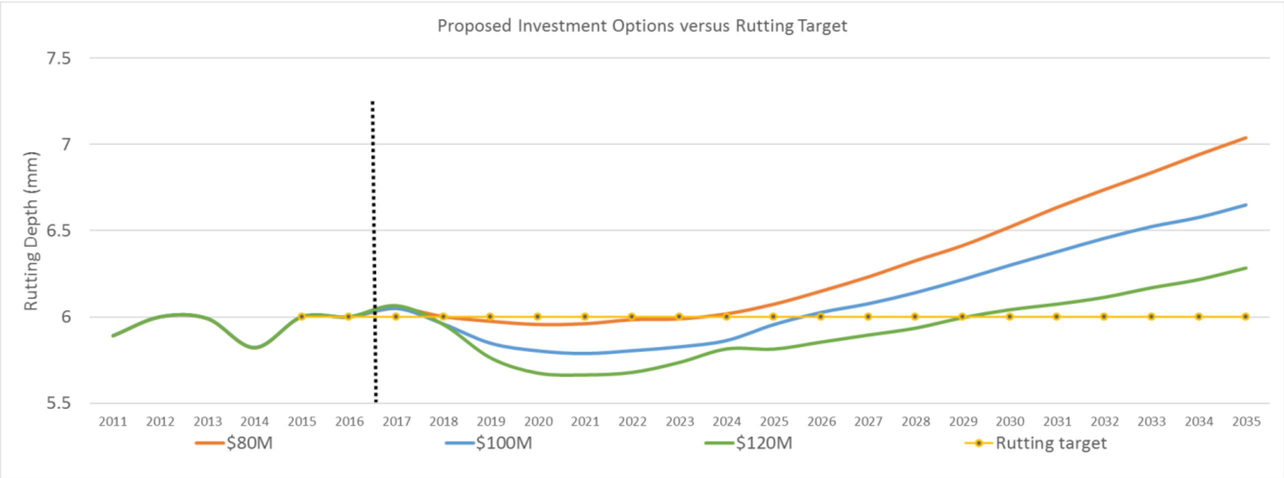
- Deformations
- Shoving
- Flushing
- Roughness
- Cracking/potholes/pumping
- Extensive maintenance patches

Pavement and Surface Outcomes

The 2016 modelling was undertaken at numerous budget levels to determine the least cost sustainable long term investment required to prevent the pavements from reaching the "tipping" point beyond which would require large investment to reinstate the pavement. In modelling terms, the tipping point is the point at which deterioration accelerates to an unacceptable level or at an unacceptable rate.

Three investment levels are shown to demonstrate the impact on levels of rutting across the network:

1. $80m per annum
2. $100m per annum
3. $120m per annum

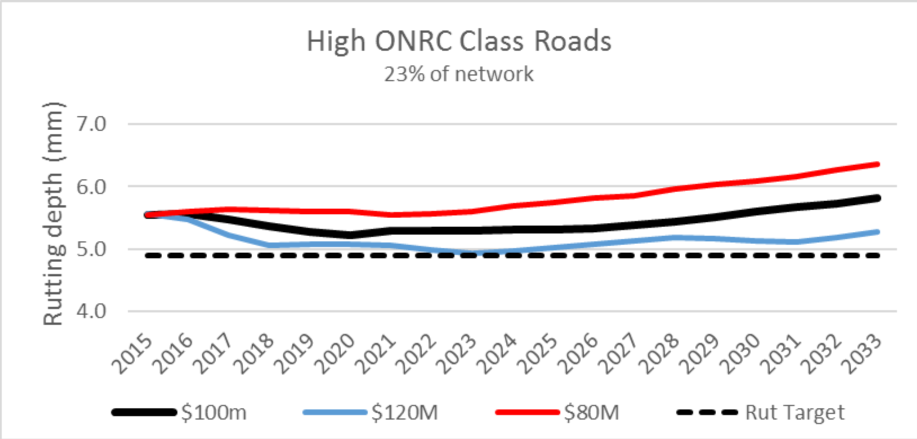


Each of the three investment options maintains the network at average target levels over the short term. From year 2024, rutting starts to accelerate, and it is expected that increased levels of investment will be required. It is estimated that the level of extra investment to maintain the current target level from 2024 will be approximately $30m-$50m per annum, but this will be confirmed closer to the time.

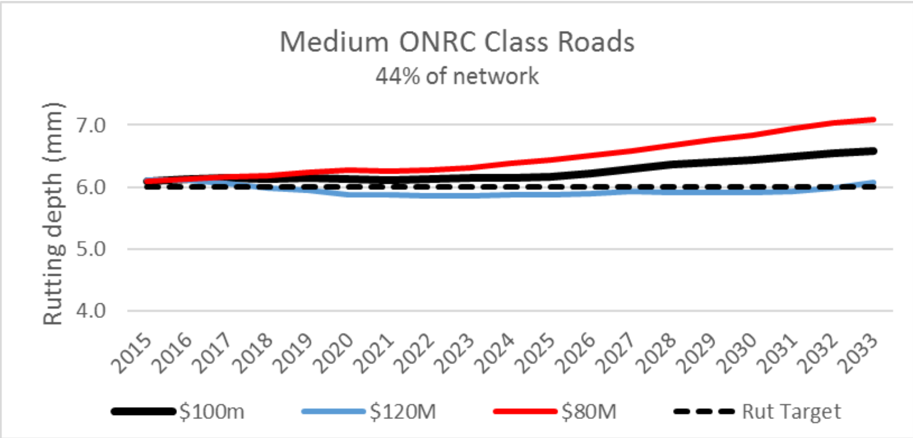
The reason that the rutting exceeds the target from 2018-2024 is that lower ONRC class roads are in better condition than is targeted. The impact on classes of roads is shown in the next section.

The recommended level of investment for renewals is $100m per annum, until approximately 2024. Although, the $80m level of investment meets target rutting levels across the network, it will not maintain key high ONRC class roads at levels that are acceptable to customers.

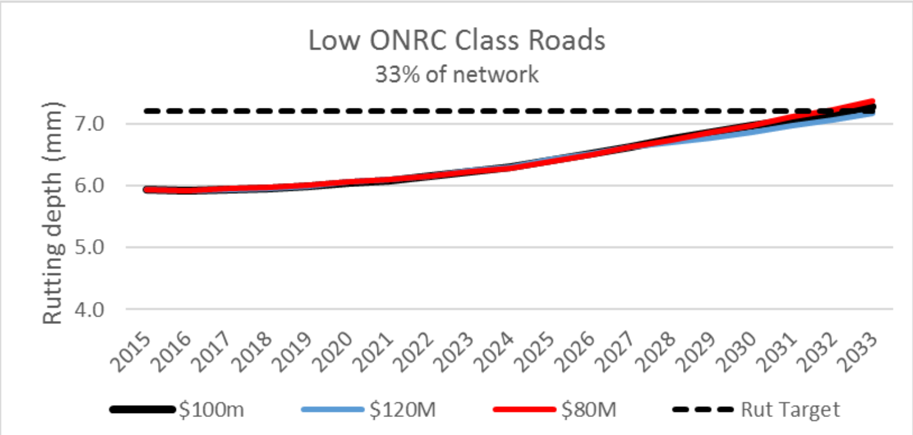
Impact of Investment Options on ONRC classes of roads



High ONRC class roads are currently worse (higher) than target levels. The $80m investment option does not improve the condition of these roads, and would result in three times more roads prematurely reaching the end of life than the recommended option. The $100m option improves the performance towards the target, while the $120m enables these roads to reach the target.

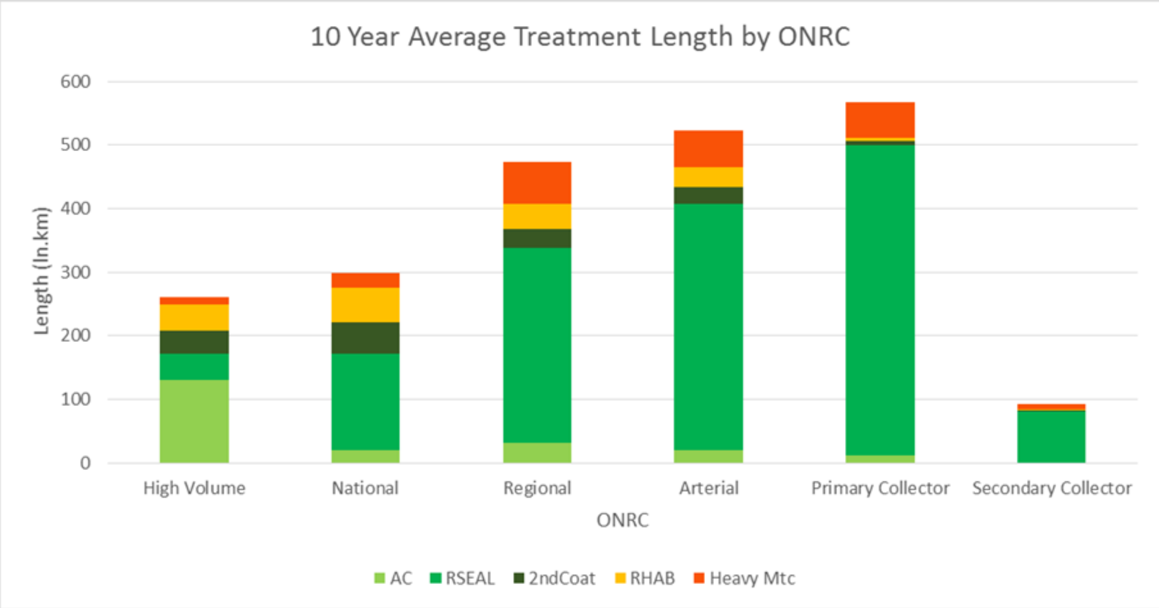


Medium ONRC class roads are currently at target levels. The $80m investment option results in a faster rate of deterioration than the $100m option. The $120m option enables these roads to stay at or below the target.



The low ONRC class target is achievable even with the lowest investment. The overall level of investment does not impact significantly on the performance of the lower class roads as the investment options have similar levels of expenditure on lower ONRC class roads. The $100m and $120m investment options include a greater proportion of expenditure on medium and high ONRC class roads.

The ten-year average treatment length by type and by ONRC classification are shown below:



The investment model[1] selects the most economic treatment type over the long term. The high volume roads are predominantly constructed and treated with asphaltic concrete. Reseals are the most common treatment for other classes of road.

Maintenance

The Agency has been investigating methods to determine the optimum quantity of maintenance required. The current budgets for maintenance are approximately $30m per annum and it is recommended to hold those levels until a more accurate maintenance model can be developed.

Recommendation for Pavement and Surface Renewal and Maintenance

The recommended outcome is a resurfacing and rehabilitation budget of $100m per annum over the next 6 to 7 years and routine maintenance at current levels of approximately $30m per annum for work categories 111, 212 and 214. This level of budget will enable 1856 lane km to be renewed per annum (8.1% of the total network).

The reason is that this level maintains the network at an acceptable level of service for the short-medium term, and achieves the aims of a better standard of pavement for the higher ONRC road classifications.

[1] 2016 NZ Transport Agency Strategic Maintenance Investment Model Report

Safety

Safety is a key priority for NZTA. Despite substantial progress over the last 30 years, New Zealand still lags behind many other countries in road safety. Every year, around 300 people are killed, 2700 hospitalised, and a further 10,000 injured on New Zealand's roads at a social cost of around $3.5 billion.

Slightly over half of all fatalities and around 37 per cent of serious injuries occur on the state highway network, at an approximate cost of $1 billion each year[2]. A proportion of the current pavement renewal work improves the safety of the network, and over the last three years the number of wet road crashes on the state highway network has continued to decrease by about 5% from 2,526 in 2014 to 2,391 in 2016.

NZTA has developed a new model to quantify how much of the renewal work is driven by safety needs and how much more is required in order to maintain a safe network.

The modelling has provided answers to the following questions:

- What is the safety need to improve the skid resistance of high risk sites on the network?
- How much of this safety need is actually treated by asset preservation prior to manifesting as a safety concern?
- What is the predicted network skid resistance profile following the combined asset preservation and surface safety program?

What is acceptable?

Currently NZTA policy[3]is to improve sites with a high traffic volume, low skid resistance, low road surface texture and a history of 2 or more wet weather crashes over the past 5 years. The safety modelling uses the same policy intervention thresholds for skid resistance and road surface texture to determine the annual safety related pavement rehabilitation need, and focuses on high risk sites as per the table below:

NZTA Safety Risk Categories		
Risk	**Site Category**	**Skid Site Descriptions**
High	1	Approaches to railway level crossings, traffic signals, pedestrian crossings, controlled intersections, roundabouts and one lane bridges.
	2	Urban curves < 250m radius, rural curves <400m radius, down gradients > 10% and on-ramps with ramp metering.
Medium	3	State highway approach to a local road junction, down gradients 5% – 10%, motorway junction area including on/off ramps and roundabouts, circular section only.
Low	4	Undivided carriageways (even-free)
	5	Divided carriageways (event-free)

[2] Incorporating Safety Management Modelling in NZ:dTIMS", May 2016
[3] NZTA T10 Specification:2013 "Specification for state highway skid resistance management."

As chip seal surfaces age and are exposed to friction from traffic, the texture depth of the surface reduces and can reach a condition described as flushed. Flushing can lead to a dramatic lowering of the skid resistance available to vehicles because the tyre rubber is supported on the low skid resistant bitumen. The photo below shows how a flushed section of state highway looks. Flushing represents one of the expected end-of life conditions of a chip seal surface. Premature flushing indicates a potential asset preservation issue.

Safety Outcomes

When the safety programme is considered alongside the pavement and surface renewal and rehabilitation (asset preservation) programme, there are some treatment lengths that would be treated both for safety and asset preservation reasons. The modelling forecasts that over the 10 year analysis period, the safety treatment need is reduced in the order of 40% on account that resurfacing under asset preservation addressed some of the length of state highway that breaches skid resistance and texture safety thresholds. On a per annum basis, this corresponds to 114 lane-km.

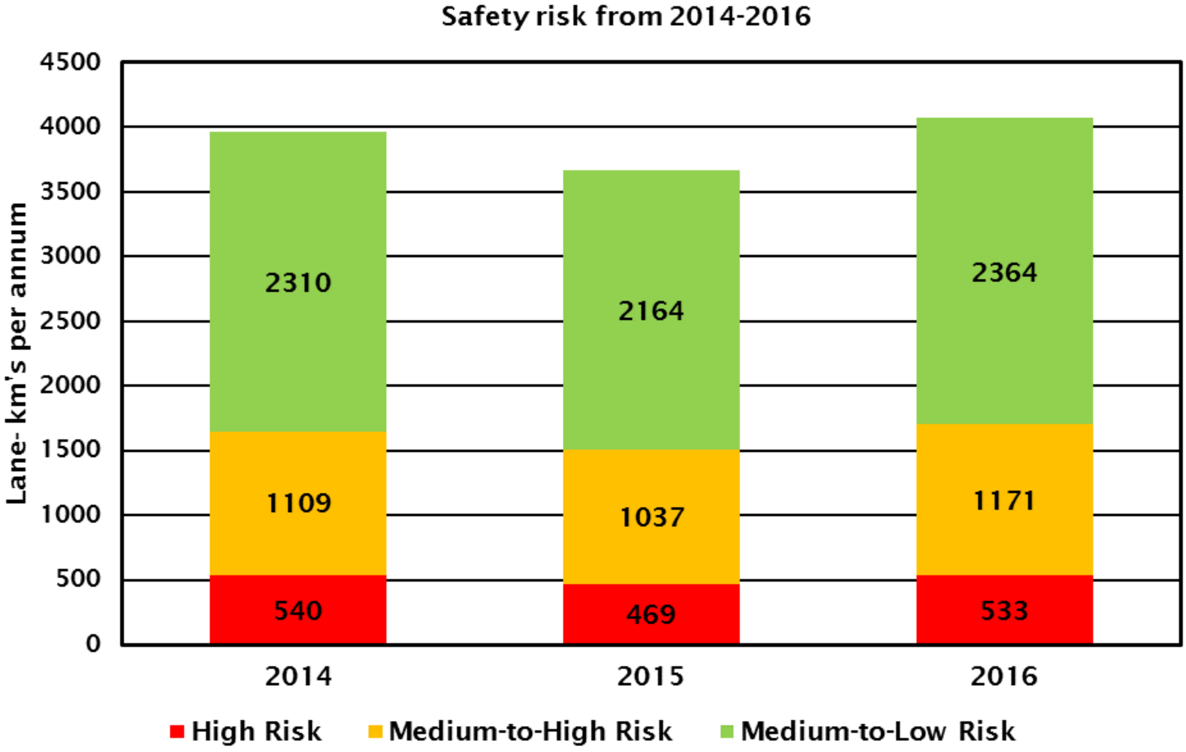
Conversely, as a result of the safety programme addressing some of the surfacing required under asset preservation, more funding can be diverted to pavement related work. This results in a 97 lane-km reduction in the forecast annual asset preservation resurfacing need from 1,890 lane-km to 1,793 lane-km, which corresponds to a 5.1% reduction.

The cost saving that results through combining the asset preservation and safety programmes is estimated to be about $5.2 million per annum.

Treating sites with a high risk of wet crashes occurring is shown to be very cost effective, with an annual expenditure on safety works of $5.95 m returning $30.5 m in benefit from 42 less wet injury crashes per annum. This corresponds to a benefit cost ratio over 5 [4].However, the true benefit cost is somewhat greater because "property damage only" (i.e. non-injury) crashes under wet conditions will also reduce due to improved road surface skid resistance.

[4] page 42, Opus Research Report, "Incorporating Safety Management Modelling in NZ:dTIMS", May 2016).

The bar chart below shows over the past 3 years the length of state highway that is high risk in terms of the likelihood of a wet skidding crash (i.e. below the skid resistance threshold level) and medium-to-high risk (i.e. between threshold level and halfway between the threshold and investigatory levels) and medium-to-low risk (i.e. between halfway between the threshold and investigatory levels and the investigatory level).



On average, about 3,370 lane km's per year or about 15% of the state highway network is medium risk and may deteriorate into high risk. The orange bars show in the chart show that about a third of this length (1,106 lane km) is very close to becoming high risk (reaching the threshold level). Maintenance treatment of this 1,106 lane km was shown to have a benefit cost ratio of 1, which is fiscally neutral with every $1 spent on resurfacing yielding $1 in crash cost saving. At present, some of these medium-to-high risk sites are being treated as safety works whenever wet crash numbers and skid and texture level deficits meet the trigger values set in NZTA's T10 specification. The resulting benefit-cost ratio in such cases is in excess of 4.

The above bar chart highlights that there is considerable opportunity for asset preservation surfacing to contribute to safety by:

- Impacting on the amount of the state highway that is close to breaching skid resistance and texture thresholds, thereby allowing safety works to remain at manageable levels.
- Reducing crashes wherever asset preservation surfacing coincides with sections of state highway with a history of surfacing related crashes.

Safety Recommendation

The outcome of the modelling is a total length of safety need over the 10-year period of 292 lane km per annum ($7.4m pa). This safety need is based on minimum levels of road surface

texture and skid resistance adopted in the NZTA's T10 Specification: 2013 being breached and is equivalent to 1.2% of the total network lane length per annum.

The recommendation is for 178 lane km per annum ($5.95m pa) to be treated solely for safety needs, as some of the safety need sites are improved through already budgeted asset preservation treatments. This is significantly less that the historical safety need of about 500 lane km per annum and results from the contribution from asset preservation treatment and NZTA's expectation that as the industry gains more experience with safety management of road surfaces, better use of available aggregates will occur leading to longer seal lives.

Evidence

How do we know that the modelling outcomes are robust?

In 2013, NZTA modelled the state highway pavement renewal needs using Deighton's Total Infrastructure Asset Management System (dTIMS). The dTIMS lifecycle modelling tool uses an internationally recognised and proven methodology to forecast pavement deterioration, and is underpinned by 20 years' development experience in New Zealand for local conditions. The outcome of the modelling was base preservation quantities which were tested and then formed the basis for Network Outcome Contracts with civil engineering contractors. The contractors and NZTA engineering assessments have shown the modelling outcomes in 2013, to have a high degree of alignment with subsequent pavement treatments undertaken. In 2016, significant improvements have been made to:

- Develop new models which include a new crack initiation model for asphalt surfaces, and a safety model
- A new optimisation technique was adopted in order to cater specifically for the ONRC classification
- A separate treatment category was created for a heavy maintenance option
- Developing and incorporating a new safety model into the overall investment planning
- A stronger focus on the validation of the modelling results.

The following actions have provided a high degree of confidence that the 2016 modelling is producing robust outcomes:

Sensitivity Analysis

- The modelling has assessed many investment levels to determine the optimum level. Sensitivity analysis was undertaken to assess the impact of reduced or lowered levels of investment
- Further analysis was undertaken to determine the sensitivity of pavement performance to different variables. The pavement performance was found to be sensitive to changes in the unit rates of pavement surfacing treatments.
- The impact on investment of changes in treatment unit rates were found to be highly sensitive. A 20% change in asphalt surfacing and rehabilitation rates resulted in approximately 20% change in investment to meet targets.
- The recommended renewal investment over the period 6 to 7 years was insensitive to up to 20% change in maintenance investment.

Pavement Validation

- **Comparing models –** Used alternative model form to predict investment need from totally different viewpoint. [5]
- **Sample networks** – Analysed historical data on three sample networks, resetting back 5 years including condition and treatments to determine predicted condition. This was then tested against current condition and the model calibrated to a high degree of accuracy.
- **Untreated sections** – Analysed historical data (5 years past) for key condition models nationally for all untreated sections to confirm rate of deterioration and model accuracy.
- **Economic efficiency –** Models use optimisation techniques to select the most economic long term treatment option.
- **Previous Modelling** – Current models are built on the 2013 National modelling which has proven to be robust in the field
- **Standard rates** – Standard National unit rates were used to assess pavement renewal quantities required to achieve agreed levels of service for different ONRC classes of road. Once the quantities of road renewal were determined from the modelling, regional rates were applied to determine the final budgets. Section 6 of the 2016 NZ Transport Agency Strategic Maintenance Investment Model Report analyses the effect of different unit rate combinations.
- **Data Quality –** The State Highway data is of a high quality, particularly from a modelling perspective. It is further recognised that the NZTA has spent a considerable effort in improving the base data for state highways
- **Supporting Technical documents** – The modelling methodology and outcomes are explained in Technical Reports and the appendices analyse specific issues.
- **Peer review** – A peer review of the Technical Report by Greenwood Associates Infrastructure Consultants found "the report and supporting materials to be comprehensive and well structured".
- **Experienced team** – NZTA utilised leading consultants and NZTA staff to work together to improve the modelling and ensure that it is robust. The modelling team included Elke Beca (Opus), Theuns Henning (IDS), Peter Cenek (Opus) and Luca de Marco (Jacobs). The steering team for the project included Gordon Hart (NZTA), Roger Bailey (NZTA), Samuel Grave (NZTA), Kym Neaylon (Opus) and David Jeffrey (Just Add Lime).

Safety Validation

The safety model has been validated on two levels as follows:

1) Retrospective application to establish how well it replicated historical trending of state highway condition with regard to skid resistance and road surface texture over the 5-year period 2011 to 2015[6].

2) Forward application to determine for 2015/16 how well predictions of "high" safety risk sections of state highway agreed with those actually observed

The high level of agreement achieved in both cases provides confidence in the safety model. For example, model predicted breaches of skid resistance and texture threshold levels resulted in cumulative SH lengths that were within a factor of 0.7 (flushing) and 1.4 (skid resistance) of that actually observed.

[5] Refer to 2016 NZ Transport Agency Strategic Maintenance Investment Model Report
[6] Refer to section 5 of Incorporating Safety Management Modelling into NZ-dTIMS, May 2016.

Assumptions

The following assumptions were made for planning purposes. For more detailed explanation of the modelling assumptions refer to the Technical Reports.

- No inflation included in costs
- No increase in network length or configuration due to capital projects
- No change in traffic mix i.e. assumed no increase in percentage of heavy vehicles (HPMV)
- Based on current growth projections of 1 – 1.5% per annum.

Limitations

The modelling methodology has the following recognised limitations:

- Asphalt – An increasing quantum of New Zealand's Roads of National Significance (RONS) are being surfaced in asphalt, which costs a similar amount to a rehabilitation. This resurfacing has been included in the modelling. Over the next 20 years, most of this length of new asphalt will require its first renewal, contributing to the predicted long term increase in investment. Future growth in asphaltic surfaces has not been included in the modelling.
- Targets for low volume roads – The technical performance targets used in the modelling have been set to align with the intent of ONRC levels of service for differing classes of road, but the targets are untested. There is a risk the target set for low volume roads are overly optimistic, allowing too much deterioration with potential for pavements to deteriorate beyond acceptable levels. It is expected these targets will be reviewed within the next 3 years to assess the accuracy and may need to be adjusted accordingly.
- Maintenance – the level of maintenance required was not modelled. The maintenance budgets recommended in this business case are based on current levels. It is intended to develop robust maintenance modelling in the future.

Appendix 1 Average annual investment by corridor

		Annual Average Investment ($m)				Pavement Condition			
Corridor	Total Area	Surface	Pavement	Safety	Routine	*Good 2016*	*Good 2025*	*Poor 2016*	*Poor 2025*
Urban Auckland	3,917,634	8.02	0.28	0.37	0.56	89%	82%	1%	4%
Piarere to Tauranga	878,827	0.93	0.68	0.11	0.22	44%	64%	17%	11%
Auckland to Whangarei	2,371,391	1.86	2.35	0.32	0.50	33%	56%	29%	12%
Wellington to Palmerston North	2,309,536	2.63	1.33	0.24	0.46	67%	72%	8%	4%
Pokeno to Tauranga	2,879,774	2.82	1.88	0.27	0.87	33%	46%	32%	24%
Auckland to Levin	7,473,729	4.58	7.47	0.56	1.45	33%	62%	28%	9%
Christchurch to Dunedin	4,358,041	2.97	2.02	0.40	0.93	48%	66%	17%	7%
Picton to Christchurch	3,878,388	2.64	1.73	0.24	0.88	47%	66%	12%	5%
Wellington to Woodville	2,167,808	2.01	0.26	0.06	0.36	67%	70%	9%	8%
Access to Rotorua from N.S.E.W	4,290,668	2.58	1.84	0.15	1.61	25%	36%	30%	19%
Port Chalmers to Bluff	3,118,671	1.90	1.12	0.28	0.77	25%	36%	36%	25%
New Plymouth to Palmerston North	2,575,668	1.64	1.00	0.08	0.77	25%	41%	33%	19%
Tauranga to Gisborne	2,677,845	1.30	1.21	0.06	0.67	31%	45%	19%	10%
Hamilton to New Plymouth	2,684,770	1.44	0.85	0.24	0.80	43%	53%	18%	12%
Blenheim to Collingwood	2,262,861	1.79	0.16	0.17	0.60	48%	53%	8%	6%
Whangarei to Kaitaia	2,939,432	1.47	0.85	0.32	0.82	27%	28%	36%	38%
Palmerston North to Napier/Gisborne	4,682,819	2.24	1.05	0.33	0.81	50%	58%	13%	9%
Napier to Taupo	1,126,787	0.45	0.33	0.08	0.25	25%	39%	34%	23%
Christchurch to Kumara	1,797,359	0.99	0.23	0.08	0.38	56%	67%	5%	5%
Raglan to Hamilton to Coromandel	4,978,349	2.79	0.43	0.34	1.36	48%	52%	13%	10%
Opotiki to Gisborne	2,416,134	1.30	0.36	0.05	0.60	40%	45%	17%	16%
Nelson to Queenstown	7,347,354	3.79	0.63	0.18	1.66	48%	62%	11%	7%
Northland Primary Collectors	3,268,396	1.46	0.25	0.15	0.87	36%	31%	27%	36%
Northern Arterial and Primary Collector cluster	3,261,099	1.64	0.14	0.07	0.69	63%	68%	4%	4%
Milton to Queenstown	1,404,905	0.50	0.15	0.08	0.31	35%	40%	18%	17%
Central Group West	6,119,796	2.86	0.12	0.20	1.80	47%	51%	15%	10%

Corridor	Total Area	Surface	Pavement	Safety	Routine	*Good 2016*	*Good 2025*	*Poor 2016*	*Poor 2025*
Southern Arterial and Primary Collector cluster	6,694,494	2.87	0.29	0.31	1.70	48%	52%	13%	13%
Cromwell to Rangitata	3,512,972	1.62	0.09	0.08	0.74	44%	55%	12%	7%
Queenstown to Milford Sound	2,422,270	0.93	0.11	0.11	0.54	40%	54%	17%	11%
Waipara to Inungahua	1,869,562	0.74	0.01	0.04	0.35	47%	54%	9%	4%
Total	**97,632,147**	**64.75**	**29.22**	**5.95**	**24.30**				