



Pavement Delivery System Review

Workstream 2: Whole of Life

PDSR Authors

1 November 2022

V1 Final

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1.0 Purpose of this Report

The ‘Review of State Highway Pavement Delivery’ report was communicated to the New Zealand Pavement Industry by Waka Kotahi in March 2020. This holistic and collaboratively sourced review examined the steps Waka Kotahi and the wider industry could take to improve their collective performance in the end-to-end delivery of new and rehabilitated pavement construction in New Zealand. The review was guided by Waka Kotahi’s value for money investment principle; *“the delivery of the right outcomes, at the right time, at the right cost and financed at the right level of risk”*.

Whilst the review was not expected to generate a fundamental change to systems and processes, it did identify areas where further focus, refinement and discipline would improve design, delivery and reliability confidence. Opportunities to improve, clarify and supplement existing pavement specifications, design processes and construction delivery were also highlighted. These opportunities were summarised within nine recommendations that were subsequently endorsed by Waka Kotahi. The recommendations of the Report are summarised in Figure 1.

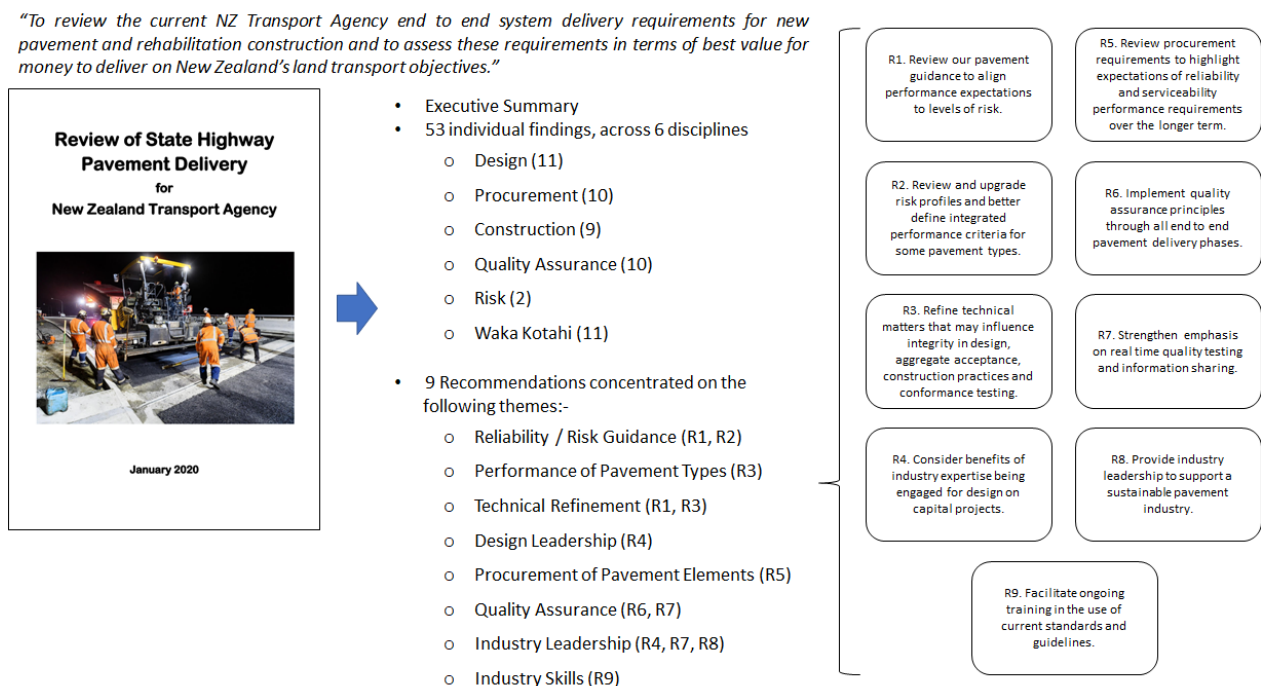


Figure 1: A summary of the outputs from the ‘Review of State Highway Pavement Delivery’ report.

An Industry Steering Group was then established to plan, resource and enable the implementation of the nine recommendations. The Industry Steering Group, shown in Figure 2, is chaired by Janice Brass of Waka Kotahi and is supported by senior industry representatives across its seven targeted Workstreams.

- Workstream 1 – Technical Matters
- **Workstream 2 – Whole of Life**
- Workstream 3 – Procurement
- Workstream 4 – Strategic Risks
- Workstream 5¹ - Z1 & Z8 Awareness
- Workstream 6 – Industry Capability
- Workstream 7 – Cross Industry Communications

¹ In June 2022, the Steering Group agreed to combine the outputs of a separate workstream, targeting improved awareness of Z01 and Z08 quality related documentation, into the scope of Workstream 5 – Quality of Project Delivery.

2.0 Structure of this Report

This report contains a record of the work undertaken by the Workstream 2 Team. It is comprised of four sections and an Appendix. The section titles and their contents are described in Figure 3 below:-

Section Title	Content
1: Purpose of this Report	Describes the creation and purpose of the seven Workstreams operating under the Pavement Design System Review (PDSR) Steering Group.
2: Structure of this Report	Demonstrates the structure of the report, typically comprising background information, headline findings and recommendations.
3: Executive Summary	Waka Kotahi commissioned Beca Ltd to review of the Whole of Life (WOL) cost analysis for pavements with a view to determining a consistent and evidence-based approach to WOL cost analysis for pavements, especially in the Network Outcome Contract (NOC) environment. The Executive Summary of the Beca Ltd report is provided for reference in Section 3.
4: Required Responses	A summary of the Required Responses determined by the PDSR Steering Group, following their review of the Beca Ltd report.
Appendix 1	A full copy of the Beca Ltd report 'Pavement Economic Analysis: Whole of Life Costs' dated 1 July 2022 is provided in Appendix 1.

Figure 3: Report structure

2.1 Prioritisation of Required Responses:

The Required Responses made by the Technical Matters Workstream are presented in this report.

Given that each of the separate workstreams described in Figure 2 is challenged to produce its own report, and recognising that some considerations between these workstreams overlap, the decision has been made by the Steering Group to consider and prioritise the Required Responses as a whole, once all reports are complete. The full list of prioritised Required Responses, complete with the Implementation Plan describing their enactment, is provided within an overarching PDSR Steering Group Report, titled **PDSR Summary Report** which is accessible via this [link](#).

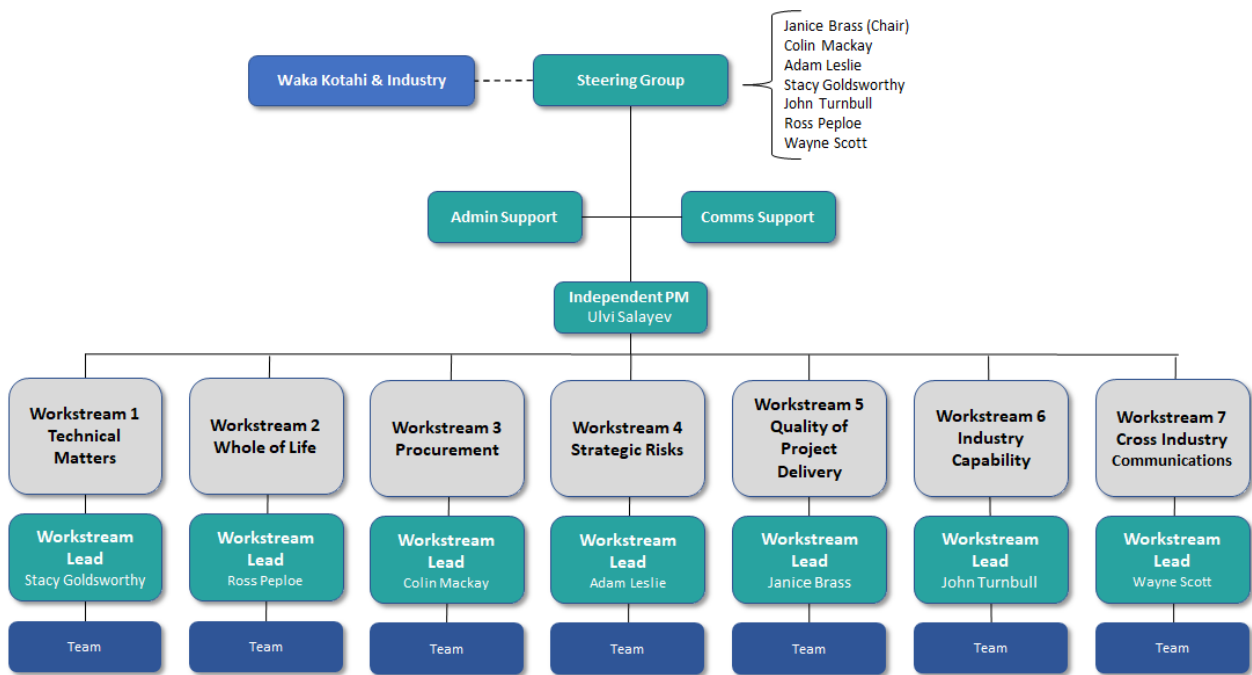


Figure 2: The structure of the Industry Steering Group, showing the Workstream 6: Industry Capability Team

The Workstream 2 Team were tasked to rationalise Whole of Life (WoL) principles and practices and challenge net present value (NPV) sensitivities to ensure risks are minimised for best economic efficiency. The team were also asked to consider what steps could then be taken to improve the process for raising awareness on these key principles, within the industry.

3.0 Executive Summary

Waka Kotahi commissioned Beca Ltd to review of the Whole of Life (WOL) cost analysis for pavements with a view to determining a consistent and evidence-based approach to WOL cost analysis for pavements, especially in the Network Outcome Contract (NOC) environment. The Executive Summary of the Beca Ltd report is provided below. A full copy of the Beca Ltd report is provided in Appendix 1.

Economic Whole of Life (WOL) analyses are carried out to calculate a Net Present Value (NPV) to determine the difference between the present values of the various pavement treatment options available, over a 30-year analysis period. In essence it assesses which strategy (i.e., maintain, heavy maintenance, renewal option) provides the best return on investment for the Agency, and its stakeholders. The outcomes of the analyses are very sensitive to many of the inputs which are largely subjective and based on the experience of the design engineer.

The Waka Kotahi NZ Transport Agency (Waka Kotahi) “Review of State Highway Pavement Delivery” report identified several opportunities for improvement. The report states that with respect to the Network Outcomes Contract (NOC) environment “the principles and economics of WOL maintenance regimes are not well understood across the industry”.

Waka Kotahi commissioned Beca Ltd to review of the WOL Cost analysis for pavements with a view to determining a consistent and evidence-based approach to WOL cost analysis for pavements, especially in the NOC environment. The report details the examination of data in RAMM regarding seal life cycles and pavement maintenance requirements under different traffic loading environments, pavement condition scenarios and risk profile of the pavement treatment.

Where trends have been identified, these generally validate what was previously considered anecdotal evidence of pavement WOL periodic and reactive maintenance requirements. The exception is the level of maintenance effort following rehabilitation treatments has historically been considered as negligible, however, there is good evidence to indicate that is not the case for high-risk treatment options. The results of the analyses carried out can be used to help standardise inputs into the WOL cost analysis and NPV calculation and example analyses using the suggested inputs have been provided. The proposed inputs should be considered as providing a consistent starting point for an NPV calculation and local knowledge should be used to alter these where appropriate.

Outputs from the analyses carried out in this project have resulted in the recommendations for the following:

- Resurface cycle time for the do-minimum option
- Surfacing cycle times following different rehabilitation treatment options
- Maintenance costs calculation for the do-minimum option
- Maintenance costs calculation after rehabilitation treatment options
- Flow charts on how to apply the above outputs in the NPV process

The report does not recommend any change to the procedure specified in the Monetised Benefits and Costs Manual (Aug. 2021) but provides guidance on how to determine future seal life cycles, pavement treatment life cycles and maintenance costs for all options including the do-minimum. This review does not address the selection of candidate pavement treatments because guidance is given regarding the choice of suitable

treatments in the relevant Waka Kotahi guides and instructions, but instead focuses on determining suitable maintenance strategies for each option considered in the NPV.

Should Waka Kotahi choose to update the NPV instructions and spread sheet application provided, this report provides a specification for that process.

4.0 Required Responses

A total of five Required Responses have been determined by the PDSR Steering Group, following their review of the Beca Ltd report, provided in Appendix 1.

Required Response WS2.1

Expand on the current work to include NPV calculations for pavements with a thin asphalt surface, and for structural asphalt pavements.

Required Response WS2.2

Carry out a wider assessment of the use of the proposed NPV input parameters using actual project information taken from a range of NOCs.

Required Response WS2.3

Adopt the proposed input parameters for calculation of NPVs for chip sealed unbound granular (or modified granular) pavement treatments (based on satisfactory results from Required Response WS2.1).

Required Response WS2.4

Resolve that NPV figures should be used in terms of a ranking tool as opposed to a pass/fail criterion.

Required Response WS2.5

Develop a Technical Advice Note (TAN) and deliver training to designers and Waka Kotahi staff with respect to the proposed NPV input parameters.

Appendices

Appendix Number	Content
App. 1	Beca Ltd report 'Pavement Economic Analysis: Whole of Life Costs' dated 1 July 2022