Peer Review: State Highway 5 Rangitaiki to Esk Valley Speed Reduction Review undertaken by EY

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1 Introduction and Background

The SH5 Rangitaiki to Esk Valley speed reduction was implemented by Waka Kotahi in February 2022. Partly in response to community views concerning speed limit reductions at that time, an independent review of the outcomes of the speed reduction was commissioned by Waka Kotahi and undertaken by EY.

This report provides an independent peer review of the EY SH5 Rangitaiki to Esk Valley Speed Reduction Review.

2 Scope and Purpose of the Peer Review

Generally, the purpose of an independent peer review is to reduce the risks that projects either do not deliver on the outcomes forecast, or they fail to deliver the outcomes at the level of efficiency and effectiveness stated. In essence, the EY Review provides this level of assurance for the SH5 Rangitaiki to Esk Valley speed reduction. Therefore, this Peer Review provides a second level of assurance, for what is an important issue to the community and road users.

This Peer Review focuses on the conformity of the EY Review with best practice and relevant guidelines. To assist in this, the review is undertaken where possible with reference to the standard Waka Kotahi economic assessment framework as set out in the Monetised Costs and Benefits Manual (MBCM) and Waka Kotahi Knowledge Base. The tests to be included within an independent peer review which are relevant here include:

- Economic methodology – scope of benefits, assumptions and input parameters.
- Validity and reliability of input data.
- Consideration of alignment with the methodology applied in other similar reviews.
- Additionally, the review also considers:
    - Whether the evidence provided supports and aligns with the findings of the Review.
    - Whether there are any clarifications needed to ensure that readers are very clear about the approach, assumptions, methodology and results.

3 Introduction

3.1 Structure of this Peer Review

To ensure easy reconciliation with the EY Review this Peer Review follows the section by section structure of the EY report. The review then pulls together the main observations in the concluding section.

3.2 Background Context (Section 1.1)

Geographical scope of the EY Review. It is noted that the EY Review refers "to the specific segment that was affected by the 2022 speed limit reduction as SH5" (the segment of State Highway 5 (SH5) that lies between Rangitaiki and Esk Valley).

- **Comment:** Did EY also look at changes in speed and crashes on the remaining sections of SH5 between Taupo and Napier as part of their review? If so, it might be helpful to report the findings? I suspect this question may be raised by other readers of the Review.

Other Interventions: It is noted by EY that "[I]n addition to performing the speed review, the Agency has provided further investment, which was used to install side barriers, road markings, and maintain the overall roading quality to improve safety outcomes."

- **Comment** Has it been considered and is it possible that these interventions have made some contribution to the reduction in crashes on the section of SH5 where the speed reduction has been implemented? I wasn't able to definitively determine this from my reading of the Review and it would be helpful to clarify this point as again, I suspect it may be raised by other readers.

Scope of the economic assessment: It is noted that the EY report provides a clarification that it is not a full business case nor an economic forecast of future outcomes.

> **Comment**: This is a helpful point to make. As the Review is not an economic forecast of future outcomes then the application of Waka Kotahi's economic assessment methodology can only be done within the context of the observed data/outcomes. So for example, there is no attempt by EY to project future costs and benefits, to discount these back to a present value or to produce a benefit cost ratio. I agree that the reliance solely on observed evidence is the correct approach for the Review to adopt.

3.2 Driver Behaviour (Section 1.2)

I concur with EY that this section provides a useful context and I note the difficulty of measuring compliance with speed limits. My main observations on this section are as follows:

- Firstly, the box and whisker plots indicate a degree of variability from year to year, particularly for the range of driver speeds.
    - **Comment**: Is this something that needs further explanation/elaboration in the report?
- Secondly, it is noted that the 'the speed limit change did not significantly affect compliance within the group of drivers involved in a crash on SH5'.
    - **Comment**: I would say it appears from the data to have had no effect at best, given that the upper quartile of drivers in 2022 were above the speed limit and this is the same as for 2018 and 2020 and worse than 2019 and 2021. Albeit in 2022, drivers were required to comply with a lower speed limit.

- Figure 3 reports the distribution of the estimated freeflow speed for SH5 for 2020 and 2023 (post the speed reduction):
    - **Comment**: It would help to clarify the precise geographical location that the MegaMaps data refers to. I am assuming this covers just the section of SH5 over which the speed restriction applies, but this is not clearly stated. I also not that in Figure 3 the max plot appears to be missing for 2023.
    - **Comment**: The data indicates that prior to the speed limit reduction, 75% of observed freeflow speeds were 90 km/h or less, well below the 100 km/h speed limit. Although freeflow speeds have fallen slightly post the speed limit reduction, there now appears to a significant level of disregard for the new, lower speed limit. This partly explains the small reduction in observed average speed. When linking this observation to the later analysis of transport dis-benefits associated with the speed limit reduction, it would pay to include a sensitivity test based on a lower freeflow speed, on the assumption that over time drivers may well become more compliant with the new speed limit (which would be expected to increase the dis-benefits).

3.3 MBCM Updates (Section 1.3)

The clarification of the reliance on the updated MBCM parameters and values is helpful. I concur with the use of the updated values for the assessment and also note that it is helpful that a sensitivity test using previous values is provided for comparison. This can be considered a 'best practice' approach.

4 Methodology (Section 2)

The EY review considers the costs and benefits of the safety and economic impacts of the speed reduction on the region. It does so by applying as much as possible a range of reliable data sources to related to crashes and speed and by using methodologies and values derived from accepted guidelines, primarily the Waka Kotahi Monetised Benefits and Costs Manual.

- **Comment**: On this basis, the EY Review can be considered an evidence based assessment, using industry accepted practices. This an important point to make clear to readers.

4.1 Data Collation (Section 2.2)

I concur with EY that the Waka Kotahi CAS and MegaMaps data is largely robust, noting the limitations identified and that overall, this is the most reliable data available the purpose of the EY Review.

4.2 Statistical Analysis (Section 2.3)

The EY Review applies "a statistical methodology in order to isolate the effect that is associated with the speed limit change, rather than conflating any potential impacts that may rise from a change in other variables."(Review, p11.) I agree that this is a valid approach to use for this review.

- **Comment**: As I noted in my earlier comment, a number of other safety interventions have also been made to the section of SH5 where the speed reduction has been implemented. It might be helpful to clearly differentiate the effect of these interventions on the frequency and severity of crashes, separately from the speed reduction.

EY note that with the speed limit change only being in effect for one year at the time of analysis, this "limits their ability to perform the t-test (and by extension, the z-test), both of which are a traditional methodology for hypothesis testing."

- **Comment**: I note that these tests could potentially be applied at some point in the future. They may also be applied to other parts of the State Highway network where speed reductions have been in place for a sufficiently long time.

- **Comment**: I concur with the probability distribution approach adopted for the study.

Need for more explanation around the estimation of the reduction in crashes:

The data reported in Figure 4 and the following paragraph (para 1 on p12) combined with Table 1 form the core of the evidence around the reduction in crashes arising from the speed limit reduction. But this information requires quite detailed inspection in order to deduce the impact of the speed limit reduction on the number of crashes. For example, Figure 4 identifies the mean number of crashes between 2018 and 2021 as being 59. The next paragraph then states:

> "The analysis suggests that, for a given year in which the speed limit was set at 100km/h for SH5, one would observe an annual crash count of 25 or lower roughly 1% of the time. It is, therefore, highly unlikely that such a crash count would be caused by random chance or variation."

But this section doesn't explain why an annual crash count of 25 might be relevant. Only on reading Table 1 on the following page is this explained, via the mean reduction in crashes of 34 (59 - 34 = 25 crashes). On the other hand, I note that the Executive Summary very clearly states:

> "Analysis found that the speed limit change on SH5 both reduced the frequency of crashes and decreased the severity of injuries that would result from a crash. **Approximately 34 crashes were avoided in the year following introduction of the speed limit change,** based on statistical analysis against a comparable prior year."

In my view Sections 2.3.1 and 2.3.2 would benefit from some re-ordering, with Table 1 integrated into Figure 4, with a clear reference to the reduction in the number of crashes post the speed limit reduction (as per the Executive Summary). But, more importantly, as this finding is at the core of the safety benefits it would also be useful to provide a more detailed description of the data and analysis which leads to the finding that 34 crashes were avoided in the year following introduction of the speed limit change.

Comment: **This is probably the most important point made in my review.**

Comparison of the SH5 speed reduction to similar parts of the State highway network:

Figure 1 illustrates the geographical extent of the speed reduction on SH5 between Taupo and Napier and the extent to which the 100 km/h limit has been retained. This raises two points:

- It would be helpful if EY were to confirm in their Review whether the crash data referred to in Section 2.3 is related only to the section of SH5 over which the speed reduction has been imposed?
- If this is the case, then I note in Section 2.3.1 the references to undertaking robustness checks on other comparable parts of the State Highway network (e.g. sections of SH39, SH3, SH1). However, I cannot see any reference to crash data for 2022-2023 for the sections of SH5 where the speed limit has not been reduced. I would think that a comparison of the crash data between the different sections of SH5 (i.e. the section with reduced speed compared to the section without reduced speed) would be the most relevant test and that those interested in the outcomes of the speed reduction would be looking for this information. If this test has not been undertaken it would be worthwhile considering adding this to the review.
- **Comment: Inclusion of a clear an assessment of the number of crashes on the sections of SH5 between Taupo and Napier not covered by the speed reduction and comparison of the 2022/23 results with the section of SH5 where the speed reduction applies.**

4.3 Econometric Analysis (Section 2.3.2)

Value of Crashes:

- I have checked the values applied to different types of crash events the accompanying spread sheet with the most recent MBCM values as follows:

Table 4.1: Value of Crashes

Event	Value in Spreadsheet	Comment
Death	$12,500,000	As per MBCM Updated
Serious Injury	$660,100	As per MBCM Updated
Minor Injury	$68,000	As per MBCM Updated

- I concur with the methodology used in this Section, but what is missing in my view is a clear summary of the combined assessment of the value of avoided crashes ($31.8m) plus the value of the reduced severity of crashes ($61.9m) leading to the total benefit of $93.7m. The Executive Summary provides such a clear summary of these results, but this is not included in the actual detail of the review.

> "*Approximately 34 crashes were avoided in the year following introduction of the speed limit change, based on statistical analysis against a comparable prior year. We estimate the monetised value of each avoided crash to be $0.9m based on Waka Kotahi appraisal tools, which when applying the number of average avoided crashes will be equivalent to $31m for a full year. In addition, the reduction in the severity of a crash is equivalent to $3.2m (equivalent to approximately one quarter of a fatality). For the observed year, we see a benefit of $62m from reduced crash severity. This results in total safety benefits of $93 million for the year.*"

For readability it would be helpful to provide this (or a version of this) summary at the end of section 2.3.2.

4.4 Cost Benefit Analysis (Section 2.4)

The approach used to estimate the transport related costs and benefits of the speed reduction considers

- Vehicle operating costs (VOC)
- Emissions
- Travel time

The approach is described as being consistent with the methodologies set out in the MBCM and is therefore in line with standard industry practice.

Specific Checks:

- Section 2.4 Corridor length of 76 km. **Confirm whether this is the length of the section covered by the speed reduction**.
- Section 2.4.1: Splitting VKT by vehicle type using the fleet profile in the VEPM. This is an acceptable way of disaggregating overall VKT into vehicle type. I have checked this approach against the Waka Kotahi State Highway Traffic Volume, for the proportion of heavy vehicles. The EY Review assumes that 6.1% of all traffic are heavy commercial vehicles. I note that in 2020 The Te Pohue telemetry site (roughly at the mid-point between Taupo and Napier) observed a heavy vehicle split of 16.5% between 2016 and 2020. The average proportion of heavy vehicles across all telemetry State Highway sites over this period was 9.1% in 2020. So it might be the case that the VEPM data reflects a lower proportion of heavy vehicles. However, I do not believe the effect on the results of the assessment would be very significant if this was the case and an adjustment was made to reflect the telemetry site data.

  Table 4.2: Proportion of Vehicle Types

Vehicle Type	EY Assumption	SH Telemetry
Private Car	69.1%	
Light Commercial	24.1%	
Medium Commercial	0.0%	
Heavy Commercial (1)	3.7%	16.5%
Heavy Commercial (2)	2.4%	
Bus	0.7%	

- I note that the growth factor for VKT is assumed to be zero from 2020/21. This is an appropriate assumption and as this is a point in time assessment, rather than a future projection changing this assumption will have little impact on the result.
- Section 2.4.1: From my observation of the accompanying excel spreadsheet, the appropriate VEPM data for emissions (2022 Fleet average emission factors) are applied.

- Section 2.4.2: From my observation of the accompanying excel spreadsheet, the appropriate MBCM values have been applied to monetise the value of the impact on emissions (emissions cost)

- Section 2.4.2: I note the three scenarios tested. **It might be helpful to test a fourth 'worst case' scenario comprising the pre reduced speed limit high freeflow speed (95km/h) and post speed limit low freeflow speed (73 km/h). just to show what effect this would have. I presume it would only be small.**

- Section 2.4.3: The use of the MBCM and VEPM values/inputs/effect sizes is appropriate and done correctly. I note the speed adjustment for HCVs for the pre speed reduction, again this is appropriate. Overall, the effect on the monetised value of emissions, even under the updated MBCM values is marginal. This is as expected.

- Section 2.4.4: As per Section 2.4.2, I would suggest undertaking a **fourth, 'worst case' scenario.** It might be worth noting too that if enforcement is effective at bring freeflow speed down to at or below the new limit, then it would be expected that travel time disbenefits will increase, but then so too would the safety benefits.

4.5 Qualitative Impacts

I have not examined these in detail, as they do not contribute to the monetised results, but this is useful for completeness and I support the logic of including these points.

5 Summary

This Peer Review has considered the conformity of the EY Review with best practice and relevant guidelines. The Peer Review finds that in general the EY Review is consistent with relevant guidelines and methodologies, such as Waka Kotahi's Monetised Benefits and Costs Manual and can therefore be considered to be best practice.

The EY Review would benefit from a number of relatively small changes, including:

- A more detailed explanation around the estimation of the reduction in crashes due to the speed reduction

- The inclusion of a more comprehensive explanation around the estimation of the reduction in crashes due to the speed reduction.

Overall the EY SH5 Rangitaiki to Esk Valley Speed Reduction Review can be considered to be a reliable, evidence based assessment of the effects of the SH5 speed reduction on the number and severity of crashes and on travel time, vehicle operating costs and vehicle emissions.

The main finding of the EY Review, that the benefits of a reduced number and severity of crashes outweighs the economic costs arising from increased travel time can be considered to be correct.

Table 5.1: Summary of Peer Review Comments

	Summary of Comments	Importance
1	**Geographical scope of the EY Review.** EY Review refers "to the specific segment that was affected by the 2022 speed limit reduction as SH5" (the segment of State Highway 5 (SH5) that lies between Rangitaiki and Esk Valley). • Did EY also look at changes in speed and crashes on the remaining sections of SH5 between Taupo and Napier as part of their review? If so, it might be helpful to report the findings? I suspect this question may be raised by other readers of the Review.	**M**
2	**Other Interventions:** EY note that "[I]n addition to performing the speed review, the Agency has provided further investment, which was used to install side barriers, road markings, and maintain the overall roading quality to improve safety outcomes." • Has it been considered and is it possible that these interventions have made some contribution to the reduction in crashes on the section of SH5 where the speed reduction has been implemented? It would be helpful to clarify this point as again, I suspect it may be raised by other readers.	**M**

3	**Driver Behaviour:**
	• Firstly, the box and whisker plots indicate a degree of variability from year to year, particularly for the range of driver speeds. Is this something that needs further explanation/elaboration in the report?
	
	• Secondly, it is noted that the 'the speed limit change did not significantly affect compliance within the group of drivers involved in a crash on SH5'. I would say it appears from the data to have had no effect at best, given that the upper quartile of drivers in 2022 were above the speed limit and this is the same as for 2018 and 2020 and worse than 2019 and 2021. Albeit in 2022, drivers were required to comply with a lower speed limit.
	
	• Figure 3 reports the distribution of the estimated freeflow speed for SH5 for 2020 and 2023 (post the speed reduction):
	  ○ It would help to clarify the precise geographical location that the MegaMaps data refers to. I am assuming this covers just the section of SH5 over which the speed restriction applies, but this is not clearly stated.
	  ○ I also not that in Figure 3 the max plot appears to be missing for 2023.
	
	The data indicates that prior to the speed limit reduction, 75% of observed freeflow speeds were 90 km/h or less, well below the 100 km/h speed limit. Although freeflow speeds have fallen slightly post the speed limit reduction, there now appears to a significant level of disregard for the new, lower speed limit. This partly explains the small reduction in observed average speed. When linking this observation to the later analysis of transport dis-benefits associated with the speed limit reduction, it would pay to include a sensitivity test based on a lower freeflow speed, on the assumption that over time drivers may well become more compliant with the new speed limit (which would be expected to increase the dis-benefits).
		L
		
		M
		
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		M

4	**Methodology:** The EY Review can be considered an evidence based assessment, using industry accepted practices. This an important point to make clear to readers.	
5	**Statistical Analysis**	

	The EY Review applies "a statistical methodology in order to isolate the effect that is associated with the speed limit change, rather than conflating any potential impacts that may rise from a change in other variables."(Review, p11.) I agree that this is a valid approach to use for this review. • As I noted above, a number of other safety interventions have also been made to the section of SH5 where the speed reduction has been implemented. It might be helpful to clearly differentiate the effect of these interventions on the frequency and severity of crashes, separately from the speed reduction. EY note that with the speed limit change only being in effect for one year at the time of analysis, this "limits their ability to perform the t-test (and by extension, the z-test), both of which are a traditional methodology for hypothesis testing." • **Comment**: I note that these tests could potentially be applied at some point in the future. They may also be applied to other parts of the State Highway network where speed reductions have been in place for a sufficiently long time. • **Comment**: I concur with the probability distribution approach adopted for the study.	**H** **M**
6	**Need for more explanation around the estimation of the reduction in crashes:** The data reported in Figure 4 and the following paragraph (para 1 on p12) combined with Table 1 form the core of the evidence around the reduction in crashes arising from the speed limit reduction. But this information requires quite detailed inspection in order to deduce the impact of the speed limit reduction on the number of crashes. For example, Figure 4 identifies the mean number of crashes between 2018 and • In my view Sections 2.3.1 and 2.3.2 would benefit from some re-ordering, with Table 1 integrated into Figure 4, with a clear reference to the reduction in the number of crashes post the speed limit reduction (as per the Executive Summary). • But, more importantly, as this finding is at the core of the safety benefits it would also be useful to provide a more detailed description of the data and analysis which leads to the finding that 34 crashes were avoided in the year following introduction of the speed limit change. **This is probably the most important point made in my review.**	**H** **H**
7	**Comparison of the SH5 speed reduction to similar parts of the State highway network:** Figure 1 illustrates the geographical extent of the speed reduction on SH5 between Taupo and Napier and the extent to which the 100 km/h limit has been retained. This raises two points: • It would be helpful if EY were to confirm in their Review whether the crash data referred to in Section 2.3 is related only to the section of SH5 over which the speed reduction has been imposed? • If this is the case, then I note in Section 2.3.1 the references to undertaking robustness checks on other comparable parts of the State Highway network (e.g. sections of SH39, SH3, SH1). I would think that a comparison of the crash data between the different sections of SH5 (i.e. the section with reduced speed compared	

	to the section without reduced speed) would be the most relevant test and that those interested in the outcomes of the speed reduction would be looking for this information. • **Inclusion of a clear an assessment of the number of crashes on the sections of SH5 between Taupo and Napier not covered by the speed reduction and comparison of the 2022/23 results with the section of SH5 where the speed reduction applies.**	**H**
8	**Value of Crashes:** I concur with the methodology used in this Section, but what is missing in my view is a clear summary of the combined assessment of the value of avoided crashes ($31.8m) plus the value of the reduced severity of crashes ($61.9m) leading to the total benefit of $93.7m. The Executive Summary provides such a clear summary of these results, but this is not included in the actual detail of the review. "*Approximately 34 crashes were avoided in the year following introduction of the speed limit change, based on statistical analysis against a comparable prior year. We estimate the monetised value of each avoided crash to be $0.9m based on Waka Kotahi appraisal tools, which when applying the number of average avoided crashes will be equivalent to $31m for a full year. In addition, the reduction in the severity of a crash is equivalent to $3.2m (equivalent to approximately one quarter of a fatality). For the observed year, we see a benefit of $62m from reduced crash severity. This results in total safety benefits of $93 million for the year."* For readability it would be helpful to provide this (or a version of this) summary at the end of section 2.3.2.	**H**
9	**Section 2.4** Corridor length of 76 km. Confirm in the report whether this this the length of the section covered by the speed reduction	**M**
10	**Section 2.4.2:** It might be helpful to test a fourth 'worst case' scenario comprising the pre reduced speed limit high freeflow speed (95km/h) and post speed limit low freeflow speed (73 km/h). just to show what effect this would have. I presume it would only be small.	**M**
11	**Section 2.4.4:** As per Section 2.4.2, I would suggest testing a fourth, 'worst case' scenario.	**M**