Safe Speeds Tranche 1 Monitoring and Evaluation Analysis

Auckland Transport

Transport + Location Intelligence

AT Safe Speeds Tranche 1 Monitoring and Evaluation Analysis

Auckland Transport

Quality Assurance Information

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Executive Summary

On 30 June 2020, Auckland Transport implemented Tranche 1 of the Safe Speeds Programme. This first phase set safe and appropriate speed limits on approximately 11% (over 800km) of Auckland's local road network.

To assess the effectiveness of the Tranche 1 changes, help determine what is working well and where further road safety measures are required, Auckland Transport has engaged Abley Limited (Abley) to undertake monitoring and evaluation of the first 18-months since the changes came into effect.

This report addresses the following areas within the Safe Speeds Monitoring and Evaluation Plan:

- Deaths and serious injuries (DSI)
- Driver travel speeds and traffic volumes
- Compliance with the new speed limits

The analysis includes a combination of crash data, speed data and the use of predictive models to draw conclusions on the effectiveness of the Tranche 1 changes to date.

It is important to note that road trauma does fluctuate over time, therefore changes in road trauma between years is expected and ongoing programme monitoring will continue to be required.

After the first 18-months, the Tranche 1 roads have experienced a reduction in DSI crashes of 16.9%, a decrease in fatal crashes of 35.5% and a reduction in serious injuries crashes of 15.0%.

Rural roads have seen the most significant reduction in road trauma, with a reduction in rural road DSIs crashes of 28.6%. Urban roads have seen only a small reduction in DSI crashes to date of 6.4%.

When taking into account control sites, consisting of the balance of the Auckland road network not subject to a speed limit change, the analysis was able to determine a more accurate representation of the change in crash risk. The difference between the control sites and the Tranche 1 sites showed:

- 42.3% reduction in fatal crashes compared to what would have been expected if no changes to speed limits was made;
- 5.5% reduction in DSI crashes;
- 17.5% reduction in Minor injury crashes; and
- 15.1% reduction in all injuries.

It is noted that these figures differ from those calculated immediately following the completion of the 18-month period. This is due to data changes within the national Crash Analysis System (CAS), where, because of COVID related delays, not all crashes had been updated into CAS at the time of the initial analysis. Thus, this report better reflect the actual change in crashes.

As part of the analysis, the social cost of injury crashes for each road has been mapped. This provides a visual aid to assist Auckland Transport in identifying areas or individual roads for closer monitoring and review based upon the level of road trauma.

Driver travel speeds were analysed with a combination of tube counts and geospatial (TomTom) data, which includes actual recorded driver speeds, travel times and traffic density.

Two time periods were analysed as part of the geospatial (TomTom) data analysis, one five months after the changes (November 2020) and the second 20 months after the changes (February 2022). The November 2020 analysis compared November 2020 to November 2019 data and the February 2022 analysis compared February 2022 data with February 2020 data.

The November 2020 analysis showed an average vehicle speed reduction at the Tranche 1 locations of 3.4%, and the February 2022 analysis an average speed reduction of 2.7%. This is similar across both time periods.

Using road trauma prediction models and not considering the control group, these reductions in average vehicle speed would be anticipated to result in a long-term DSI crash reduction of between 7.7% - 8.5%.

Rural roads saw an average reduction of between 4.8% and 5.0% in average vehicle speed, with urban roads experiencing minimal change as a whole.

Speeds at control sites were also analysed using the same comparison periods. This showed an increase in average vehicle speed of 1.6% (November 2020) and 2.4% (February 2022) on the wider Auckland road network.

Considering the control group, the trauma prediction models used in the February 2022 analysis determined that the change in speed would result, on average, in an 13.5% decrease in death and serious injury crashes, compared to no speed limits being changed (7.7% decrease in deaths and serious injuries predicted from the effected group + 5.8% decrease in deaths and serious injuries predicted from the control group).

Due to the small after period in the crash data, this TomTom speed analysis is considered the best representation of the decrease in deaths and serious injuries.

Traffic volumes

At the tube count sites, measured traffic volumes were on average 24% lower when measured mid-2021 than before 30 June 2020. This is expected to have a negative correlation with driver speed, i.e. less traffic volume resulting in increased vehicle speeds, all other things being equal.

Compliance

When compared against the monitoring and evaluation targets:

- 8.4% of measured mean speeds are more than 5km/h above the posted speed limit (target = 0%)
- 33.7% of the 85th percentile speeds are more than 10% above the speed limit (target = 0%)

Compliance is generally good in the northern and western rural areas, mixed in the southern rural area and relatively poor within the city centre, with many city centre streets having an 85% percentile speed 10% or more above the speed limit.

COVID-19 influence

During the 18-months evaluation period, traffic volumes were abnormal across the local road network due to the ongoing impact of COVID-19. This has influenced the level of road congestion, the speed of vehicles traversing the network, and road user risk.

Overseas research has indicated that reduced COVID traffic volumes and less congestion have generally resulted in less crashes overall, but higher driver speeds and an increase in more serious crashes.

Conclusions

The Safe Speed Programme appears to be reducing road trauma within the areas of Auckland where speed limits have been reviewed. The level of DSI reduction is currently tracking below the target 30% reduction, most likely due to vehicle speeds not decreasing as much as expected.

Better compliance with the new posted speed limits would be expected to translate directly into further reductions in the risk of death or serious injury.

It is also noted that driver speeds across the network have increased over the past 18-months compared to the pre-COVID period. As these return to normal, this is anticipated to support greater urban DSI reductions.

Recommendations

It is recommended that AT:

1. Work to improve the level of enforcement on the network at locations of highest benefit.
2. Consider additional repeater signs for roads with poor compliance and highest evaluated benefit.
3. Consider active speed feedback signs for roads with poor compliance and highest evaluated benefit.
4. Evolve the evaluation framework, including stronger usage of geospatial data and associated insights.
5. Undertake additional research into the insights and limitations of geospatial data

Contents

1. Background

Safe Speeds Tranche 1

On 30 June 2020, Auckland Transport implemented Tranche 1 of the Safe Speeds Programme. This included the delivery of speed changes on approximately 11% (over 800km) of Auckland's local road network to achieve safe and appropriate speed limits.

Tranche 1 roads were a mixture of high-risk roads and those operating at lower speeds than the existing speed limit. It included roads from high-risk rural areas, the city centre, several town centres, residential areas and urban roads. The overall objective of the speed limit changes was to reduce the number of death and serious injury (DSI) crashes on those roads subject to a speed limit change by at least 30% within 5-years of implementation.

Figure 1.1 shows a map of the roads included as part of Tranche 1 of the Safe Speeds Programme, including the proposed new speed limit. While some of the town centre speed limit changes were implemented later in the year, most changes occurred on the 30 June 2020. All speed limit changes that took place on 30 June 2020 were included as part of this evaluation.

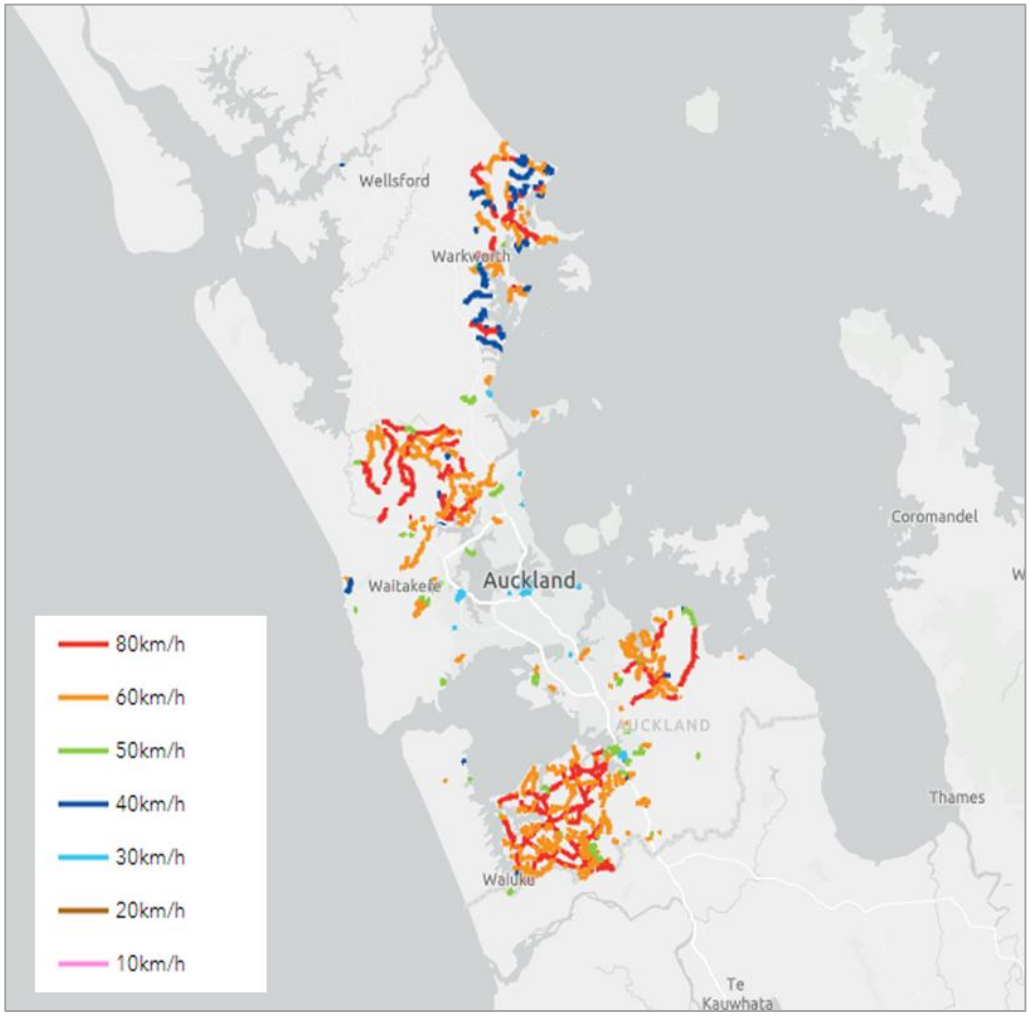

Figure 1.1 Tranche 1 Speed limit changes in Auckland (2020)

2. Introduction

2.1 Monitoring and Evaluation Plan

Prior to the implementation of these changes, Auckland Transport created a Monitoring and Evaluation Plan (2019). The monitoring and evaluation of roads where speed changes have been implemented helps Auckland Transport determine the effectiveness of these changes and the benefits achieved. Additionally, monitoring and evaluation also demonstrates how the performance of these roads are contributing to the 'safe and appropriate' requirements, informing better decision making for future speed limit reviews and determining locations where additional interventions may be required to achieve the safe and appropriate travel speeds.

This analysis covers the 18-month period following implementation of the Tranche 1 speed limit changes. It is important to appreciate that this analysis is an interim evaluation of Tranche 1 of the Safe Speeds Programme. It is the first stage of a multistage evaluation process, which will continue to be updated as the 'after' period increases.

This full evaluation process specified by Auckland Transport includes:

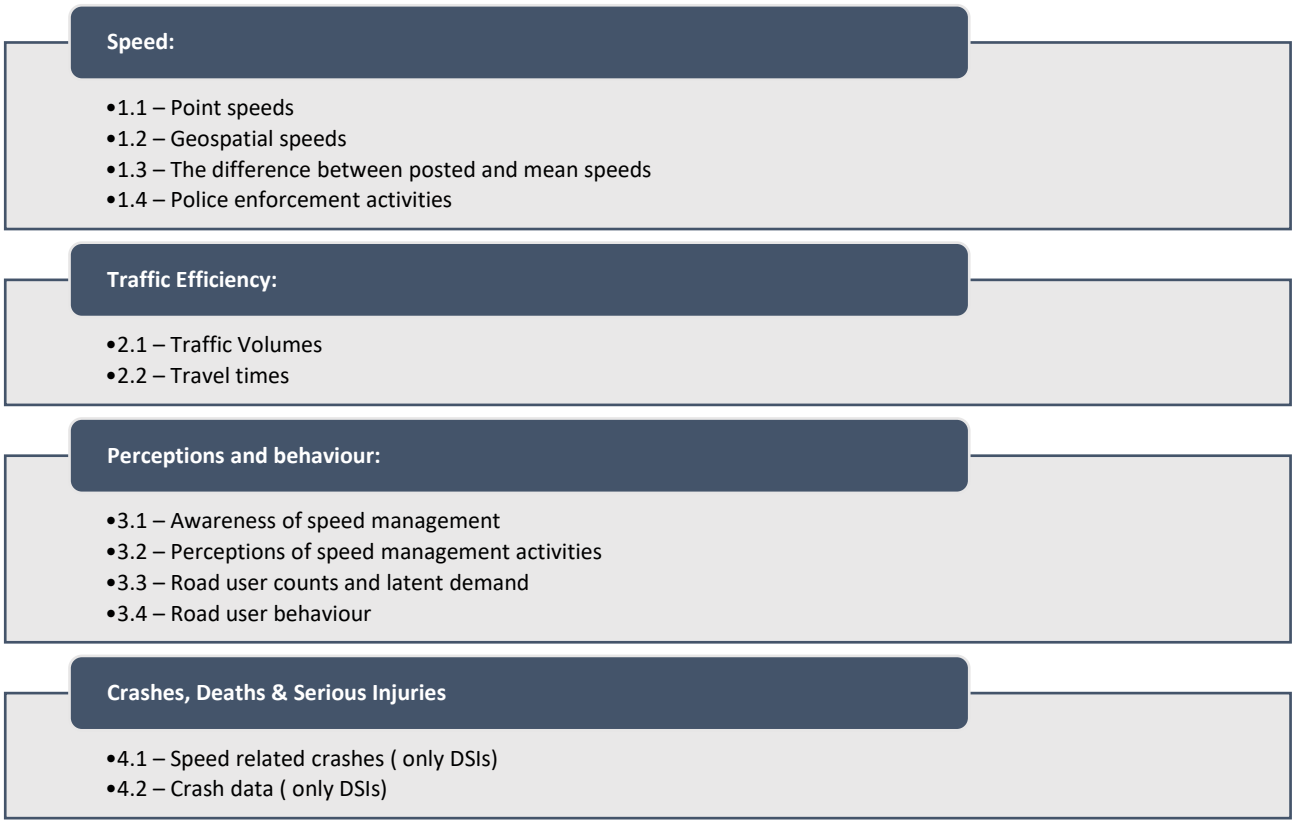

Figure 2.1 Evaluation plan measures

Abley has been commissioned to evaluate the following aspects of Tranche 1 of the Safe Speeds Programme:

Figure 2.2 Evaluation measures included in this analysis

These measures have been evaluated using:

- TomTom data,
- traffic monitoring data counts, and
- crash data.

TomTom data has been provided by Auckland Transport to evaluate the effects on speeds.

Traffic monitoring data counts (tube surveys) have been undertaken to monitor and evaluate the effects on speeds and traffic volumes.

Crash data has been analysed from the Waka Kotahi Crash Analysis System (CAS) to gain insight into the crash trends following the speed limit implementation.

These data sources are explained in greater detail in the Methodology section of this report.

2.2 Evaluation Considerations

Vision Zero and the Safe Speeds Programme

There are several considerations that are made while undertaking the evaluation to indicate the impact of Tranche 1 of the Safe Speed Programme on Auckland Transport achieving its safety goals. These considerations primarily focus on the Safe System and Vision Zero.

This evaluation considers Safe System and Vision Zero by undertaking the evaluations through both a Safe System lens and Vision Zero lens. To address the current road safety crisis, Auckland Transport has adopted Vision Zero, which sets a goal of achieving zero deaths and serious injuries on Auckland Roads by 2050. The Safe System approach has been implemented to aid in this goal.

The Safe System approach is a holistic approach to the road system and the interactions among roads and roadsides, travel speeds, vehicles, and road users. It is an inclusive approach catering for road users, including drivers, motorcyclists, passengers, pedestrians, cyclists, and commercial and heavy vehicle drivers.

The Safe System approach operates on the following guiding principles:

- **People make mistakes**: Humans will continue to make mistakes, and the transport system must accommodate these. The transport system should not result in death or serious injury because of errors on the roads.
- **People are vulnerable, and the system should be managed within human biomechanical injury limit**: Our bodies have a limited ability to withstand crash forces without being killed or seriously injured. A Safe System ensures that the forces in collisions do not exceed the limits of human tolerance. Speeds must be managed so that humans are not exposed to impact forces beyond their physical tolerance. System designers and operators need to consider the limits of the human body in designing and maintaining roads, vehicles and speeds.
- **Shared responsibility**: The burden of road safety responsibility no longer rests solely with the individual road user. System managers have a primary responsibility to provide a safe operating environment for road users and ensuring that the system is forgiving when people make mistakes.
- **Strengthening all parts of the system**: All pillars of the road system need to be strengthened so that if one part fails, other parts will protect the people involved from serious harm.

Central to the Safe System approach is human tolerance to crash impacts and the management of kinetic energy transfer so these are within survivable limits. The Safe System approach is based on the following four Safe System pillars:

- **Safe Roads** - Roads and roadsides are designed and maintained to reduce the risk of crashes occurring, and to lessen the severity of injury if a crash does occur.
- **Safe Speeds** – speeds are managed to complement the road environment and ensure crash impact forces are within human tolerances.
- **Safe Vehicles** – vehicles lessen the likelihood of a crash and protect occupants and other road users.
- **Safe People** – road users are skilled, competent, alert, and unimpaired.

Speed management is the key method for managing kinetic energy transfer and is the most practical way for addressing the safety of the most vulnerable road users, such as pedestrians, cyclists and motorcyclists. Research shows that even small changes in travel speeds can significantly reduce both deaths and serious injuries.

While the Safe Speeds Programme focuses predominantly on the Safe Speeds pillar of the Safe System, all elements are interlinked to providing a safe road environment.

2.3 Targets for the Safe Speeds Programme

The speed limit changes implemented have the overall goal of reducing the number of DSI crashes. Within five years, the mean number of DSI crashes on the roads with lowered speed limits is expected to reduce by 30%. On top of this main goal, there are multiple secondary targets, including:

- The measured mean operating speed should be no higher than 5 km/h above the posted speed limit. On top of this, the 85th percentile speed should be within 10% of the posted speed limit.
- The public perception of the speed limit changes, and the effectiveness should be positive overall.
- The number of injury crashes on the roads where the speed limit is reduced should decrease.
- The number and proportion of injury crashes where excessive speed/going too fast is a contributing factor should decrease.
- The amount the speed is reduced by should reflect the function and effectiveness of the road.

In this report, a number of these targets will be assessed to see how the Tranche 1 of the Safe Speeds Programme has performed against the targets.

3. External Factors

There are several external factors that can impact the analysis that are not directly related to the effectiveness of the programme. It is important that readers of the report understand the role these factors can play in the evaluation of the before and after data. The key external factors are summarised here and discussed in more detail in Appendix A.

3.1 COVID-19

During COVID-19 lockdowns traffic volumes on Auckland's road network decreased significantly. Traffic volumes during April 2020 were approximately 10-15% of pre-pandemic levels. Decreases were seen during Auckland's subsequent lockdowns but not to the same extent.

A significant impact of the pandemic is the effect of changing work behaviours on traffic volumes. It is now far more common for people to work from home. This has resulted in a decrease in traffic volumes in non-lockdown periods, with traffic volumes in 2021 being approximately 5% lower than the traffic volumes in the 6 months prior to the pandemic (except for the standard Christmas trough). A small decrease in traffic volume can have significant effects on traffic congestion and improve the flow of traffic. Therefore, whilst it is not exactly quantifiable, it can be expected that the COVID-19 pandemic has affected the free-flow and operating speeds on Auckland's road network.

3.2 Regression to the Mean

Regression to the mean is a concept that is associated with extreme observations in a sample period and different observations of the same variable in a subsequent period that is much closer to the mean.

In terms of this analysis, regression to the mean occurs where there is an unusually high (or low) number of crashes in the before period data. If no changes are made to the transport network, chances are that locations with crash numbers significantly above their mean will reduce in the next sampling period and increase where the crash numbers are significantly below the mean.

In road safety, the regression to the mean effect often occurs due to a selection bias. This often comes about from selecting locations with high crash numbers in recent years. This phenomenon is worse when targeting a short section of the road network with a high density of crashes in recent years, but little crash history in the years before that.

In the case of the Tranche 1 analysis, regression to the mean is not expected to play a significant role because, in general, roads were selected on an area-wide basis rather than an individual road basis based on crash history. As such, regression to the mean is not accounted for in this interim analysis.

3.3 Weather

During the 7-day tube count period, the weather can play a role in the number of vehicles on the road and their travel speeds. It is expected that the large sample size (7 days) will help address the impacts of individual weather events; however, sustained periods of poor weather could impact the data. Given the uncertainty around this, no adjustment for weather has been allowed for in this analysis.

4. Methodology

This section provides a summary of the methodology used in the preparation of this report.

4.1 Data Categories

The main data categories that are used as part of this evaluation are as follows:

Speed limit map

Auckland Transport provided Abley with a geospatial map of the speed limit changes implemented as part of Tranche 1 of the Safe Speeds Programme. This data includes the previously posted speed limit on the road, the new speed limit, the date that the speed limit change came into effect, the reason for the speed limit change taking place and geospatial road length.

Tube count data

Auckland Transport provided Abley with tube count data for a sample of roads that had a speed limit change in Tranche 1. Of the sample provided - 32 sites were taken through for detailed analysis, with 10 of the 32 sites subsequently excluded because of insufficient data. From the tube counts, the two-way mean operating speed and 85th percentile travel speed were determined and used in determining compliance with the new speed limit.

Crash Data

Injury crash data was extracted from the Waka Kotahi Crash Analysis System from 1 July 2015 until 31 December 2021. For analysis and comparison purposes, the yearly average of the 5-year period prior to the speed limit changes (1 July 2015 – 30 June 2020) was calculated, and then compared with the crashes in the 18 months following the change in speed limit.

MegaMaps data

The Waka Kotahi MegaMaps tool was used as the primary source for estimating the traffic volume (AADT) for each road.

TomTom data

TomTom geospatial data includes actual recorded driver speeds, travel times and traffic density, among a variety of other useful information. It should be noted that TomTom data is relatively new as a data source and the limitations of the data are not fully understood.

4.2 Stages

The evaluation process can be thought of in three separate stages:

- **Crash evaluation** - where historical crash data is analysed to determine the change in safety performance.
- **Speed evaluation** - which involves statistically analysing the changes in speeds at sites and then using these changes as a surrogate measure to estimate the likely change in crashes over a longer period.
- **Compliance evaluation** – evaluates how mean speeds and 85th percentile speeds compare to posted speed limits.

The use of change in travel speed as a surrogate measurement the likely change in crashes is well grounded in research. There are numerous studies that show the relationship between a speed limit reduction and the subsequential crash reduction.

The evaluation has also been broken down by workstream to provide additional insights. Further detail on the methodology is contained within Appendix B.

5. Crash Evaluation

Injury crash data was extracted from the Waka Kotahi Crash Analysis System from 1 July 2015 until 31 December 2021. For analysis and comparison purposes, the yearly average of the 5-year period prior to the speed limit changes (1 July 2015 – 30 June 2020) was calculated, and then compared with the crashes in the 18 months following the change in speed limit (1 July 2020 – 31 December 2021).

5.1 Overall Change in Crashes

Comparison of the average annual number of crashes for the Tranche 1 sites before and after speed limit changes is shown in Figure 5.1. This shows a significant decrease in the annual rate of crashes across all injury categories.

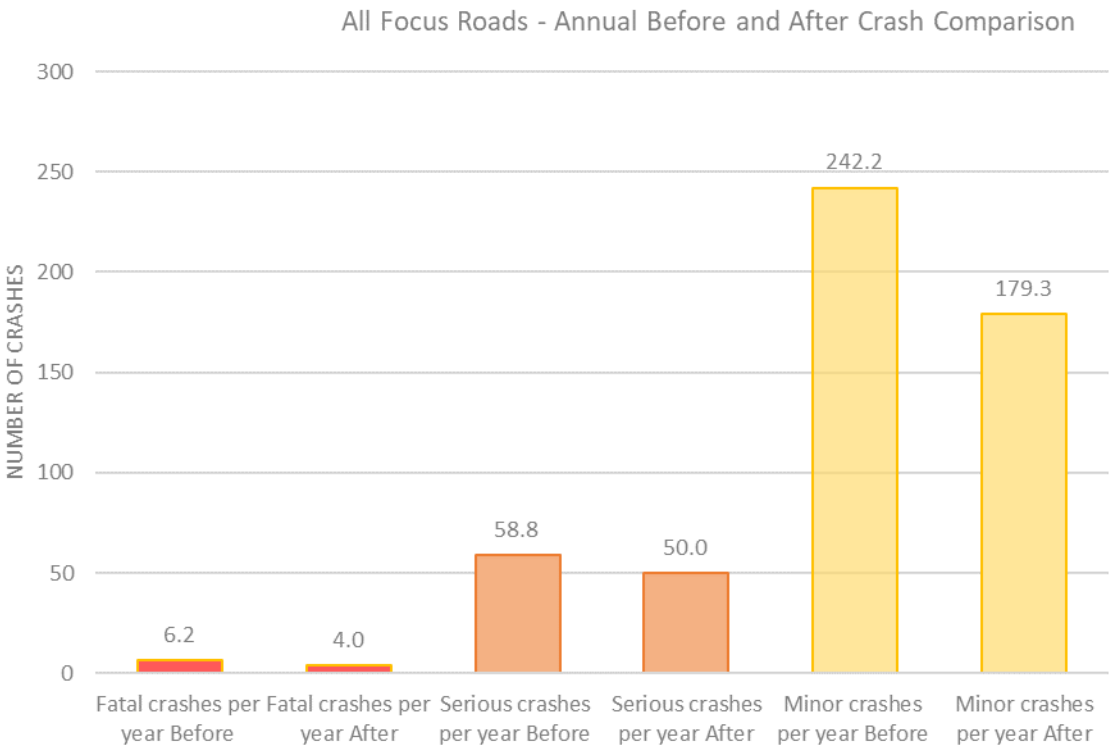

Figure 5.1 Before and after injury crash comparison for Tranche 1 sites – 18-month after period

Figure 5.1 shows that (not taking into account control sites):

- Fatal crashes have decreased by 35.5%
- Serious crashes have decreased 15.0%
- Fatal and serious injury crashes have decreased by 16.9%
- Minor injury crashes have decreased by 26.0%
- All injury crashes have decreased by 24.1%

Whilst these reductions are very encouraging, it is important to note that the post-analysis period of 18-months is still a relatively short post-implementation period and there were extended periods in which Auckland was in 'COVID lockdown' in the after period.

Overseas research on COVID related traffic flows[1] indicated that, generally, crashes dropped during lockdowns with less cars on the roads, but the severity of collisions (and resultant fatalities) increased as fewer cars resulted in more free flowing traffic conditions and higher vehicle speeds.

The impact of the lockdown periods on the reliability of the before and after crash analysis has been evaluated by conducting a similar analysis with crash data from the lockdown periods excluded. This analysis found that removing the lockdown periods from the analysis did not have a significant impact on the base analysis. Given the results of this analysis, the assumption going forward will be that lockdown periods do not need to be removed from the data to get an accurate reflection of the changes in crashes that have occurred between the before and after periods.

5.2 Change in Social Cost of Injury Crashes by Road Segment

Changes in the social cost of injury crashes on a road-by-road basis is shown in Figure 5.2,\. Road segments have been determined based on road name and by speed limit change. This map helps to show how crashes have changed on roads subject to changed speed limits in Tranche 1 of the Safe Speeds Programme. Whilst this map provide quantitative data for individual roads that can be used to validate anecdotal reports from Auckland Transport customers of increased crashes at a particular location; due to the low number of crashes per road, they should not be taken as a reliable reflection of actual change in risk on a road-by-road basis.

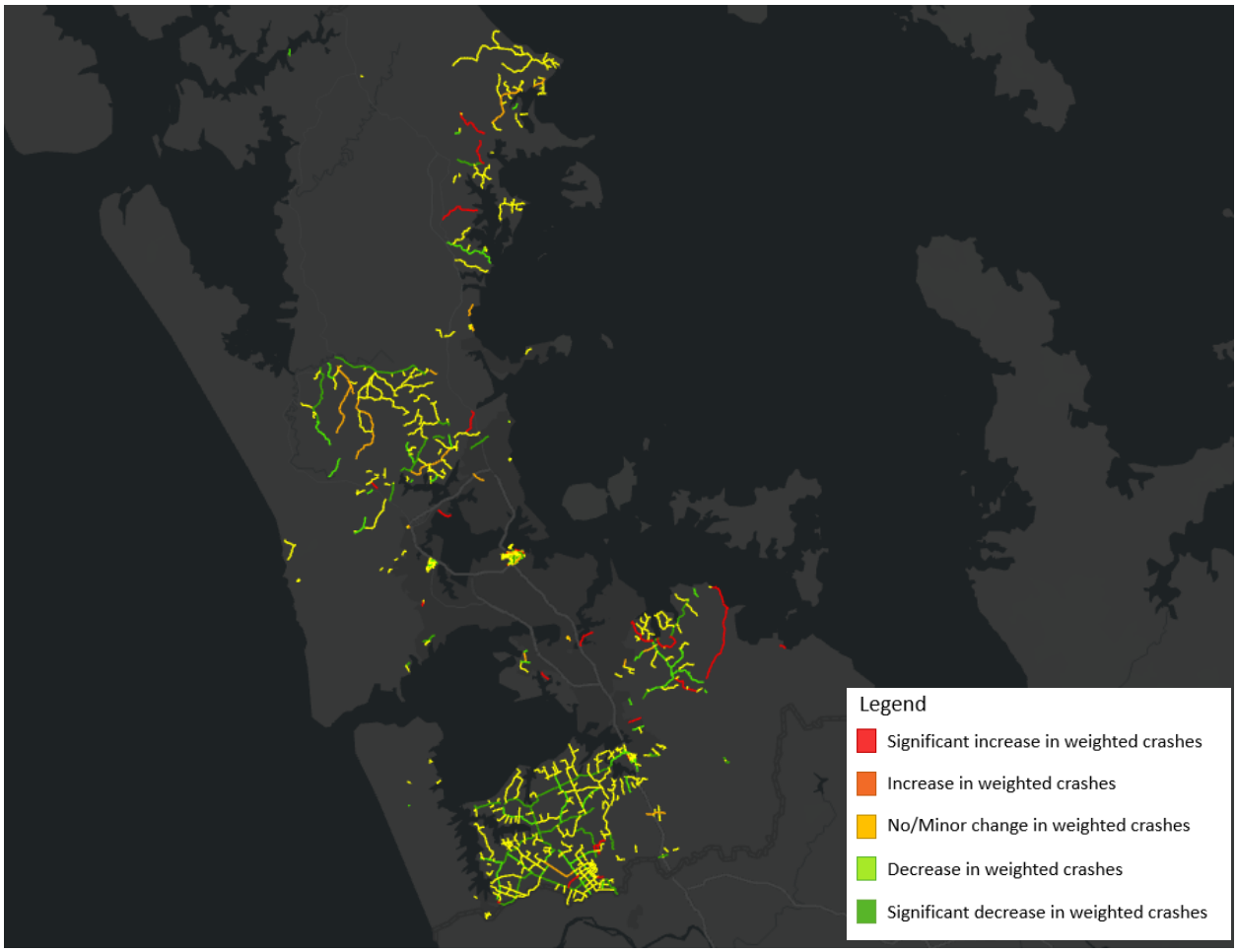

Figure 5.2 Before and after mapped injury crash social cost comparison for Tranche 1 sites

[1] https://www.nhtsa.gov/sites/nhtsa.gov/files/2021-10/Traffic-Safety-During-COVID-19_Jan-June2021-102621-v3-tag.pdf

Figure 5.2 shows that in general the social cost of injury crashes has either not significantly changed on most roads or had decreased. However, there are a few selected roads where the social cost of crashes has increased since the speed limit change. This could either be because of the random nature of high severity crashes, where serious and fatal crashes can often occur on one part of the network where there has not been a crash in recent years, or it could be related to the speed limit change.

A more in-depth analysis would be required to drill into the individual road sections where an increase occurred to determine the underlying cause. It is important to note, because of the random nature of crashes, roads that have seen an increase or decrease in crashes have not necessarily seen the same change in risk. However, there could be other factors that have increased risk on roads that are showing a significant increase in weighted crashes and these sites may be worth looking investigating further.

Changes in the social cost of injury crashes for each workstream is shown in Appendix G.

5.3 Change in Crashes by Workstream

Analysis of the change in the average annual number of crashes by workstream has also been undertaken to provide insight to any differential change in performance across Auckland.

The different safety performance in rural and urban workstreams is shown in Table 5.1.

Table 5.1 Rural and Urban summary of before and after injury crash comparison for Tranche 1 (18 month after period)

Workstream	Fatal crashes per year - before	Fatal crashes per year - after	Serious crashes per year - before	Serious crashes per year - after	Minor crashes per year - before	Minor crashes per year - after
Rural	4.6	1.3	26.2	20.7	93.4	85.3
Urban	1.6	2.7	32.6	29.3	148.8	94
Total	6.2	4	58.8	50	242.2	179.3

Rural Roads have seen a significant reduction in the seriousness of road trauma, reflected by a 71.7% decrease in fatal crashes and a 28.6% decrease in death and serious injury collisions. All injury crashes on Rural Roads have also decreased by 13.6%. The changes in the different level of severity crashes for rural roads aligns with research which indicates that changes in speeds are likely to have a greater effect on higher severity crashes rather than lower severity crashes.

Urban roads have not experienced the same significant reduction in the higher severity crash outcomes. There has been a 68.8% increase in fatal crashes and a 6.4% decrease in death and serious injury collisions. All injury crashes on Urban Roads have decreased by 31.1%, which is far more pronounced than on Rural Roads. The smaller reduction in death and serious injury collisions on Urban Roads is consistent with the modified form of Nilsson's Power Model, where a smaller exponent is applied on urban roads compared to rural roads. The modified form of Nilsson's Power Model used in New Zealand to predict the change in deaths and serious injuries (DSi) following a speed limit change is:

$$Estimated\ DSi\ After = Estimated\ DSi\ Before\ x\ (\frac{Speed\ After}{Speed\ Before})^{exponent}$$

Where the exponent is 3.5 on rural corridors and 2.0 on urban corridors.

Breakdown of the Urban workstream into further sub-categories is shown in Table 5.2.

Table 5.2 Workstream summary of before and after injury crash comparison for Tranche 1 (18 month after period)

Workstream	Fatal Crashes per year - Before	Fatal Crashes per year - After	Serious Crashes per year - Before	Serious Crashes per year - After	Minor Crashes per year - Before	Minor Crashes per year - After
Higher speed urban (excluding previously 70km/h)	0.4	0	1	2.7	9	12
Urban - City Centre (Excluding Hobson Nelson and Fanshaw street only)	0.6	0.7	16	15.3	82.2	42.7
Peri-urban (previously 70km/h)	0.4	2	10	6	33.8	27.3
Urban - City Centre (Hobson Nelson and Fanshaw street only)	0.2	0	3.2	2	14.6	5.3
Urban - Town Centres and Residential	0	0	2.4	3.3	9.2	6.7

Urban City Centre

Sites in the urban city centre workstream show an increase in average annual fatal crashes of 0.1 fatal crashes per year. However, it is important to appreciate that there is only a single fatal crash in the after period, so it is too presumptuous to draw any definitive conclusion about the actual change in fatal crash risk. Serious injury crashes have dropped by 0.7 per year representing a 4.4% decrease in serious crashes. There is also a decrease in both the serious crashes recorded and the minor crashes recorded between the before and after periods, with minor crashes dropping by 48.1%.

It is important to note the significant change in traffic volumes and the nature of traffic due to COVID impact. This is likely to affect the City Centre Workstream the most for two reasons:

- Office workers have been more regularly working from home from March 2020 onwards. With a large proportion of the City Centres work force consisting of office workers this means there is a lower proportion of the original.
- Due to relatively high congestion that occurs in the City Centre, traffic volume fluctuations are likely to have a greater effect on travel times and speeds.

City centre traffic continues to be abnormal and will take some time to return to 'normal'.

This change in traffic volumes has two impacts on crash risk – while less volume means that there are a lower number of potential conflicts on the road between vehicles, it also means lower congestion and thus, likely higher mean speeds. This makes determining an accurate change in risk challenging for this workstream as while lower speed limits and lower crash exposure are likely to decrease risk, decreased congestion is likely to increase risk.

Urban Town Centres and Residential

Sites in the Urban Town Centres and Residential workstream show an increase in average annual death and serious injury crashes of 37.5% and a decrease in all injury crashes of 13.8%. As noted above, with small crash numbers in the

before and after periods, it is too presumptuous to draw any definitive conclusion about the actual change in crash risk in these locations.

Higher Speed Urban

Sites in the higher speed urban workstream show a decrease in average annual number of fatal crashes (100%), an increase in serious crashes (170.0%) and an increase in injury crashes overall (41.3%).

As noted above, with small crash numbers in the before and after periods, it is too presumptuous to draw any definitive conclusion about the actual change in crash risk in these locations.

Peri-Urban (Previously 70 km/h Roads)

Sites in the Peri-urban (previously 70km/h roads) workstream show a significant increase in the average annual number of fatal crashes (400%), a 40.0% decrease in the number of serious injury crashes and a 19.2% decrease in the number of minor injury crashes.

Fatal and serious crash numbers in the before and after periods are small meaning any change in crash numbers will appear as a relatively big percentage change. As such it is important not to draw any definitive conclusions about the actual change in crash risk in these locations. That said, it is recommended that the 3 fatal crashes recorded in the after period be reviewed in conjunction with one another to see if there is link between them. This review should also cover if additional repeater signs could be used to reduce the risk of future crashes.

As there are more minor injury crashes in the before and after periods, we can be more confident that any changes observed is likely to be reflective of an underlying change in the actual crash risk.

5.4 Wider Auckland Safety Performance

The change in the average annual number of crashes and injuries across the wider Auckland region (excluding the Tranche 1 locations) has also be analysed. The purpose of this analysis is to understand the change in crash and injury trends across the wider Auckland region and contrast them to the changes observed at the Tranche 1 locations. If the changes observed at the control sites (rest of Auckland) are similar to the Tranche 1 sites, then we can conclude that the speed limit changes have had little impact on crashes and injuries; however, where the changes are different, we can more confidently conclude that the speed limit changes are likely to have played a major role in driving the change in performance.

Table 5.4 Control group summary of before and after injury crash comparison (18 month after period)

Workstream	Fatal crashes per year - before	Fatal crashes per year - after	Serious crashes per year - before	Serious crashes per year - after	Minor crashes per year - before	Minor crashes per year - after
Total	40	42.7	484.2	422	2484.6	2272.7

Table 5.4 shows that, in the control group:

- Fatal crashes have increased by 6.8%
- Serious injury crashes have decreased by 12.8%
- Fatal and serious injury crashes have decreased by 11.4%
- Minor injury crashes have decreased by 8.5%
- All injury crashes have decreased by 9%

A comparison of the control sites against the Tranche 1 sites is shown in Table 5.6 for crashes and Table 5.7 for injuries. The 'Difference' column shows the performance of Tranche 1 sites relative to the control sites.

Table 5.6 Change in Crashes when accounting for control sites

Change in Crashes	Control Sites	Tranche 1 Sites	Difference
Fatal Crashes	+6.8%	-35.5%	-42.3%
Serious Crashes	-12.8%	-15.0%	-2.2%
Fatal and Serious Crashes	-11.4%	-16.9%	-5.5%
Minor Injury Crashes	-8.5%	-26.0%	-17.5%
All Injury Crashes	-9.0%	-24.1%	-15.1%

Table 5.6 shows that the average annual number of crashes at Tranche 1 sites has reduced more than the control sites across all injury categories. The most significant change is for fatal crashes, where Tranche 1 sites show a 42.3% reduction compared with the Control Sites. However, the number of fatal crashes in the before and after periods at the Tranche 1 sites is small so limited confidence can be placed on the actual change in crash risk at these locations.

In contrast, more confidence can be placed on the changes observed in fatal and serious crashes combined, and for injury crashes overall. Fatal and serious crashes at Tranche 1 sites decreased 5.5% compared to the Control Sites and injury crashes overall decreased by 15.1%. This suggests we can conclude the speed limit changes have been successful in reducing injury crashes at Tranche 1 locations, although the scale of change remains significantly lower than the 30% reduction in fatal and serious crashes that is sought by Auckland Transport.

Whilst the reductions are generally encouraging, especially for minor injuries, it is important to note that the post-analysis period of 18-months is still a relatively short post-implementation period compared with the preceding 5-year period and there were extended periods in which Auckland was in 'lockdown' in the after period, which will have impacted travel patterns. The ongoing impacts of COVID have likely influenced the level of congestion, the speed of vehicles traversing the network, and road user exposure to multi-vehicle collisions. However, the overall influence of COVID-related changes on injury crashes in both the before and after period, is still not currently quantifiable.

6. Speed and Traffic Volume Evaluation

6.1 Speed Crash Risk Evaluation (Nov 2019 and 2020)

A speed data analysis was conducted for the months of November 2019 and November 2020. These months were selected because Auckland was not in lockdown in either month and because the months fall approximately 6 months either side of the speed limit changes (7 months before and 5 months after to be exact). Due to the relatively low amount of time both following and prior to the implementation it is unlikely that there have been a significant number of projects that have come into effect that would influence the speed data. As noted by Auckland Transport, there can be some fluctuation in speed data over the year due to climate, environmental and social effects (such as weather, holiday traffic, and fluctuation in enforcement levels). Therefore, the same month was used for both the before and the after evaluation.

The November 2019 to November 2020 TomTom sample data analysis showed that on the roads where speeds were changed in June 2020 the mean speeds decreased on average by 3%.

Applying the Nilsson's power models to the change in speeds on each of the segments, it was determined that the change in speed should result, on average, in a predicted 8.5% decrease in death and serious injury crashes and a 10.9% decrease in fatal crashes (not accounting for other external factors that may also influence risk, such as traffic volumes).

A TomTom data analysis was also conducted for all roads in Auckland not included in the 30 June speed limit reduction. Analysed using the same methodology as the Tranche 1 sites, the Control sites were determined to have seen an average increase in mean speeds of 1.6%. This change in speed was modelled to, on average, result in a 2.6% increase in death and serious injury crashes (not accounting for other external factors that may also influence risk, such as traffic volumes).

The tube count data analysis, consisting of 22 sites, showed that on the roads where speeds were changed in June 2020 the mean speeds decreased on average by 8.3%. Applying the Nilsson's power models to the change speeds, it was determined that the change in speed should result, on average, in a predicted 22.4% decrease in death and serious injury crashes and a 28.4% decrease in fatal crashes.

The difference between the TomTom data and tube count data might be explained by several reasons. Mainly, the sample size for the TomTom data is much greater than that of the tube count analysis, with the TomTom data spanning the majority of the programme while the tube count data is limited to 22 sites.

It is recognised that the TomTom data potentially has some currently unknown limitations and is a relatively new data source for these types of evaluations. However, due to its much greater sample size, the TomTom data is considered a better representation of the Safe Speeds Programme performance.

The TomTom data shows lower than desired equivalent reductions in both death and serious injury crashes and in fatal injury crashes. One reason for this is potentially due to significantly reduced traffic volumes on the network due to COVID 19.

At the tube count sites, AADT was on average 24% lower in the after period than it was in the before period. As AADT decreases this is expected to have a negative correlation with speeds, i.e. increasing speeds. That said, the substantial reductions in AADT could have been expected to produce more noticeable reductions in the number of injury crashes in the after period given AADT is the primary predictor variable for injury crashes. However, because this effect is similar network wide, the control sites help us understand the relative contribution of the speed limit changes irrespective of the change in AADT.

The tables below show a breakdown of the predicted DSi crash reduction calculated for each of the workstreams based on operating speed changes. The tables also show a comparison between urban and rural predicted DSI crash reductions. Generally, when the average speed decreases the predicted DSi crashes also decrease; however there are some instances where the average speed has decreased but the predicted DSI crashes has increased. This situation arises where the average speed has increased on a road with a lot of crashes and reduced on roads with a small number of crashes. The overall average speed change might show as a small decrease but the crash outcome can be a small increase because of the higher number of crashes on the road where speeds have increased.

An additional benefit resulting from the speed data analysis is the limited impact that previous projects have on the analysis. With the crash data analysis, because there are in some cases projects that have been implemented in the before 5-year period these can potentially affect the risk on the road.

For example, if there has been a project that decreases the risk on a road included in the analysis:

- If this project had been implemented 2-years before the speed limit implementation this project would decrease risk on the road for 40% of the before period and for 100% of the after period.
- Thus, the decrease in crashes recorded would likely be overestimated.

Conversely, if there had been a project that increased the collective risk on the road – potentially a project that added another lane (increasing traffic volume and operating speed), then this would affect the change in crashes recorded.

With the speed analysis on the other hand, because the review period is not extended so far into the past there has been less opportunity for the road environment to have changed between the before and after period. Additionally, many projects that may affect crash risk have a smaller impact on speeds. This means that even if a project has been implemented it will have a less significant impact on the analysis. An example of this might be roadside barriers. While this treatment would decrease crash severity, it is unlikely to have a significant impact on speed.

Table 7.1 Workstream summary of predicted DSI changes Tranche 1 (November 2019 to November 2020 comparison)

Workstream		Average speed change	Predicted DSI crashes change
Rural		-4.8%	-12.6%
Urban – City Centre	30km/h	-0.4%	0.6% (increase)
	40km/h	0.3% (increase)	1.8% (increase)
Urban - Town Centres and Residential		-0.7%	0.7% (increase)
Higher speed urban		-1.5%	-3.5%
Peri-urban (previously 70km/h roads)		-2.7%	-6.7%
All Workstreams		-3.4%	-8.5%

Table 6.2 Rural and Urban summary of predicted DSI changes Tranche 1 (November 2019 to November 2020 comparison)

Workstream	Average speed change	Predicted DSI change
Rural	-4.8%	-12.6%
Urban	-1.4%	-2.7%
Overall	-3.4%	-8.5%

The results in the tables indicate that Rural roads have had a larger decrease in average speeds and predicted DSI crash risk (-4.8% and -12.6% respectively) compared to urban road decrease in average speeds and predicted DSI crash risk (-1.4% and -2.7% respectively).

Compliance evaluation

From the TomTom sample group analysis, it was found that:

- 12.2% of mean speeds are more than 5km/h above the new posted speed limit, and
- 35% of 85th percentile speeds are more than 10% above the speed limit.

Traffic volume

Based on a sample size of 33 tube count sites, there has been a 24% decrease in traffic where speed limit changes have been implemented. However, this doesn't align with the TomTom data timeframes and is likely to be highly affected by COVID restrictions during and around the tube count periods.

6.2 Speed Crash Risk Evaluation (Feb 2020 and 2022)

Speed data analysis was also conducted for the months of February 2020 and February 2022. Again, neither of the months were periods where Auckland was in lockdown, additionally, it reflects a before period approximately 4 months prior to the implementations and 20 months after the implementation. This analysis was conducted in addition to the November 2019 to November 2020 speed data analysis to capture an after period much later than the previous analysis. Thus, this analysis is likely a better reflection of the long-time impact of the programme compared to the November 2019 to November 2020 speed analysis.

Due to the relatively short amount of time prior to the implementation that this analysis covers, it is unlikely that there have been a significant number of projects that have come into effect that would influence the before and after speed data. As Auckland noted that there can be some fluctuation between speed data over a year due to climate, environmental and social effects (such as weather, holiday traffic and fluctuation in enforcement levels), the same month was used for both the before and the after period.

The TomTom sample data analysis showed that on the roads where speeds were changed in June 2020 the mean speeds decreased on average by 2.7% from February 2020 to February 2022. Applying the Nilsson's power models to the change in speeds on each of the segments, it was determined that the change in speed would result, on average, in a predicted 7.7% decrease in death and serious injury crashes (not accounting for other external factors that might also influence risk, such as traffic volumes).

A TomTom data analysis was also conducted for all roads in Auckland not included in the 30 June speed limit reduction. Analysed using the same methodology as the focus group, all other roads in Auckland they were determined to have seen an average increase in mean speeds of 2.4% and it was determined that the change in speed would result, on average, in a predicted 5.8% increase in death and serious injury crashes (not accounting for other external factors that might also influence risk, such as traffic volumes).

The February results show speed reductions at the Tranche 1 sites were very similar to the November observations (2.7% compared to 3.0%); however, the speed increases at the Control Sites went from 1.6% to 2.4% which should be of concern for Auckland Transport.

The below tables show a breakdown of the predicted DSi crash reduction calculated for each of the workstreams based off operating speed changes. The tables also show a comparison between urban and rural predicted DSI crash reductions. In some instances, although the average speed has decreased, the predicted DSI crashes have increased. This is possible because relationship between speed and DSI risk is non-linear.

Table 6.3 Workstream summary of predicted DSI changes Tranche 1 (February 2020 to February 2022 comparison)

Workstream		Average speed change	Predicted DSI crashes change
Rural		-5.0%	-14.4%
Urban – City Centre	30km/h	4.4% (increase)	12.1% (increase)
	40km/h	2.3% (increase)	6.4% (increase)
Urban - Town Centres and Residential		-1.9%	-2.4%
Higher speed urban		-5.5%	-12.7%
Peri-urban (previously 70km/h roads)		-1.8%	-5.5%
All Workstreams		-2.7%	-7.7%

Table 6.4 Rural and Urban summary of predicted DSI changes Tranche 1 (February 2020 to February 2022 comparison)

Workstream	Average speed change	Predicted DSI change
Rural	-5.0%	-14.4%
Urban	0.4% (increase)	1.3% (increase)
Overall	-2.7%	-7.7%

Table 6.5 Control group summary of predicted DSI changes Tranche 1 (February 2020 to February 2022 comparison)

Workstream	Average speed change	Predicted DSI change
Overall	2.4% (increase)	5.8% (increase)

The results in the tables indicate that overall, the speed management programme is decreasing speed and decreasing the risk of fatal and serious crashes. Given that the speeds in the control group have increased by 2.4% and the DSI increase was 5.7%, it is expected that if no speed limit change was implemented then the change in speeds and crash risk at the Tranche 1 locations would have been 2.4% and 5.7% respectively. Taking this into consideration, the difference between the actual speed change from what the speed would likely have been if new speed limit were not implemented is 5.1% (2.7% decrease in speed on the effected roads + 2.4% increase in speed on the control roads). The respective decrease in death and serious injuries that is expected to have been achieved is 13.5% (7.7% decrease in deaths and serious injuries predicted from the affected group + 5.8% increase in deaths and serious injuries predicted from the control group).

In addition, higher speed limit environments have had a better result in average speeds and predicted DSI crash risk (-5% and -14.4% respectively) when compared to urban roads (0.4% and 1.3% respectively).

While the decrease in deaths and serious injuries predicted at the Tranche 1 locations was larger in the earlier TomTom data evaluation, the more recent TomTom analysis has shown a greater decrease in death and serious injury crashes,

compared to no speed limits being changed. In addition, the two TomTom analyses combined reflects an overall improvement in the performance of the speed programme overtime.

Compliance evaluation

From the TomTom sample group analysis, it was found that:

- 8.4% of measured mean speeds in the TomTom data are more than 5km/h above the posted speed limit.
- 33.7% of the 85th percentile speed in the TomTom data are more than 10% above the speed limit.

Traffic volume

No additional tube counts were conducted in this period to evaluate the change in AADT.

7. 18-Month Comparison Against Targets

Priority Target
The overall target of the speed limit changes is to reduce the mean number of DSI crashes on the roads with speed limit changes by at least 30% within five years of implementing all the approved changes while balancing this with the effectiveness and efficiency of the roading network for all road users.

Discussion:

The crashes reported in the 18 months after period since the speed limits have been implemented have resulted in a decrease in DSI (death and serious injury) crashes of 16.9%.

Applying the Nilsson's power models to the change in speeds on each of the segments recorded in the TomTom data (using a February 2020 as the before period and February 2022 as the after period) resulted in a predicted 7.7% decrease in deaths and serious injuries.

In addition, the analysis on the network outside of the Safe Speeds Program showed that the change in speed would result, on average, in a predicted 5.8% increase in death and serious injury crashes, on these roads. Indicating that, if speeds were not lowered on the road in question speeds and thus risk, would have likely increased.

Thus, it was determined that the change in speed would result, on average, in a 13.5% decrease in death and serious injury crashes, compared to no speed limits being changed (7.7% decrease in deaths and serious injuries predicted at the Tranche 1 sites + 5.8% decrease in deaths and serious injuries predicted from the control sites).

Secondary Target
Measured mean speeds should be no more than 5km/h above the posted speed limit and the 85th percentile speed should be within 10% of the speed limit.

Discussion:

The speed data from February 2022 showed:

- 8.4% of measured mean speeds in the TomTom data are more than 5km/h above the posted speed limit.
- 33.7% of the 85th percentile speed in the TomTom data are more than 10% above the speed limit.

If compliance was better than we would expect significantly better safety outcomes, as per Nilsson's power model.

Secondary Target
There is a reduction in the number of injury crashes on the roads where speed limits have been changed.
Discussion: Injury crashes per year have decreased by 24.1%.

Secondary Target
There is a reduction in the proportion of crashes where the police consider excessive speed or going too fast for the conditions as a contributory factor.
Discussion: There has been a 13.8% decrease in speed related injury crashes.

8. Conclusions

Injury crashes

While there has not been enough time in the after-crash period to get an accurate reflection of the actual change in crash risk, the crashes reported in the "18-month" after period since the speed limits have been implemented have resulted in an annual decrease in death and serious injury crashes of 16.9% and an annual decrease in fatal crashes of 35.5%. In addition, injury crashes per year have decreased by 24.1% decrease.

When taking into account the control sites, the analysis was able to determine a more accurate representation of the change in crash risk. Compared to what would have been expected if no changes to speed limits were made, the difference between the control sites and the Tranche 1 sites showed:

- 42.3% reduction in fatal crashes;
- 5.5% reduction in Deaths and Serious injury crashes;
- 17.5% reduction in minor injuries crashes; and
- 15.1% reduction in all injury crashes.

The most significant change is for fatal crashes, where Tranche 1 sites show a 42.3% reduction compared with the Control Sites. However, the number of fatal crashes in the before and after periods at the Tranche 1 sites is small so limited confidence can be placed on the actual change in crash risk at these locations.

Whilst these reductions are generally encouraging, especially for minor injuries, it is important to note that the post-analysis period of 18-months is still a relatively short post-implementation period and there were extended periods in which Auckland was in 'lockdown' in the after period, which will have impacted travel patterns. The ongoing impacts of COVID have likely influenced the level of congestion, the speed of vehicles traversing the network, and road user exposure to multi-vehicle collisions. However, the overall influence of COVID-related changes on injury crashes in both the before and after period, is still not currently quantifiable.

Speed and traffic volume

The TomTom sample data analysis comparing November 2019 with November 2020 showed that mean speeds decreased on Tranche 1 roads by an average of 3%. Applying the Nilsson's power models to the change speeds on each of the segments, it was determined that the change in speed would result, on average, in a predicted 8.5% decrease in death and serious injury crashes and a 10.9% decrease in fatal crashes.

The subsequent analysis of February 2020 and February 2022 data resulted in a predicted 7.7% decrease in deaths and serious injury crashes . In addition, the same analysis on the network outside of the Safe Speeds Programme indicated that the observed change in travel speeds would result, on average, in a predicted 5.8% increase in death and serious injury crashes, on the wider Auckland road network. The increase in average speeds on those parts of the network outside Tranche 1 suggest that speeds would likely have increased on Tranche 1 roads too if speed limit changes had not been implemented. Thus, the real change in safety performance on Tranche 1 roads is expected to be greater than simply comparing the before and after speeds. Adjusting before speeds with the same average speed increase, it was determined that, on average, death and serious injury crashes would decrease by 13.5% compared to no speed limits being changed (7.7% decrease in deaths and serious injuries predicted from the effected group + 5.8% decrease in deaths and serious injuries predicted from the control group). Due to the small after period in the crash data, this TomTom speed analysis is considered the best representation of the decrease in deaths and serious injuries.

While the decrease in deaths and serious injuries predicted from the Tranche 1 locations was larger in the earlier TomTom data evaluation, the more recent TomTom analysis has shown a greater decrease in death and serious injury crashes when considering the change in risk compared to the control group. Thus, the two TomTom analyses combined reflects an overall improvement in the performance of the speed programme over time.

Compliance

In respect of compliance in the November 2020 TomTom speed data, 12.2% of measured mean speeds in the TomTom data are more than 5km/h above the posted speed limit and 35% of the 85th percentile speeds in the TomTom data are more than 10% above the speed limit.

For the February 2022 TomTom speed data, 8.4% of measured mean speeds in the TomTom data are more than 5km/h above the posted speed limit and 33.7% of the 85th percentile speeds in the TomTom data are more than 10% above the speed limit.

This shows there is a relatively poor level of non-compliance with the new speed limits although improved compliance was found in the more recent speed data analysis. If compliance improved then significantly better safety outcomes would be expected, as per Nilsson's power model.

Overall, the Safe Speed Programme appears to be reducing the risk of death and serious injury collisions over the areas of Auckland where it has been implemented. However, it is not currently achieving the level of reduction that was initially expected – most likely due to operating speeds not decreasing as much as expected. Better compliance with the new posted speed limits would be expected to translate directly into further reductions in the risk of death or serious injury.

Looking geographically at compliance, the northern and western rural areas generally have good compliance with the new speed limits with few roads or road sections having an 85% percentile speed 10% or more above the speed limit.

The southern rural area has mixed compliance – with many roads exhibiting high compliance with the new limits, especially closely around Pukekohe, but other roads showing poor levels of compliance. These appear to be greater in number closer to Waiuku, and also where a road change has been made in isolation rather than as part of an area-wide review.

Compliance is poor in many city centre streets, with many streets having an 85% percentile speed 10% or more above the speed limit. As discussed earlier in this report, COVID-19 continues to create abnormal traffic volumes in the city.

9. Recommendations

Enforcement

Enforcement can have a significant effect on driver compliance with safe and appropriate speed limits. This is well documented in literature. Research highlights that speed limit enforcement and compliance is vital to achieve Vision Zero outcomes on Australasian roads. While enforcement will have different impacts on road risks, depending on current driver culture, the previous statement is expected to be true internationally, regardless of the context (Corben, Integrating Safe System with Movement and Place for Vulnerable Road Users., 2020)

One international example that illustrates this is from France which included a strong focus on speed enforcement in its road safety action plan, with the introduction of automatic enforcement in 2003. This resulted in an unprecedented 30% decrease in fatalities of on France's roads and a 5km/h decrease in the average speed of France's roads (Speed Management , 2006).

It is important to note that enforcement is a powerful tool to decrease risk not only at locations where the speed limits have been lowered, but also in areas where the speed limit have not been lowered. It is important that AT ensure that enforcement covers areas where it will achieve the highest benefit (where compliance is poorest), rather than simply prioritising areas where speed limits have been lowered.

Repeater signs

Repeater signs should be considered to help remind road users of lower speed limits in locations of poorer compliance, where there is high risk, and where there is increased social crash costs after the implementation of the speed limit change. It is recommended that an analysis be undertaken to determine the location where these additional signs would achieve the highest benefit and that they be implemented based on their expected DSI reduction. It is also recommended that the implementation of additional signage on roads be recorded in Auckland Transport's GIS proposed speed limit layer. This will ensure that these roads can be compared to lower signage roads for Auckland Transport to better understand the effectiveness of additional repeater signs.

Speed feedback sign

Speed feedback signs should be considered on roads where there are higher levels of non-compliance. These have been shown in literature to have an effect on 85th percentile speeds. A study in the US where four speed feedback signs were installed reported that all four signs showed changes in mean, 85th, and categories of speed above the speed limit one month after installation (Hallmark, Hawkins and Knickerbocker, 2015).

Evolving the Evaluation Framework

Auckland Transport should consider developing an evaluation framework that sets the requirement for all future Safe Speed Programme Evaluations. This should lay out the timeline for when evaluations should be conducted and what level of analysis should be undertaken at each stage. In addition, an action plan could be formed laying out actions should the programme preform at different levels.

It is recommended that TomTom data analyses be included in the evaluation framework going forward. It is understood that the TomTom data wasn't available when developing the monitoring and evaluation framework; however, now it has become available, its significant value to measuring and evaluation should be captured in the documented process.

Research into TomTom data

TomTom data is a very powerful data source that can provide a multitude of insights into the Auckland Network without the requirement for hardware to be installed at the cost of Auckland Transport. However, all data has limitations. As this data is relatively new for use in the context of evaluating speeds across a network, it is recommended that AT consider conducting research with the goal of better understanding how TomTom data compares to traditional speed measuring methods and what possible limitations exist in the data.

Appendix A External factors

There are a number of external factors that can affect the results of the analysis that are not related to the effectiveness of the programme. These factors are discussed here along with how they will be taken into consideration.

COVID-19

It is important to understand the effect that the COVID-19 pandemic and its associated lockdowns have had on the traffic flow and characteristics in Auckland. During lockdowns the traffic flow on Auckland roads significantly decreased, during April 2020 it was approximately 10-15% of pre-pandemic levels (STATS NZ DASHBOARD). Similar decreases were seen (slightly more traffic on the road) during Auckland's subsequent lockdowns.

A significant impact of the pandemic is the effect of changing work behaviours on the traffic flow. It is now significantly more common for people to work from home. This has resulted in a decrease in traffic flows in non-lockdown periods. The traffic flow in 2021 is approximately 5% lower than the traffic flow in the 6 months prior to the pandemic (except for the standard Christmas trough) (STATS NZ DASHBOARD). Whilst this decrease in traffic might seem insignificant, a small decrease in traffic flow can have significant effects on congestion and the feel of less congestion on the road. Therefore, whilst it is not exactly quantifiable, it is expected that the COVID-19 pandemic has had effects on the free-flow and operating speeds on Auckland Roads. Therefore, the flow characteristics and speed changes are expected to be affected by the pandemic.

Regression to the Mean

The regression to the mean is also an aspect that needs to be considered in this type of analysis.

The regression to the mean effect can occur where there is an unusually high (or low) number of crashes in the before period data exists. If there is an unusually high number of crashes in the before period it can make the results look better than they really are. Alternatively, if there is an unusually low number of crashes in the before period, the opposite result emerges.

The regression to the mean effect often occurs due to a selection bias. This is because, when selecting locations for treatment, engineers are inclined to go for sites with high numbers of crashes in recent years. This phenomenon is worse when targeting a short section of the road network with a high density of crashes in recent years, but little crash history in the years before that.

In the case of the Safe Speeds Tranche 1 analysis, regression to the mean is not expected to play a significant part. This is because, in general, roads were selected on an area basis rather than an individual road basis plus a five-year pre-implementation comparison period has been used.

There are ways to analyse this regression to the mean effect[2], however this would be a significant undertaking for AT and would require additional analysis to determine appropriate safety metrics.

The speed data analysis is not impacted by regression to the mean and will therefore help to identify if regression to the mean has had an effect on the crash analysis. Though the speed data analysis will only form a prediction in the change in risk at these sites, using speed data to estimate crash reduction is a well-established and well-published method. Given the short time period since the implementation (18-months), the crash data is also unable to provide a clear indication of the actual change in risk. Speed data on the other hand does not require a large after period to provide insight into the change in risk.

To summarise, while regression to the mean may play some effect, it is only expected to be minor and the speed data analysis will complement the crash data analysis and help to indicate what effect regression to the mean has played.

[2] Estimating Safety by the Empirical Bayes Method, Transportation Research Board, https://trid.trb.org/view/726704

Other External Factors

On top of the factors mentioned earlier, there are other factors which are expected to influence the data captured, but the extent of this is difficult to define. The first of these is the weather. During the 7-day tube count period, the weather is expected to play a role in the number of vehicles on the road and their travel speeds. It is expected that the large sample size (7 days) will account for this, however, if there was an irregular batch of bad weather, this could affect the data. Given the uncertainty around this, it is not accounted for in this analysis.

Appendix B Methodology

Data Categories

This section outlies the methodology used to evaluate the safe speed programme, starting with the data required for the evaluation.

The main data categories that are used as part of this evaluation include:

- Speed limit map
- Tube data
- Crash Data
- MegaMaps data
- TomTom data

Speed limit map

AT provided Abley with a map of the speed limit changes implemented as part of the first Tranche of the Safe Speeds Programme. This data includes the previously posted speed limit on the road, the new speed limit on each of the roads, the date that the speed limit change came into effect and the reason for the speed limit change taking place. As this is a geospatial data layer, it could also be used to determine the length of road that fall within the above categories.

Tube count data

AT provided Abley with tube count data for a sample of roads that have had a speed limit change in Tranche 1. A review of the data was conducted and sites that did not sufficiently align between the before and the after period were removed from the analysis. For the review, site locations were plotted, and consideration was given to the road elements around the sites that could affect the traffic volumes and the travel speeds. For example, road geometry and the location of nearby intersections. If the before and after tube counts were not implemented at the exact same location for the before and after period, and there was considered to be an element that would affect the recorded vales, the site was excluded. Following this screening exercise, 32 sites were taken through for detailed analysis. Of these 32 sites, a further 10 sites were excluded because of insufficient data.

From the tube counts, the two-way mean operating speed and 85th percentile travel speed were determined. The mean speed was used in the crash prediction calculations and the 85th percentile travel speed was used for determining compliance with the new speed limit.

The tube count data also includes the AADT for each site. This has been assessed before and after to determine how similar the traffic flow was before and after the speed limit change. If there was a significant change in the AADT, then this is expected to affect the speed characteristics at the site.

Crash Data

Injury crash data was extract from the Waka Kotahi crash database from 1 July 2015 until 30 June 2021. The dataset was broken down into the wider network (all of Auckland) and just the areas where the speed limits were changed. This was used to compare the speed limit changes to the wider network and see if the lower speed limits had a significant effect on injury crashes. For analysis and comparison purposes, the yearly average of the five-year previous crash data has been calculated, and then compared with the crashes in the one year since the change in speed limit.

The analysis also examined whether speed was listed as an expected factor in causing the crash. For a crash to be speed related, one or more of the vehicles involved must be identified as having speed as a factor. The number of

crashes before and after the speed limit change can be compared to understand the impacts of a lower speed limit on crashes where speed is identified as a factor.

It is important to note that, while speed is normally listed as a factor in only crashes where people are travelling above the speed limit, speed effects both the likelihood and severity of nearly every crash.

MegaMaps data

MegaMaps presents a wide range of information, however, this data set was primarily used to get an AADT volume for each road.

TomTom data

While only the tube count data was initially intended to be used, AT recently came into possession of TomTom data. TomTom uses driving data collected from their customers. This data includes road speeds, travel times and traffic density, among a variety of other useful information.

It should be noted that TomTom data is relatively new as a data source and the limitations of the data are not fully understood. Research is currently being conducted to see how this compares to the traditional data sources. However, additional research will likely be required before it can be used with a high level of confidence.

This TomTom data was provided to Abley by AT for the months of November 2019, November 2020, February 2020 and February 2022. Two separate evaluations have been conducted on this data. One compared the November 2019 to the November 2020 data and the second compared the February 2020 to the February 2022 data.

Stages

The evaluation process can be thought of in three separate stages:

- The crash evaluation - where historical crash data is analysed to determine what the change in crash data has been; and
- The speeds evaluation - which looks at statistically analysing the changes in speeds at sites and then using these changes as a surrogate measurement to estimate the long term decrease in crashes.
- Compliance evaluation – how do the mean speeds and 85th percentile speeds compare to the posted speed limits.

The reason why speed is used as a surrogate measurement to estimate the long term decrease in crashes, even though there is crash data, is because, the crash data after period is not currently long enough to indicate the real change in crashes. Thus, estimates made from the speed change is likely to be a more accurate measurement of the actual decrease likelihood in crashes.

Using speed as a surrogate measurement for decrease in crashes is well grounded in research as there are numerous studies that show the relationship between a speed limit reduction and the subsequential crash reduction.

Another way that the evaluation was broken down was by workstream. First, the evaluation would be carried out across all workstreams combined and then by individual workstreams. These included:

- Urban City Centre - All roads in Tranche 1 within the Waitemata local board
- Urban Town Centres and Residential
- Higher speed urban (excluding previously 70km/h) – all roads in Tranche 1 that have a proposed speed limit of 50km/h except roads where the speed limit was previously 70km/h
- Peri-urban (previously 70km/h roads) – all roads in Tranche 1 where the speed limit was previously 70km/h

- Rural – All roads in Tranche 1 with a new speed limit greater of 60km/h or greater, where the previous speed limit wasn't 70km/h

Crash evaluation

In the Crash evaluation stage, a buffer was used around the roads included in the Tranche 1 implementation, to determine crashes thought to be affected by the speed limit changes. At first a 10 m buffer was used as this is generally standard in NZ; however, through an inspection, many crashes that were related to the roads in question were falling outside of the buffer zone. This was thought to be an unfair representation as these crashes where clearly on the effected roads. Thus, the buffer was expanded. The same visual check was conducted. This was continued until the buffer was found to adequately capture the vast majority of crashes, without capturing a significant number of crashes on side roads.

First, these crashes were evaluated as a combination of all roads. Secondly, these were broken down into their respective individual workstreams. To determine the crash frequency on these roads for the before period compared to the after period, 5 years of before data was used and 1 year of after data. They were then normalised to get a number of crashes per year. This was done by dividing the number of crashes that occurred over the entire period by the number of years in that respective period.

To account for the effect that the Covid lockdowns had on the crash period, after the initial evaluation looking at the entire before and after periods, these lockdown periods and their respective crashes were removed from the data. They were then renormalised to get the number of crashes that occurred per year.

When it came to the crash frequency mapping stage, the purpose of the map was to communicate where on the network there was a positive effect from the speed limit change and where a negative effect had occurred (all in terms of crash frequency. The roads were broken down into segments of different speed limit changes (i.e. a road would be broken down into multiple segments if it had either different existing speed before the speed limit change or different new speeds from a different section of road). Crashes were then assigned to the segments to which they related. As there were crashes of varying severity, a way to quantify one crash severity over another was required so that a single qualitative value could be obtained for each road, indicating if there was a decrease or increase in risk. Rather than creating a new methodology for evaluating one crash severity against another, the Ministry of Transport Social cost of road crashes and injuries 2019 report, was used. As per the report, the crashes were given the following values.

The general average social cost of crashes was used, rather than categorising the crashes between urban and rural. Additionally, these estimates have not been adjusted for the level of non-reporting, because while adjusting for non-reported crashes is important when estimating the total social costs savings achieved from a project, in this case we only want to know, of the recorded crashes, has there been a benefit or disbenefit.

	Severity		
Cost components	**Fatal**	**Serious**	**Minor**
	June 2019 prices ($)		
Loss of life/permanent disability	5,320,300	520,800	21,800
Loss of output (temporary disability)	700	1,700	300
Medical –			
Hospital/medical	8,700	11,000	200
Emergency/pre-hospital	4,300	1,600	800
Follow-on	2,100	5,400	100
Legal and court	25,500	3,500	1,100
Vehicle damage	12,400	7,800	6,300
Total	**5,374,100**	**551,700**	**30,800**

Figure Social cost of crashes (Ministry of Transport: Social cost of road crashes and injuries 2019)

Speed crash risk evaluation

TomTom data speed evaluation

The TomTom analysis was able to determine an estimation of the average travel speed of vehicles on each section of road where speed limits had been changed, for both before and after implementation. Using the average before and after speeds alongside Nilsson's power models, shown in Figure 4.2, the analysis was able to estimate the estimated change in death and injury collisions.

Box: Nilsson's power model, quoted by Elvik, Christensen & Amundsen (2004), TØI report 740/2004
The model can be summarised in terms of six equations that relate changes in the number of accidents or in the number of road users killed or injured in accidents to changes in the mean speed of traffic. Denote speed by V, accidents by Y, and accident victims by Z. Furthermore, subscript by 0 the values observed before a change in mean speed and by 1 the values observed after a change in mean speed. The Power model is then presented in equations 1 to 6 below:

$$\text{Number of fatal accidents} = Y_1 = \left(\frac{V_1}{V_0}\right)^4 Y_0 \quad (1)$$

$$\text{Number of fatalities} = Z_1 = \left(\frac{V_1}{V_0}\right)^4 Y_0 + \left(\frac{V_1}{V_0}\right)^8 (Z_0 - Y_0) \quad (2)$$

$$\text{Number of fatal and serious injury accidents} = Y_1 = \left(\frac{V_1}{V_0}\right)^3 Y_0 \quad (3)$$

$$\text{Number of fatal or serious injuries} = Z_1 = \left(\frac{V_1}{V_0}\right)^3 Y_0 + \left(\frac{V_1}{V_0}\right)^6 (Z_0 - Y_0) \quad (4)$$

$$\text{Number of injury accidents (all)} = Y_1 = \left(\frac{V_1}{V_0}\right)^2 Y_0 \quad (5)$$

$$\text{Number of injured road users (all)} = Z_1 = \left(\frac{V_1}{V_0}\right)^2 Y_0 + \left(\frac{V_1}{V_0}\right)^4 (Z_0 - Y_0) \quad (6)$$

Figure Nilsson's Power Model (M.H. Camerona, 2010)

The following equation was used to estimate the change in deaths and serious injury crashes across the network:

$$\text{Number of fatal and serious injury accidents} = Y_1 = \left(\frac{V_1}{V_0}\right)^3 Y_0 \quad (3)$$

Figure Nilsson's Power Model for deaths and serious injury crashes (M.H. Camerona, 2010)

The analysis made use of all sites where TomTom data was available, however, not all of the roads where speed limits changed had TomTom data. TomTom data was available for 76% of the network where speed limits had changed for both the before and after period. This proportion of the network was considered to be a large enough sample size to provide good insight into the performance of the program.

TomTom data was provide broken down into 4 data sets: before weekend data, after weekend data, before weekday data and after weekday data. In instances where the before and after weekday and weekend data was available both data sets were used to estimate the operating speeds along the road. In these cases, as the TomTom data didn't provide an estimation of the AADT down the road, the data was normalised to the number of days in the week it represented before it was averaged (i.e the weekend mean was weighted by 2 days and the weekday operating speed for the various analysis was weighted by 5 days). For data where the weekend data was missing, the analysis was conducted only using weekday information. However, in any cases where either the before or after weekday data was missing the section was removed from the analysis.

The data was also weighted with the AADT extracted from MegaMaps and the length of the road segments to which the data relates. Thus, the data is weighted by the vehicle kilometres travelled at a given mean speed. The process means that more weight is placed on roads with higher volumes and longer lengths than roads with lower volumes and shorter lengths. The approach ensures average speed changes are based on vehicle kilometres travelled and not averaged across all roads equally. The approach provides a better representation of actual average speed changes. Equation 1**Error! Reference source not found.** shows this weighing process.

Equation 1 General form of the equation to determine the Average Weighted Speed Change

$$Average\ weighted\ speed\ change = \frac{\sum(Average\ speed\ change_i \times Length_i \times AADT_i)}{\sum(Length_i \times AADT_i)}$$

For example, if there were two sections of road, one that had an average speed decrease of 2 km/h and another that had an average speed increase of 1 km/h, without weighting, the overall average speed change would be 1.5 km/h. For the sake of this example, the first section is 500m long with an AADT of 20,000 vehicles per day and the second is 100 m with an AADT of 10,000 vehicles per day.

When applying the weighting to this example, as seen in the equation below:

Equation 2 Example of how determine the Average Weighted Speed Change.

$$Average\ weighted\ speed\ change = \frac{2 \times 500 \times 20{,}000 + 1 \times 100 \times 10{,}000}{500 \times 20{,}000 + 100 \times 10{,}000}$$

Thus, the weighted average speed change, or the average speed change per Vehicle kms travelled (VKT), is 1.91 km/h, which is more representative of speed change across the network.

The same analysis was conducted for all roads in Auckland not included in the Tranche 1 analysis. Again, a proportion of the roads where insufficient data was available were excluded before the analysis was conducted.

Tube count data speed evaluation

Initially, Kloeden et al's relative risk curves and confidence limits were intended to be used to calculate the change in risk following the speed limit implementation. This method is discussed by Kloeden, McLean AJ and Glonek G in several literature (Kloeden CN, 2002). These are considered to be superior to using the traditional Nilsson's model when determining crash reduction using tube counts, because it doesn't just take into account the mean speeds, but also the variance in speeds; with higher variance generally resulting in much higher risk.

However, due to limited information in the tube count data for the before period, it was determined that the Nilsson's power model would instead be used for the analysis.

Tube count data vs TomTom data

While the TomTom data potentially has some unknown limitations and is a relatively new data source for these types of evaluations, due to its much greater sample size, it is the TomTom data evaluation and not the tube count evaluation that is considered to be a better representation of the Safe Speeds Programmes performance

Compliance evaluation

An analysis was also conducted on the TomTom data to evaluate the mean speeds and 85th percentile speeds against the new posted speeds. This was to determine what level of compliance with speed limits is being achieved post implementation.

Similar to the TomTom data, an analysis was also conducted on the tube count data to evaluate the mean speeds and 85th percentile speeds against the new posted speeds. This was to determine what level of compliance with speed limits is being achieved post implementation.

Appendix C 18-month after period - mapped injury crash change per year

The below maps show the per year change in injury crashes for every road included in Tranche 1 of the safe speeds programme.

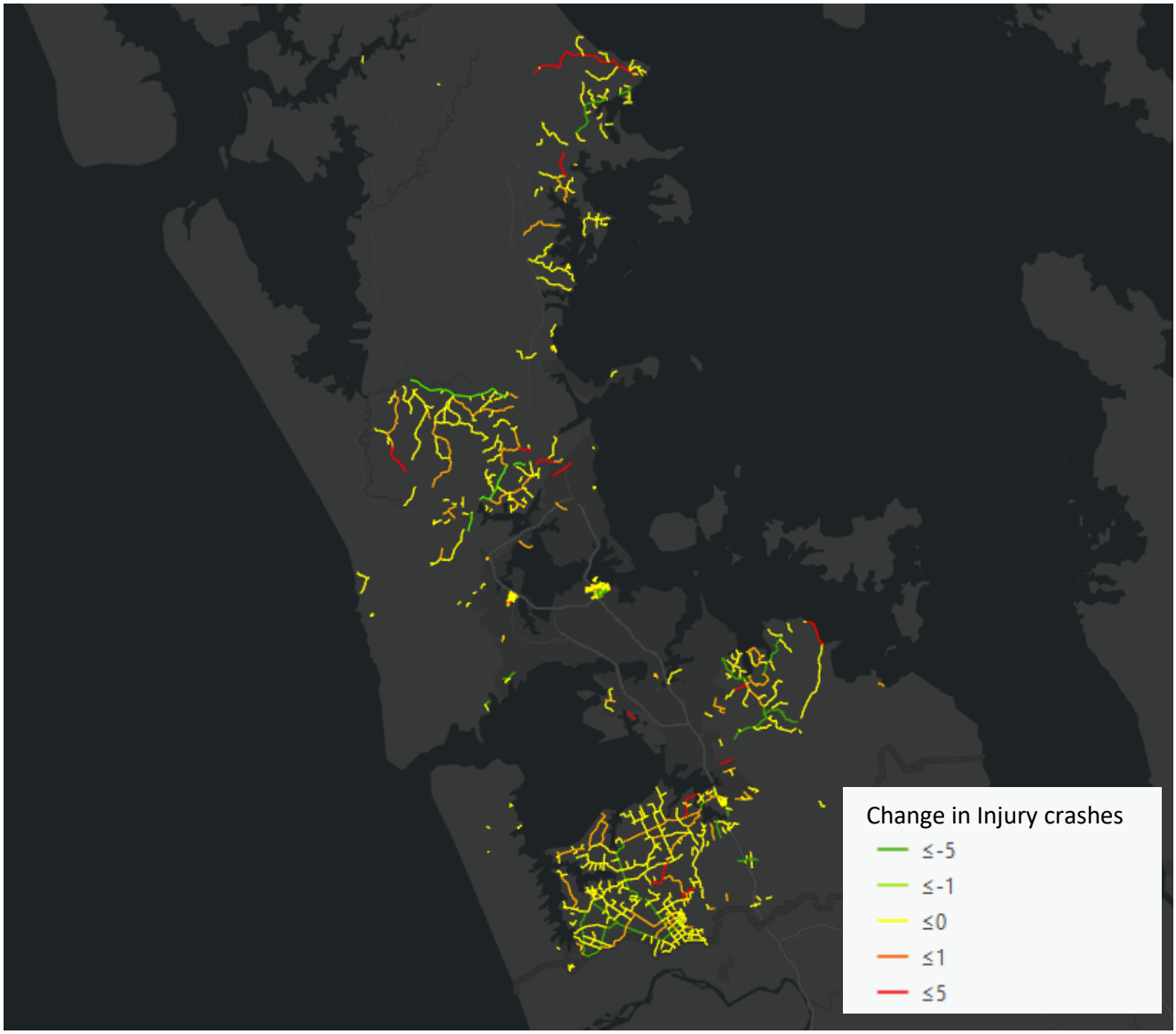

Figure – 18-month after period mapped injury crash change per year

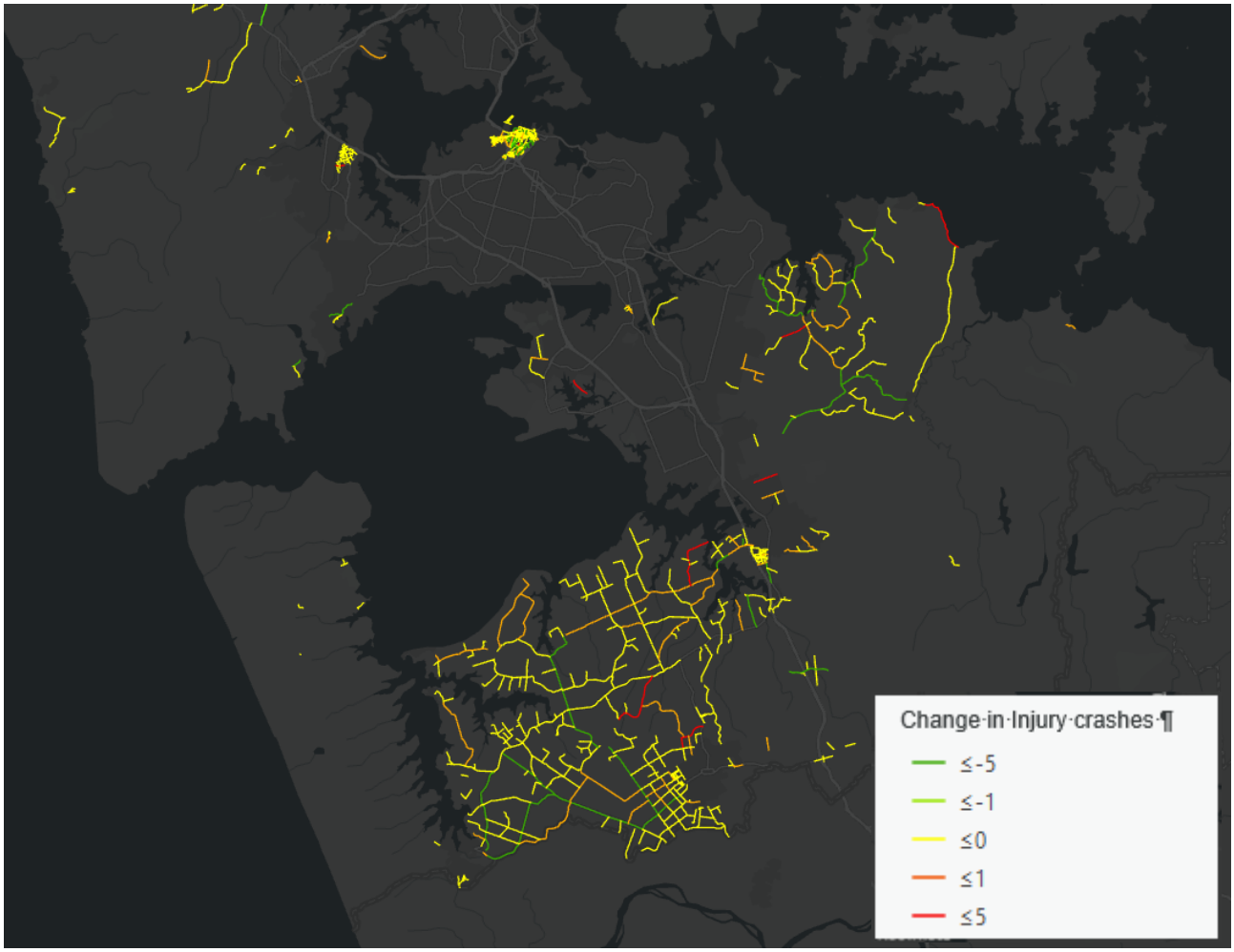

Figure – 18-month after period - mapped injury crash change per year

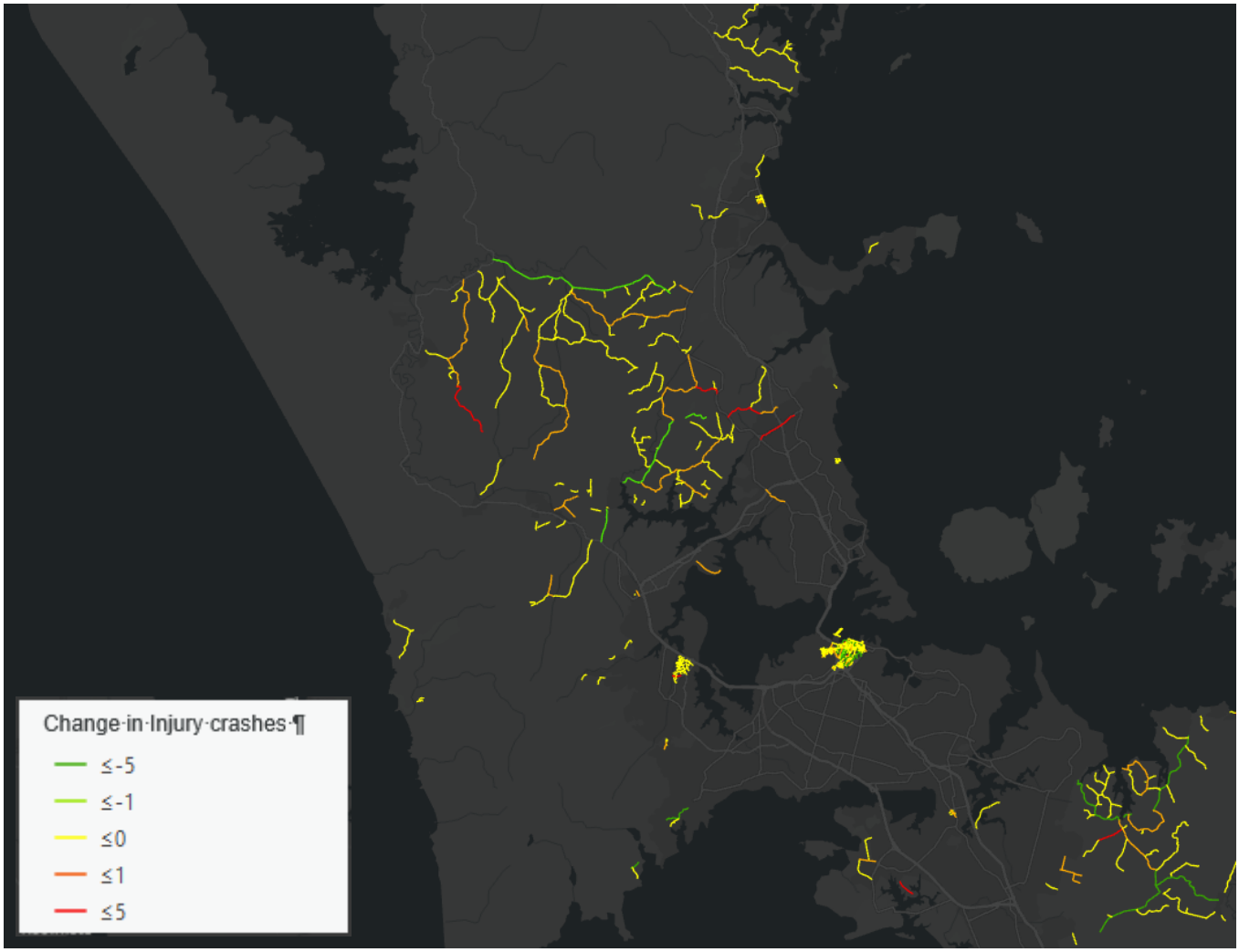

Figure – 18-month after period - mapped injury crash change per year

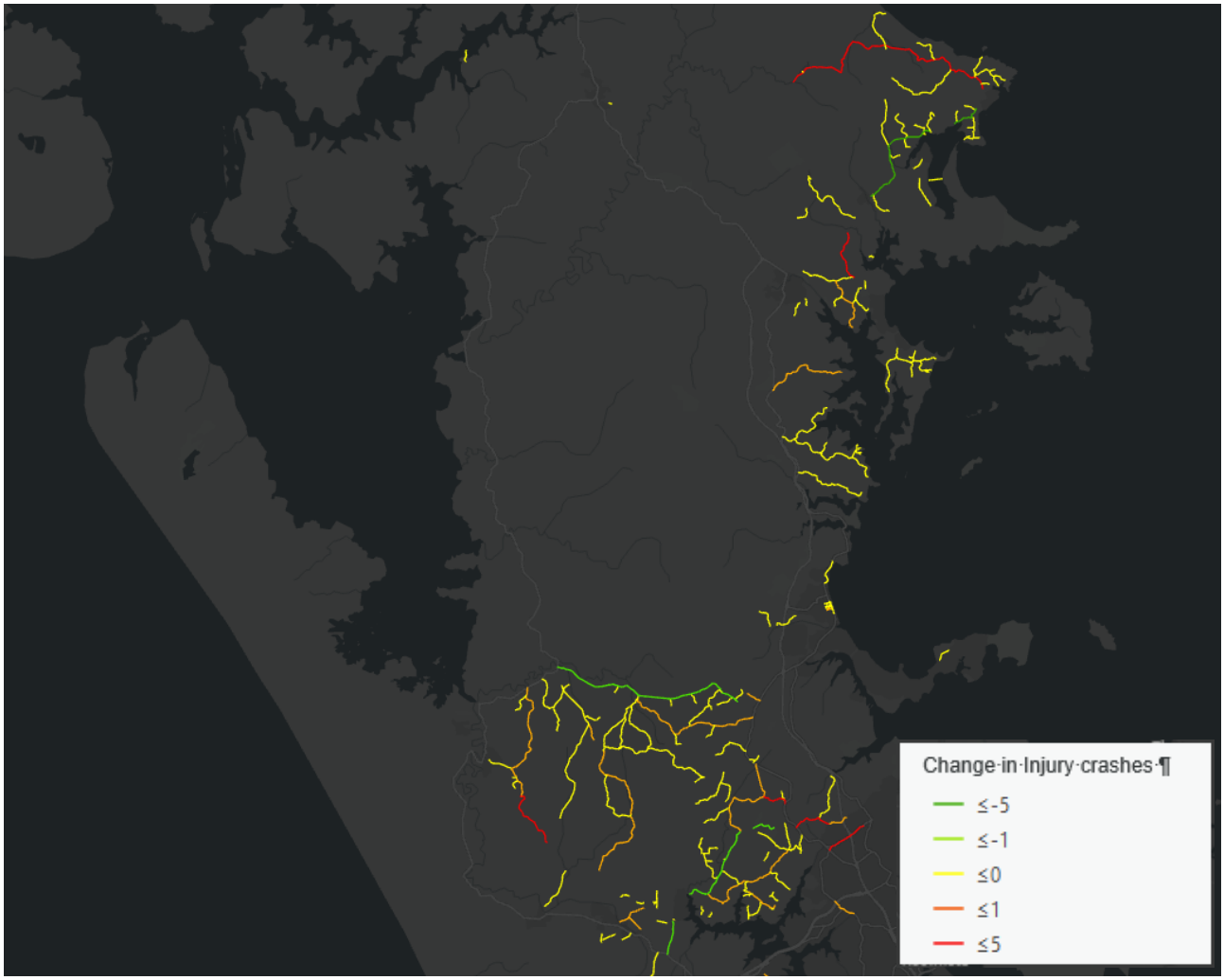

Figure – 18-month after period - mapped injury crash change per year

Figure – 18-month after period - mapped injury crash change per year

Appendix D Maps showing the level of compliance (February 2022)

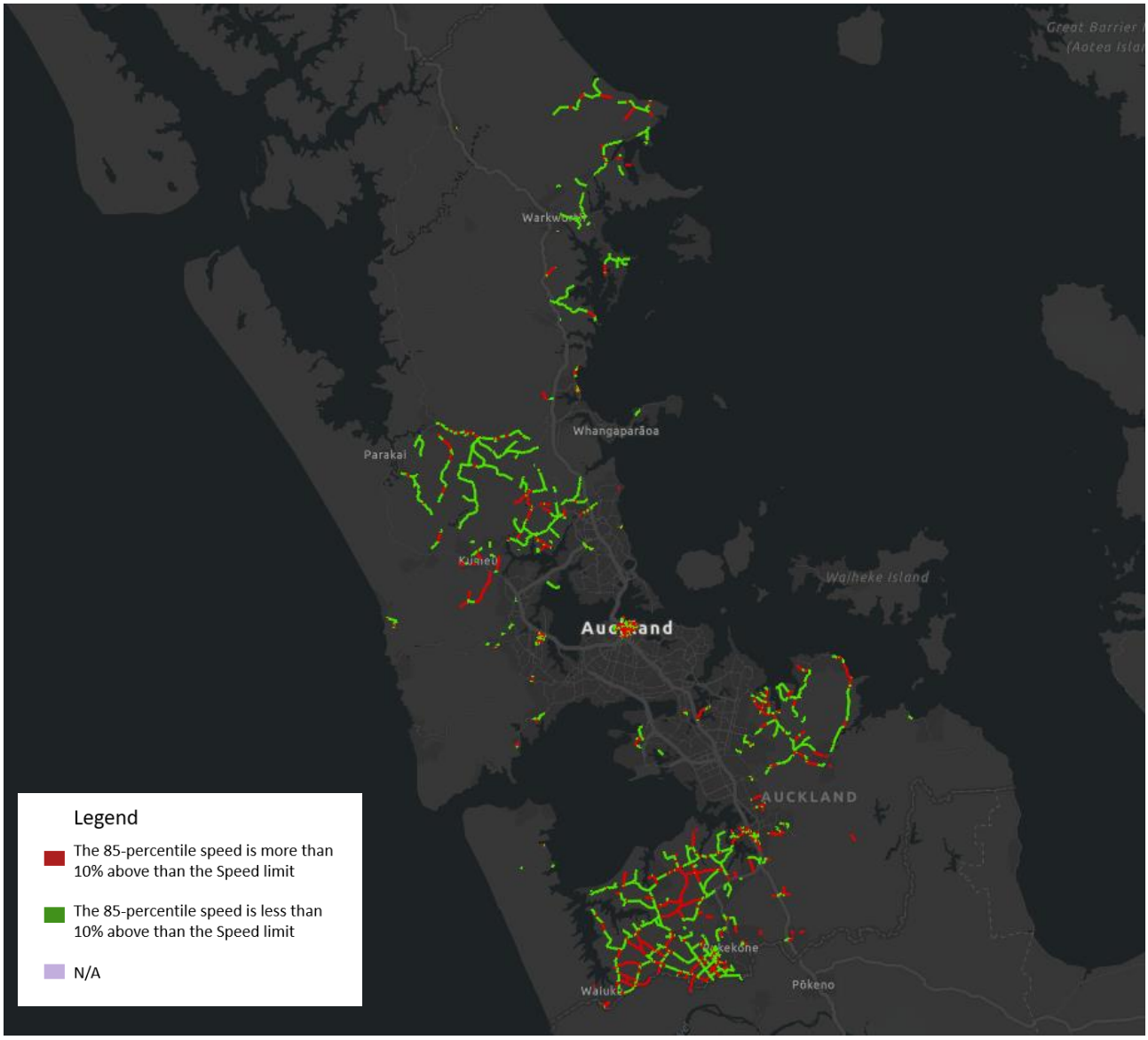

Figure - Compliance map All Auckland Direction 1 (February 2022)

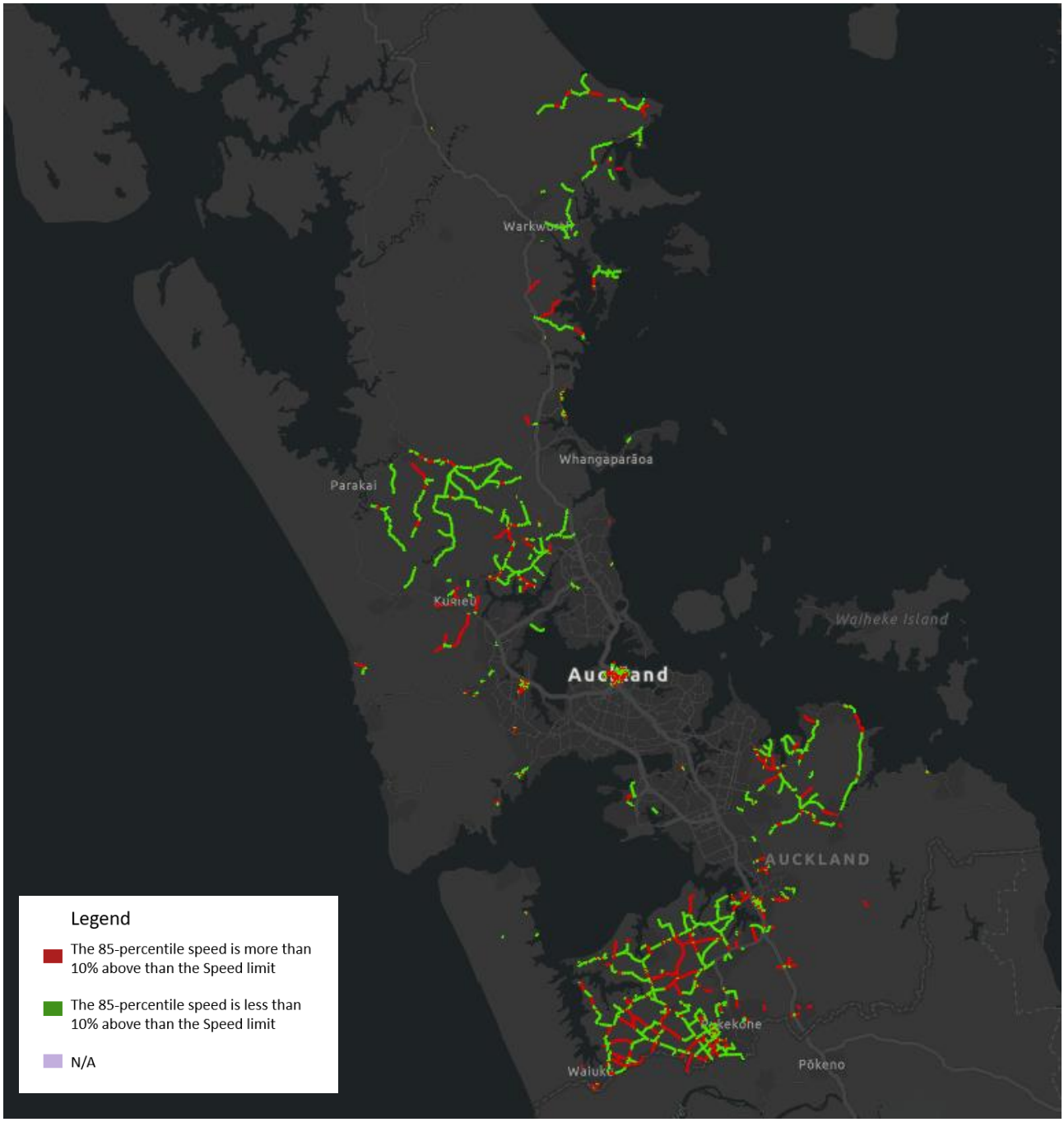

Figure - Compliance map All Auckland Direction 2 (February 2022)

Figure - Compliance map City Centre Direction 1 (February 2022)

Figure - Compliance map All Auckland Direction 2 (February 2022)

Figure - Compliance map North Auckland Direction 1 on Left and Direction 2 on right (February 2022)

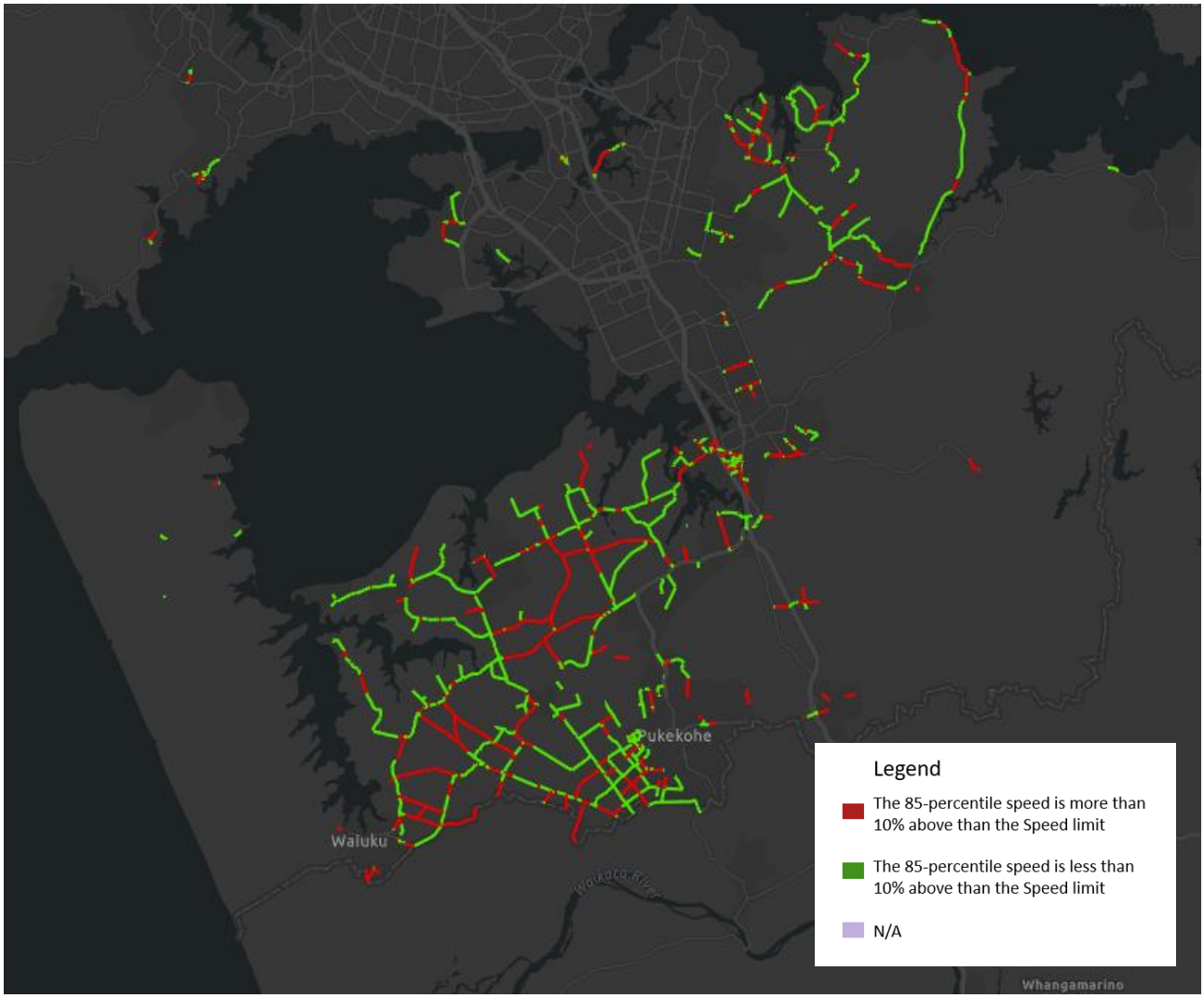

Figure - Compliance map Southern Auckland Direction 1 (February 2022)

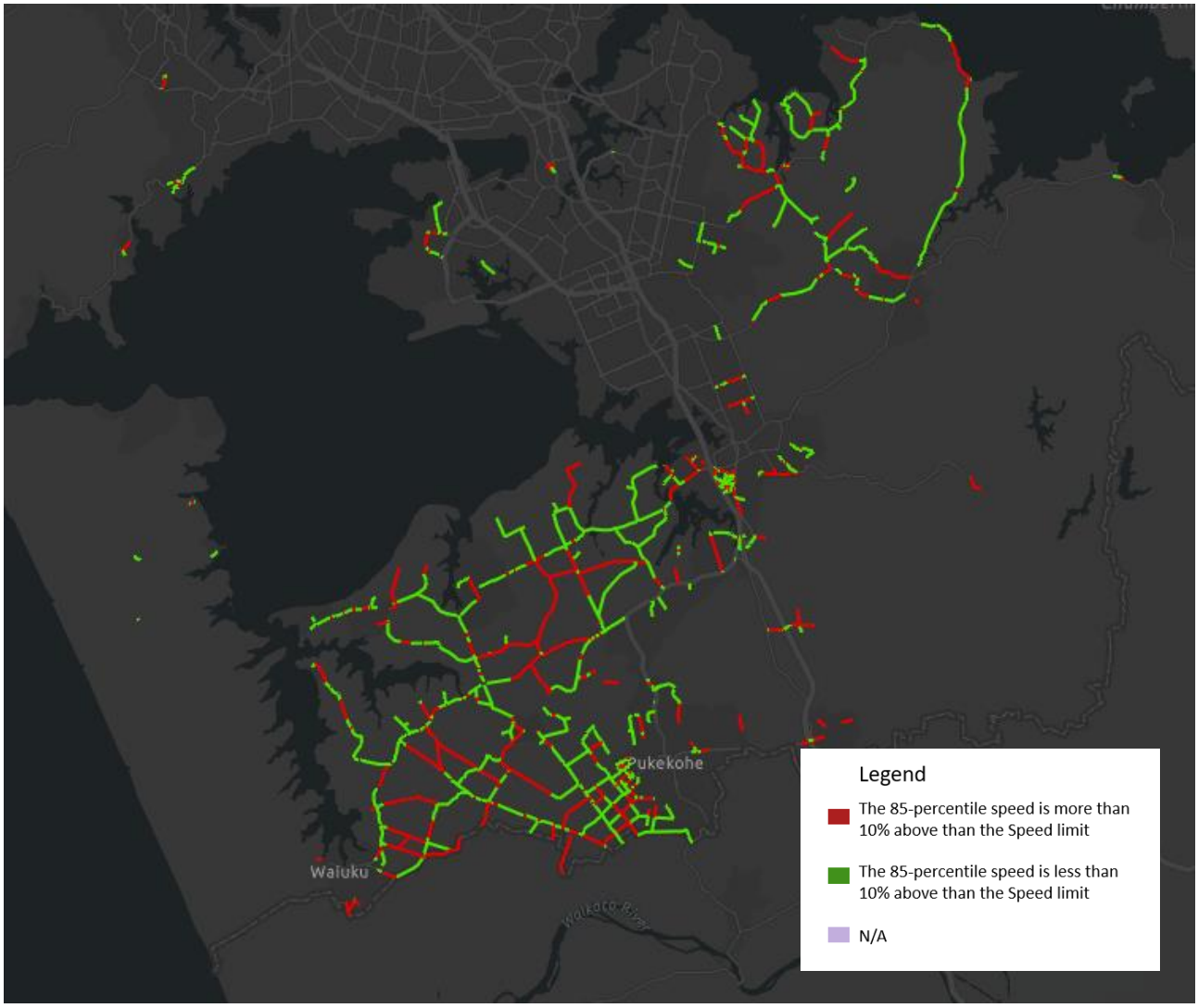

Figure - Compliance map Southern Auckland Direction 2 *(February 2022)*

Appendix E Detailed Crash Breakdown 18 month after analysis

All Speed limit changes

AT_Local_Board	New Speed Limit	Fatal Crashes per year - Before	Fatal Crashes per year - After	Serious Crashes per year - Before	Serious Crashes per year - After	Minor Crashes per year - Before	Minor Crashes per year - After
Franklin	60	0.4	1.3	5.6	6	24.2	15.3
Franklin	80	2.8	0.7	13.8	8.7	44.2	46
Franklin	40	0	0	0	0	0	0
Waitemata	10	0	0	0	0	1.2	0
Rodney	60	0.4	0	3.8	2.7	16.2	12.7
Rodney	80	0.8	0	4.6	4.7	15.6	16.7
Waitemata	30	0.6	0.7	16	15.3	80.6	42.7
Franklin	50	0.2	0	0.8	0.7	4	2.7
Rodney	40	0	0	0.6	0.7	0.2	0
Rodney	50	0	0	0.4	0	1.6	0
Upper Harbour	60	0	0	0.8	0.7	3.4	4
Hibiscus and Bays	60	0	0	0	0	0.2	0
Papakura	60	0	0	0.4	0.7	2.2	2
Papakura	30	0	0	0.6	1.3	2	0.7
Henderson-Massey	30	0	0	0.8	0.7	3.8	2
Papakura	50	0.2	0	1.6	0	9.2	7.3
Waitakere Ranges	40	0	0	0	0	0	0
Papakura	40	0	0	0.2	0	0.4	1.3
Franklin	No Change	0	0	0	0	0	0

Waitakere Ranges	30	0	0	0	0.7	0.6	0.7
Waitakere Ranges	60	0	0	0	0	0.6	0
Waitemata	20	0	0	0	0	0.4	0
Howick	60	0.2	0.7	1.8	0.7	4.4	4.7
Waitakere Ranges	50	0	0	0.6	0	0	0
Waitemata	40	0.2	0	3.2	2	14.6	5.3
Rodney	No Change	0	0	0	0	0	0
Upper Harbour	No Change	0	0	0	0	0	0
Mangere-Otahuhu	60	0	0	0.4	1.3	0.6	0.7
Upper Harbour	40	0	0	0	0	0	0
Upper Harbour	50	0.4	0	0.8	2	4.6	8
Mangere-Otahuhu	50	0	0	0.4	0.7	2	1.3
Howick	50	0	0	0	0	0.2	1.3
Henderson-Massey	50	0	0	0	0	0	0
Mangere-Otahuhu	30	0	0	0.8	0.7	2.4	2
Hibiscus and Bays	30	0	0	0	0	0	0
Hibiscus and Bays	50	0	0	0	0	0	0
Upper Harbour	80	0	0	0	0	0.4	0
Ōtara-Papatoetoe	60	0	0.7	0.4	0	1.6	1.3
Howick	80	0	0	0.4	0	0.8	0.7

Appendix F Road length greater than 110% of the posted speed (Feb 2022)

Note that all lengths in the below tables are for both directions (where data is available). Thus, road lengths will sometime be longer than the length of the road.

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Franklin	Adams Road	1206.4m	0m	1206.4m	0.0%
Franklin	Adams Road South	848.8m	0m	848.8m	0.0%
Franklin	Aka Aka Road	0m	3744.4m	3744.4m	100.0%
Franklin	Alfriston Road	2006.3m	62.1m	2068.4m	3.0%
Franklin	Anchor Road	353.2m	353.2m	706.3m	50.0%
Franklin	Anderson Way	62.2m	0m	62.2m	0.0%
Franklin	Anzac Road	943.7m	790.7m	1734.5m	45.6%
Franklin	Ara-Kotinga	3346.7m	3181.1m	6527.8m	48.7%
Franklin	Arana Drive	88.8m	0m	88.8m	0.0%
Franklin	Ararimu Road	1153.4m	3815m	4968.4m	76.8%
Franklin	Attewell Road	3423.2m	0m	3423.2m	0.0%
Franklin	Aulyn Drive	0m	1178.8m	1178.8m	100.0%
Franklin	Awhitu Road	0m	718.4m	718.4m	100.0%
Franklin	Bald Hill Road	444.4m	9101.3m	9545.7m	95.3%
Franklin	Barriball Road	1185.2m	0m	1185.2m	0.0%
Franklin	Bassett Road	1594.9m	0m	1594.9m	0.0%
Franklin	Batty Road	485.8m	10012.9m	10498.6m	95.4%
Franklin	Bayly Road	1442.3m	0m	1442.3m	0.0%
Franklin	Beatty Road	499.1m	1793.7m	2292.8m	78.2%
Franklin	Belgium Road	504m	580.9m	1084.9m	53.5%
Franklin	Belmont Road	2513.6m	88.8m	2602.4m	3.4%
Franklin	Blackbridge Road	6786.9m	971.5m	7758.4m	12.5%
Franklin	Blake Road	823.4m	2916.5m	3739.8m	78.0%
Franklin	Bombay Road	0m	1105.2m	1105.2m	100.0%
Franklin	Bowker Road	818.8m	51.9m	870.7m	6.0%
Franklin	Brook Road	257.9m	458.3m	716.2m	64.0%
Franklin	Brookby Road	7947.8m	2849.6m	10797.4m	26.4%
Franklin	Brookside Road	3402.8m	317.3m	3720.2m	8.5%
Franklin	Broomfields Road	4029.9m	2433m	6462.9m	37.7%
Franklin	Brownhill Road	3166.8m	0m	3166.8m	0.0%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Franklin	Bryant Road	1130.2m	0m	1130.2m	0.0%
Franklin	Burberry Road	75.6m	0m	75.6m	0.0%
Franklin	Butcher Road	1563.4m	141.3m	1704.7m	8.3%
Franklin	Calcutta Road	1344.3m	0m	1344.3m	0.0%
Franklin	Cape Hill Road	1991.3m	1962.5m	3953.8m	49.6%
Franklin	Cemetery Road	76.4m	1283.9m	1360.2m	94.4%
Franklin	Charles Road	4382.9m	4751.1m	9134m	52.0%
Franklin	Clark Road	411.8m	320.2m	732m	43.7%
Franklin	Clarks Beach Road	6305.1m	723.3m	7028.4m	10.3%
Franklin	Clevedon Kawakawa Road	1279.7m	228m	1507.8m	15.1%
Franklin	Clifton Road	6449.6m	1341.6m	7791.1m	17.2%
Franklin	Collingwood Road	178.3m	941.6m	1119.9m	84.1%
Franklin	Conroy Road	1386.2m	887.9m	2274.1m	39.0%
Franklin	Cornwall Road	1458m	222.2m	1680.2m	13.2%
Franklin	Crown Road	1123.5m	285.4m	1408.9m	20.3%
Franklin	Cuff Road	460.8m	3536.7m	3997.5m	88.5%
Franklin	Dale Road	601.3m	0m	601.3m	0.0%
Franklin	Day Road	1783m	0m	1783m	0.0%
Franklin	Dazeley Road	230.5m	1387.2m	1617.7m	85.8%
Franklin	Dell Road	1280.6m	0m	1280.6m	0.0%
Franklin	Domain Road	1293.4m	0m	1293.4m	0.0%
Franklin	Douglas Road	1773.7m	611.3m	2385m	25.6%
Franklin	Dyke Road	0m	303.6m	303.6m	100.0%
Franklin	East Street	532.8m	24m	556.9m	4.3%
Franklin	Eden Road	2153.1m	692.8m	2845.9m	24.4%
Franklin	Ellett Road	3590.2m	0m	3590.2m	0.0%
Franklin	Ernest George Drive	0m	221.4m	221.4m	100.0%
Franklin	Estuary View Road	699.2m	7.2m	706.3m	1.0%
Franklin	Factory Road	628.9m	0m	628.9m	0.0%
Franklin	Findlay Road	1943.9m	0m	1943.9m	0.0%
Franklin	Fitzpatrick Road	187.6m	0m	187.6m	0.0%
Franklin	Flanagan Road	1457.3m	0m	1457.3m	0.0%
Franklin	Foy Road	603.2m	512.8m	1116m	46.0%
Franklin	Gallagher Road	373.8m	0m	373.8m	0.0%
Franklin	Galloway Road	1104.6m	0m	1104.6m	0.0%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Franklin	Gearon Road	0m	4533.5m	4533.5m	100.0%
Franklin	Gellert Road	1673.4m	0m	1673.4m	0.0%
Franklin	Glenbrook Beach Road	7000m	2832.5m	9832.5m	28.8%
Franklin	Glenbrook Road	16366.4m	12404.8m	28771.2m	43.1%
Franklin	Glenbrook Station Road	3190.4m	5252.6m	8442.9m	62.2%
Franklin	Glenbrook-Waiuku Road	5636.7m	3203.5m	8840.1m	36.2%
Franklin	Golding Road	53m	122.8m	175.8m	69.9%
Franklin	Great South Road	335.1m	376.9m	712m	52.9%
Franklin	Green Lane	289m	0m	289m	0.0%
Franklin	Griggs Road	560.6m	0m	560.6m	0.0%
Franklin	Gun Club Road	5471.7m	1503.4m	6975.1m	21.6%
Franklin	Hall Road	0m	2617.6m	2617.6m	100.0%
Franklin	Hart Road	2829.9m	975.8m	3805.6m	25.6%
Franklin	Hawthorne Lane	0m	25.6m	25.6m	100.0%
Franklin	Heights Road	3637.3m	0m	3637.3m	0.0%
Franklin	Helvetia Road	1454.1m	0m	1454.1m	0.0%
Franklin	Henson Road	1825m	0m	1825m	0.0%
Franklin	Hill Top Road	0m	3799.8m	3799.8m	100.0%
Franklin	Huamanu Street	284.9m	127m	411.9m	30.8%
Franklin	Hull Road	119.7m	707.5m	827.1m	85.5%
Franklin	Hunter Road	5272m	226.1m	5498.1m	4.1%
Franklin	Irwin Road	186.2m	6647.2m	6833.3m	97.3%
Franklin	Jack Lachlan Drive	773.2m	3000.5m	3773.7m	79.5%
Franklin	Jellicoe Road	946.7m	0m	946.7m	0.0%
Franklin	Jesmond Road	667.9m	3371.5m	4039.4m	83.5%
Franklin	Jutland Road	481m	93.3m	574.3m	16.2%
Franklin	Karaka North Road	6636.5m	0m	6636.5m	0.0%
Franklin	Keanes Road	31.6m	0m	31.6m	0.0%
Franklin	Kellys Road	321.6m	1392.2m	1713.8m	81.2%
Franklin	Kidd Road	2920.6m	379.5m	3300.1m	11.5%
Franklin	Kimptons Road	2913.7m	0m	2913.7m	0.0%
Franklin	Kingseat Road	12982.9m	4272.3m	17255.2m	24.8%
Franklin	Kitchener Road	646.2m	1623m	2269.3m	71.5%
Franklin	Klipsch Road	1278.9m	0m	1278.9m	0.0%
Franklin	Koropupu Street	450.2m	450.2m	900.4m	50.0%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Franklin	Laing Road	4991.5m	0m	4991.5m	0.0%
Franklin	Leamy Way	245.3m	0m	245.3m	0.0%
Franklin	Lewis Road	6777.5m	0m	6777.5m	0.0%
Franklin	Linwood Road	16633.6m	4453.9m	21087.5m	21.1%
Franklin	Maher Road	25.3m	25.3m	50.7m	50.0%
Franklin	Makatiti Street	477.7m	16.7m	494.4m	3.4%
Franklin	Maraetai Coast Road	2743m	4737.8m	7480.8m	63.3%
Franklin	Maraetai Drive	824.3m	68m	892.2m	7.6%
Franklin	Matakawau Road	1736m	25.6m	1761.6m	1.5%
Franklin	Matawai Puna Drive	215.2m	0m	215.2m	0.0%
Franklin	Mauku Road	279.1m	3545.2m	3824.3m	92.7%
Franklin	Maxwell Road	534.3m	0m	534.3m	0.0%
Franklin	Mceldownie Road	116.5m	0m	116.5m	0.0%
Franklin	Mckenzie Road	6829m	967.6m	7796.6m	12.4%
Franklin	Mclarin Road	1206.6m	726.8m	1933.4m	37.6%
Franklin	Mcnally Road	1013.4m	266.7m	1280.1m	20.8%
Franklin	Mcrobbie Road	1032.3m	1714.2m	2746.4m	62.4%
Franklin	Mercer Street	150.2m	0m	150.2m	0.0%
Franklin	Middleton Road	2074.3m	806m	2880.2m	28.0%
Franklin	Mill Road	882.9m	1379.2m	2262.1m	61.0%
Franklin	Monument Road	0m	708.5m	708.5m	100.0%
Franklin	Morley Road	385m	5764.8m	6149.8m	93.7%
Franklin	Muir Road	80.6m	6820.7m	6901.3m	98.8%
Franklin	North Road	17326m	2446.4m	19772.4m	12.4%
Franklin	O Ruamano Crescent	192.4m	0m	192.4m	0.0%
Franklin	Okaroro Drive	0m	75.5m	75.5m	100.0%
Franklin	Ostrich Farm Road	484.9m	4426.5m	4911.4m	90.1%
Franklin	Ostrich Road	7254.1m	516.5m	7770.6m	6.7%
Franklin	Papakura-Clevedon Road	1338.3m	0m	1338.3m	0.0%
Franklin	Paparata Road	0m	1140.2m	1140.2m	100.0%
Franklin	Patumahoe Road	9118.5m	1275.5m	10393.9m	12.3%
Franklin	Pearson Road	2546.6m	222.2m	2768.7m	8.0%
Franklin	Pilgrim Road	0m	2401.9m	2401.9m	100.0%
Franklin	Pollock Road	0m	3847m	3847m	100.0%
Franklin	Pollok Wharf Road	173.9m	0m	173.9m	0.0%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Franklin	Polo Lane	918.1m	0m	918.1m	0.0%
Franklin	Porterfield Road	0m	871.7m	871.7m	100.0%
Franklin	Potts Road	4370.1m	0m	4370.1m	0.0%
Franklin	Pukekohe East Road	325.7m	859.1m	1184.9m	72.5%
Franklin	Pukeoware Road	308.1m	4406.8m	4714.9m	93.5%
Franklin	Puni Road	1038.8m	597m	1635.8m	36.5%
Franklin	Quinn Road	294.1m	4510.6m	4804.7m	93.9%
Franklin	Raki Street	143.1m	192.3m	335.4m	57.4%
Franklin	Ramarama Road	0m	1688.4m	1688.4m	100.0%
Franklin	Ray Wright Road	3516.2m	0m	3516.2m	0.0%
Franklin	Reg Bennett Road	49.1m	0m	49.1m	0.0%
Franklin	Reid Road	1470.4m	0m	1470.4m	0.0%
Franklin	Richardson Road	162.5m	0m	162.5m	0.0%
Franklin	Rifle Range Road	289.8m	0m	289.8m	0.0%
Franklin	Rogers Road	0m	4012.1m	4012.1m	100.0%
Franklin	Rowles Road	445.8m	592.7m	1038.5m	57.1%
Franklin	Runciman Road	0m	1524.2m	1524.2m	100.0%
Franklin	Russell Road	2034.4m	0m	2034.4m	0.0%
Franklin	Ryan Road	298m	0m	298m	0.0%
Franklin	Saddleton Road	0m	1068.8m	1068.8m	100.0%
Franklin	Saleyard Road	64m	0m	64m	0.0%
Franklin	Sandstone Road	1560.1m	1932.4m	3492.5m	55.3%
Franklin	Schlaepfer Road	1567m	0m	1567m	0.0%
Franklin	Seagrove Road	310.7m	3535.1m	3845.9m	91.9%
Franklin	Sedgebrook Road	716.7m	0m	716.7m	0.0%
Franklin	Shakespeare Road	566.7m	2743m	3309.7m	82.9%
Franklin	Sim Road	2729.9m	0m	2729.9m	0.0%
Franklin	Solway Road	1775m	0m	1775m	0.0%
Franklin	Sommerville Road	2616.8m	0m	2616.8m	0.0%
Franklin	Stan Wright Road	126.6m	2672.7m	2799.3m	95.5%
Franklin	Stuart Road	1226.5m	0m	1226.5m	0.0%
Franklin	Sydney Owen Road	0m	833.8m	833.8m	100.0%
Franklin	Tawhiti Road	1195.3m	0m	1195.3m	0.0%
Franklin	Taylor Road	1083m	0m	1083m	0.0%
Franklin	Te Manaki Street	604.6m	184.1m	788.7m	23.3%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Franklin	Titi Road	3148.8m	671.4m	3820.2m	17.6%
Franklin	Tramway Road	430.7m	2159.2m	2589.9m	83.4%
Franklin	Trig Road	4724.8m	184.8m	4909.6m	3.8%
Franklin	Tuakau Road	4860.8m	0m	4860.8m	0.0%
Franklin	Tudor Park Drive	1977.4m	165.1m	2142.5m	7.7%
Franklin	Tuhimata Road	2259.4m	101.1m	2360.5m	4.3%
Franklin	Twilight Road	7060.9m	3940.2m	11001.1m	35.8%
Franklin	Tyldens Road	49.4m	0m	49.4m	0.0%
Franklin	Union Road	5168.2m	4163.9m	9332.1m	44.6%
Franklin	Upper Queen Street	1450.7m	1118.5m	2569.2m	43.5%
Franklin	Urquhart Road	2890.9m	3997.5m	6888.4m	58.0%
Franklin	Victoria Crescent	118.6m	0m	118.6m	0.0%
Franklin	Victoria Street West	0m	718m	718m	100.0%
Franklin	Wades Road	1016.9m	1016.9m	2033.9m	50.0%
Franklin	Waiau Pa Road	10275.8m	808.2m	11084m	7.3%
Franklin	Waikopua Road	561.1m	0m	561.1m	0.0%
Franklin	Waitangi Falls Road	0m	680.8m	680.8m	100.0%
Franklin	Waiuku Road	25533m	6207.6m	31740.6m	19.6%
Franklin	Waiuku-Otaua Road	0m	1452m	1452m	100.0%
Franklin	Waller Road	835.6m	635.9m	1471.5m	43.2%
Franklin	Walters Road	5122.2m	0m	5122.2m	0.0%
Franklin	West Road	3756.7m	3900.2m	7656.9m	50.9%
Franklin	Whangapouri Road	157.7m	3367.8m	3525.5m	95.5%
Franklin	Wharf Road	811.9m	0m	811.9m	0.0%
Franklin	Whites Road	1964.1m	0m	1964.1m	0.0%
Franklin	Whitford Park Road	6662.9m	1323.9m	7986.8m	16.6%
Franklin	Whitford-Maraetai Road	10085.8m	2532.8m	12618.6m	20.1%
Franklin	William Potter Lane	375m	0m	375m	0.0%
Franklin	Wily Road	0m	1446.4m	1446.4m	100.0%
Franklin	Woodlands Road	1787.4m	0m	1787.4m	0.0%
Franklin	Woodlyn Drive	626.1m	12.6m	638.7m	2.0%
Franklin	Wright Road	2863.3m	490.4m	3353.7m	14.6%
Franklin	Wymer Road	1442.1m	0m	1442.1m	0.0%
Franklin, Howick	Ormiston Road	2274.9m	777.7m	3052.6m	25.5%
Franklin, Howick	Whitford Road	2806.3m	6795.3m	9601.5m	70.8%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Franklin, Papakura	Bremner Road	3295.8m	153.4m	3449.1m	4.5%
Franklin, Papakura	Hingaia Road	676.6m	1810.5m	2487m	72.8%
Franklin, Papakura	Hunua Road	0m	4724.2m	4724.2m	100.0%
Franklin, Papakura	Waihoehoe Road	355.4m	816.3m	1171.7m	69.7%
Henderson-Massey	Amberley Avenue	799.7m	360.3m	1160m	31.1%
Henderson-Massey	Blethyn Place	231.4m	0m	231.4m	0.0%
Henderson-Massey	Chamberlain Road	1857.4m	0m	1857.4m	0.0%
Henderson-Massey	Flanshaw Road	830.1m	1605.9m	2436m	65.9%
Henderson-Massey	Grainger Road	404.7m	30.8m	435.5m	7.1%
Henderson-Massey	Maki Street	658.8m	21.1m	680m	3.1%
Henderson-Massey	Marewa Street	194.9m	172.4m	367.3m	46.9%
Henderson-Massey	Marlene Avenue	270.7m	0m	270.7m	0.0%
Henderson-Massey	Mccormick Road	0m	96.4m	96.4m	100.0%
Henderson-Massey	Paton Avenue	147.8m	147.8m	295.7m	50.0%
Henderson-Massey	Porter Avenue	177.8m	133.1m	311m	42.8%
Henderson-Massey	Royal View Road	391.8m	1477.5m	1869.3m	79.0%
Henderson-Massey	School Road	453.7m	547.2m	1000.9m	54.7%
Henderson-Massey	Sherwood Avenue	0m	1354m	1354m	100.0%
Henderson-Massey	Sylvan Crescent	1712m	0m	1712m	0.0%
Henderson-Massey	Vera Road	728.4m	599.7m	1328m	45.2%
Henderson-Massey	Vodanovich Road	992.1m	1682.6m	2674.7m	62.9%
Hibiscus and Bays	Alice Avenue	25.1m	25.1m	50.1m	50.0%
Hibiscus and Bays	Bakehouse Lane	220m	0m	220m	0.0%
Hibiscus and Bays	Beach Road	581.3m	607.3m	1188.7m	51.1%
Hibiscus and Bays	Cammish Lane	189.3m	36m	225.4m	16.0%
Hibiscus and Bays	Empire Road	50.6m	50.6m	101.3m	50.0%
Hibiscus and Bays	Florence Avenue	332.5m	466.9m	799.4m	58.4%
Hibiscus and Bays	George Lowe Place	119.9m	0m	119.9m	0.0%
Hibiscus and Bays	Hasting Road	40.6m	118.5m	159.1m	74.5%
Hibiscus and Bays	Hibiscus Coast Highway	1797.4m	3293.1m	5090.4m	64.7%
Hibiscus and Bays	Keith Morris Lane	219.6m	0m	219.6m	0.0%
Hibiscus and Bays	Marine View	57.6m	0m	57.6m	0.0%
Hibiscus and Bays	Moana Avenue	738.6m	36.1m	774.8m	4.7%
Hibiscus and Bays	Moenui Avenue	598.5m	155.7m	754.2m	20.7%
Hibiscus and Bays	Montrose Terrace	495.9m	189.4m	685.3m	27.6%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Hibiscus and Bays	Ramsgate Terrace	49.6m	164m	213.6m	76.8%
Hibiscus and Bays	Riverside Road	42.4m	101.3m	143.7m	70.5%
Hibiscus and Bays	Sidmouth Street	414m	10.5m	424.5m	2.5%
Hibiscus and Bays	Tamariki Avenue	759.8m	0m	759.8m	0.0%
Hibiscus and Bays	Tenzing Lane	95.7m	0m	95.7m	0.0%
Hibiscus and Bays	Toroa Street	39.9m	0m	39.9m	0.0%
Hibiscus and Bays	Whangaparaoa Road	1837.5m	0m	1837.5m	0.0%
Hibiscus and Bays, Rodney, Upper Harbour	Lonely Track Road	2531.6m	213.6m	2745.1m	7.8%
Howick	Flat Bush School Road	2483.5m	392.5m	2876m	13.7%
Howick	Mcquoids Road	889.4m	0m	889.4m	0.0%
Howick	Murphys Road	1806.1m	0m	1806.1m	0.0%
Howick	Thomas Road	1606.6m	0m	1606.6m	0.0%
Mangere-Otahuhu	Ascot Road	1104.3m	942.8m	2047.1m	46.1%
Mangere-Otahuhu	Avenue Road	120.2m	154m	274.2m	56.2%
Mangere-Otahuhu	Creamery Road	865m	0m	865m	0.0%
Mangere-Otahuhu	Criterion Street	102.2m	0m	102.2m	0.0%
Mangere-Otahuhu	Gordon Road	89.4m	156.1m	245.4m	63.6%
Mangere-Otahuhu	Great South Road	853.4m	272.8m	1126.2m	24.2%
Mangere-Otahuhu	Greenwood Road	2708.8m	0m	2708.8m	0.0%
Mangere-Otahuhu	Hall Avenue	66.5m	0m	66.5m	0.0%
Mangere-Otahuhu	King Street	73.4m	102.7m	176.1m	58.3%
Mangere-Otahuhu	Mason Avenue	118.2m	240.2m	358.4m	67.0%
Mangere-Otahuhu	Montgomerie Road	1626.6m	1575.5m	3202.1m	49.2%
Mangere-Otahuhu	Pukaki Road	1886.8m	0m	1886.8m	0.0%
Mangere-Otahuhu	Station Road	154.3m	267.5m	421.7m	63.4%
Otara-Papatoetoe, Howick	Highbrook Drive	1127.3m	2240.7m	3368m	66.5%
Papakura	Airfield Road	795.7m	2197.9m	2993.6m	73.4%
Papakura	Boundary Road	729.6m	1349.8m	2079.4m	64.9%
Papakura	Chichester Drive	899.3m	2004.6m	2903.9m	69.0%
Papakura	Derbyshire Lane	342m	0m	342m	0.0%
Papakura	Dominion Road	1654.4m	810.3m	2464.7m	32.9%
Papakura	Edinburgh Avenue	915.2m	69.3m	984.5m	7.0%
Papakura	Erceg Way	145.8m	0m	145.8m	0.0%
Papakura	Gatland Road	834.3m	0m	834.3m	0.0%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Papakura	Goodwin Drive	484.2m	311.5m	795.7m	39.1%
Papakura	Great South Road	0m	2488.5m	2488.5m	100.0%
Papakura	Grove Road	528.8m	836.8m	1365.6m	61.3%
Papakura	Harbourside Drive	410.5m	552.8m	963.3m	57.4%
Papakura	Hayfield Way	1262.8m	0m	1262.8m	0.0%
Papakura	Hilldene Road	0m	451.4m	451.4m	100.0%
Papakura	Hingaia Road	886.2m	2533.3m	3419.5m	74.1%
Papakura	Jupiter Street	844.7m	0m	844.7m	0.0%
Papakura	Magnolia Avenue	305.7m	36.6m	342.4m	10.7%
Papakura	Normanby Road	748.8m	243.5m	992.3m	24.5%
Papakura	Oakland Road	1069.4m	1351.2m	2420.6m	55.8%
Papakura	Orchard Rise	501.1m	299.4m	800.5m	37.4%
Papakura	Pararekau Road	475.2m	1341.4m	1816.6m	73.8%
Papakura	Park Estate Road	903.6m	271.5m	1175m	23.1%
Papakura	Red Hill Road	1056.5m	0m	1056.5m	0.0%
Papakura	Rosehill Drive	466.1m	1507.9m	1973.9m	76.4%
Papakura	Royal Arch Place	188.6m	0m	188.6m	0.0%
Papakura	Royston Street	849.5m	91.1m	940.6m	9.7%
Papakura	Settlement Road	2153m	194m	2347m	8.3%
Papakura	Sunnypark Avenue	390.1m	349.1m	739.1m	47.2%
Papakura	Tairere Crescent	413.7m	0m	413.7m	0.0%
Papakura	Tanah Merah Drive	299.9m	0m	299.9m	0.0%
Papakura	Taonui Street	70.4m	170.1m	240.5m	70.7%
Papakura	Tatariki Street	1459.4m	0m	1459.4m	0.0%
Papakura	Victoria Street	1102.9m	0m	1102.9m	0.0%
Papakura	Walters Road	614.7m	2209.9m	2824.5m	78.2%
Papakura	Wastney Road	1166.7m	278m	1444.6m	19.2%
Rodney	Access Road	302.9m	1095.5m	1398.4m	78.3%
Rodney	Anderson Road	1028.1m	0m	1028.1m	0.0%
Rodney	Ararimu Valley Road	20625.9m	0m	20625.9m	0.0%
Rodney	Austin Road	5440.7m	0m	5440.7m	0.0%
Rodney	Bald Hill Road	6186.8m	786.5m	6973.3m	11.3%
Rodney	Bathgate Road	53.5m	0m	53.5m	0.0%
Rodney	Beacon Road	108.7m	0m	108.7m	0.0%
Rodney	Blackbridge Road	9378.6m	154.9m	9533.4m	1.6%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Rodney	Blake Lane	461.7m	0m	461.7m	0.0%
Rodney	Broadlands Drive	0m	1589.7m	1589.7m	100.0%
Rodney	Burne Road	347.7m	0m	347.7m	0.0%
Rodney	Cape Rodney Road	0m	1116.7m	1116.7m	100.0%
Rodney	Coatesville-Riverhead Highway	7948.1m	11374.7m	19322.8m	58.9%
Rodney	Constable Road	2024.2m	285m	2309.1m	12.3%
Rodney	Cottle Road	387.1m	2323.9m	2711m	85.7%
Rodney	Cowan Bay Road	577.9m	3357.3m	3935.2m	85.3%
Rodney	Coxhead Creek Road	0m	232.8m	232.8m	100.0%
Rodney	Donaldson Drive	618.3m	0m	618.3m	0.0%
Rodney	Dormer Road	1299.6m	0m	1299.6m	0.0%
Rodney	Drinnan Road	930.8m	0m	930.8m	0.0%
Rodney	Duck Creek Road	705.1m	0m	705.1m	0.0%
Rodney	Escott Road	2820.8m	0m	2820.8m	0.0%
Rodney	Flagstaffe Road	422.8m	0m	422.8m	0.0%
Rodney	Forestry Road	9996.8m	0m	9996.8m	0.0%
Rodney	Goat Island Road	2531.4m	387.2m	2918.6m	13.3%
Rodney	Green Road	4446.6m	0m	4446.6m	0.0%
Rodney	Hamilton Road	2733.3m	0m	2733.3m	0.0%
Rodney	Hepburn Creek Road	303.5m	0m	303.5m	0.0%
Rodney	Horseshoe Bush Road	17557.2m	610.8m	18168m	3.4%
Rodney	Hull Road	827.5m	16.1m	843.6m	1.9%
Rodney	Hungry Creek Road	237.3m	0m	237.3m	0.0%
Rodney	Inland Road	15939.2m	77.3m	16016.5m	0.5%
Rodney	Ireland Road	7237.4m	0m	7237.4m	0.0%
Rodney	Jackson Crescent	232.8m	0m	232.8m	0.0%
Rodney	Jeffs Road	688.7m	0m	688.7m	0.0%
Rodney	Jones Road	2696m	0m	2696m	0.0%
Rodney	Kahikatea Flat Road	18177m	7438.8m	25615.8m	29.0%
Rodney	Kennedy Road	873.9m	310.3m	1184.2m	26.2%
Rodney	Koraha Road	333.1m	1815.8m	2148.9m	84.5%
Rodney	Lathrope Road	1014.6m	0m	1014.6m	0.0%
Rodney	Lawrie Road	1445.9m	0m	1445.9m	0.0%
Rodney	Leigh Road	17052.9m	871.4m	17924.4m	4.9%
Rodney	Lewis Lane	86.2m	0m	86.2m	0.0%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Rodney	M Greenwood Road	46m	0m	46m	0.0%
Rodney	Mahurangi East Road	1114.3m	0m	1114.3m	0.0%
Rodney	Mahurangi West Road	12251.7m	0m	12251.7m	0.0%
Rodney	Manuka Grove	1224.9m	0m	1224.9m	0.0%
Rodney	Martins Bay Road	5901.5m	0m	5901.5m	0.0%
Rodney	Mill Flat Road	4210m	0m	4210m	0.0%
Rodney	Miller Way	1573.1m	0m	1573.1m	0.0%
Rodney	Ngarewa Drive	1580.9m	2308.5m	3889.4m	59.4%
Rodney	Nobilo Road	584.4m	1092.2m	1676.6m	65.2%
Rodney	Oaia Road	1411.8m	1616.1m	3027.9m	53.4%
Rodney	Old North Road	8159.4m	99.7m	8259.1m	1.2%
Rodney	Omaha Valley Road	0m	463.8m	463.8m	100.0%
Rodney	Oraha Road	2764.9m	975.2m	3740.1m	26.1%
Rodney	Pakiri River Road	5650.3m	0m	5650.3m	0.0%
Rodney	Pakiri Road	25428.7m	8227.3m	33656.1m	24.5%
Rodney	Peak Road	12099.9m	7833.7m	19933.6m	39.3%
Rodney	Pinetone Road	1153.7m	0m	1153.7m	0.0%
Rodney	Point Wells Road	705.3m	914.8m	1620.1m	56.5%
Rodney	Potter Road	3138.7m	68.1m	3206.9m	2.1%
Rodney	Pukapuka Road	3904.9m	3823.8m	7728.7m	49.5%
Rodney	Rangitopuni Road	691.4m	0m	691.4m	0.0%
Rodney	Rautawhiri Road	2341.7m	804.3m	3146m	25.6%
Rodney	Richards Road	174.7m	0m	174.7m	0.0%
Rodney	Ridge Road	2893.2m	2663m	5556.3m	47.9%
Rodney	Robinson Road	0m	3885.8m	3885.8m	100.0%
Rodney	Rodney Road	0m	2766.3m	2766.3m	100.0%
Rodney	Sandspit Road	6850.1m	165.6m	7015.7m	2.4%
Rodney	Sawmill Road	288.4m	0m	288.4m	0.0%
Rodney	Scandrett Road	2294m	0m	2294m	0.0%
Rodney	Sharp Road	6797.8m	0m	6797.8m	0.0%
Rodney	Sheffield Road	1355.6m	0m	1355.6m	0.0%
Rodney	Sophia Road	736.4m	0m	736.4m	0.0%
Rodney	Station Road	0m	1023.3m	1023.3m	100.0%
Rodney	Sunnyside Road	4121.9m	5351.3m	9473.3m	56.5%
Rodney	Tairere Road	289m	0m	289m	0.0%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Rodney	Taupaki Road	933.8m	9023.6m	9957.3m	90.6%
Rodney	Tender Road	1639.8m	0m	1639.8m	0.0%
Rodney	Thompson Road	215m	0m	215m	0.0%
Rodney	Three Oaks Drive	3334.3m	0m	3334.3m	0.0%
Rodney	Ti Point Road	3562.6m	259.6m	3822.2m	6.8%
Rodney	Turley Road	642.9m	0m	642.9m	0.0%
Rodney	Upper Orewa Road	0m	2683.5m	2683.5m	100.0%
Rodney	Waikoukou Valley Road	4326.3m	1113.3m	5439.6m	20.5%
Rodney	Waitakere Road	891.5m	2394.3m	3285.8m	72.9%
Rodney	Wake Road	2933m	0m	2933m	0.0%
Rodney	Wharf Road	0m	93.8m	93.8m	100.0%
Rodney	Wright Road	10119.3m	0m	10119.3m	0.0%
Rodney	Zanders Road	3922m	0m	3922m	0.0%
Rodney, Hibiscus and Bays	Kowhai Road	1193.5m	0m	1193.5m	0.0%
Rodney, Upper Harbour	Albany Heights Road	4506.2m	593.5m	5099.7m	11.6%
Rodney, Upper Harbour	Brookdale Road	1768.3m	688.5m	2456.8m	28.0%
Rodney, Upper Harbour	Mahoenui Valley Road	2430.9m	2228.6m	4659.5m	47.8%
Rodney, Upper Harbour	O'brien Road	3447.7m	74.7m	3522.3m	2.1%
Rodney, Upper Harbour	Ridge Road	15219.6m	0m	15219.6m	0.0%
Upper Harbour	Albany Highway	3138.7m	276m	3414.6m	8.1%
Upper Harbour	Attwood Road	0m	86.1m	86.1m	100.0%
Upper Harbour	Elmore Road	3869.3m	22.9m	3892.2m	0.6%
Upper Harbour	Hardens Lane	1113.6m	0m	1113.6m	0.0%
Upper Harbour	Hobson Road	587.3m	1824.9m	2412.2m	75.7%
Upper Harbour	Iona Avenue	758m	0m	758m	0.0%
Upper Harbour	Leveloff Road	193m	0m	193m	0.0%
Upper Harbour	Merewhira Road	903.5m	1797.6m	2701.1m	66.6%
Upper Harbour	Oteha Valley Road	1865.8m	1442.6m	3308.4m	43.6%
Upper Harbour	Paremoremo Road	20.1m	4085.1m	4105.2m	99.5%
Upper Harbour	Ridge Road	2630.9m	0m	2630.9m	0.0%
Upper Harbour	Sanders Road	1265.3m	0m	1265.3m	0.0%
Upper Harbour	Scott Road	3582.4m	38.3m	3620.7m	1.1%
Waitakere Ranges	Albionvale Road	225.1m	971.4m	1196.5m	81.2%
Waitakere Ranges	Crows Road	761m	0m	761m	0.0%
Waitakere Ranges	Helios Place	132.8m	93.8m	226.7m	41.4%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Waitakere Ranges	Huia Road	3323.5m	1638m	4961.5m	33.0%
Waitakere Ranges	Laingholm Drive	817.3m	644.6m	1461.9m	44.1%
Waitakere Ranges	O'Neills Road	688.2m	303.1m	991.3m	30.6%
Waitakere Ranges	Pooks Road	579.9m	0m	579.9m	0.0%
Waitakere Ranges	Shirley Road	755.3m	0m	755.3m	0.0%
Waitakere Ranges	Tasman View Road	10.4m	0m	10.4m	0.0%
Waitakere Ranges	Tram Valley Road	602.1m	273.9m	876m	31.3%
Waitakere Ranges	Tuck Nathan Drive	716.7m	0m	716.7m	0.0%
Waitemata	Abbey Street	140.5m	44.3m	184.8m	24.0%
Waitemata	Adelaide Street	204.3m	0m	204.3m	0.0%
Waitemata	Airedale Street	537.5m	0m	537.5m	0.0%
Waitemata	Albert Street	1096m	470.7m	1566.8m	30.1%
Waitemata	Alten Road	67.2m	476m	543.1m	87.6%
Waitemata	Anzac Avenue	0m	1185.4m	1185.4m	100.0%
Waitemata	Arthur Street	639.4m	26.4m	665.8m	4.0%
Waitemata	Bacon's Lane	26.7m	122.6m	149.3m	82.1%
Waitemata	Bankside Street	141.3m	0m	141.3m	0.0%
Waitemata	Beach Road	0m	1513.3m	1513.3m	100.0%
Waitemata	Beaumont Street	77.4m	792m	869.4m	91.1%
Waitemata	Beresford Square	23.9m	207.2m	231m	89.7%
Waitemata	Boardman Lane	12.7m	12.7m	25.4m	50.0%
Waitemata	Bowen Avenue	82.7m	497.1m	579.8m	85.7%
Waitemata	Bradnor Lane	108.1m	0m	108.1m	0.0%
Waitemata	Brigham Street	671.6m	1132.3m	1803.9m	62.8%
Waitemata	Britomart Place	216.4m	94.4m	310.8m	30.4%
Waitemata	Canada Street	40.8m	334.1m	374.9m	89.1%
Waitemata	Cascade Street	176.2m	0m	176.2m	0.0%
Waitemata	Centre Street	197m	0m	197m	0.0%
Waitemata	Chancery Street	408.8m	0m	408.8m	0.0%
Waitemata	Churchill Street	136.6m	43.5m	180.1m	24.1%
Waitemata	Cintra Place	45.6m	0m	45.6m	0.0%
Waitemata	City Road	432m	73.7m	505.7m	14.6%
Waitemata	Cobden Street	0m	89.6m	89.6m	100.0%
Waitemata	College Hill	0m	11.4m	11.4m	100.0%
Waitemata	Commerce Street	582.6m	10.8m	593.4m	1.8%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Waitemata	Cook Street	418m	711.4m	1129.4m	63.0%
Waitemata	Costley Street	453.6m	0m	453.6m	0.0%
Waitemata	Courthouse Lane	153.5m	0m	153.5m	0.0%
Waitemata	Cross Street	0m	181.1m	181.1m	100.0%
Waitemata	Customs Street East	147.9m	553.5m	701.4m	78.9%
Waitemata	Customs Street West	1075.8m	381.4m	1457.2m	26.2%
Waitemata	Day Street	293.6m	0m	293.6m	0.0%
Waitemata	Drake Street	332.4m	0m	332.4m	0.0%
Waitemata	Durham Lane	177.8m	0m	177.8m	0.0%
Waitemata	Durham Street West	220.3m	5.8m	226.1m	2.6%
Waitemata	East Street	228m	154.2m	382.2m	40.4%
Waitemata	Eden Crescent	199.3m	419.2m	618.5m	67.8%
Waitemata	Edinburgh Street	245m	65.3m	310.3m	21.1%
Waitemata	Elizabeth Street	140.9m	0m	140.9m	0.0%
Waitemata	Emily Place	455.5m	147.7m	603.2m	24.5%
Waitemata	England Street	348m	89.9m	437.8m	20.5%
Waitemata	Fanshawe Street	860.4m	1045.4m	1905.8m	54.9%
Waitemata	Federal Street	371.1m	495m	866.1m	57.2%
Waitemata	Fields Lane	166.8m	0m	166.8m	0.0%
Waitemata	Fort Street	184.7m	422.3m	607m	69.6%
Waitemata	Franklin Road	109.4m	1812.5m	1921.9m	94.3%
Waitemata	Galatos Street	67.1m	0m	67.1m	0.0%
Waitemata	Galway Street	227.4m	192.5m	419.9m	45.9%
Waitemata	Georgina Street	617.2m	0m	617.2m	0.0%
Waitemata	Gore Street	534.4m	21.2m	555.6m	3.8%
Waitemata	Gore Street Lane	0m	111.9m	111.9m	100.0%
Waitemata	Governor Fitzroy Place	0m	88.2m	88.2m	100.0%
Waitemata	Grafton Road	41.6m	394.6m	436.2m	90.5%
Waitemata	Graham Street	416.5m	0m	416.5m	0.0%
Waitemata	Greys Avenue	443.6m	522.5m	966.1m	54.1%
Waitemata	Gundry Street	217.3m	152.7m	370m	41.3%
Waitemata	Gunson Street	399.6m	0m	399.6m	0.0%
Waitemata	Gwilliam Place	240.3m	0m	240.3m	0.0%
Waitemata	Halsey Street	114.3m	411.2m	525.6m	78.2%
Waitemata	Hamer Street	162.1m	0m	162.1m	0.0%
Waitemata	Hardinge Street	249m	0m	249m	0.0%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Waitemata	Heke Street	168.7m	0m	168.7m	0.0%
Waitemata	Hepburn Street	226.2m	49.8m	276m	18.0%
Waitemata	Hereford Street	93.6m	0m	93.6m	0.0%
Waitemata	High Street	309.1m	0m	309.1m	0.0%
Waitemata	Hobson Street	460.5m	812.7m	1273.2m	63.8%
Waitemata	Hopetoun Street	0m	58m	58m	100.0%
Waitemata	Howe Street	8m	8m	15.9m	50.0%
Waitemata	Ireland Street	195.6m	103.3m	298.9m	34.6%
Waitemata	Jean Batten Place	0m	64m	64m	100.0%
Waitemata	Jellicoe Street	688.7m	30.2m	719m	4.2%
Waitemata	Karangahape Road	491.4m	1603.3m	2094.7m	76.5%
Waitemata	Kingston Street	170.6m	0m	170.6m	0.0%
Waitemata	Kitchener Street	531.3m	428.6m	959.9m	44.7%
Waitemata	Liverpool Street	442.5m	7.5m	449.9m	1.7%
Waitemata	Lorne Street	282.6m	116.8m	399.4m	29.3%
Waitemata	Lower Albert Street	65.2m	253.8m	318.9m	79.6%
Waitemata	Lower Hobson Street	309.3m	467.7m	777m	60.2%
Waitemata	Lyndock Street	134.3m	0m	134.3m	0.0%
Waitemata	Mahuhu Crescent	630.7m	32.7m	663.4m	4.9%
Waitemata	Market Place	149.7m	84.9m	234.6m	36.2%
Waitemata	Marmion Street	99.6m	0m	99.6m	0.0%
Waitemata	Mayoral Drive	247.7m	1903.7m	2151.4m	88.5%
Waitemata	Mercury Lane	189.9m	73.6m	263.5m	27.9%
Waitemata	Middle Street	35.6m	248m	283.6m	87.5%
Waitemata	Mills Lane	347.3m	0m	347.3m	0.0%
Waitemata	Mount Street	353.4m	0m	353.4m	0.0%
Waitemata	Napier Lane	0m	49.1m	49.1m	100.0%
Waitemata	Napier Street	400.9m	47.6m	448.4m	10.6%
Waitemata	Nelson Street	342.2m	766.8m	1109m	69.1%
Waitemata	Ngaoho Place	230.5m	48.2m	278.6m	17.3%
Waitemata	Ngata Street	3.3m	14.9m	18.3m	81.8%
Waitemata	Nicholas Street	163.1m	4.6m	167.7m	2.7%
Waitemata	O'connell Street	0m	115.4m	115.4m	100.0%
Waitemata	Ophir Street	372.4m	0m	372.4m	0.0%
Waitemata	Parliament Street	235.7m	0m	235.7m	0.0%
Waitemata	Pember Reeves Street	325.8m	0m	325.8m	0.0%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Waitemata	Pitt Street	116.6m	754.4m	871m	86.6%
Waitemata	Plumer Street	189.6m	79.6m	269.2m	29.6%
Waitemata	Poynton Terrace	377.6m	0m	377.6m	0.0%
Waitemata	Princes Street	215.4m	1164.1m	1379.6m	84.4%
Waitemata	Quay Street	581.6m	1737m	2318.6m	74.9%
Waitemata	Queen Street	81.7m	826.6m	908.2m	91.0%
Waitemata	Renall Street	183.7m	0m	183.7m	0.0%
Waitemata	Ronayne Street	173.7m	173.4m	347m	50.0%
Waitemata	Runnell Street	0m	209.9m	209.9m	100.0%
Waitemata	Russell Street	159.7m	25.5m	185.2m	13.8%
Waitemata	Rutland Street	234.5m	0m	234.5m	0.0%
Waitemata	Ryle Street	408m	0m	408m	0.0%
Waitemata	Sale Street	64.7m	703.1m	767.7m	91.6%
Waitemata	Sam Wrigley Street	30.5m	205m	235.5m	87.1%
Waitemata	Scotia Place	254.4m	19.6m	274m	7.2%
Waitemata	Scotland Street	82.8m	187.2m	270m	69.4%
Waitemata	Sheridan Lane	122.7m	0m	122.7m	0.0%
Waitemata	Short Street	141.8m	52.2m	194m	26.9%
Waitemata	Shortland Street	310.4m	519.8m	830.2m	62.6%
Waitemata	Spring Street	247.1m	0m	247.1m	0.0%
Waitemata	St Martins Lane	228.5m	12.6m	241.1m	5.2%
Waitemata	St Paul Street	353.3m	135m	488.3m	27.6%
Waitemata	Sturdee Street	0m	447.8m	447.8m	100.0%
Waitemata	Swanson Street	422.2m	70.8m	493m	14.4%
Waitemata	Symonds Street	9.6m	2383.1m	2392.7m	99.6%
Waitemata	Tangihua Street	0m	409.6m	409.6m	100.0%
Waitemata	Tapora Street	194.8m	0m	194.8m	0.0%
Waitemata	Te Taou Crescent	673.2m	142.2m	815.4m	17.4%
Waitemata	Tinley Street	221.7m	36.3m	258m	14.1%
Waitemata	Tooley Street	82.6m	82.6m	165.2m	50.0%
Waitemata	Turner Street	228.7m	91.9m	320.6m	28.7%
Waitemata	Tyler Street	255.1m	169.1m	424.3m	39.9%
Waitemata	Union Street	327.6m	1130.8m	1458.4m	77.5%
Waitemata	Upper Queen Street	88.2m	388.2m	476.4m	81.5%
Waitemata	Vernon Street	100.7m	0m	100.7m	0.0%
Waitemata	Victoria Street East	217.7m	38.9m	256.6m	15.2%

AT_Local_Boar	AT_Road	Less than 110% of the posted speed	Greater than 110% of the posted speed	Total road length	Percentage of road greater than 110% of posted speed
Waitemata	Victoria Street West	809.3m	1870.7m	2679.9m	69.8%
Waitemata	Vincent Street	0m	808.9m	808.9m	100.0%
Waitemata	Wakefield Street	276m	873.7m	1149.7m	76.0%
Waitemata	Warimu Place	0m	41m	41m	100.0%
Waitemata	Waterloo Quadrant	87.5m	515.8m	603.3m	85.5%
Waitemata	Waverley Street	138.6m	0m	138.6m	0.0%
Waitemata	Wellesley Street East	216.7m	956.2m	1172.8m	81.5%
Waitemata	Wellesley Street West	470.6m	1237.6m	1708.2m	72.5%
Waitemata	Wellington Street	91m	89.5m	180.5m	49.6%
Waitemata	Whitaker Place	813.5m	18.3m	831.8m	2.2%
Waitemata	White Street	238.5m	19.2m	257.7m	7.5%
Waitemata	Wilkins Street	133.3m	10m	143.3m	7.0%
Waitemata	Wolfe Street	84.9m	85.4m	170.3m	50.1%
Waitemata	Wood Street	529.8m	422.6m	952.4m	44.4%
Waitemata	Wyndham Street	563.9m	224m	787.9m	28.4%

Appendix G Changes in the social cost of injury crashes for each workstream

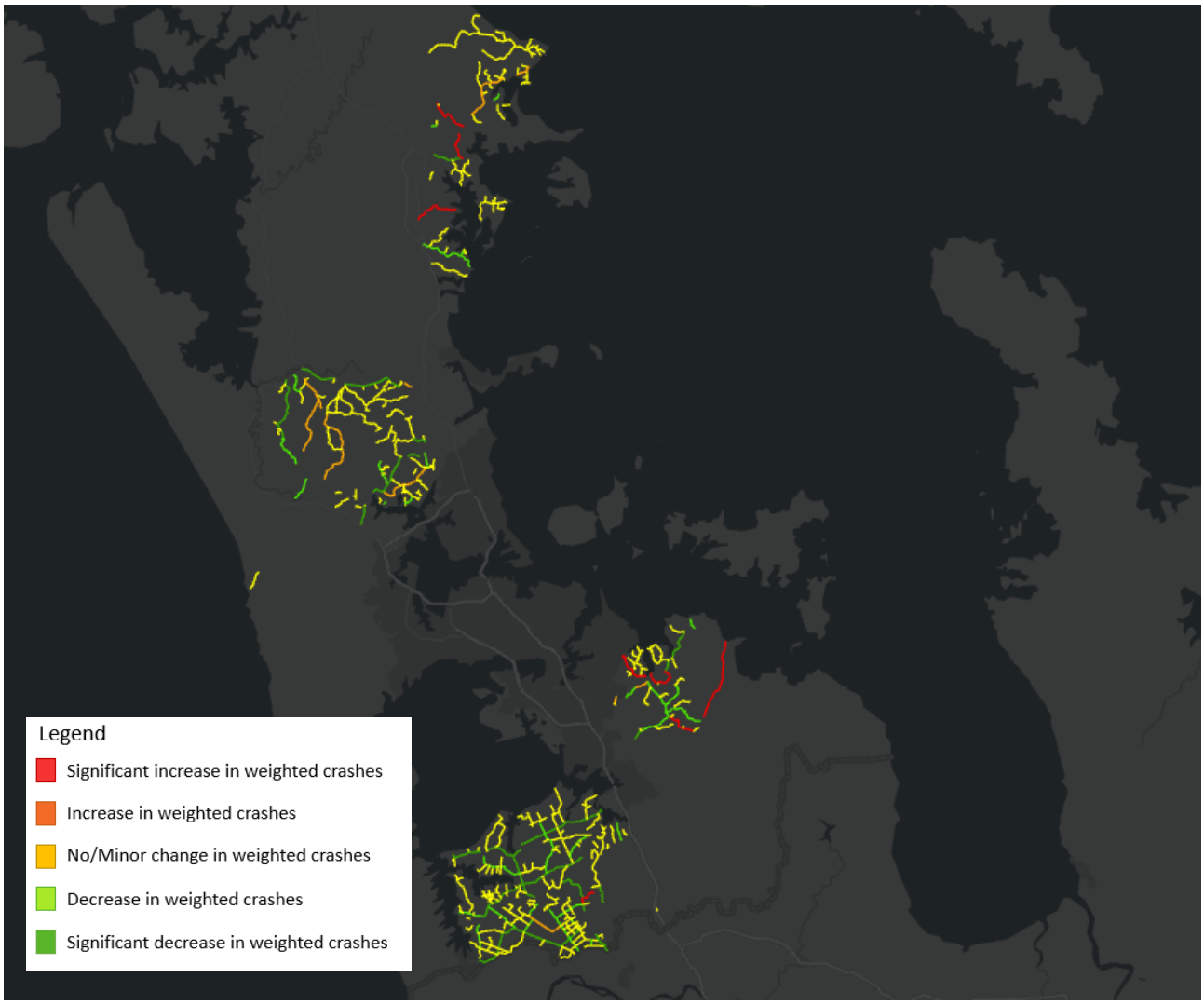

Figure - Before and after mapped injury crash social cost comparison for Rural Tranche 1 sites number

Figure - Before and after mapped injury crash social cost comparison for City Centre Tranche 1 sites

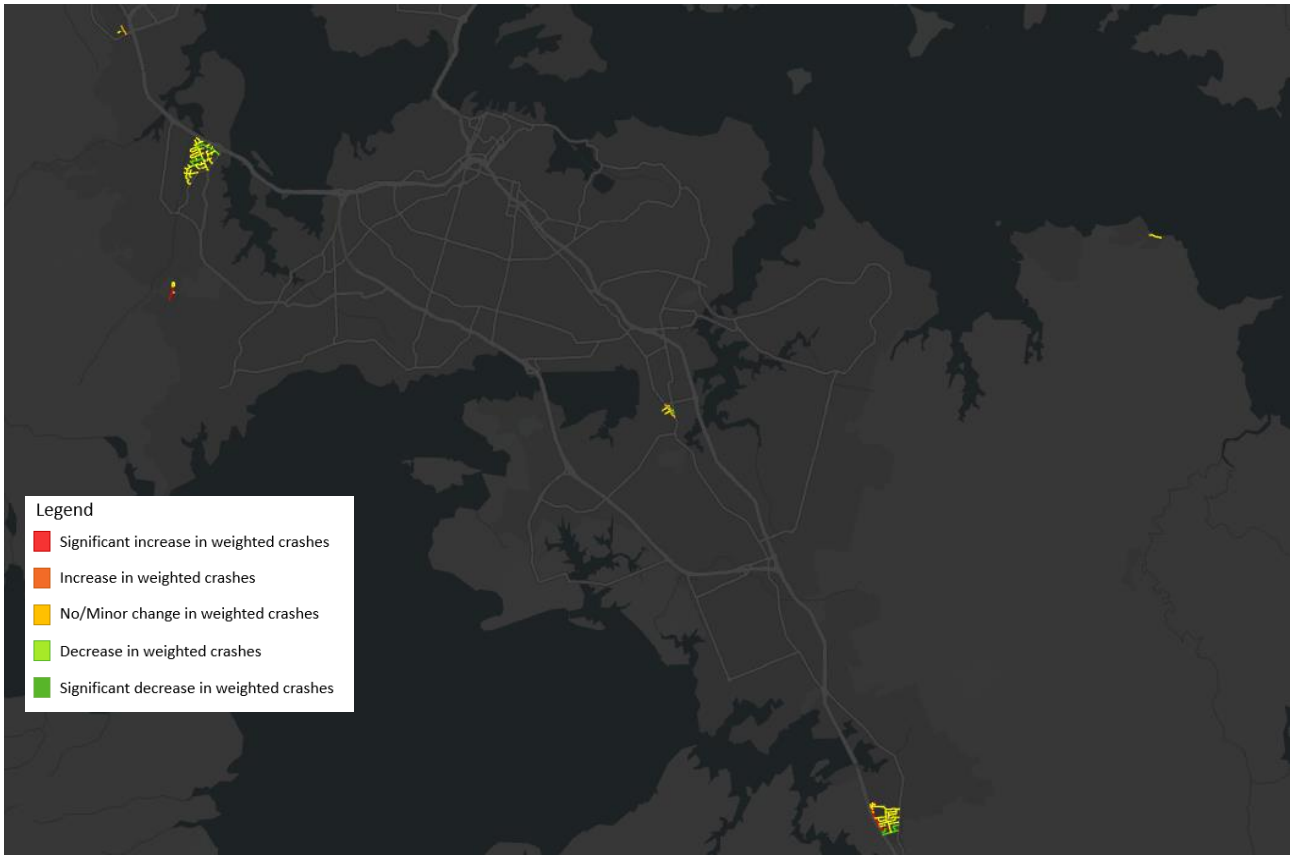

Figure- Before and after mapped injury crash social cost comparison for Town Centres and Residential Tranche 1 sites

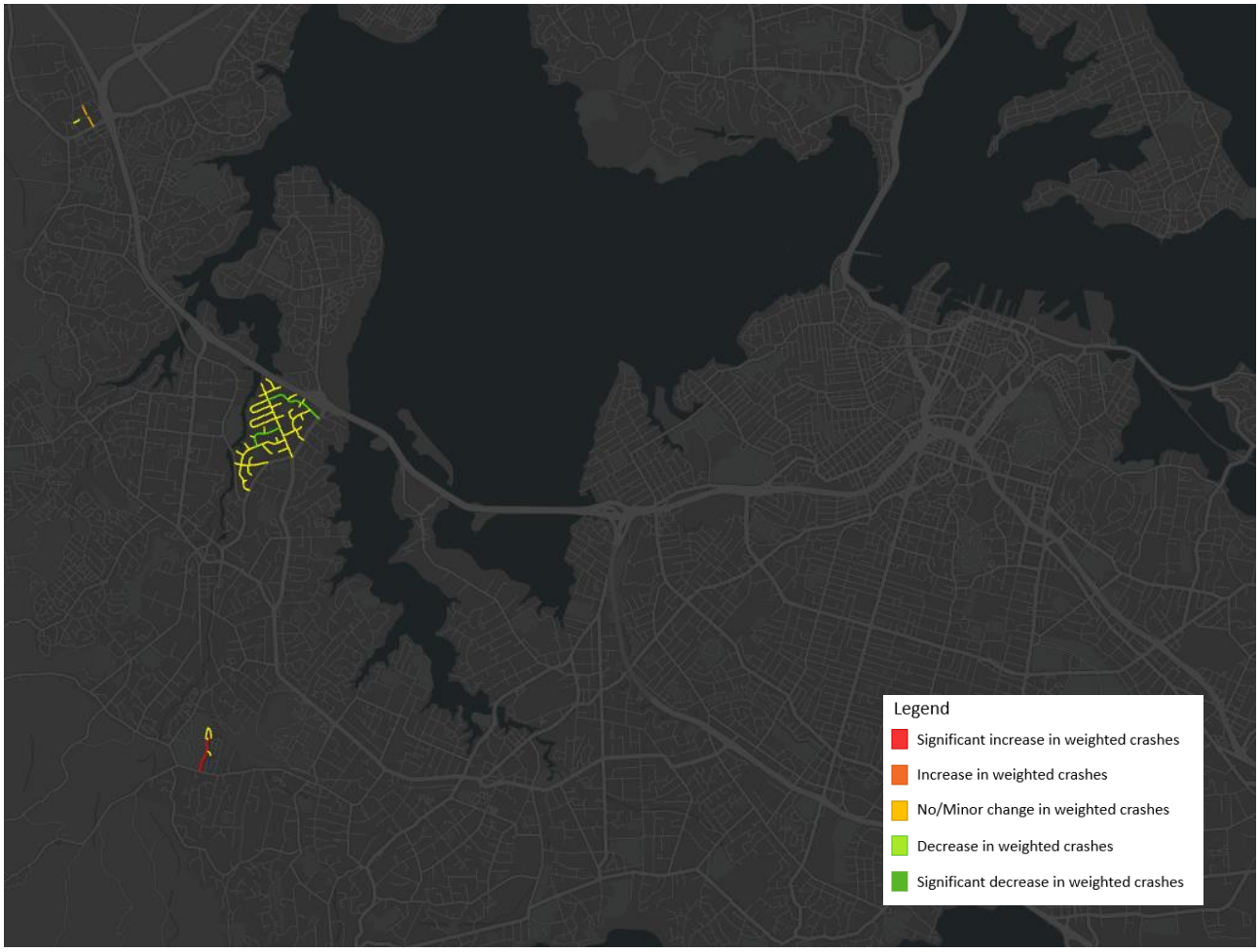

Figure - Before and after mapped injury crash social cost comparison for Town Centres and Residential Tranche 1 sites (west)

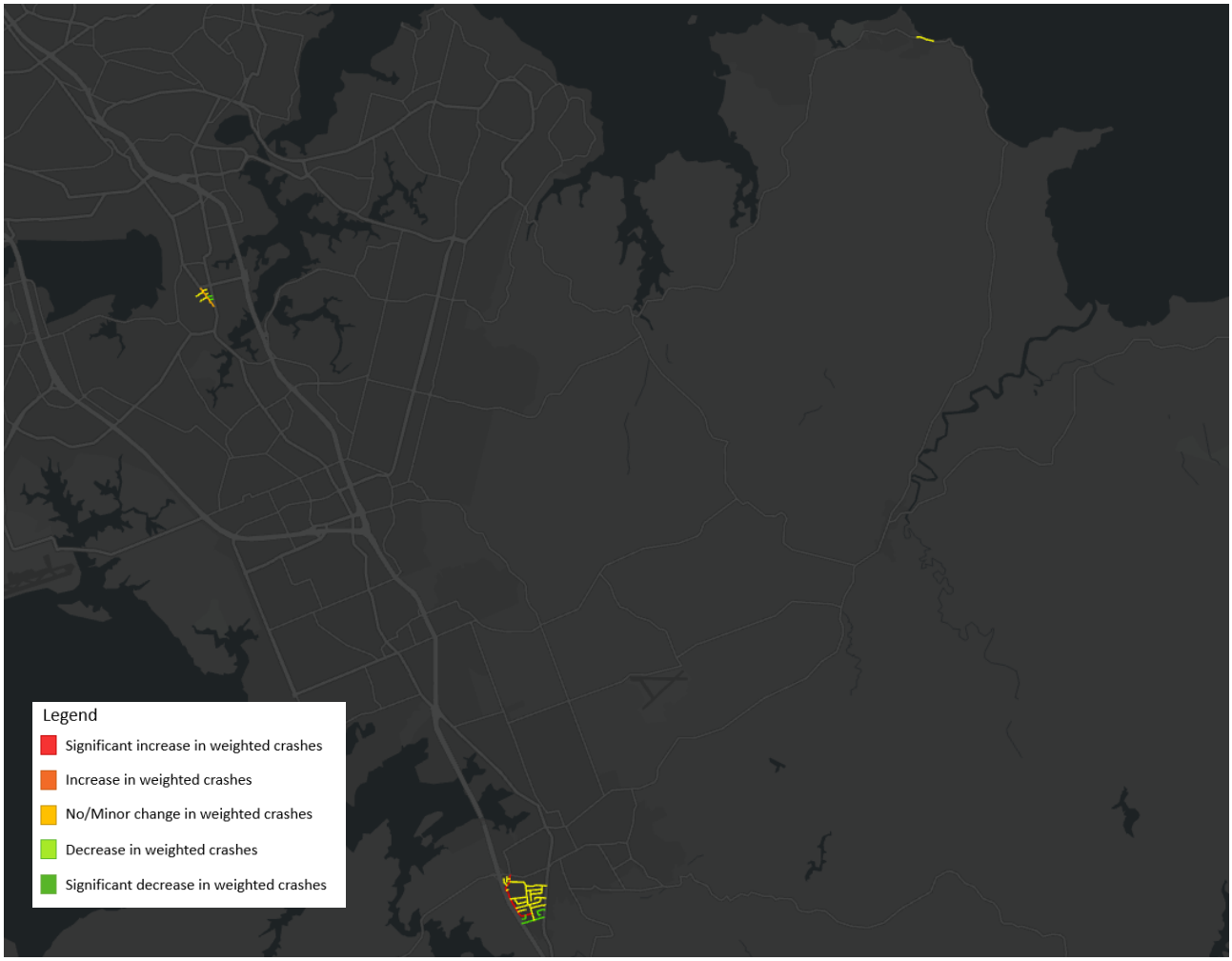

Figure -Before and after mapped injury crash social cost comparison for Town Centres and Residential Tranche 1 sites (south)

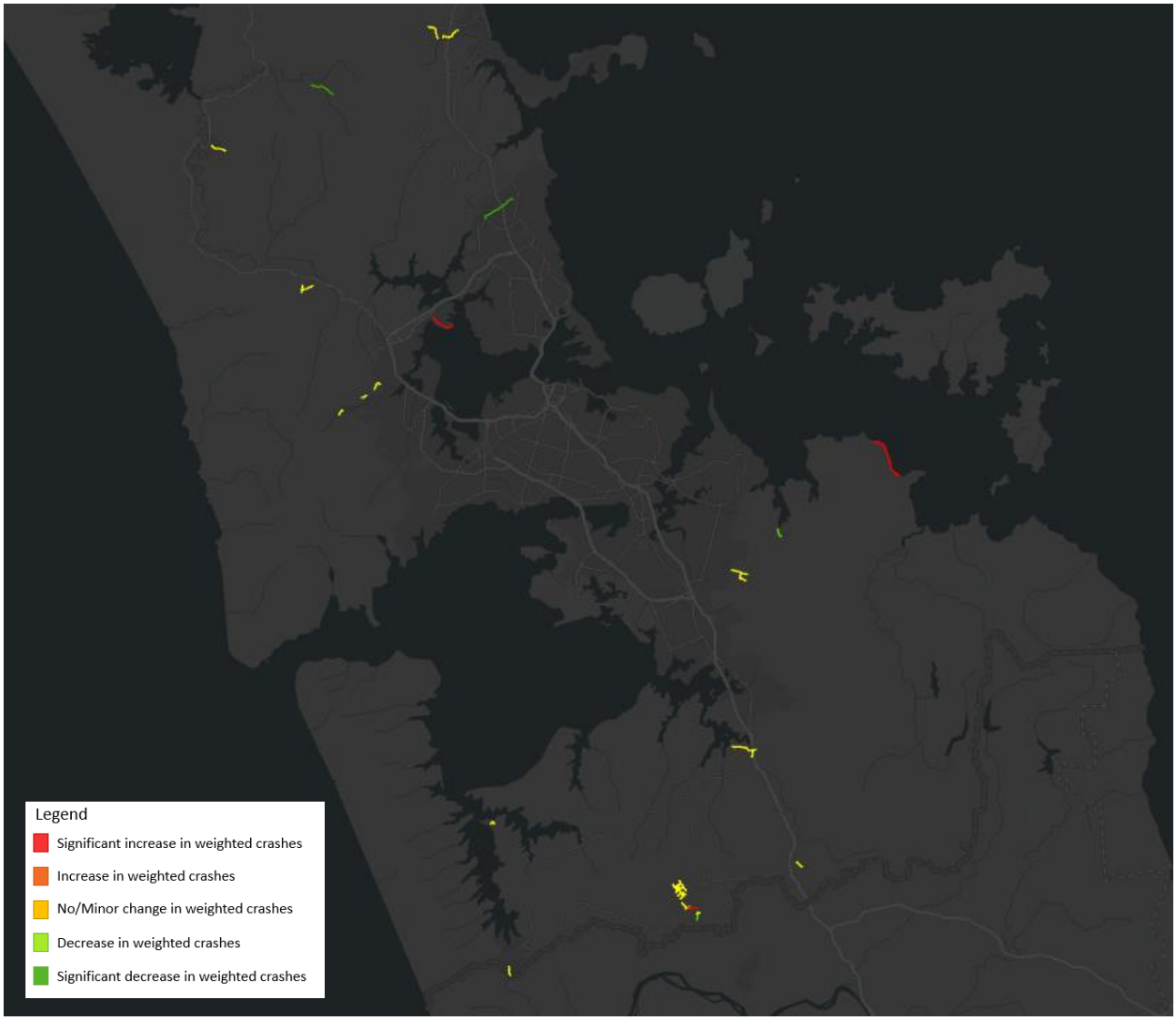

Figure - Before and after mapped injury crash social cost comparison for Higher speed urban Tranche 1 sites

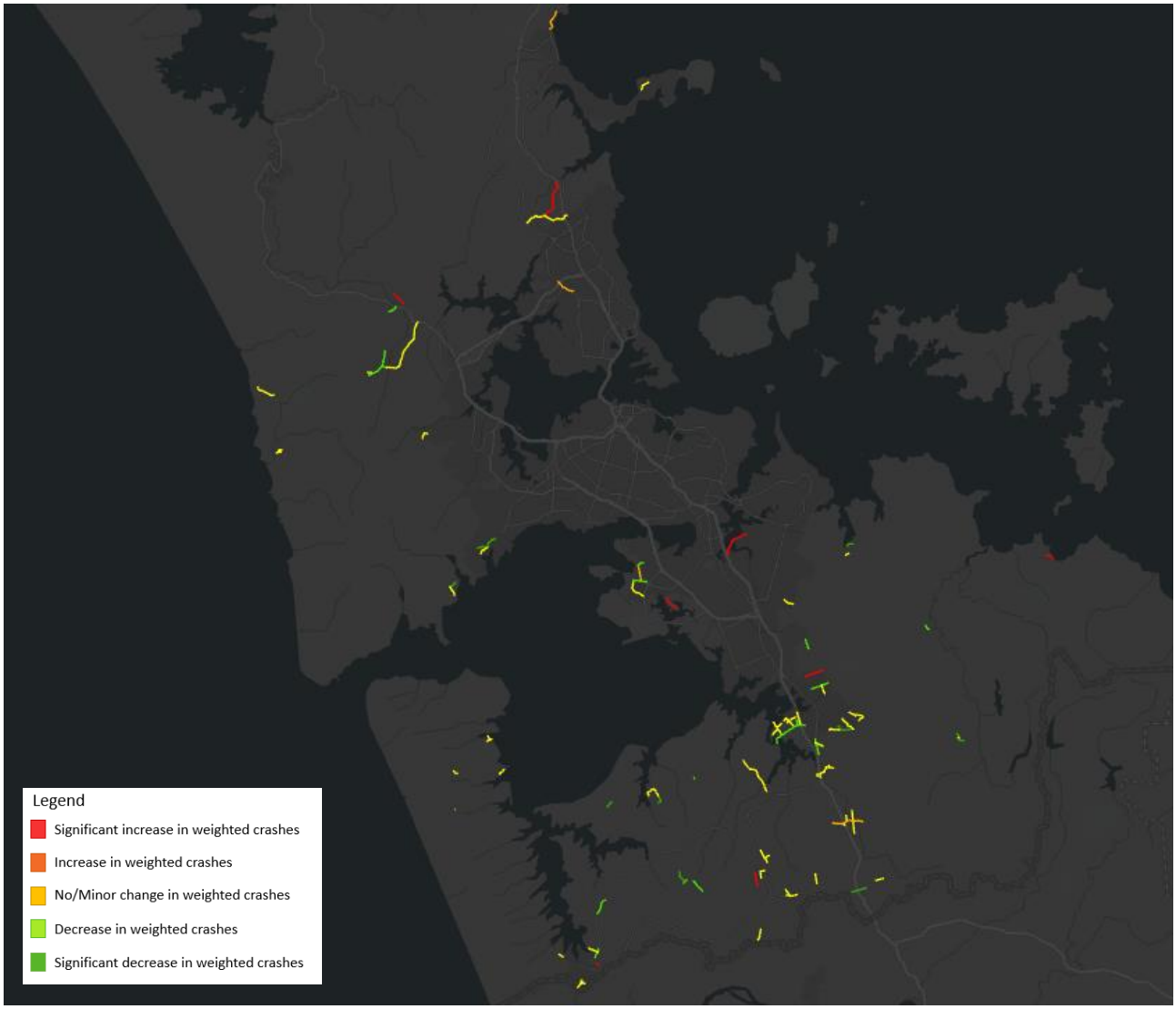

Figure - Before and after mapped injury crash social cost comparison for Peri-urban (previously 70km/h roads) Tranche 1 sites