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FINAL REPORT OF THE 30 KM/H SPEED LIMIT TRIAL EVALUATION IN THE CITY OF YARRA

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Final Report of the Evaluation of the 30km/h Speed Limit Trial in the City of Yarra

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Abstract:

A trial was undertaken to evaluate the benefits of a lower speed limit in a local residential area in the City of Yarra. It aimed to reduce the risk of severe injury to Vulnerable Road Users by installing a 30km/h speed limit in a local residential area as a Towards Zero initiative. The intervention replaced the existing 40km/h speed limit signs with 30km/h signs and pavement marking in the treated area. An adjacent area with a 40km/h speed-limit was employed as a control region. A before and after study method was employed with vehicle speeds observed to measure change in speed after the treatment, and surveys to understand community attitudes to the trial. The results showed several positive benefits. Modest reductions in mean speed were observed in the after-phase of the study where average travel speed fell by 0.3km/h. Importantly, though, reductions were more apparent at higher speeds where the risk of severe injury or death to vulnerable road users is more likely. There were, though, unexpected speed reductions in the control sites too. Notwithstanding, adjusting for these, a significant “treatment effect” for the trial showed an 11% reduction of the likelihood of a vehicle travelling above 40km/h in the treated area, and a 25% reduction above 50km/h. These findings translate to an estimated 4% reduction in the risk of severe injury for pedestrians in the event of a collision. Questionnaire responses further revealed an increase in support for the 30km/h speed limit in local streets from 42.7% to 50.3% of people within the trial area. Support also increased from 43.9% to 51.1% from people within the treated area. These findings give support to the possibility of a 30km/h speed limit across all local residential streets in the municipality.

Key Words:

Disclaimer

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Preface

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EXECUTIVE SUMMARY

The Transport Accident Commission in Victoria recently reported that in the last 10 years, more than 400 pedestrians have lost their lives on Victorian roads, mainly in Metropolitan Melbourne. Of those, one-third were aged 70 years or more and crossing the road was the predominant type of collision. Of the 37 pedestrians who lost their lives on Victorian roads in 2018, 43% of these collisions occurred in metropolitan areas on roads signed at 60km/hr or less (TAC, 2018).

With a vision to help achieve zero fatal and severe injury outcomes for pedestrians in residential streets in Melbourne, the Yarra City Council decided to trial a 30km/h speed-limit in a selected residential area of their municipality. Part of this trial was to evaluate the likely speed reductions and associated trauma benefits and identify the attitudes of the community within and adjacent to the trial area towards 30km/h speed-limits. The Monash University Accident Research Centre was selected to conduct the evaluation.

The intervention involved introducing a 30km/h area-wide speed-limit on a cluster of local roads in the suburbs of Fitzroy and Collingwood, where the speed-limit was 40km/h. The new speed-limit was introduced in October 2018 and regulated through a combination of area-wide and localised signage. The evaluation involved a "before" and "after" examination of travel speeds on all local roads within the treatment area, and travel speeds in an adjacent area of Fitzroy and Collingwood where the speed-limit was and remained at 40km/h. The evaluation also involved a "before" and "after" examination of the attitudes of the community towards the new limit, where this was identified by a questionnaire mailed to a random selection of properties in the treated and non-treated areas.

Average speed

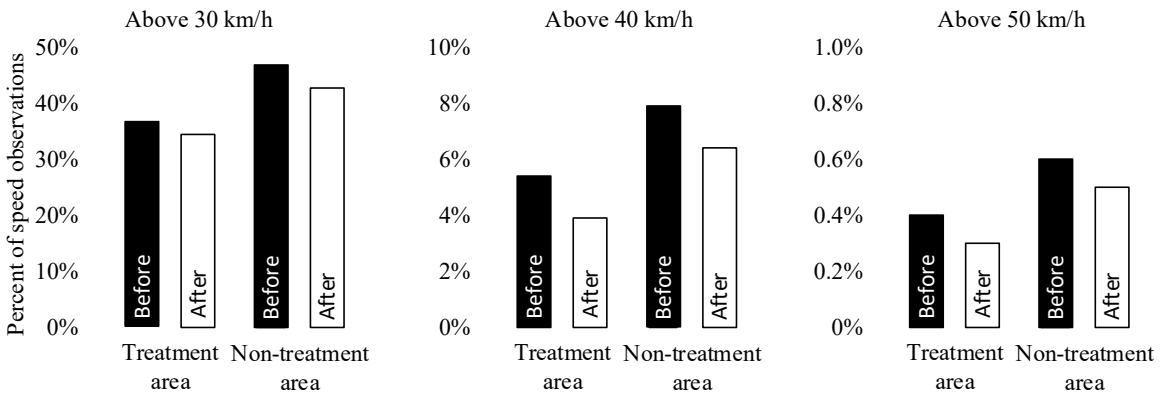
Typical road tube installation (Source: David Gleason. Flickr//CCBy-SA 2.0)

The speed of vehicles was recorded at 91 locations in both the treatment (50 sites) and non-treatment areas (41 sites) before the intervention, and at the same locations after 12-months. Speeds were measured for at least one week each time, using automated traffic detectors and data loggers to an accuracy of +/- 1 km/h.

The difference in average speed at all the treated sites after the trial showed a small reduction in the mean speed from 27.6km/h before to 27.3km/h after (down 1.1%). However, there was also a reduction in the non-treated area from 29.4km/h before to 28.6km/h after (down 2.7%). It was assumed that the reduction in the non-treated area was a consequence of a misconception of the trial boundaries (a carry-over effect) by those living or visiting the area, and/or influences of marketing the trial which was not limited to the treated area.

Higher speed sites

The average speed statistics are a good starting point for understanding the change in speed from the trial, although an alternative (and preferred) means of expressing the change in speed is by examining the change in the percentage of vehicles that exceed various speeds above the mean, before and after the intervention. This includes the percentage exceeding a nominal *Safe System* speed recommendation of 30km/h, and speeds at the higher end of 40km/h, and 50km/h. The change in the percentage of these speeds is illustrated below.



These figures reveal consistent reductions in the proportions of vehicles exceeding these speed categories. Assuming that a speed of 30km/h or less is an appropriate safe speed for residential areas, 37% in the treated area and 47% in the non-treatment area were initially above this speed, although the proportions above did fall in both areas after the trial. This reduction was of statistical significance, and more importantly, means a greater percentage of vehicles are travelling at a speed that is more consistent with the safe system speed limit for sharing of space with vulnerable road users.

Changes to excessive and extreme speeds was of special interest. Of the locations in the treatment area where speeds were measured before the intervention, 16% were found to have at least one in ten vehicles exceeding 40km/h. These were the locations with higher speed characteristics. After the trial, the percentage of vehicles exceeding 40km/h reduced at all these sites, along with the average speed and spread of speeds.

At the higher level of speeds (above 50km/h), the percentage of vehicles in treatment area before was around 0.4%, and after the trial, this percentage also reduced to 0.3%. Based on the number of observations before the trial, this reduction is equivalent to over 26,000 fewer observations of excessive speed. There was also a reduction in the number of extreme speeds observed after the trial, which for the purpose of this study was a speed over 66km/h. These trends are reassuring, given the higher severe injury consequences for pedestrians at these speeds.

Treatment Effect

Given that there were speed reductions in both the treated and untreated (control) areas, it was necessary to adjust the speed changes in the trial region in the light of those in the control area to compute the overall *Treatment Effect* of the trial. A Logistic Regression model was conducted to make these adjustments for the three speed categories, namely, of model of the odds of a vehicle exceeding 30km/h, 40km/h, and 50km/h, as shown below.

Measure	Odds Ratio	CI (95%)		Significance
Exceeding 30km/h	1.07	-	-	p>0.05
Exceeding 40km/h	0.89 (-11%)	0.87	0.92	P<.001
Exceeding 50km/h	0.75 (-25%)	0.67	0.84	P<.001

Following the adjustment, the model of the Treatment Effect indicated that the odds of a speed exceeding 40km/h reduced by 11% and by 25% above 50km/h, given the speed limit change to 30km/h. However, the model did find that the treatment did not directly reduce the odds of a vehicle exceeding 30km/h in the treatment area. This was not surprising as the mean speed both before and after treatment was below 30km/h. These findings clearly showed that the area-wide benefit of the trial undertaken by the City of Yarra was successful in reducing the higher speeds of traffic in the trial region from the lower 30km/h limit.

Other Speed Findings

While this study was an area-wide evaluation, nevertheless, there were several additional speed and traffic-related issues regarding the 30km/h speed limit trial that were also addressed in this study and are discussed below.

Top 5 Sites. An analysis was undertaken of the individual survey sites that recorded the greatest speed reductions by the percent of vehicles exceeding 40km/h from baseline to after 12-months. Five sites headed the list namely, Easey Street, Ballarat Street, Hotham Street, Napier Street, and Mater Street. The speed reductions at these sites before and after the trial varied from -7.3% to -23%, demonstrating the likely individual street safety benefits from the trial.

Stratification by Road Type. Given this finding, an attempt was made to see if it was possible to to examine the speed reductions by type of roads within the treated area. Road types were initially stratified according to a four-road class system, differentiated by traffic direction (one, two-way, with on-road parking, or collector road status). While this would have been a useful adjunct to the study, unfortunately, it was only possible to compare the first two road definitions in this trial. The speed reductions before and after at these two categories mirrored the overall average speed differences in the treatment zone, suggesting that the overall benefit is relatively consistent. There were, however, notable differences between the two road types in the central tendency of speeds before and after the trial.

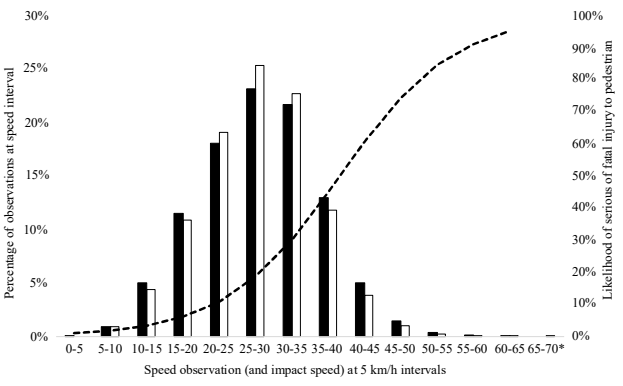
Free Speed Choice. A further dimension of the study related to how many of the vehicle observations were taken at free speed (this is without being constricted by a vehicle in front), and if there were differences in the treatment effect for free-speed versus restricted-speed observations. Unfortunately, the speed data collected were not detailed enough to make this judgement directly. Thus, the only possible way of assessing this was by level of congestion given peak, off-peak, weekday and weekend. The periods with a classically lower likelihood of a free-speed observation (peak periods) were noted to have the greatest percentage reduction in the percentage of observations exceeding 40km/h. A similar trend was also observed in the non-treatment area.

Wellington Street Case Study. The final analysis related to the main collector road in the study region, namely Wellington Street that runs from the treated to the non-treated region. This road was of interest in this trial, however, there were road constructions carried out during the trial period and it was excluded from the evaluation given bias concerns. It was though included as a special case study in the report.

The findings showed reductions in mean speed on Wellington Street of around 6.5%, with the greatest reduction was observed at midway between the two major intersections along Wellington Street. It must be stressed that given the road construction works, these speed reductions may or may not have necessarily been directly impacted by the 30km/h trial.

Potential injury savings

The potential injury savings from the 30km/h speed-limit trial over the previous 40km/h speed-limit, limited to the treatment area, were estimated by identifying the difference in the relative risk of injury, before and after the intervention, using the Davis (2001) risk curve (figure on page 1).



The findings showed that the risk of sustaining a serious or fatal injury (given a collision) reduced from 0.24% before to 0.23% after treatment. This represents a 4% reduction in the risk of

sustaining a severe injury, should a collision occur between a motor-vehicle and a pedestrian. This analysis does not account for any reductions in the risk of a collision on account of the reduced speed, although this may also occur due to the lower speed limit.

Survey of Community Attitudes

People who live, work, or own a property in the treatment and non-treatment area were asked if they agreed or disagreed to the introduction of a 30km/h speed limit in their residential area before and after the 12-month trial. Interestingly, while only 44% of the responses from people in the treatment area were positive before the trial, that increased to 51% afterwards and the percent of negative responses fell accordingly. The level of support in the non-treated area also increased (from 41% to 49%).

Respondents were also asked a range of attitudinal questions related to their views about other factors associated with the lower speed limit. From their main responses, approximately 75% agreed that the 30km/h speed limit would improve safety for walking and cycling generally, and especially for children and the elderly. Two-thirds of the respondents understood that reducing speeds would lead to less injurious crash outcomes and that it would also lead to fewer crashes for pedestrians and cyclists in their region.

The majority thought that a 30km/h speed limit would have no impact on their travel time (30% differed), while around 60-70% thought that 40km/h was about right for main feeder roads in the district. There were only minor changes in the responses to these questions before and after the trial, and no differences of statistical significance were identified.

Conclusions

The findings reported here showed only a modest speed reduction overall in the treated area from the 30km/h trial. However, there were significant reductions in the percent of people travelling in the higher speeds (above 40km/h and 50km/h) where severe injuries would likely occur in a collision. While there were also speed reductions observed in the non-treated area, after adjusting for these with regression modelling, there was still a significant *Treatment Effect* observed from this trial. It was further estimated that the speed reductions observed in the treated area would amount to a 4% reduction in the risk of a severe or fatal injury to vulnerable road users, with potentially higher benefits in crash prevention too.

Equally important was the increase in support for the 30km/h speed limit in these residential streets after the trial was completed. Importantly, the resident's opposition to the lower speed limits similarly decreased as well. A range of issues were further explored many of them positive in their responses in terms of safety, comfort and security in living in the area with little impact on their abilities to get around. These responses confirmed an increase in the residents' willingness to see the 30km/h speed limit adopted more widely in local streets in the municipality.

1 INTRODUCTION

Motor-vehicle speed in residential areas is associated with the risk of an injury to Vulnerable Road Users (VRU), especially pedestrians and cyclists. There is a breadth of literature describing the relationship between the risk of injury and motor-vehicle speed (e.g., Davis 2001; Rosen and Sanders 2011), and they all report a relationship representative of that illustrated in Figure 1. It is a non-linear relationship, where impacts as low as 40km/h are still related to a considerable risk of serious injury to these vulnerable road users.

In addition, the World Health Organisation (2018) declare that road traffic injury is the leading cause of death among children and young adults aged 5 to 29 years. In an earlier report, they claimed that Vulnerable Road Users such as pedestrians and cyclists are disproportionally over-represented in crash statistics globally. Further, they noted that given the relationship between speed and the risk of injury, reductions in travel speeds even at the lower end can still result in a meaningful reduction in deaths and serious injuries to VRU (World Health Organisation 2004).

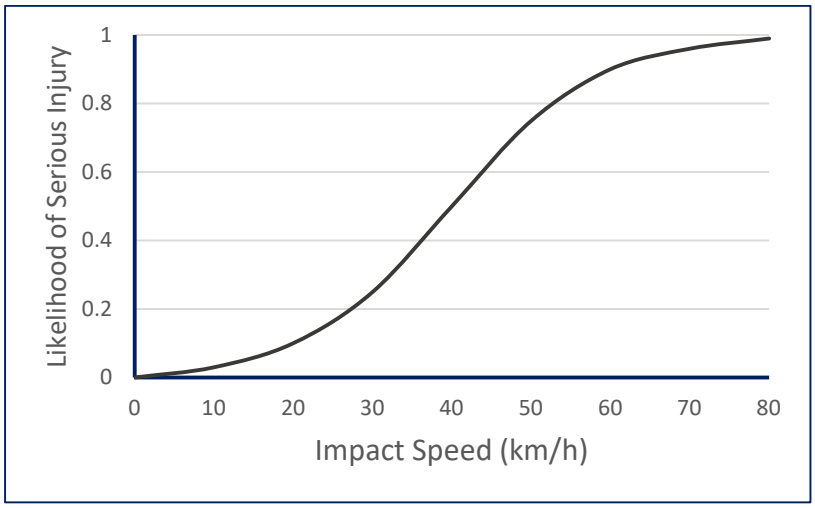


Figure 1 Severe injury risk curve for pedestrians (Source: Logan et al, 2019)

In 2016, the Yarra City Council Safe Travel Strategy outlined a plan of action to reduce vehicle speeds in the municipality including reducing speed-limits to levels compatible with the safe sharing of roads by all road users. The Strategy also emphasised that changes to speed-limits should be informed by a research evidence-base. Broadly, this includes evidence of the relationships between speed-limits and motor-vehicle speed, and motor-vehicle speed and the risk of an injury. It also considers the impact of changes in the speed environment on people's sense of comfort and safety when using the road.

As the safety to residents' movements in local streets is an important and critical feature in the City of Yarra, it was decided to introduce a trial of lower speed limits in two selected key areas in the municipality for a 12-month period with a full evaluation of the outcomes from the trial. The Monash University Accident Research Centre were commissioned to undertake the evaluation and oversee the conduct of the trial.

This report presents the evaluation of a speed-limit reduction trial, from 40km/h 30km/h, on a selection of local roads within an area of the municipality. There are two parts to the evaluation. The first focuses on change in motor-vehicle speed in the area in which the speed-limit was changed, moreover, the change attributed to the speed-limit reduction (the treatment effect). The second part focuses on the attitudes of the community within the trial area, towards speed, speed-limits, and the 30km/h speed-limit trial. The implications of the change in speed on the risk of an injury to a VRU given a notional collision, are also addressed.

2 THE TRIAL

2.1 OVERVIEW

A speed-limit reduction from 40km/h to 30km/h (the *treatment*) was introduced on selected local roads in the suburbs of Fitzroy and Collingwood in October 2018 (the *treatment area*). The treatment comprised signage indicating an area-wide 30km/h speed-limit on the entrance to the treatment area, with repeater signage throughout the treated area (see Appendix A).

Motor-vehicle speeds were observed in the treatment area before the trial (*Baseline, t_0*), and 12-months after the treatment was introduced (*12-months, t_1*). Speeds were measured in the treatment area at t_0 and t_1 using an automated traffic detection system. To ensure that the effects observed were from the treatment alone, a similar adjacent area was included as a control area (*untreated area*) where the existing 40km/h speed-limit was maintained to measure any other unrelated influences during the trial.

Within the chosen treatment area, there were approximately 15.8 kilometres of local road affected by the treatment, and two main roads that remained untreated. The roads on the boundary of the treatment area were not included in the trial. The properties located within the treatment area were largely residential, although also included commercial and retail establishments. The treatment area comprised two Local Area Place Making zones, namely, Rose and Gold. Local area place making zones have strategic relevance to the Yarra City Council.

The attitudes of the community towards the 30km/h trial was sampled using a questionnaire mailed to 2,000 property addresses in the treatment area, and 2,000 in the non-treatment area at both t_0 and t_1. The focus of the questionnaire was to ascertain the level of support for 30km/h speed-limits on local streets. Several other themes were also addressed in the questionnaire, including 24 questions related to demographic, perceptions of safety, personal characteristics, and travel characteristics.

People who responded to the questionnaire at t_0, where also asked, if interested, to provide their contact details (E-mail) if they agreed to be followed-up at t_1. This sample were then followed up directly at t_1, so to evaluate change in level of support for 30km/h speed-limits at the level of the individual person. A copy of the list of questions are attached in Appendix 1 in this report.

2.2 RESEARCH QUESTIONS

The evaluation aimed to address several key questions related to change in speed, and change in attitude by residents and visitors. There are two main questions related to speed. The first relates to the absolute change in speed in the treatment area without adjusting for the change in speed observed in the non-treatment area. The findings to this question provide insight into what is likely to be experienced by observers of speed in the treatment area after the speed-limit reduction (e.g., perception of excessive speeds by residents). The second question relates to the change in speed in the treatment area adjusted for changes in the non-treatment area, and so provides insight into the isolated effect of the speed-limit reduction on speed.

2.2.1 Speed evaluation

- What is the area-wide change in speed in the treatment area from before the 30km/h speed-limit was introduced (Baseline, t0) to 12-months after the limit (12-month, t1) was introduced Including?
    - change in the central tendency and distribution in the speed of motor vehicles; and

- change in the proportion of vehicles travelling in excess of 30km/h, 40km/h, and 50km/h throughout the treatment area.

- What is the change in vehicle speed in the treatment area from t0 to t1, when adjusting for change in vehicle speed observed in the control area without a speed-limit reduction? Focusing on:
  - the proportion of vehicles travelling in excess of 30km/h, 40km/h, and 50km/h.

2.2.2 Community attitude

- Has there been a change from t_0 to t_1 in the level of support for the 30km/h speed-limit in the community that live on a neighbourhood street in the treatment area?
- Are there demographic or travel characteristics of the community more or less likely to support 30km/h speed-limits in neighbourhood streets?
- Has there been a change in the level of support for 30km/h speed-limits within individuals, who consented to being followed-up from Baseline to 12-months?
- Has there been a change in the perceptions of safety and community from t_0 to t_1, in the community that live on a neighbourhood street in the treatment area?

3 METHOD – SPEED EVALUATION

The speed evaluation comprised two sections. The first was an evaluation of the absolute and percentage change in travel speed in the treatment area. The aim of this evaluation was to quantify the difference in vehicle speed on local roads where the speed-limit reduction was applicable. Specifically, it was based on a comparison of motor-vehicle speeds observed at t_0 when the speed-limit was 40km/h, to that observed at t_1 when the speed limit was 30km/h. The baseline period (t_0) of approximately four weeks was undertaken during August 2018. The post-treatment period (t_1) was undertaken during September 2019.

The second part was to evaluate the effects of the treatment more specifically on speed. In general, this evaluation adjusted changes in speed in the treatment area by changes in the level of speeding (if any) observed in the non-treatment (control) area, where the speed-limit remained at 40km/h. It also accounts for the effect of other factors on the change in speed that are not related to the treatment. This part of the evaluation was based on controlled before-after research methods using speed data from the same time periods.

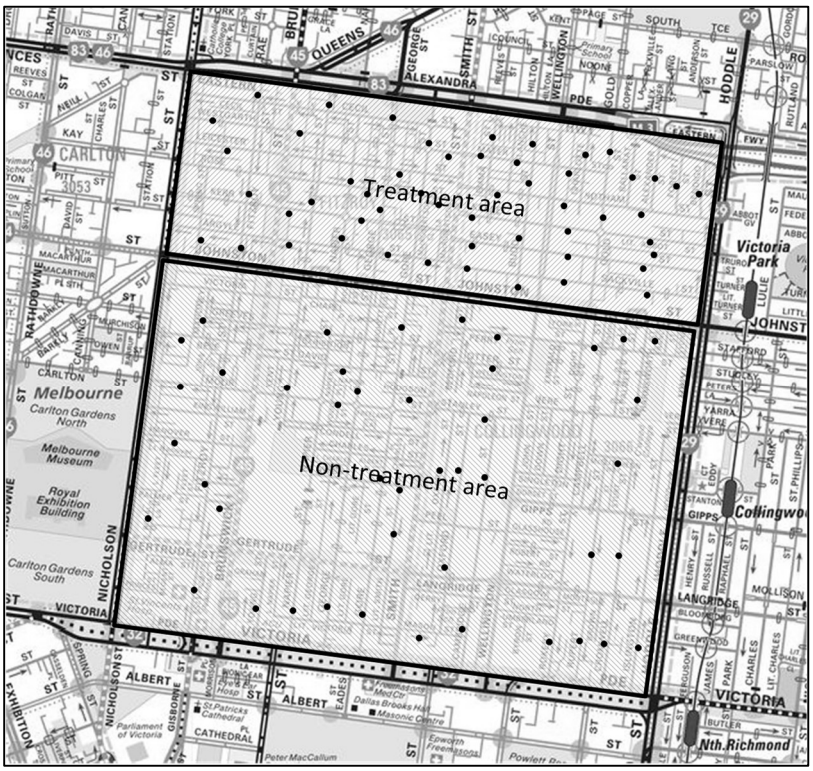


Figure 2: Data stations (base map source: Melway online, https://online.melway.com.au/melway)

3.1 SELECTION OF THE CONTROL REGION

The need for a control area in evaluation studies is well explained and outlined in the Global Road Safety Partnerships guidelines for *Speed Management: A Road Safety Manual for Decision-Makers and Practitioners* (GRSP 2009). They noted that a controlled before-and-after study to measure impact and outcome is the most practical design for evaluating speed intervention programmes.

A separate (untreated) control group is included to prevent any undue external influences from extraneous factors affecting the study outcome. A before-and-after trial with a control group strengthens the evidence of the effectiveness of the programme, over a study without a control group. It is important that the control group be as similar as possible to the treatment group to ensure any external differences that may have occurred during the life of the trial apart from the treatment itself can be adjusted for in the final analysis. In a study

like this, the control group ideally needs to have the same road, residential, and characteristics as the treatment group to ensure consistent environments but without any treatment effects. The manual further advised that "*robust evaluation study designs typically involve both quantitative methods for impact evaluation and qualitative methods such as surveys, for supporting formulative process evaluations*."

Selecting the adjacent area to the treatment area in Fitzroy and Collingwood addresses the site characteristic requirements specified by GRSP (2009) by providing an equivalent environment adjacent to the area to be treated and thus satisfying these requirements for a robust before-and-after evaluation trial.

3.2 PROCEDURE

Motor-vehicle speeds were collected using automated traffic detectors and data loggers at 91 data collection stations across the study area. Speeds were collected at the unit level (per vehicle speed) approximating the spot-speed of the vehicle. They were collected to a precision of ±1 kilometre per hour. Data were collected over a period of at least one week to ensure adequate representation of the speed characteristics at each data station. The first full week of speed data were used for the analysis, and this included of each of day of the week.

Speeds were collected at the same data stations at Baseline and 12-months for both the treatment and non-treatment area. There were 50 data stations in the treatment area, and 41 data stations in the non-treatment control area. The approximate location of these stations is provided in Figure 2.

All local roads were surveyed in at least one location, and data stations interrupted by physical works or other methods of traffic control (e.g., lane closure) were excluded from the study. The data stations were located as clear of intersections as practicable.

The data stations were indexed according to their location, in the first instance, by study group (treatment area; non-treatment area), and Local Area Place Making zone (Rose; Gold; Collingwood; Fitzroy). Each data station was also identified by a unique road segment number, where a road segment was any uninterrupted section of road between major intersections. Data stations located on the same road segment were given the same number, and where applicable, their speed observations were pooled in the analysis.

3.3 SPEED DATA ANALYSIS

The change in speed in the treatment area between Baseline and 12-months is primarily presented as descriptive statistics. These statistics represent the change in the speed characteristics of the treatment area without adjusting for other factors. The analysis focused on in this report include:

1. The central tendency of the speed distribution and measures of the variability about these central values, including:
    a. Median and interquartile range
    b. Mean and standard deviation
2. The percentage of speed observations exceeding:
    a. 30km/h
    b. 40km/h
    c. 50km/h
3. The proportion of extreme speed observations, identified as:
    a. Speeds three-times the interquartile range greater than the third quartile speed.

Throughout the report, the most appropriate measure of central tendency is indicated by an asterisk, where this is informed by the Kolmogorov-Smirnov test for normality. In general, however, it is expected to be the median and interquartile range are most appropriate, given the likely skewed distribution of speed observations towards the upper range.

The 85th percentile speed is also presented as a measure of the higher speed values. While it is not a central focus of the report, given its use as a standardised metric against which evaluating existing or new speed-limits are often judged, it is included where appropriate.

3.3.1 Treatment effect

The focus of the treatment-effect evaluation is identifying the change in speed from Baseline to 12-months, directly attributed to the treatment. Importantly, the evaluation adjusts the change in speed observed in the treatment area at Baseline and 12-months, for the expected change in speed that may have occurred in the treatment area had the treatment not occurred (natural change). The expected change in speed without the treatment, is assumed to be the change in speed observed in the non-treatment area from Baseline to 12-months, where the speed-limit was and remained at 40km/h.

The treatment-effect evaluation also accounts for changes in speed observed in the treatment or non-treatment area, that may be due to natural differences in characteristics of the sample at Baseline and 12-months (e.g., fluctuations in traffic volume), or artefacts of the study procedure (e.g., scheduled maintenance of traffic sensors).

3.3.2 Treatment Effect Model

The treatment-effect was modelled using Generalised Linear Modelling methods, which is a class of models founded on regression techniques. This system allows for the flexible modelling of the relationship between one or more variables and an outcome variable, where the outcome variable can have different formats.

The binary logit model was the general class of model used to evaluate the treatment effect on the outcome measure. In general, this model allows for each individual observation, and the attributes of that observation (e.g., day of week of observation), to be modelled explicitly. An example of the form of this model is provided below. In this model, $Ln\left(\frac{P}{1-P}\right)$ reflects the odds of the dependent variable adopting one of two conditions (e.g., 0: speed ≤40km/h, 1: speed >40km/h), or the probability of an outcome over the probability of no outcome, given the different combinations of independent study variables (X and Y).

$$Ln\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 X + \beta_2 Y + \beta_3 X.Y$$

Dependent variables

The treatment effect is primarily assessed against the odds of a speed in the treatment area at 12-months, exceeding 30km/h, 40km/h, and 50km/h. In this model, the speed of each observation is expressed as a dichotomous variable, indicating a speed that exceeds the speed value (1), or does not exceed the speed value (0).

Independent variables

Two types of independent variables are included in the modelling of treatment effect. The first are the principal variables, that index each speed observation as occurring or not occurring at a data station with the treatment. The other variables are secondary variables, that are used to adjust the model for changes in speed attributed to artefacts of the study, or natural variation in the sampling distribution. These are listed in *Table* 1.

The *road segment* variable was used as a unique site identifier in the model. In most cases, each data station was allocated a unique road segment number. If two or more data stations were considered to be not adequately independent, these data stations were allocated the same road segment number, and the speed observations at these sites were pooled. Sites

were considered not independent if they were located on the same road, and not separated by an intersection at which a motorist is required to yield.

Table 1: Speed evaluation: Independent variables

Variable	Values	Description
Principal independent variables		
Location	0 = Non-treatment area 1 = Treatment area	Speed observation in treatment or non-treatment area
Time period	0 = Baseline (t_0) 1 = 12-month (t_1)	Speed observation before treatment or 12-months after treatment commencement
Secondary independent variables		
Road segment	1,2,…,n	Index of road segments in treatment or non-treatment area
Type of day	0 = Weekend 1 = Weekday	Speed observation on weekend or weekday
Time of day	0 = Outside peak 1 = Morning peak 2 = Afternoon peak 3 = Evening peak	Speed observation during different traffic conditions

An example of a binary logistic model with the dependent and independent variables is provided below.

$$Ln\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 TypeofDay + \beta_2 TimeofDay + \beta_3 RoadSegment + \beta_4 Location + \beta_5 TimePeriod + \beta_6 Location \cdot TimePeriod$$

In this model, the interaction between *Location* and *Time period* is the treatment effect adjusted for differences in the type of day, time of day, and sampling distribution at individual survey sites. Specifically, the beta coefficient β_6 indicates the (non-exponentiated) odds of a speed exceeding a speed value in the treatment area at 12-months, compared to non-treatment areas.

During the modelling process, consideration was given to the possibility of there being a small number of cases in one of the two outcomes (exceeding speed value; not exceeding speed value), for the given model arrangement. In this case, the rarer of the two outcomes was typically an observed exceedance of the speed value, and the rarity of this outcome was expected to increase when modelling the odds of a speed exceeding the higher values of 50km/h and 60km/h. Moreover, a small number of outcomes was expected to be more likely at these speed values when the *road segment* independent variable was included in the model. To account for the possibility of small values and their influence on the model outcomes, the results include outcomes for models with and without the *road segment* variable.

4 METHOD - COMMUNITY ATTITUDES

Attitudes towards the 30km/h trial were established from two samples of the community that lived, worked, or owned a property in the study area. The first was of a sample of the community that responded to a questionnaire mailed to a random selection of property addresses in the treatment area (n= 2,000) and in the non-treatment area (n= 2,000). The property addresses were randomly selected from the same sampling frame (list of property addresses) separately at the Baseline and 12-month time-point, and a questionnaire was mailed to each address. This is referred to as the *community sample*.

The second was a sub-set of people in the area who had responded to the Baseline survey and consented to be followed up at the 12-month time-point. These people were targeted using E-mail addresses and were selected independent of their potential selection in the random sample at 12-months. This sample were asked to respond to an abridged version of the questionnaire, focused on the question of support for 30km/h speed-limits. This is referred to as the *repeat sample*.

The Baseline (t_0) questionnaire preceded the treatment and was mailed to property addresses in September 2018. The follow-up questionnaires (t_1) were mailed to property addresses and were administered in August 2019.

4.1 QUESTIONNAIRE

The community questionnaire consisted of 40-questions under two themes related to the 30km/h speed-limit trial. The first theme related to the participants personal characteristics and travel behaviour. The second theme related to the participants attitudes towards, and perceptions of the benefits of speed-limit reductions. An abbreviated version of the questionnaire is provided in Table 2 and Table 3.

Table 2: Attitude survey: Personal characteristics

Demographic and household information
Work, live, or own a property (non-resident) at the address where the questionnaire was received.
Gender.
Age.
Duration lived, worked, and owned property at address.
Car ownership.
Structure of household, dwelling type, housing situation, and type of street at address.
Language in addition to English in household.
Person in household identify as having a disability.
Travel information
Method of travel for short and long trips.
Distance travelled by car or motor bicycle.
Walking and cycling behaviour.

Table 3: Attitude survey: Attitudes towards 30km/h trial

Safety and existing speed-limits
Feeling of safety walking and cycling in neighbourhood streets.
Safety of children and elderly crossing the road.
Feeling of connectivity to local community.
Appropriateness of speed-limits on specific local roads.
Perceptions of speed-limit reductions
Impact of speed-limit reduction on travel time, short-cutting traffic, and levels of walking and cycling.
Impact of speed-limit reduction on collision likelihood and injury severity.
Level of support for 30km/h speed-limits
On their street.
On neighbourhood streets broadly.
On roads in shopping strips.

4.2 DATA ANALYSIS

4.2.1 Community sample

The community survey was first presented as descriptive statistics, namely, the number and percentage of responses to each condition within each question. In general, responses were separated by study group (treatment or non-treatment), and time-period (Baseline or 12-months). Respondents were asked to identify their level of support for 30km/h speed-limits across a five-point Likert scale of agreement; namely, strongly disagree; disagree; neither agree or disagree; agree; strongly agree (and do not know). This is referred to as the *descriptive* measure of support.

The level of support is also presented in four other formats in various locations in the report. First, support measured across a 5-point scale excluding *do not know* responses (opinion scale). Second, support measured across a 3-point scale with positive responses combined and negative responses combined (trend of opinion scale). Third, with positive responses combined, negative responses combined, and omitted neutral and do not know (decisive scale). Fourth, support across a 2-point scale, with positive and neutral responses combined, and negative responses combined. The last indicates the percentage of responses that are unfavourable, or not unfavourable (seeTable 4).

Table 4: Attitude survey: Outcome of level of support

Outcome		Level of support for 30km/h speed-limits					
Interpretation	**Scale**	**Strongly agree**	**Agree**	**Neither**	**Disagree**	**Strongly disagree**	**Do not know**
Descriptive only	5(6)-point scale	✓	✓	✓	✓	✓	✓
Opinion on full-scale	5-point scale	✓	✓	✓	✓	✓	×
Trend of opinion	3-point scale	✓		✓	✓		×
Decisive	2-point scale	✓		×	✓		×
Unfavourable (yes/no)	2-point scale	✓			✓		×

In the first instance, differences in the distribution of level of support were assessed using bivariate statistical tests at a significance level of at least 95 probability. This included differences between the two time periods (Baseline and 12-months), the personal characteristics of the sample, and the travel characteristics of the sample. Where appropriate, multivariate modelling methods were used to identify the association between each study factor on the level of support, adjusted for the other factors.

4.2.2 Repeat sample

The evaluation of the repeat survey was also focused on the change in level of support for 30km/h speed-limits, and responses were separated by study group and time-period. This survey design is consistent with a repeated measures methodology, where the response of people to the same question under different conditions (before and after treatment), are matched in the analysis. In this evaluation, the level of support is initially presented as a five-point Likert scale.

5 RESULTS - SPEED EVALUATION

5.1 SAMPLE DETAILS

The sample of speed observations in the treatment and non-treatment areas at baseline and 12-months are provided in Table 5. All samples are for one week of data collection, and all results are based on this sample. There were more than 1.2 million speed observations in the study area across the week at baseline and at 12-months, with a small majority of observations occurring in the non-treatment area (58.3 percent).

The number of observations at baseline and at 12-months were numerically similar, with only a slight reduction at 12-months in both the treatment area (-2.2 percent), and the non-treatment area (-4.4 percent). The number of observations at the individual data stations ranged substantially from 200 to 65,499 observations per week yet were within the typical range of a two-way street (from local streets to busy collector roads).

Table 5: Speed: Sample size by group and time-period

Group	Time-period		
	Before (baseline)	After 12 months	*Sub total*
Treatment	264,562 (41.5%)	258,679 (42.0%)	*523,241 (41.7%)*
Control	373,169 (58.5%)	356,884 (58.0%)	*730,053 (58.3%)*
Total	*637,731 (100.0%)*	*615,563 (100.0%)*	*1,253,294 (100.0%)*

The detailed distribution of the sample across different days of the week is provided in Appendix A. In summary, however, most observations in the treatment and non-treatment area were on a weekday rather than a weekend (treatment area: 73.1 percent; non-treatment area: 76.3 percent), and this was similar at baseline and after 12-months.

The distribution of the sample across different times of day is also provided in Appendix A. The distribution of the sample was relatively uniform during the typical hours of work (between 8am and 6pm). There were only minor differences in the distribution of the sample across different hours of the day between Baseline and 12-months, for both the treatment and non-treatment areas.

5.2 MEAN SPEEDS

The mean speed (and 85th%ile speed) is provided in *Table* 6. It shows that the central tendency of speed across the trial area was relatively low at Baseline, with a mean speed of 27.6 km/h in the treatment area (and 29.4km/h in the non-treatment area). Additionally, the 85th percentile speed across the trial area was less than 40 km/h at Baseline, indicating that the majority of speed observations were within the previous speed limit.

At 12-months, there was a modest reduction of 0.3km/h (-1.1%) in mean speed in the treated area, and a 0.8km/h (-2.8%) reduction) in the non-treatment area. Similarly, there was a modest reduction in the 85th percentile speed, from 36km/h to 35km (-2.8%) in the treatment area and 38km/h to 37km/h (-2.6%) in the non-treatment area.

Table 6: Speed: Mean speed (and 85th percentile)

Group	Time-period		
	Before (baseline)	After 12 months	*Reduction*
Mean speed (km/h)			
Treatment area	27.6	27.3	*-1.1%*
Non-treatment area	29.4	28.6	*-2.7%*
85th%ile speed			
Treatment area	36.0	35.0	*-2.8%*
Non-treatment area	*38.0*	*37.0*	*-2.6%*

A more complete distribution of the speeds observed in the treatment area at Baseline and 12-months, is provided as *Figure* 3, (not including extreme values). This distribution resembles a normal distribution, with the mean speed (27.6km/h) closely matching the median speed (28km/h). The interquartile range of the distribution at Baseline was 11km/h, indicating that the middle 50% of speeds had a spread of 11km/h (from 22km/h, to 33km/h), and this reduced to 10 km/h at 12-months.

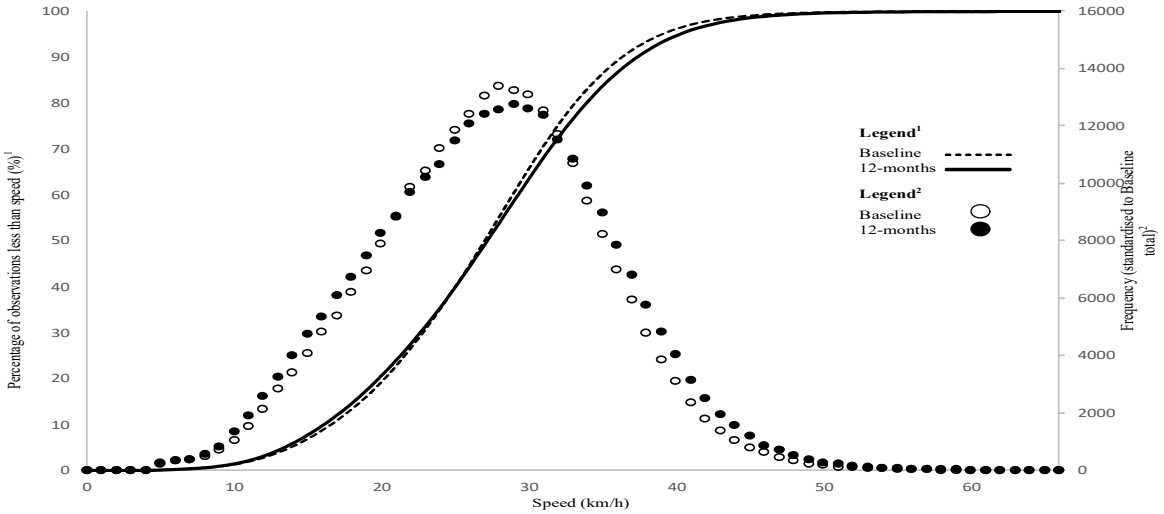


Figure 3: Speeds: Cumulative percent of speed observation in treatment area: baseline and 12-months

The reductions in speeds in the non-treatment area were unexpected, and interpreted as a carry-over effect. This was attributed to the location of the non-treatment area immediately adjacent to the treatment area, and that marketing for the trial did not clearly separate the two regions. Consequently, it did have a negative impact for the analysis (see Section 5.5).

5.3 SPEED CATEGORIES

5.3.1 Percentage exceeding speed values

The percentage of speeds observed at baseline in the treatment and non-treatment area exceeding 30km/h, 40km/h, and 50km/h at Baseline and 12-months are summarised in *Table* 7. In the treatment area, 36.7% of the 264,562 vehicles observed at baseline exceeded 30km/h, and 5.4% exceeded 40km/h. A much smaller percentage exceeded 50km/h (n= 1,081, 0.4%).

The percentage change in the number of observations exceeding the higher speed values (40km/h and 50km/h) was greater in the treatment area than the non-treatment area. Conversely, there was a greater percentage reduction in the percentage of observations exceeding 30km/h in the non-treatment area, than the treatment area.

Table 7: Speed: Percentage of observations exceeding speed values

Group	Percentage of observations exceeding speed value		
	30 km/h	40 km/h	50 km/h
Treatment area			
Baseline	36.7%	5.4%	0.4%
12-months	34.4%	3.9%	0.3%
Percentage change	-6.3%	-27.8%	-25.0%
Control area			
Baseline	46.8%	7.9%	0.6%
12-months	42.7%	6.4%	0.5%
Percentage change	-8.9%	-19.0%	-16.6%

5.3.2 Change by initial speed

The difference in the percentage of observations exceeding 40 km/h from Baseline to 12-months in the treatment area, by the initial median speed at the survey site, is illustrated in *Figure* 4. It indicates that greater reductions in the percentage of vehicles exceeding 40km/h, were observed at those locations with a higher initial speed. Further, that only modest changes in the percentage of observations exceeding 40km/h were observed at low speed sites, in particular, sites with a median up to around 30km/h.

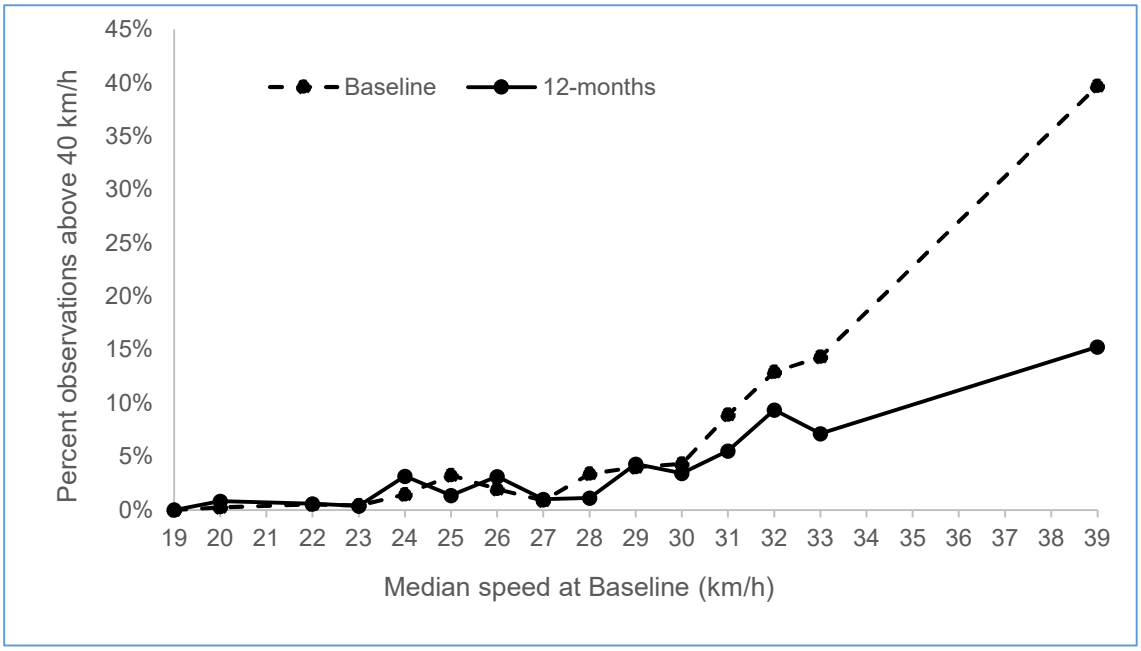


Figure 4: Speeds: Percent speeds over 40 km/h by initial speed at survey site

5.3.3 Extreme speed values

An extreme speed was identified as any speed exceeding 66km/h (see methods for derivation). The number of extreme speeds observed in the treatment area at Baseline (across the week) was 152, which represented a small percentage of all observations (0.06%). At 12-months, there was a reduction in the number of extreme speeds observed (n= 69), and also the percentage that these observations represented of all observations (0.03%). Additionally, there was a reduction in the number of survey sites at which extreme speeds were observed in the treatment area, from 27 data stations at Baseline, to 21 at 12-months.

5.4 TREATMENT EFFECT

Section 5.3 noted that there was a 0.3km/h (-1.1%) reduction in mean speed at 12-months in the treated area with a 0.8km/h (-2.8%) reduction) in the control region with a similar trend in the 85th percentile speed reductions. The reductions in the control region were unexpected, and appeared to be a carry-over effect, given that the two regions were adjacent and that marketing for the trial did not clearly separate the two regions. Nevertheless, it did have a confounding effect for the overall effectiveness analysis that needed to be addressed in determining the overall treatment effect of the trial.

Through the use of a linear regressing modelling approach, it was possible to adjust the outcome for the difference between the treated and control speed reductions (see *Table* 8). The treatment effect was assessed against the odds of a speed observation exceeding

30km/h, 40km/h, and 50km/h, in the treatment area, minus the reductions observed at the control sites. It was meaningless to focus too much on the 30km/h mean speed difference, given the mean baseline speed in both regions before and after was below 30km/h.

Table 8: Speed: Treatment effect results

Measure	Odds Ratio	CI (95%)		Significance
Exceeding 30km/h	1.07	-	-	p>0.05
Exceeding 40km/h	0.89 (-11%)	0.87	0.92	P<.001
Exceeding 50km/h	0.75 (-25%)	0.67	0.84	P<.001

The results of the regression analysis, after adjusting for the speed reductions in the control area, indicate that the real treatment effect can be summarised as follows.

1. The odds of a speed exceeding 50km/h in the treatment area at 12-months was 25% lower than that in the non-treatment area.
2. The odds of a speed exceeding 40km/h in the treatment area at 12-months was between 11% and 12% lower than that in the non-treatment area.

The odds of a speed exceeding 30km/h in the treatment area was not significantly different than that in the non-treated (control) area.

While there was little difference in average speed before and after the trial, the main Treatment benefits from the trial were among the higher speeders (those travelling 40km/h and above), where greater safety benefits in terms of fewer severe injuries were more likely.

5.5 ADDITIONAL SPEED FINDINGS

While the main focus of the trial was to evaluate the overall area-wide effects of the reduced 30km/h speed trial (as stated in the objectives in Section 2.2 and reported above), several additional aspects of the speed results were further requested, and these are reported and discussed below.

5.5.1 Free Speed Choice

An assessment of change in speed for observations of vehicles travelling at a speed not influenced by that of the preceding vehicle, is typically determined on-road by the time-gap between vehicles. This is limited by the resolution at which the speed observations were collected. In this case, the observations provided were time-stamped to the nearest one-minute as shown in Figure 6 below. As it was not anticipated in the study design that free speed would be required, the data contractor was restricted to sampling at a level of plus or minus one minute between vehicles. Thus, it was not possible to calculate what the time-gap level was between vehicles at the necessary resolution for determining free speeds by time-gaps of every second, using this method.

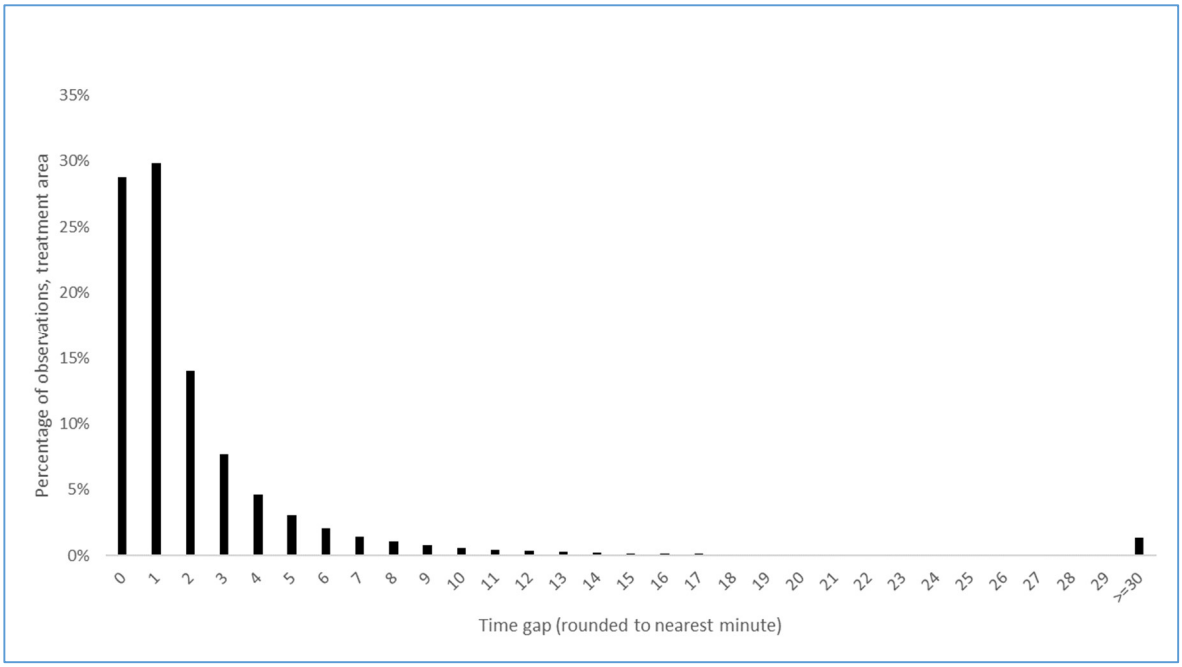


Figure 5: Speeds: Percent of observations by time-gap in minutes

Notwithstanding this limitation, though, it is likely that given the low volume of traffic on most of these local roads, a high majority of observations were of vehicles travelling at speeds not impacted by the preceding vehicle. If this is the case, then the results are likely to represent a degree of 'free speed' choice in this study. Two closely associated indicators of free speed were the treatment effect by road environment and the level of congestion. Data for estimating the free speeds of the traffic were available and are elaborated further below.

5.5.2 Treatment effect moderated by the road environment

A relevant proportion of the data stations at which speeds were observed, were likely to be within the halo-of-influence of features that moderate the effect of the speed-limit on speed choice. These features include intersections, speed-humps, sections of road narrowing, points of property access, and on-street parking. Given this, consideration was given to stratifying speed observations into two or more groups differentiated by the likelihood that the speed-limit was the main factor contributing to the motorists' choice of speed. Then, assessing the treatment effect separately (or by adjustment) for these groups of observations to understand if the treatment effect is increased or decreased at locations under less influence of other speed-mitigating features.

As a first iteration, data stations with a notionally greater likelihood of the speed-limit contributing to speed choice, were identified as those on roads without road narrowing due to on-street parking, and at least 50 metres clear of intersections and other speed-mitigating features. Under these conditions, the number of data stations that satisfied these criteria was low and considered not to sufficiently represent the trial area.

It is also noted that the data stations were originally located in positions along the road that minimised the influence of other speed-mitigating features, and so may reflect the highest speed on the road. Further selecting sites with greater likelihood of higher speed may diverge from the *area-wide* nature of the speed-limit reduction trial.

5.5.3 Treatment effect moderated by congestion

The time of day and day of week of an observation is an indicator of periods of lower traffic congestion, where in some road environments, motorists are more able to choose their speed independent of the preceding vehicle. This assumes that there is a greater likelihood that the speed-limit is the main factor contributing to the motorists' choice of speed. In the

treatment area, there were numerical differences in the percentage of speed observations exceeding 40km/h (for example) between observations occurring during periods nominally considered the morning peak, evening peak, afternoon peak, and outside peak (*Table* 9).

Table 9: Speed: Percentage over 40 km/h by time of day

Nominal likelihood of free speed	Speed observation exceeding 40 km/h (%)				
	Baseline		12-months		Difference (as a percent)
	No	Yes	No	Yes	
Low					
Morning peak	90.5	9.5	92.6	7.4	-2.1 (-22.1%)
Evening peak	92.0	8.0	93.9	6.1	-1.9 (-23.8%)
Moderate					
Afternoon peak	94.7	5.3	95.7	4.3	-1.0 (-18.9%)
High					
Outside peak	91.7	8.3	93.1	6.9	-1.4 (-16.9%)

Over these periods, the difference in the percentage of observations exceeding 40km/h ranged from -1.0% (afternoon peak), to -2.1% (morning peak). This difference as a percentage of the baseline measurements, ranged from -16.9% outside peak, to -23.8% in the evening peak. The periods with a classically lower likelihood of a free-speed observation (peak periods) were noted to have the greatest percentage reduction in the percentage of observations exceeding 40km/h. A similar trend was also observed in the non-treatment area.

5.6 SPEEDS AT SELECTED SITES

Analysis of the individual survey sites that recorded the greatest speed reductions in the percent of vehicles exceeding 40km/h from baseline to after 12-months, can provide some additional insights into the types of roads and conditions where a 30km/h speed-limit may be more effective. Individual sites were examined in terms of their level of speed reduction above 40km/h in the treatment area and the top 5-road locations were identified and listed below in *Table* 10.

Table 10: Speed: High performing sites

Site	Percentage of observations exceeding 40 km/h		
	Baseline	12-months	Difference (%)
1. Easey Street	37.3%	14.2%	-23.1 (-62.0%)
2. Ballarat Street	13.2%	3.5%	-9.7 (-73.2%)
3. Hotham Street	13.9%	4.6%	-9.3 (-67.1%)
4. Napier Street	9.4%	0.4%	-8.9 (-95.3%)
5. Mater Street	16.8%	9.8%	-7.3 (-43.5%)

Of the five individual road site locations, differences in the percentage of vehicle speed reductions between baseline and after 12-months ranged from -7.3% (Mater Street) to 23.1% (Easey Street). The five road segments are detailed in order of greatest speed reduction in Box 1 below, along with basic observations of the road condition at each site.

Box 1: Five top sites with the highest speed reductions above 40km/h

1. **Easey Street; between Gold Street and Hoddle Street.**
   An uninterrupted road length of approximately 320 metres. Two formal traffic calming measures in two speed humps, centrally located along the road with an internal spacing of 135 metres. Speed observations made centrally between speed humps. Marked on-street parking allowing for a trafficable road width of approx. 6 to 6.2m.
2. **Ballarat Street; between Hotham Street and Alexandra Parade**.
   An uninterrupted road length of approximately 196 metres that is truncated at the northern end. Speed observations made equidistant from road ends. Marked on-street parking with approximately 7 metres available to through traffic. No formal traffic calming measures.
3. **Hotham Street; between Wellington Street and Charlotte Street**.
   uninterrupted road length of approximately 140 metres, with speed observations made around 40-50 metres from one end. Unmarked kerbside parking with approximately 6 metres available to through traffic. No formal traffic calming measures.
4. **Napier Street; between Rose Street and Leicester Street**.
   An uninterrupted road length of approximately 200 metres, with speed observations made centrally. One formal traffic calming treatment located centrally, in the form of a speed hump. The speed observation was made proximal, but not immediately adjacent to the speed hump. Marked on-street parking and a bicycle lane in each direction delineated by a broken white line. A width of approximately 7.5 metres between marked parking, and 3.2 metres between marked bicycle lanes.
5. **Mater Street; between Smith Street and Emma Street.**
   An uninterrupted road length of approximately 260 metres, with speed observations made around 40-50 metres from one end. Pedestrian refuge islands centrally located, and no other formal traffic calming measures. Marked on-street parking, with approximately 7.2 metres available to traffic.

5.6.1 Wellington Street - Case Study

Wellington Street is a collector road that runs through Collingwood from Alexandra Parade to Victoria Parade in the City of Yarra. It runs through both the treated and control areas and ideally, it would have been a good example of speeds in a major collector road in both the treated and untreated regions. Unfortunately, though, during the 12-month period of the trial, Wellington Street was subjected to local roadworks to the street and thus, was excluded from the analysis for likelihood of confounding the results. Nevertheless, it was worthy of a separate analysis as a special case study. Travel speeds were measured at three survey locations along Wellington Street in the treatment area at baseline and at 12-months and these results are shown in are shown in *Table* 11.

Table 11: Speed: Wellington Street, special case

Site	Percentage of observations exceeding 40km/h		
	Baseline	12-months	Difference (%)
1	16.0%	9.8%	-6.2 (-38.9%)
2	14.1%	5.4%	-8.7 (-61.6%)
3	17.9%	9.4%	-8.5 (-47.4%)

NB: baseline data were only available for the treated area.

With observations pooled across each location, there were reasonable reductions in the percentage of vehicles observed to be exceeding 40km/h from baseline to after 12-months (-6.2% to -8.7%). These were associated with reductions in mean speed from 31.9km/h to

29.8km/h (-6.5%). Notably, the greatest reduction was observed at Site 2 between Keele and Hotham Streets, which is located roughly midway from the two major intersections along Wellington Street.

As noted earlier, that there were road works on this section of the street during the study period and while these speed reductions may or not have necessarily directly impacted by these changes, it is not appropriate to claim these reductions as a consequence of the 30km/h trial.

5.7 STRATIFICATION BY ROAD TYPE

The final speed analysis set out to examine the speed reductions by type of roads within the treated area. Road types were stratified according to a four-class system, differentiated by the traffic directionality (one, or two-way), likely traffic volume or capacity, and *available road width* due to on-street parking or similar constraints. The intention was to understand the road types where the treatment effect is more impactful.

- **Type 1**: One-way roads, including any survey site on sections of Rose St (east), Argyle St, Leicester St, or Cecil Street.
- **Type 2**: Two-lane two-way roads, where the majority of sites in the treatment area.
- **Type 3**: Low volume one-lane two-way roads, including any survey site on sections of Rose Street (west), noting that sections of some local roads (e.g., Napier Street north of Johnston Street) have pavement and line-marking (e.g., bicycle lane) that are passively restricted, whilst largely retaining two-lanes of traffic. The latter were not considered restricted.
- **Type 4**: Higher capacity traffic roads, such as Wellington Road - for reasons previously noted, this was not further included here.

A review of the survey sites against the four-class typology above, found that only Type 1 and Type 2 locations were available for the assessment. There were 13 of the 50 survey sites in the treatment area that were classified as Type 1 and another 37 were classified as Type 2. There were roads of Type 3 and 4 in the treatment area with survey sites, although these survey sites were necessarily excluded given changes to the road environment over the trial period. The change in mean and 85th percentile speed values, and the percentage of observations exceeding 30km/h, 40km/h, and 50km/h, by road type (1 or 2) is provided in *Table* 12 and *Table* 13.

Table 12: Speed: Change in speed by road type, mean and 85th%ile

Road type	Mean (85th%ile) speed (km/h)		
	Before	After	Difference (%)
One-way	23.6 (31.0)	23.5 (31.0)	-0.1 (-0.4%)
Two-way	28.3 (37.0)	28.2 (36.0)	-0.1 (-0.4%)

Not surprisingly, the average speeds on two-way roads (Type 2) were higher that on the one-way roads (Type 1), given that the road and design characteristics are quite different for these road types. What is of interest, though, is that the speed reductions before and after mirror the overall average speed differences in the treatment zone, suggesting that the overall benefit is relatively consistent across these two road categories.

An important consideration in interpreting these results is how representative the survey sites of the roads are, in particular, their position relative to intersection yield-points, and other traffic calming treatments.

Table 13: Speed: Change in speed by road type, percentage over speed values

Road type	Percentage of observations exceeding 30, 40, and 50 km/h		
	Before	After	Difference (%)
Exceeding 30 km/h			
• One-way	17.7%	16.0%	-1.7% (-9.8%)
• Two-way	40.3%	38.5%	-1.8% (-4.4%)
Exceeding 40 km/h			
One-way	1.2%	1.0%	-0.2% (-16.7%)
Two-way	6.2%	4.5%	-1.6% (-26.5%)
Exceeding 50 km/h			
One-way	0.1%	0.0%	-0.01% (-23.2%)
Two-way	0.5%	0.3%	-0.18% (-37.5%)

5.7.1 High Speeders

The survey locations categorised as high speeders where more than 10% of vehicles exceeded 40km/h at baseline, were compared at 12-months. There was a reduction in the proportion of vehicles exceeding 40km/h at all locations ranging from -3.0% to -24.4%. There was also a reduction in the mean speed at all locations ranging from -0.9% to -18.5%, and reductions in the median speed at all except two sites where the median speed remained the same.

5.7.2 Compliance with Speed Limit

The level of compliance to the speed-limit at baseline and 12-months in the treatment area is provided in Table 14. There was an increase in the percentage of speeds exceeding the limit from baseline (5.4%) to 12-months (34.4%). A comparison of the odds of exceeding the limit (ratio of exceeding to not exceeding) at each data station at baseline and 12-months is provided in Table 14. It indicates that the odds of exceeding the limit reduced at only one location (2.0%).

Table 14: Speed at t0 and t1: Compliance to speed-limit

Condition	Proportion of speeds relative to speed-limit (n, %)	
	Baseline (40km/h)	12-months (30km/h)
Less than or equal to limit	250,339 (94.6%)	169,639 (65.6%)
Exceeding limit	14,223 (5.4%)	89,040 (34.4%)
Total	*264,562 (100.0%)*	*258,679 (100.0%)*

6 RESULTS - POTENTIAL INJURY SAVINGS

Towards Zero is a bold new strategy and action plan that involves governments, communities, vehicle manufacturers, road authorities, transport companies and the community to get serious about saving lives and serious injuries. The Victorian Government published the Towards Zero road safety strategy (VicRoads 2016) outlining a target to reduce serious injuries in Victoria by 15% between 2016 and 2020.

Towards Zero has been adopted as a road transport policy The Transport Accident Commission in Victoria (TAC 2018) recently reported that in the last 10 years, more than 400 pedestrians have lost their lives on Victorian roads, mainly in Metropolitan Melbourne. Of those, one-third were aged 70 years or more. Crossing the road was the predominant type of collision, the majority at speeds above 40km/h or more.

In the quest to achieve a “Towards ZERO” death and severe injury outcome for pedestrians in residential streets in Melbourne, the City of Yarra decided to set up a trial of a 30km/h speed limit in a selected residential area of their municipality and evaluate the likely trauma benefits for their residents.

The potential injury savings attributed to the 30km/h speed-limit over a 40km/h speed-limit, were assessed by identifying the difference in the cumulative risk of injury before and after the intervention, given percentage distribution of speed observations. Studies by Rosen and Sanders (2011), Tefft (2013), and Kroyer (2015) have also reported multiple risk curves that are available to assess changes in injury risk given speed reductions.

In this study, each speed observation measured before and after the trial, was assigned a value indicating the likelihood of an injury given the speed of impact. Each observation was then simplified as occurring within a speed interval (5km/h bins), and the risk of injury of the mid-point of each interval was computed (see *Figure* 6).

This analysis indicated that the likelihood of a serious or fatal injury (given a collision) before the treatment was 0.24%, and 0.23% after the treatment. This represents a 4% reduction in the risk of a pedestrian injury, should a collision occur between a vehicle and a pedestrian.

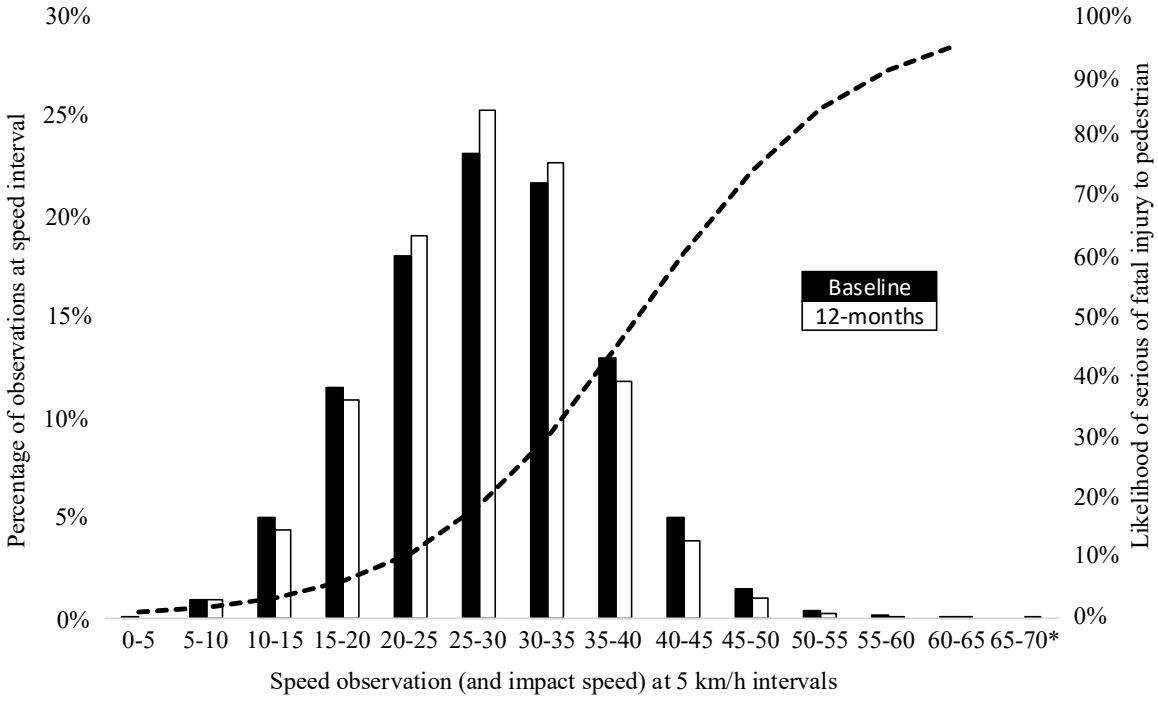


Figure 6: Speed evaluation: Risk of pedestrian injury curve

This analysis shows the likely safety benefit of a pedestrian impacted by a vehicle in terms of sustaining a fatal or severe injury (FSI) but does not include any likely reduction in having a crash attributed to the observed reductions in speed. The World Health Organisation (WHO 2004) claimed that the higher the speed of a vehicle, give less time for a driver to stop to avoid having a crash. Corben (2006) further noted there is approximately a 50% reduction in the distance required to stop when travelling at 30km/h compared to 40km/h (assuming a 1.2 second driver perception-reaction time; and 0.7 coefficient of friction), which is a 25% reduction in speed. A car travelling at 50km/h will typically require around 13metres to stop, while a car travelling at 40km/h will stop in less than 8.5 metres. Thus, an increase in average speed of 1 km/h typically results in a 3% higher risk of a crash involving injury, with a 4 to 5% increase for crashes that result in fatalities (WHO 2004; Corben 2006).

Thus, the safety benefits attributed above are likely to be only part of the real safety benefits of a lower speed limit; that is a reduction in severity of a pedestrian injury as well as a reduced likelihood of a collision occurring, given the reduced stopping distance. It was not possible in this study however to estimate the likely crash reductions of the 30km/h lower speed benefit in the study region.

7 RESULTS - COMMUNITY ATTITUDES

The full analysis of the two community attitude surveys before and after that were conducted in 2018 and 2019 is found in Appendix B. What is reported in this section is an overview of the main findings from the two surveys of interest. A detailed report on the baseline survey can be found in Lawrence, Oxley and Fildes (2017) and is not reported here again.

The main results of special interest are illustrated in tables and/or figures while other incidental findings are listed in tables. The number of responses to the community attitude survey for baseline and after 12-months from people that lived, worked, or owned a property in the treatment and non-treatment areas are shown below in Table 15. There was an increase in the sample size from baseline (n=484) to (n=548) in the 12-month survey.

Table 15: Attitude survey: Sample size of community survey

Group	Sample size (no.)		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment	290 (59.9%)	328 (59.9%)	*618 (59.9%)*
Control	194 (40.1%)	220 (40.1%)	*414 (40.1%)*
Total	*484 (100.0%)*	*548 (100.0%)*	*1,032 (100.0%)*

As noted earlier, survey responses were categorised in 5-levels, (i) strongly agreed, (ii) agreed, (iii) strongly disagree or either agree, (iv) disagreed, or (v) strongly disagreed. To simplify the reporting processes, here, however, these 5-categories were subsequently re-grouped into 3-categories: (i) agree, (ii) either agreed or disagreed, or (iii) disagreed. For those interested, results for the 5-categories are shown in Appendix B.

7.1 LEVEL OF SUPPORT FOR 30KM/H SPEED-LIMIT

The main response sought from the survey, identified in the research questions, was the level of support for the 30km/h speed limit in both the treated and control samples. *Figure 7* shows that there was a significant increase in the level of support for the lower speed limit and a decrease in opposition to it in the after 12-month survey (Chi^2 <0.05) as shown in *Figure 7* below. It shows a 15% increase and a 9% decrease in opposition to the lower 30km/h limit in the after survey.

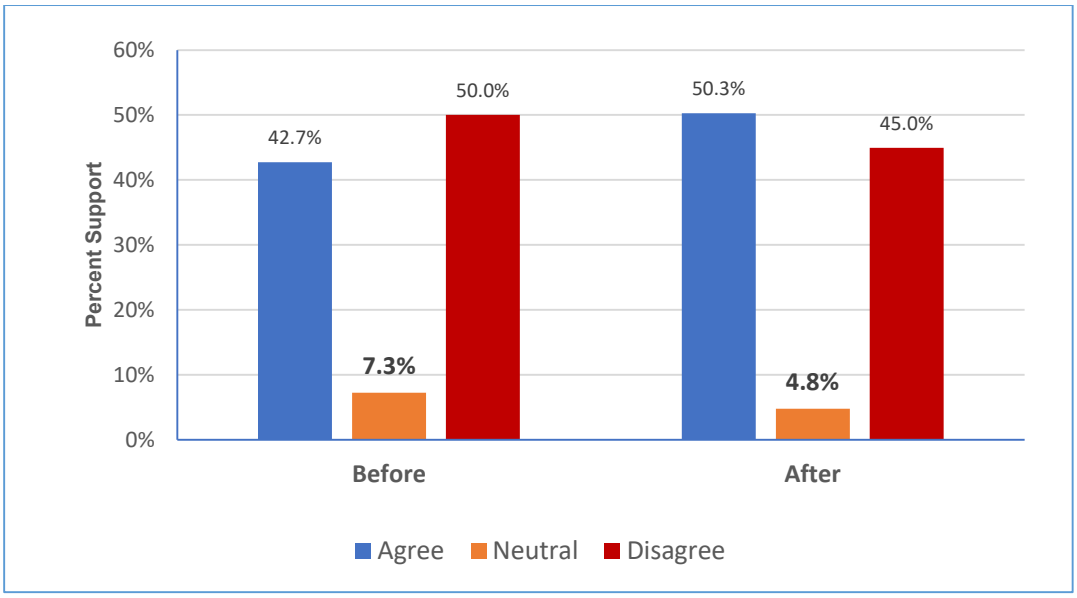


Figure 7: Support for 30 km/h in local streets

7.1.1 Support Among Treated and Control Groups

The responses were then separated for the treated and control regions shown in *Figure* 8 and *Figure* 9 and are both significant (Chi^2 <0.05). The trend in both groups confirm the overall findings, suggesting that both the treated and control respondents were equally supportive of the 30km/h speed limits.

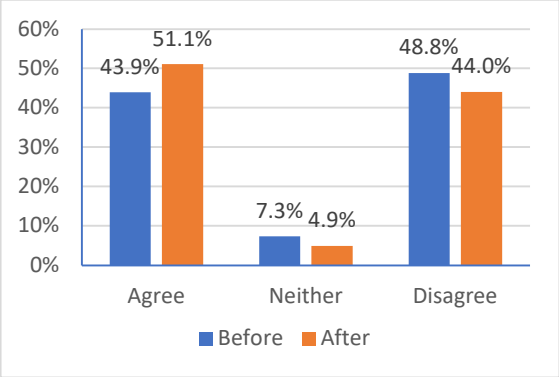


Figure 8: Level of support in the treated sample

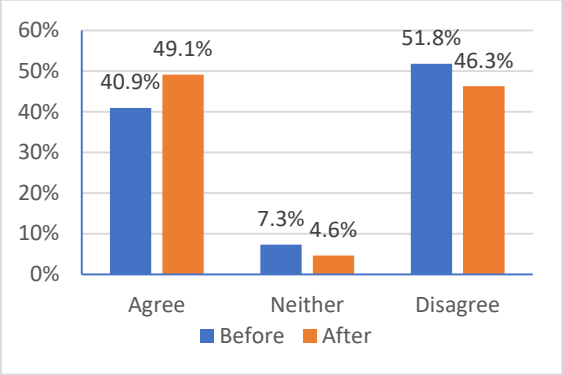


Figure 9: Level of support in the control sample

7.2 ATTITUDES TOWARDS 30KM/H SPEED-LIMIT TRIAL

Several questions in both the surveys (Before and After 12-months) were aimed at soliciting responses from the residents on a number of important local issues related to their attitudes around the 30km/h speed limit trial. The answers below were descriptive and not subjected to statistical analysis.

7.2.1 Safer for Walking & Cycling in Area

An important question aimed to address the likely benefit of the 30km/h speed limit on the safety for all pedestrians and cyclists in the area, shown in *Figure* 10.

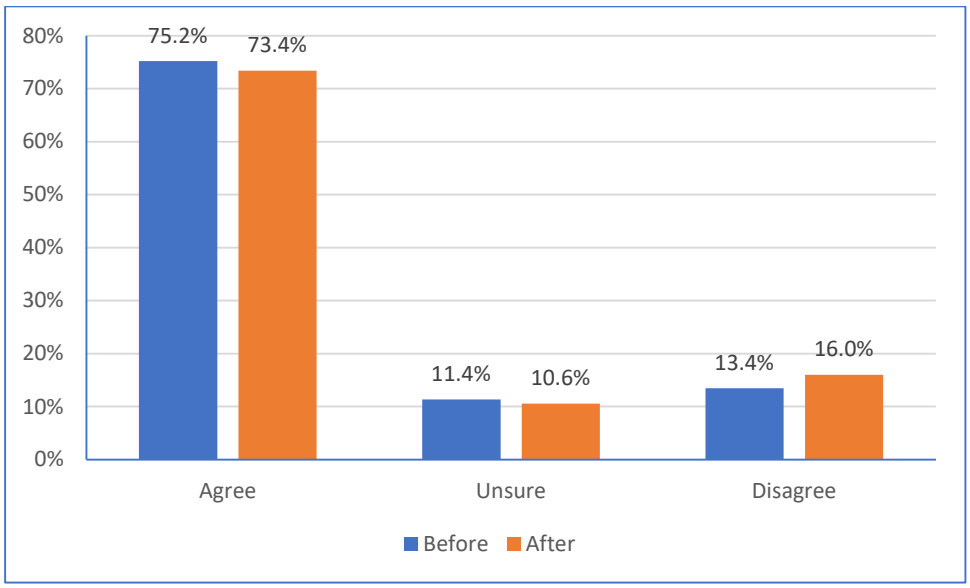


Figure 10: Lower speed limit will be safer for walking & cycling in the area

Three-quarters of the respondents claimed that the 30km/h speed limit would make the area safer to walk and cycle in and this was relatively consistent, both before and after the trial had concluded, and across the treated and control regions (not shown here).

7.2.2 Safer Roads for Children & Elderly

Respondents were further asked if they thought the 30km/h trial would make the area safer for crossing the road particularly for children and the elderly. Responses before and after the trial are shown in *Figure* 11 below.

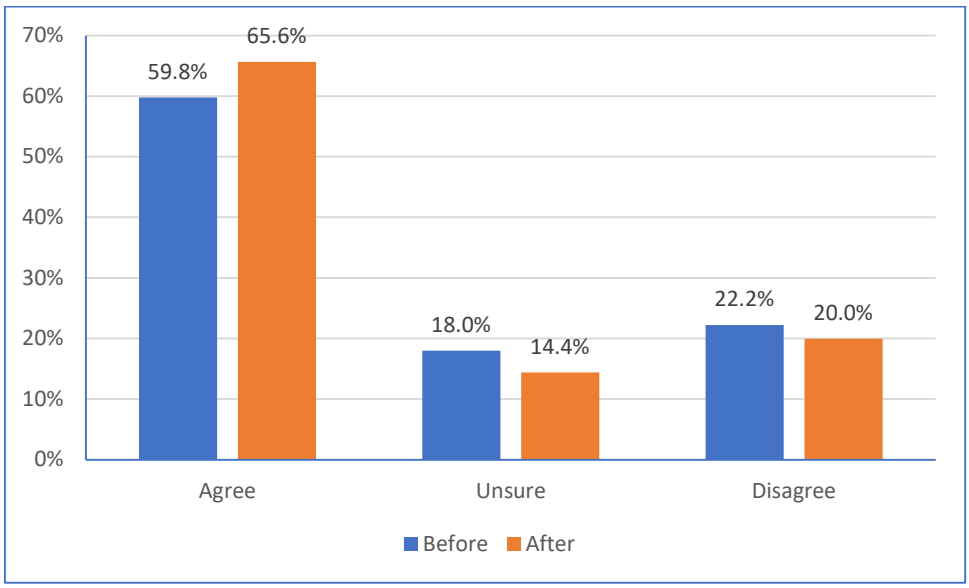


Figure 11: Lower speed limit will be safer for children and the elderly

Almost 60% of the respondents thought it would be safer for these vulnerable road users before treatment that subsequently increased to around two-thirds after the trial concluded. Only a small percent of respondents thought it would not, although a similar amount was also unsure of its likely impact.

7.2.3 Speed Limit and Injury Severity

In an attempt to clarify the residents' appreciation of the relationship between speed and severity of impact (Figure 1 on page 1), another safety question was included in both surveys on whether they thought that a lower speed limit would lead to a reduction in in injury severity in a crash – *Figure* 12 below.

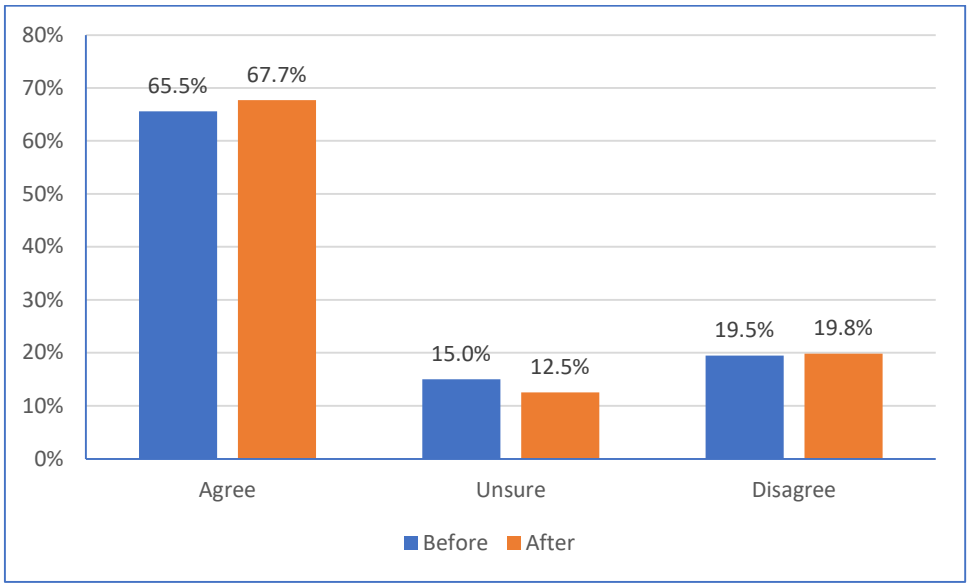


Figure 12: Lower speed limit will reduce injury severity in a crash

Two thirds of the respondents agreed correctly that a lower speed limit would reduce the likelihood of a severe injury while around 20% thought it would not. This finding was relatively stable across both surveys, and in both the treated and control regions (not shown here). This was a useful adjunct of the residents' appreciation for a lower speed limit in their local streets.

7.2.4 Reduced Risk of a Collision for Pedestrian & Cyclists

A further question was aimed at the respondents' appreciation of the likely reduced risk of having a collision for a pedestrian and cyclist with the 30km/h speed limit in their region. These findings from both surveys are shown in *Figure* 14.

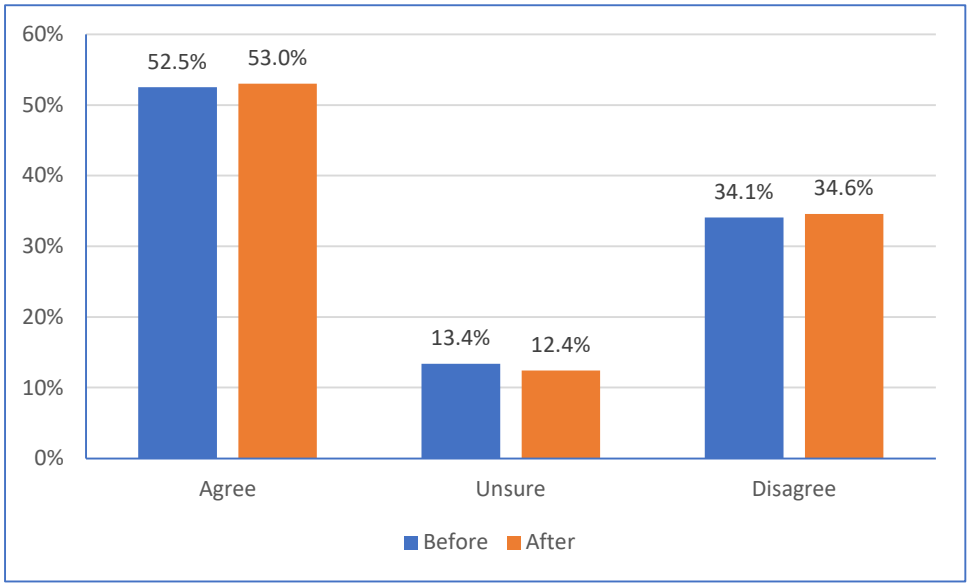


Figure 13: Reduced speed-limit will decrease the likelihood of pedestrian/cyclist collisions

7.2.5 Impact on Travel Time

Reducing speed limits is often associated with an increase in people's concern about the effect it will have on their time getting from Point A to Point B. Thus, a question was included in the surveys before and after 12-months that asked if they thought the reduced 30km/h speed limit would have a negative impact on their travel time in the region.

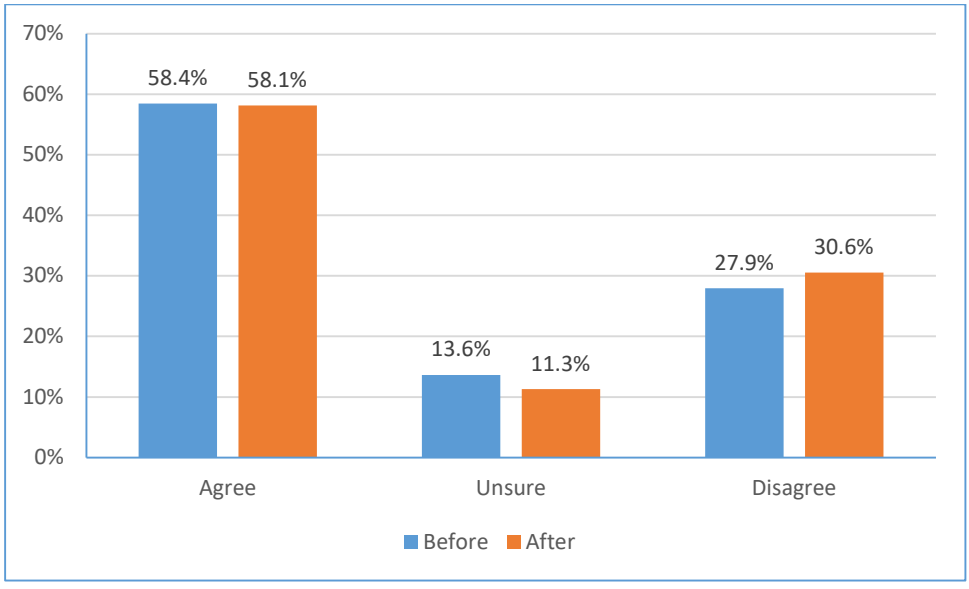


Figure 14: Perceived impact of lower speed limit on travel time

The responses in *Figure* 14 show that the majority of respondents believed that the 30km/h speed limit in their local streets would not impact on travel time and this finding was consistent before and after the 12-month trial (Chi^2 >0.10).

7.2.6 Appropriateness of 40km/h Speed Limit on other neighbourhood streets?

A final question of interest here related to the respondents view towards the appropriateness of the current 40 km/h on other neighbourhood streets (see *Figure* 15 below). Of interest, almost 60% of those sampled thought that a 40 km/h speed limit on other neighbourhood streets was about right, with 26% to 30% thinking it was too fast, and 12% to 17% claiming it was too slow. There was a slight increase in the too slow and a small reduction in the too fast categories in the after survey although these differences were not significant (Chi^2 = 0.07).

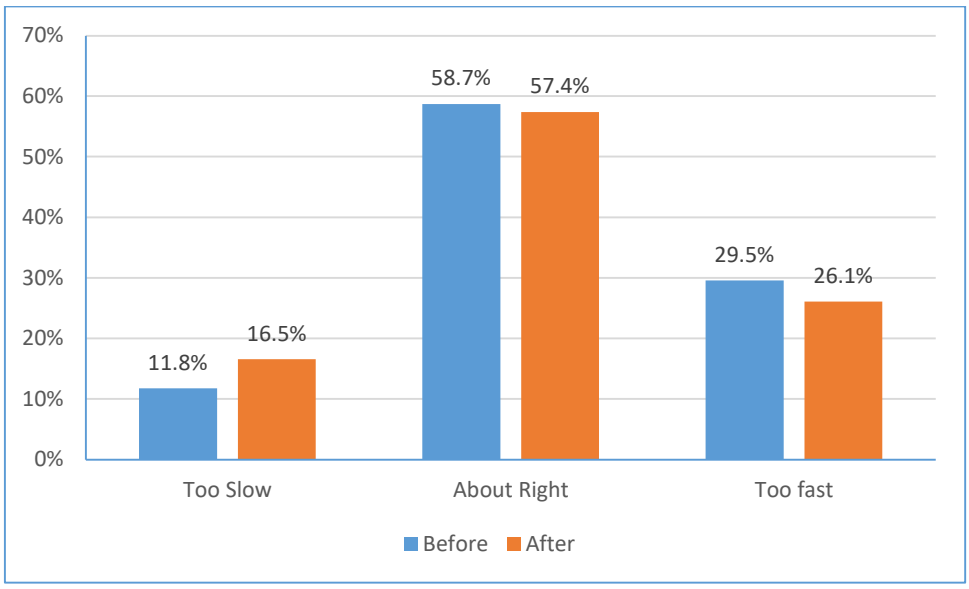


Figure 15: Appropriateness of 40km/h speed limit on other neighbourhood streets

Respondents were also asked if the current 40km/h speed-limit was appropriate for Brunswick Street and Smith Street, two mixed function main roads proximal to the trial area. The responses indicated that before the trial, most people in the treatment and non-treatment area (66.6% and 63.9% respectively) considered the current speed limit was about right. There were only marginal changes in this view after the trial (68.9% in treatment area; and 71.8% in non-treatment area).

7.3 COMMUNITY ATTITUDE REPEAT SAMPLE

An additional repeat survey was further conducted at the conclusion of the trial among 349 previous baseline respondents who had agreed to complete an additional survey after the trial was completed. These people were not invited to contribute to the main after survey but instead undertook the repeat survey. It was intended to be a special analysis of those with a special interest in the trial.

Of the 349 people who had agreed to do the repeat survey, 120 responses were received, the majority (n= 88, 73%) were identified as living, working, or owning a property in the treatment area.

7.3.1 Level of support

The response to the question '*I support the 30km/h speed trial in neighbourhood streets in City of Yarra'* before and after the trial is provided in Table 16. At baseline, 53 people (44.2 percent) indicated general agreement with the treatment. A greater number of people were in general agreement with the treatment at 12-months (n=59, 49.2%).

Table 16: Attitude survey: Repeat sample, change in support for 30 km/h

Baseline (t0)	**12-month (t1)**			
	General agreement	Neutral	General disagreement	*Total*
General agreement	48 (90.6%)	2 (3.8%)	3 (5.7%)	53 (100.0%)
Neutral	5 (71.4%)	1 (14.3%)	1 (14.3%)	7 (100.0%)
General disagreement	6 (10.0%)	1 (1.7%)	53 (88.3%)	60 (100.0%)
Subtotal	59 (49.2%)	4 (3.3%)	57 (47.5%)	120 (100.0%)

The majority of people did not change their level of support as measured on the 5-point scale from baseline to after 12-months (n= 79, 65.8%). A small minority of people that either generally agreed or did not agree or disagree with the treatment at baseline, changed their view to a general disagreement with the treatment (n= 4, 3.3%).

Of the people that changed their level of support as measured on the 5-point scale (n= 41, 34.2%), the minority (n= 18, 43.9%) changed their level of support on the generalised 3-point scale (general agreement, neutral, or general disagreement). Of these, the majority increased their level of support from either a general disagreement to neutral or agreement, or from neutral to a general agreement (n= 12, 66.7%).

7.4 SUMMARY

This selected sample of survey responses were chosen given the research questions listed earlier and a valuable addition to the speed results listed in Chapter 6. Of special interest, there was an increase in support for the 30km/h trial from people in the treatment area, and a consequent decrease in those opposing it. This were only minor differences in the change in opinion of those living in the treated area and those in the non-treated area.

For the various attitude responses, approximately 75% agreed that the 30km/h speed limit would improve safety for walking and cycling generally, and in particular, for children and the elderly. Two-thirds of the respondents understood that reducing speeds would lead to less injurious crash outcomes and that it would also lead to fewer crashes for pedestrians and cyclists in their region. The majority thought that a 30km/h speed limit would have no impact on their travel time (30% differed), while around 60% thought that 40km/h was about right for main feeder roads in the district.

8 RESULTS - SUPPLEMENTARY OUTCOMES

8.1 CRASHES

The duration, recency, and geospatial extent of the trial does not allow for a robust evaluation of the change in the incidence rate of crashes or injuries given the treatment. For the purpose of this report, however, mass crash data can be used to provide some insight into the historic crash and injury incidence rate in the treatment area and provide a baseline for future assessment.

A limitation of mass crash data, however, is that it only captures crashes attended by the Police, where these are typically those involving at least one motor-vehicle that occur on a public road. There is also a delay between the date of the crash and the public release of the crash details, where the dataset may not include crashes that have occurred in the previous 6-12 months.

Accordingly, any crash history described using mass crash data is a reduced sample of the total crash population, and a limited sample of the total injury population. Notwithstanding these limitations, over time it can provide some insight into any systematic difference in the incident rate of police-reported crashes in the treatment area given the change in speed-limit.

To establish crude estimates of the crash incidence rate, crashes in the treatment area occurring over the 5-year period before trial, with a locale on a road impacted by the speed-limit reduction were selected. Crashes meeting the same locale criteria that occurred during or after the trial (from September 2018 onwards) were identified. It is noted here, that the most recent crash date available was in January 2019.

Before the trial in the treatment area, the mean number of crashes reported to the Police in the treatment area was eight, and there was no clear trend in the crash incidence rate over this period. The severity of the crash was reported as *serious* in 20% of the crashes, with the remaining identified as resulting in a severity less than *serious*. Notwithstanding the small number of crashes, it was observed that crashes that were reported to involve pedestrians, were more likely to be classified as *serious* crashes than crashes not involving pedestrians.

At this stage, there is insufficient crash data after the trial to establish any meaningful descriptive statistics, including comparison to the crash incidence rate before the trial.

8.2 PEDESTRIAN AND CYCLIST ACTIVITY

Observations of pedestrian and cyclist activity were undertaken at eight locations in the treatment area, and a further eight in the control area (see Attachment E). These observations were made using video footage across limited time periods on one Thursday (10am to 12pm; and 2pm to 4pm), Friday (12pm to 2pm), and Saturday (11am to 1pm) at baseline, and at 12-months. The purpose of the observations was to identify any marked changes in the level of pedestrian and cyclist activity between before the treatment and afterwards. The small number of locations at which counts were undertaken does not allow for any observed changes to be generalised across the trial area. It is possible, however, to gain some insight into the effect of the speed-limit reduction (and possible reduction in speed) on pedestrian and cyclist activity.

A review of these data found that the number of pedestrians observed (crossing the road or walking along the footpath) varied by survey site and survey day. With all observations aggregated, there was a 12.7% reduction in the number of pedestrians observed at 12-months (n= 5,748) compared to baseline (n= 6,582). It was noticed, however, that one survey site had an unexpectedly large reduction in pedestrian activity on the Saturday, and that this site chiefly contributed to this reduction. At this site, the number of pedestrians

reduced by 64.2%, from 1,076 at baseline to 385 at 12-months. It was noted that the site was adjacent to a market that is open on Saturdays, and it is possible that variation in visitation to this market (e.g., due to special event) primarily contributed to this difference in pedestrian activity. With this site excluded, there was a 2.6% reduction in the number of pedestrians observed at 12-months (n= 5,363) compared to baseline (n= 5,506).

In general, there were substantially fewer people cycling than walking across the eight sites. With all observations aggregated, there was a 27.8% increase in number of people cycling at 12-months (n= 437) compared to baseline (n= 342). The percentage increase was similar across the weekdays (27.7%) and on the Saturday (27.9%). Care needs to be taken in interpreting the effects of these across both regions, given that this was not intended to be a major outcome measure of the trial and the small numbers of sites observed.

9 GENERAL DISCUSSION

This report has summarised the findings of an evaluation of a 12-month trial of 30km/h speed limits in local streets in the City of Yarra, conducted during 2018 and 2019. Prior speed limit signage of 40km/h was replaced with a new 30km/h speed limit signage scheme during the trial. Speeds were recorded before and the trial and 12-months after the trial, and a representative sample of residents were surveyed on their acceptance of the reduced speed limits and associated issues. A control area was also employed without the change in speed limit to control for any extraneous factors beyond the speed limit change.

9.1 SPEED REDUCTIONS

The reduction in average speed was a modest overall (from 27.6 to 27.3km/h). This was not that surprising, given that the average speed of the traffic both before and after the trial was less than 30km/h. However, when vehicle speeds were examined at various categories above the 30km/h speed limit (40km/h and 50km/h) the reductions were much greater. The percent of speeds above 40km/h fell from 5.4% to 3.9%, and those exceeding 50km/h reduced from 0.4% to 0.3% in the treated area.

One unexpected result of the trial was the speed reductions observed in the control area. This was explained as a carry-over of the effects of the trial, given that the two regions abutted each other and in marketing the trial at the onset, it was possible that the boundaries were not that clearly obvious. Accordingly, it may be that a proportion of people driving in the control area may have believed the new limit was applicable to them, or, there may have been a generalised change in attitude and then behaviour attributed to the broad marketing of lower speed and speed-limits. This had consequences for the study evaluation, however.

To test the impact of this, it was necessary to adjust for these differences in assessing what the overall effect of the treatment was from the installation of the lower 30km/h speed limit in the treatment area. A regression modelling approach was undertaken that adjusted the overall findings.

The subsequent "***Treatment Effect***" results revealed a reduction in the odds of speeding at these higher speeds (40km/h and 50km/h) in the treated area. When adjusted for the observed speed changes in the control region, the findings still showed an 11% reduction in the odds of a speed exceeding 40km/h and a 25% reduction at 50km/h. Moreover, the five highest observed speed sites in the treatment area had also reduced markedly. Thus, the trial was successful in reducing speeds that potentially could have severe injury consequences for Vulnerable Road Users in this treatment area.

The findings of this study are roughly in line with findings from a similar reduced speed trial from 30mph to 20mph in the Sherwood Shire of Nottingham in the UK (2012 to 2014), [(20sPlenty]. Their average speeds reduced from 30mph (48km/h) to 20mph (32km/h) and from a before and after evaluation, they reported a speed reduction from 19.4 mph (31km/h) to 18.7mph (30km/h), a 0.7% reduction in average speeds.

In addition, they noted the higher 85th percentile speed fell from 29mph (46.4km/h) to 23.2mph (37.1km/h), a 25% reduction. Average speeds at the control sites increased marginally by a small 2.3%, although the 85th percentile speed did reduce by 5% (Fildes, Cooke and Berry (2017). Unfortunately, they did not appear to use a control region in their evaluation.

The Nottingham Council noted other potential benefits from lowering the speed limit, including the streets were more cycle and pedestrian friendly, residents had greater ownership of streets and public places, improvements in air quality, improved safety at road junctions, and less traffic noise. They also noted there were minimal benefits in overall journey times, a finding in the City of Yarra trial also found in the survey results.

9.2 POTENTIAL INJURY SAVINGS

Towards Zero is a road safety strategy adopted in the State of Victoria and other Australasian states with a particularly important focus for intervention studies, such as this one, aimed at saving lives and serious injuries for Vulnerable Road Users (TAC 2018). While it was not possible to measure any actual savings in death or serious injuries from such a small trial, it was possible to estimate what likely savings could be expected, given the speed reduction findings.

The analysis of the 30km/h, 40km/h and 50km/h speed reductions were modelled from published risk curves for pedestrian collisions. This led to a benefit estimate of a likely 4% reduction in severe and fatal injuries from the speed reduction findings reported above. While this may sound small, when spread across a much larger region than the trial site adopted here, it does nevertheless, represent a saving to a substantial group of Vulnerable Road Users, a group that appears to be increasing noted by local and international road safety organisations (World Health Organisation 2018; TAC 2018).

This does not include other savings associated with a reduction in speeds, such as crash avoidance. While it was not possible to calculate these additional benefits here, a reduction in speed has been shown to have significant savings in preventing the crash also ((WHO 2004; Corben 2006). Thus, the benefits claimed here would also be expected to have an associated reduction in collisions, thereby increasing the impact benefits estimated here.

9.3 COMMUNITY ATTITUDES

In addition to the speed reductions, on-line surveys were carried out before and after the intervention period on a range of local community attitudes relevant to the trial and VRU safety. Responses increased from 484 residents in the before study to 548 residents in the after study.

Local acceptability of the 30km/h speed limit in the treated area increased from 43.9% to 51.1% (before and after) while in the non-treated area, a similar increase from 40.9% to 49.1% was also observed. Importantly, the proportions of those opposed were less after the trial. The fact that the trend was similar again in the control area adds further weight to the earlier claim of a flow over of the speed reduction effect from the treated to the control areas.

It was also possible to examine who were more positive to the reduced speed limit trial, based on a number of characteristics such as age, gender, living area, household type, length of residential status, language and disability. The only statistical factor here turned out to be their relationship to the area (whether they lived, work in the area and if they owned their home), where people who work in the area were more likely to not support 30km/h speed-limits.

Travel factors such as travelling over short or long trips, using motorised vehicles, and a history of walking or cycling was related to their level of agreement to the lower speed limit. There was also an increase in the residents' appropriateness of a 40km/h speed limit on major roads (arterials and collectors) around the study test area.

The 20sPlenty trial in Nottingham did include a questionnaire survey in the leadup to their trial and asked whether citizens would like to see 20mph speed limits on local or collector roads within the area. At that time, 75% of the respondents replied *no* to this question. Unfortunately, they did not further test their residents after the trial was over. Nevertheless, 20mph (32km/h) was mandated throughout the whole council after the trial (Fildes, Cooke and Berry (2017).

It is important to emphasize that as well as influencing safety, lower speed limits in local streets, can influence the quality of life, the environment, and the local economy. Levels of walking and cycling within the local area would be expected to increase with a lower speed limit.

9.4 LEARNINGS FROM THE STUDY

The 30km/h evaluated trial was the first in Australia and showed the speed reductions in the trial area of significant benefits to people living, working, and/or passing through in improved safety. Without any other treatment than just new signage, potential for safety improvement to residents of this area have been identified in less speeding. Obviously, with additional infrastructure calming measures (curb extensions lane restrictions, speed bumps, intersection platforms, etc) further speed reduction improvements would be expected (Miller 2014).

This study set out to measure the benefits of a low-cost intervention in a local residential area and reasonable safety improvements occurred without any police enforcement program in the area. It would be expected that with police surveillance, the benefits would likely be longer lasting and targeted. The results obtained in this study provide regions where enforcement would be prioritised.

There are always new learnings from studies such as these. Even with careful planning involving experienced partners and participants, unexpected events can occur – this is not uncommon in research studies such as this one. The choice of a control region for this study, adopting traditional selection procedures, turned out to be less than ideal, for reasons not apparent initially.

9.5 CONCLUSION

These findings suggest that with widespread use, 30km/h local speed limits in residential local streets have promise to be a useful intervention for saving lives and serious injuries to Vulnerable Road Users in residential areas.

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11 APPENDIX A: SPEED DATA & SAMPLING

11.1 DATA STATION LOCATIONS AND CODES

Table A1a: Survey sites, Treatment area

Code	Road	Section
CH4T*	Hotham Street	Ballarat Street and Alexander Street
GAL1T	Alexander St	Hotham Street and Alexandra Parade
GB1*	Budd Street	Mater Street and Alexandra Parade
GB2T*	Budd Street	Hotham Street and Mater Street
GB3T*	Budd Street	Easey Street and Keele Street
GB4T*	Budd Street	Johnston Street and Sackville Street
GBA1T	Ballarat Road	Hotham Street ad Alexandra Parade
GBE1T	Bendigo Street	Hotham Street ad Alexandra Parade
GC1	Charlotte Street	Mater Street and Alexandra Parade
GE1*	Easey Street	Gold Street and Hoddle Street
GE2*	Easey Street	Wellington Street and Gold Street
GE3	Easey Street	Smith Street and Budd Street
GE4	Emma Street	Mater Street and Alexandra Parade
GFO1T	Forest Street	Hotham Street and Alexandra Parade
GG1	Gold Street	Keele Street and Hotham Street
GH3	Hotham Street	Blanche Street and Budd Street
GH4*	Hotham Street	Wellington Street and Charlotte Street
GK2	Keele Street	Wellington Street and Gold Street
GK3T	Keele Street	Smith Street and Budd Street
GLA1T	Little Abott Street	Gold Street and Hoddle Street
GM1*	Mater Street	Blanche Street and Budd Street
GM2T*	Mater Street	Smith Street and Emma Street
GM3T	Mater Street	Wellington Street and Charlotte Street
GS1*	Sackville Street	Gold Street and Hoddle Street
GS2*	Sackville Street	Smith Street and Budd Street
GS3*	Sackville Street	Wellington Street and Gold Street
RA1*	Argyle Street	Gore Street and Smith Street
RA4T*	Argyle Street	Brunswick Street and Young Street
RA5T	Argyle Street	Spting Street and Fitzroy Street
RF1*	Fitzroy Street	Rose Street and Kerr Street
RF4T*	Fitzroy Street	Cecil Street and Alexandra Parade
RF5T*	Fitzroy Street	Johnston Street and Argyle Street
RG2T	George Street	Kerr Street and Rose Street
RGO1T*	Gore Street	Rose Street and Leicester Street
RGO2T*	Gore Street	Westgarth Street and Cecil Street
RK2	Kerr Street	Fitzroy Street and Brunswick Street
RK4*	Kerr Street	Naper Street and George Street
RK7T*	Kerr Street	Brunswick Street and Young Street
RL3T	Leicester Street	Nicholson Street and Fitzroy Street
RL5T	Leicester Street	George Street and Gore Street
RN4T*	Napier Street	Kerr Street and Argyle Street
RN5T*	Napier Street	Rose Street and Leciester Street
RR5T*	Rose Street	Naper Street and George Street
RR6T*	Rose Street	Smith Street and Gore Street
RS3T	Spring Street	Johnston Street and Argyle Street
RW1*	Westgarth Street	Gore Street and Smith Street
RW4	Westgarth Street	Nicholson Street and Fitzroy Street
RW5T*	Westgarth Street	Brunswick Street and Young Street
RY1*	Young Street	Cecil Street and Alexandra Parade
RY3T*	Young Street	Kerr Street and Rose Street
** Survey sites pooled with adjacent and non-independent sites in treatment effect model*		

Table A1b: Survey sites, Non-treatment area

Code	Road	Section
CB1	Bedford Street	Perry Street and Johnston Street
CC1	Cambridge Street	Peel Street and Stanley Street
CC2T	Cambridge Street	Victoria Parade and Derby Street
CC5	Cromwell Street	Victoria Parade and Langridge Street
CCT6	Cromwell Street	Langridge Street and Gipps Street
CG2	Gipps Street	Rupert Street and Cromwell Street
CH1T	Harmsworth Street	Vere Street and Perry Street
CL1	Langridge Street	Rupert Street and Cromwell Street
CLTL1	Little Oxford Street	Peel Street and Stanley Street
CM1	Mason Street	West of Oxford Street
CM2	McCuthceon Way	Sturt Street and Cromwell Street
CO1	Otter Street	Bedford Street and Wellington Street
CO2*	Oxford Street	Peel Street and Stanley Street
CO3T*	Oxford Street	Langridge Street and Peel Street
CP2	Perry Street	Bedford Street and Wellington Street
CP3	Perry Street	Dight Street and Campbell Street
CR1	Rokeby Street	Victoria Parade and Langridge Street
CR3	Rupert Street	Victoria Parade and Langridge Street
CS1	Stanley Street	Oxford Street and Cambridge Street
FBEL1T	Bell Street	Nicholson Street and Cremorne Street
FD2T	St David Street	Napier Street and George Street
FF1T*	Fitzroy Street	James Street and Brunswick Place
FF3T	Fitzroy Street	Victoria Parade and Gertrude Street
FF4T*	Fitzroy Street	Moor Street and Bell Street
FG1	George Street	North of Little Victoria Street
FG2	George Street	Moor Street and St David Street
FGO1T	Gore Street	Victoria Parade and Gertrude Street
FGO2T*	Gore Street	Webb Street and Charles Street
FGO3T*	Gore Street	Greeves Street and Johnston Street
FHA1T	Hanover Street	Nicholson Street and Fitzroy Street
FLS1T	Little Smith Street	Gertrude Street and Webb Street
FM1	Moor Street	Napier Street and George Street
FM2T	Moor Street	Nicholson Street and Fitzroy Street
FMAH1T	Mahoney Street	Bell Street and Victoria Street
FN2T	Napier Street	Victoria Parade and Gertrude Street
FPA2T	Palmer Street	Fitzroy Street and Brunswick Street
FRO1T	Royal Lane	Gertrude Street and Palmer Street
FW1	Webb Street	Gore Street and Smith Street
FY1T	Young Street	Victoria Parade and Gertrude Street
FY2T	Young Street	Moor Street and St David Street
GWT3	Islington Street	Victoria Parade and Langridge Street
** Survey sites pooled with adjacent and non-independent sites in treatment effect model*		

11.2 EXCLUDED DATA STATIONS

Some speed data in the treatment analysis had to be removed for reasons of improper positioning of the tubes, implementation of other traffic management inclusions, and imperfections in the data collected. In all, they accounted for around 15%. The list of excluded data stations in Table A1.

Table A2: Speed survey: Excluded data stations

Location (Code)
Gold Street between Mater Street and Alexandra Parade (GG4)
Napier Street between Greeves Street and Chapel Street (FN4T)
George Street between Cecil Street and Alexandra Parade (RG4T)
Wellington Street between Otter Street and Perry Street (GW6T)
Wellington Street between Gipps Street and Stanley Street (CW5)
Rose Street between Brunswick Street and Fitzroy Street (RR1)
Hodgson Street between Gore Street and Smith Street (FHO1T)
Wellington Street between Easey Street and Sackville Street (CL1T)
Wellington Street between Keele Street and Hotham Street (GW1)
Wellington Street between Mater Street and Alexandra Parade (GW2)
Wellington Street between Victoria Parade and Langridge Street (CW4)
Francis Street between Perry Street and Johnson Street (CF1T)
Palmer Street between Perry Street and Johnson Street (CP1T)
Rupert Street between Langridge Street and Gipps Street (CR4T)

11.3 DISTRIBUTION OF SAMPLE

Number of observations in treatment and non-treatment area at baseline and 12-months, by day of week and time of day.

Table A3: Speed: Sample size by group, time-period, and type of day

Group	Type of day	Time-period		
		t_0	t_1	***Sub total***
Treatment	Weekday	192,737 (72.9%)	189,824 (73.4%)	*382,561* (73.1%)
	Weekend	71,825 (27.1%)	68,855 (26.6%)	*140,680* (26.9%)
	Total	*264,562* (100.0%)	*258,679* (100.0%)	*523,241* (100.0%)
Non-treatment	Weekday	285,981 (76.6%)	270,783 (75.9%)	*556,764* (76.3%)
	Weekend	87,188 (23.4%)	86,101 (24.1%)	*173,289* (23.7%)
	Total	373,169 (100.0%)	356,884 (100.0%)	*730,053* (100.0%)

Table A4: Speed: Sample size by group, time-period, and day of week

Group	Day of week	Time-period		
		t_0	t_1	***Sub total***
Treatment	Sunday	28,987 (11.0%)	29,453 (11.4%)	58,440 (11.2%)
	Monday	33,196 (12.5%)	32,698 (12.6%)	65,894 (12.6%)
	Tuesday	39,313 (14.9%)	35,503 (13.7%)	74,816 (14.3%)
	Wednesday	37,791 (14.3%)	38,005 (14.7%)	75,796 (14.5%)
	Thursday	38,904 (14.7%)	40,181 (15.5%)	79,085 (15.1%)
	Friday	43,533 (16.5%)	43,437 (16.8%)	86,970 (16.6%)
	Saturday	42,838 (16.2%)	39,402 (15.2%)	82,240 (15.7%)
	Total	*264,562* (100.0%)	*258,679* (100.0%)	*523,241* (100.0%)
Non-treatment	Sunday	36,678 (9.8%)	37,428 (10.5%)	74,106 (10.2%)
	Monday	51,595 (13.8%)	47,516 (13.3%)	99,111 (13.6%)
	Tuesday	57,110 (15.3%)	52,815 (14.8%)	109,925 (15.1%)
	Wednesday	57,311 (15.4%)	54,507 (15.3%)	111,818 (15.3%)
	Thursday	58,940 (15.8%)	56,795 (15.9%)	115,735 (15.9%)
	Friday	61,025 (16.4%)	59,150 (16.6%)	120,175 (16.5%)
	Saturday	50,510 (13.5%)	48,673 (13.6%)	99,183 (13.6%)
	Total	373,169 (100.0%)	356,884 (100.0%)	*730,053* (100.0%)

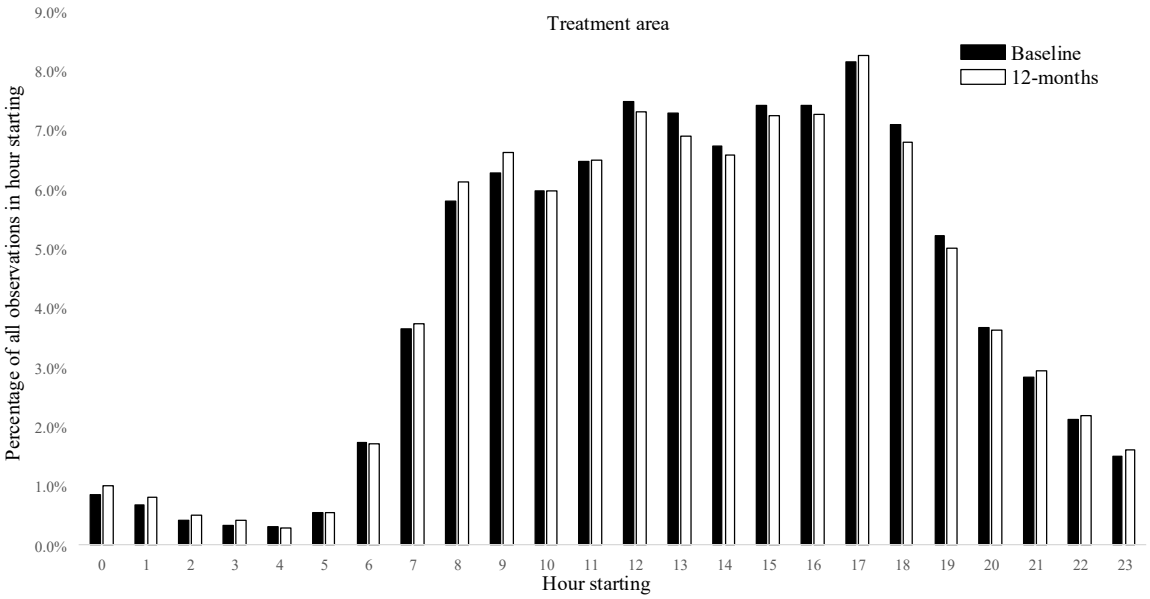


Figure A1: Speed evaluation: Distribution of sample across time of day, treatment area

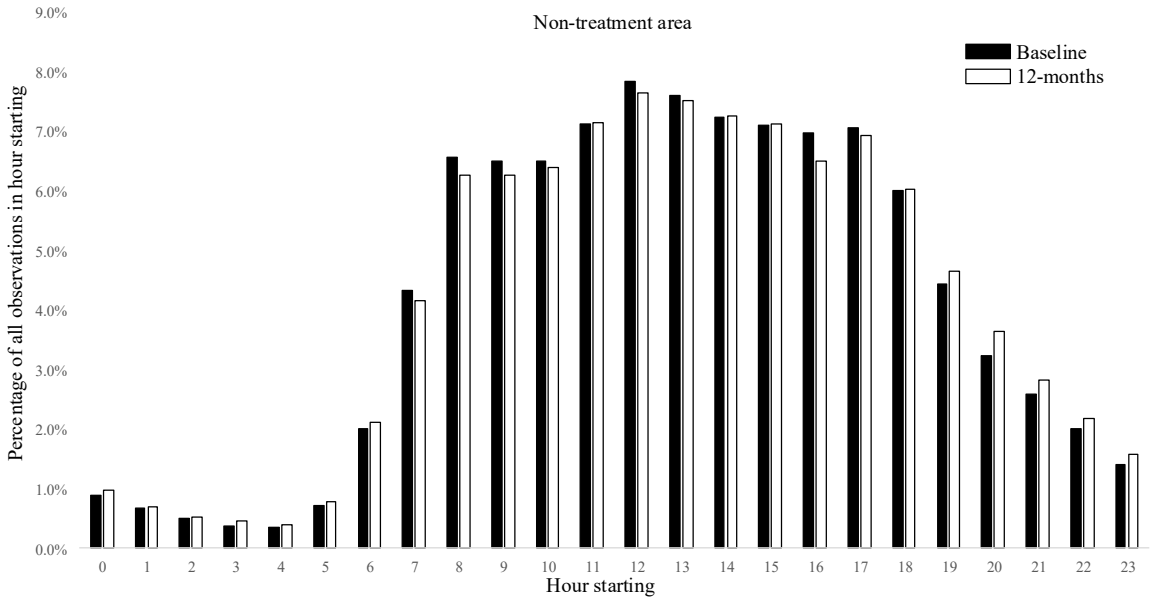


Figure A2: Speed evaluation: Distribution of sample across time of day, non-treatment area

Table A5: Speed: Sample size by group, time-period, and time of day

Group	Time of day	Time-period		
		t_0	t_1	***Sub total***
Treatment	Outside peak	161,378 (61.0%)	157,195 (60.8%)	318,573 (60.9%)
	Morning peak	25,007 (9.5%)	25,536 (9.9%)	50,543 (9.7%)
	Afternoon peak	36,951 (14.0%)	35,745 (13.8%)	72,696 (13.9%)
	Evening peak	41,226 (15.6%)	40,203 (15.5%)	81,429 (15.6%)
	Total	*264,562* (100.0%)	*258,679* (100.0%)	*523,241* (100.0%)
Non-treatment	Outside peak	224,335 (60.1%)	218,895 (61.3%)	443,230 (60.7%)
	Morning peak	40,633 (10.9%)	37,241 (10.4%)	77,874 (10.7%)
	Afternoon peak	55,797 (15.0%)	52,788 (14.8%)	108,585 (14.9%)
	Evening peak	52,404 (14.0%)	47,960 (13.4%)	100,364 (13.7%)
	Total	373,169 (100.0%)	356,884 (100.0%)	*730,053* (100.0%)

11.4 SPEED OBSERVATIONS BY DATA STATION

11.4.1 Median speed and quartiles

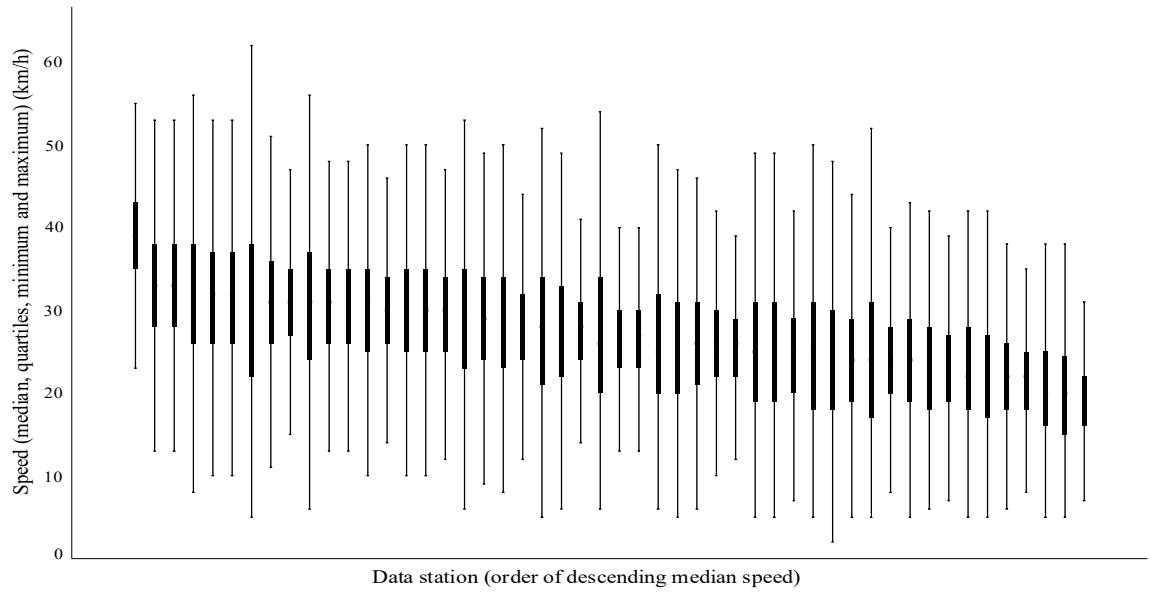


Figure A3: Speed boxplots (median, quartiles) at data stations in treatment area at baseline

11.4.2 Mean speed and standard deviation

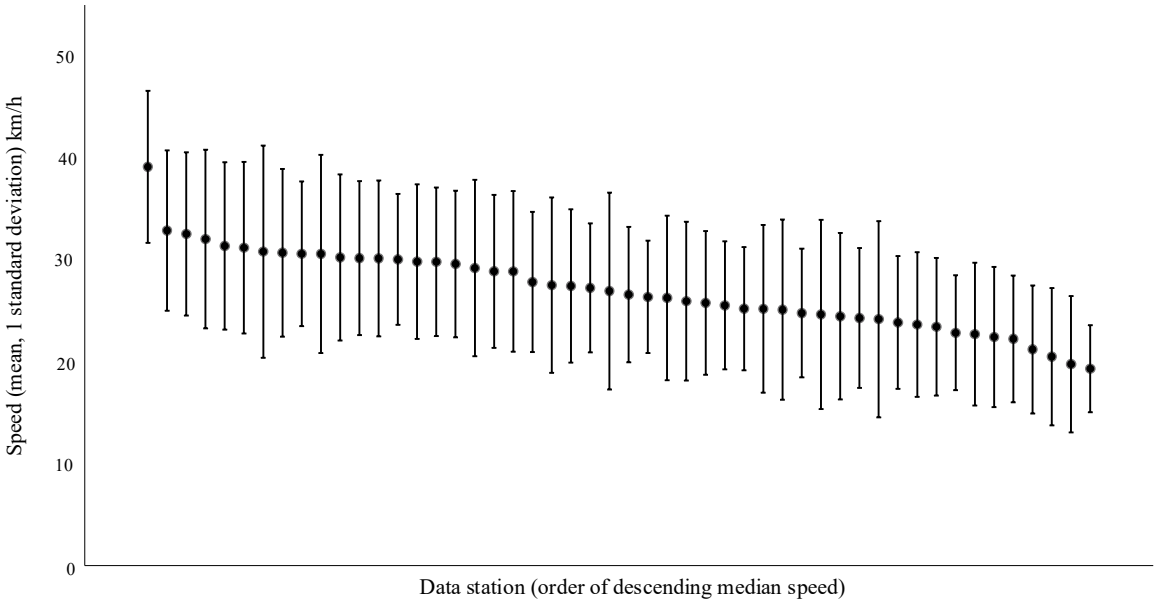


Figure A4: Speed boxplots (mean, standard deviation) at data stations in treatment area at baseline

11.4.3 Percentage of observations exceeding 30km/h

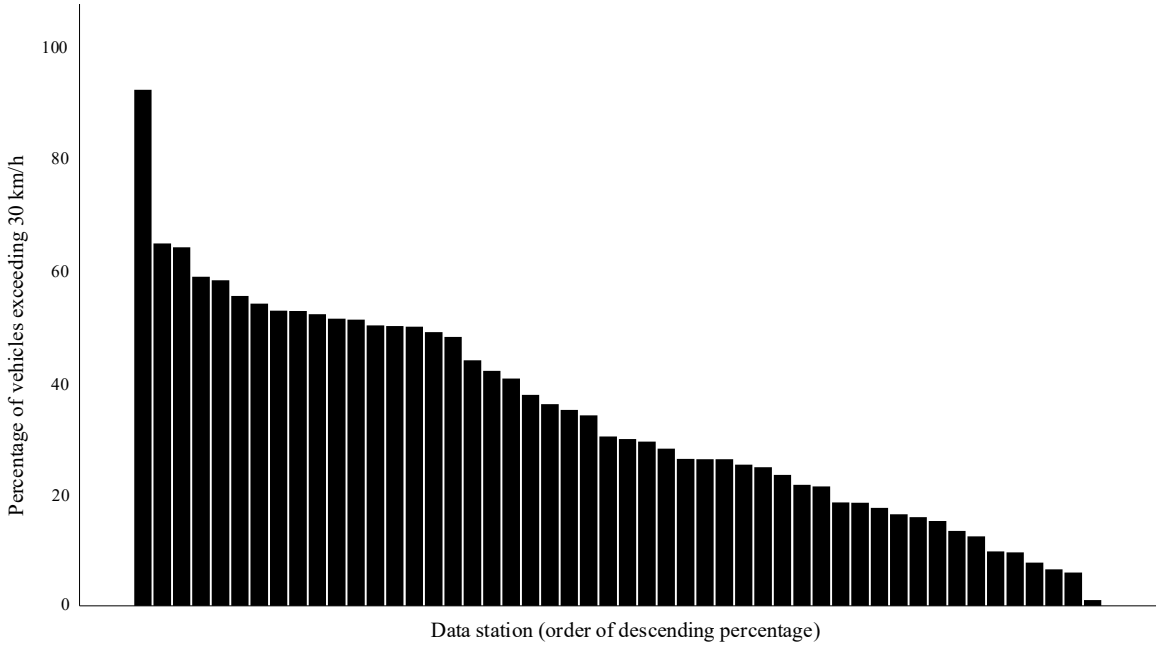


Figure A5: Percentage of vehicles exceeding 30km/h in treatment area at baseline

11.4.4 Percentage of observations exceeding 40km/h

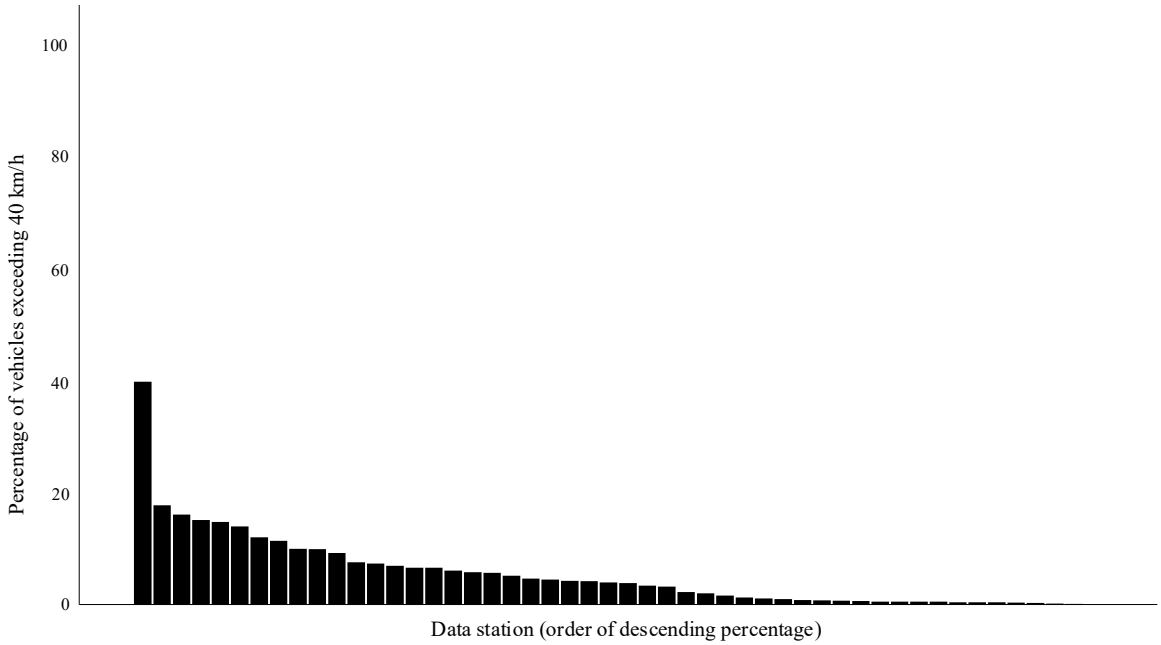
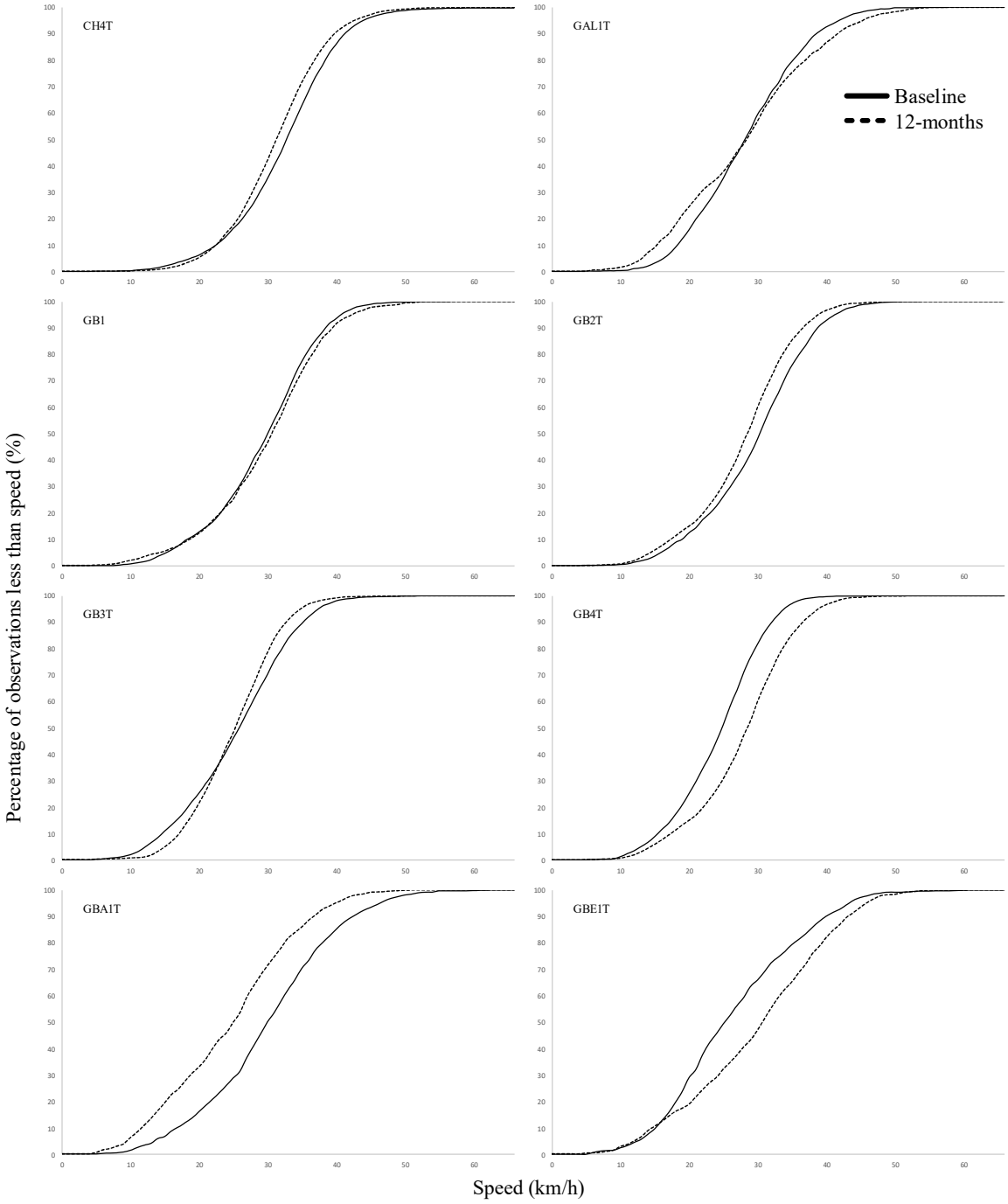
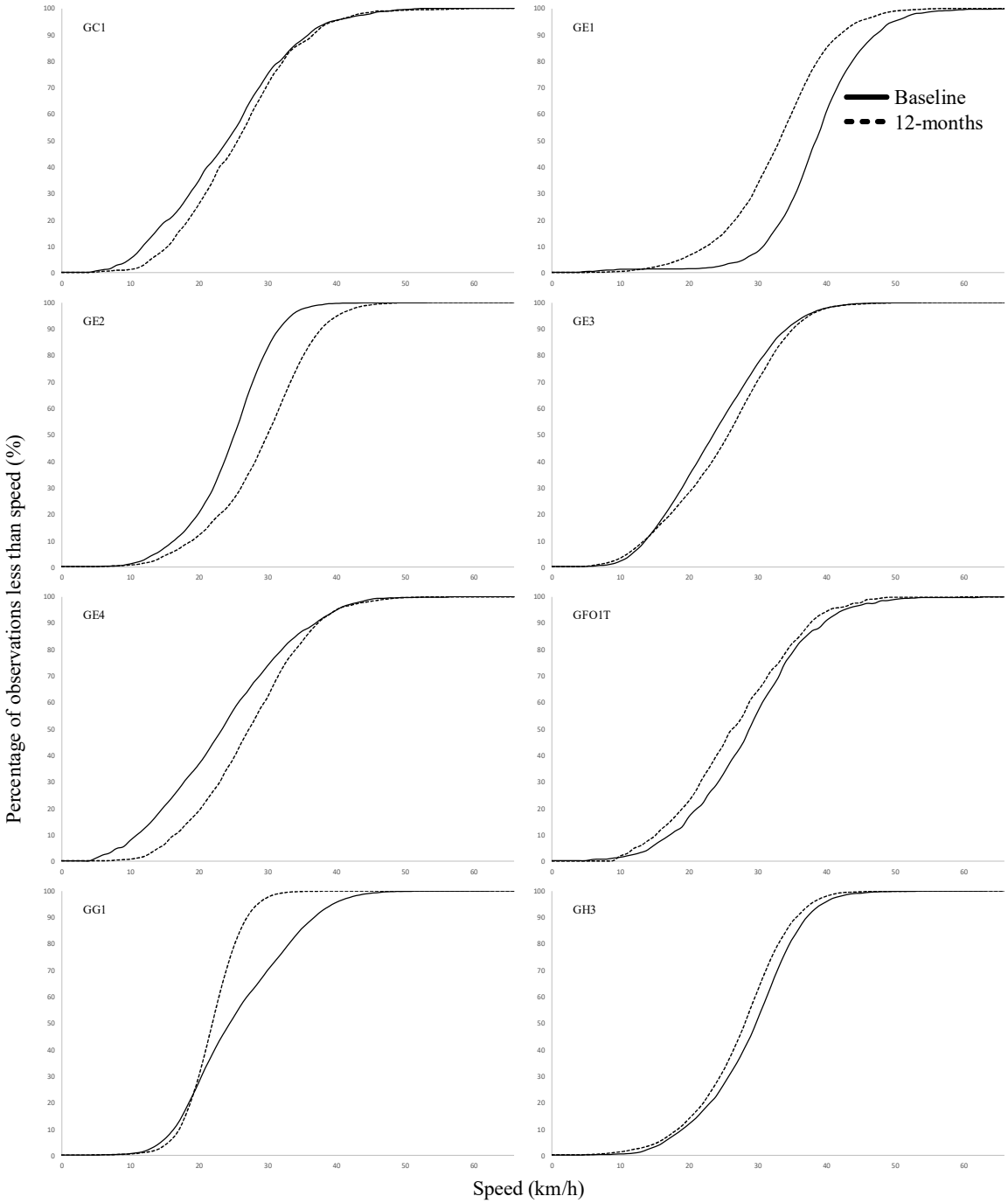
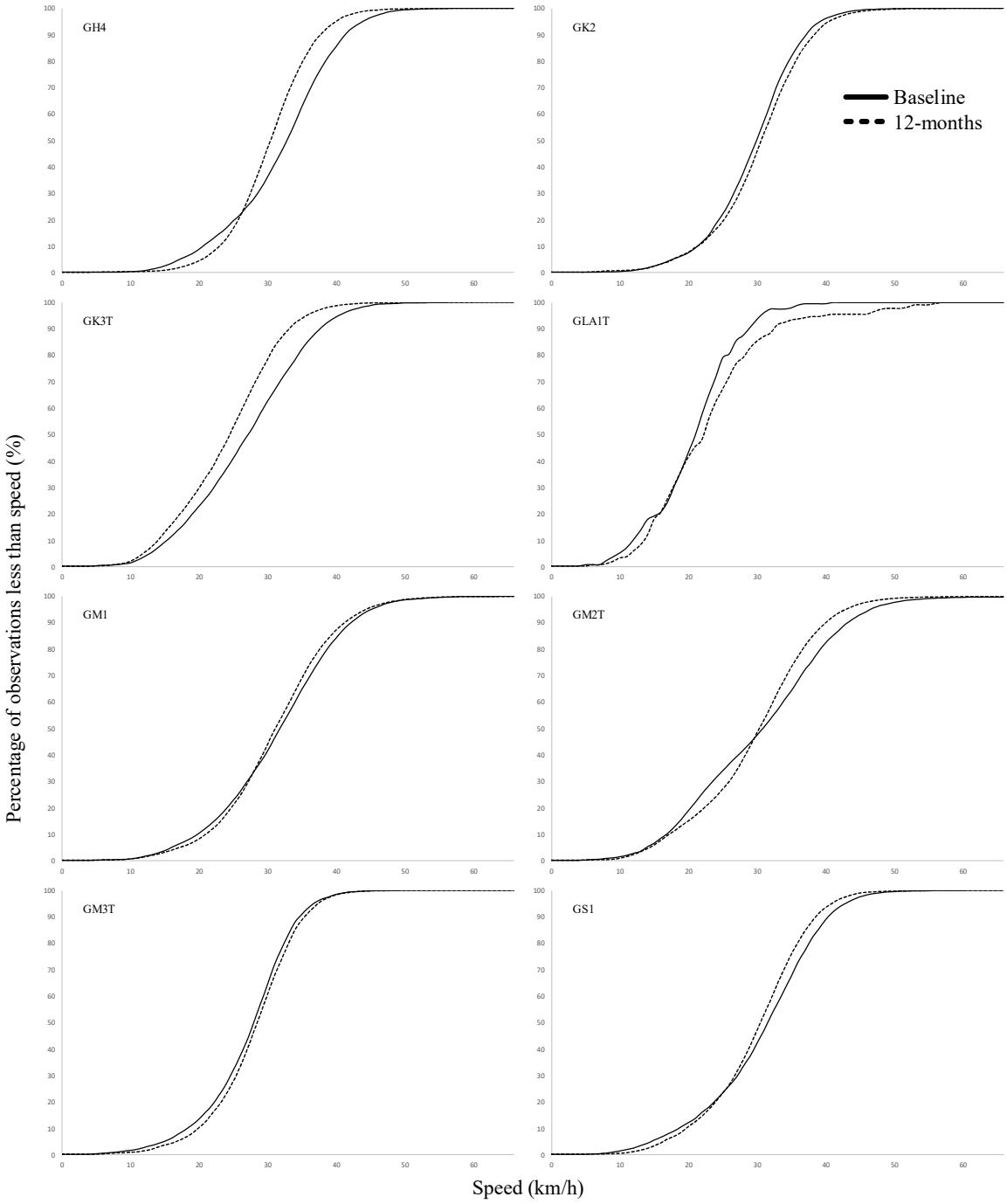


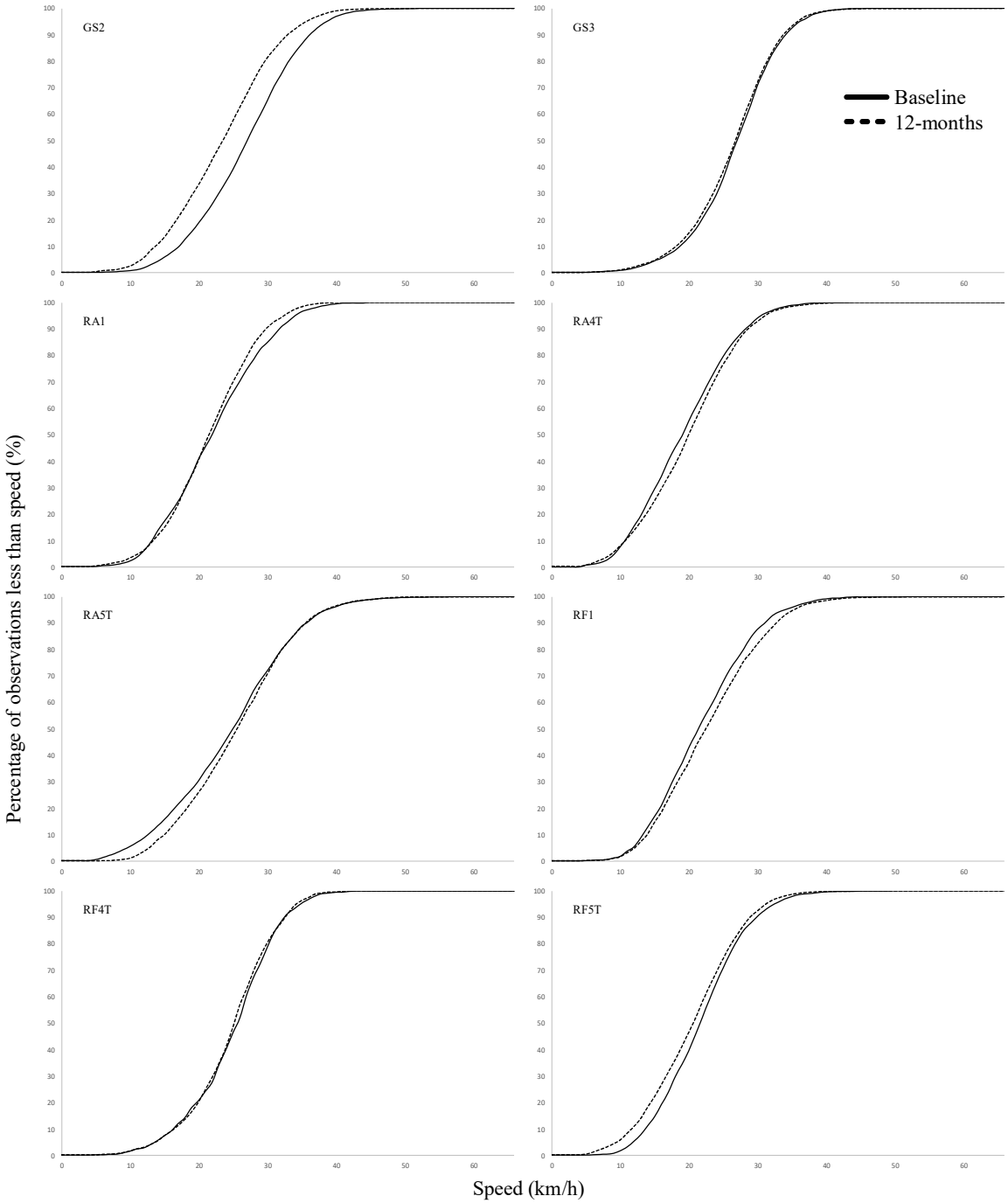
Figure A6: Percentage of vehicles exceeding 40km/h in treatment area at baseline

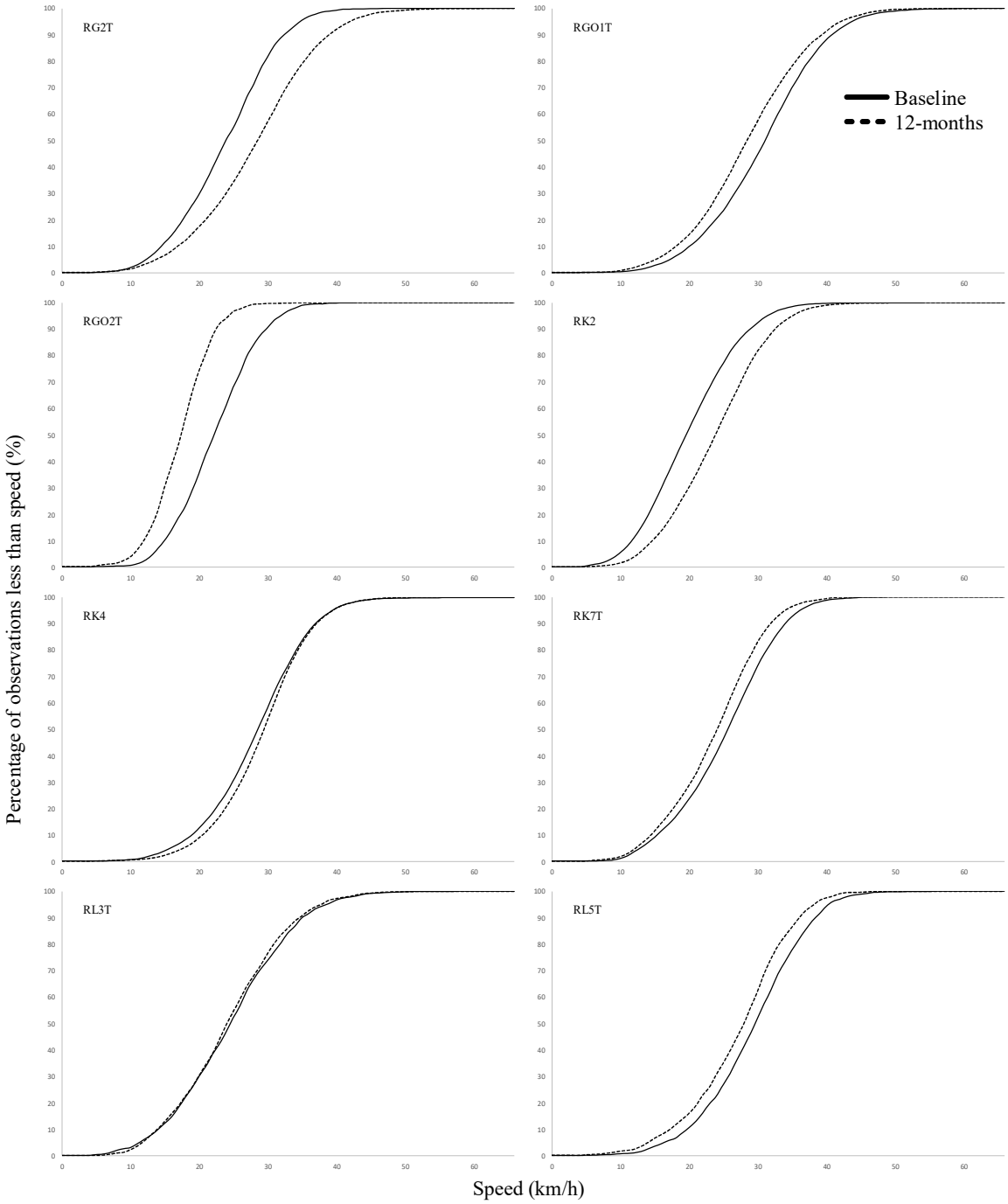
11.4.5 Cumulative percentage of observations less than speed

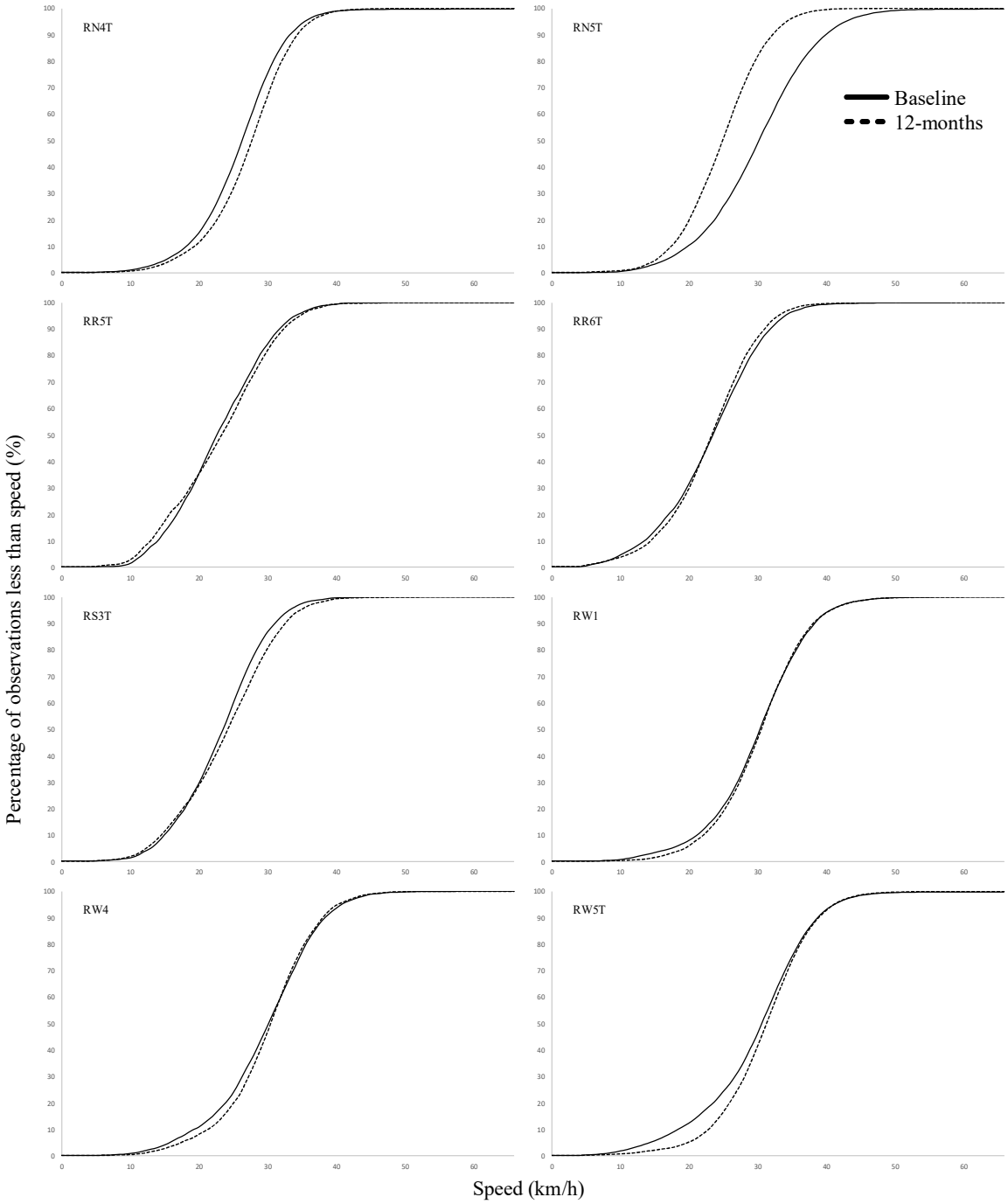


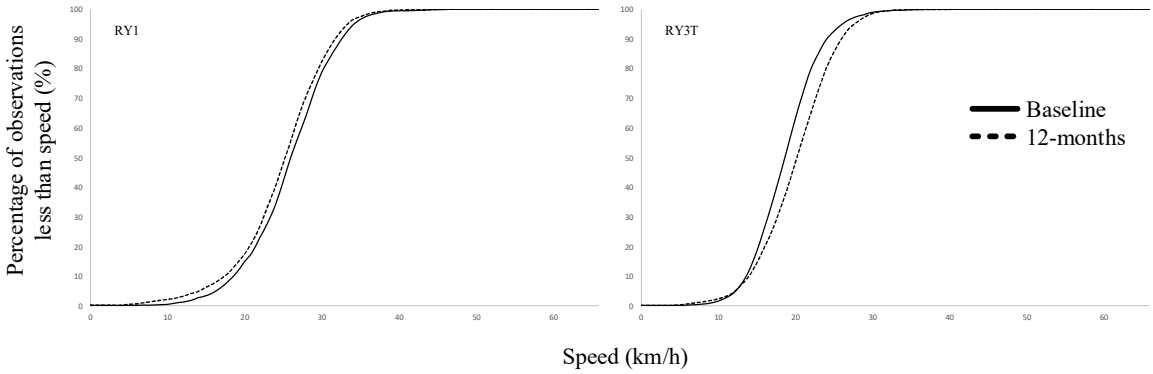

GC1
GE1
GE2
GE3
GE4
GFO1T
GG1
GH3
Baseline
12-months
Percentage of observations less than speed (%)
Speed (km/h)


GH4
GK2
GK3T
GLA1T
GM1
GM2T
GM3T
GS1
Baseline
12-months
Percentage of observations less than speed (%)
Speed (km/h)


GS2
GS3
RA1
RA4T
RA5T
RF1
RF4T
RF5T
Baseline
12-months
Percentage of observations less than speed (%)
Speed (km/h)


RG2T
RGO1T
RGO2T
RK2
RK4
RK7T
RL3T
RL5T
Baseline
12-months
Percentage of observations less than speed (%)
Speed (km/h)


RN4T
RN5T
Baseline
12-months
RR5T
RR6T
RS3T
RW1
RW4
RW5T
Percentage of observations less than speed (%)
Speed (km/h)


Percentage of observations less than speed (%)
RY1
RY3T
Baseline
12-months
Speed (km/h)

12 APPENDIX B: COMMUNITY ATTITUDE SURVEY

12.1 DEMOGRAPHIC AND HOUSEHOLD INFORMATION

The personal characteristics of those who responded to the community survey are provided from Table to Table .

Table B1: Attitude survey: Age, community survey

Condition	Age (years)		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
16 to 24 years	7 (2.4%)	5 (1.5%)	*12* (1.9%)
25 to 34 years	87 (30.0%)	89 (27.1%)	*176* (28.5%)
35 to 49 years	108 (37.2%)	130 (39.6%)	*238* (38.5%)
50 to 59 years	53 (18.3%)	49 (14.9%)	*102* (16.5%)
60 to 69 years	24 (8.3%)	40 (12.2%)	*64* (10.4%)
70 to 79 years	8 (2.8%)	15 (4.6%)	*23* (3.7%)
80 years+	3 (1.0%)	0 (0.0%)	*3* (0.5%)
Total	*290 (100.0%)*	*328 (100.0%)*	*618 (100.0%)*
Non-treatment area			
16 to 24 years	6 (3.1%)	8 (3.6%)	*14* (3.4%)
25 to 34 years	61 (31.4%)	60 (27.3%)	*121* (29.2%)
35 to 49 years	56 (28.9%)	76 (34.5%)	*132* (31.9%)
50 to 59 years	32 (16.5%)	41 (18.6%)	*73* (17.6%)
60 to 69 years	29 (14.9%)	19 (8.6%)	*48* (11.6%)
70 to 79 years	9 (4.6%)	14 (6.4%)	*23* (5.6%)
80 years+	1 (0.5%)	2 (0.9%)	*3* (0.7%)
Total	*194 (100.0%)*	*220 (100.0%)*	*414 (100.0%)*
N= 1,032 (100.0%)			

Table B2: Attitude survey: Gender

Condition	Gender		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
Female	128 (44.1%)	147 (44.8%)	*275* (44.5%)
Male	147 (50.7%)	170 (51.8%)	*317* (51.3%)
Prefer not to say	14 (4.8%)	11 (3.4%)	*25* (4.0%)
Other	1 (0.3%)	0 (0.0%)	*1* (0.2%)
Total	*290 (100.0%)*	*328 (100.0%)*	*618 (100.0%)*
Non-treatment area			
Female	80 (41.2%)	85 (38.6%)	*165* (39.9%)
Male	111 (57.2%)	125 (56.8%)	*236* (57.0%)
Prefer not to say	3 (1.5%)	7 (3.2%)	*10* (2.4%)
Other	0 (0.0%)	3 (1.4%)	*3* (0.7%)
Total	*194 (100.0%)*	*220 (100.0%)*	*414 (100.0%)*
N= 1,032 (100.0%)			

Table B3: Attitude survey: Relationship to location

Condition	Relationship to location		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
Live	232 (80.0%)	272 (82.9%)	*504* (81.6%)
Work	31 (10.7%)	23 (7.0%)	*54* (8.7%)
Own property	27 (9.3%)	33 (10.1%)	*60* (9.7%)
Total	*290 (100.0%)*	*328 (100.0%)*	*618 (100.0%)*
Non-treatment area			
Live	149 (76.8%)	185 (84.1%)	*334* (80.7%)
Work	29 (14.9%)	18 (8.2%)	*47* (11.4%)
Own property	16 (8.2%)	17 (7.7%)	*33* (8.0%)
Total	*194 (100.0%)*	*220 (100.0%)*	*414 (100.0%)*
N= 1,032 (100.0%)			

Table B4: Attitude survey: Street type at location

Condition	Street type in location		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
Neighbourhood street	256 (88.3%)	303 (92.4%)	*559* (90.5%)
Main road	15 (5.2%)	12 (3.7%)	*27* (4.4%)
Shopping strip road	19 (6.6%)	13 (4.0%)	*32* (5.2%)
Total	*290 (100.0%)*	*328 (100.0%)*	*618 (100.0%)*
Non-treatment area			
Neighbourhood street	155 (79.9%)	174 (79.1%)	*329* (79.5%)
Main road	17 (8.8%)	22 (10.0%)	*39* (9.4%)
Shopping strip road	22 (11.3%)	24 (10.9%)	*46* (11.1%)
Total	*194 (100.0%)*	*220 (100.0%)*	*414 (100.0%)*
N= 1,032 (100.0%)			

Table B5: Attitude survey: Duration lived in location

Condition	Duration lived in location (years)		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
Less than a year	22 (9.5%)	23 (8.5%)	*45* (8.9%)
1 to 5 years	102 (44.0%)	121 (44.5%)	*223* (44.2%)
6 to 10 years	38 (16.4%)	37 (13.6%)	*75* (14.9%)
More than 10 years	70 (30.2%)	91 (33.5%)	*161* (31.9%)
Total	*232* (100.0%)	*272* (100.0%)	*504* (100.0%)
Non-treatment area			
Less than a year	16 (10.7%)	23 (12.4%)	*39* (11.7%)
1 to 5 years	59 (39.6%)	80 (43.2%)	*139* (41.6%)
6 to 10 years	31 (20.8%)	23 (12.4%)	*54* (16.2%)
More than 10 years	43 (28.9%)	59 (31.9%)	*102* (30.5%)
Total	*149* (100.0%)	*185* (100.0%)	*334* (100.0%)
N= 838 (81.2%)			

Table B6: Attitude survey: Structure of household

Condition	Structure of household		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
Single person	49 (21.2%)	56 (20.7%)	*105* (20.9%)
Couple without children	97 (42.0%)	115 (42.4%)	*212* (42.2%)
Family (youngest 0-7-year-old)	33 (14.3%)	36 (13.3%)	*69* (13.7%)
Family (youngest 0-7-year-old)	13 (5.6%)	10 (3.7%)	*23* (4.6%)
Family (adult children)	8 (3.5%)	15 (5.5%)	*23* (4.6%)
Group	31 (13.4%)	39 (14.4%)	*70* (13.9%)
Total	*231 (100.0%)*	*271 (100.0%)*	*502 (100.0%)*
Non-treatment area			
Single person	48 (32.4%)	49 (26.9%)	*97* (29.4%)
Couple without children	51 (34.5%)	71 (39.0%)	*122* (37.0%)
Family (youngest 0-7-year-old)	12 (8.1%)	21 (11.5%)	*33* (10.0%)
Family (youngest 0-7-year-old)	11 (7.4%)	10 (5.5%)	*21* (6.4%)
Family (adult children)	7 (4.7%)	6 (3.3%)	*13* (3.9%)
Group	19 (12.8%)	25 (13.7%)	*44* (13.3%)
Total	*148 (100.0%)*	*182 (100.0%)*	*330 (100.0%)*
N= 832 (80.6%)			

Table B7: Attitude survey: Dwelling type

Condition	Dwelling type		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
Flat, unit, or apartment	92 (39.7%)	117 (43.3%)	*209* (41.6%)
Semi-detached row or terrace	90 (38.8%)	100 (37.0%)	*190* (37.8%)
Separate house	44 (19.0%)	51 (18.9%)	*95* (18.9%)
Other	6 (2.6%)	2 (0.7%)	*8* (1.6%)
Total	*232 (100.0%)*	*270 (100.0%)*	*502 (100.0%)*
Non-treatment area			
Flat, unit, or apartment	91 (61.5%)	107 (58.5%)	*198* (59.8%)
Semi-detached row or terrace	49 (33.1%)	51 (27.9%)	*100* (30.2%)
Separate house	8 (5.4%)	21 (11.5%)	*29* (8.8%)
Other	0 (0.0%)	4 (2.2%)	*4* (1.2%)
Total	*148 (100.0%)*	*183 (100.0%)*	*331 (100.0%)*
N= 833 (80.7%)			

Table B8: Attitude survey: Housing situation

Condition	Housing situation		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
Private rental	80 (34.8%)	103 (38.0%)	*183* (36.5%)
Renting social or public housing	5 (2.2%)	1 (0.4%)	*6* (1.2%)
Mortgage (paying off home)	75 (32.6%)	82 (30.3%)	*157* (31.3%)
Own home	70 (30.4%)	85 (31.4%)	*155* (30.9%)
Total	*230 (100.0%)*	*271 (100.0%)*	*501 (100.0%)*
Non-treatment area			
Private rental	66 (44.6%)	78 (42.6%)	*144* (43.5%)
Renting social or public housing	10 (6.8%)	13 (7.1%)	*23* (6.9%)
Mortgage (paying off home)	27 (18.2%)	39 (21.3%)	*66* (19.9%)
Own home	45 (30.4%)	53 (29.0%)	*98* (29.6%)
Total	*148 (100.0%)*	*183 (100.0%)*	*331 (100.0%)*
N= 832 (80.6%)			

Table B9: Attitude survey: Language other than English spoken in the household

Condition	Language in addition to English		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
No	201 (87.0%)	245 (90.1%)	*446* (88.7%)
Yes	3 (13.0%)	27 (9.9%)	*57* (11.3%)
Total	*231 (100.0%)*	*272 (100.0%)*	*503 (100.0%)*
Non-treatment area			
No	131 (87.9%)	150 (81.5%)	*281* (84.4%)
Yes	178 (12.1%)	34 (18.5%)	*52* (15.6%)
Total	*149 (100.0%)*	*184 (100.0%)*	*333 (100.0%)*
N= 836 (81.0%)			

Table B10: Attitude survey: Person in household identify as having disability

Condition	Identify as having disability		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
No	216 (93.5%)	256 (94.8%)	*472* (94.2%)
Yes	8 (3.5%)	8 (3.0%)	*16* (3.2%)
Prefer not to say	7 (3.0%)	6 (2.2%)	*13* (2.6%)
Total	*231 (100.0%)*	*270 (100.0%)*	*501 (100.0%)*
Non-treatment area			
No	134 (90.5%)	166 (90.2%)	*300* (90.4%)
Yes	10 (6.8%)	13 (7.1%)	*23* (6.9%)
Prefer not to say	4 (2.7%)	5 (2.7%)	*9* (2.7%)
Total	*148 (100.0%)*	*184 (100.0%)*	*332 (100.0%)*
N= 833 (80.7%)			

Table B11: Attitude survey: Duration worked in location

Condition	Duration worked in location (years)		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
Less than a year	0 (0.0%)	1 (4.3%)	*1* (1.9%)
1 to 5 years	17 (54.8%)	8 (34.8%)	*25* (46.3%)
6 to 10 years	10 (32.3%)	7 (30.4%)	*17* (31.5%)
More than 10 years	4 (12.9%)	7 (30.4%)	*11* (20.4%)
Total	*31* (100.0%)	*23* (100.0%)	*54* (100.0%)
Non-treatment area			
Less than a year	3 (10.3%)	1 (5.6%)	*4* (8.5%)
1 to 5 years	10 (34.5%)	7 (38.9%)	*17* (36.2%)
6 to 10 years	6 (20.7%)	3 (16.7%)	*9* (19.1%)
More than 10 years	10 (34.5%)	7 (38.9%)	*17* (36.2%)
Total	*29* (100.0%)	*18* (100.0%)	*47* (100.0%)
N= 101 (9.8%)			

Table B12: Attitude survey: Duration owned in location

Condition	Duration owned in location (years)		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
Less than a year	3 (11.1%)	5 (15.2%)	*8* (13.3%)
1 to 5 years	9 (33.3%)	9 (27.3%)	*18* (30.0%)
6 to 10 years	7 (25.9%)	8 (24.2%)	*15* (25.0%)
More than 10 years	8 (29.6%)	11 (33.3%)	*19* (31.7%)
Total	*27* (100.0%)	*33* (100.0%)	*60* (100.0%)
Non-treatment area			
Less than a year	1 (6.3%)	2 (11.8%)	*3* (9.1%)
1 to 5 years	6 (37.5%)	6 (35.3%)	*12* (36.4%)
6 to 10 years	1 (6.3%)	4 (23.5%)	*5* (15.2%)
More than 10 years	8 (50.0%)	5 (29.4%)	*13* (39.4%)
Total	*16* (100.0%)	*17* (100.0%)	*33* (100.0%)
N= 93 (9.0%)			

12.2 TRAVEL CHARACTERISTICS

The travel characteristics of those who responded to the community survey are provided from Table to Table .

Table B13: Attitude survey: Travel method, short trips

Condition	Travel method for short trips		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
Walking	216 (74.5%)	255 (77.7%)	*471* (76.2%)
Cycling	30 (10.3%)	23 (7.0%)	*53* (8.6%)
Car	27 (9.3%)	39 (11.9%)	*66* (10.7%)
Public transport	13 (4.5%)	9 (2.7%)	*22* (3.6%)
Motorbike	1 (0.3%)	1 (0.3%)	*2* (0.3%)
Other	3 (1.0%)	1 (0.3%)	*4* (0.6%)
Total	*290 (100.0%)*	*328 (100.0%)*	*618 (100.0%)*
Non-treatment area			
Walking	159 (82.0%)	164 (74.5%)	*323* (78.0%)
Cycling	14 (7.2%)	15 (6.8%)	*29* (7.0%)
Car	13 (6.7%)	22 (10.0%)	*35* (8.5%)
Public transport	7 (3.6%)	16 (7.3%)	*23* (5.6%)
Motorbike	0 (0.0%)	3 (1.4%)	*3* (0.7%)
Other	1 (0.5%)	0 (0.0%)	*1* (0.2%)
Total	*194 (100.0%)*	*220 (100.0%)*	*414 (100.0%)*
N= 1,032 (100.0%)			

Table B14: Attitude survey: Travel method, long trips

Condition	Travel method for long trips		
	Baseline (t_0)	12-month (t_1)	*Sub-total*
Treatment area			
Walking	12 (4.1%)	13 (4.0%)	*25* (4.0%)
Cycling	45 (15.5%)	43 (13.1%)	*88* (14.2%)
Car	159 (54.8%)	181 (55.2%)	*340* (55.0%)
Public transport	70 (24.1%)	81 (24.7%)	*151* (24.4%)
Motorbike	4 (1.4%)	6 (1.8%)	*10* (1.6%)
Other	0 (0.0%)	4 (1.2%)	*4* (0.6%)
Total	*290 (100.0%)*	*328 (100.0%)*	*618 (100.0%)*
Non-treatment area			

Walking	13 (6.7%)	17 (7.7%)	*30* (7.2%)
Cycling	25 (12.9%)	23 (10.5%)	*48* (11.6%)
Car	101 (52.1%)	114 (51.8%)	*215* (51.9%)
Public transport	51 (26.3%)	63 (28.6%)	*114* (27.5%)
Motorbike	4 (2.1%)	3 (1.4%)	*7* (1.7%)
Other	0 (0.0%)	0 (0.0%)	*0* (0.0%)
Total	*194 (100.0%)*	*220 (100.0%)*	*414 (100.0%)*
N= 1,032 (100.0%)			

Table B15: Attitude survey: Distance travelled by car or motorbike per week

Condition	**Distance travelled (km)**		
	Baseline (t_0)	**12-month (t_1)**	***Sub-total***
Treatment area			
Up to 20 km	74 (29.6%)	95 (32.9%)	*169* (31.4%)
21 to 50 km	64 (25.6%)	77 (26.6%)	*141* (26.2%)
51 to 100 km	56 (22.4%)	50 (17.3%)	*106* (19.7%)
101 to 200 km	32 (12.8%)	35 (12.1%)	*67* (12.4%)
More than 200 km	24 (9.6%)	32 (11.1%)	*56* (10.4%)
Total	*250 (100.0%)*	*289 (100.0%)*	*539 (100.0%)*
Non-treatment area			
Up to 20 km	42 (27.5%)	57 (31.3%)	*99* (29.6%)
21 to 50 km	48 (31.4%)	45 (24.7%)	*93* (27.8%)
51 to 100 km	28 (18.3%)	38 (20.9%)	*66* (19.7%)
101 to 200 km	22 (14.4%)	20 (11.0%)	*42* (12.5%)
More than 200 km	13 (8.5%)	22 (12.1%)	*35* (10.4%)
Total	*153 (100.0%)*	*182 (100.0%)*	*335 (100.0%)*
N= 874 (84.7%)			

Table B16: Attitude survey: Walk more than 10 minutes each day

Condition	**Walk more than 10 minutes each day**		
	Baseline (t_0)	**12-month (t_1)**	***Sub-total***
Treatment area			
No	25 (8.7%)	25 (7.6%)	*50* (8.1%)
Yes	262 (91.0%)	302 (92.1%)	*564* (91.6%)
Do not know	1 (0.3%)	1 (0.3%)	*2* (0.3%)
Total	*288 (100.0%)*	*328 (100.0%)*	*616 (100.0%)*
Non-treatment area			
No	16 (8.3%)	20 (9.1%)	*36* (8.7%)
Yes	175 (90.7%)	199 (90.5%)	*374* (90.6%)
Do not know	2 (1.0%)	1 (0.5%)	*3* (0.7%)
Total	*193 (100.0%)*	*220 (100.0%)*	*413 (100.0%)*
N= 1,029 (99.7%)			

Table B17: Attitude survey: Cycle at least once most weeks

Condition	**Cycle at least once most weeks**		
	Baseline (t_0)	**12-month (t_1)**	***Sub-total***
Treatment area			
No	131 (53.9%)	169 (60.6%)	*300* (57.5%)
Yes	112 (46.1%)	108 (38.7%)	*220* (42.1%)
Do not know	0 (0.0%)	2 (0.7%)	*2* (0.4%)
Total	*243 (100.0%)*	*279 (100.0%)*	*522 (100.0%)*
Non-treatment area			
No	94 (61.8%)	125 (68.3%)	*219* (65.4%)
Yes	56 (36.8%)	57 (31.1%)	*113* (33.7%)
Do not know	2 (1.3%)	1 (0.5%)	*3* (0.9%)
Total	*152 (100.0%)*	*183 (100.0%)*	*335 (100.0%)*
N= 857 (83.0%)			

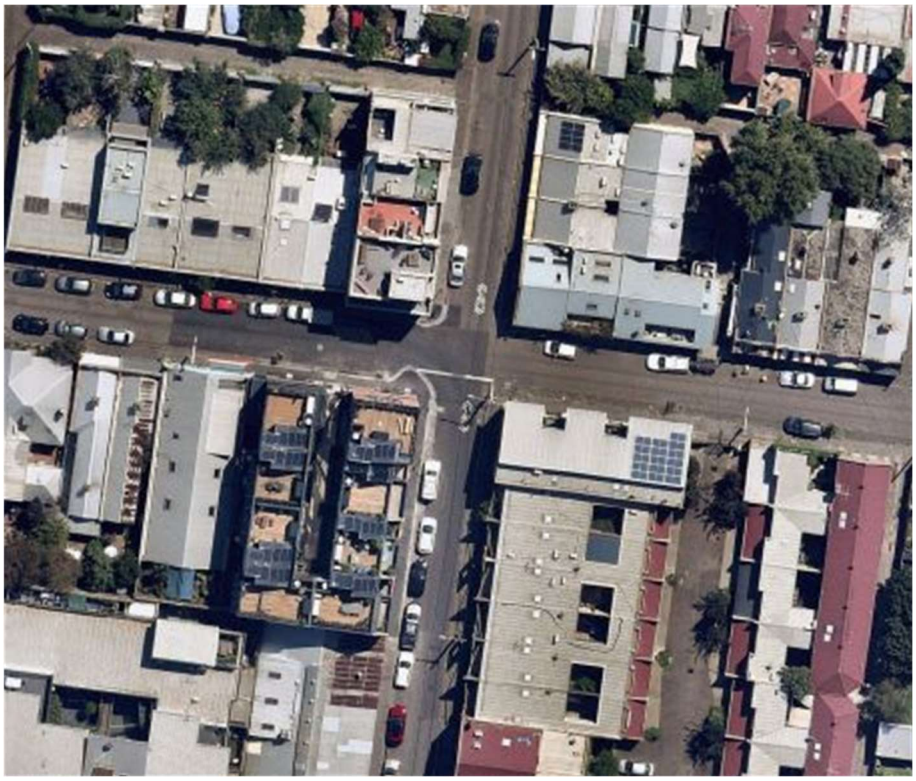
Table B18: Attitude survey: Children walk or cycle to school most days

Condition	Children walk or cycle to school most days		
	Baseline (t_0)	**12-month (t_1)**	***Sub-total***
Treatment area			
No	131 (53.9%)	169 (60.6%)	*300* (57.5%)
Yes	112 (46.1%)	108 (38.7%)	*220* (42.1%)
Do not know	0 (0.0%)	2 (0.7%)	*2* (0.4%)
Total	*243 (100.0%)*	*279 (100.0%)*	*522 (100.0%)*
Non-treatment area			
No	94 (61.8%)	125 (68.3%)	*219* (65.4%)
Yes	56 (36.8%)	57 (31.1%)	*113* (33.7%)
Do not know	2 (1.3%)	1 (0.5%)	*3* (0.9%)
Total	*152 (100.0%)*	*183 (100.0%)*	*335 (100.0%)*
N= 857 (83.0%)			

13 APPENDIX C: SITE DIAGRAMS

The discussion in Section 5.7 on Stratification by road type classified roads in the trial area in 4-groups. These are illustrated below*.

13.1 ONE WAY STREETS – PART OF ROSE ST, ARGYLE ST, LEICESTER ST, CECIL ST



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*The authors are grateful for the provision of the site diagrams by the Dept. Transport in Victoria.

13.2 LOW VOLUME TWO-WAY STREETS

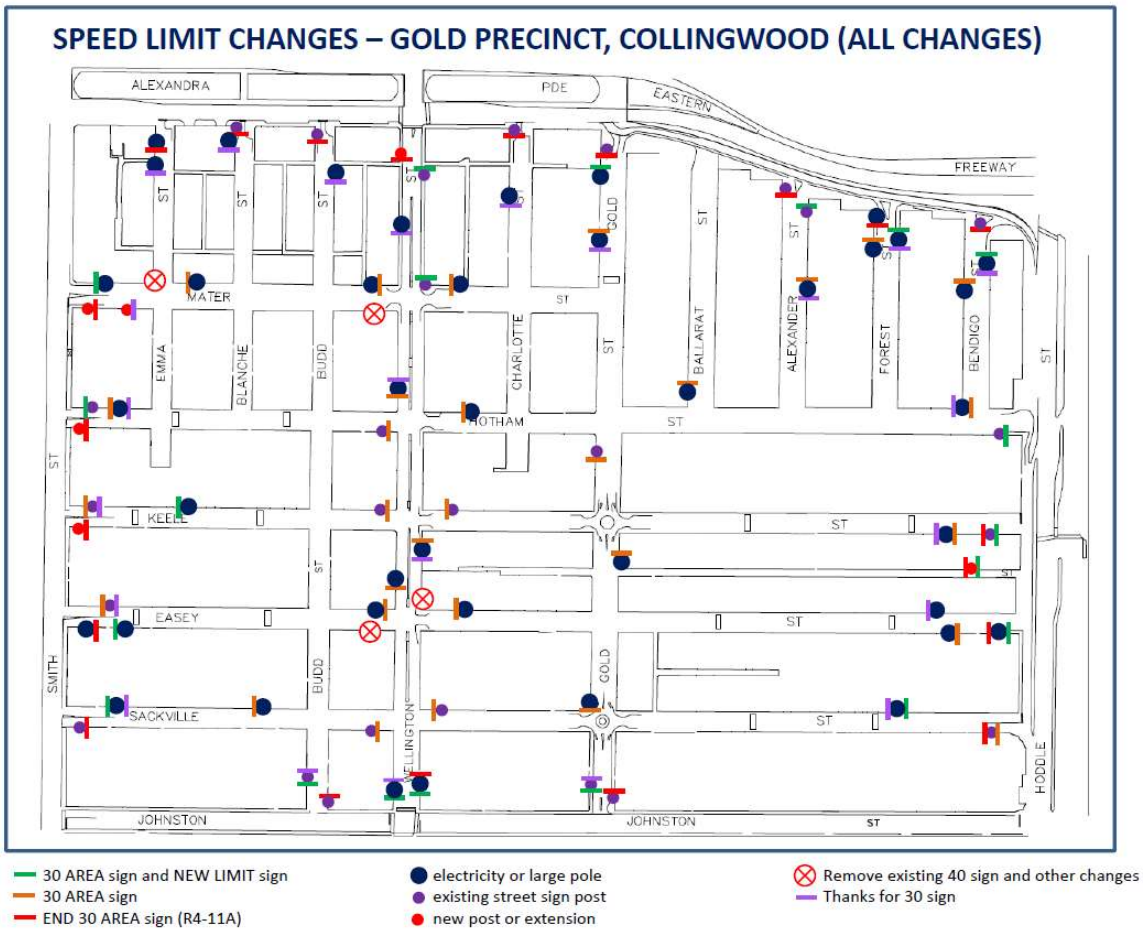
Lower volume Two lane/two-way streets (not necessarily marked with a centre line but of width that allows cars to pass each other without pulling over) – Mater St, Kerr St, most of the roads in the trial area. Lots of LATM

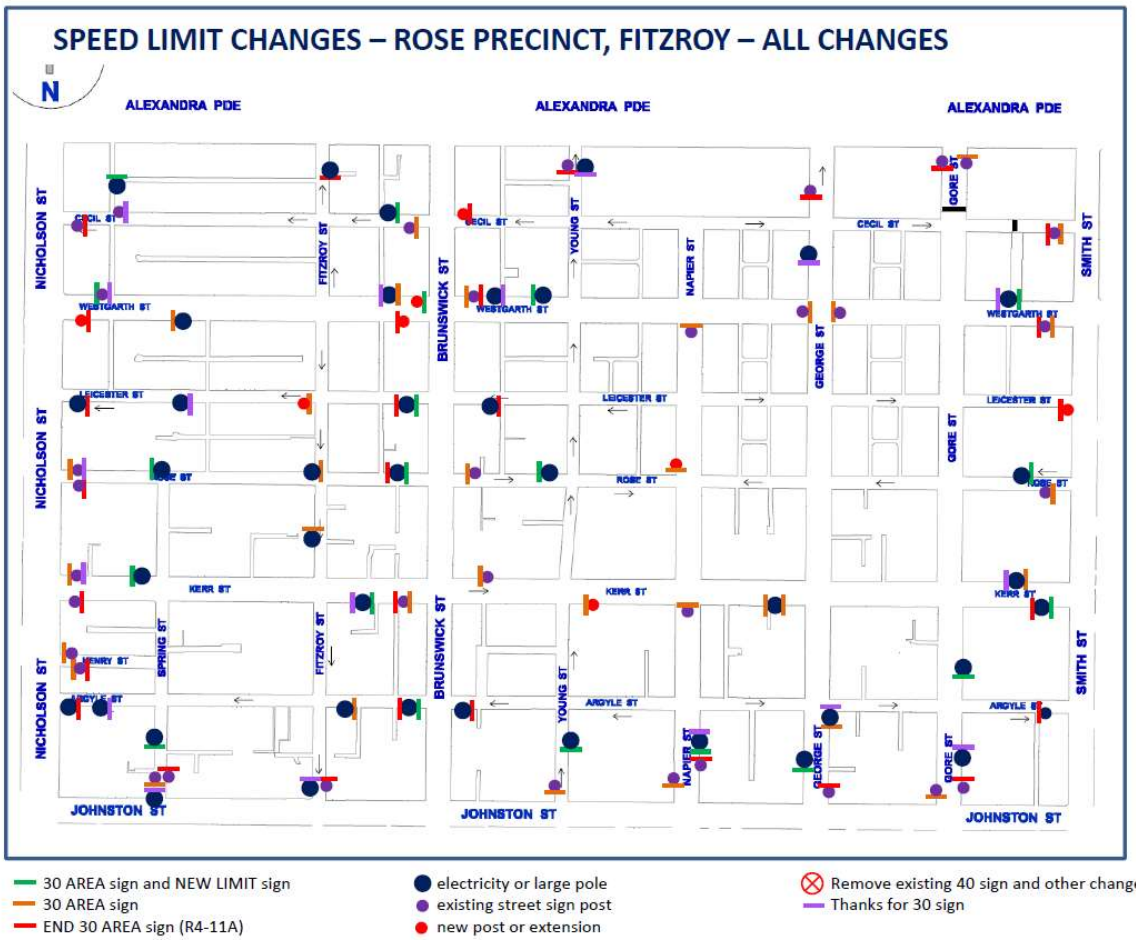
13.3 ONE LANE/TWO WAY (BECAUSE OF PARKING) – VERE ST, PERRY ST, PARTS OF NAPIER ST, PART OF ROSE ST

13.4 HIGHER VOLUME TWO LANE TWO WAY WITH LIMITED LOCAL AREA TRAFFIC MANAGEMENT

14 APPENDIX D: SIGNAGE

14.1 SIGNAGE SCHEME




SPEED LIMIT CHANGES – ROSE PRECINCT, FITZROY – ALL CHANGES
N
ALEXANDRA PDE
ALEXANDRA PDE
ALEXANDRA PDE
NICHOLSON ST
NICHOLSON ST
NICHOLSON ST
BRUNSWICK ST
BRUNSWICK ST
SMITH ST
SMITH ST
FITZROY ST
FITZROY ST
YOUNG ST
NAPIER ST
GEORGE ST
GORE ST
CECIL ST
WESTGARTH ST
LEICESTER ST
ROSE ST
KERR ST
SPRING ST
HENRY ST
ARGYLE ST
JOHNSTON ST
JOHNSTON ST
JOHNSTON ST
30 AREA sign and NEW LIMIT sign
30 AREA sign
END 30 AREA sign (R4-11A)
electricity or large pole
existing street sign post
new post or extension
Remove existing 40 sign and other changes
Thanks for 30 sign

15 APPENDIX E: PEDESTRIAN & CYCLIST OBERVATIONS

The sixteen sites where observation cameras were installed in the treatment and control areas before and after treatment for the 30km/h trial are shown in the diagram below.

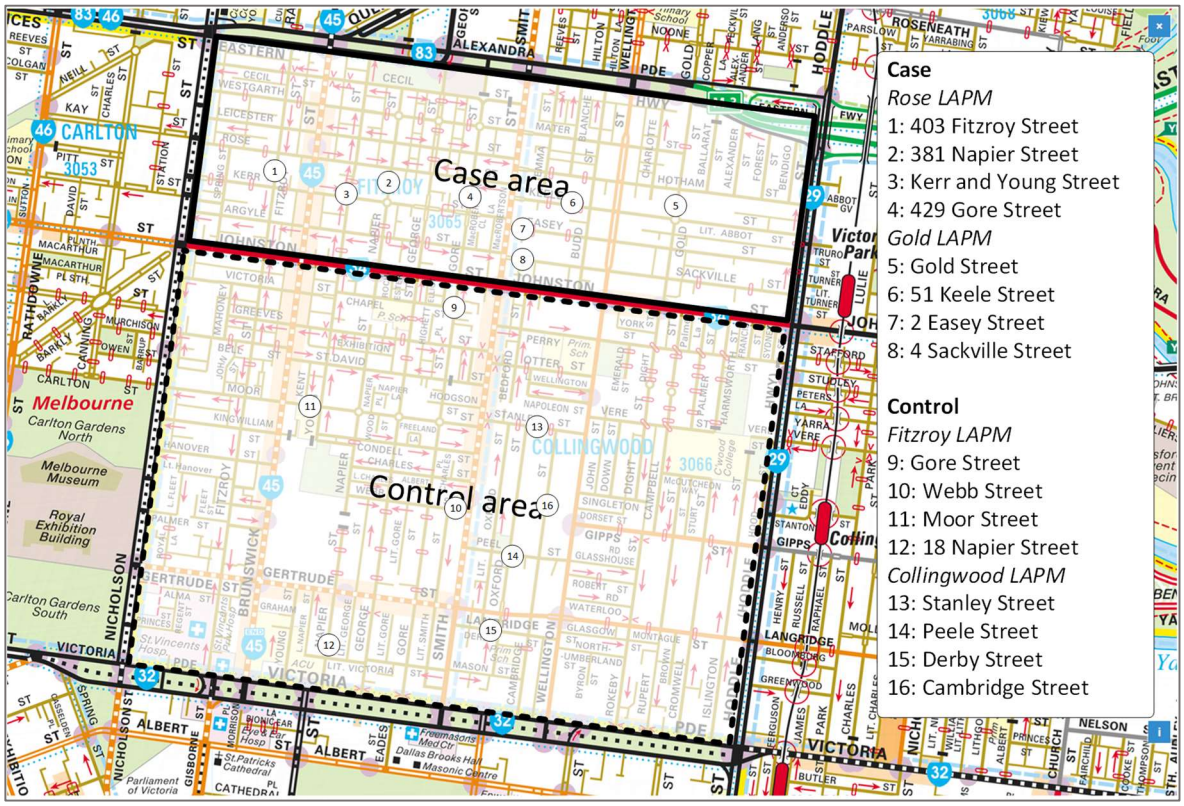


Diagram showing the data station Locations for the pedestrian and cyclists' movements (base map source: Melway online, https://online.melway.com.au/melway)