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Document Title: Evaluation of Federal Street contra-flow cycle lane

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Prepared for: Auckland Transport

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Prepared by: Mackie Research

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Signed

28 September 2018



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## Revision history

Revision No.	Amendments	Completed by	Date
1	Minor revisions following presentation of findings	Lily Hirsch and Hamish Mackie	23 October 2018
2	Finalisation of report	Hamish Mackie and Lily Hirsch	31 October 2018

## Citation

Thorne, R., G Hawley, L. Hirsch, H. Mackie, and A. Woodward (2018). Evaluation of Federal Street contra-flow cycle lane. Auckland, New Zealand, prepared by Mackie Research for Auckland Transport

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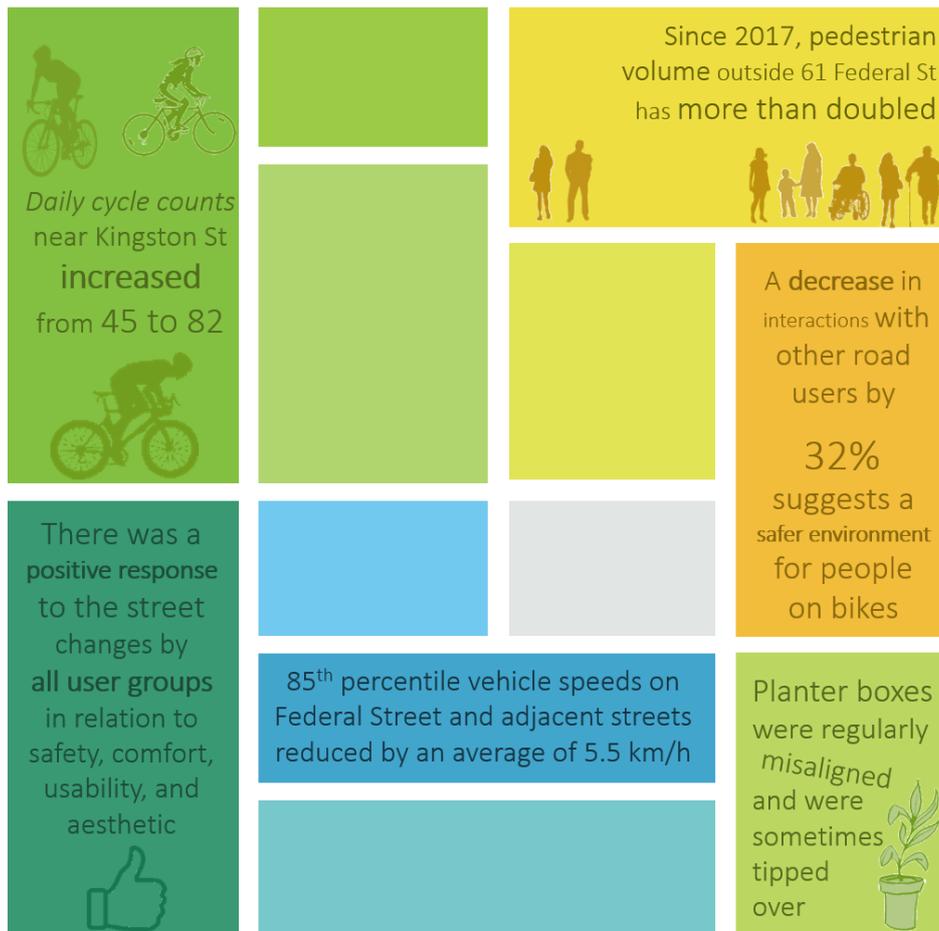
# SUMMARY

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## Overview

Federal Street is an important first test of contra-flow cycling in Auckland Central. Low-cost painted bicycle lanes, with physical buffering, and intersection treatments were installed in March 2018. This report provides an understanding of the effect of the treatments on safety, usability, comfort, and road user perceptions.

## Summary of findings



## Recommendations

The contra-flow cycleway and temporary street improvements on Federal Street have improved connections through the city centre by providing an alternative north/south cycling route parallel to Hobson and Albert Streets. The indicators measured in this study suggest that contra-flow cycling on Federal Street is likely to be safe and has shown to be user-friendly and accepted by a range of user types. Accordingly, formalisation of contra-flow cycling on other low volume streets should be considered. The research raised some issues regarding safety at specific points on the route, amenities, and maintenance. We suggest that these be considered as part of an ongoing iterative process of improvement and mitigated prior to any permanent work being undertaken. Based on the overall positive findings, we recommend that the temporary nature of these street improvements be converted into a permanent upgrade when appropriate. Before this however, given the ‘tactical urbanism’ nature of the scheme, it would be sensible to take all feedback about its performance and tweak the design to overcome some of the issues identified. Afterall, this is the point of cheaper temporary projects of this nature. The further implementation of low-cost contra-flow cycling routes and other temporary treatments could positively contribute to the growing cycling network and placemaking in Auckland.

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# 1. INTRODUCTION AND BACKGROUND

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## 1.1. Purpose and scope

Federal Street is an important first test of contra-flow cycle lanes in Auckland Central. This is a crucial parallel route to Albert Street, which is highly disrupted due to the CRL. Low-cost painted bicycle lanes, with some physical buffering, and intersection treatments were installed in March 2018 after baseline measures were undertaken in June/July 2016. There is a need to thoroughly understand the effect of the treatments on safety, use, and road user perceptions. Potentially, further implementation of low-cost cycling routes, including contraflow lanes, could positively contribute to the growing cycling network in Auckland, and this evaluation will contribute to understanding this potential.

The purpose of the post-implementation evaluation is to understand the effect of the Federal Street contra-flow cycling treatments on:

- The use of Federal Street by road users, including how people on bikes (and other road users) use the contra- flow lanes;
- Cycle/vehicle and cycle/pedestrian interactions; and
- Pedestrians, people who use bikes, and businesses' perceptions of safety, usability, and comfort.

The resilience of the infrastructure that was installed is also of interest for long-term maintenance considerations.

## 1.2. Trial features

- A protected southbound 'contra-flow' cycle lane up the eastern side of Federal Street with colourful planter boxes and 'armadillos' as separation;
- Improved pedestrian facilities in the lower section of Federal Street through a pedestrian crossing on Wyndham Street east of Federal Street, and kerb build-out road markings;
- Painted polka dots on the road at all minor intersections to create slower traffic, and a safer environment for pedestrians and people using bicycles.

*Figure 1: Polka dots, 'contra-flow' cycle lane, and 'armadillos' as part of the Federal Street upgrade. Source: AT*



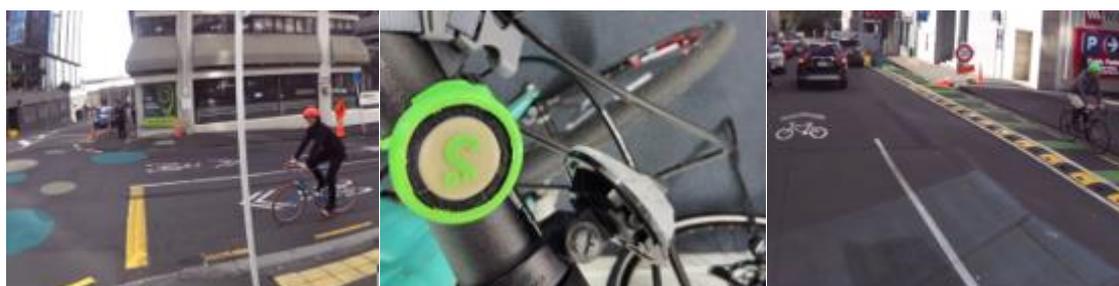
## 2. EVALUATION METHODOLOGY

The following method was developed as a pragmatic approach to assessing the merits of the contra-flow cycling treatments on Federal Street. The suite of measurements carried out at baseline (June/July 2016) were repeated in July/August 2018 to enable before/after comparisons. A summary of the method is provided in Table 1. For the duration of the follow-up data collection, construction encroached onto the lower end of Federal Street and this may have affected the results. More details about each step of the method are presented in Appendix A.

Table 1: Summary of evaluation method and data collection

MEASURE	METHOD	BASELINE DATA	FOLLOW-UP DATA
Traffic speed and volume on Federal Street and side roads	Vehicle tube counters	4x locations (1 on Federal, 1 Wyndham, 1 Swanson, 1 Wolfe)	5x locations (2 on Federal, 1 Wyndham, 1 Swanson, 1 Wolfe)
Cycle counts on Federal Street	Cycle tube counters	1 located on St Patrick's Square	1 on St Patrick's Square, 2 in Federal Street contra-flow cycle lanes
Analysis of crash data	Crash Analysis System	Examined five-year bicycle crash history on Federal Street	Examined five-year bicycle crash history on Federal Street
Road usability and road user interactions	Video analysis: movement categories and a interactions framework	One location (Level 2 Sky City employee carpark). 4 days during peak hours (morning and evening), total 11 hours	One location (streetlight next to Sky City carpark). 2 days during peak hours (morning and evening), total 11 hours
Attitudes of road safety, usability, and comfort	Survey	Convenience sample over three sessions of 46 pedestrians, 17 people on bikes, 29 business owners or employees	Convenience sample over four sessions of 50 pedestrians, 20 people on bikes, 23 business owners or employees
Expert route assessment for safety, usability, and comfort	Analyse ride from head cam video and Sensibel data	Four 'expert' rides: 2 at peak times, 2 off-peak; wore headcams	Eight 'expert' rides: all off-peak; Sensibel good/bad ratings at locations along route (annotated later)

Figure 2: The Sensibel and two expert riders



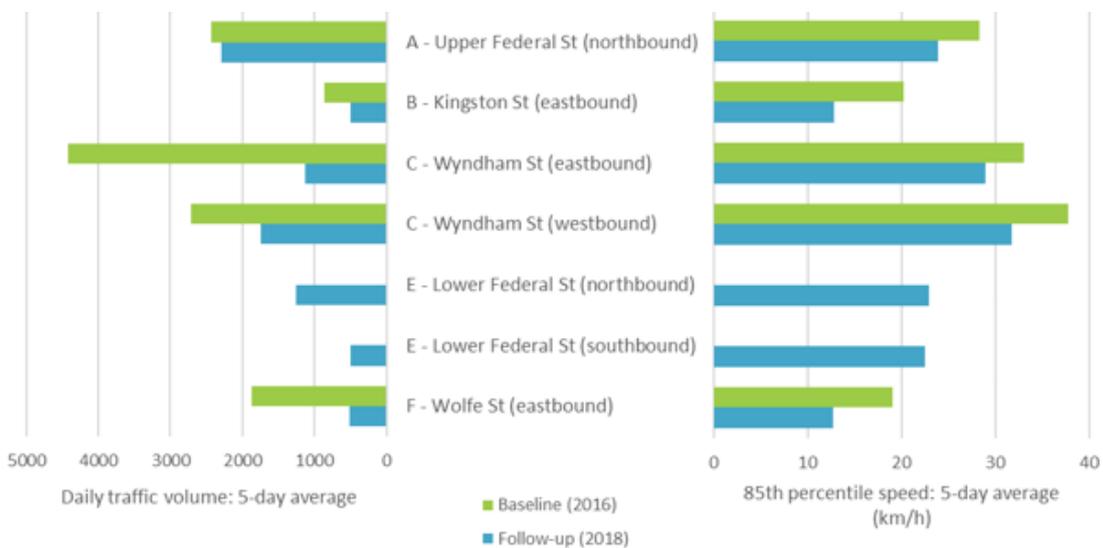
### 3. FINDINGS

In this section we present a brief summary of the findings. For a more comprehensive description of the findings, please refer to Appendix B.

#### 3.1. Traffic speed and volume

In the follow-up condition, traffic volumes had decreased by between 44-75% at all locations (except Upper Federal Street which reduced by 7%). In addition, average vehicle speeds across all locations decreased from 27.7 km/h to 22.2 km/h (85<sup>th</sup> percentile speeds) (Figure 3). This decrease in traffic volumes is likely to have been influenced by the CRL works and the narrowing of the street by the contra-flow lane, and the construction at the northern end of Federal Street is likely to have affected vehicle speeds. Please see Figure 32, Appendix A for the traffic count/speed locations.

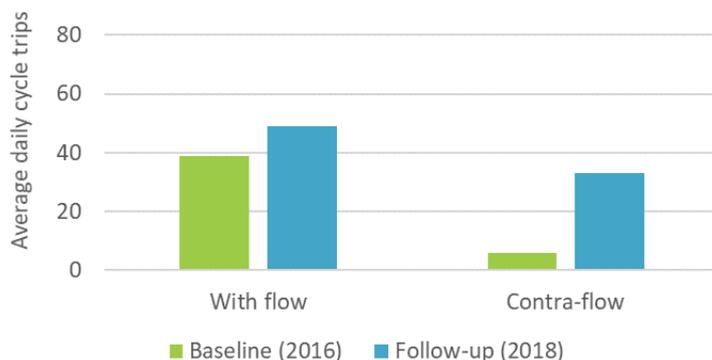
Figure 3: Traffic volume and vehicle speeds on Federal Street and side roads



#### 3.2. Cycle speed and volume

Across both years cycle speed was marginally faster when travelling in a northern direction (downhill) than the southern direction (uphill). Figure 4 shows cycle counts at the tube location A. A key finding is that there are many more contraflow cycle trips at follow-up, showing that the contraflow lane has provided a useful facility for some. Overall, there is also more cycling.

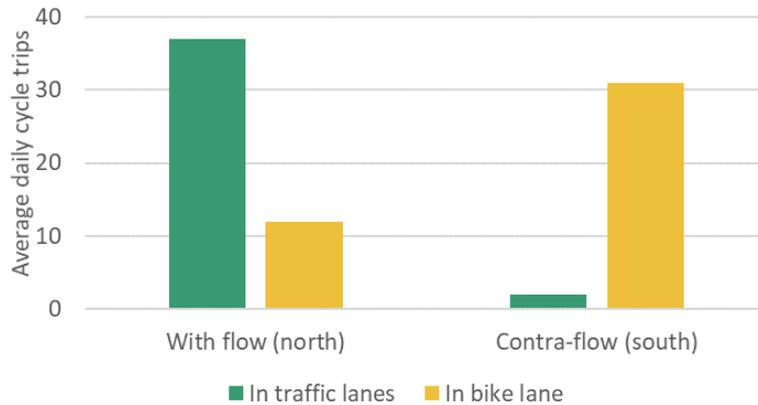
Figure 4: Average daily cycle trips at Upper (southern) Federal Street (5-Day counts)



Although there was an 11% decrease in the number of people cycling through St Patrick’s Square in the follow-up condition, there was an 82% increase in people cycling on Federal Street between Kingston Street and Victoria Street West (Figure 4). It is possible that some of the decrease through the Square may be explained by the sensitivity of the cycle tube counters

In the majority of cases, people on bikes travelling in a southbound direction used the contra-flow lane, but it’s noteworthy that some northbound cyclists (with the flow) also used the lane (Figure 5). The presence of push scooters and skateboards were not filtered out during the tube analysis and therefore the cycle counts are likely to include these user types.

Figure 5: Use of cycle lane and traffic lane on Upper (southern) Federal Street



### 3.3. Analysis of crash data

No crashes involving people on bikes have been reported on Federal Street since 2015.

### 3.4. Video analysis

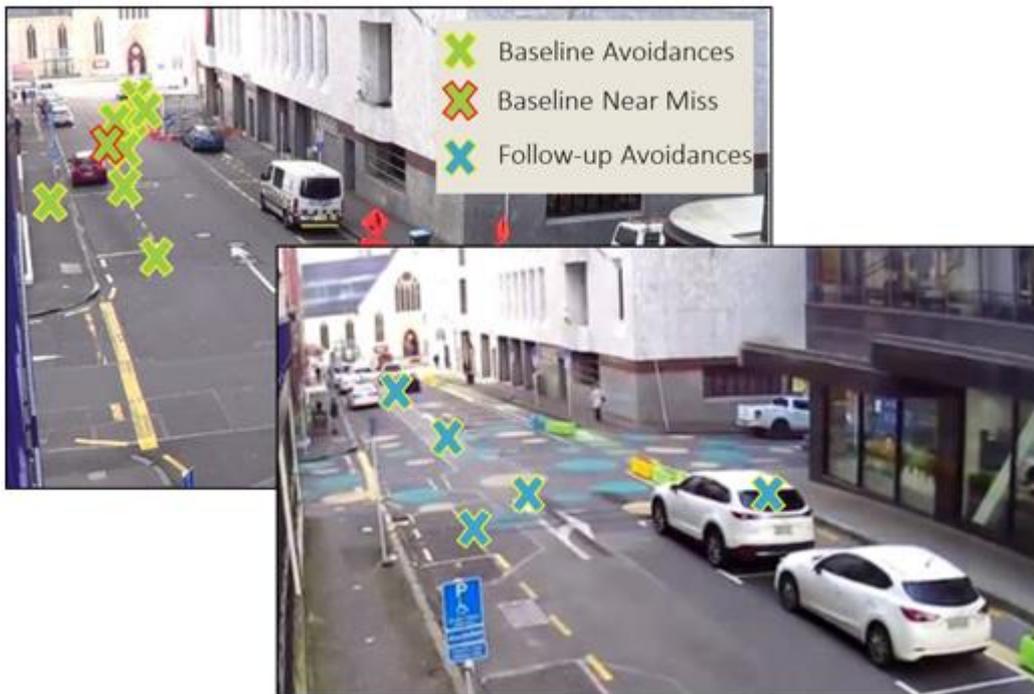
In 2016, 86 people on bikes were coded in the 11 hours of video, and in 2018 a total of 102 people on bikes were coded over the same time period. The analysis examined the road positioning of the people cycling, and the extent and nature of their interactions with other road users. Interactions were coded into categories broadly defined by proximity and speed of response (no interaction, standard encounter, avoidance, and near-miss) (For more detail please refer to Figure 24 in Appendix A).

Over two thirds of people cycling travelled with the flow, both at baseline and at follow-up. Just under 30% rode contra-flow. In 2018, footpath cycling was reduced to short sections (i.e. to access driveways), rather than the use of it as a route in 2016 (n=7).

There was a 32% decrease in interactions between people on bikes and other road users at follow-up. The biggest decrease (73%) was observed in interactions for people on bikes travelling contra-flow. In addition, people cycling were less likely to have multiple interactions at follow-up than at baseline. Standard encounters made up the majority of all interactions analysed (66 at baseline and 46 at follow-up). There were fewer avoidances at follow-up (5 compared to 8 at baseline), and no near misses (compared to 1 at baseline).

In 2016, avoidances were focused towards Wyndham Street, with several related to visibility issues near driveways. In contrast, most interactions in 2018 occurred at, or near the Kingston Street intersection and were generally associated with failure to give way by vehicles on Kingston Street (Figure 6).

Figure 6: Comparison of avoidances and near miss locations at baseline and follow-up



It was common to observe heavy vehicles parked near the Kingston Street intersection, meaning that vehicles stopped at Kingston Street do not have adequate views of oncoming road users along Federal Street (Figure 7). In this low-speed environment, this lack of sight distance may not be problematic as it encourages people to drive slower and be more cautious. However, in some instances, the reduced visibility was severe, which may introduce some risk.

Figure 7: Parked heavy vehicle obscuring road users' view of the intersection



One avoidance was recorded between a person on a bike and pedestrians positioned in the cycle lane. Events of this nature were also described in the surveys with people who ride, and during the expert ride. In general, the movements of people on bikes in the follow-up condition appeared more controlled and less 'risky'. The presence of the contra-flow lane appears to be supporting more consistent road user behaviour and a safer environment for people cycling.

### 3.5. Survey responses

A breakdown of survey respondents is presented in Table 2.

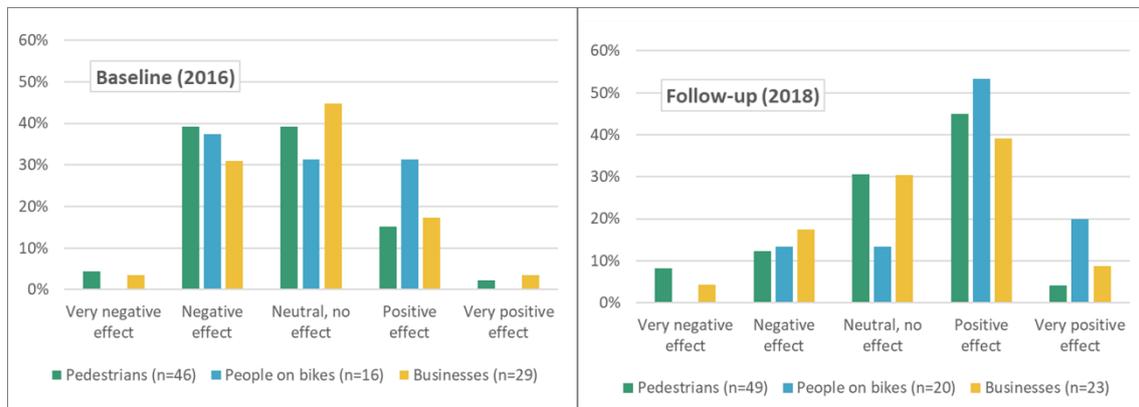
Table 2: Number of survey respondents

	2016	2018
People on bikes	17	20
Pedestrians	46	50
Businesses	29	23

Across all user types there was consensus that in the follow-up condition, the layout of the street afforded better safety outcomes for its users (Figure 8). In relation to personal safety, Federal Street was perceived to be safe during the day. However, some respondents raised concerns about their personal safety at night due to a lack of passive surveillance, a lack of adequate street lighting, and the presence of homeless people.

For business respondents, the street upgrade was mostly positive, with no bikelash (as seen following the implementation of some other cycleways). Key issues raised by businesses concerned the ongoing maintenance caused by the planter boxes (picking them up, realigning them, sweeping up dirt).

Figure 8: All respondent types - "How does the present street layout affect the safety of people using the street?"



For all users, the perceived comfort of Federal Street improved following the street changes. Respondent’s attitudes towards the bright colour palette was polarised, with some stating it had a positive influence on their perceptions of the street, but others disliking the new ‘look and feel’. Negative aspects of the design related to issues with maintenance, the introduction of armadillos as a potential trip hazard, and confusion regarding the meaning of the dots (often both pedestrians and vehicles thought they each had right of way). In addition, it was noted that whilst amenity for people on bikes had been greatly improved, this was not replicated for pedestrians and footpaths remained narrow and with an uneven surface condition.

Figure 9: Survey respondent themes – Pedestrian behaviour and amenities

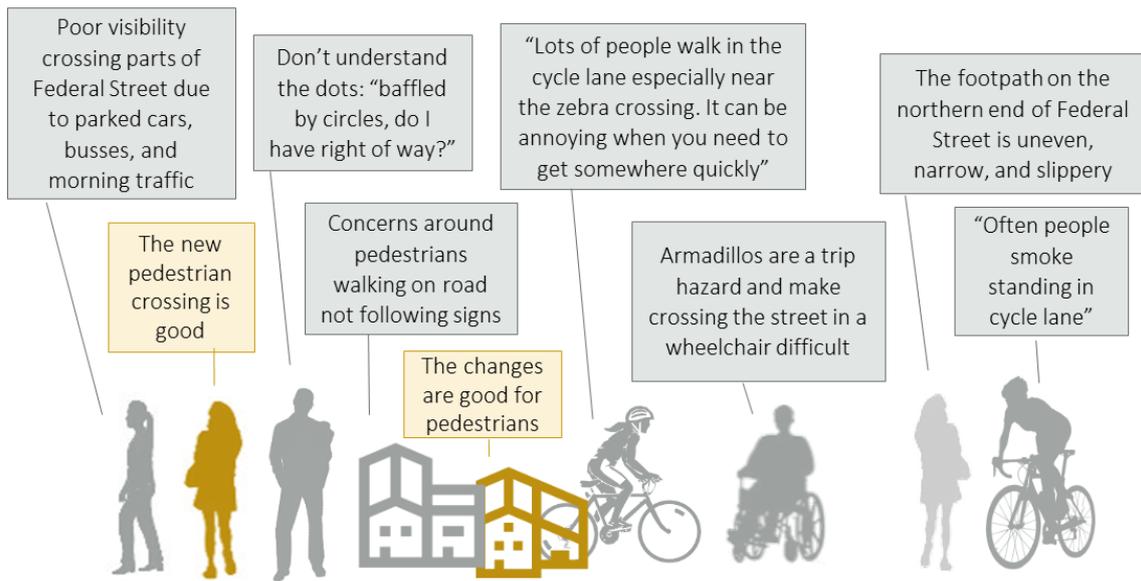
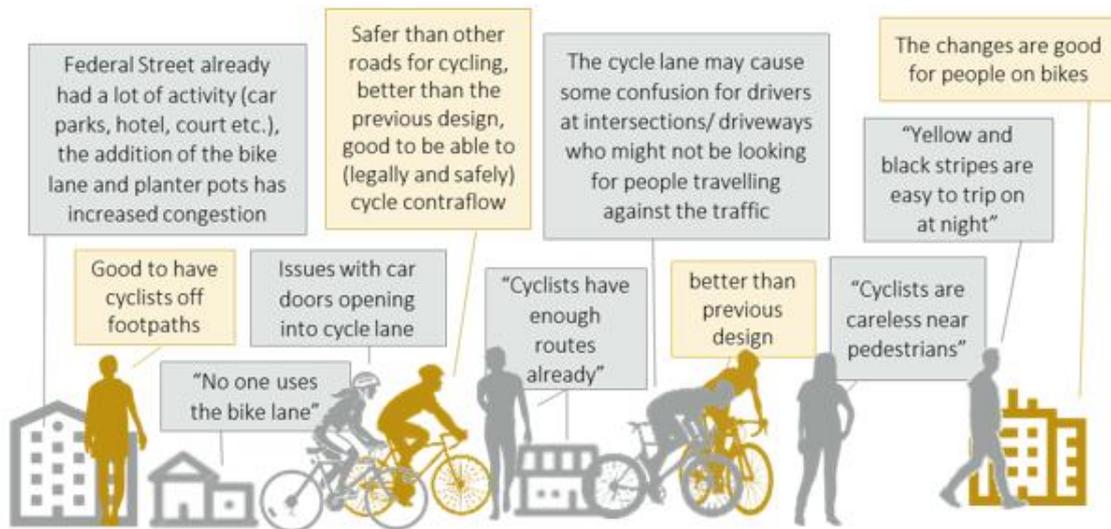


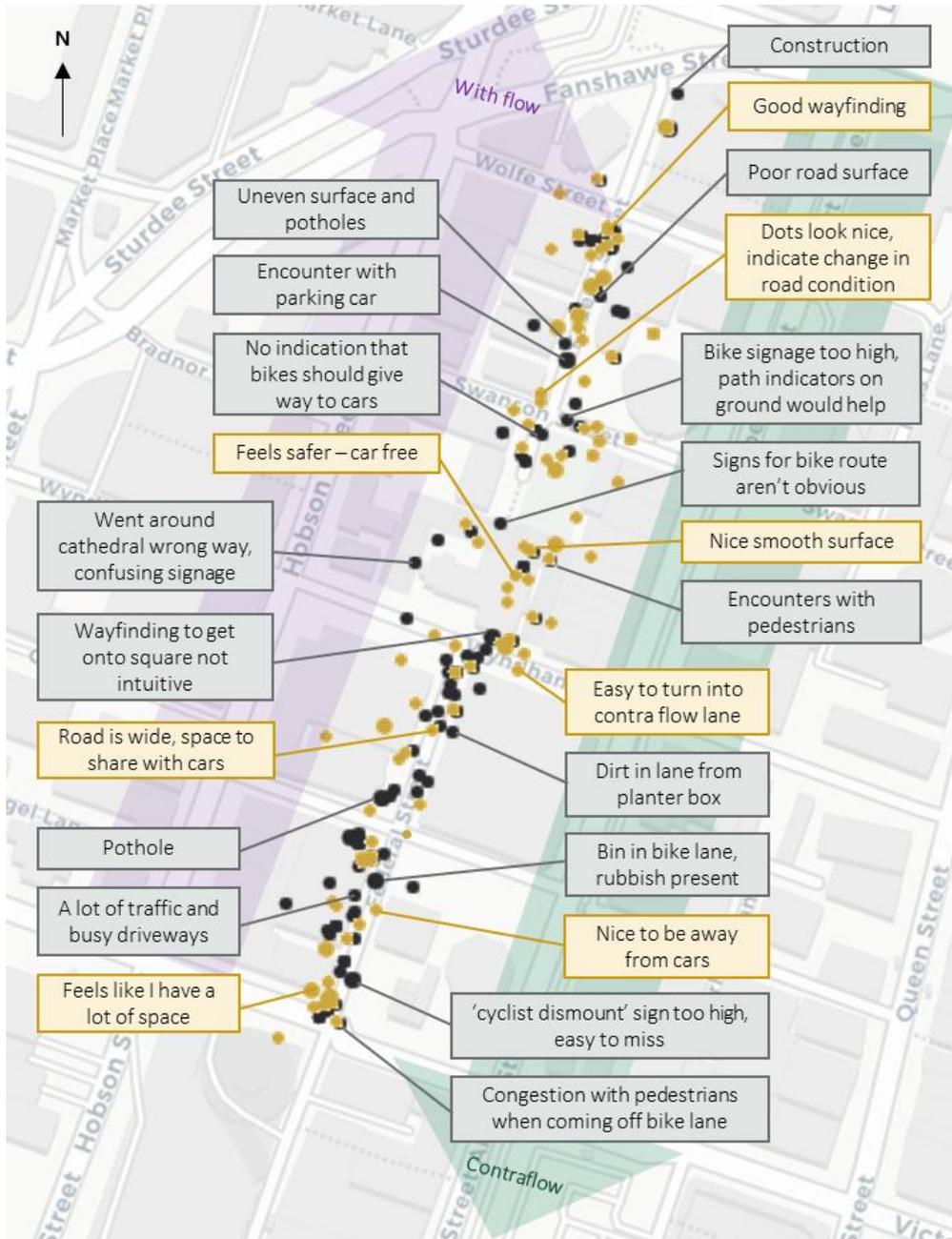
Figure 10: Survey respondent themes –The behaviour of people who cycle and cycleway amenities



### 3.6. Expert route assessment for safety, usability, and comfort

The Sensibel exercise had an output of 61 records with the flow and 250 records in the contra-flow direction. Participants had the opportunity to annotate their comments following the ride (Figure 11). In general, themes related to maintenance, wayfinding, interactions with vehicles at intersections, and the quality of the road’s surface. For more analysis on the Sensibel output, please refer to Appendix B.

Figure 11: Sensibel output with annotated comments. Orange indicates positive and black indicates negative



### 3.7. Resilience, maintenance, and unintentional uses

Several business respondents admitted to feeling obliged to maintain the planter pots as otherwise the “look and feel” of the street – and by association their business – would be compromised. Planter pot maintenance included: removing cigarette butts, straightening the pots, and up-righting knocked over pots. These issues were reinforced by survey respondents (pedestrians and people on bikes), and during the expert ride (Figure 12, Figure 13, Figure 14, and Figure 15).

Figure 12: Dirt from planter box in the bike lane



Figure 13: Graffiti on planter box



Figure 14: Planter boxes are regularly misaligned and may encroach into the vehicle or cycle lane

Figure 15: Signs of wear on the newly painted surfaces



Observations and survey comments demonstrated that the planter boxes served as an unintentional amenity for people waiting outside the Court building. The planter boxes were used as seats (as no seating is provided elsewhere), and as ashtrays. Finally, the height of the planter box was described as impacting on the sightlines of people using wheelchairs.

Finally, it was noted that whilst the Wyndham Street crossing was a vast improvement for pedestrians, there was some uncertainty about the right of way for people on bikes using this crossing. This may be due to the unique nature of zebra crossings incorporating a bike lane.

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## 4. DISCUSSION

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The purpose of this post-implementation evaluation was to understand the effect of the Federal Street contra-flow cycling treatments on:

- The use of Federal Street by road users, including how people on bikes (and other road users) use the contra-flow lanes;
- Cycle/vehicle and cycle/pedestrian interactions; and
- Pedestrian, people on bikes, and business perceptions of safety, usability, and comfort.

An increase in cycle volumes on Federal Street, and in particular a significant increase in the number of cycles travelling contra-flow demonstrate the effectiveness of this intervention for improving the amenities and routes for people who cycle. This is despite the introduction of the Nelson Street bike path which also provides an alternative north/south route for people on bikes, and which was not present during baseline. The findings suggest that whilst overall cycle volumes are relatively low, findings suggest that volumes will continue to grow, as connections are made with the wider network and changes have been implanted for longer.

Vehicle speeds and volumes have reduced on Federal Street as well as the nearby side streets. It is likely that the primary reason for this is the ongoing impact of the CRL works. On Federal Street, the narrowing of the vehicle lane, the painted dots, and the bright colours may also serve to encourage slower speeds by drivers. The speed and volume reduction has helped to create a more forgiving environment for vulnerable road users and this was evidenced through the decrease in interactions between vehicles and people on bikes.

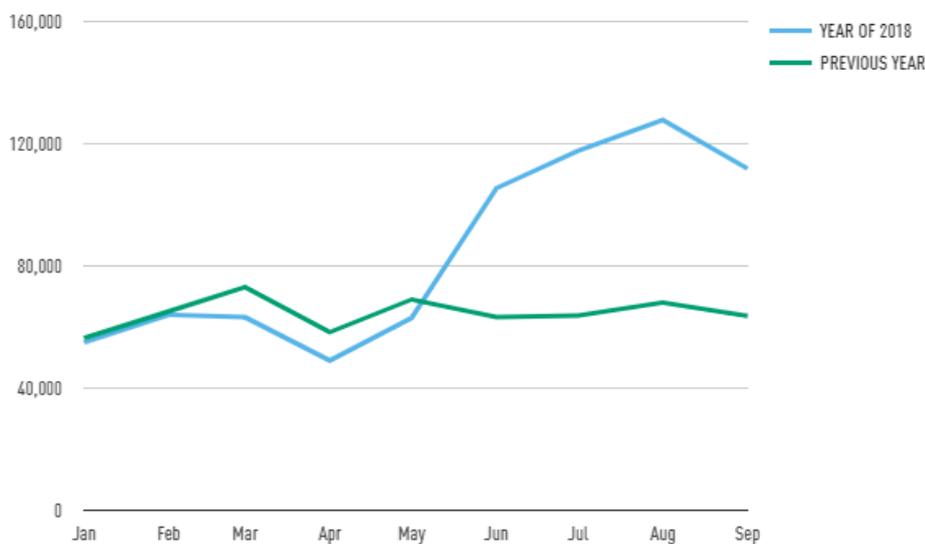
The upgrade has provided more amenity to people on bikes who are travelling the length of Federal Street and serves as a safer alternative route to other north/south options in the CBD. However, it was also noted that partial journeys exist, and people on bikes were likely to join or exit Federal Street in three distinct regions. This 'partial use' by people cycling is illustrated in Figure 16, and serves to reiterate that in addition to improving cycling amenity for routes, the quality of the surrounding streets also needs to be considered.

Figure 16: Common routes and destinations for people on bikes



All active user journeys are important when considering a street upgrade such as this one. The features of this trial recognised the need to upgrade amenities for pedestrians as well as people on bikes, and to a degree this was reflected in the design. Heart of the City counts show that pedestrian volume on Federal Street has more than doubled when compared to the counts from the same period in 2017 (Figure 17)<sup>1</sup>. Certainly, the video observations confirmed an increase in pedestrian activity during the follow-up condition. The increase is likely due to the opening of a new apartment on Federal Street, as well as the CRL works on nearby streets which negatively impact active journeys. Therefore, the Wyndham Street zebra crossing, and improved road markings and signage may not be sufficient improvements in and of themselves to support the increase in pedestrians. This is reinforced by the presence of pedestrians (walking, sitting, and smoking) in the cycle lane as described by survey respondents, the expert ride, and the video analysis. For pedestrians, the cycle lane has provided a place to sit (planter boxes), a smooth surface to traverse, and a wider space to walk as a group.

Figure 17: Pedestrian counters outside 61 Federal Street. Source: Heart of the City



Overall, the goal of the project was to create a sense of place along Federal Street to help offset the impacts of the CRL work. It is clear that the scheme has improved Federal Street in this regard, and it has certainly improved the look and feel of Federal Street. But it has probably only provided partial placemaking value, as there are no seats or other reasons to linger in the area. A similar scheme in Alfred Street at the University has possibly been more successful in this regard as people are often seen sitting, gathering and interacting using the street elements that have been introduced.

The redevelopment of this section of Federal Street as an iterative trial has been planned since 2016. Figure 18 depicts an early design for the street. The design included aspects of placemaking situated within an historical context. In the current design, the elements of placemaking were removed. However, given that this trial sits within an iterative setting it is possible that future versions which include placemaking aspects could be considered.

<sup>1</sup> [www.hotcity.co.nz/pedestrians-in-the-city](http://www.hotcity.co.nz/pedestrians-in-the-city). The pedestrian counter is positioned outside 61 Federal Street. Online accessed: 25 September.



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## 5. RECOMMENDATIONS

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The contra-flow cycleway and temporary street improvements on Federal Street have improved connections through the city centre by providing an alternative north/south cycling route parallel to Hobson and Albert Streets. This report has found that contra-flow cycling on Federal Street is safe and accepted by users and that formalising contra-flow cycling on other low volume streets should be considered. The research raised some issues regarding safety at specific points on the route, amenities, and maintenance. We suggest that these be considered as part of an ongoing iterative process of improvement and mitigated prior to any permanent work being undertaken. Based on the overall positive findings, we recommend that the temporary nature of these street improvements be converted into a permanent upgrade when appropriate. Before this however, given the 'tactical urbanism' nature of the scheme, it would be sensible to take all feedback about its performance and tweak the design to overcome some of the issues identified. After all, this is the point of cheaper temporary projects of this nature. The further implementation of low-cost contra-flow cycling routes and other temporary treatments could positively contribute to the growing cycling network and placemaking in Auckland.

The research raised some issues and suggest some changes regarding safety and amenities at specific points on the route. These findings reinforce the benefits of this iterative approach to street re-design. In this case, the temporary nature of the infrastructure means that the use of the street under the new conditions can be observed and altered until the function is seen to be working in an optimal manner. This approach highlights the weakness of the alternative, permanent model of street design where retrofitting can be cost prohibitive. We suggest that the following points should be considered and mitigated prior to permanent work being undertaken:

### Safety

- A reduction in the posted speed limit on Federal Street and adjacent side roads to 30 km/h would seem appropriate to reflect and reconfirm current traffic behaviour;
- Extend the broken yellow lines around driveways and intersections to improve visibility;
- Consider the messaging of the 'dots' and how their ambiguous meaning may be minimised. Currently some pedestrians and vehicle operators think they have right of way, and this could result in conflict;
- Consider the trip hazard potential of armadillos (particularly for people with low vision and impaired mobility);
- Install more appropriate signage at the intersection of Kingston Street and Federal Street to reinforce to drivers that people on bikes may be present;
- Install more car park alarms on driveways along the extent of Federal Street;
- Installing a raised table at the Wyndham Street zebra crossing would be more consistent with Safe System principals, especially given some of the likely uncertainty regarding priority for cyclists. However, this would be an expensive upgrade. In line with the cheap and temporary trial features featured at this site, temporary bolted bumps could be installed before the crossing to slow drivers.
- Install signage or narrow vehicle entrances into St Patrick's Square to slow vehicles turning into the shared space off Wyndham Street.

### Amenity provision

- Address the access issue to the driveway at 60 Federal Street;
- Reinstall the removed parking for mobility impaired drivers;
- The street changes have benefited people on bikes, but apart from the Wyndham Street zebra crossing, pedestrian amenity has not been substantially improved. Pedestrian amenity could be enhanced through improving the quality and width of the footpaths;
- Improve pedestrian light phasing at the intersection of Federal Street and Victoria Street West;

### Suggestions for ongoing iteration

- Consider all functions of the street in the design process. Allow space between the planter boxes for people to put their bins out. This may discourage their placement in the cycle lane;
- Improve the way-finding for people on bikes with more ground-based signs;
- Provide seating for people waiting outside the Courts.
- Install temporary bolted 'bumps' at the approach to the Wyndham Street zebra crossing;
- Consider the value of placemaking in further iterations;
- Continue to develop a relationship with the businesses on Federal Street and foster a sense of ownership for the planter boxes.

The research has also highlighted that overall, temporary treatments such as those implemented at Federal Street can be effective and accepted by users. However, there are issues that may negatively affect user perceptions. We recommend that these are considered prior to the commencement of new trials:

- The positioning of planter boxes needs to be considered in relation to intersections, and the likelihood that they will be hit/moved by vehicles;
- The temporary nature of the materials used in the street upgrade means that the resilience and ultimate life-cycle of the features used in the trial will depend on a maintenance schedule that may need to be more comprehensive than on a BAU road;
- The importance of fostering and encouraging a sense of ownership from the surrounding businesses for the roadside infrastructure (e.g. planter boxes).

Finally, the full benefit of temporary, cost effective tactical urbanism style projects is the ability to improve or iterate based on feedback and learning. It is suggested that tweaks are made to the Federal Street scheme based on all feedback to date to make the project even more of a success than has been demonstrated in this report.

# APPENDICES

## Appendix A: Detailed evaluation method

This section presents a detailed, replicable method that was followed for this research (2016 and 2018). For the duration of data collection, construction encroached onto the lower end of Federal Street and this may have affected the results. Due to the diverse nature of data collection, each measure type is described under a different heading.

### Traffic speed and volume on Federal Street and side roads, and cycle counts

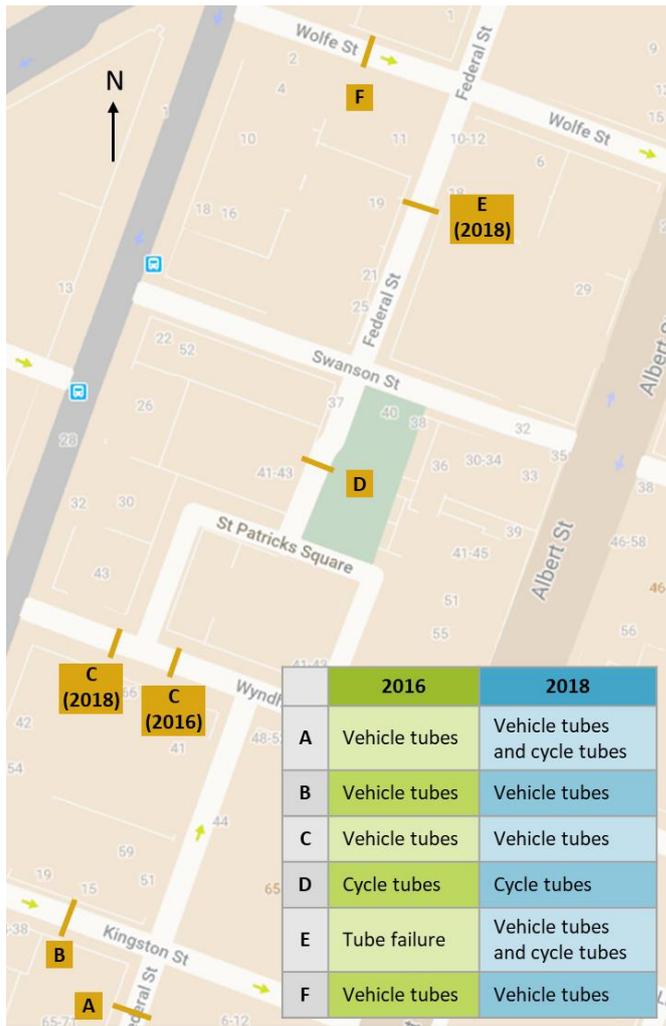
MEASURE	METHOD	BASELINE DATA	FOLLOW-UP DATA
Traffic speed and volume on Federal Street and side roads	Vehicle tube counters	4x locations (1 on Federal, 1 Wyndham, 1 Swanson, 1 Wolfe)	5x locations (2 on Federal, 1 Wyndham, 1 Swanson, 1 Wolfe)
Cycle counts on Federal Street	Cycle tube counters	1 located on St Patrick's Square	1 on St Patrick's Square, 2 in Federal Street contra-flow cycle lanes

#### Data collection

To understand if there was a change in traffic volume and speed on Federal Street and the proximal streets, pneumatic tube traffic counters were installed in five locations. The tubes were installed by a third-party provider, TEAM Traffic. They recorded data for a period of one week. For the baseline condition in 2016, tubes were laid on the 16<sup>th</sup> August, and in 2018 on the 25<sup>th</sup> July. Figure 19 shows the placement of tubes across both years. Please note that in 2016 the tubes failed at location E. In addition, due to a change in the availability of attachment points on Wyndham Street, in the follow-up condition, tubes at location C were laid approximately 20m west from the baseline condition.

Vehicle tubes are able to identify bicycles from their wheelbase, and therefore the baseline (2016) tubes at location A (and intended at location E, although these tubes failed) provided cycle counts. However, following the installation of the contra-flow cycle lanes, vehicle tubes were unable to cross into the cycle lane. Therefore, in the 2018 condition, cycle tubes were laid in the cycle lane at locations A and E. The combination of vehicle tubes across the road, and cycle tubes in the lane were then able to provide us with cycle counts and speeds on Federal Street. Finally, under both the 2016 and 2018 conditions, cycle tubes were placed in St Patrick's Square.

Figure 19: Placement of vehicle and cycle tubes



### Data analysis

Data were analysed for 85<sup>th</sup> percentile speeds, traffic volume, and cycle counts in each direction.

To identify bicycles using the road, a wheelbase of up to 1.1m was applied.

### Analysis of crash data

MEASURE	METHOD	BASELINE DATA	FOLLOW-UP DATA
Analysis of crash data	Crash Analysis System (CAS)	Examined five-year crash history on Federal Street	Examined five-year crash history on Federal Street

A 10-year CAS search for bicycle-involved crashes on Federal Street was completed in 2016 and again in 2018.

An analysis of crashes on Albert Street (parallel to Federal Street) between 2006 and 2016 was also conducted. This was to understand the relative risk on Federal Street in comparison to the busier Albert Street. A crash search on Albert Street for 2016-2018 was also conducted.

## Road usability and road user interactions

MEASURE	METHOD	BASELINE DATA	FOLLOW-UP DATA
Road usability and road user interactions	Analyse video using movement categories and a road user interactions framework	One location (Level 2 Sky City employee carpark). 4 days during peak hours (morning and evening), total 11 hours	One location (streetlight next to Sky City carpark). 2 days during peak hours (morning and evening), total 11 hours

### Video collection

A video analysis of road user interactions (involving people on bikes) was undertaken to understand what influence the contra-flow lane and the other street changes may have on these. Over both years a video camera recorded road users on Federal Street for a total of 11 hours (per year). Cameras were set to record on fine weather days. The camera faced north and was located on Federal Street between Victoria Street West and Kingston Street. The camera was placed in an elevated position to ensure it captured a comprehensive view of the street (Figure 20). In addition, the elevation meant that the camera was inconspicuous from street level and therefore did not impact on road user behaviour.

In 2016, the camera was placed on the 2<sup>nd</sup> floor of the Sky City employee car park. The camera was placed on a tripod and was manually operated by a Mackie Research employee. Video was recorded on Monday 27<sup>th</sup> June from 8-8:30am (wet and windy conditions), Tuesday 28<sup>th</sup> June from 3-6pm, Friday 1<sup>st</sup> July from 7:30am-12:30pm, and Tuesday 5<sup>th</sup> July from 3-6pm.

In 2018 the camera was attached to a light pole next to the Sky City employee car park by a third-party provider, TEAM Traffic. The camera was set to automatically film on Wednesday 25<sup>th</sup> July and Thursday 26<sup>th</sup> July from 7:30-10:30am and 3:30-6pm each day.

Figure 20: Camera placement



Despite the different camera placement across the two years, a similar field of view was achieved. In 2018 the footage was of a higher quality, meaning that the video could be zoomed to accurately understand road user interactions past Kingston Street (Figure 21 and Figure 22).

Figure 21: 2016 field of view



Figure 22: 2018 field of view



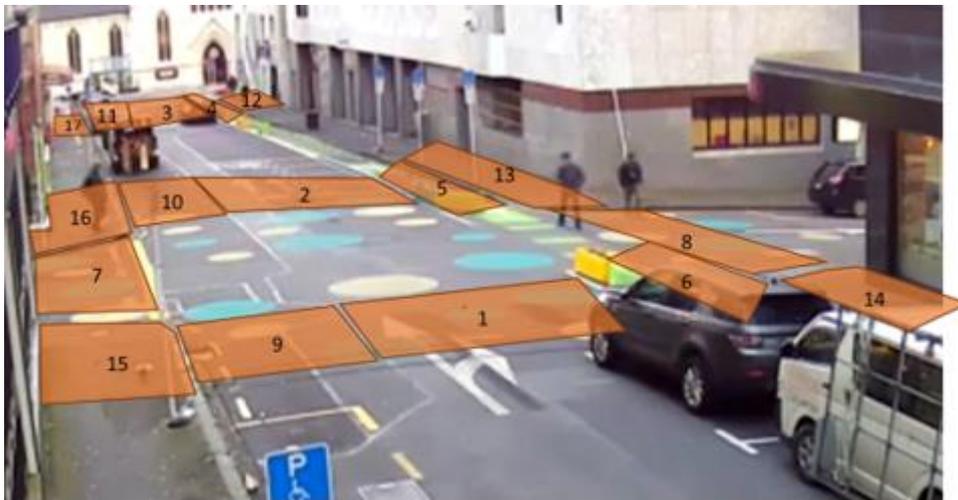
### Video analysis

The video served two purposes. Firstly, in addition to the tube counts it further confirmed the number of people on bikes using Federal Street. Secondly, it allowed for a naturalistic understanding of road user behaviour and interactions.

In 2016, the video was manually collected by a Mackie Research employee and all counts of people on bikes were determined from the video by Mackie Research. In 2018, the third-party provider TEAM Traffic provided Mackie Research with a timestamp of each person on a bike.

Prior to coding, the field of view was divided into 17 sections to understand the movement of people on bikes and the interacting road users (Figure 23). This is a standard method for understanding road user movements.

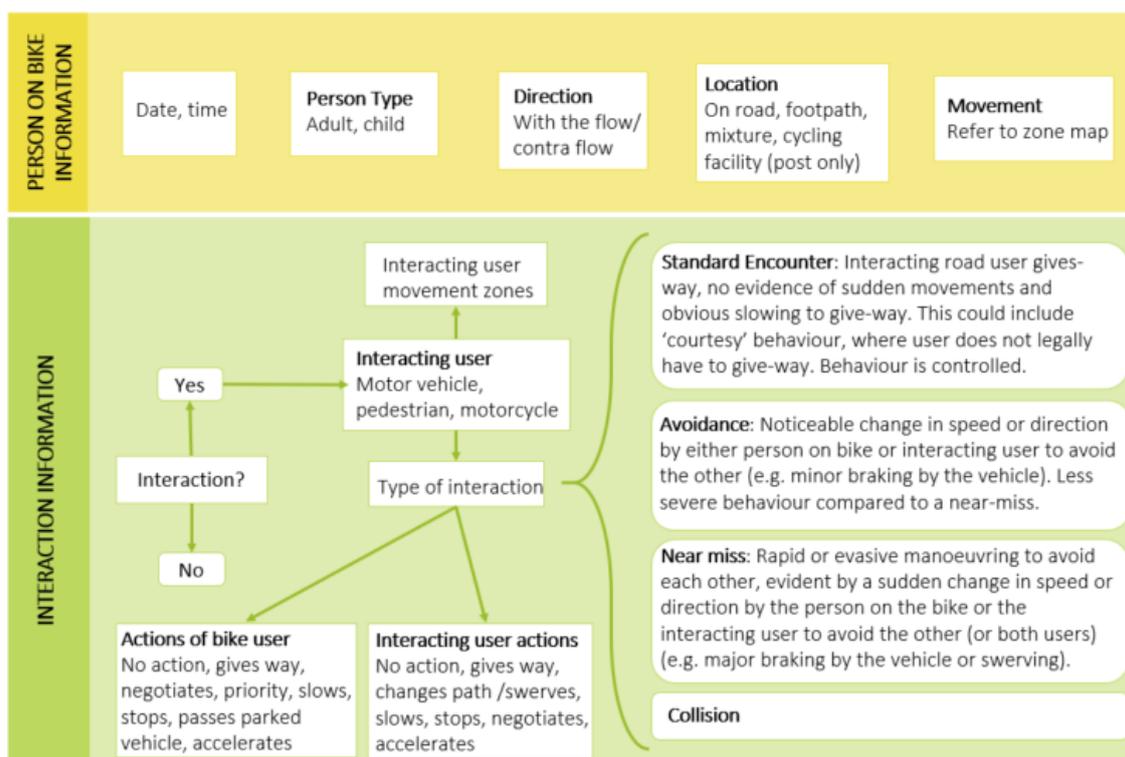
Figure 23: Movement zones



A coding framework was established (Figure 24) which describes relevant information about all people on bikes who were identified in the video (yellow box). For those people on bikes who were identified as having an ‘interaction’ with another road user, further detail could be coded (green box). The coding framework was modified from the more comprehensive framework used in the Te Ara Mua Future Streets Project (unpublished)<sup>3</sup>.

<sup>3</sup> <http://www.futurestreets.org.nz/>

Figure 24: Video coding framework



The coding framework provided a clear guide for identifying and describing events. Nevertheless, coding road user interactions is a qualitative measure and different coders may disagree about certain aspects of an interaction. To mitigate the potential for this, and to ensure we were comparing the same interaction information across both years, the same analyst coded all of the footage from both years. In addition, two people coded the first 10 interactions to ascertain differences in coding decisions, and to determine how these could be lessened.

### Attitudes of road safety, usability, and comfort

MEASURE	METHOD	BASELINE DATA	FOLLOW-UP DATA
Attitudes of road safety, usability, and comfort	Survey	Convenience sample over three sessions of 46 pedestrians, 17 people on bikes, 29 business owners or employees	Convenience sample over four sessions of 50 pedestrians, 20 people on bikes, 23 business owners or employees

To understand people’s attitudes towards the safety, usability, and comfort of Federal Street both before and after the changes, a survey was conducted. A convenience sample of people on bikes, pedestrians, and businesses along Federal Street were approached and asked questions about their perceptions and experiences on the street (Figure 26, Figure 27, and Figure 28). In 2016 the surveys were collected over several days in July and in 2018 surveys were collected in July and August.

Most pedestrians and people on bikes were intercepted at the traffic lights at the intersection of Victoria Street West and Federal Street opposite the Sky Tower, or in St Patrick’s Square. Only

people on the eastern side of the crossing were approached, and only while the pedestrian symbol was red. This meant that not all people on bikes or pedestrians could be captured, but it was determined that this was the safest location for people to stop and talk. All businesses along Federal Street were approached (Figure 25). However, some were difficult to access due to their security arrangements and some did not want to participate. Many businesses had changed or closed since 2016 – a likely symptom of the CRL works – and therefore only four businesses were surveyed in both years.

Figure 25: Location of business surveys

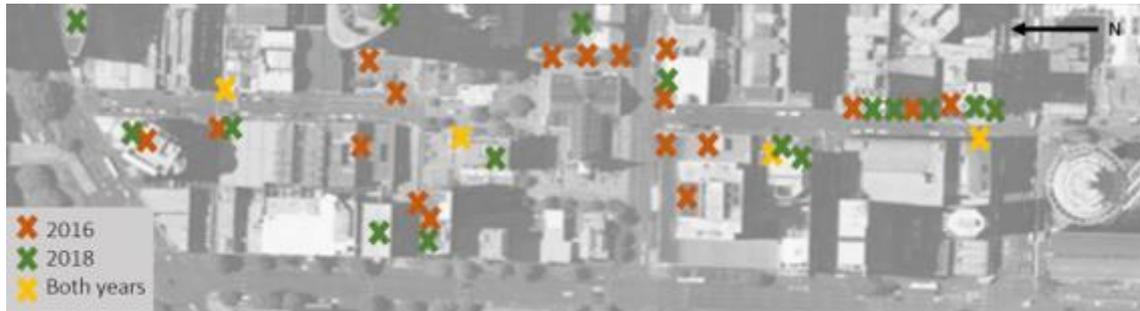


Figure 26: Survey for people on bikes



## Federal Street Questionnaire: People cycling

We are interested in how the street layout in Federal Street affects people who cycle through the area. We are conducting this work on behalf of Auckland Transport.

**1. Which direction are you travelling in today?**

North away from the Sky Tower  South towards the Sky Tower

**2. What journey purpose best describes why you are cycling here today? (Please tick one)**

Recreation <input type="checkbox"/>	Visitor/Tourist <input type="checkbox"/>	Shopping <input type="checkbox"/>
Courier <input type="checkbox"/>	Commuting to or from work or study <input type="checkbox"/>	Other: _____ <input type="checkbox"/>

**3. Why did you choose Federal Street to cycle on rather than other surrounding streets?**

(Please tick all that apply)

Most direct route <input type="checkbox"/>	Less traffic than nearby streets <input type="checkbox"/>
My origin or destination is on Federal Street <input type="checkbox"/>	Safer than nearby streets <input type="checkbox"/>

Comments/Other:

**4. In your view, how does the present street layout affect the safety of people using the street? (Please circle one)**

Very negative effect	Negative effect	Neutral, no effect one way or other	Positive effect	Very positive effect
1	2	3	4	5

Comments:

**5. From a road safety point of view, how safe do you feel cycling on this street? (Please circle one)**

Very unsafe	Unsafe	Neutral	Safe	Very safe
1	2	3	4	5

Comments:

**6. Did you cycle on Federal Street before the changes were made? (Please circle one)**

Yes / No / Other: \_\_\_\_\_

If you circled No, please tell us why you started cycling on Federal Street:

**7. Do you have any other comments about the recent changes to Federal Street? (i.e. the changes made for people walking or cycling.) If so, please write them on the back of this sheet).**

Gender \_\_\_\_\_ Age \_\_\_\_\_

Figure 27: Pedestrian survey



# Federal Street Pedestrian Questionnaire

We are interested in how the street layout in Federal Street affects people who walk through the area. We are conducting this work on behalf of Auckland Transport.

**1. In your view, how does the present street layout affect the safety of people using the street?** (Please circle one)

Very negative effect	Negative effect	Neutral, no effect one way or other	Positive effect	Very positive effect
1	2	3	4	5

Comments:

**2. How comfortable is Federal Street to walk along?** (Please circle one)

Very uncomfortable	Uncomfortable	Neutral	Comfortable	Very comfortable
1	2	3	4	5

Comments:

**3. From a road safety point of view, how safe do you feel walking on this street?** (Please circle one)

Very unsafe	Unsafe	Neutral	Safe	Very safe
1	2	3	4	5

Comments:

**4. Do you have any other comments about the recent changes to Federal Street? *i.e.* the changes made for people walking or cycling.**

Gender  Age

Figure 28: Business survey



## Federal Street Businesses Questionnaire

We are interested in how the street layout on Federal Street affects people who work in the area. We are conducting this work on behalf of Auckland Transport. Your comments won't be linked to you or your business in reports.

Name of Business \_\_\_\_\_

Address \_\_\_\_\_

I consent to taking part in this survey

1. What is your position in this business?

Owner  Employee

2. In your view, how does the present street layout affect this business? (Please circle one)

Very negative effect	Negative effect	Neutral, no effect one way or other	Positive effect	Very positive effect
1	2	3	4	5

Comments:

3. In your view, how does the present street layout affect how easy it is to get in and out of your business/workplace? (Please circle one)

Very negative effect	Negative effect	Neutral, no effect one way or other	Positive effect	Very positive effect
1	2	3	4	5

Comments:

4. In your view, how does the present street layout affect the safety of people using the street? (Please circle one)

Very negative effect	Negative effect	Neutral, no effect one way or other	Positive effect	Very positive effect
1	2	3	4	5

Comments:

5. Do you have any other comments about the recent changes to Federal Street? If so, please write them below (or on the back of this sheet).

Thank you for taking part in this survey

Gender

Age

## Expert route assessment for safety, usability, and comfort

MEASURE	METHOD	BASELINE DATA	FOLLOW-UP DATA
Expert route assessment for safety, usability, and comfort	Analyse ride from head cam video and Sensibel data	Four 'expert' rides: 2 at peak times, 2 off-peak; wore headcams	Eight 'expert' rides: all off-peak; Sensibel good/bad ratings at locations along route (annotated later)

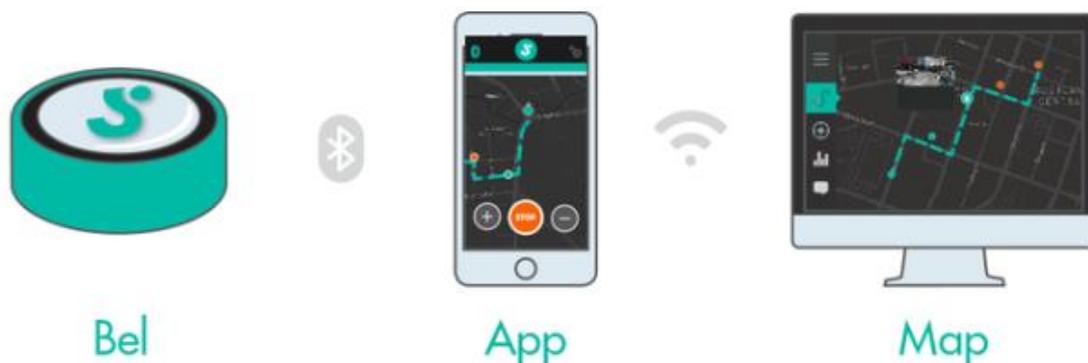
To understand the safety, usability, and comfort of the street - before and after the changes - from the perspective of people who ride bikes, Federal Street was ridden twice each by regular riders (or 'experts') who then provided feedback on their experience. In 2016, four people rode Federal Street wearing a head cam. In 2018, eight people<sup>4</sup> rode Federal Street using a Sensibel.

The video collected from the headcams in 2016 were analysed to understand the behaviour of road users in relation to people on bikes. In addition, the experts gave feedback about their perceptions of the street layout, their safety, and gave details of any interactions that they had experienced. Screenshots from the video were taken to illustrate these comments.

Data in 2018 were collected differently to the baseline condition due to the development of, and access to the Sensibel<sup>5</sup>. This is a Bluetooth-enabled button attached to the handlebars of a bicycle, linked to a Smartphone App. Sensibel seeks to inform public policy around cycling infrastructure with data collected by people who ride bikes. Riders press the button whenever they encounter a positive or negative aspect of their ride. Following the ride, they can then annotate the 'event' on the App. These data are mapped and can help identify common problems (Figure 29). This method collected real-time perceptual insights into the experience of riders on Federal Street.

The Sensibel ride was conducted on the 14<sup>th</sup> August 2018. Participants met at the Mackie Research Offices (Figure 30) at 1pm where they were given a health and safety briefing, signed a consent form (Figure 31), and were given information about the planned activity. Between 1:45 and 2:30, participants left the Mackie Research Offices for Federal Street and rode the route in both directions at approximately 5-minute intervals. Following the ride, they annotated their 'events' and provided feedback about the layout of the street and their perceptions of riding on it. A \$50 voucher was provided as a thank you to the participants.

Figure 29: Steps for using the Sensibel



<sup>4</sup> 3 members of Auckland Transport's Walking and Cycling Team also participated in this activity. However, their comments were not included in the analysis due to conflict of interest.

<sup>5</sup> <https://fabriko.squarespace.com/sensibel>

Figure 30: Participants met at the Mackie Research Offices

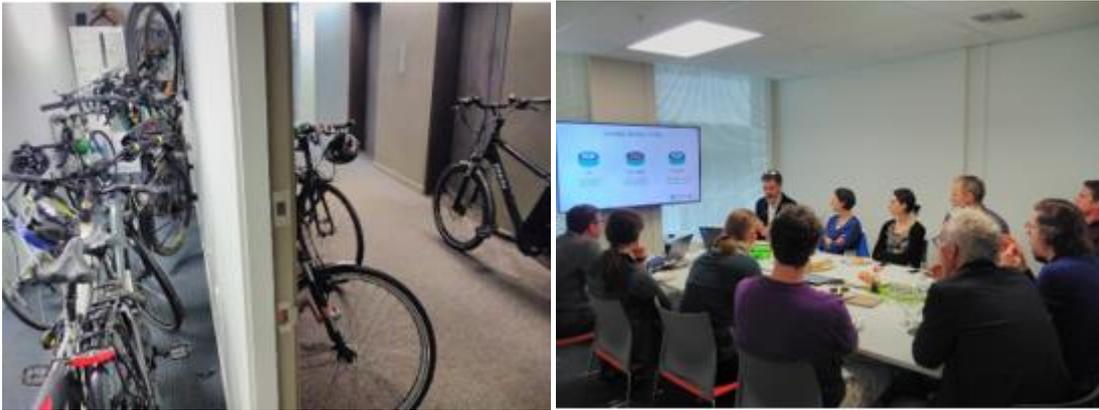


Figure 31: Sensibel information sheet and consent form

## FEDERAL STREET EVALUATION

### *Sensibel Ride - Information Sheet*

#### **What is the study about?**

We are evaluating the recent walking and cycling changes on Federal Street, on behalf of Auckland Transport.

This is to understand the effect of the treatments on:

- cycle/vehicle and cycle/pedestrian interactions;
- the use of Federal Street, including how cyclists (and other road users) use the contra-flow lanes;
- road user perceptions of safety, usability, and comfort.

#### **What will I be asked to do?**

You will be asked to ride your bike along Federal Street and push the Sensibel button when you have a 'positive' or 'negative experience'.

#### **How will my confidentiality be protected?**

The information you provide will be anonymous. It will not be linked to your personal information in reports.

#### **What if I change my mind?**

Participation is voluntary. You are free to withdraw your participation at any time.

#### **What if I have questions about the study?**

For more information, or if you have any concerns, please contact:

Greer Hawley, Mackie Research & Consulting  
 Mobile: 0226 018 809  
 Email: greer@mackieresearch.co.nz



## FEDERAL STREET EVALUATION

### *Sensibel Ride - Information Sheet*

- I have read the Information Sheet. The nature and the purpose of the evaluation has been explained to me. I understand and agree to take part;
- I confirm that I am over 18 years of age;
- Health & Safety protocols have been explained to me. I agree to follow these protocols;
- I understand my participation is voluntary and I can withdraw at any stage of the study; and
- I will not be personally identified in the report arising from this evaluation.

Name:

\_\_\_\_\_

Signature:

\_\_\_\_\_

Date:

\_\_\_\_\_

## Appendix B: Comprehensive findings

### Traffic speed and volume on Federal Street and side roads

Traffic tubes were laid at two locations on Federal Street and on three side roads nearby (Figure 32). The purpose of the tubes was to understand if vehicle volumes and speed changed between the baseline (2016) and follow-up (2018) conditions. Please note that in 2016 the tubes failed at location E and therefore no data were recorded.

Figure 32: Tube locations



In 2018, traffic volumes decreased significantly at all locations (except upper Federal Street) by between 44-75%. At upper Federal Street, traffic volumes reduced only marginally by 7% (Figure 33, Table 3). This decrease in traffic is likely due to the CRL works and the construction at the northern end of Federal Street.

At all locations, vehicle speeds were slower at follow-up than at baseline (Figure 33, Table 3) by between 4.1-7.5 km/h (85<sup>th</sup> percentile speeds). On Federal Street this may be explained by the narrowing of the street by the contra-flow lane. Again, the CRL works may have influenced vehicle speeds on the nearby streets.

Figure 33: Traffic volume and vehicle speeds on Federal Street and side roads

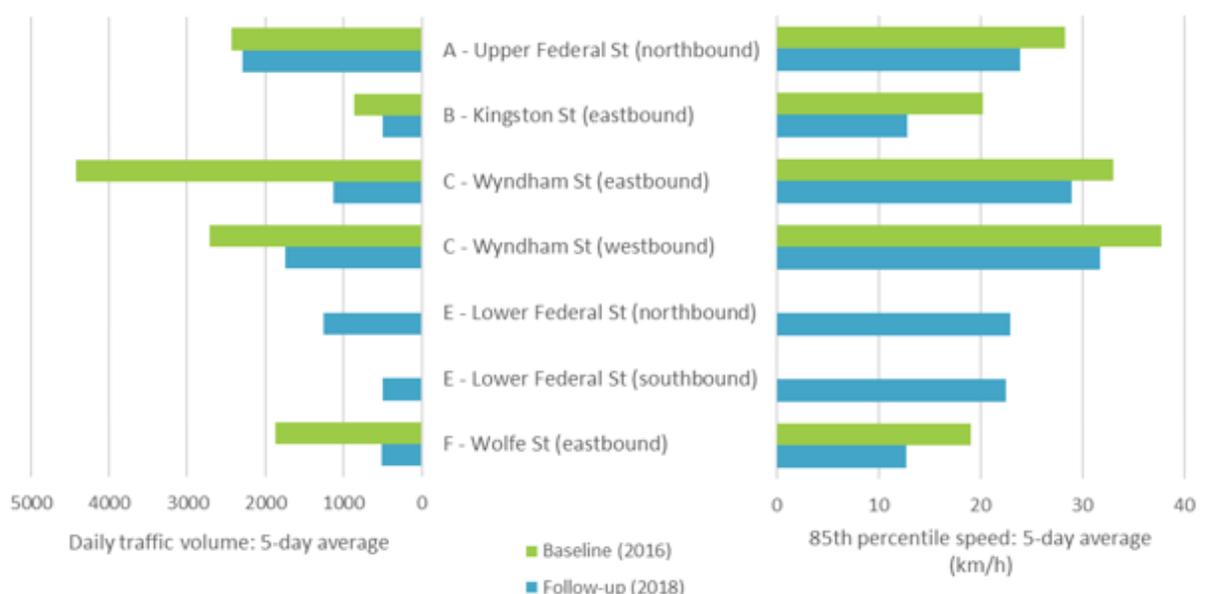


Table 3: Summary data of vehicle volume and speed

Location	Direction	85th percentile speed (5-day average)		Daily traffic volume (5-day average)	
		Baseline	Follow-up	Baseline	Follow-up
<b>A (Upper Federal Street)</b>	North toward Kingston St	28.3km/h	23.9km/h	2439	2290
<b>B (Kingston Street)</b>	East toward Federal St	20.3km/h	12.8km/h	866	492
<b>C (Wyndham Street)</b>	East toward Federal St	33.1km/h	29km/h	4418	1128
	West toward Hobson St	37.8km/h	31.8km/h	2708	1740
<b>E (Lower Federal Street)</b>	North toward Wolfe St	-	22.9km/h	-	1252
	South toward Swanson St	-	22.5km/h	-	492
<b>F (Wolfe Street)</b>	East toward Federal St	19.1km/h	12.7km/h	1866	518

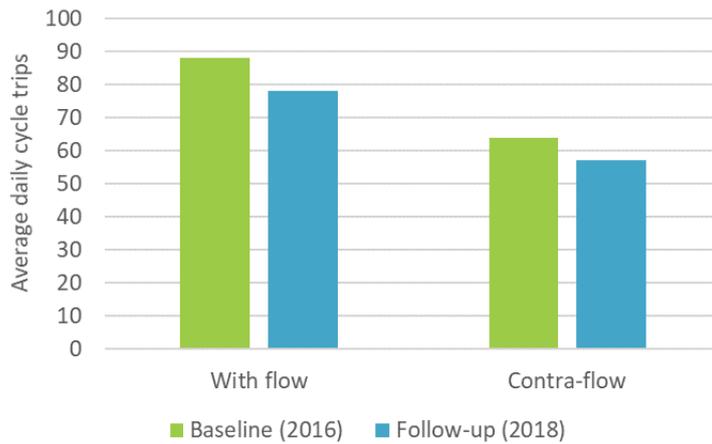
## Cycle counts, road/bike lane use, and speed on Federal Street and St Patrick’s Square

### Cycle counts

The presence of push scooters and skateboards in the cycle lane, and in St Patrick’s Square were noted during video observations and route assessment. These user types were not filtered out during the tube analysis and therefore, the cycle counts presented below is likely to include these user categories.

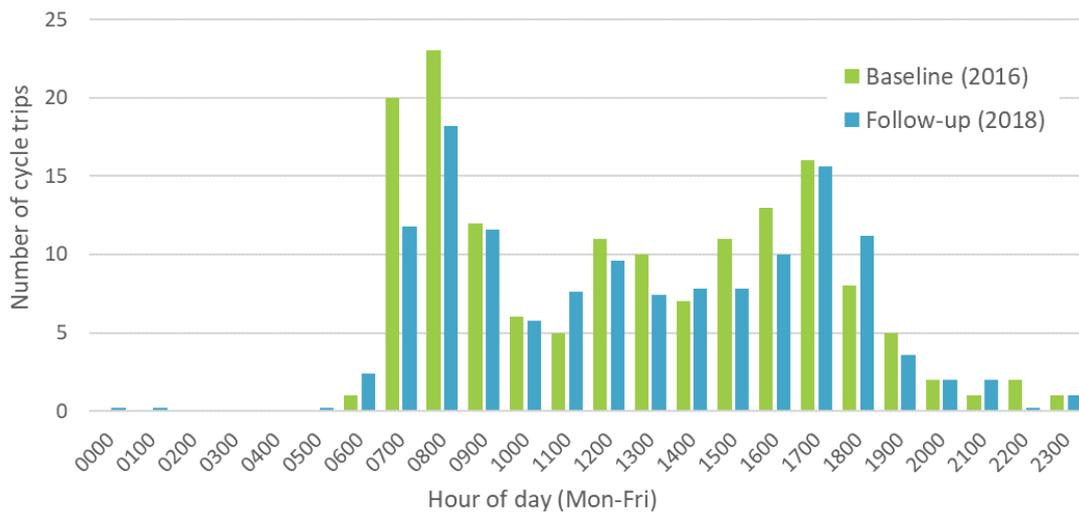
Figure 34 shows a slight decrease in the number of people on bikes travelling through St Patrick’s Square in the follow-up condition. Given the ongoing CRL works on Hobson Street and Albert Street, construction at the bottom of Federal Street, and the introduction of a parallel alternative cycling route on Nelson Street, this decrease is not discouraging.

Figure 34: Average daily cycle counts at St Patrick's Square (5-Day counts)



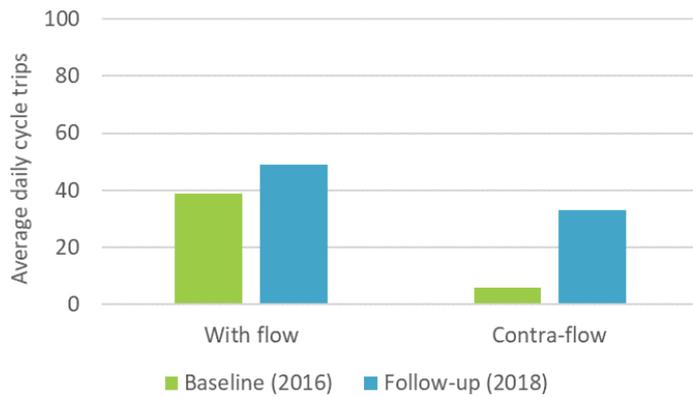
Cycle volume data at St Patrick's Square were analysed for the time of day that people on bikes were present (Figure 35). The follow-up condition is mostly aligned with travel patterns from the baseline condition, but it a marked drop in numbers travelling between 7-9am.

Figure 35: Bicycle volume through St Patrick's Square by time of day (5-Day counts)



Comparatively, the tube counters at location A showed an increase in cycle counts on the southern end of Federal Street since the baseline condition, particularly for people riding contra-flow (Figure 36).

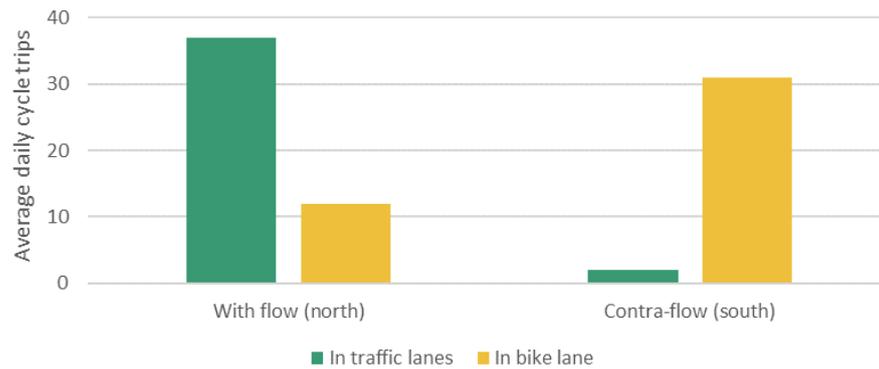
Figure 36: Average daily cycle trips at Upper Federal Street (5-Day counts)



### Road/bike lane use of people who cycle

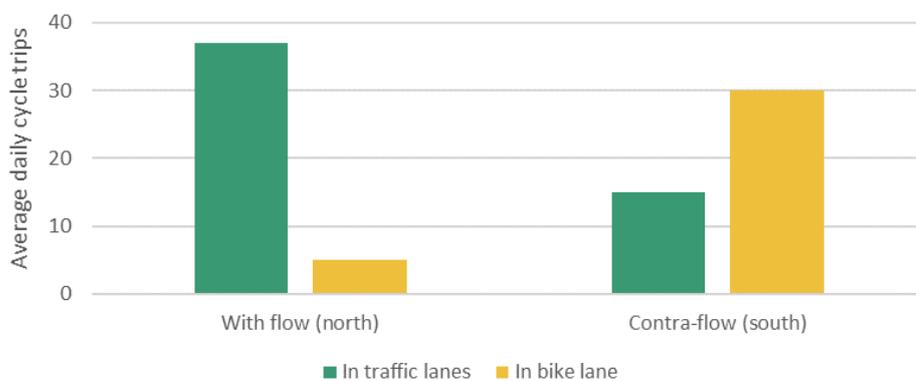
Figure 37 demonstrates that for people who cycled contra-flow at the southern end of Federal Street predominantly chose to ride in the bicycle lane. The introduction of the contra-flow cycle lane has therefore served to shift contra-flow-travelling people on bikes away from the road space and into a more protected location. To a lesser degree, some people on bikes travelling with the flow also opted to ride in the bike lane.

Figure 37: Use of cycle lane and traffic lane on the southern end of Federal Street



Results from the northern end of Federal Street show less of an uptake in the cycle lane than at the southern end, with road use being more retained (Figure 38). This is likely due to the construction that was present near Fanshaw Street which meant that a proportion – including the entrance - of the cycle lane was blocked during follow-up data collection.

Figure 38: Use of cycle lane and traffic lane on the northern end of Federal Street



## Bicycle speed

A summary of bicycle speed and volume at the three measurement points is provided in Table 4. Please note that at location E there was a tube failure in 2016 and no cycle counts or speeds were recorded for that time.

As expected, across both years cycle speed was marginally faster when travelling in a northern direction (downhill) than the southern direction (uphill).

Cycle speeds at location A were similar across both years. However, for people on bikes travelling with flow (north) but positioned in the contra-flow bike lane, their 85<sup>th</sup> percentile riding speed was slower (19 km/h) compared with those travelling in the same direction in the vehicle lane (25 km/h). At location E (lower Federal Street), there was little difference between the speeds of northbound people on bikes in and out of the bike lane.

At St Patrick's Square, people on bikes riding north tended to ride slightly faster than they did at baseline, while those biking south tended to ride marginally slower than the baseline speed. This could be explained by the weather conditions and the number of pedestrians in the Square.

Table 4: Summary data of cycle volume and speed

Location	Direction	85th percentile speed		Daily volume (5-Day average)	
		Baseline	Follow-up	Baseline	Follow-up
<b>A (Upper Federal Street)</b>	North - in bike lane (wrong way)	-	19.3km/h	-	12
	South - in bike lane	-	17.4km/h	-	31
	North - in traffic lanes	26.1km/h	25.0km/h	39	37
	South - in traffic lanes	17.8km/h	19.4km/h	6	2
<b>D (St Patrick's Square)</b>	North	15.2km/h	14.6km/h	88	78
	South	10.2km/h	12.7km/h	64	57
<b>E (Lower Federal Street)</b>	North - in bike lane (wrong way)	-	20.3km/h	-	5
	South - in bike lane	-	18.5km/h	-	30
	North - in traffic lanes	-	21.2km/h	-	37
	South - in traffic lanes	-	15.8km/h	-	15

### 5.1.1. Analysis of crash data

A CAS analysis of bicycle-involved crashes on Federal Street was undertaken. No new crashes have occurred since 2016. In the last ten years, one bicycle-involved crash was recorded on Federal Street (Figure 39), involving a reversing police car entering the driveway at the Courts. An analysis of crashes on Albert Street between 2006 and 2016 revealed 4 crashes involving people on bikes in that timeframe.

Figure 39: Location of 2015 crash



### 5.1.2. Road usability and road user interactions

Video footage from a camera positioned at the southern end of Federal Street facing north (towards St Patrick’s Cathedral) was analysed to understand how people on bikes use the street, and also to describe their interactions with other road users. Please note that all numbers and behaviours of people on bikes described in this section relate to observations from the video only and cannot be extrapolated to other locations on Federal Street.

#### Road position and movement of people who cycle

Over two thirds of the people on bikes who were analysed in the video footage travelled with the flow, both at baseline and at follow-up. Just under 30% rode contra-flow, and very few rode straight along Kingston Street (Table 5).

Table 5: Number of people on bikes recorded travelling in each direction

	Baseline (2016)	Follow-up (2018)
With flow	59	73
Contra-flow	25	28
Along Kingston Street	2	1
Total analysed	86	102

Footpath cycling was not uncommon in the 2016 analysis, with 7 examples recorded (note one footpath was partially closed). In 2018, no people on bikes went all the way along Federal Street on the footpath, though many crossed over it or used it for short sections before or after exiting driveways along the street.

People riding with the flow usually rode straight down the centre of the road both at baseline and follow-up. At follow-up, 3 people on bikes used the contra-flow bike lane all the way down Federal Street (i.e. in the wrong direction) and 4 travelled in the central traffic lane for most of the way, then moved into the contra-flow bike lane just before they reached Wyndham Street.

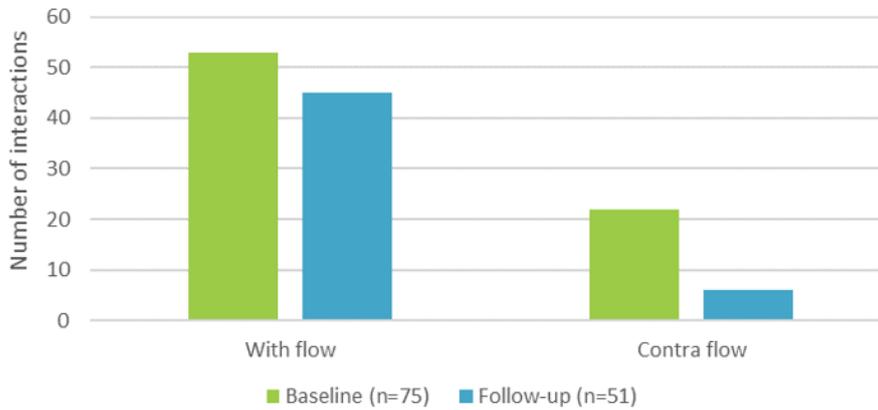
In 2016, people riding contra-flow tended to ride up Federal Street along the edges of the road or on the footpath. With the introduction of the bike lane at follow-up, most people riding contra-flow used the bike lane for all, or most of their ride (86%). A few people used a mix of the road, footpath, and contra-flow bike lane, particularly those exiting the driveway on the west side of Federal Street.

In summary, the predominant movement in 2018 is on the ‘proper’ facility, i.e. most people are riding all the way up in the contra-flow bike lane (86%), or all the way down the middle of the street (70%).

## Road user interactions

Overall, there were fewer interactions between people on bikes and other road users at follow-up. The biggest decrease was observed in interactions for people on bikes who were travelling contra-flow (Figure 40, Table 6).

Figure 40: Interactions by direction of travel



In 2016, 65% of people on bikes who were travelling up or down Federal Street interacted with another user, compared to only 41% in 2018 (Figure 41, Table 6).

Figure 41: Number of people on bikes in each direction who interacted with another road user

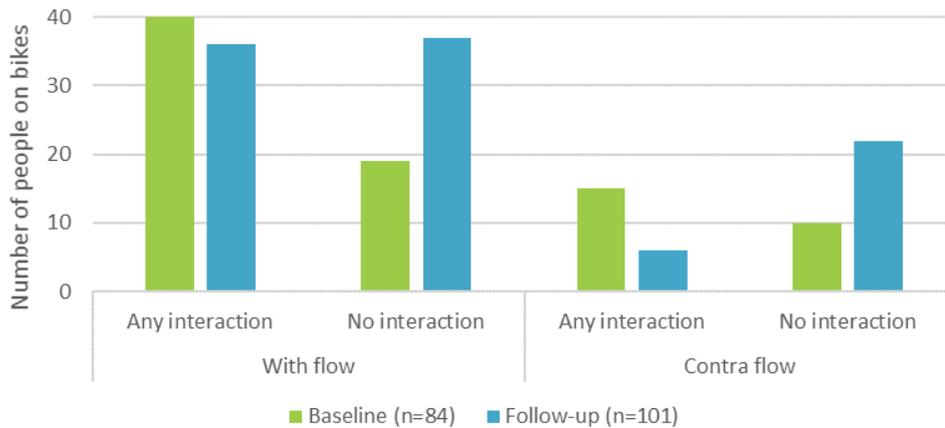
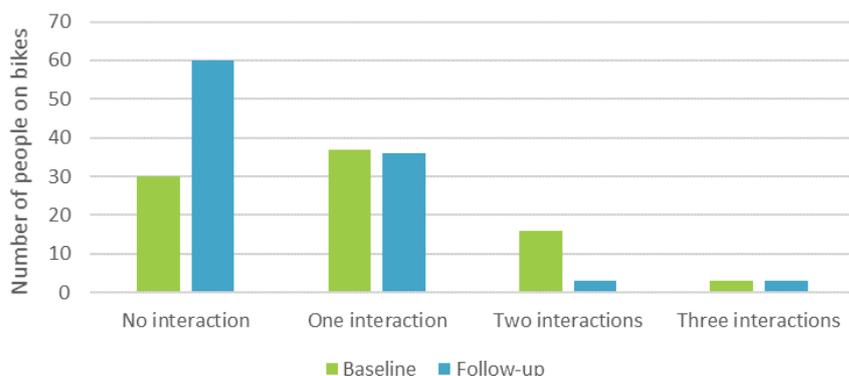


Table 6: Summary of location and interaction data

		Baseline	Follow-up
<b>With flow</b>	Any interaction	40	36
	No interaction	19	37
	<b>Total with-flow</b>	<b>59</b>	<b>73</b>
<b>Contra-flow</b>	Any interaction	15	6
	No interaction	10	22
	<b>Total contra-flow</b>	<b>25</b>	<b>28</b>
<b>Other direction (along Kingston Street)</b>	Any interaction	1	0
	No interaction	1	1
	<b>Total other</b>	<b>2</b>	<b>1</b>
<b>Total people on bikes who had any interaction</b>		<b>56</b>	<b>42</b>
<b>Total people on bikes who had no interaction</b>		<b>30</b>	<b>60</b>

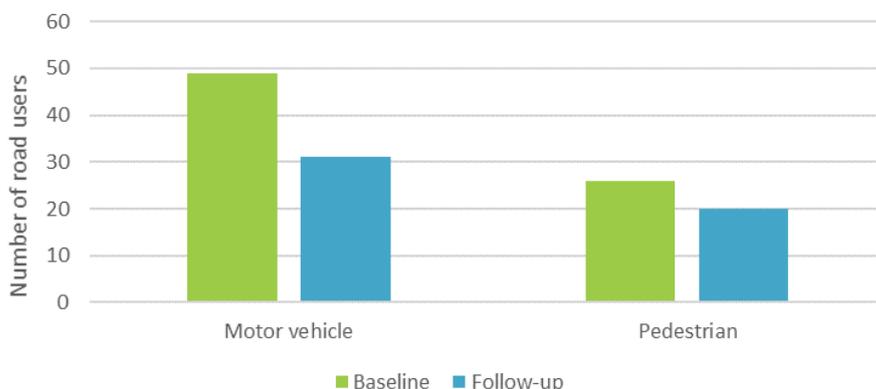
People on bikes who interacted with other roads users were less likely to have multiple interactions at follow-up than at baseline (Figure 42). Of those people cycling who interacted multiple times with other road users at baseline, 5 were travelling contra-flow compared to none at follow-up.

Figure 42: Number of interactions per person on a bike



Motor vehicles were involved in fewer interactions with people on bikes at follow-up. No interactions with motorcyclists were recorded either at baseline or follow-up (Figure 43).

Figure 43: Types of road users involved in interactions with people on bikes



### Nature of interactions

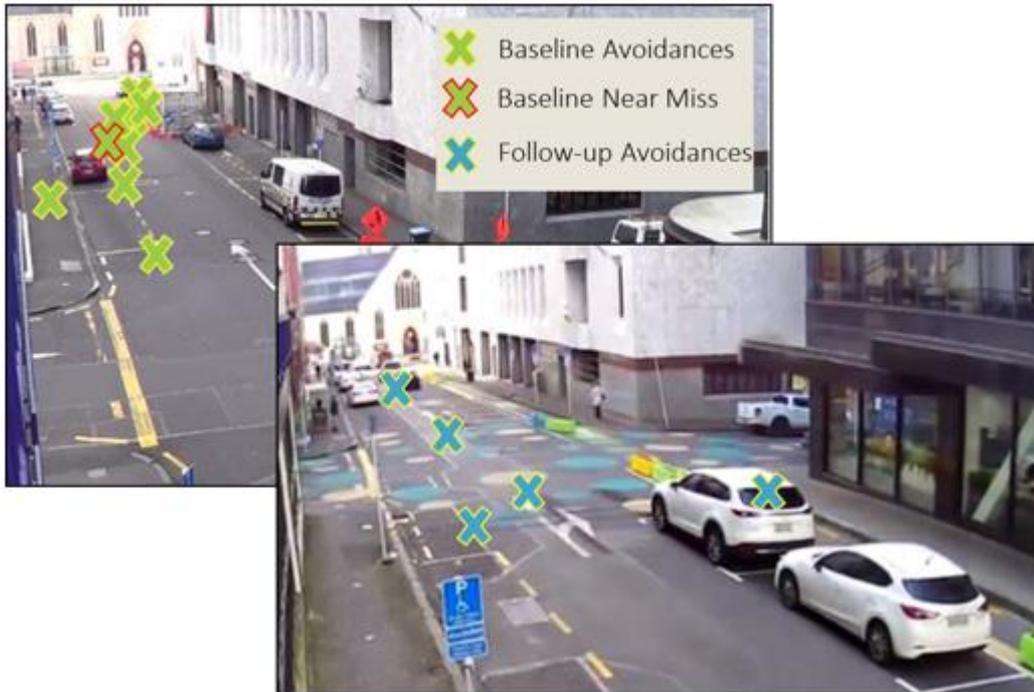
Table 7 shows that standard encounters made up the majority of all interactions analysed. There were fewer avoidances at follow-up (5 compared to 8 at baseline), and no near misses (compared to 1 at baseline)

Table 7: Types of road user interactions

Interaction type	Baseline	Follow-up
Standard encounter	66	46
Avoidance	8	5
Near miss	1	0
Collision	0	0
<b>Total interactions</b>	<b>75</b>	<b>51</b>

In the 2016 video analysis, avoidances were focused at the northern end of upper Federal Street, with several related to visibility near the car park driveways. Parked car doors were also identified as a risk at baseline. In contrast, several interactions in 2018 occurred at the Kingston Street intersection (Figure 44).

Figure 44: Comparison of avoidances and near miss interactions at baseline and follow-up



Failure of vehicles at Kingston Street to give way to people on bikes was observed in the video analysis (Figure 45), and was experienced by an expert rider travelling contra-flow in the cycle lane.

Figure 45: Avoidance - left turning car does not give way to person on a bike



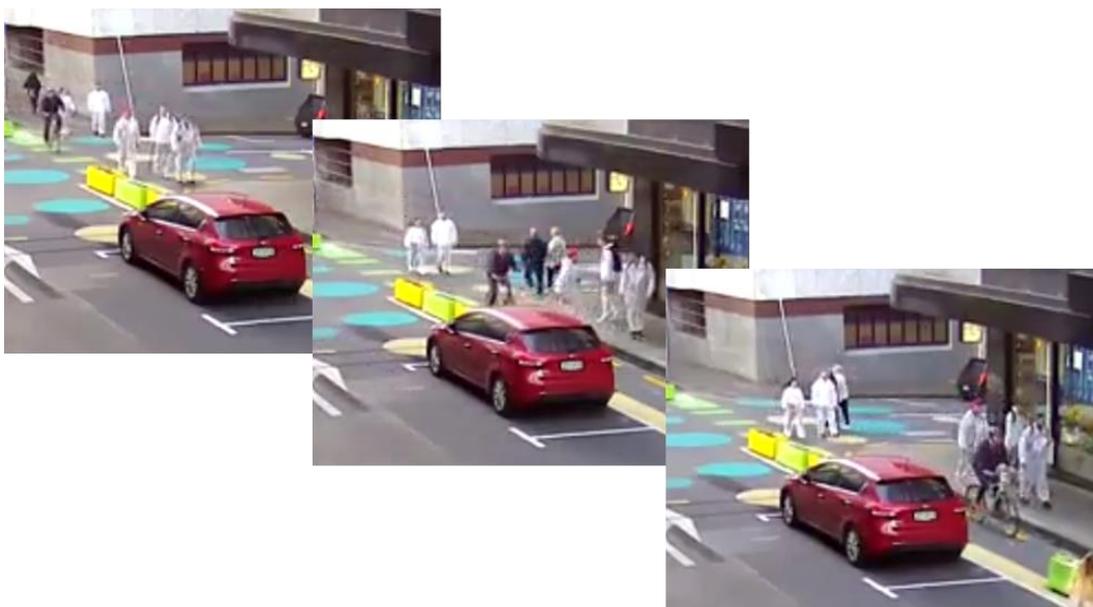
Many interactions, particularly avoidances, at both baseline and follow-up were related to visibility issues for cars and people on bikes turning out of Kingston Street, and driveways along Federal Street. In addition, it was common to observe heavy vehicles parked near the Kingston Street intersection, meaning that vehicles stopped at Kingston Street do not have adequate views of the oncoming road users (Figure 46).

Figure 46: Parked heavy vehicle obscuring road users' view of the intersection



One avoidance was recorded between a person on a bike and pedestrians positioned in the cycle lane (Figure 47). Although this was only captured once on video, events of this nature were described in the surveys with people on bikes, and during the expert ride. In the example pictured here, the footpath is not wide enough to support the pedestrians walking together.

Figure 47: Avoidance – person cycling and pedestrian



Overall, people cycling were more likely to respond than vehicles in interactions both at baseline and at follow-up (for example, by braking or negotiating around a vehicle in their path). Pedestrians were more likely to give way to people on bikes (usually when crossing the road) at follow-up.

The movements of people on bikes in the follow-up condition appear more controlled and less 'risky'. The presence of the contra-flow lane appears to be supporting a safer environment for people cycling.

### 5.1.3. Attitudes of road safety, usability, and comfort

The majority of survey responses are provided in this section. However, respondents were given the opportunity to provide open-ended feedback and, where relevant, some of the themes which emerged are presented in later sections as they better relate to those findings.

Two organisations who support people with mobility impairments were approached over the course of this research to comment on the new street layout. Unfortunately, we were unable to secure an interview or feedback from them. However, during AT's broad public consultation regarding the changes at Federal Street, some key themes regarding mobility issues were cited. They are summarised alongside the survey responses in this section.

#### **Survey respondents: People on bikes**

A total of 17 people on bikes were surveyed at baseline and 20 at follow-up. The majority of respondents were commuting to or from work (76% at baseline, 70% at follow-up), and this is likely to be a result of sampling bias, relating to the times of that that surveys were conducted. At baseline, 61% of surveyed people cycling were riding contra-flow (south), compared to 55% at follow-up. Sampling locations and times may have influenced these numbers. Most people on bikes (85%) already cycled on Federal Street before the changes. Of the three who did not, only one said that the presence of the contra-flow lane influenced her decision to ride on this street.

Gender and age data were not collected in the baseline survey, but they were collected in the follow-up survey. In the follow-up survey (n=4) respondents were female.

The most commonly given reason for choosing Federal Street over surrounding streets both at baseline (53%) and follow-up (55%) was the riders' perception that it was as the most direct route. In addition, Federal Street has numerous destinations for people who cycle (particularly car parks), or for bicycle couriers, and therefore 47% of baseline and 30% of follow-up respondents were travelling to a destination on Federal Street when they were surveyed. Federal Street as a 'destination for people who cycle' was also confirmed in the video observations and on-site observations. This will be described more in the discussion.

#### **Survey respondents: Pedestrians**

A total of 46 pedestrians were surveyed at baseline and 50 at follow-up. Some pedestrians commented that they chose to walk down Federal Street instead of Albert Street as it was quieter and more comfortable.

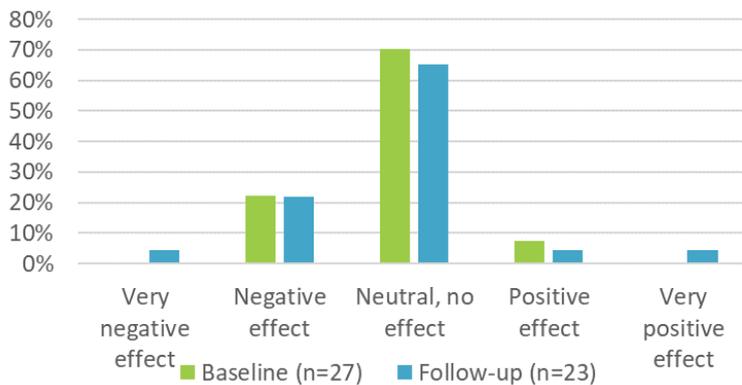
#### **Survey respondents: Businesses**

A total of 29 businesses surveys were completed at baseline and 23 at follow-up. Please note that many employees in the businesses surveyed accessed their workplace on foot and were therefore affected by the street changes on their daily commute in addition to during working hours.

The effect of the CRL works on neighbouring streets was reported in the survey to have had a negative impact on businesses, and this was observed during the surveys as many of the original businesses surveyed in 2016 were no longer operational in 2018.

For the business respondents, there was a marginal shift to both extremes (very negative versus very positive) in the follow-up condition regarding the effect of the street layout on the business (Figure 48). Some respondents commented that the changes made the street more attractive, whilst others cited some key issues that negatively impacted them. Where relevant, these are discussed in more detail throughout this section.

Figure 48: Business survey – How does the present street layout affect this business?



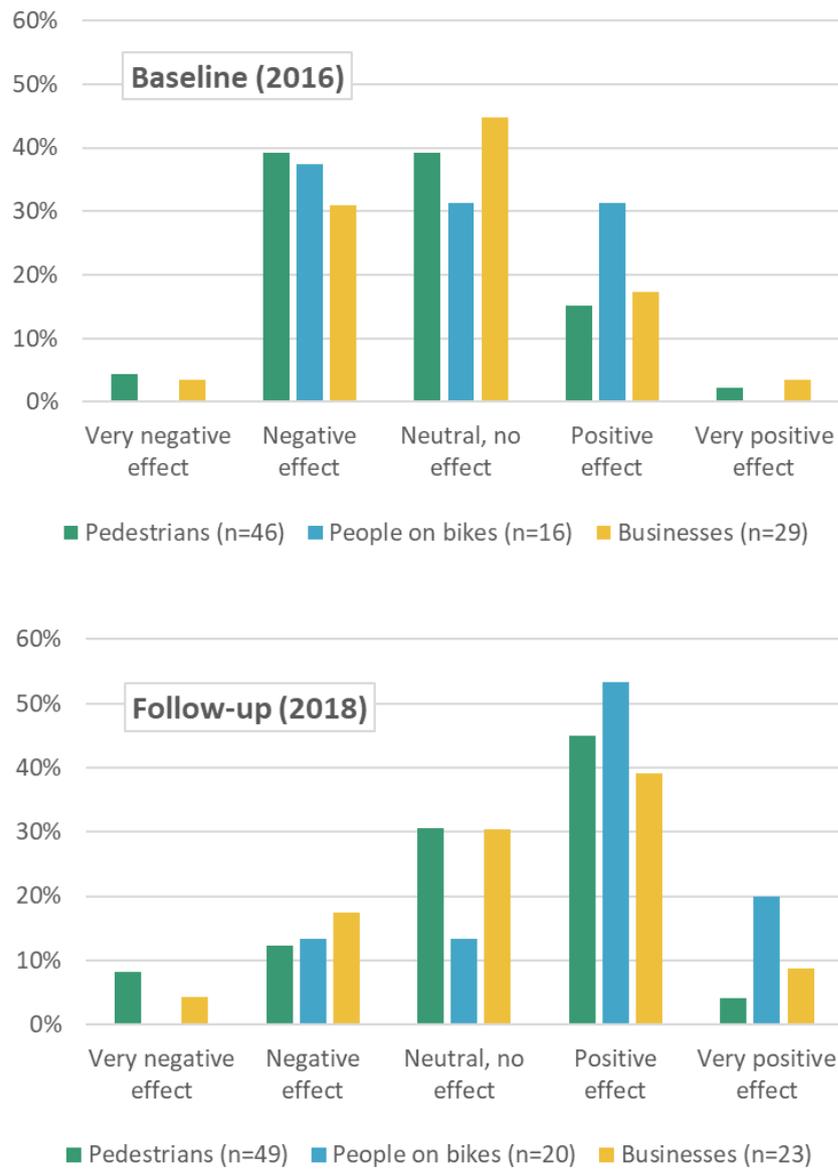
### Perceptions of safety

All survey respondents were asked to comment on how the layout of the street affected the physical safety of those who used it (Figure 49). Across all user types there was consensus that in the follow-up condition, the layout of the street afforded better safety outcomes for its users. Of all respondent types, perceptions of safety improved the most for people cycling (around 1/3 felt that the street had a positive or very positive effect at baseline, compared to over 3/4 at follow-up<sup>6</sup>).

A theme which emerged from the open-ended survey questions related to perceptions of personal safety. During the day, Federal Street was perceived to be safe. However, some respondents raised concerns about their personal safety at night due to a lack of passive surveillance, a lack of adequate street lighting, and the presence of homeless people.

<sup>6</sup> Note that these findings are based on relatively low response rates.

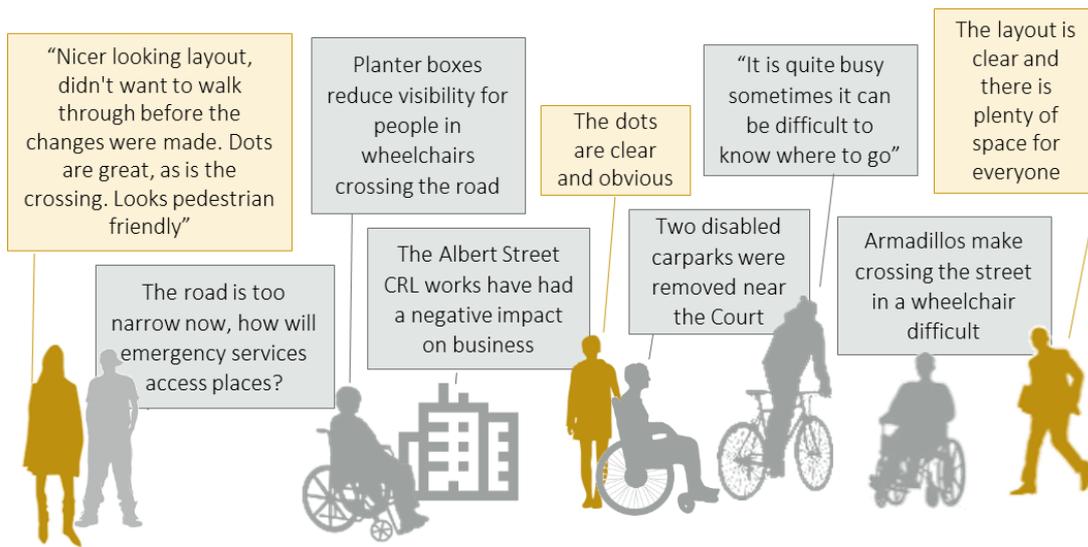
Figure 49: All respondent types - “How does the present street layout affect the safety of people using the street?”



### New street layout

The themes which emerged from the survey comments relating to the new street layout are summarised in Figure 50. Themes were developed by user type and therefore each comment will be associated with either a pedestrian, person cycling, or business silhouette. Please note orange comments refer to positive attributes and grey comments to negative attributes.

Figure 50: Survey respondent comments – New Street Layout



For pedestrians, the perceived comfort of Federal Street improved following the street changes (Figure 51). The zebra crossing at Wyndham Street was referenced both in relation to improved safety and comfort. In addition, pedestrians cited the bright colour palette selected for the street as having a positive influence on their perception of the street.

Negative aspects of the design related to the armadillos being a trip hazard and confusion surrounding the meaning of the dots (pedestrians unsure if they had right of way). In addition, it was noted that whilst amenity for people who cycle had been greatly improved, this was not replicated for pedestrians and footpaths remained narrow and with an uneven surface condition.

Figure 51: Pedestrian survey – How comfortable is Federal Street to walk along?

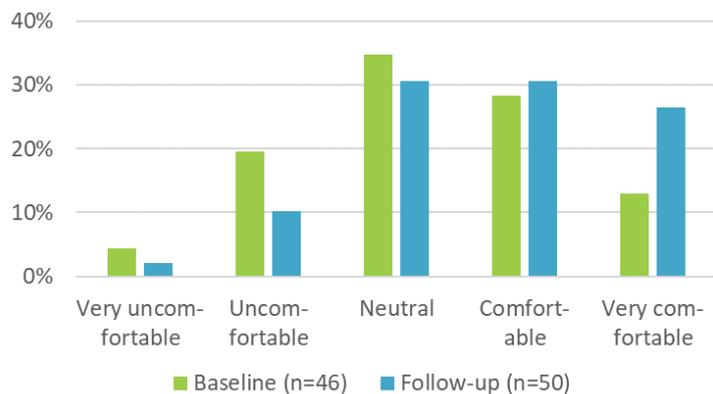
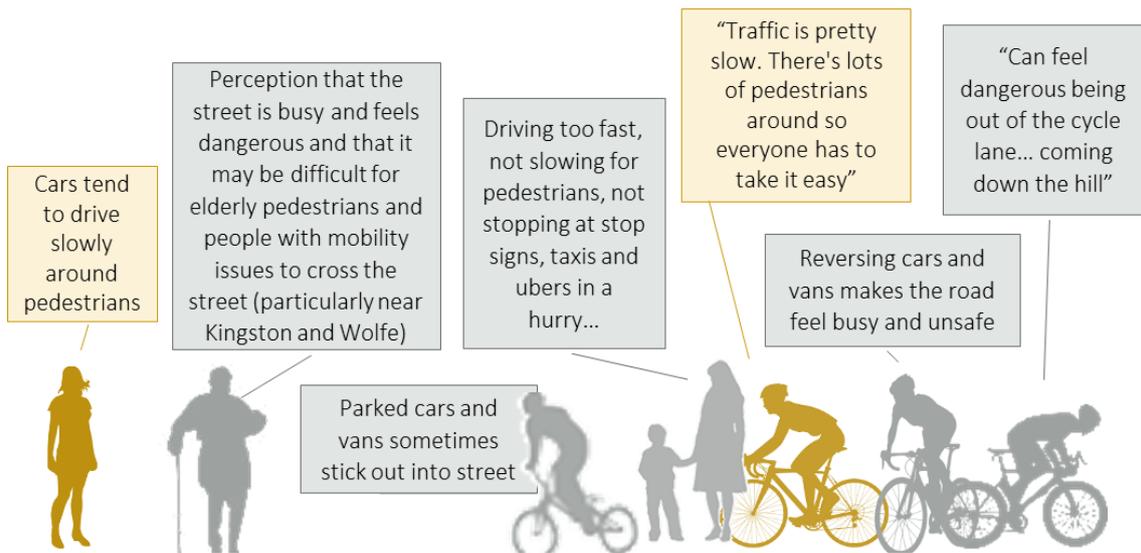




Figure 54: Survey respondent comments – Vehicles and driving behaviour



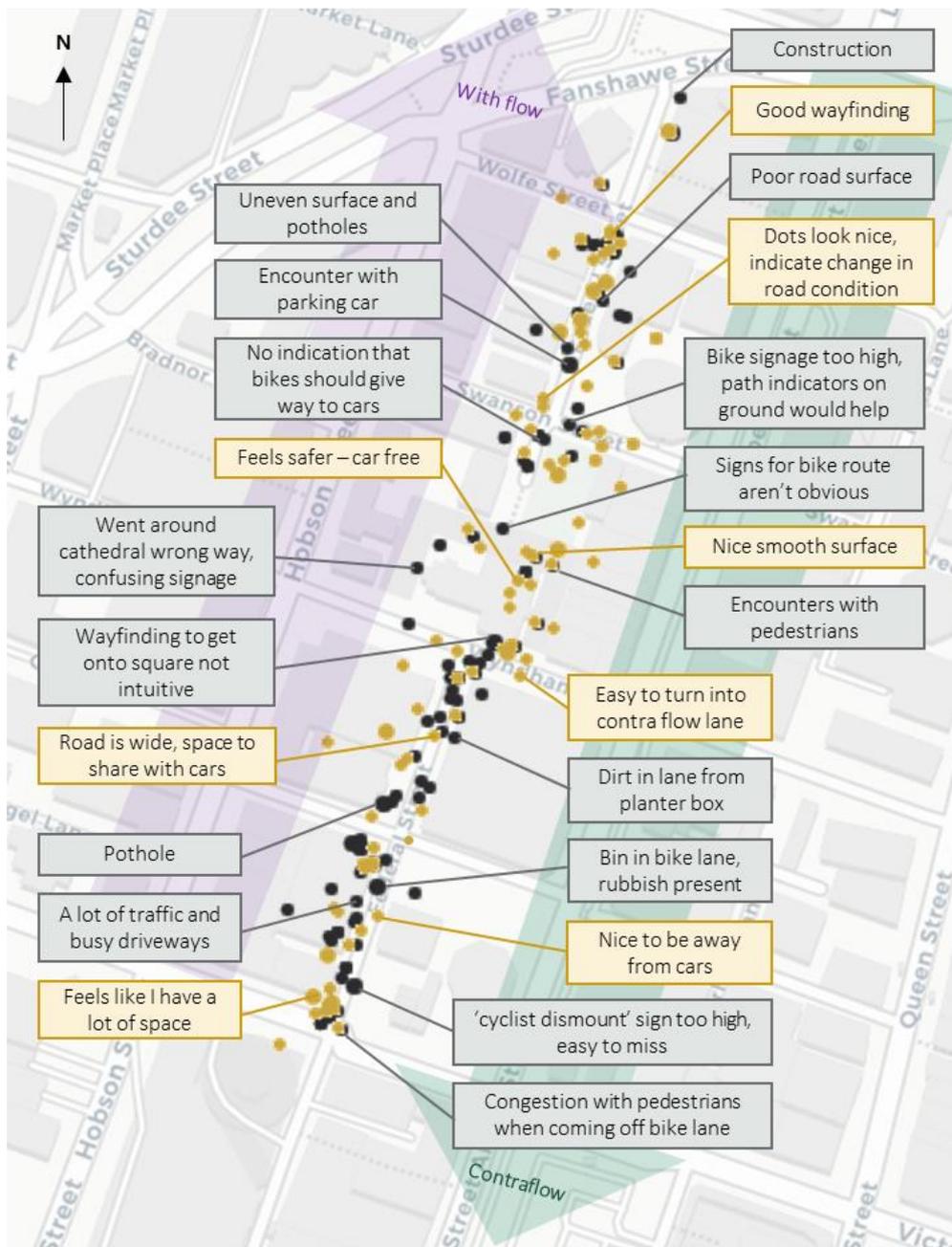
#### 5.1.4. Expert route assessment for safety, usability, and comfort

The Sensibel exercise had an output of 61 records with the flow and 250 records in the contra-flow direction. Participants had the opportunity to annotate their comments following the ride and the key themes or comments relating to particular locations are presented in the map below (Figure 55). In general, themes related to maintenance, wayfinding, interactions with vehicles at intersections, and the quality of the road’s surface.

The expert ride identified three key safety issues:

- The presence of the cycle lane on the southern end of Federal Street has narrowed the street for traffic. This means that trucks turning left from Kingston Street have less room to manoeuvre than they previously did.
- Larger parked vehicles remove sight lines for pedestrians and people on bikes. Vehicles exiting driveways are not always obvious, or aware of vulnerable road users. Warning lights and alarms are helpful, but more could be implemented along Federal Street. These safety issues have not been addressed in the street upgrade.
- Prisoner transfer vehicles reverse into transfer point behind the High Court. They frequently reverse over the contra-flow cycle lane. The Court garage has no warning lights or alarm and this is a safety concern. This safety issue has not been addressed in the street upgrade.

Figure 55: Sensibel output with annotated comments. Orange indicates positive and black indicates negative



### 5.1.5. Resilience and maintenance

Several business respondents admitted to feeling obliged to maintaining the planter pots as otherwise the “look and feel” of the street – and by association their business - would be compromised. Planter pot maintenance included: removing cigarette butts, straightening the pots, and up-righting knocked over pots. These issues were reinforced by pedestrian surveys, surveys with people on bikes, and during the expert ride (Figure 56, Figure 57, Figure 58, Figure 59, and Figure 60).

Figure 56: Dirt from planter box in the bike lane



Figure 58: Planter boxes are regularly misaligned and may encroach into the vehicle or cycle lane

Figure 57: Graffiti on planter box



Figure 59: Signs of wear on the newly painted surfaces



Figure 60: Survey comments regarding maintenance issues

