Evaluation of Veloway 1: Stage D

Prepared for Queensland Department of Transport and Main Roads

CDM RESEARCH

Contents

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Executive Summary

The Department of Transport and Main Roads (TMR) commissioned CDM Research to undertake an evaluation of Stage D of the Veloway 1 bikeway. The project extends from south of O'Keefe St (Buranda) to Lewisham St (Greenslopes), and in conjunction with subsequent project stages will provide a contiguous high-quality cycleway from Eight Mile Plains to the Brisbane River. The project length is around 1.4 km and has bridges over Cromwell St, Juliette St and Lewisham St. The estimated outturn cost is around $24 m. The high project cost was motivated by the presence of the three bridges and the costs associated with retrofitting the infrastructure within a highly constrained corridor.

Two fieldwork activities were undertaken to obtain input data for the evaluation:

- video-based manual counts classified by mode, direction of travel and time of day from Tuesday 20 March to Monday 26 March 2018, and
- intercept surveys with path users undertaken on two weekdays and two weekend days (Monday 23 April, Tuesday 24 April and Saturday 28 April 2018).

The counts and surveys were undertaken at the at-grade crossing of O'Keefe Street in Buranda, just north of the project. In addition, two regular commuter riders provided GPS trip data from the Ekibin Park route (prior to opening of Veloway 1 Stage D) and the new Veloway 1 route.

The key results of this evaluation were as follows:

- Average daily traffic between 6 am and 8 pm on the Veloway of around 957 users, of which almost all are bicycle riders. The cycleway is predominantly used for transport on weekday peak periods and recreation on weekends.
- Almost all users (95%) indicated they previously rode along the older path through Ekibin Park, with the remainder indicating they would otherwise have used public transport. No users indicated they would otherwise not have ridden at all. At this early stage (four months after opening) it appears there has been at best limited mode shift towards cycling and no all-new cycling trips generated based on the intercept surveys.
- Most bicycle riders travelling for transport indicate they have access to a car (72%) or convenient public transport (59%) for their journey. For these travellers riding is a choice, not a necessity. It follows that by choosing to ride they are providing marginal road decongestion and public transport crowding benefits given that they are generally travelling at peak periods of the day when the road and public transport networks are operating at or near capacity.
- The manual counts near the Greenslopes Bus Station and the automatic counts in Ekibin Park (north of Ridge St) provide some suggestive evidence of an increase in cycling activity; for the first five months of 2017 there were 1,054 riders per day in Ekibin Park. Over the five-day counting period in April 2018 after opening Stage D there were 272 riders per day in Ekibin Park and 951 riders/day using Veloway 1.

This total of 1,223 riders per day is 16% greater than the total observed in Ekibin Park prior to opening Veloway 1.

- The cyclist level of service has significantly improved due in large part to the absence of corners and interactions with pedestrians. Our level of service modelling suggests a typical rider would previously have incurred a delay every 8.5 minutes riding through Ekibin Park due to having to pass other path users. This has increased to 9.8 minutes for riders who continue to use Ekibin Park (as there are fewer riders) and the model suggests delays are largely non-existent on Veloway 1. The result is that the level of service for riders in Ekibin Park has improved from D to C, and to A for those using Veloway 1. These estimates are consistent with the intercept survey results, where almost all respondents indicated they felt much more comfortable using Veloway 1 than Ekibin Park. Asked why they felt this way, most respondents mentioned the absence of pedestrians (63%) and that it was more direct (35%) and faster (32%).
- The level of service estimates provided in this report are for bicycle riders only – it is very likely that pedestrians using Ekibin Park will perceive a significant improvement in their level of service given the absence of many riders (and particularly faster commuter and sport cyclists).
- The 1.4 km Veloway 1 Stage D route is around 400 m shorter than the Ekibin Park alternative, but also facilitates higher rider average speeds given the path width and absence of corners and pedestrians. Travel time surveys along both routes suggest an average travel time benefit of 95 seconds can be attributed to Veloway 1.
- The cost-benefit analysis suggests the project does not represent good value for money; the BCR for the central discount rate of 7% was 0.4 assuming a 25% reduction in pedestrian injuries attributable to the removal of many riders from Ekibin Park. Under no reasonable set of assumptions would the BCR reach 1.0.
- The key reason for the relatively poor BCR is the very high capital cost of the project. The observed travel time benefits are insufficiently large, and spread across too few users, to compensate for this capital cost. Other reasons include the absence (at this stage) of significant diversion from car or public transport and the absence of all-new cycling trips (both of which would contribute significant health benefits). In addition, it is difficult to robustly estimate the safety benefits that will accrue to bicycle riders from the project; while it is very likely to risk of cyclist-cyclist and cyclist-pedestrian collision is reduced, we cannot be confident in the quantum of this reduction. Moreover, this project differs from many others insofar as we are not providing an off-road facility to eliminate the motor vehicle-cyclist collision risk.
- The cost-benefit analysis does not account for many additional factors, which may be more than sufficient to justify the project on non-monetary terms. Further, we suggest that while individual stages of the wider Veloway 1 project may not be economically justified in *combination* the stages may produce net benefits which exceed the benefits of each stage individually (i.e. there is a package effect).

- The sole remaining obstacle to cyclist travel along the corridor from Greenslopes to the city is the at-grade crossing of O'Keefe Street. During weekday peak periods 57% of riders incur a delay at this intersection of at least five seconds, and the average delay is 17 seconds. Given the cyclist volumes a grade-separated crossing is unlikely to be justified on the basis of rider travel time savings alone. Instead, it would be necessary to consider also the delays incurred by motorists and the potential safety benefits.

1 Introduction

1.1 Background

CDM Research was commissioned by the Queensland Department of Transport and Main Roads (TMR) to undertake an evaluation of Stage D of the Veloway 1 project. The project extends from south of O'Keefe St (Buranda) to Leiwsham St (Greenslopes), and in conjunction with subsequent project stages will provide a contiguous high-quality cycleway from Eight Mile Plains to the Brisbane River (Appendix C). The project consists of a 3.5 m wide concrete path of around 1.4 km with bridges over Cromwell St, Juliette St and Lewisham St (Figure 1.1). The estimated outturn cost is around $24 m.

■ **Figure 1.1: Veloway 1 Stage D (green) and pre-existing path through Ekibin Park (blue)**

1.2 Methodology

This evaluation used the cost-benefit analysis (CBA) methodology adopted nationally as part of the Australian Transport Assessment and Planning (ATAP) guidelines established by the state road agencies. The approach has been adapted for TMR and implemented as an online tool (CDM Research 2016). [1] The methodology requires a number of inputs, of which the most important are:

- average daily cyclist counts,
- average distances ridden, and
- diversion rates and induced travel proportions.

The latter refer to the proportion of demand that:

- was already riding before the project, and have changed their route to use the project,
- have diverted from other transport modes (e.g. private car, public transport), and
- all-new trips that would not have otherwise occurred in the absence of the project.

To obtain these input parameters two fieldwork activities were undertaken:

1. video-based manual counts classified by mode, direction of travel and time of day from 6 am to 8 pm between Tuesday 20 March and Monday 26 March at:
    a. the T-junction between the new Veloway route and the pre-existing path to Ekibin Park near Greenslopes Bus Station, and
    b. the pre-existing path through Ekibin Park immediately north of Juliette St,
2. intercept surveys with path users at the signalised crossing of O'Keefe St:
    a. 6:30 - 9:30 am and 3:30 – 6:30 pm, Monday 23 April
    b. 6:30 - 9:30 am and 3:30 – 6:30 pm, Tuesday 24 April, and
    c. 6:30 – 9:30 am, Saturday 28 April 2018.

The fieldwork was undertaken around four months after the official opening of Stage D.

This report first presents the summary data obtained from the fieldwork activities before then providing the output of the cost-benefit analysis.

[1] https://cdmresearch.shinyapps.io/ActiveTravelBenefits/

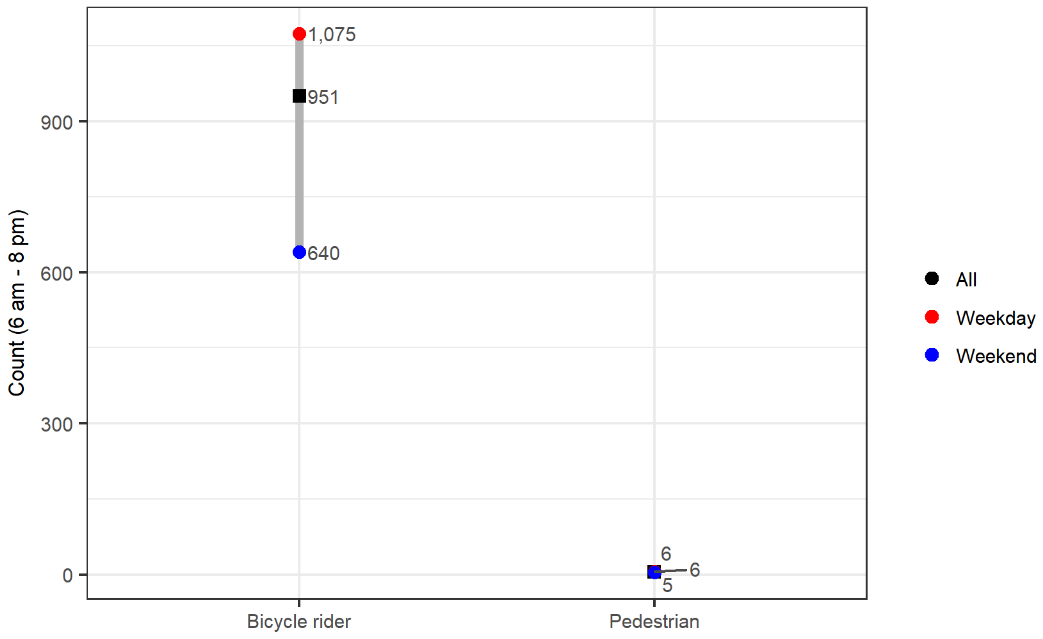
2 Counts

Video-based manual counts were obtained at the southern end of Veloway 1 Stage D near Greenslopes Bus Station. During the counts observation period there was a significant rainfall event that suppressed the counts on at least two weekdays:

- Thursday 22 March (28 mm rainfall in 24 hours preceding 9 am)
- Friday 23 March (6 mm rainfall in 24 hours preceding 9 am)

These two days were observed to have substantially lower cyclist activity than the other days, even compared with the Wednesday when there was 13.6 mm of rainfall. For the purposes of this evaluation these two days are considered to be outliers and are disregarded in the analysis that follows.

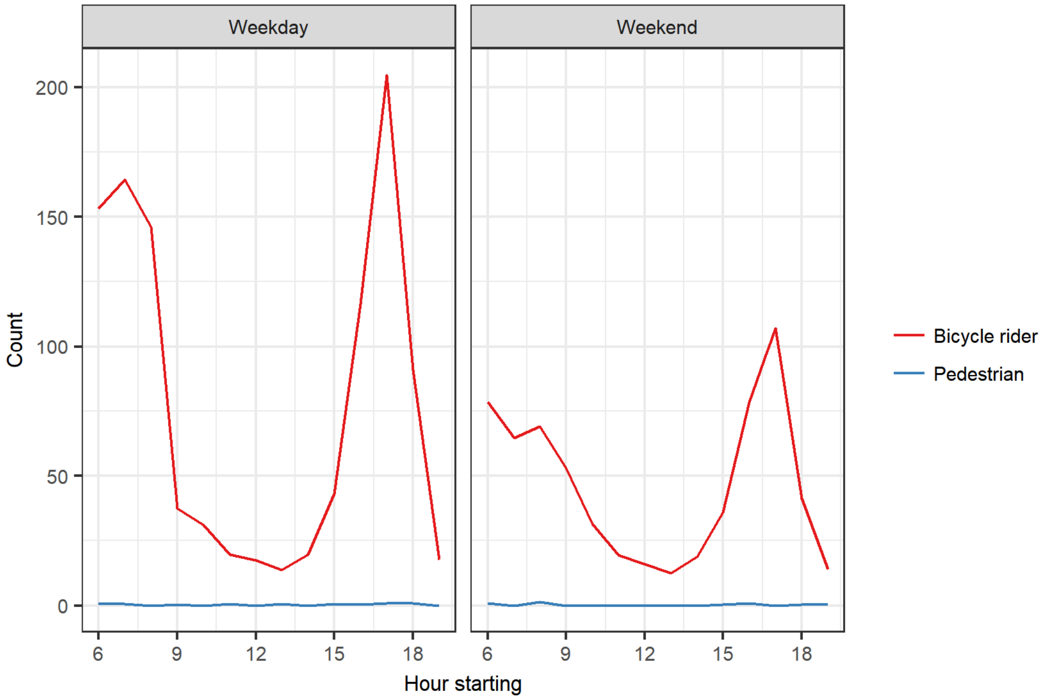
Only movements across the Lewisham St bridge are presented here. The average daily count on the bridge over the count period was 951 users per day[2], of which almost all were bicycle riders (Figure 2.1). Average demand on weekdays was 67% greater than weekends.



■ **Figure 2.1: Average count by mode and day of week**

[2] Note the counts were from 6 am to 8 pm, or 14 hours such that they do not correspond to a 24-hour day. Full 24-hour counts will be slightly higher.

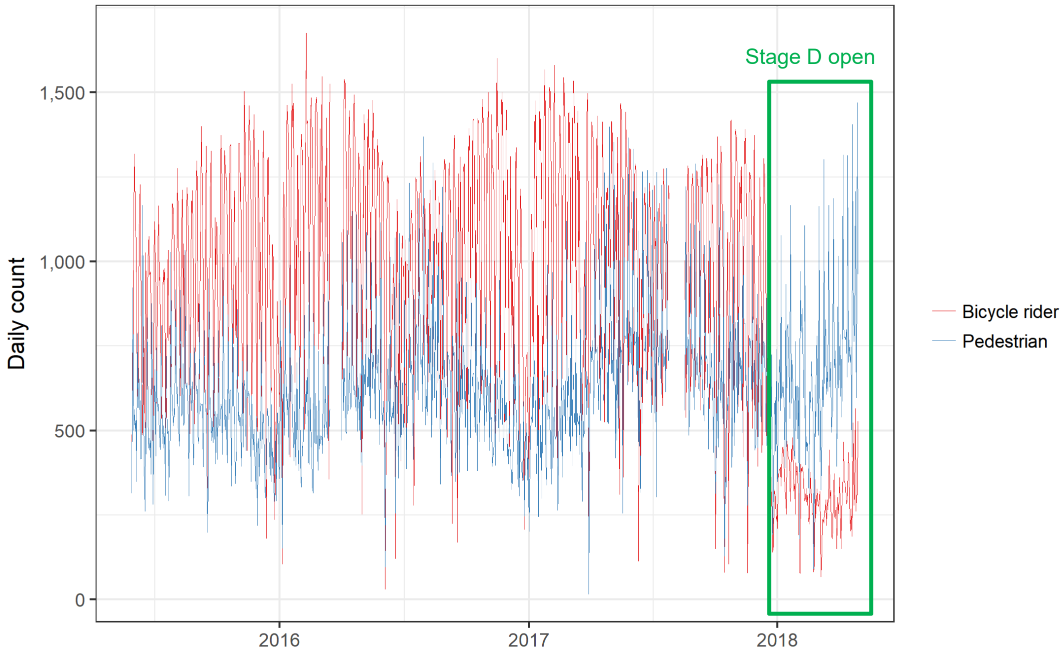
The time of day profile suggests demand is strongest during mornings and afternoons on both weekdays and weekends (Figure 2.2). This reflects the commuter demand profile on weekdays.



■ **Figure 2.2: Time of day by day of week (hourly bins) for all modes**

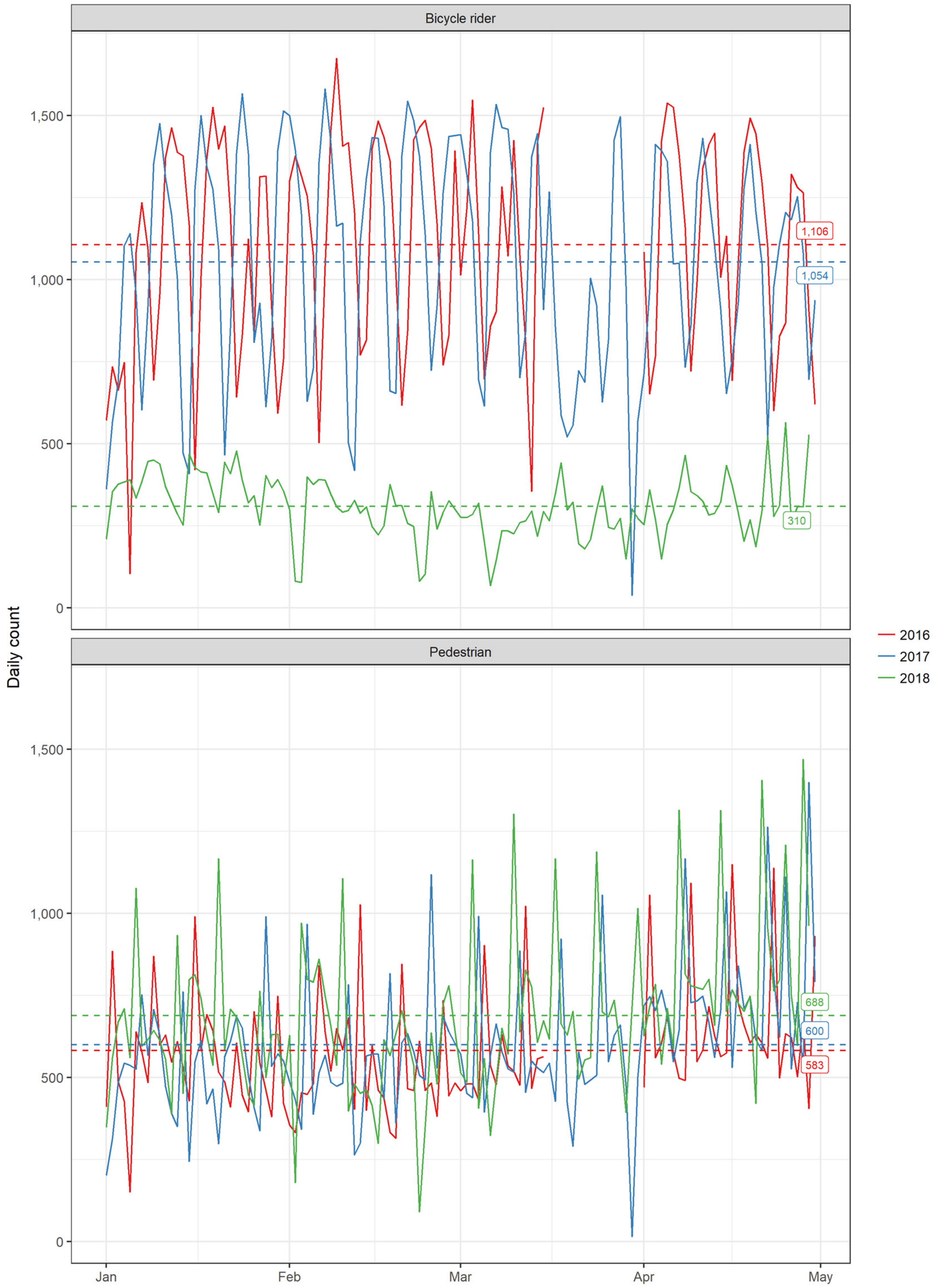
2.1 Diversion from Ekibin Park

The Veloway 1 Stage D provides a higher quality and more direct cycling route towards the Brisbane CBD than the narrow and winding shared path that runs through Ekibin Park (Figure 1.1). As such, we would expect many bicycle riders would divert to the Veloway. An automatic cyclist and pedestrian counter operated by Brisbane City Council is positioned around 180 m north of Ridge St near Victoria Tce. This counter provides cyclist and pedestrian counts from mid-2015 to present and shows a precipitous decline in cyclist usage from 21 December 2017 (Figure 2.3). This decline in cycling demand was not matched by any clear change in pedestrian demand.

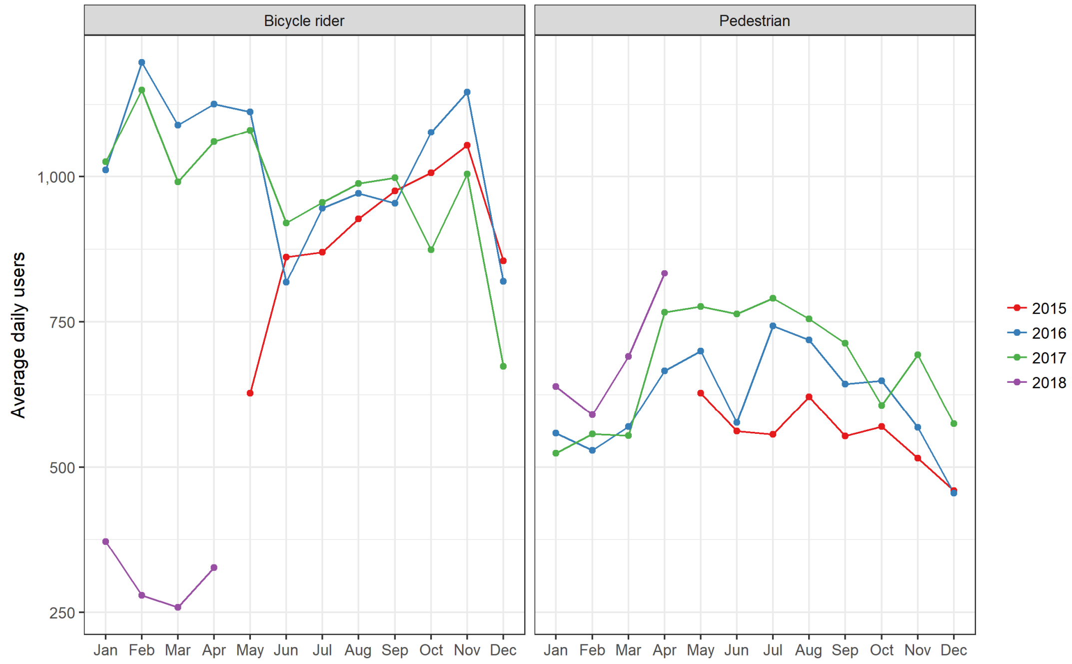


■ **Figure 2.3: Cyclist and pedestrian counts in Ekibin Park (source: BCC automatic counter)**

The decline is further demonstrated by comparing January to April 2018 (after the opening of the Veloway) with comparable periods in 2016 and 2017 (Figure 2.4). Cyclist demand averaged around 310 riders/day after the Veloway opened, compared with just over 1,000 riders/day in the two years preceding the opening of the Veloway. At a monthly level the impact on cyclist demand is clearly evident, and there is no significant impact on pedestrian demand (Figure 2.5).



■ **Figure 2.4: Cyclist and pedestrian demand by time period (source: BCC automatic counter)**



■ **Figure 2.5: Average daily users by month (source: BCC automatic counter)**

There is some evidence from these counts to suggest there has been a net increase in cycling activity in the corridor:

- Over the five days of manual counts on Veloway 1 there were an average of 951 riders per day. On the same days the Ekibin Park automatic counter detected 272 riders per day, giving a total of 1,223 riders per day.
- In 2017, before the opening of Stage D, between January and May there were 1,054 riders per day travelling through Ekibin Park (Figure 2.4).
- This comparison suggests an increase in cycling activity of around 16%.

While this analysis is suggestive of an increase in activity we would note the after-construction data is based on a short-period count (five days). Short-period counts are subject to significant interday variability such that robust conclusions cannot be drawn from this data. Ideally automatic counts obtained either on Stage D itself, or from pre-existing automatic counters to the north and south along Veloway 1, will – over time – provide a more robust picture of any increase in cycling activity on the corridor.

2.2 Level of service

The project had the design intent of improving the level of service for both bicycle riders (who would likely choose the Veloway 1 instead of the pre-existing shared path) and pedestrians (who would no longer interact with as many riders, particularly faster commuters). The level of service was assessed using the counts and a cyclist level of service model developed for TMR based on rider surveys (CDM Research 2013). This model takes into account the width of the paths, directional flows and volumes of cyclists and pedestrians as well as their speed distributions. It neglects factors such as the presence of corners which are likely to be influential in this project.

The results from this analysis are shown in Table 2.1. It is assumed riders using Veloway 1 will be able to maintain a marginally higher speed and there will be less variation in this speed among riders. The key finding from this calculation is that bicycle riders transferring from the Ekibin Park route to Veloway 1 will experience a marked improvement in level of service – from D to A. This will come largely from no longer having to incur a delay every 8.5 minutes, and instead effectively never incurring a delay along Veloway 1. Riders who continue to ride through Ekibin Park after the opening of Veloway 1 experience a minor improvement in level of service (from D to C) attributable to the presence of fewer riders. It should be noted this analysis applies to the "average" rider (that is, a rider travelling in the dominant direction of travel at the average speed). It does not apply to pedestrians, but it seems very likely pedestrians will perceive a step change in their level of service given the much lower cyclist demand and (presumably) the absence of higher speed commuter and sport cyclists.

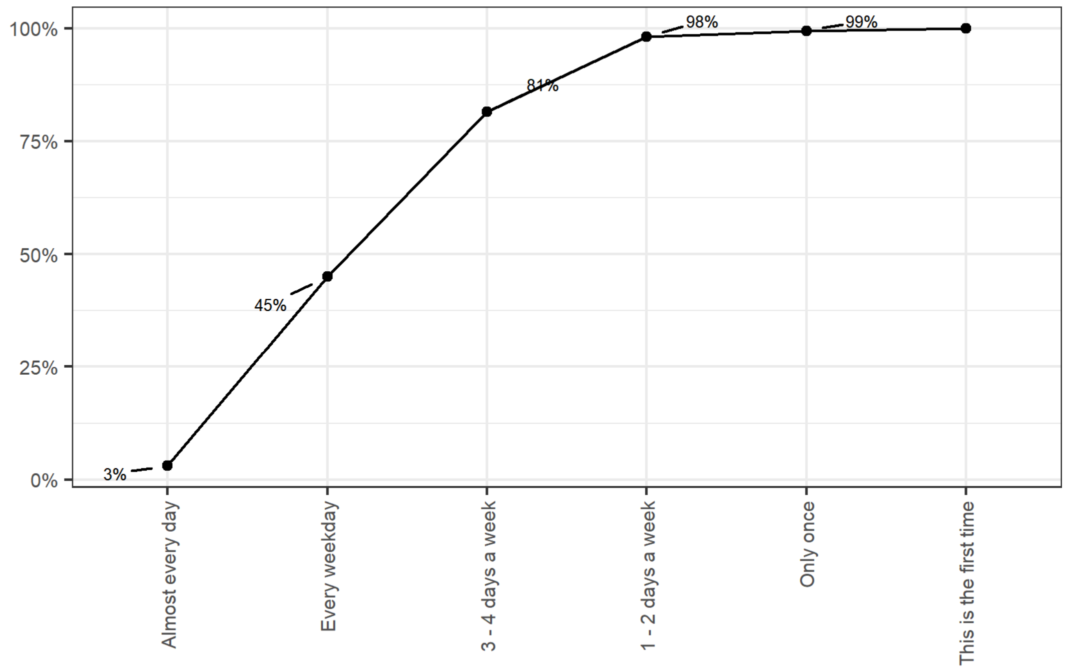
■ **Table 2.1: Level of service calculation**

	Scenario		
	Ekibin Park pre-V1	**Ekibin Park post-V1**	**Veloway 1**
Path width	3.0 m	3.0 m	3.5 m
Bicycle riders			
Demand (per day)	1,054	310	1,075
Demand (peak hr – assume 19% pk hr ratio)	200	59	204
Directional split	80/20	80/20	80/20
Average speed	20 km/h	20 km/h	25 km/h
Speed distribution (std. dev.)	5 km/h	5 km/h	3 km/h
Pedestrians			
Demand (per day)	600	600	n/a
Demand (peak hr – assume 15% pk hr)	90	90	n/a
Average speed	6 km/h	6 km/h	n/a
Speed distribution (std. dev.)	1 km/h	1 km/h	n/a
Directional split	50/50	50/50	n/a
LOS	**D**	**C**	**A**
Delay every…	8.5 mins	9.8 mins	679 mins
Overtake cyclist every …	3.9 mins	13.1 mins	3.8 mins
Overtake pedestrian every…	0.6 mins	0.6 mins	n/a

3 Intercept surveys

Intercept surveys were conducted with bicycle riders at the O'Keefe St signalised crossing. This location was chosen as most riders would be required to stop here and wait for the crossing, making it a safe and convenient location to interview riders. A total of 161 complete interviews were obtained over the three-day period, of which most (90%) were obtained on weekdays.

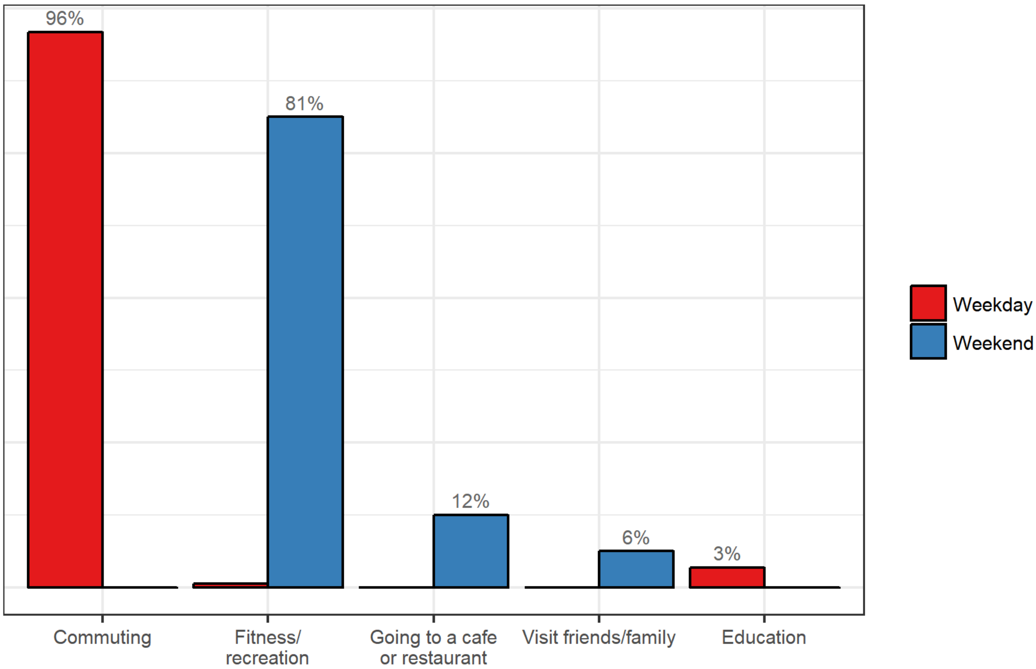
The frequency with which users use the bridge is shown in Figure 3.1. Just under half of all respondents' ride along the Veloway 1 every weekday and almost all do so at least once a week.



■ **Figure 3.1: Frequency of use by mode (cumulative totals are shown)**

Most respondents (93%) were aware Veloway 1 Stage D is new. A similar proportion (91%) recallrf riding through Ekibin Park before the Veloway opened.

Almost all trips on weekdays were for commuting while four fifths on weekends were for fitness or recreation (Figure 3.2).



■ **Figure 3.2: Trip purpose by day of week**

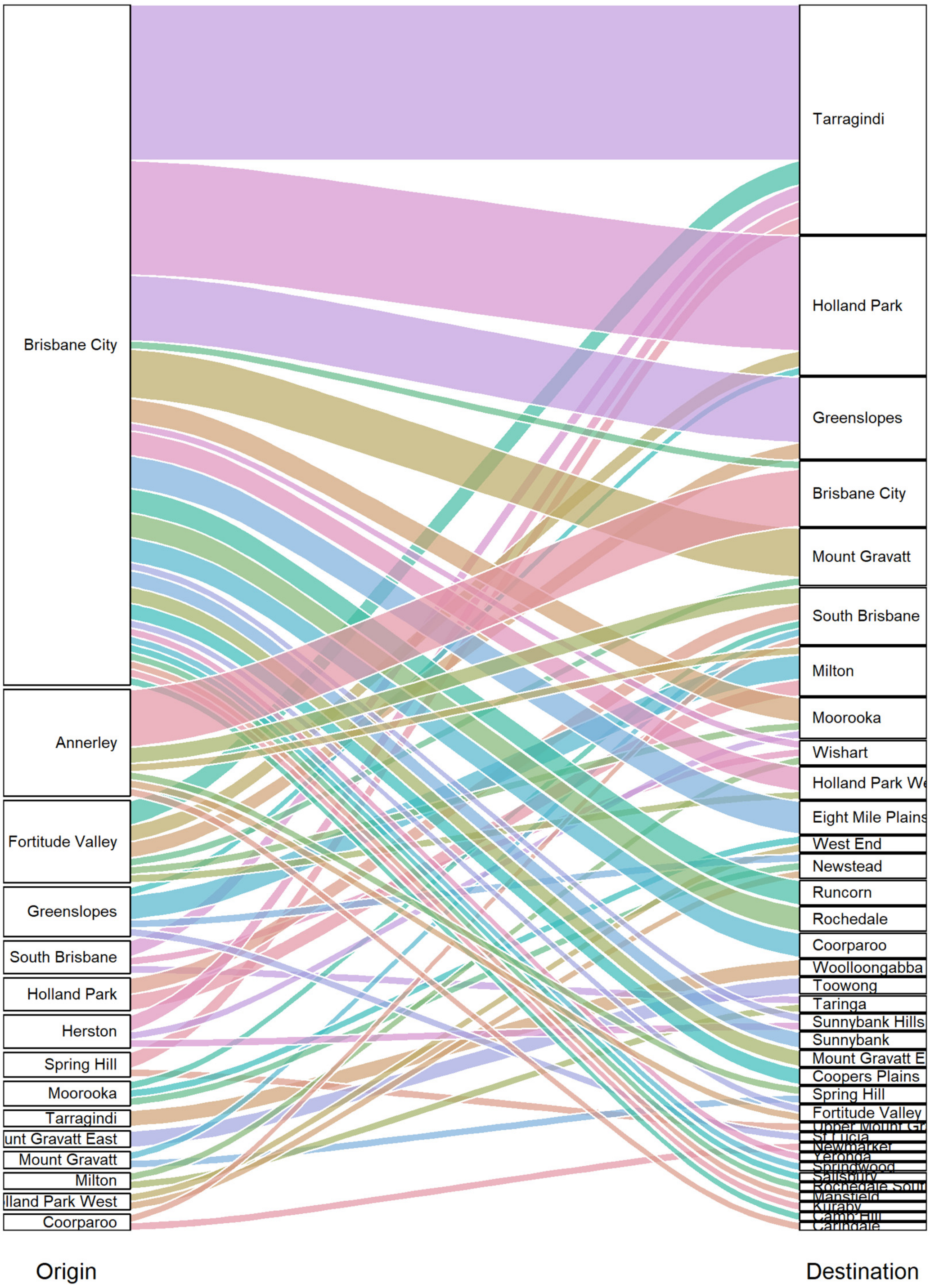
The average bicycle trip for recreation took 73.9 minutes over 27.9 km while transport trips took 32 minutes over a distance of 15 kilometres (Table 3.1).

■ **Table 3.1: Trip distances and durations**

	Recreation	Transport	All
Trip distance			
Average	27.9 km	11.8 km	13.2 km
Median	30 km	10 km	11 km
Trip duration			
Average	73.9 mins	31.6 mins	35.3 mins
Median	80 mins	30 mins	30 mins

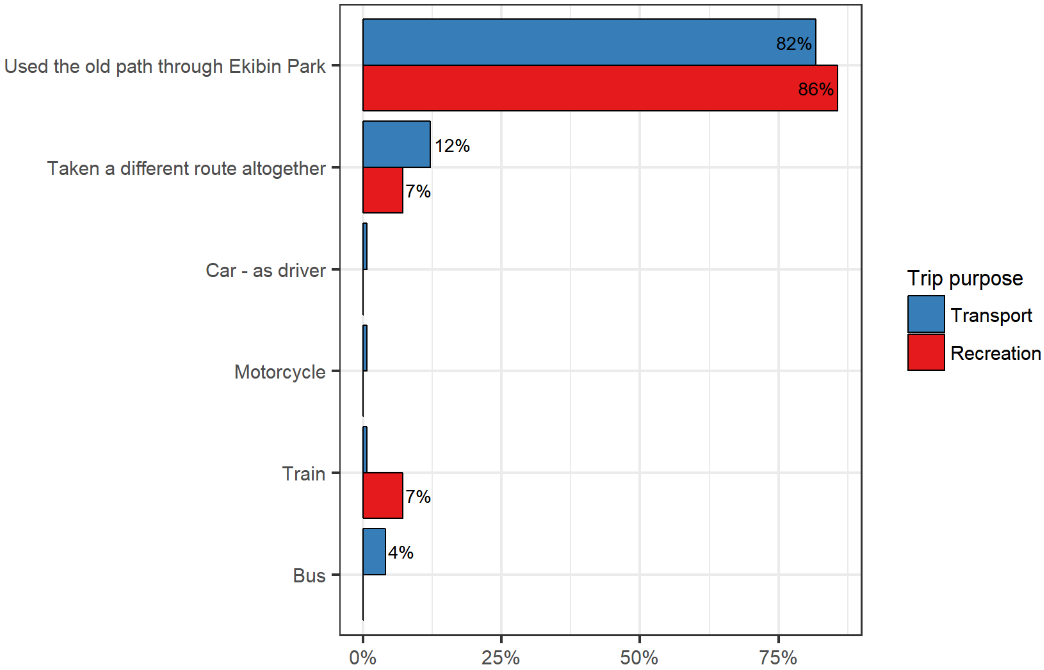
The trip origin and destination suburbs for transport trips is illustrated in Figure 3.3. The major trip flows are as follows:

- 12.8% of trips were between Tarrangindi and Brisbane City,
- 9.5% were between Holland Park and Brisbane City,
- 5.4% were between Greenslopes and Brisbane City,
- 4.7% were between Annerley and Birsbane City, and
- 4.1% were between Mount Gravatt and Brisbane City.



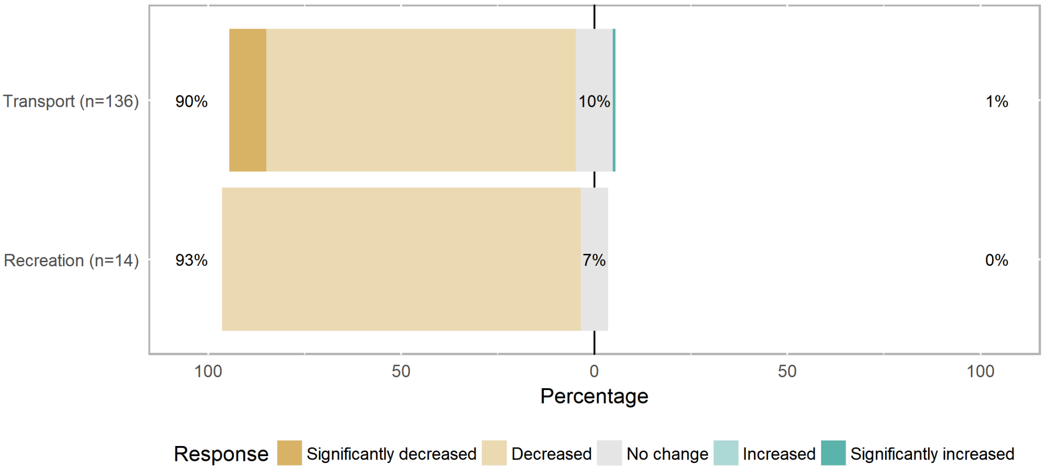
■ **Figure 3.3: Origins and destinations of cycling trips for transport (n=148)**

Respondents were asked what they would have done for their trip if Stage D was not present. Most would have used the old path through Ekibin Park (Figure 3.4). A negligible proportion indicated they would have driven a car, and less than 10% would have used public transport.



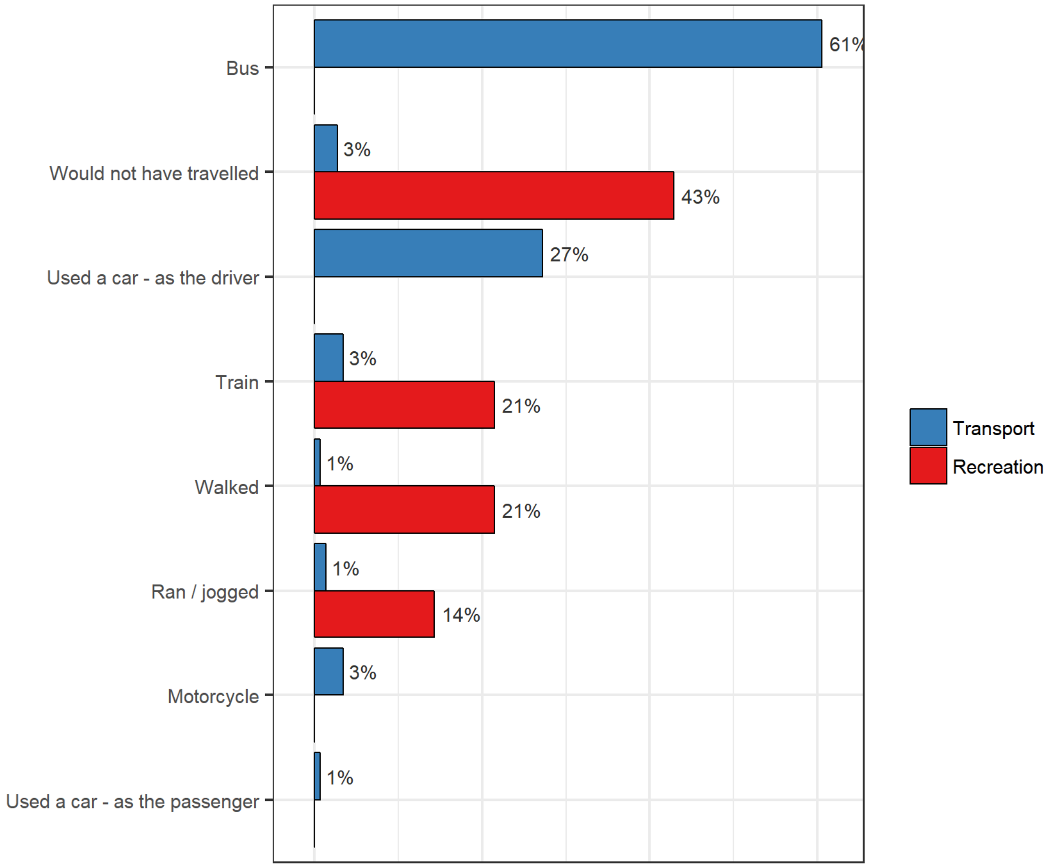
■ **Figure 3.4: What would you have done if Stage D was not here?**

A large majority of bicycle riders indicated the project had decreased the amount of time they'd spent riding over the past month (Figure 3.5). For those riding for transport these travel time savings are likely to have economic benefits just as they do for motorised transport. For recreation travellers the benefits are contestable; indeed, there may be disbenefits for this group if they were to achieve less physical activity as a result of the project.



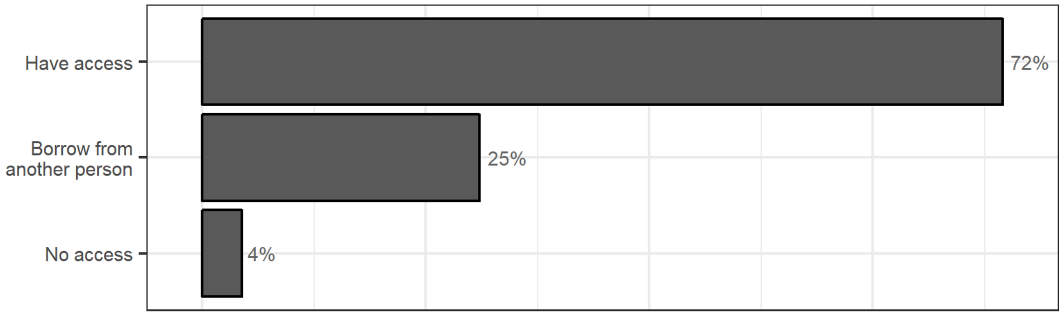
■ **Figure 3.5: Has the project changed the amount of time you've spent riding over the past month?**

Respondents were also asked what they would have done if they could not have used their bicycle for their trip. Around 61% of those travelling for transport would otherwise have taken a bus while 27% would have driven a car (Figure 3.6). Among those who travelled for recreation (n=14) just under half would not have travelled at all if they could not have ridden – this seems consistent with the notion that riding itself is a key purpose of recreational cycling.

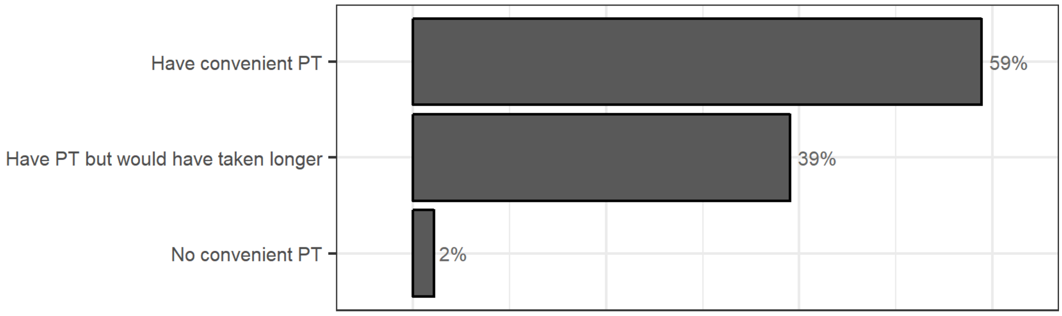


■ **Figure 3.6: What would you have done if your bicycle was not available for this trip?**

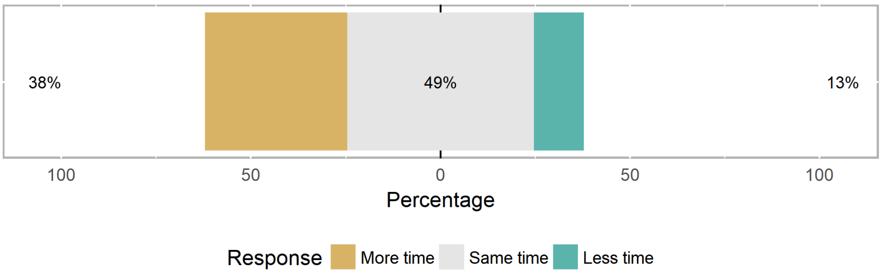
Of those travelling for transport most indicated they had car (Figure 3.7) or convenient public transport alternatives (Figure 3.8). In both cases far more indicated car (Figure 3.9) or public transport (Figure 3.10) would have taken longer than riding.



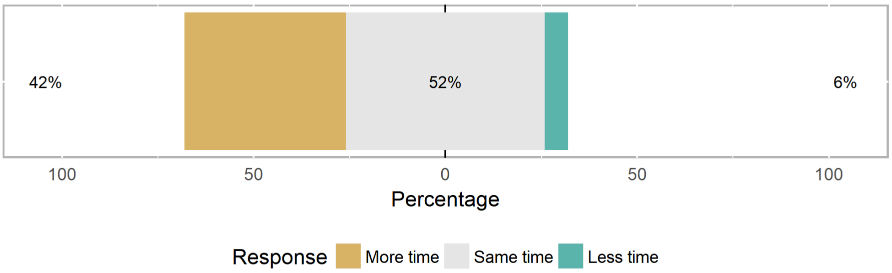
- **Figure 3.7: Which of the following best describe how easily you could have used a car for this trip?**



- **Figure 3.8: Which of the following best describes how easily you could have made this trip by public transport?**

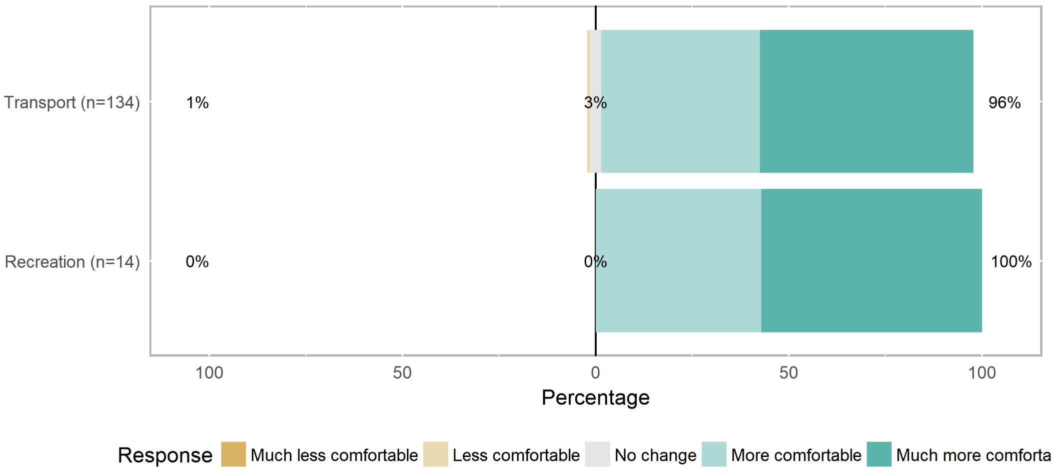


■ **Figure 3.9: Would it have taken more or less time to reach your destination by car?**

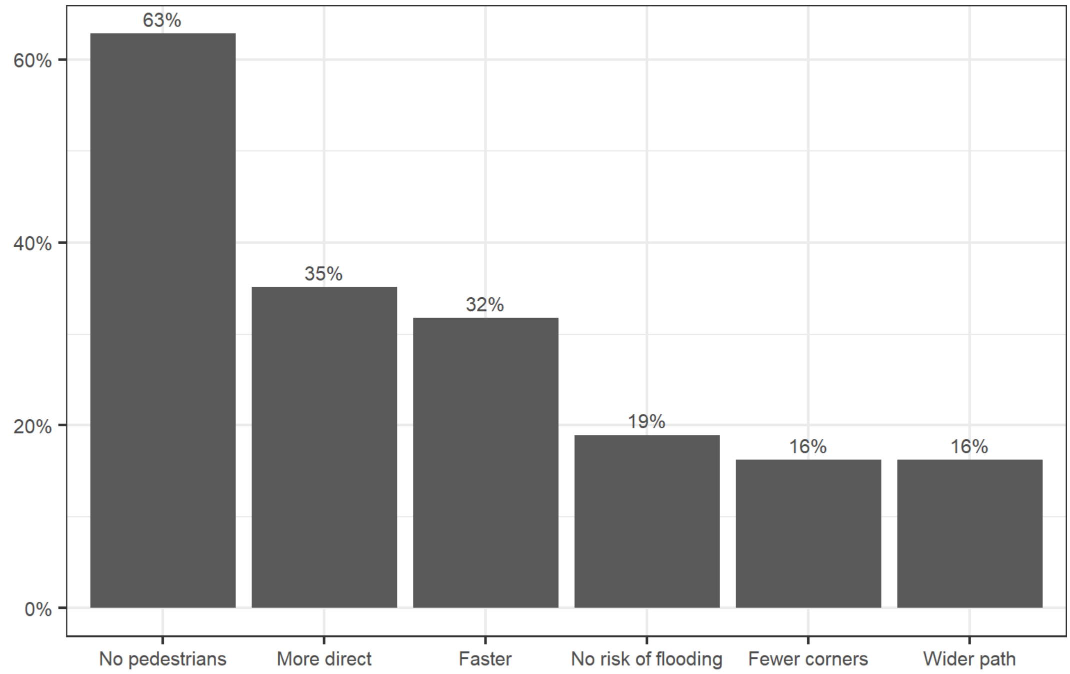


■ **Figure 3.10: Would public transport have taken more or less time?**

Respondents who recalled using the old route through Ekibin Park indicated that they overwhelming felt more comfortable using the Veloway (Figure 3.11). Almost two thirds of respondents indicated that the absence of pedestrians on the Veloway motivated this increased sense of comfort (Figure 3.12), followed by it being more direct and faster.



■ **Figure 3.11: How would you say your comfort riding along here has changed after the new section of bikeway opened?**



■ **Figure 3.12: Reasons cited for feeling more comfortable (multiple choice)**

Respondents were asked after the survey if they had any other comments about the project. These comments are provided verbatim in Appendix B.

4 Travel time benefits

4.1 Travel time savings

Travel time savings are often used to justify transport investments, and these benefits often account for two thirds or more of the economic benefits in cost-benefit analysis. One of the main justifications for Veloway 1 Stage D was similarly that it would provide travel time benefits to bicycle riders, for whom the older route was both more circuitous and slower given the lower design standard (not least being the presence of many corners and pedestrians). The new route is 1.4 km compared to the alternative via Ekibin Park at 1.8 km between O'Keefe St and the Greenslopes Bus Station.

To assess the travel time impacts of the project two riders provided GPS trip logs for multiple journeys between the path alongside Greenslopes Bus Station to the railway overpass just north of O'Keefe St. The GPS traces were logged using the Strava app at time intervals varying from one to five seconds. A total of 29 trips were available from the older Ekibin Park route and 34 from Veloway V1 (Table 4.1). While ideally more observations from a wider range of riders would be available for comparison it is noted that the travel time differences between these two riders are very similar, giving some confidence that the results are representative of the wider riding population.

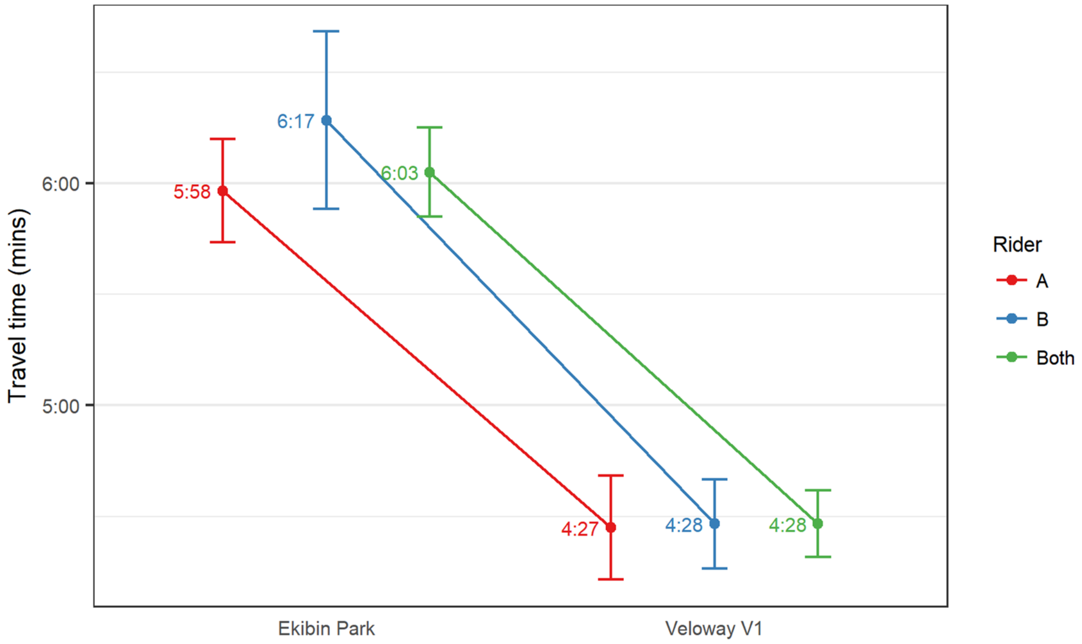
■ **Table 4.1: Travel time observations by route and rider**

	Route		
Rider	**Ekibin Park**	**Veloway V1**	**Total**
A	21	20	41
B	8	14	22
Total	29	34	63

Both riders experienced significant decreases in their travel times (Figure 4.1). On average, the travel time saving was 95 seconds (Table 4.2). The distribution of travel times by route and direction is shown in Figure 4.2. Only one trip on the Veloway V1 was as long as any trip on Ekibin Park, and there is no clear difference by direction of travel.

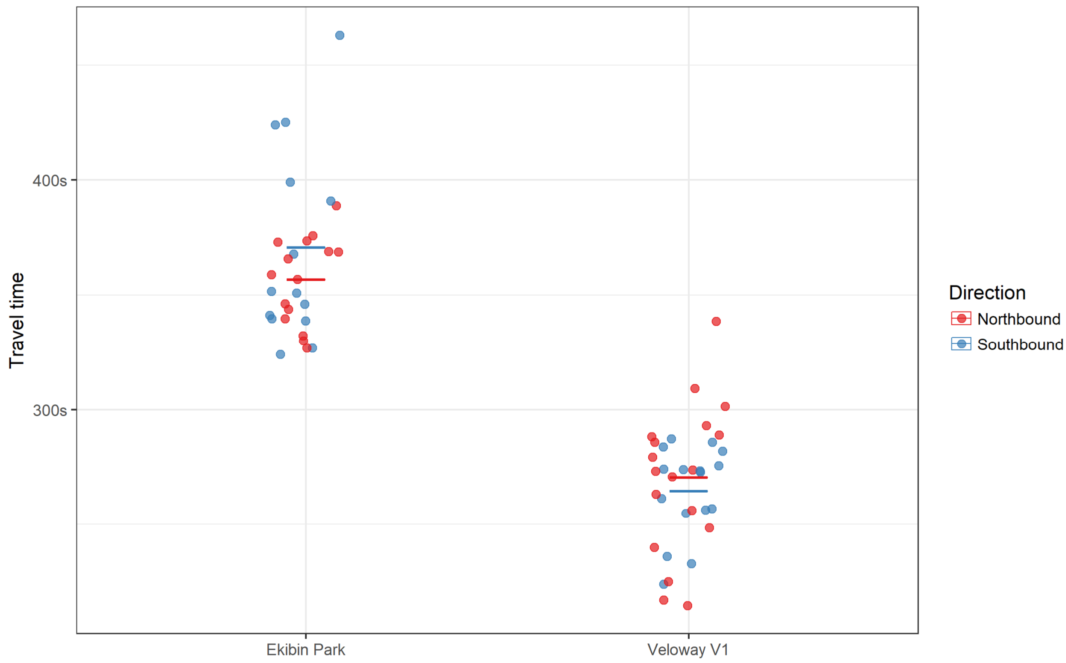
■ **Table 4.2: Travel time statistics by route**

Statistic	Ekibin Park	Veloway 1	Difference
No. observations	29	34	—
Average	363 s	268 s	95 s
Median	357 s	273 s	84 s
Standard deviation	33 s	27 s	6 s
Minimum	324 s	215 s	109 s
Maximum	463 s	339 s	124 s



Error bars are 95% confidence intervals

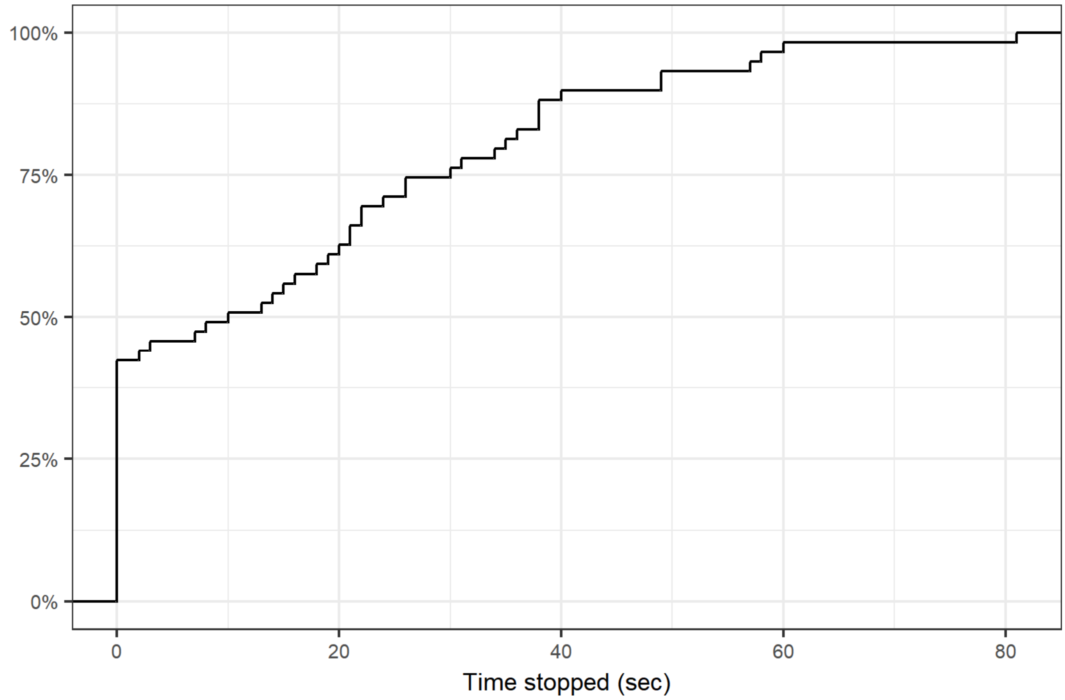
■ **Figure 4.1: Average travel times between Greenslopes Bus Station and railway overpass north of O'Keefe St**



■ **Figure 4.2: Travel times by route and direction of travel (averages are denoted by bars)**

4.2 Delay at O'Keefe St

The removal of the at-grade crossing at Lewisham St removes all at-grade crossings along the Veloway aside from at O'Keefe St. The travel time data suggests that just over half (57%) of riders incur delays at O'Keefe St of at least five seconds and half incur delays of at least ten seconds (Figure 4.3). The average delay incurred by riders was 17 seconds, and a median of 10 seconds.



- **Figure 4.3: Cumulative delay at O'Keefe St**

As a rapid cost-benefit exercise, if this 17 seconds were avoided by 1,000 riders per day over 30 years the net present benefit would be around $322,000 at a discount rate of 7%. It is highly unlikely a project such as a bridge could be built for this cost so as to avoid the cyclist delay. Instead, it would be necessary to consider the impact of such a project on safety and, possibly, on motorist travel time delays that would be avoided by removing the at-grade crossing. The latter potentially has a significant impact; if we assume crudely 10,000 vpd with 1.2 occupants all travelling for non-work purposes and that the signalised crossing is red to motorists for 30 seconds in every 120 seconds the average delay would be about 5 seconds per vehicle. The present value of benefit in this instance would be about $1.3 m over 30 years, or more than four times the rider travel time saving. It is suggested that any business case for a grade-separated crossing of O'Keefe St should consider both cyclist and motorist travel time savings, and also the injury reduction benefits.

5 Cost-benefit analysis

The cost-benefit analysis framework followed the framework recommended in ATAP Part M4[3] and described in CDM Research (2016). The key elements of this framework are:

- broad consistency with the current national guidelines (Transport and Infrastructure Council 2016),
- 30-year economic life with no residual value at the end of the appraisal period,
- estimates mortality and morbidity health benefits using a willingness to pay methodology for valuing statistical life,
- no safety in numbers effect,
- 20% of bicycle travel in the area occurs on-road without provision, 5% on-road with bicycle lanes, 70% on off-road shared paths and 5% on footpaths,
- relative risks for bicycle lanes of 0.5, off-road shared paths of 0.3 and footpaths of 1.8 (all relative to on-road with no provision),
- relative risk reduction for pedestrians of 25% (relative to the pre-existing condition where pedestrians had to interact with cyclists in Ekibin Park),
- cumulative annual demand growth of 3%,
- rule-of-half applies to the willingness-to-pay component of health costs, vehicle operating and parking costs, PT fares for all users and travel time savings for new users only,
- Monte Carlo simulation to represent parameter uncertainty,
- capital and operating cost estimates to +/-10% at 95% confidence level, and
- demand estimates to +/-20% at 95% confidence level.

The input assumptions to the cost-benefit analysis are summarised in Table 4.1 and are based wherever possible on the survey data. The estimated project cost of $24 m was provided by TMR and is assumed to be 2017 prices.

[3] https://atap.gov.au/mode-specific-guidance/active-travel/index.aspx

■ **Table 5.1: Economic assumptions**

Parameter	Assumption	Source
General assumptions		
Economic life	30 years	
Discount rate	3%, 7%, 10%	
Health benefit ramp-up period	5 years (linear)	Genter et al. (2009)
Effective average motorist speed	30 km/h	Estimate
Effective average cyclist speed	25 km/h	Typical speed from automatic counters is 23 km/h
Effective average PT speed	15 km/h	Estimate
Bicycle riders		
Opening year demand (AADT)	951	Video counts
Average trip distance	13.2 km	Intercept surveys
Diversion: PT	5%	Intercept surveys
Diversion: car	0%	Intercept surveys
Diversion: reassign	95%	Intercept surveys
Diversion: induced	0%	Intercept surveys
Transport purpose split	80%	Intercept survey
Trip time savings	None	Assume travel time equivalent to roadway
Pedestrians (Ekibin Park)		
Opening year demand (AADT)	600	BCC automatic counter (2017)
Average trip distance	5.0 km	Guesstimate
Crash relative risk	0.75	Guesstimate, assumes removing riders from Ekibin Park reduces crash risk by 25%
Facility		
Length	1.4 km	Total length of project
Type	Off-road path	
Diverted motor vehicle travel time by period	Busy: 50% Medium: 30% Light: 20%	Guesstimate

Parameter	Assumption	Source
Investment		
Capital cost	$24 m	TMR
Operating cost	$10,000 p.a.	Guesstimate

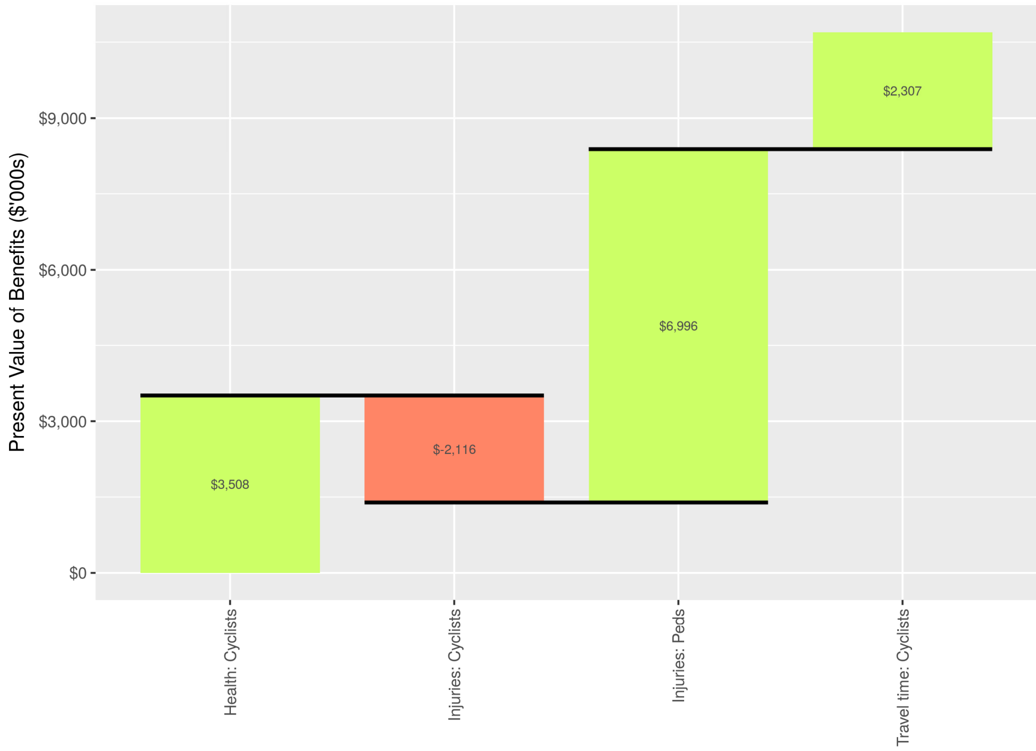
The results of the cost-benefit analysis are summarised in Table 5.2. For the central discount rate of 7% the BCR is 0.4, and the BCR remains less than one for the lower discount rate of 4%.

■ **Table 5.2: Economic assessment with pedestrian injury savings**

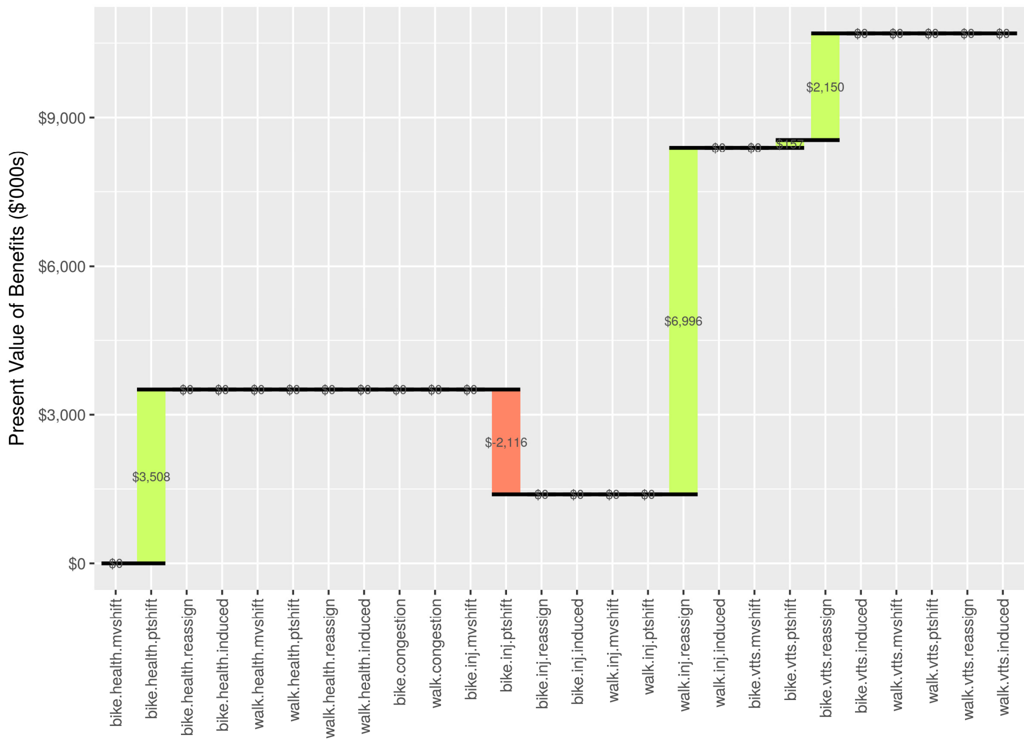
	Discount rate		
Parameter	**4%**	**7%**	**10%**
Benefit-Cost Ratio (BCR)	0.7	0.4	0.3
Likelihood BCR < 1.0	100%	100%	100%
Net Present Value (NPV)	-$8.10 m	-$13.56 m	-$16.68 m
Internal Rate of Return (IRR)	-2.6%	-5.6%	-8.4%
Present Value of Benefits (PVB)	$16.16 m	$10.70 m	$7.58 m
Present Value of Costs (PVC)	$24.26 m	$24.26 m	$24.26 m

All values are 2017 prices and values.

The breakdown of the NPV for the central discount rate is shown in Figure 5.1. Most the benefits accrue from cyclist health benefits, injury reduction to pedestrians and travel time savings for cyclists. The detailed breakdown of the benefits by user class are shown in Figure 5.2. This figure suggests that most of the benefits are attributable to injury savings to existing pedestrians and health benefits to those who previously used public transport who have now shifted to riding. The sole disbenefits are to this same group, for whom taking public transport presents a lower risk of injury compared to riding. However, this risk has a present value of $2.1 m is more than compensated for by the health benefits this group incurs ($3.5 m).



■ **Figure 5.1: Summary breakdown of net present value**



■ **Figure 5.2: Detailed breakdown of net present value**

It is recognised that the pedestrian injury reduction of 25% is speculative; it could be significantly higher or lower than this value. Moreover, the CBA is highly sensitive to this assumption, as shown in Table 5.3. While speculative, we suggest the key finding remains that the monetised costs of the project exceed the benefits.

■ **Table 5.3: Sensitivity testing of pedestrian injury reduction (discount rate of 7%)**

	Pedestrian injury reduction		
Parameter	**0%**	**25%**	**50%**
Benefit-Cost Ratio (BCR)	0.2	0.4	0.7
Likelihood BCR < 1.0	100%	100%	100%
Net Present Value (NPV)	-$20.56 m	-$13.56 m	-$6.56 m
Internal Rate of Return (IRR)	-10.8%	-5.6%	-2.4%
Present Value of Benefits (PVB)	$3.70 m	$10.70 m	$17.69 m
Present Value of Costs (PVC)	$24.26 m	$24.26 m	$24.26 m

All values are 2017 prices and values.

6 Discussion

6.1 Travel time benefits

The project provides a very high-quality connection between Greenslopes and Buranda that is clearly beneficial to transport riders by providing travel time savings of the order of 95 seconds. However, the project cost is also very high – around $24 m for 1.4 km of cycleway. The issue is whether the benefits, including the travel time savings accrued by some 1,075 riders per weekday, are sufficient to compensate for this project cost. The cost-benefit analysis undertaken herein would suggest these travel time benefits are, of themselves, insufficient to do so. There are several explanations for this result:

- the high capital cost is incurred at the start of the project economic life, and as such is not discounted,
- the travel time benefits are accrued over the economic life of the asset, and become increasingly less valuable (in net present terms) over time (that is, the travel time benefits occurred in the 10th year will have a present value 51% of those in the opening year, and 26% in the 20th year), and
- the cyclist demand is insufficient for the 95 second travel time saving to accrue to a sizeable financial return (at least, not relative to the capital cost).

None of these explanations are unique to this project. Indeed, they are common to capital intensive large transport projects in inner city areas. While equivalent road and public transport projects have capital costs orders of magnitude greater than this project, they similarly have usage that is much higher. What matters is that the usage and travel time savings combine to produce benefits greater than the capital cost.

It was estimated from the travel time data (Section 4.1) that bicycle riders are saving in the order of 95 seconds per trip. Crudely, a rider travelling at 25 km/h would cover the 400 m distance saved in 58 seconds. The additional 37 seconds saved in practice is likely to be attributable to the higher quality route, and particularly the absence of corners and pedestrians. However, even if the project had instead saved 240 seconds per trip (four minutes) the BCR would only increase to 0.6. In other words, with the current cyclist demand even very high travel time savings would be insufficient to recoup the capital cost.

The travel time benefits are only assigned to transport riders; it is uncertain how, and if, recreational riders would assign value to the travel time benefits of using the project in preference to the older Ekibin Park route. Recreational riders may choose to ride farther than they otherwise would, thereby negating the travel time savings. Irrespective, the *quality* of travel time is not accounted for in the present analysis. That is, it seems reasonable to argue that the project provides a more comfortable route to Ekibin Park that avoids the stress for riders to have to negotiate tight corners, narrow paths and pedestrians and runners. In theory such benefits could be included in the CBA using a willingness-to-pay methodology. However, obtaining robust estimates of user willingness-to-pay for these benefits would be challenging.

Another potential travel time benefit stream is that associated with delay and diversion along the Ekibin Park path during flood events. These events, although infrequent, require that path users deviate to at-grade road crossings. This additional travel time is likely to be perceived as having higher cost than travel time, particularly delays at intersections. However, it is unknown how frequent such flood events occur – and nor would it be easy to assign travel time weights to this additional component of travel time.

6.2 Project cost

The project capital cost of $24 m is an estimate provided by TMR and includes the three bridges and improvements to the path which previously existed along the corridor that was built as part of the busway works several years ago. The cost of construction of that path is not explicitly included, although given the outturn cost is closer to $20 m it is likely the $24 m is a fair estimate of the total capital cost. This is a very high cost for 1.4 m of cycleway; however, the presence of the three bridges clearly drives the cost. Furthermore, the highly constrained corridor presented additional costs associated with enforced night time works, traffic management and design limitations presented by the existing infrastructure. If the project were built in conjunction with major road or busway works in the corridor it quite likely would have been substantially cheaper. Sensitivity testing of the cost-benefit analysis indicates the project BCR would only reach 1.0 for a capital cost of between $10 - $11 m. It seems highly unlikely the project could have been delivered for this cost.

The appraisal, in a manner consistent with the ATAP guidance, covers a 30-year economic life. No residual value is assumed for the asset at the end of this 30-year period, implying that the path and bridges would all need to be replaced at this time. In practice, the asset is likely to have a functional life well beyond this period – perhaps 50 to 100 years. One means of redressing this shortcoming is to assign a residual value to the asset; that is, assume some benefit at the end of the economic life that is a proportion of the capital cost. However, doing so would not materially affect the cost-benefit analysis given the impact of discounting. For example, even if it were assumed 50% residual value (i.e. $12 m) after 30 years this only equates to $1.6 m in present value terms. This additional present benefit would not materially affect the results of the cost-benefit analysis.

6.3 Effect on trip generation and modal diversion

Unlike many other cycling infrastructure projects, Veloway 1 Stage D does not provide an all-new link in the cycling network. Instead, it duplicates an already extant shared path. While clearly much higher quality and more direct, for those travellers with a preference for an off-road route such a facility already existed along the corridor. Clearly, as illustrated by both the cyclist counts at Ekibin Park and by the intercept survey, the vast majority of bicycle riders are consciously choosing to use Veloway 1 Stage D over the Ekibin Park route. Similarly, the clear majority of these riders say they feel more comfortable doing so (Figure 3.11) because the new route avoids interactions with pedestrians and is faster and more direct (Figure 3.12). These findings are consistent with the design intent. However, the economic benefits that arise to society from pre-existing riders who divert onto the project are far less than from those who divert from other forms of transport (i.e. private car or public transport), and indeed from all-new recreational cycling trips which the project may induce. The difficulty arises that, at least within four months of opening, there has not been any discernible new cycling activity aside from minor diversion from public transport (Figure 3.4).

The cost-benefit analysis is highly sensitive to the level of trip generation and modal diversion. If, for example, instead of 90% of those cycling divert from Ekibin Park but only 60% of project users previously rode, 30% used public transport and 10% were all-new cycling trips, the BCR would be 1.0. It seems plausible that over time the project will have greater impact on travel behaviour such that the level of diversion will increase from that observed in this study. However, it also seems unlikely it would increase to a level sufficient for the project to be economically viable.

While there is no evidence from the intercept survey to suggest any additional cycling activity has occurred to date, there is suggestive evidence from the cyclist counts that cycling activity has increased (Section 2.1). It is suggested that the automatic counters in the vicinity of the corridor may provide more robust evidence of this growth, if indeed it exists, after 12-18 months.

6.4 Cyclist safety

The cost-benefit analysis assumes no safety benefit to bicycle riders from the project. This is almost certainly unduly conservative; the wider path, absence of corners and pedestrians would be expected to significantly reduce the cyclist crash risk. However, it is difficult to quantify to what extent this will occur. We can crudely test this conservative assumption by assuming the project reduces the per-km crash rate by 50% compared with the base case. Doing so would increase the BCR marginally from 0.4 to 0.5. While significant, this factor of itself is unlikely to be sufficient to justify the project.

6.5 Pedestrian safety

Just as bicycle riders (particularly commuters and sport cyclists) prefer not to have to share with pedestrians, so to do pedestrians prefer not to have to share with bicycle riders. This is motivated both by the objective risk of being involved in a collision with a cyclist, and the subjective sense of discomfort that comes from having to share the path with riders. There is very little data or evidence on the objective safety risks of riders and pedestrians sharing paths. As such, the 25% risk reduction assumed in the central case for this cost-benefit analysis is highly speculative. It is unknown whether the actual risk reduction to pedestrians may be higher or lower. Irrespective, there is almost certainly a strong willingness-to-pay among pedestrians to minimise interactions with bicycle riders. As such, even if the speculated risk reduction did not eventuate it may serve as an (admittedly crude) proxy for the comfort benefits experienced by pedestrians.

6.6 Conclusion

Overall, it is suggested that the project cannot be justified purely on economic grounds given the high capital cost and modest impacts on mode shift and encouraging cycling activity. However, this does not mean it cannot be justified on broader grounds, and on factors which are not accounted for in the cost-benefit analysis. Moreover, we suggest that as part of a broader investment into an active transport network that connects trip generators and attractors the overall package of investment may show favourable economic returns. This is particularly true in this instance, where TMR is investing in stages along the Veloway 1 corridor – it is plausible that the net impact of the stages *in combination* will have greater impact than each element individually.

References

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Genter, J. A., S. Donovan, B. Petrenas, and H. Badland. 2009. “Valuing the Health Benefits of Active Transport Modes.” Research Report 359. Wellington, N.Z.: NZ Transport Agency.

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Appendix A: Intercept survey script

We're completing a quick survey on the path. Could you help us?

1. WE're taking to riders who ride along the new section of bikeway from O'Keefe St down to Greenslopes alongside the motorway. Is this bikeway part of your trip today?
   a. Yes
   b. No – THANK AND END
2. In what suburb did you start your trip, and where will you finish your trip?
   a. Start: ___________
   b. Finish: __________
3. How long will the trip take?
   a. Hours: _____
   b. Minutes ____
4. How far is the trip?

   ____ km
5. What is the purpose of your trip?
   a. Commuting to or from work
   b. Fitness, recreation or sport
   c. Shopping
   d. School, university or other education activity
   e. Other: _________
6. How often have you walked/ridden here in the past month?
   a. Almost every day
   b. Every weekday
   c. 3 – 4 days a week
   d. 1 – 2 days a week
   e. Every fortnight
   f. Only once
   g. This is the first time
7. The bikeway from here [O'Keefe St] down to Lewisham St in Greenslopes opened late last year. Were you aware that the path is new?
   a. Yes
   b. No

8. The new section of bikeway replaces an older path that goes through Ekibin Park farther east of the motorway. Can you recall riding along the path through Ekibin Park before the new section of bikeway opened?
    a. Yes
    b. No
9. IF RECALLS RIDING THRU EKIBIN PARK: How would you say your comfort riding along here has changed after the new section of bikeway opened?
    a. Much more comfortable
    b. More comfortable
    c. No change
    d. Less comfortable
    e. Much less comfortable
10. Why do you say this?
    a. More direct
    b. Faster
    c. Fewer corners
    d. Wider path
    e. No pedestrians
    f. No risk of flooding
11. How would you have made this trip if this path wasn't here?
    a. Taken a different route (incl. used the road)
    b. Would not have travelled
    c. Car – as driver
    d. Car – as passenger
    e. Motorcycle
    f. Bus
    g. Taxi
    h. Don't know
    i. Other: _________
12. What change, if any, would you say the construction of the path has had on the amount of time you've spent walking/riding over the past month?
    a. Significantly decreased (by at least an hour a week)
    b. Decreased (by less than an hour a week)
    c. No change
    d. Increased (by less than an hour a week)
    e. Significantly increased (by at least an hour a week)
13. What would you have done if you couldn't ride your bike for this trip?
    a. Would not have travelled

b. Used a car – as the driver
c. Used a car – as the passenger
d. Motorcycle
e. Bus
f. Taxi
g. Walked
h. Ran / jogged
i. Don't know
j. Other: ___________

14. IF TRANSPORT PURPOSE: Which of the following best describe how easily you could have used a car for this trip?
    a. I had a car available and could easily have got access to it
    b. I could have got a car from another person where I started my trip (e.g. another household member)
    c. I did not have ready access to a car to make this trip
    d. I do not have a drivers licence
    e. Other: _________
15. IF COULD HAVE USED CAR: Would it have taken more or less time to reach your destination by car?
    a. More time
    b. Same time
    c. Less time
16. IF TRANSPORT PURPOSE: Which of the following best describes how easily you could have made this trip by public transport?
    a. I had a convenient public transport alternative
    b. I had a public transport alternative but it would have taken longer
    c. I did not have a viable public transport alternative
    d. Other: _________
17. IF COULD HAVE USED PUBLIC TRANSPORT: Would it have taken more or less time to reach your destination by public transport?
    a. More time
    b. Same time
    c. Less time
18. INTERVIEWER enter any other comments: _______________

Appendix B: Verbatim comments

Impressed with bikeway

Extend pathway through Macgregor

Please extend further into Greenslopes

Excited for further development and completion of stages

Bikeway over road needed

New path good as it separates commuter and leisure bikes safer for kids

Create a path down the bottom of Greenslopes of bush reserve at Holland Park (to avoid the steep path)

Keep building more

Appendix C: Veloway 1 staging