IPENZ TRANSPORTATION GROUP CONFERENCE 2016

Lessons from Urban Cycleways in Auckland

Ben Wilshere BE(Hons), Graduate Engineer, GHD Ltd.

(Benjamin.Wilshere@ghd.com)

ABSTRACT

As Auckland grows and intensifies, Auckland Transport (AT) is providing a greater range of travel options to its residents, with an increasing emphasis on cycling and active modes. To develop cycling as a popular means of transport, AT, NZTA and central government are investing $207 million over the next three years to improve cycling infrastructure in the region. Much of this investment will be in cycleways that provide cyclists significant protection from moving traffic – an essential aspect of designing cycleways to cater for mainstream commuters.

Throughout 2015, AT implemented several significant cycleway schemes in central Auckland. Two of these schemes - Beach Road and Carlton Gore Road – were among the first of their kind in New Zealand, and they presented a number of novel challenges to those involved in their development. These schemes are discussed in this paper, with two key lessons presented for each and remarks made on how those lessons could be incorporated into cycleway designs going forward.

INTRODUCTION

In 2012, Auckland Council adopted the City Centre Master Plan (CCMP), setting the vision for the future of the Auckland City Centre as the 'engine room' of the city. It contains a number of initiatives to unlock the city centre's potential, contributing towards the Auckland Plan's vision of being the world's most liveable city.

Underpinning the plan is a focus on making the city centre more family, pedestrian, and environmentally friendly. A key component of achieving this is through a modal shift from the private car to public transport, walking, and cycling. There are a number of interventions that can be made to promote modal shift, but a considerable body of research shows that a major shift to cycling can only occur with cycling infrastructure which appeals to mainstream commuters by separating bicycles from general traffic (NZTA, 2011). Such infrastructure is the topic of this paper.

Auckland Cycle Network

Recognising that a network of high quality interconnected cycleways was needed to achieve a modal shift across Auckland, Auckland Transport developed the Auckland Cycle Network (ACN), setting out a blueprint for cycling infrastructure in the region.

The ACN serves as a key planning tool, and provides the strategic programme for cycling infrastructure development in Auckland. The ACN is divided into three categories, reflecting the varying roles that different cycling treatments play in the wider network. These are:

- **Cycle Metros** – the highest level of service; providing regional links to connect metropolitan centres, public transport interchanges, and other key regional destinations. Beach Road is classified as a Cycle Metro.
- **Cycle Connectors** – provide links to cycle metros and key local destinations – e.g. town centres and schools. They tend to be along arterial and collector roads. Carlton Gore Road is classified as a Cycle Connector.
- **Cycle Feeders –** provide access from local neighbourhoods and community facilities to cycle connectors and cycle metros; tend to be smaller scale interventions on local roads.

The future of the Auckland Cycle Network

There is a bright future for cycling in New Zealand. On June 25th, 2015, the government announced that a total of $333 million would be invested in cycling throughout New Zealand between 2015 and 2018, with $207 million being spent in Auckland. This investment has been pulled together through a medley of different funding mechanisms, and will make a significant contribution to implementing the ACN and other cycling networks.

However, the development of cycling networks across the country is still at an early stage. And, while the $207m figure represents a significant investment in cycling, when this funding is exhausted in 2018 a significant portion of the ACN will remain to be completed (see Figure 1). The rest of New Zealand is similarly placed, with a significant amount of cycling development to occur over the coming years.

This paper will present two recently completed cycling schemes; Beach Road and Carlton Gore Road, and discuss some specific lessons learned during their development. Bearing in mind that cycling infrastructure development in New Zealand is still at an early stage, it is intended that some of the lessons learnt during these projects can be applied on future cycling schemes.

Figure 1: Development of Auckland cycleways through 2018 and beyond

BEACH ROAD

The Beach Road Cycle route project was initiated in 2012, with the intent to provide a link between the Grafton Gully Cycleway and the Auckland waterfront. During early investigations, the project was split into two stages; stage one connecting Grafton Gully through to Mahuhu Crescent and Quay Street, and stage two extending the first stage through to Britomart. Figure 2 shows the route, and how it connects with Grafton Gully and proposed cycling facilities on Quay Street.

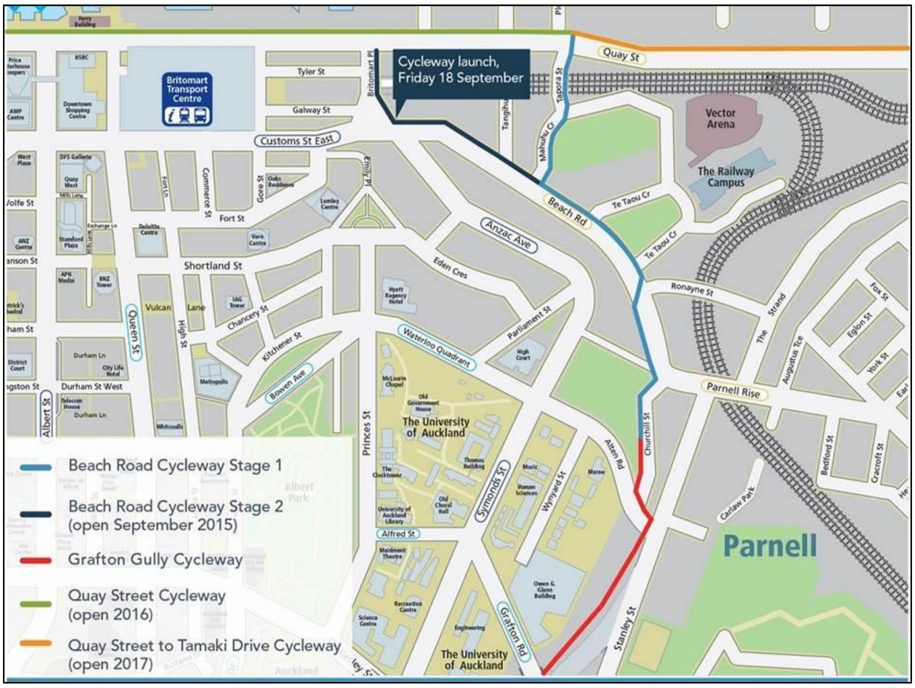

Figure 2: Beach Road Cycleway Route

The first stage of the scheme was completed in September 2014, providing Auckland's first two-way separated on-road cycleway. It was then extended in September 2015 with the completion of stage 2, which utilised a significant footpath reserve area to provide an off-road two-way facility through to Britomart. Figure 3 below shows each of the completed stages.

Figure 3: Beach Road Stage 2 (left, with the footpath against the building line, and the cycle path offset) and Stage 1 (right).

Design Challenges

Beach Road Stage 1 was presented to the IPENZ TG conference in 2015 by Lightowler and Ah Mu. This paper will focus on the lessons from stage 2, and lessons gained from stage 1 since its implementation. Two lessons are discussed below.

1. Pedestrians, cyclists, and desire lines

Providing a high level of service for both cyclists and pedestrians, when volumes of each are high, requires them to be separated from each other. Pedestrians do not feel comfortable with cyclists travelling nearby at speed, and, in turn, cyclists often have difficulty making their way through shared facilities without having to veer and swerve to avoid pedestrians (NZTA, 2011).

As shown on the left of Figure 3, the design of Stage 2 provided a separate footpath and cycle path, with the footpath running adjacent to the building line. However, the road is a sweeping curve with the cycle path on the inside of curve (and is therefore the shortest route), placing it on the natural desire line for pedestrians. This has led to a large number of pedestrians walking through the cycle path, as shown in Figure 4.

Figure 4: Pedestrians walking in cycle path. Note cycle markings on the ground.

In retrospect, one could think that this outcome that could have been foreseen in the earlier stages of the project. However the intent was to allow pedestrians to walk along the building line (as shown on the left of Figure 3), with the protection it provides from the elements. The unintended consequences of this may have been avoided by undertaking an analysis of pedestrian desire lines in the area, and modifying the design accordingly.

KEY LEARNING 1

Given that it is commonplace for cycle schemes to interface with pedestrian environments, it is critical to have an understanding of what the dominant pedestrian desire lines are and how they will interact with the project. Signage and markings generally may not override desire lines.

2. Cycling and tolerances

A common theme that emerged during the construction phases of Beach Road and Carlton Gore Road was the need for stringent attention to detail when implementing cycling infrastructure. This tended to manifest in three recurring items:

1. Service covers – these appeared in various types throughout the two projects. Service covers often cause surface or level changes which affect safety and ride quality. Identification and designing for service covers is important to achieving a high-quality finish.
2. Asphalt lips – even very minor level differences between different road surfaces (e.g., asphalt surfacing and concrete channel) can significantly impact on the ride quality for a cyclist, and can be a safety issue as well. Any transitions should be flush, which is well known, yet these lips are still common. This requires close construction supervision to achieve.
3. Crossing ramps – the shallower the gradient the better; a transition from a flat surface to a 1:12 gradient ramp is very noticeable on a bike.

The importance of the above items may be apparent to *those who are regular cyclists*. The author developed a full appreciation for these details after he took up cycling himself, and recommends that those closely involved in the development of cycling infrastructure consider doing the same. Understanding the needs of users is a key principle of effective engineering design, and is regularly integrated into 'traditional' traffic engineering projects via drive-throughs and walkovers. Similar methods should be considered to understand the needs of cyclists, though it needs to be remembered that the confidence and ability of cyclists can vary widely.

KEY LEARNING 2

Attention to detail is needed to ensure a high level of rideability and safety in cycling schemes, with the design tolerances in such schemes being much less than vehicle-orientated projects. A way to gain an appreciation for this is to understand the needs of the cycling group by experiencing the route as a cyclist. Would the reader expect an engineer to be adept in roading design, if that engineer had never driven a car?

CARLTON GORE ROAD

Carlton Gore Road was completed in September 2015, providing cycle facilities with a mix of painted buffers and physical separation along the length of the corridor. Figure 5 shows part of the project.

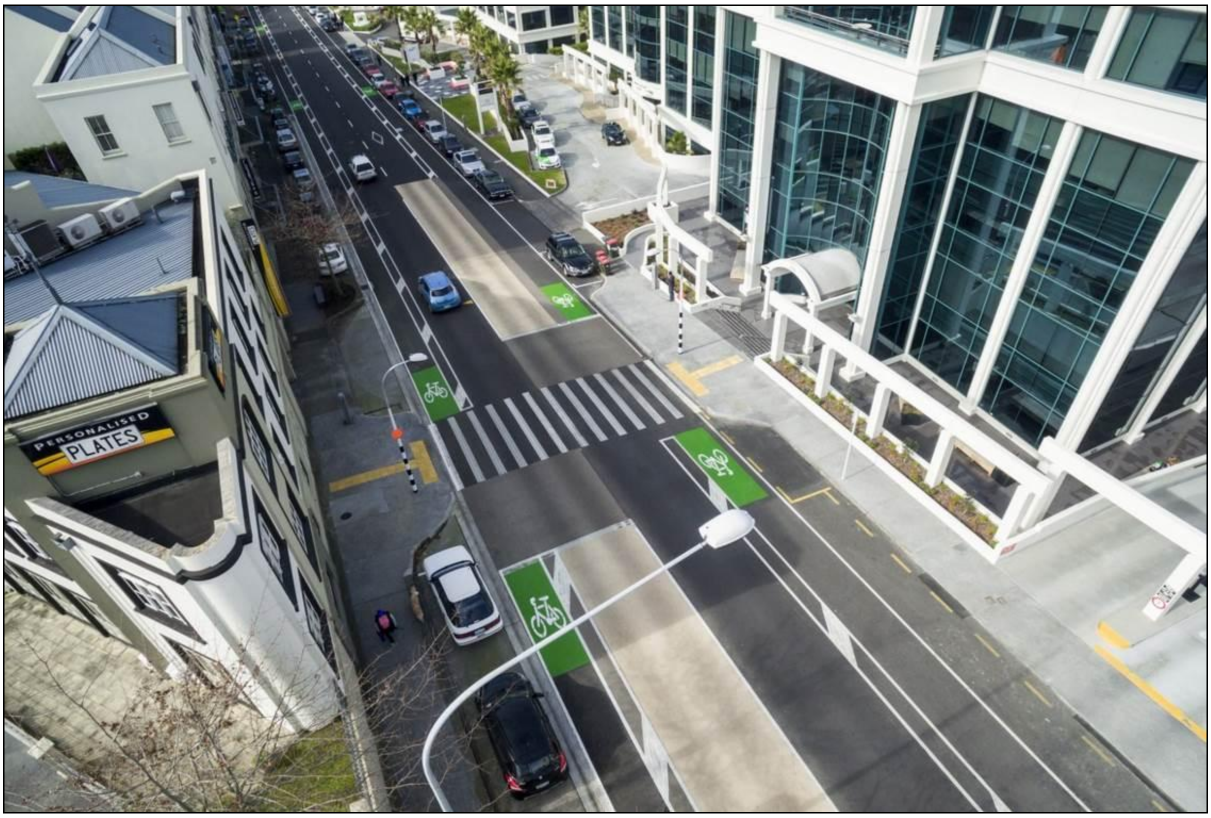

Figure 5: Carlton Gore Road cycleway - midblock crossing (photo credit Resin Surfaces Ltd)

The project started as a 'quick win' – painting a cycle lane on the carriageway after a road rehabilitation was completed as part of routine maintenance. As the ACN branched out from the central city, the corridor would eventually be upgraded to a higher standard.

After extensive stakeholder input, further investigations were undertaken on cycling provision along the route. While Carlton Gore Road was one lane in each direction, its 13.5m carriageway provided potential for extra width to be allocated to other uses. Moreover, it links the suburbs of Newmarket and Grafton, and was nearby to University campuses and the Auckland Domain – key cycling attractors. Taking these factors into consideration, it was resolved that more substantial cycling facilities could be justified along the corridor, including physical protection over part of its length. These facilities were eventually designed, and constructed as part of the road maintenance activities in October 2015.

Project Challenges

Similarly to Beach Road, the cycleway scheme presented new challenges. Two are discussed here: allocating surplus road width, and teething issues associated with the new cycleway.

1. Cycle Lane Buffers

As seen in Figure 5, part of the cycleway has cycle lanes adjacent to kerbside parking. This arrangement left approximately 2.4m of width that could be used as a cycle lane on either side of the road. There were three design options for this cycle lane:

1. A 1.8m cycle lane with a 0.6m buffer between parking and the cycle lane;
2. A 2.4m wide lane, or;
3. A 1.8m cycle lane with a 0.6m buffer between the cycle lane and the general traffic lane.

The latter option was used, as shown in Figures 5 and 6.

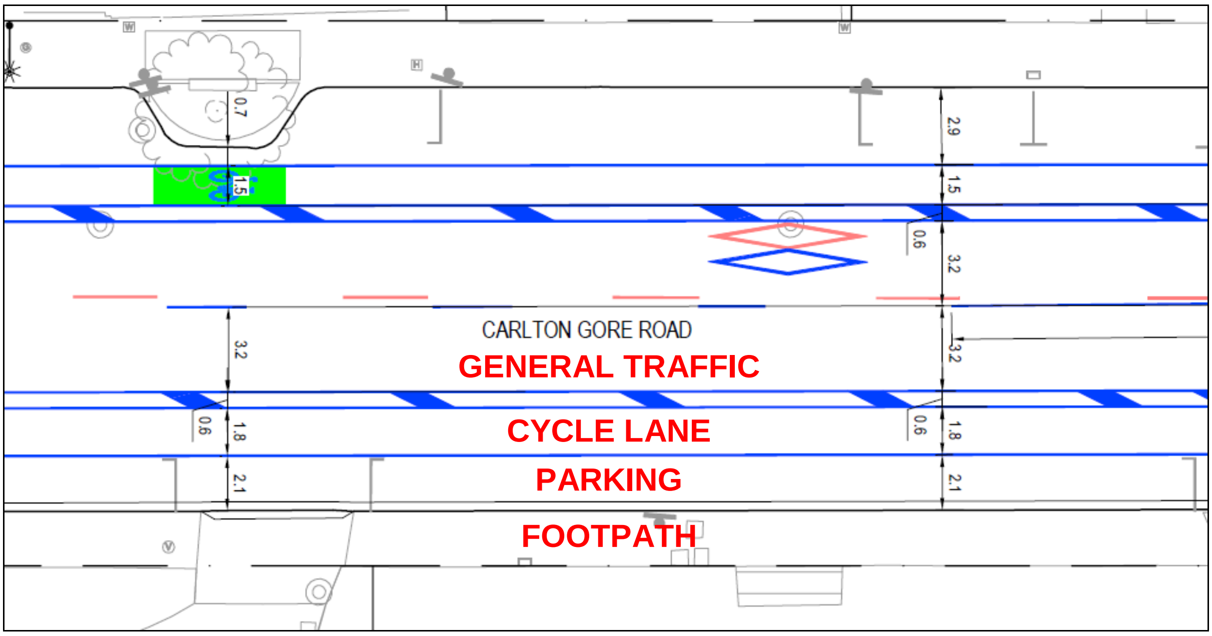

Figure 6: Excerpt of markings plan for Carlton Gore Rd (annotations added in red)

When designing a cycle lane, a key risk to be assessed is *dooring.* This is when a parked motorist opens their door into the path of an oncoming cyclist, forcing them to swerve or crash into the door. The risk is substantial, and has resulted in a number of deaths and injuries across the country. In built up urban areas, the risk of cyclists being hit from behind by moving traffic is minor by comparison.

Another factor to be considered is the *perception* of safety. It is important to note that the perception of risk for inexperienced cyclists does not always correlate with actual risk (Parkin, Wardman and Page, 2007), and unconfident cyclists are generally not comfortable cycling with traffic without some form of separation (NZTA, 2011). A perceived lack of safety is a significant barrier to cycling uptake (NZTA, 2011); improving the *feeling* of safety, therefore, is a desirable outcome, provided that it doesn't come at the cost of genuine safety.

Referring to relevant design standards yielded conflicting guidance on the issue. 'Cycling Aspects of Austroads Guides (2014)' advises that any surplus space is to be provided as a painted buffer between parking and the cycle lane. However, the 2008 NZ Supplement to Austroads Part 14 (cycling) advises that *"Cycle lanes next to parking should not use a 'buffer strip' as suggested in [Austroads Part 14]…. Any extra width should be provided in the cycle lane".* The Auckland Transport Code of Practice mirrors this view. When Austroads Part 14 was superseded by the Cycling Aspects of Austroads Guides (2014), the NZ supplement content was intended to be included, but was not incorporated due to an oversight. For this reason, the NZ supplement is still listed on the NZTA website and its content is currently being incorporated into Traffic Control Devices (TCD) Manuals.

Research on parking-cycle lane buffers has not yielded clear direction on how and when to use such buffers. A trial of various parking-cycle lane buffer treatments was undertaken in Dunedin on the central city SH1 one-way pair, where a cycle lane runs adjacent to kerbside parking. The results showed that while the buffer markings slightly shifted cyclists away from the kerb, vehicles tended to park further from the kerb, resulting in unchanged separation between the cyclists and parked vehicles – effectively nullifying the benefit of the buffer. The trial did experience some methodological issues, hampering how its conclusions and data can be used (and its report is consequently still in draft stage); however there have been American studies which show similar issues with parking discipline (Furth et al., 2010). Further research is needed to determine how best to mark a parking-cycle lane buffer, and establish guidance on where they should be used.

There were three other relevant factors for this site:

- The route has a longitudinal gradient. Dooring is a greater risk to downhill cyclists due to the increased speeds involved. However, as seen in Figure 5, on the downhill side of the road there is an approx. 400mm wide dish channel which acts as a buffer between parking and the cycle lane, reducing the need for a painted buffer;
- Cycling uphill is at a lesser risk of dooring due to reduced speeds, so a buffer was not an urgent safety requirement on the other side either, and
- The majority of parking is long duration (2-3 hours), reducing the frequency of motorists entering and exiting their vehicles

The combination of the factors above led to the chosen arrangement.

KEY LEARNING 3

The optimal way to allocate surplus road space in cycling schemes is not set in stone, and there is conflicting guidance on the matter. It is recommended that a thorough review of site-specific factors (e.g. gradient, road widths, parking controls etc.) be undertaken to ensure that this road space is optimally allocated.

2. Teething Issues

Some elements of the project presented challenges as road users grew accustomed to the new infrastructure. The inclusion of 'floating parking', on the southern side of part of the corridor, was an example of this. The floating parking arrangement has carparks adjacent to a kerbside cycle lane, with physical separator islands in between. A plan view of this arrangement is shown in Figure 7.

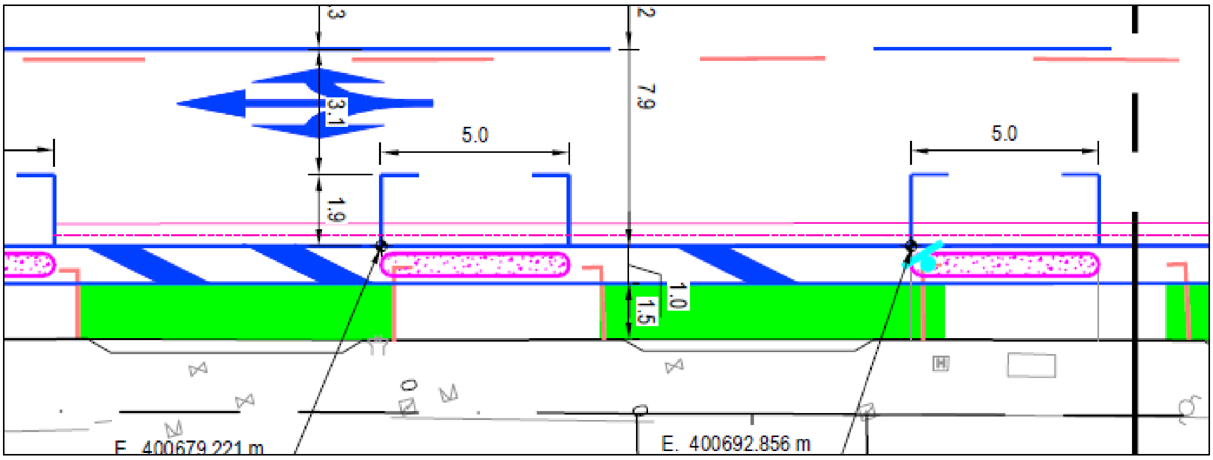

Figure 7: Plan of Carlton Gore Road floating carparking

While this approach afforded cyclists a high level of protection – and has been used overseas – drivers had two major difficulties in dealing with the new layout:

1. **Driveway manoeuvring** – Complaints were received that it was difficult to exit many of the driveways along the route, due to a combination of visibility concerns and the 'hooked turn' manoeuvre required to enter and exit the driveway. To remedy the concerns of the stakeholders, AT officers travelled to site and demonstrated the manoeuvre to them, showing that it was safely achievable.

2. **Intersection queuing** – complaints were received that additional congestion was being caused at a nearby intersection by motorists mistaking parked cars as queuing for the intersection. This is a difficult issue to pre-empt, but is likely to diminish over time as road users become more accustomed to cycleway facilities. In the meantime, it is recommended that communications and engagement resources are dedicated to the project to front-foot any issues which arise.

Another issue arose on the opposite side of the road, where a small number of motorists failed to identify the cycleway and collided with the separator islands. Most of these were minor brushes; however one incident involved significant damage to the vehicle as it drove over the islands separating the cycle lane from traffic. The aftermath is shown in Figure 8.

Figure 8: Car perched on cycle lane separators; vehicle damaged but no injuries.

The leading edge of the cycleway was marked and signed, as shown in Figure 9. However the green surfacing of the cycle lane had not been applied, as this section of the road had recently been resurfaced.

Figure 9: Beginning of cycle lane at the time of the incident shown in Figure 8.

Following the incident above, the green surfacing was promptly applied, along with some more substantial warning posts on the leading island, as shown in Figure 10.

Figure 10: The new lead in to the cycleway.

What was learned from this is that the leading edge of a cycle lane can present a safety hazard to motorists when the cycleway is first commissioned. Care needs to be taken in the design and construction methodology to ensure that the new road layout is safe.

KEY LEARNING 4

Protected cycleways are new to New Zealand, and as such, many road users are unfamiliar with them. Implementation of these cycleways needs to be accompanied with dedicated stakeholder communication so that the transition to the new road layout is as smooth as possible. The 'leading edge' of a new cycleway needs particular attention to ensure it is visible to motorists.

PROJECT OUTCOMES

While this paper has focussed on what these two schemes could have improved upon, it is not to say that the schemes have not been successful. Both projects provide a high level of protection and comfort to cyclists, while also providing benefits to pedestrian amenity and urban renewal. The projects were built on a strong economic foundation, and AT has received positive feedback from the community on both of them. What remains is to join up these facilities together to build the fully-connected Auckland Cycle Network.

CONCLUSIONS

In developing the cycleways discussed in this paper, Auckland Transport has had some great successes, but also met with some new challenges. Four such challenges have been discussed in this paper, with four main lessons derived:

1. The importance of understanding pedestrians movements, and how they will interact with the project;
2. The need to appreciate the different tolerances involved in cycling design, and the attention to detail needed to achieve optimal outcomes;
3. How best to allocate surplus road space when implementing an on-road cycling facility, and
4. What some 'teething issues' one needs to be aware of when implementing a cycleway, and thoughts on how to pre-empt or ameliorate these issues.

While this paper has presented lessons that could be learnt from these two schemes, they have overall succeeded in providing a high level of protection to cyclists and are positive steps forward in developing Auckland's Cycle Network.

ACKNOWLEDGEMENTS

The author owes thanks to many people within Auckland Transport who have supported the development of this paper as well as the professional development of the author. There are too many names to list all, but thanks go out to:

- The **AT Walking & Cycling team**, with particular thanks to Malcolm McAulay, who provided a wealth of insight for this paper, and
- The **AT CBD Roading Development team,** who supported and assisted the author throughout 2015. Particular thanks go to Joe Schady, who mentored the Author for most of the year.

Thanks also go out to GHD Ltd, the author's current employer, for providing him the opportunity to present this paper and providing feedback on the final presentation.

REFERENCES

AUCKLAND COUNCIL, (2012). City Centre Masterplan. [ONLINE] Available at: http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/plansstrategies/ccmp/Pages/documents.aspx. [Accessed 23 January 16].

AUCKLAND TRANSPORT, (2015). Cycling and Walking Programme (Auckland Cycle Network). [ONLINE] Available at: https://at.govt.nz/cycling-walking/cycling-and-walking-programme/. [Accessed 27 November 15]

AUCKLAND COUNCIL, (2013). The Auckland Plan. [ONLINE] Available at: http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/plansstrategies/theaucklandplan/Pages/theaucklandplan.aspx. [Accessed 27 November 15].

AUSTROADS, (2014). Cycling Aspects of Austroads Guides. [ONLINE] Available at: https://www.onlinepublications.austroads.com.au/items/AP-G88-14. [Accessed 27 November 15].

FURTH, P. G., DULASKI, D. M., BUESSING, M. & TAVAKOLIAN, P. 2010. Parking Lane Width and Bicycle Operating Space. Transportation Research Record: Journal of the Transportation Research Board, 2190, 6.

LIGHTOWLER, A. and AH MU, M. (2015). Delivering Auckland City Centre's First On Road Segregated Cycleway. IPENZ Transportation Group Conference, 22-24 March 2015, IPENZ Transportation Group, Christchurch, New Zealand.

NEW ZEALAND TRANSPORT AGENCY, (2008). New Zealand supplement to Austroads guide to traffic engineering practice: part 14 bicycles. [ONLINE] Available at: https://www.nzta.govt.nz/resources/nz-supplement-austroads-gtep-part-14-bicycles/. [Accessed 27 November 15].

NEW ZEALAND TRANSPORT AGENCY, (2011). Assessment of the type of cycling infrastructure required to attract new cyclists. [ONLINE] Available at: http://www.nzta.govt.nz/assets/resources/research/reports/449/docs/449.pdf. [Accessed 27 November 15].

PARKIN J.; WARDMAN, M.R. and PAGE, M. (2007) Models of Perceived Cycling Risk and Route Acceptability. Accident Analysis and Prevention, 39, pp.364-371.