

BICYCLE NETWORK PLANNING: THE TARGET AUDIENCE APPROACH

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Abstract

The purpose of this paper is to inform about a new approach to bicycle network planning that is emerging in New Zealand. Fundamental to this is the cycling typology developed by Roger Geller, who differentiates between the *Enthusied & Confident* (broadly those people who already cycle in urban areas; some 8% of the population) and the *Interested but Concerned* (those who would cycle but are afraid of interacting with traffic; some 60% of the population). The difference to previous planning approaches is that the target audience for each network link is defined from the start.

This planning approach has the advantage of creating routes that are consistent in their level of service over their entire length, a direct outcome of defining who a network link is supposed to cater for right from the beginning. It requires more planning effort upfront, but results in corridors being chosen that are more realistic to achieve.

This approach has been used in Dunedin and Christchurch. The network in South Dunedin, which mainly caters for the *Interested but Concerned*, is under implementation. The Major Cycle Routes in Christchurch are in either the planning or implementation phase, with all 13 routes targeting the *Interested but Concerned*.

Introduction

A variety of planning approaches are available when defining a strategic network of routes for cycling. In this paper, the relevant Australasian planning guidance is explored through a literature review. In practice, there is a recent move towards defining the target audience for each cycle network link at the planning stage, but the relevant planning guidance has not yet caught up with this. 'Target audience' refers to types of cyclists and their requirements, as defined by trip type. This paper suggests adoption of a slightly different approach, where people are divided into typologies in relation to their willingness to interact with motorised traffic when travelling by bike. This is based on a method developed by Geller, who describes the largest audience type, making up more than half the population, as the *Interested but Concerned*, i.e. those who would like to travel by bike but are reluctant to interact with motorised traffic.

This paper describes how Dunedin and Christchurch have based the planning of their networks on providing for the *Interested but Concerned*. The commonalities of their planning approaches are described, but there are also significant differences. The authors suggest that the target-audience-based planning approach is superior to traditional planning approaches, and that other local authorities should adopt this approach and review existing network plans. It is further suggested that the relevant planning guidance is in need of updating.

Literature review

Planning in New Zealand

Most territorial authorities in New Zealand have a cycle strategy; this is commonly done at the city or district council level. Sometimes, this strategy is produced by the regional council, and some areas are covered by a unitary authority. The NZ Transport Agency (NZTA) does not produce its own cycle strategies, but planning is usually undertaken in conjunction with (and often by) the local authority, although sometimes this is covered through a regional land transport strategy or a state highway 10 year plan. Hence, state highways are generally included in the territorial authority's strategy (Macbeth et al., 2005). A stocktake in 2005 found that 36 walking and cycling strategies were held by 30 different councils throughout New Zealand (Macbeth et al., 2005). Three years later, there were 61 strategies prepared by 55 different councils out of a total of then 85 councils (Fowler, 2008). As 2008 was the last stocktake, the number of strategies prepared since is not known. The rate of producing new strategies would have slowed considerably, since the preparation has not been subsidised for territorial authorities since the 2009 Government Policy Statement became operative through the 2009–12 National Land Transport Programme (Ministry of Transport, 2009).

Most strategies include a network map that defines spatial coverage, whilst some strategies have implementation plans that describe localities. The focus of most network implementation is on urban areas (Fowler, 2008).

Applicable planning guidance

A variety of sources are applicable for planning a network for cycling in the New Zealand context. As is shown in Figure 1, the oldest of these is the *Cycle Network and Route Planning Guide* (CNRPG) (LTSA, 2004), which in itself expands on chapter 2 ("Planning") of the *Guide to Engineering Practice Part 14 – Bicycles* (Austrroads, 1999). Chapter 5 of the CNRPG discusses possible cycle network planning approaches, and lists five different options:

1. The 'Every Street' approach recognises that "cyclists' trip origins and destinations are as complex as those of car drivers", and allows for the whole road network to also form the network for cycling;
2. The relative advantages and disadvantages of roads and paths are then discussed;

3. The third option is dual networks, which recognises that different groups of cyclists might have different needs. It is discussed that it might sometimes be necessary to provide dual networks within the same road corridor, so that for example the needs of commuters and school children can both be met;
4. A fourth planning approach is to assign routes to hierarchies, with for example regional network elements having different functions to principal, collector or local links;
5. The last planning approach is based on cyclist needs, which involves comparing the route options for each situation on their merits.

The CNRPG defines in its Table 3.1 five types of cyclists (neighbourhood, commuting, sports, recreation, and touring). The needs of each type are cross-referenced to network or route requirements, with a variety of criteria further refining these requirements. The resulting 4x16 matrix is comprehensive, but a planner using this tool may struggle with comprehension.

The *Guide to Engineering Practice* (GTEP) series has been formally withdrawn and superseded by a new series of guides. The *Austrroads Part 14* material was dispersed throughout the new guides to enable a more integrated approach to include cycling and all other road user groups. The network planning aspects are covered in the *Guide to Traffic Management (GTM) Part 4: Network Management* (Austroads, 2009), of which the second edition has recently been published (Austroads, 2014).

The *GTM Part 4* guide focuses on the hierarchical planning approach (point 4 above), differentiating between regional and local bicycle networks, and mixed traffic streets. Beyond that, it does not discuss possible different network planning approaches. Seven different categories of cyclists are defined (primary school children, secondary school children, recreational, commuter, utility, touring, and sporting), and the needs matrix is much simpler than the CNRPG. That said, the matrix has the problem that it fails to clearly define the riding environment for each category of cyclist. For example it states that “some [commuters] prefer paths or low stress roads, willing to take longer to get to destination, others want quick trip regardless of traffic conditions, primarily require space to ride and smooth riding surface, speed maintenance.” This advice is ambiguous and further discussed below.

Whilst it was a commendable approach to disperse the cycling guidance across general topic area guides, it also resulted in the complication that when guidance specific to cycling was sought, seventeen different guides had to be consulted: seven *Guides to Road Design*, one each of the *Guide to Project Evaluations* and *Guide to Road Safety* series, and eight *Guides to Traffic Management* (Wilke, 2014b). Austroads responded to this situation by issuing the summary guide *Cycling Aspects of Austrroads Guides* “to ensure that information is readily available for practitioners who have a specific interest in cycling issues and facilities” (Austroads, 2011). So like the original *Austrroads Part 14*, all of the cycling-related guidance is now in one document, as shown in Figure 1.

The *Cycling Aspects of Austrroads Guides* gives the same 4½ pages of network management content that the *GTM Part 4* guide dedicates to the topic, but in a different order. *GTM Part 4* is available for purchase, whilst the *Cycling Aspects of Austrroads Guides* is available for free.

In summary, the present version of Austroads network planning guidance relating to cycling is not comprehensive, is difficult to comprehend, and is ambiguous in content.

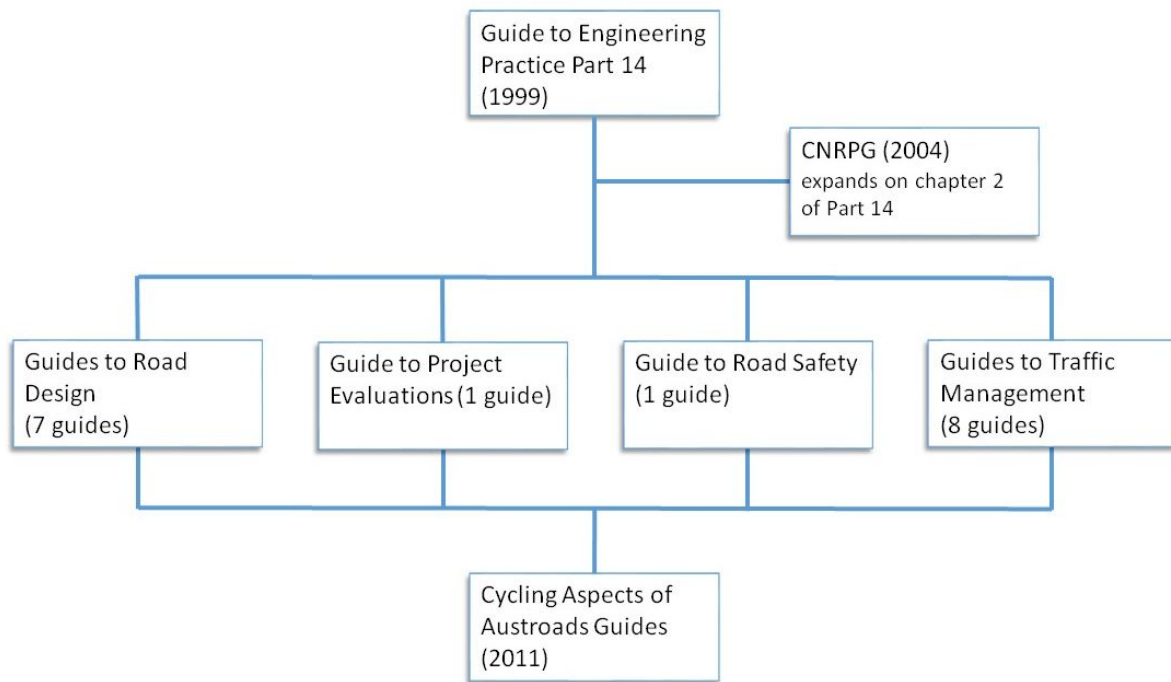


Figure 1: Relationship between Austroads and CNRPG guidance

Geller planning approach

An alternative option is the ‘dual networks’ planning approach from the CNRPG (point 3 above), where different routes cater for different target audiences. This was popularised by Roger Geller on his visit to New Zealand as part of the *2WalkandCycle Conference* in Hastings in 2012. Geller, the cycling coordinator from Portland in the US state of Oregon, gave nine presentations throughout the country prior to the conference and made audiences aware of the simple but meaningful breakdown of cycling typologies developed by him and since widely adopted.

The method is based on an entire population being broken down into four types of transportation cyclists as shown in Figure 2, with the bar graph representing the proportions of a population that fall into the various categories (Geller, 2009). Whilst Geller’s original chart has the four colours forming defined boundaries, Figure 2 uses gradual transitions reflecting the fact that groups are not necessarily fixed. Proportions might vary according to local culture and other demographic factors, and it is not possible to clearly assign every person into one of the categories. Geller originally developed this categorisation in 2005, and it has since been widely discussed by his American peers, and been subject to academic research. Geller’s initial estimates of the category proportions have largely been confirmed through this process (Geller, 2009).



Figure 2: Geller’s four types of transportation cyclists

Geller stresses that it is important to identify the target audience that a particular cycle route is supposed to cater for. Different routes may have different target audiences, with for example experienced cyclists (i.e. *Enthusied & Confident*) accepting a facility provision that would not

be sufficient for novices (i.e. *Interested but Concerned*). It is important that the target audience be defined for each route, as the level of provision should meet the needs of its target audience over its entire length. Conversely, where a facility caters for novice cyclists over most of its length, but requires them to mix with traffic at even one intersection along the way, this could well be off-putting enough that the journey might not be undertaken by cycle along this corridor by novices.

The four groups shown in the figure can be explained as follows:

Strong & Fearless: A group of people who will travel by bike regardless of the conditions. The cities that provide the most hostile cycling environments still see around 0.8% of all trips made by bicycle, and the users in that group can aptly be named as *Strong & Fearless*.

Enthusied & Confident: The next group of the population requires some space on the carriageway, and where that is made available either informally (for example by wide kerbside lanes) or formally (for example by painted cycle lanes), they will be prepared to travel by bike. People in this group are generally prepared to mix with motorised traffic to some extent. Where a bicycle network is aimed at the *Enthusied & Confident*, the maximum uptake of cycling may result in a cycling mode share of 8% to 10%.

Interested but Concerned: The next group of the population requires physical separation from motorised traffic before they are prepared to travel by bike, or allow their children to go by bike. Some people in this group may be prepared to mix with motorised traffic where both volumes and speeds are low. Where a bicycle network caters for the *Interested but Concerned*, about 60% of the population may be prepared to go by bike, at least some of the time. Some of the people in this group may not think of themselves as cyclists, but would take up cycling if the conditions were right (the physical environment) and when they see other 'non-cyclists' starting to use bicycles for some trips (the social environment).

No way No how: The remainder of the population would not use a bicycle. It is simply not something they would entertain. No efforts need to be spent to convince this group to take up cycling, as they are not receptive to it.

This aligns well with findings by Koorey and Kingham (2011), who investigated what type of infrastructure would most likely result in people who don't yet ride a bike for transport to take up cycling. Through working with focus groups they determined that safety was by far the most important factor, and the required infrastructure had to achieve separation from motor vehicles.

Discussion on NZ planning guidance

Despite its age, it is the authors' opinion that the CNRPG is much more useful in assisting with the cycle network planning process than the Austroads guides. The CNRPG is more comprehensive and gives various planning approaches, whilst Austroads guidance concerns itself with the hierarchical approach only. Both the CNRPG and the Austroads guidance give a large number of cyclist types, each with their own requirements. The Austroads guidance suffers from providing ambiguous advice for various cyclist categories. Geller has chosen a different way of categorising cyclists which is both simpler and, in the author's opinion, does not suffer from the fact that a categorisation by trip type is not the best approach for planning purposes. On the face of it, there is no reason why parties interested in the cycle network planning process would purchase the *GTM Part 4* guide, as the CNRPG guidance is more comprehensive, more useful, less ambiguous, and freely available for download.

However, whilst the CNRPG may be more helpful, it, like the Austroads material, does not specifically mention the cycle route type that in many North American cities adds most mileage to cycling networks. This route type is known under a variety of names, such as Bicycle Boulevards (the original name used in Palo Alto, California), Neighbourhood Greenways (e.g. Portland, Oregon, rebranded its Bicycle Boulevards, "a political move to broaden the support base and minimise any backlash associated with cycling-specific facilities"), or Quiet Streets

(the term adopted by Dunedin City as referred to henceforth in this paper) (Koorey, 2012, Dunedin City Council, 2013b). These appeal to the *Interested but Concerned* if designed well. The CNRPG dedicates a little less than one page to “mixed traffic”, but fails to explain the network planning potential. The *Cycling Aspects of Austroads Guides* does not provide any useful guidance on the topic of mixed traffic. In North America, there are whole design guides available that cover this topic (e.g. Walker et al., 2009), or guides that dedicate substantial chapters to it (e.g. NACTO, 2014). Koorey (2012) published a paper on this planning tool at the 2WALKandCYCLE Conference in 2012, but despite it having first been implemented in 1981 in Palo Alto, little use has been made of it as yet in New Zealand.

Given the strong uptake in North America of Quiet Streets, relevant Australasian guidance is clearly in need of updating. The authors also recommend that planning guidance should make use of Geller’s cyclist typology, as it is a simple yet effective tool, much easier to use and understand than the planning approaches based on cyclist types that the Australasian guidance uses.

Description of network planning based on target audience

This paper describes a new approach to bicycle network planning that is emerging in New Zealand. Fundamental to this is Geller’s cycling typology (Geller, 2009), with a target audience defined for each link at the network planning stage. Equally important is the inclusion of Quiet Streets.

Previously, at the planning stage, a route was defined and only at a later point during the scheme development stage, the option assessment determined what type of infrastructure could be provided. Depending on what could be achieved determined which target audience a corridor could accommodate. Most commonly, this was the group of *Enthusied & Confident* who did not mind interacting with traffic to some extent.

With the new approach, the difference is that the target audience for each network link is defined from the start. This makes planning more complex but will generate a significant improvement in uptake if the aim is to increase the mode share of cycling. This paper explores how Dunedin and Christchurch have approached their network planning, using two quite different methods. In Dunedin, the network was originally planned with a view of wanting to provide for the *Interested but Concerned* on most corridors, and, funding permitting, also provide some corridors for the *Enthusied & Confident*. As the planning phase went straight to implementation, much more effort was spent on ensuring that corridors were chosen that could realistically be achieved. In contrast, Christchurch planned a hierarchical network with an implementation timeframe of several decades. Much less planning effort was therefore put in during the initial network development. In a move not expected by officers, the provision of 13 Major Cycle Routes (MCRs) that would all appeal to the *Interested but Concerned* was subsequently funded for immediate implementation.

Case Study: The Dunedin Strategic Cycle Network

A Strategic Cycle Network (SCN) was developed for Dunedin in 2009/10 (Abley Transportation Consultants, 2010) and adopted by the Council in 2011. A decision was made to implement the network on a suburb-by-suburb basis, and the South Dunedin area was identified in 2011 as Dunedin City Council’s (DCC) top priority area for the SCN implementation (Dunedin City Council, 2013a). Six routes were defined for South Dunedin, and the NZTA agreed to subsidise the work as a package. \$4.5m of funding was allowed for in the NLTP 2012–2015 for the implementation of these routes.

Up to that point, the city’s approach was to mainly provide for the *Enthusied & Confident*, for example through the removal of pinch points or the provision of cycle lanes (e.g. Midland Street in South Dunedin). The main exception to this is the Harbour cycleway, which mostly provides for the *Interested but Concerned*, and is being jointly delivered by the NZTA (the pathway parallel to SH88) and DCC (for example Portsmouth Drive).

During the 2009/10 network planning phase, the target audience had been defined as 'ordinary people going about everyday activities'. This meant that Dunedin would not benefit from the approach proposed by Geller in terms of planning for the *Interested but Concerned*, and provision on the six South Dunedin routes was proposed to be cycle lanes on five routes, and a shared path on the sixth. Further planning to develop the network was undertaken in 2012/13 once funding was secured, and at that stage it was highlighted that separation from traffic would be essential in providing for that target audience. It was therefore decided to further adjust the network, define a target audience for each corridor, and provide facilities accordingly. This meant that a considerable amount of extra work had to be undertaken during the network planning stage, as only certain facility types would accommodate a given target audience. These generally require more width in the road cross-section to provide the necessary level of service as compared to providing cycle lanes, as per the original plan. Parameters such as carriageway width, traffic volume, and parking demand, amongst others, had to be assessed against typical cross-sections to gain an understanding of the feasibility of each route. But this planning approach also meant that more certainty could be gained, as difficulties during implementation should form part of the consideration when deciding on the routes that are to make up the cycle network (Wilke, 2014a).

The outcome of this review was a network plan which catered for the intended target audience (ordinary people going about everyday activities, or *Interested but Concerned*), and all but three of the proposed network routes catered for the *Interested but Concerned*. The network was feasible and would have attracted much higher usage than the previous network design, as the previous approach utilised many busy roads where generally only a lower level of service suitable for the *Enthusied & Confident* could have been provided. The revised network was considerably denser (i.e. more people live close to the various corridors), avoided the steepest part of the previous network, but most importantly had a much higher proportion of corridors where cyclists would be physically separated from motorised traffic. The new network also utilised some Quiet Streets, which the previous network plan had not envisaged. With the exception of one school in the suburb (a primary school with 100 pupils located on a steep slope), the network serviced all schools in South Dunedin. Compared to the previously planned network, it could expect to have had much lower crash rates due to reduced interaction with drivers, and a significantly higher uptake in cycling (which would be more effective in reducing congestion on the road network, or preventing congestion from getting worse).

Not all local cycling advocates are supportive of the planning approach, as they have a preference for using the arterial road network for its directness and priority at intersections. In the South Dunedin area, little cycling infrastructure existed (a shared path along the harbour, and cycle lanes on SH1), and some of the advocates preferred infrastructure provision on arterial roads. This may eventually be achieved if there is a significant shift towards cycling and strong community support; however at this stage the impact of separated facilities on those arterial roads would be highly disruptive to on-street parking, and therefore not likely to be a politically attractive solution.

At the end of the planning phase, the network was estimated at \$5.3m, i.e. \$0.8m over budget, with completion thus extended beyond the 2012–2015 NLTP period. Once construction started the initial tenders for the first and second packages of work showed that the revised network was more expensive and was then estimated to cost \$7.85m (i.e. the allocated budget was exceeded by \$3.35m). This was a considerable increase and was partly due to increased costs of Quiet Streets, which were thought to be relatively low cost, but had proved quite costly due to the treatments required at intersections. In other locations costs had been higher because of the community's desire to retain parking, which could be achieved in some places by relocating kerbs as an added expense.

In July 2014, city councillors were presented with three options to react to the budget overrun: building a network within the original \$4.5m budget, building a revised network for \$5.5m, or building the network as planned for \$7.85m. Councillors decided to go with the second option, which allows for a 14.8 km network, some 10 km less than the full network. The revised cycle network is suitable for the *Interested but Concerned* in its entirety, apart from one link with

cycle lanes along a busy commercial street (Midland Street) that was implemented several years ago.

At the time of writing this paper, some corridors had been built, others are under consultation, with some of the balance in the scheme design phase. Figure 3 gives a comparison between the Dunedin network as planned in 2012/13, and the July 2014 revision. Note that only the routes targeting the *Interested but Concerned* are shown. Connectivity to schools and activity centres is also identified in Figure 3.

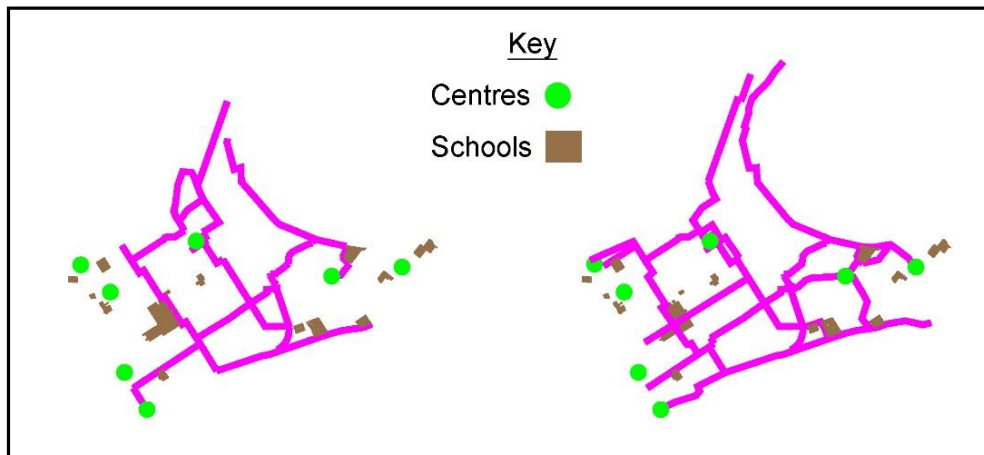


Figure 3: Network of routes targeting the *Interested but Concerned* in South Dunedin as per July 2014 revision (left) compared to 2012/13 plan

Case Study: Christchurch Transport Strategic Plan

The Christchurch approach to cycle provision post its 2004 Cycling Strategy has been steadily moving towards recognising networks for different target audiences, including those who have not yet taken up cycling. The 2004 strategy essentially showed a blueprint cycle network plan for the city that did not differentiate any routes or sub-networks based on target audience, but the intention was stated that all types of cyclists would be catered for (CCC, 2004).

The 2004 strategy was replaced in 2012 by the Christchurch Transport Strategic Plan (CTSP). Three different cycle networks were defined in this work that covered all transport modes – major cycling routes, local routes, and recreational routes (CCC, 2012). This change in approach has been brought about by a number of influences:

- There has been a growing awareness of the differing needs of different types of cyclists;
- There is a better understanding what environments need to be created that cater for those differing needs;
- The increase in cycling participation in several western cities in recent years where target audiences were identified and effectively catered for.

The three networks mentioned above were identified with the CTSP for implementation over a 30-year period beginning in 2012. Elected members adopted the CTSP, but also resolved shortly afterwards that all of the 13 Major Cycle Routes (MCRs) are to be built in the first five years, and provided \$68.5m in funding. The MCRs are specifically targeting the *Interested but Concerned*, which in Christchurch is defined as children as young as ten, with a high concern for road safety. Compared to previous approaches, this requires a considerable increase in the level of service that is to be provided, and some interesting challenges present themselves. CCC has agreed with other Road Controlling Authorities (RCAs) and major stakeholders on a 'one network' approach, which has smoothed the way in many situations for the impacts of the delivery of the MCRs on other transport demands.

With this sudden and significant focus on constructing all the MCRs, a notable issue has arisen. The supporting cycle network, primarily the local routes, and the supporting soft measures, are

not being funded to a similar level. This imbalance is due for review in the next Long Term Plan (LTP).

Council officers believe that these additional initiatives are needed to maximise the uptake of cycling on the new infrastructure. It is planned to have the soft measures programme starting when the first sections of the MCRs are opened in the 2014/15 summer.

It should be noted that CCC is not the planning authority for the Christchurch central city, but this function was taken on by the Canterbury Earthquake Recovery Authority (CERA). In the 2013 transport chapter, *An Accessible City*, a very similar planning approach to Christchurch City Council's cycle provision is taken within the central city (CERA, 2013).

CCC has in the past implemented much infrastructure for cycling on arterial roads, mostly in the form of cycle lanes, and along many corridors in the form of bus lanes. The *Enthusied & Confident* users are thus reasonably well catered for already, and it is thus not expected that the implementation of the MCRs will cause any issue for local cycling advocates.

Dunedin-Christchurch comparison

Figure 4 shows the network of routes targeting the *Interested but Concerned* in Christchurch and Dunedin at the same scale. This figure is based on the 13 MCRs in Christchurch shown in red supplemented by the core routes shown in *An Accessible City*. The Dunedin network in purple shows the network of routes in South Dunedin as per the July 2014 revision mentioned above. The resulting network is less dense than originally planned, but is now suitable for the *Interested but Concerned* with the exception of one existing legacy cycle lane (Midland Street); this link is not included in Figure 4.

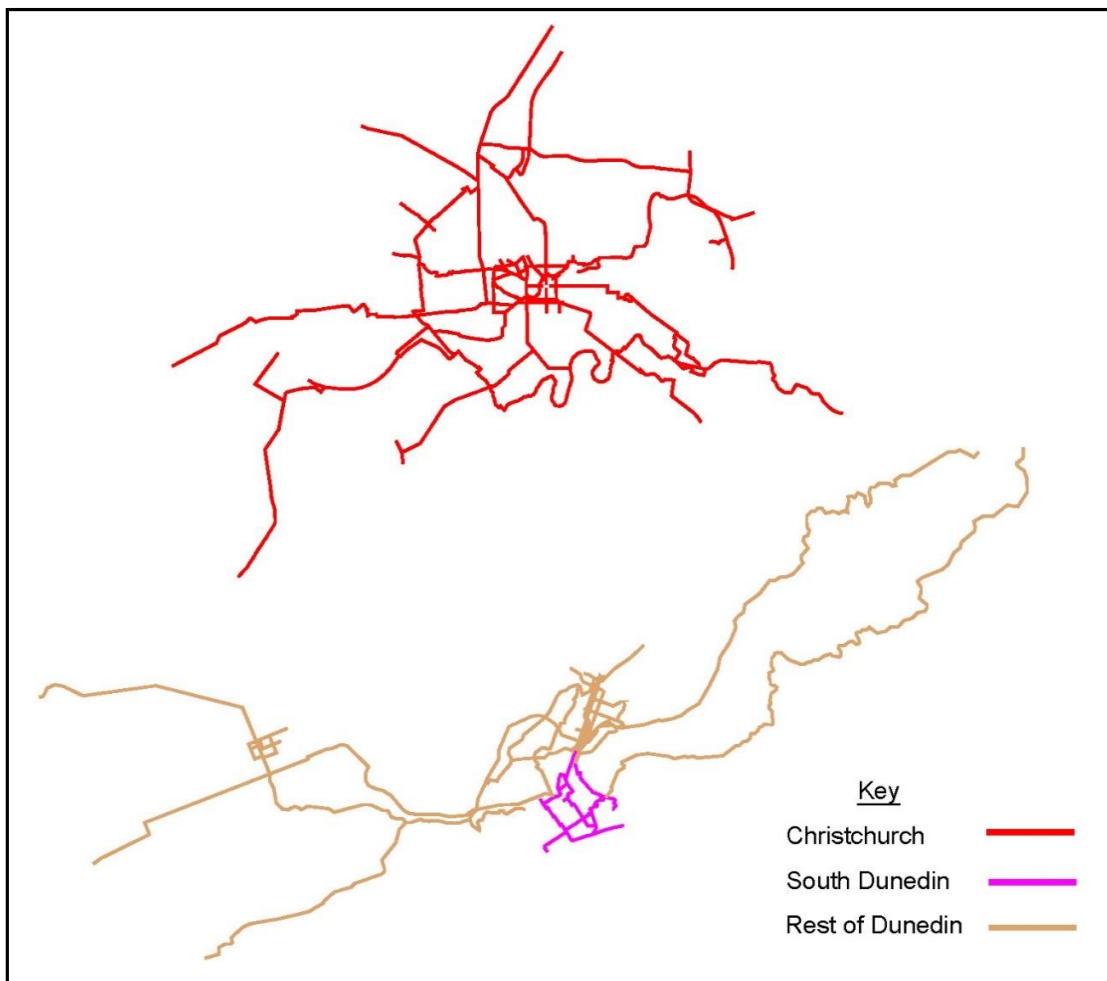


Figure 4: Network of routes targeting the *Interested but Concerned* in Christchurch (top) and Dunedin shown at the same scale

The light brown network in Figure 4 shows the Dunedin cycle network outside of South Dunedin as identified in the DCC transport strategy. The network in the central city is of similar density to South Dunedin, but the hillier suburbs west of the central city have a network that is less dense. Most of the planning work for the area outside of South Dunedin has yet to be undertaken, hence this part of the network is shown in a different colour, but the target audience is defined in the transport strategy as the *Interested but Concerned* for the entire network.

Planning is underway for a Christchurch network that covers a large geographic area, with \$68.5m to be invested. It can be seen that with the exception of the Christchurch central city, the \$5.5m South Dunedin network is much denser, even after the scaling back of the network. Whilst the current Dunedin activities cover a small geographic area, the eventual network will also cover a large area. The next area of focus for Dunedin is the Central City and North East Valley. This includes the SH1 cycleway proposal to install Separated Bicycle Facilities on the one-way pair through Dunedin. Regardless of differences in size or density between Christchurch and Dunedin, it can be expected that both networks will result in a significant increase in cycling, as the large group of the *Interested but Concerned* are accommodated.

Whilst some of the Dunedin cycling advocates are disappointed with the network not putting enough emphasis on arterial roads, the same opposition is not expected in Christchurch, as many arterial roads are already treated to cater for the *Enthusied & Confident*.

Conclusions

The relevant guidance for planning a cycle network in New Zealand can be found in the *Cycle Network and Route Planning Guide* (LTSA, 2004) and the *Cycling Aspects of Austroads* (Austroads, 2011), the latter being nearly identical to the content in the *Guide to Traffic Management (GTM) Part 4: Network Management* (Austroads, 2014).

Despite its age, it is the authors' opinion that the CNRPG is much more useful in assisting with the cycle network planning process than the Austroads guides.

However, none of this guidance specifically mentions the North American cycle route type that is variously known as Bicycle Boulevards, Neighbourhood Greenways, or Quiet Streets. The guidance should be brought up to date.

Dunedin City Council is in the process of implementing a comprehensive cycle network across the city, commencing in South Dunedin where almost all routes cater for the *Interested but Concerned*; the exception is one legacy cycle lane project. Each network link was planned for a specific audience; the work undertaken at the planning stage was more comprehensive than usual to achieve a network that is feasible and implementable. The project was then able to move straight from the planning phase into implementation, with a high degree of certainty of success.

Christchurch City Council is in the process of implementing the top-level element of a three-hierarchy network; these Major Cycle Routes (MCRs) all have the *Interested but Concerned* as their audience. The network formed part of the 2012–2042 Christchurch Transport Strategic Plan, and at the time of planning there was little budget provision for the network's implementation. Compared to Dunedin, significantly less planning effort was therefore put into the initial network elements that were planned for development several decades later.

When the two cities are compared, it can be seen that, with the exception of the Christchurch central city, the South Dunedin network is planned to be much denser, even after the recent budget review which reduced the scope of the Dunedin proposal.

Dunedin and Christchurch both make use of Geller's cyclist typology, as it is a simple yet effective tool, much easier to use and understand than the planning approaches based on cyclist types used in the current Australasian guidance. Geller's target audience approach is at the core of this paper, and the authors recommend that Australasian planning guidance be updated, and other local authorities should review their planned networks based on this new

approach. The reason for this is the superior effectiveness of this planning approach. It can be expected that both networks will result in a considerable increase in cycling; significantly more than that achievable using their previous network plans.

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