

ALLEN+CLARKE

**TRANSPORT-RELATED DETERMINANTS THAT
INFLUENCE DECISIONS TO USE CYCLING AS AN
ACTIVE MODE OF TRANSPORT FOR DAILY TRAVEL**

Final report

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1. Key findings

This report presents the results of a review of literature and documents regarding transport-related determinants that influence decisions to use cycling for daily travel. It is intended to assist the Ministry of Transport with understanding how to incorporate commuter cycling into future traffic flow modelling.

The key findings are as follows:

Determinants

The pool of possible determinants, influencers and barriers to cycling as an active mode of transport is broad, and includes:

- infrastructure issues (such as the provision of cycling lanes, road conditions, relationship with public transport, urban design issues such as street connectivity, cycling routes, etc.)
- traffic safety issues (such as transport-related injury, congestion/relative speed of transport modes, perceptions of safety, etc.)
- attitudes (such as car ownership, motorists attitudes to cyclists, cycling's status as a form of active transport, etc.)
- health benefits (such as fitness, general wellbeing, etc.)
- natural environment impacts (such as poor weather conditions, aesthetics, pleasantness of route, etc.)
- socio- economic factors (such as income, gender, profession etc.), and
- end of trip facilities (showers, lockers, etc.).

The scope of this literature review was on those determinants likely to be most impacted by decisions made by the Ministry of Transport: infrastructure issues, traffic safety issues, and attitudes. Some of the studies selected for inclusion in this review referred to the health benefits, the natural environment, socio-economic factors and end of trip facilities (although often very peripherally). Given that the literature selected for this review focused on infrastructure, safety and attitudes, we lacked the requisite research, studies and reports that would enable us to give a meaningful assessment about the extent to which these other determinants act as barriers or enablers.

Infrastructure issues

Well-designed and continuous infrastructure (such as cycle lanes and paths) is important to cyclists and is an enabler to commuter cycling. The research identifies a debate around the pros and cons of cycle lanes versus cycle paths. However, there is general agreement that some form of separation from motorists is preferable by cyclists to none. Connectivity to public transport hubs such as trains stations and bus stops is also an enabler. Barriers presented by infrastructure included lanes and paths that were shared by cyclists and motorists.

Safety issues

Safety concerns of cyclists and non-cyclists is an important factor when deciding to cycle to work. Studies and research have observed the different perceptions over safety, namely 'perceived' and 'actual' safety. There is a recognition that reliable data regarding crashes and injuries does not take into account 'near misses'. However, the more cyclists there are on the roads the safer cycling becomes, as both cyclists and motorists adapt to each other. Parental concerns about traffic and crime can also influence decisions to allow children to cycle to school.

Attitudes

Motorists and cyclists perceptions of each other can be negative and therefore act as a deterrent towards cycling. There is still a strong bias towards car ownership and policies which encourage car use. Until there is a focus towards discouraging car ownership, cycling as an active mode of transport may not be considered as a viable option for commuters.

Conclusions

To summarise, the findings of this literature review suggest that infrastructure, safety and attitudes are important when influencing decisions to cycle as mode of active transport. While there is debate as to whether or not cycle lanes are better than cycle paths, at least some degree of separation is important for cyclists. Furthermore, ensuring that infrastructure is well-designed and is efficient is also important. Fostering safety for cyclists will also likely result in higher rates of commuter cycling, particularly as cyclists and motorists become more accustomed to each other. Finally, there are a range of attitudes regarding commuter cycling. These attitudes are influenced by commonly held stereotypes of each other, for example, notions of cyclists as lycra-wearing 'pack riders', and motorists as being overly hostile and aggressive towards cyclists.

2. Introduction

The Ministry of Transport (the Ministry) is the government's principal transport adviser. A focus of the Ministry is to raise the profile of cycling in New Zealand as an active mode of transport. This aspiration is reflected in *Connecting New Zealand*, which sets out the government's policy direction for transport. In this document, the government seeks to make targeted investments towards cycling initiatives, which will encourage more people to select cycling as a transport choice.

To support the Ministry's ability to best target its investment, it is imperative to understand what influences individuals to choose (or not choose) cycling as an active form of transport. Understanding these determinants will also support the Ministry as it considers how best to develop transport modelling in a way that encourages people to travel by bicycle to work.

The Ministry contracted *Allen + Clarke Policy and Regulatory Specialists Limited (Allen + Clarke)* to conduct a short, focused review of published literature on the key transport-related determinants that influence decisions to use cycling for daily travel. This paper presents the results of this review.

2.1 Project terms of reference

There are many determinants which influence cycling; however, some cannot be influenced by the Ministry of Transport (for example, weather conditions and the geography). As such, the Ministry of Transport agreed to focus the literature review on the determinants that can be influenced, and additionally also align best with the aims set out in *Connecting New Zealand*:

1. Infrastructure issues (such as the provision of cycling lanes, road conditions, relationship to public transport, urban design issues such as street connectivity, cycling routes, etc.)
2. Traffic safety issues (such as transport-related injury, congestion/relative speed of transport modes, perceptions of safety, etc.)
3. Attitudes (like car ownership, motorists' attitudes to cyclists, cycling's status as a form of active transport, etc.).

In addition, it was agreed that the literature review would not cover:

- possible determinants that impact upon decisions to cycle for recreational purposes
- non-transport related barriers/influencers¹
- determinants for other active modes of transport (i.e., walking, etc.)
- cycling in rural areas, or
- initiatives that specifically aim to increase participation in active transport.

¹ For example, demographic information including socio-economic information, security at destinations/crime or theft, general information about urban design, attitudes and perceptions unless linked to transport safety, health and fitness/physical activity, logistical issues such as the purchase and maintenance of a bicycle and associated safety equipment, motivation by others, personal views about the enjoyment of cycling, environmental considerations unless linked to specific transportation issues, and weather conditions.

The review focuses on published literature from New Zealand, Australia (state and federal), Canada, Ireland, the United Kingdom, Switzerland, Denmark, the Netherlands and the USA.

2.2 The search strategy

The search strategy included combinations of the following terms: barrier; enabler; influencer; determinant; factor; motivator; decision; bicycle and its variants (i.e. cycle, cycling); active transport; active mode; cycling to work; daily travel; traffic demand modelling; case study; systematic analysis/es; meta-analysis ; random control trial; study; and research.

The following databases, catalogues and indexes were accessed:

- Australian Transport Research Institute (www.atri-online.org)
- OVID Transport (<http://www.ovid.com/site/index.jsp>)
- Transportation Research Board (<http://trid.trb.org/>).

The Ministry of Transport's library conducted the search.

2.3 Selection of material

The final number of documents returned by the literature search before exclusion and based on the aforementioned inclusion criteria was 43.

The titles and abstracts of the 43 documents were reviewed and considered for inclusion against the following criteria:

- Currency (2008-today);
- English language;
- Meta-analyses and systematic reviews;
- Methodological rigour (peer-reviewed and sound methodology) based on the application of the critical appraisal checklist;
- Relevance to the research questions; and
- New Zealand, Australia (state and federal), Canada, the United Kingdom, Switzerland, Denmark, the Netherlands, Ireland and the USA.

Papers focused on recreational cycling, health benefits, the natural environment, end of trip facilities and socio-economic factors were excluded. Duplicates were also excluded. Based on these exclusion criteria, a final count of 20 documents were included in the review.

Each piece of literature provided by the Ministry library was critically appraised for its methodological robustness and relevance to the inclusion criteria listed above.

2.4 Considerations of scope

Inclusions to this review were limited to 20 documents.

This review is intended to provide a snapshot of some of the key transport-related determinants affecting individuals' decisions to cycle as a form of active transport. It is not a comprehensive review of all possible determinants, nor does it focus on emerging research reported in grey sources (i.e., it is only focused on published research). Within this limited scope, we have focused tightly on the three agreed issues and papers that summarise research findings on these. As such, there may be some complexities underpinning individuals' decisions that are not clearly reflected or captured (if these are not captured in the research) but which are nonetheless factors in their decisions to cycle.

The search strategy returned a large amount of single-city case studies, with small sample sizes. It also returned a sizeable volume of material about infrastructure and safety issues, but material regarding attitudes was not as plentiful. There was also a tendency in some reports for the writer of the research paper(s) to blend findings relating to recreational and commuter cycling together (as noted earlier, recreational cycling is out of scope). We are confident that our inclusion criteria and selection process have resulted in selection of research solely limited to commuter cycling.

While we reviewed literature from a range of countries, we focused on the New Zealand based research that was available, where possible. This was in recognition of the importance of cultural approaches to cycling and the preferences of cycling; however, we note that New Zealand-specific research on cycling as an active mode of transport was limited, and this has therefore limited our ability to comment on enablers and barriers in the New Zealand context.

3. Transport-related barriers and enablers to cycling as a form of active transport

This section outlines findings from the literature regarding the barriers and enablers that support individuals' decisions to cycle as a form of active transport. There are three selected determinants: infrastructure issues, traffic safety issues and attitudes.

3.1 Infrastructure issues

Cycle lanes and paths, street connectivity and other urban design factors was selected as a determinant because a better understanding of infrastructure-related barriers and enablers to cycling may assist the Ministry to develop infrastructure accordingly. This in turn may lead to greater numbers of commuter cyclists.

The literature reviewed indicated that infrastructure dedicated to cyclists is a key influencer in the decision to cycle to work (Winters et al 2010). The following sections identify some of the key deterrents and enablers to cyclists, identified in the literature with regards to infrastructure:

- Separation of infrastructure between cyclists and motorists
- Continuity of infrastructure for cyclists
- Traffic controlling systems
- The influence of public transport

3.1.1 Separation of infrastructure between cyclists and motorists

The literature generally defined cycle paths as being a path for cyclists that is physically separate from the road, while cycle lanes were generally defined as being part of the road but marked for or dedicated to cycle use (Danila and Fink 2013, Buehler and Pucher 2011).

There appeared to be agreement amongst researchers that at least some level of separation from other traffic was preferred by cyclists than none (Wati et al 2012, Buehler and Pucher 2011, New Zealand Transport Agency 2011, Winters et al 2010). Wang et al (2011) conducted research into factors influencing 140 Auckland University students and staff's decisions to commute by bicycle or not. The results of their study suggested that having infrastructure dedicated solely to cyclists, and separate from motorists is preferable for commuter cycling as it was safer for both motorists and cyclists. Furthermore, the study found that infrastructure that is jointly shared by motorists and cyclists deters cyclists because of safety concerns.

However, there is a debate among researchers as to whether it is better for cyclists to be segregated from or integrated into the traffic. The key points of this debate include cyclist preferences, the perceived and actual level of safety for cyclists, and whether or not cycle lanes as opposed to paths are quicker and more efficient for cyclists.

The degree of on-road separation between cyclists and motorists influences decisions to cycle to work. Some studies point towards bike paths being associated with higher cycling levels. This was identified in Heinen et al's literature review (2009), as they referenced studies where this was preferred by cyclists. Buehler and Pucher's (2011) examination of data from 90 cities in the

United States found no major statistical difference between the numbers of cyclists using paths as opposed to lanes. The authors concluded that other factors such as cultural differences and geography (which differ from city to city) influence the preference for cycle paths as opposed to lanes, or vice versa.

A research report carried out by the New Zealand Transport Agency's (2011) and Buhler and Pucher's research (2011) suggests that segregated infrastructure in the form of cycle paths could potentially act as a barrier to commuter cycling. This is because the segregated nature of cycle paths may be longer in length than roads, and act as a deterrent for cyclists who value speed as important to their journey (New Zealand Transport Agency 2011, Buhler and Pucher 2011).

Educating cyclists and motorists about how best to use the facilities may also be important. The New Zealand Transport Agency's (2011) report suggested that while separate infrastructure was a key enabler to commuter cycling, education for both motorists and cyclists was needed on how to best and safely use it.

3.1.2 Continuity of infrastructure for cyclists

The importance of continuous and non-interrupted cycle lanes and paths was also cited in the research (Wang et al 2011, New Zealand Transport Agency 2011, Heinen et al 2009). The sudden ending of lanes or paths is a deterrent to cyclists as it can impact upon convenience and speed of travel. As noted above, Wang et al's (2011) study found that a key influencer of decisions to cycle was a cycleway separated from traffic for the entire duration of their journey. This was corroborated by Akar and Clifton's (2009) survey of 1,672 Washington D.C University students who found that a connected route for the duration of their journey was also preferred. Continuity of infrastructure has also been found to alleviate safety concerns for cyclists, as they are not forced to reintegrate suddenly with motorists at intersections and busy roads when their lane or path suddenly terminates (New Zealand Transport Agency 2011). In summary, the literature suggests that uninterrupted routes are important to commuter cyclists, as they are safer and more efficient.

3.1.3 Traffic controlling systems (i.e., stop signs, traffic lights etc.)

In addition to cycle paths and cycle lanes, traffic controlling systems such as traffic lights and intersections also affect decisions. Heinen et al's (2009) literature review cited a study by Stinson and Bhat (2003) which concluded that stop signs, traffic lights and other similar systems can deter commuter cyclists as it may result in delays to their journey and unnecessary effort, as they are forced to stop frequently. Danila and Fink's (2013) work investigated a range of traffic controlling techniques and resources being developed by the American Association of State Highway and Transportation Officials (AASHTO). In their report, they noted that the delays to travel caused by traffic controlling systems can deter potential cyclists, but suggested that innovations in specialised bicycle signal timing, detection methods, and bicycle-specific signals can eliminate these delays. They suggest that these tools can act as an enabler to commuter cycling as they improve safety and efficiency for cyclists. On the whole, the literature suggests that traffic controlling systems can act as both a deterrent and an enabler of commuter cycling.

3.1.4 *The influence of public transport*

Connectivity with public transport, such as trains, ferries and buses, also impact upon commuter cycling. The literature identified three key factors which encourage greater integration of cycling with public transport:

1. distance to access public transport hubs
2. secure storage and facilities at the train or bus stop, and
3. the ability to carry bicycles on public transport (Heinen et al 2009, Bauman et al 2008, Ensor 2006, Wang et al 2011).

Heinen et al's (2009) literature review noted that the distance that cyclists need to cycle to a public transport hub may potentially be a deterrent. They cited several Dutch studies which found that a distance of between 0.5 and 3.5 km from home to the train station was considered the norm for cyclists biking to a train station. However, they did not comment as to whether or not cycling further than this was likely to be a deterrent.

While studies have found that linking cycling with public transport encourages more cycling (Buehler and Pucher 2011, Ensor 2010), some studies of European cities have found that good public transport networks can decrease the amount of cycling in a city (Buehler and Pucher 2011). It is suggested that public transport in European cities tends to be well-developed and well-integrated, meaning that there is more limited need for individuals to use private transport or to cycle. The developed nature of public transport in these key European cities contrasts with other nations such as New Zealand, where public transport is not well-developed outside of the main centres. As such, public transport development is likely to be less of a consideration for New Zealand cyclists.

3.2 **Safety**

Encouraging greater numbers of people to use cycling as an active mode of travel also requires consideration about how to best ensure that traffic modelling is done which ensures the safety of cyclists.

The literature review identified both perceived and real safety concerns of cyclists as a major factor influencing decisions to their own, and their children's decisions to cycle. Other themes included the argument that the more cyclists there are, the safer it becomes ('safety in numbers').

3.2.1 *Perceptions of safety*

Cyclist's perceptions of how safe their journey is matters (Heinen et al 2010, New Zealand Transport Agency 2011). There is a difference between a cyclist's perceived view of safety as opposed to the actual risk to safety, frequently referred to in the literature as objective and subjective safety (Heinen et al 2010). Objective safety is that which is real, and is measurable by the amount of bicycle crashes and incidents occur. Subjective safety relates to a feeling of being unsafe and being concerned about being exposed to danger while cycling (Sanders 2013).

There appears to be some disagreement among researchers as to the actual level of danger involved with commuter cycling. Wang et al's (2011) research discussed previous research in New Zealand on injury rates in New Zealand. They cited research carried out over a 15-year period (1991-2006) of cyclists and noted that the rate of deaths and injuries has been increasing over the last decade in New Zealand, prompting the authors to conclude that cycling in New Zealand was just not safe. We note that it was difficult to obtain an accurate picture of the actual level of safety for cyclists, due to the lack of other New Zealand based research on this area.

Fishman et al's (2012) review of existing literature found that cyclist's fears of traffic is disproportionate to the actual level of risk that they are exposed to. They found that fear was generated by the perceived possibility that an injury will occur from collision with a motor vehicle. The notion that cyclist's perceptions of their safety versus reality was discussed in several reports (Sanders 2013, New Zealand Transport Agency 2011). The latter report suggested that the perception of safety may in fact be more important the reality. We note that there appears to be a lack of New Zealand based research regarding attitudes of cyclists, and non-cyclists (including motorists) about the safeness of cycling.

Several studies identified that a lack of data on near-misses, crashes and other incidents makes it difficult to measure safety (Sanders 2013, Fishman et al 2012, New Zealand Transport Agency 2011). An American study of cycling in the San Francisco Bay area pointed out that perceptions of safety generated from 'near misses' influences people's decisions to cycle. The study found that 'near misses' are experienced to a greater extent than actual crashes, but 'near misses' are not recorded in official crash statistics (Sanders 2013). These 'near misses' may be the leading cause of fear regarding the safety of cycling amongst both cyclists and non-cyclists (Fishman et al 2012).

In conclusion, safety is a key concern of cyclists. However, there is disagreement as to how safe cycling is. In regards to New Zealand, there appears to be a lack of research which investigates whether perceptions of cycling as unsafe marry up with data about incidents and cyclists crashes.

3.2.2. 'Safety in numbers'

Bauman et al (2008) referred to evidence that the more cyclists there are, the safer it becomes (i.e. 'safety in numbers'). This effect is because the more cyclists on the road there are, the more cyclists and motorists get used to interacting with each other (Bauman et al 2008). Furthermore, it becomes more likely to motorists themselves could also be cyclists (New Zealand Transport Agency 2011, Bauman et al 2008). Case studies from Netherlands and Australia have shown that increases in cyclist numbers have decreased rates of serious incidents (New Zealand Transport Agency 2011). As cyclist and motorists skills improve towards each other, Bauman et al (2008)'s report suggests that injuries and deaths will decrease, improving both cyclists and motorists attitudes towards the safeness of cycling.

3.2.3 Safety and children cycling to school

Parents dropping children off to school in vehicles is a major cause of congestion (Wati et al 2012, Stewart et al 2012). It follows that a greater understanding of the barriers and enablers

influencing parent's attitudes to allowing their children to cycle to school can also influence future traffic modelling.

Safety concerns of parents influence rates of children cycling to school by decreasing rates. (Stewart et al 2012). These concerns include not just a fear of traffic, but exposure to crime (O'Loughlen et al 2011). Similarly with commuter cycling, researchers identify that 'perceived' versus 'real' safety also impacts upon decisions of parents to let their children cycle to school (Wati et al 2012), as parents may consider it as too dangerous for their children.

Wati et al's (2012) research finds that concerns held by parents regarding dangers posed by traffic may potentially be justified, as children are less likely to cope with traffic, and are more vulnerable to deaths and injuries caused by cars. They go on to say that adequate infrastructure, low traffic rates and low speed limits for cars results in parents having a better perception of safety (Wati et al 2012).

Another barrier to children cycling to school relates to crime concerns held by parents, for example, kidnapping, 'stranger danger', bullying and gang activity (Stewart et al 2012). A Canadian study found that perceptions of neighbourhood safety was identified in a major driver for parents allowing their kids to use active transport to get to school; parents who consider the neighbourhood safe were more likely to let their children ride to school (Gropp et al 2012). However, some researchers argue that concerns regarding crime may be based on outdated statistics (Stewart et al, 2012), and crime rates such as kidnappings against youth were in fact declining. An Australian study of parents and children found that perceptions of stranger danger were heightened in those children who did not use active modes of transport to get to school. Rather, children identified issues of traffic safety as of greater concern when cycling to school (Stewart et al 2012).

Regularity of active travel may also influence parent's attitudes. A study of the attitudes of 65 American parents of elementary school children in Colorado suggested that their perceptions of obstacles (such as crossing intersections and areas of high traffic volume) may diminish if children are regularly cycling or walking to school (Zuniga 2012). This researcher suggested that efforts need to be put into helping children and parents cope with these barriers, rather than building families up to believe that active travel to school can only take place in perfect conditions.

In summary, the literature reviewed suggests that there are barriers and enablers to children cycling to school, including traffic risks and also, the attitudes of parents.

3.3 Attitudes to cycling

The influence of attitudes towards commuter cycling is important, as they will determine the extent to which people consider cycling as an acceptable form of active transport. The influence of attitudes towards cycling to work were explored by several researchers (Heinen et al 2010, Greig 2012).

Heinen et al's (2010) literature review suggests that attitudes of people towards cars are more positive than cycling, but negative attitudes about car use also resulted in greater levels of

cycling. Furthermore, car ownership has a negative effect on both cycling , and attitudes to towards cycling.

3.3.1 Stereotypes associated with cycling

Stereotypes associated with cycling may be a deterrent (Grieg 2012, Fishman et al 2012). These include negative connotations associated with lycra-attire and pack riding (Grieg 2012). The term 'cyclist' may also mislead motorists to take the view that they are not sharing the road with fellow commuters, but someone using the road as a sporting arena (Grieg 2012).

These stereotypes contrast with attitudes to cycling in European countries, as it is not perceived necessary to have hi-tech gear, equipment or clothing, and cyclists are seen as everyday people using bicycles as transport (New Zealand Transport Agency 2011). This is reflected in higher rates of cycling as it is not perceived to be an activity associated with enthusiasts, but regular people cycling for transport.

3.3.2 Attitudes of motorists and cyclists towards each other

Negative perceptions by both motorists and cyclists towards each other has also been identified by several researchers as a potential deterrent (Grieg 2012, New Zealand Transport Agency 2011). An American study of San Francisco Bay residents and cyclists that combined focus groups, an online survey, and an analysis of crash data found that there was a perception by motorists that cyclists frequently engage in risky behaviour which endangers both motorists and cyclists (Sanders 2013). This research also found that there was a belief amongst motorists that cyclists are the biggest dangers to themselves, through activities such as red light running and failing to stop at stop signs.

On the other hand, cyclists contest that motorists have inadequate understanding of the road rules and behaviour discourteously towards cyclists (New Zealand Transport Agency 2010). The same report cited a Christchurch City Council survey which found that 32 percent of respondents who cycle consider motorists as discourteous towards cyclists. Furthermore, in an online survey of Bicycle Victoria members in Australia found that on average, cyclists experienced some kind of harassment from motorists every two weeks (Fishman et al 2012). These findings suggest that the negative perceptions held by cyclists and motorists towards each other potential deter greater levels of cycling, as both group views each other to be unsafe.

3.3.3 Car ownership and car use

Car ownership has a negative effect on cycling, while bicycle ownership has a positive effect – (Heinen et al, 2010). This was corroborated by Buehler and Pucher's (2012) study of 90 large American cities, who found that cities with higher car ownership have lower cycling levels. In New Zealand there has been an overall decrease in the rate of people per motor vehicle, and this has resulted in car orientated society (New Zealand Transport Agency 2010). Akar and Clifton (2008) concluded in their work that as long as car use remained relatively cheap and transportation policies were predominantly aimed at cars, cycling would be seen by the public as purely a recreational activity and not as mode of travel to work. In addition, a European study of factors that influence modes of transport to work found that policies which were aimed at reducing car ownership would likely reduce car trips to work (Santos et al 2013). Examples of

these policies provided by the Authors were higher parking prices and road charges. They also noted that such measures could compliment greater incentives to use public transport, such as cheaper public transport fares.

An analysis of data provided by the 2010 Metropolitan Washington Council of Government's regional household travel survey found that providing car owners with free parking facilities at work may also act as a deterrent to bike commuting (Buehler 2012).

To conclude, the literature reviewed shows that high levels of car ownership have a negative impact upon the rate of commuter cycling.

3.3.4 Life change events as a factor

Life changing events may also influences attitudes to active travel. One of the studies reviewed suggested that not only were built environment factors such as infrastructure important, but life-change events were also a factor in choosing to commute by cycle (Chatterjee et al 2012). These things include changes in employment location, and becoming a parent (therefore providing an impetus to cycle more often with their children. This study suggested that major changes in people's lives contribute towards a reconsideration of travel behaviour, and that policy makers could be making better use of leveraging off these life-changes in promoting commuter cycling.

It is noted that this study differed greatly from the other research, as recognised and examined the impact of intrinsic motivations as an enabler to cycle as an active mode of travel, as opposed to the influence of external factors such as built infrastructure. It follows that when considering attitudes to cycling, the impact of events such as changes in location of employment may influence decisions.

4. Conclusions

The literature review focussed on exploring barriers and enablers to cycling as an active form of transport presented by three key determinants: infrastructure, safety and attitudes). The research shows that they are important, and that within these determinants there are a many factors which act as both enablers and barriers. This research and the findings outlined above can be used when considering future traffic modelling.

Infrastructure is important to cyclists, as well- designed, efficient and safe facilities such as bike lanes and paths will encourage greater levels of cycling. Linked to this, are perceptions of safety amongst cyclists. Ensuring that cyclists are made to feel safe when travelling to work is shown to be a key enabler. The research points to the existence of 'actual' versus 'perceived' safety amongst cyclists. The research also shows that attitudes to cycling as an active mode of travel influence decisions to cycle to work. This includes the prevalence of stereotypes associated with cycling, and attitudes towards car ownership.

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