

## **IF YOU BUILD IT, WILL THEY COME? CYCLE FACILITIES – STATE OF THE PRACTICE**

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### **ABSTRACT**

This paper provides an overview of successful strategies to increase cycle mode share, highlighting North American cities that have increased their cycling rates through investment in improved cycle facilities. The paper provides information on innovative on-street cycle facility design, such as cycle tracks and bicycle boulevards. In addition to cycleway facilities, public cycle hire schemes are assessed for their potential to meet cycle mode share goals and other transport-related objectives. Other cycle-related improvements such as cycle parking and bus/train bicycle racks are also evaluated for their effectiveness in promoting, encouraging and accommodating increased trips by bicycle. The paper concludes with lessons learned and recommended key steps for cities interested in making cycle improvements.

## INTRODUCTION

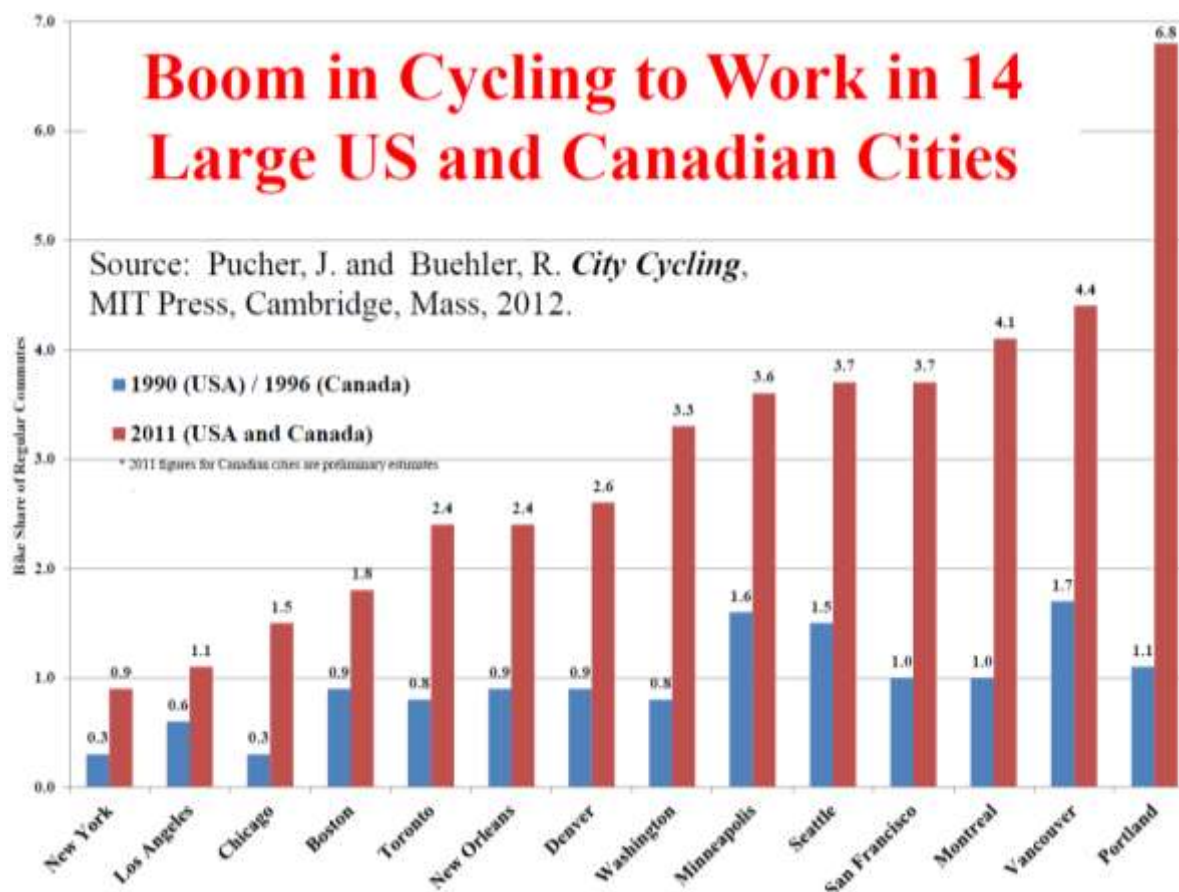
In the past century, the land use patterns and transportation systems in the United States have been largely influenced by the private automobile. While the private automobile is still the dominant mode of travel in most of North America, many cities such as Portland, OR, Seattle, WA, San Francisco, CA Chicago, IL Minneapolis, MN Montreal, QC Vancouver, BC and New York City, NY have increased their investment in cycling infrastructure in recent years, largely by providing an improved network of cycleways.

Because of the similarities between much of North America and New Zealand related to development and land use patterns, transport infrastructure, and private vehicle ownership, recent success in North American cities in improving cycling conditions can serve as a good example to guide cycle investments in New Zealand. Current cycle mode share in Auckland, New Zealand, is 1.5% with a goal of doubling the cycle mode share by 2030 (Auckland Transport, 2013). The Auckland Cycle Network proposes an extensive system of cycle facilities throughout the region. There are numerous proposals for separated cycle facilities in Auckland. Several of the key challenges that must be overcome in Auckland are narrower roads (as compared to North America or Australia) with fairly high speed traffic (50km/h), hilly topography, low density development and a vehicle code that does not provide important protections to pedestrians and cyclists.

This paper highlights some of the key cycle facilities that have been installed in US cities to improve cycling conditions and increase cycling, including innovative cycleway treatments, cycle hire schemes and other cycle facilities such as bicycle parking and cycle provision on public transport.

## CYCLING TRENDS IN NORTH AMERICA

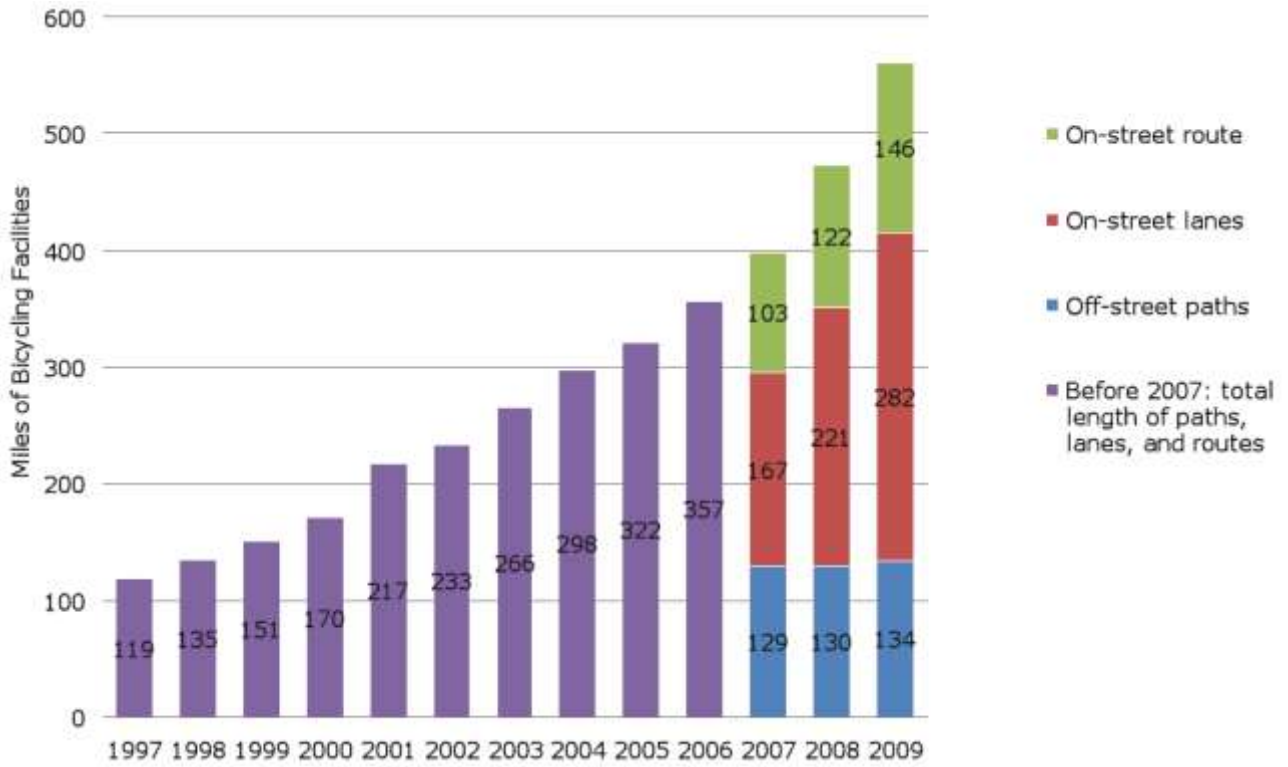
As would be expected, improved cycling conditions in US cities have coincided with increased numbers of people cycling. From 1990 to 2009, cycle commuting in the United States increased by 64%, and total cycle trips more than doubled (USDOT, 2010). Between 2000 and 2008, there was a 48% increase in cycling in the 70 largest cities in the United States. Between 1990 and 2011, Portland, OR, experienced the greatest increase in cycle commuting rates among larger cities in the US or Canada, climbing from 1.1% to 6.8% of workers (Pucher & Buehler, 2012). Figure 1 illustrates the increase in cycling to work across 14 different large US and Canadian cities between 1990 and 2011. While not the focus of this paper, it is worth noting that a number of cities outside of North America without a tradition of cycling have also experienced dramatic increases in cycling rates following an investment in cycling facilities. Seville, Spain is the most noteworthy as the percentage of cycling trips increased from 0.5% to 7.8% between 2000 and 2012, but other cities, including London, Barcelona, Paris and Bogota, have also experienced increased cycling rates (Pucher, Dill, and Handy, 2010).



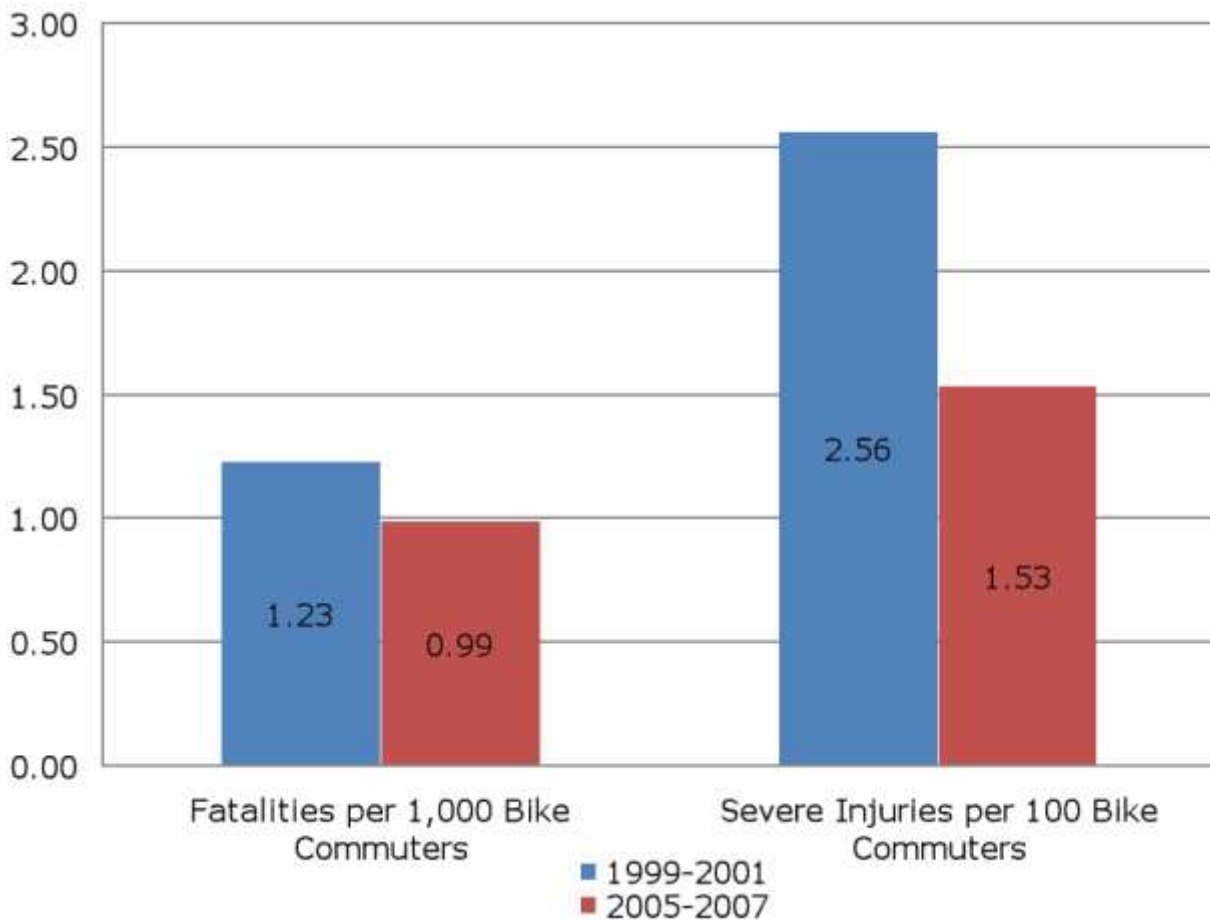
**Figure 1 – Cycle Commuting Mode Share in US and Canadian Cities (1990 – 2011)**

Source: Pucher and Buehler, 2012

In the past ten years, New York City has transformed itself from a city in which only the most fearless and confident citizens cycled, to a city in which it is not uncommon to see families and elderly citizens cycling on the city’s streets. The city adopted a bicycle master plan in 2007 that proposed significant bikeway improvements, cycle parking and cycle programs such as cycle training, traffic safety and promotional programs. Between 2007 and 2013, New York City constructed approximately 500 km of cycle paths and lanes, installed more than 8,000 new bicycle racks, distributed more than 75,000 free cycle helmets and launched the largest cycle sharing system in North America. Figure 2 presents the trend in the provision of cycle paths, lanes and routes in New York City between 1997 and 2009. It should be noted that many of the new cycleways constructed are innovative separated cycle facilities, which are discussed in more detail below. As a result of the city’s efforts, cycling has increased by 152% between 2000 and 2012 according to cycle screenline counts completed by the New York City Department of Transportation. The city plans to install an additional 745 km of cycle paths and lanes in the next ten years. It is also worth noting that while overall cycling rates have increased in New York City, there has been a reduction in cycle fatality and severe injury rates between 1999 and 2007 as illustrated in Figure 3. The reduction in cycle injuries and fatalities is frequently attributed to the ‘safety in numbers’ phenomena in which more cyclists on the road results in greater awareness of cyclists among drivers and a corresponding drop in collisions (Jacobsen, 2003).

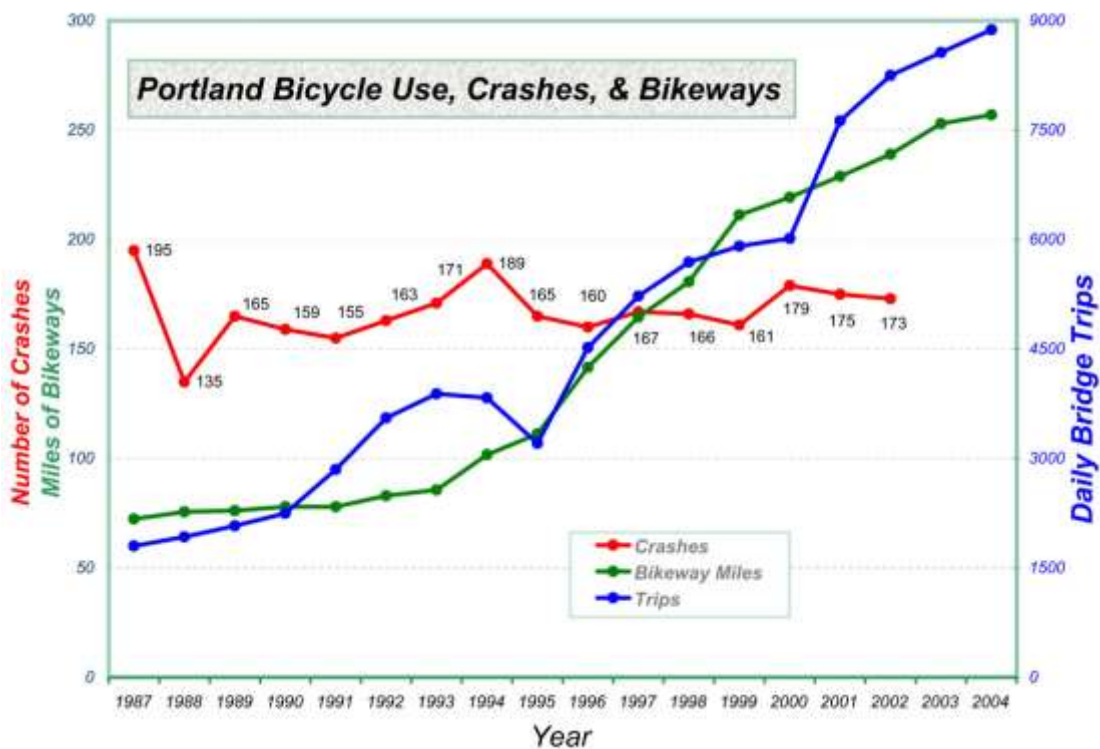


**Figure 2 – Provision of Cycle Paths, Lanes and Routes in New York City, 1997 – 2009**  
 Source: Pucher et al, 2010



**Figure 3 – Trends in Cyclist Fatality and Injury Rates, NYC (1999 – 2007)**  
 Source: Pucher et al, 2010

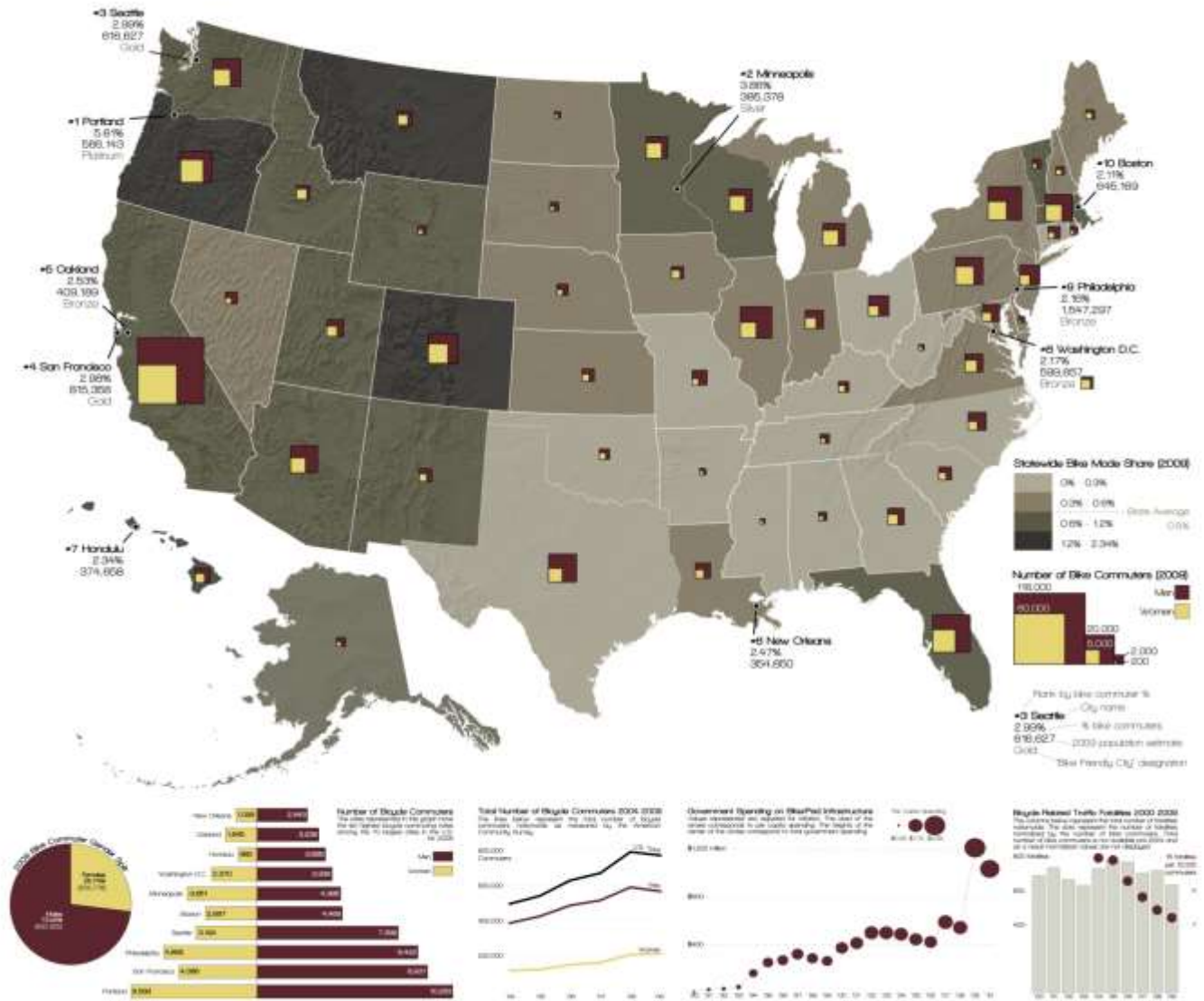
Similar to New York City, Portland, OR, has also experienced a reduction in collisions (for cyclists and other road users) following the implementation of new cycle facilities. In 2012, Portland adopted a new comprehensive plan called the Portland Plan, which established the goal of increasing the percentage of the population that walks, cycles and takes public transport to work from 39% today to 70% in 2035. Between 1987 and 2004, daily cycle trips across the bridges in Portland increased 5 fold while the number of cycle crashes fell, as illustrated in Figure 4. Due to the many variables involved in cycle crashes, it is not possible to conclude that building more bikeways and adding more cycling trips will always result in fewer cycling crashes. However, this has become a recurring trend in a number of cities that have invested in their bikeway network and the ‘safety in numbers’ theory has undoubtedly been gaining strength.



**Figure 4 – Portland Bicycle Use, Crashes, and Bikeways (1987 – 2004)**

Source: City of Portland Office of Transportation

Despite recent growth in cycling in the US, a considerable gender gap still exists among cycle commuters. In 2008, women only comprised 25% of cycle commuters in the United States. In some European countries, female cyclists take as many cycling trips as their male counterparts. In Denmark, 55% of all cycle trips are made by women (Pucher and Buehler, 2012). Survey data has shown that women are more sensitive to safety, which helps explain the high levels of female cycling in countries that have prioritised cycle safety, such as Denmark, Germany and the Netherlands, and the low levels of female cycling in the US. Figure 5 presents cycle mode share data for male and female cyclists in the US and suggests that considerable work remains to improve cycling safety in the US in order to address the gender gap in bicycling rates. The one area where the cycling gender disparity is leveling off is in cycle hire scheme membership levels. A recent study indicated that 43 percent of North American cycle hire scheme members were women (Goodyear, 2013).



**Figure 5 – Gender Gap Among Bicycle Commuting in the US**  
 Source: Northrop, 2009

While safety has improved in some cities that have prioritised cycling facilities — such as Portland and New York City — cycling safety throughout the US is still a concern that keeps many people from cycling. Cycling and pedestrian injury and fatality rates (per kilometre travelled) in the US are considerably higher than its European counterparts, as illustrated in Figure 6. The lower cycling and pedestrian injury and fatality rates in countries such as the Netherlands and Denmark as compared to the UK and the US suggest that improving conditions for walking and cycling has the potential to improve safety. New Zealand Ministry of Transport reports cycling injuries and fatalities in deaths/injuries per million hours spent travelling. Between July 2008 and June 2012, the combined fatality and injury rate for cyclists was approximately 30 per million hours spent travelling (NZ MoT, 2013). If an average speed of 15 km/h is assumed, this equates to a combined fatality/injury rate of approximately 2 per million km cycled which is closer to the injury and fatality rates for the Netherlands and Denmark than the injury and fatality rates for the USA.



**Figure 6 – Cycling and Pedestrian Injuries and Fatalities in Five Countries**

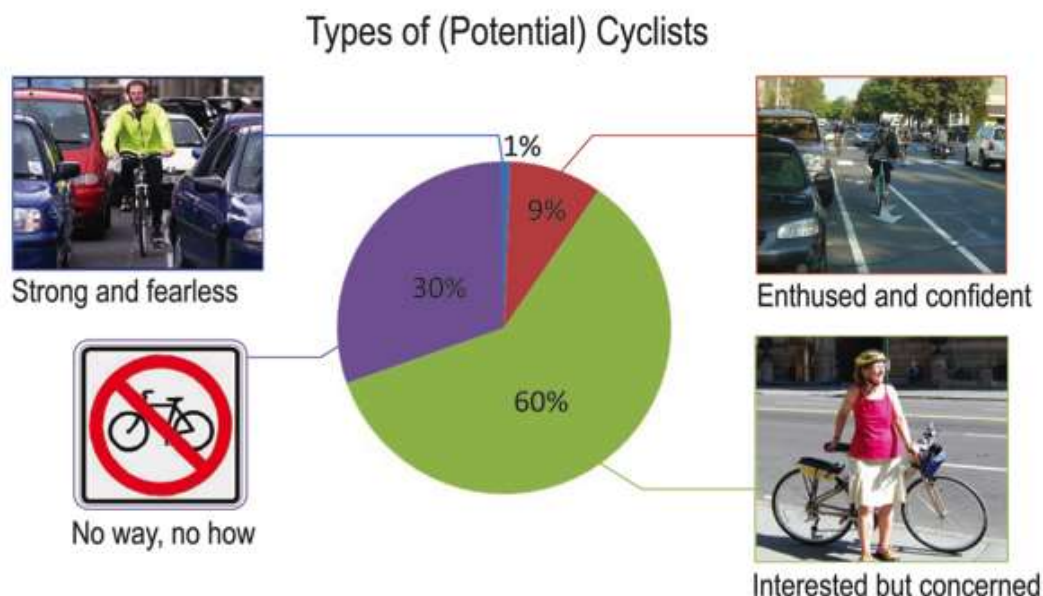
Source: Pucher and Buehler, 2012

## TYPES OF CYCLISTS

Up until the boom in cycling in the past fifteen years, cycle mode share remained extremely low and unchanged for decades in the United States throughout the latter part of the 20<sup>th</sup> century — due to minimal effort to improve cycling conditions and a perception that cycling was not safe and only for the “brave”. Roger Geller, Bicycle Coordinator at the Portland Department of Transportation, wrote that “riding a bicycle should not require bravery. Yet, all too often, that is the perception among cyclists and non-cyclists alike.” Geller had conducted surveys of the residents of the City of Portland and found that he could categorise the city’s population into four main categories as it relates to bicycling – 1) strong and fearless, 2) enthused and confident, 3) interested but concerned and 4) no way, no how (Geller, 2009).

Figure 7 illustrates the “four types of cyclists” and their approximate distribution in Portland. While the exact percentages from Geller’s research will undoubtedly vary between communities, the “four types of cyclists” concept has been vetted in many other communities throughout the United States and it has been well supported and substantiated by other survey efforts. Geller’s research also revealed that the number one reason that people did not cycle is because they are afraid of being

on the roadway on a cycle — more specifically, they are afraid of motor vehicles. Geller’s “four types of cyclists” concept and the data behind it has been extremely useful in better understanding the root cause of why more people do not cycle for transportation purposes. Perhaps most importantly, the research has helped cities realise that a new approach is necessary in order to attract new cyclists.



**Figure 7 – Different Types of Potential Cyclists**

Source: Geller, 2009

## INNOVATIVE CYCLEWAY FACILITIES

As the cycle planning profession advances and matures in the United States, an increasing number of bikeway facilities are available to better accommodate cyclists by creating a safer and more comfortable riding environment. The development of new cycle facilities has been driven by the recognition that existing cycle facilities have been inadequate in attracting and providing safety for potential cyclists. The National Association of City Transportation Officials (NACTO) released the Urban Bikeway Design Guide in 2010, which provides practitioners with state of the practice solutions for on-street cycle facilities in the US. The state of cycle facility design has evolved rapidly over the past 15 years in the US and the standard design manuals (e.g. AASHTO) have been unable or unwilling to keep pace with best practices (it should be noted that an August 2013 memorandum from FHWA endorses the NACTO Guide and suggests that it fits into the flexibilities afforded by the AASHTO Guide for the Development of Bicycle Facilities, 2012). The guide is based upon an extensive survey of expert knowledge, design guidelines from cities around the world, and experience and case studies from innovative projects in the U.S.

The NACTO Urban Bikeway Design Guide website provides a thorough discussion with supporting illustrations of each treatment, including when it should be used, considerations for recommended elements and options for different types of applications. Real-life projects are described for each design category, giving designers insight into best practices on the ground. In New Zealand, the Christchurch Cycle Design Guidelines uses a similar approach to NACTO by providing renderings of innovative cycle facilities and describing the context in which they should be considered. Good on-street cycle facilities can reduce rates of footpath cycling, wrong-way riding and other unsafe cyclist behaviors that can cause crashes and jeopardise other road users. Following is a brief summary of two of the more innovative cycleway treatments from the NACTO Urban Bikeway Design Guide that are considered be well suited for implementation in the New Zealand context.



## Cycle Tracks

Cycle tracks, also referred to as Copenhagen Cycleways, are exclusive cycle facilities that combine the user experience of a separated path with the on-street infrastructure of a conventional bike lane (NACTO, 2010). Cycle tracks can be designed as one-way or two-way facilities and can be on-street or at footpath level. If on-street, cycle tracks must be separated from motor vehicle travel lanes by some type of barrier (e.g., on-street parking, raised medians, traffic delineators or bollards). For two-way cycle tracks, additional design consideration is typically required at driveways and side street crossings. Figure 8 provides an image of a one-way cycle track on 9<sup>th</sup> Avenue in New York City.



**Figure 8 – One Way Cycle Track, 9<sup>th</sup> Avenue, New York City, NY, USA**

Photo credit: New York City Department of Transportation

## Bicycle Boulevards

Bicycle boulevards are streets with low motorised traffic volumes and speeds, designated and designed to give cycle travel priority. Bicycle boulevards use signs, pavement markings, and speed and volume management measures to discourage through trips by motor vehicles and create safe, convenient cycle crossings of busy arterial streets (NACTO, 2010). The best candidate streets for a bicycle boulevard are local streets that already have low speeds and low volumes of vehicles. Bicycle boulevards utilise signs and pavement markings, speed and volume management strategies, and appropriate crossing treatments of minor and major streets to provide cyclists with safe crossing opportunities.

While bicycle boulevards do not provide cyclists with dedicated, separated facilities similar to cycle tracks, they are in many ways much better suited for less experienced cyclists due to the low traffic speeds and volumes. Bicycle boulevards are often planned as a parallel route to a busy arterial to provide cyclists with a lower traffic and safer route option. In designing a bicycle boulevard network, it is important that the streets are direct and well-connected to key destinations in order to successfully attract cyclists to utilise the facility. Figure 9 provides an image from Eugene, Oregon, USA, illustrating how traffic volumes can be restricted on bicycle boulevards.

In New Zealand, the preferred terminology for bicycle boulevards is neighborhood greenways and

design guidance is provided for this cycle facility type in the Christchurch Cycle Design Guidelines. Auckland Transport is also currently designing a neighborhood greenway as a parallel cycleway to Dominion Road in the Balmoral, Mt Eden and Mt Roskill communities.



**Figure 9 – Restricted Access to Bicycle Boulevard in Eugene, Oregon, USA**

Photo credit: Alta Planning + Design

## CYCLE HIRE SCHEMES

Public cycle hire schemes use a fleet of cycles and stations spread over an area to provide inexpensive and accessible transportation options to communities. They have been described as a “system of individual public transport” and are well-suited for short trips, typically three miles or less. Cycle hire schemes are energy efficient and zero emission and are quick and cost-effective to implement compared with other transport infrastructure. Public cycle hire schemes have the potential to provide the flexibility and convenience of private vehicles with the accessibility and reliability of public transport.

The international community has experimented with bike share programs for over 40 years. Until recently, public cycle hire schemes worldwide have experienced low to moderate success because of theft and vandalism. The white bike program in Amsterdam in the 1960s is a famous example of a well-intentioned program that failed due to theft, vandalism and neglected bicycles. In the last ten years, innovations in technology that bring increased accountability and proprietary non-standard bicycle designs have given rise to a new generation of technology-driven public cycle hire programs with enhanced security. Modern bike sharing can dramatically increase the visibility of cycling and lower barriers to use by requiring only that the user have a desire to bike and a smart card, credit card or mobile phone. One of the more significant advances in public cycle hire schemes is the ability to provide on-demand “swipe and go” access that makes it extremely quick and easy for people to access the bicycles.

The rapid growth and popularity of public cycle hire schemes make it challenging to keep track of

how many systems there are worldwide. In May 2011, there were an estimated 375 public cycle hire schemes comprising 236,000 bicycles. In April 2013, there were 535 cities in the world with public cycle hire schemes with an estimated combined fleet of 517,000 bicycles. In two years, there was a remarkable doubling of bike share bicycles globally (Larsen, 2013).

Washington, DC, USA, public cycle hire scheme (Capital Bikeshare) has been regarded as an extremely successful program that logged more than one million trips in its first year of operation (2010-2011). Capital Bikeshare only had 19 reported crashes in its first year, which equates to approximately one crash per 53,000 trips (Alta Bike Share, 2011). New York City launched their long-awaited public cycle hire scheme in May 2013, called CitiBikes, which consists of 6,000 cycles and 330 docking stations spread across lower Manhattan and Brooklyn. In the first five months of New York City's bike share program, more than five million trips and ten million miles have been logged without a single fatality and with approximately two dozen reported injuries, most of them minor (Bernstein, 2013). This number of collisions translates to approximately one crash per 208,000 trips, a crash rate approximately four times better than Capital Bikeshare. The CitiBikes system also averages over six trips per bicycle per day (CitiBikes Blog, 2013). Figure 10 provides an image of a CitiBike member riding one of the 6,000 cycles, which are slated to expand to 10,000 cycles next year with 600 docking stations.



**Figure 10 – Public Cycle Hire Scheme in New York City, NY, USA**

Photo credit: Dmitry Gudkov

## OTHER CYCLE FACILITIES

Effective cycle planning is more than just developing bikeways and should include seamless cycle integration with public transport services and high quality end-of-trip facilities. This section will provide a brief overview of these issues and present some best practices related to cycle integration with public transport and cycle parking.

### Cycle Integration with Public Transport

Simply by accommodating bicycles on public transport or at the stations themselves, it becomes possible to expand the catchment and service area of a city's public transport network. NZTA sponsored research found that implementation of public transport/cycle improvements in New Zealand's six largest centres could produce more than 1.7 million cycle-PT trips each year (Ensor, Slason and Vallyon, 2010). A public transport stop typically draws riders from within a ten minute walk (750 metres). Cyclists can travel three to four times that distance in the same amount of time, thereby increasing the public transport catchment area about ten-fold. A recent NZTA sponsored research report found that the mean distance cycled to PT stations was 1.42km, with 25% of

people cycling more than 1.35km to reach PT (Wedderburn, 2013). Effective strategies and techniques for integrating cycling with public transport include the following:

- Cycles on Public Transport – most public transport agencies in the US are able to accommodate cycles on buses, trains and ferries. This allows a cycle to be used at both ends of the journey and also assists cyclists with mechanical failures, bad weather or fatigue/illness.
- Cycle Storage at Stations/Stops – providing cycle storage at high volume public transport stations is a cost-effective strategy to promote multi-modal trip making. Many public transport agencies provide a mix of more secure cycle parking (lockers, cycle cages and/or access-controlled storage rooms) and basic cycle racks in order to accommodate the needs of different types of cyclists. Figure 11 provides an image of secure bicycle parking from Washington, DC, USA.
- Improved Access to Stations/Stops – cycle access to public transport stations can be improved by adding cycle lanes, paths and other roading improvements. This can be especially important in more suburban environments where public transport stations can be surrounded by a park and ride lot. Providing maps that illustrate the best cycling route between stations and common destinations are also helpful.



**Figure 11 – Secure Bicycle Parking at Union Station, Washington, DC, USA**

Photo credit: TransportGooru.com

## Cycle Parking

Adequate cycle parking is an absolute necessity for utilitarian cyclists. Cycle parking facilities come in all shapes and sizes, but must be safe, visible and plentiful to be effective. In urban environments where competition for space is common, on-street parking spaces can be re-allocated to provide cycle parking without impacting the footpath. Compared with motor vehicle parking, cycle parking is remarkably space efficient as at least ten bicycles can be parked in the space that it takes to park one motor vehicle. Figure 12 illustrates how an on-street parking space can be converted to cycle parking at fairly low cost.



**Figure 12 – Bicycle Corral (on-street cycle parking) in Portland, Oregon, USA**

Photo credit: Alta Planning + Design

## CONCLUSIONS

Cycling's many benefits ensure that it will remain a key element of the transport solution in cities around the world — it's quiet, it's clean, it's inexpensive, it's healthy, it's sustainable, it's space efficient and it's fun to ride a bicycle. As illustrated in this paper, investing in cycling facilities can pay significant dividends by increasing cycling rates, reducing collisions and generally making cities more civil and enjoyable places to live. There are a number of key facility improvements that encourage and facilitate increased cycling rates, including innovative cycle facilities, public cycle hire schemes, cycle parking, and cycle integration with public transport.

For cities interested in becoming more bicycle-friendly, the following key steps are recommended to “get the wheels turning”:

1. Develop a Bicycle Plan – the plan should serve as the blueprint for cycle improvements, set priorities, establish goals, objectives and performance measures and create the funding and implementation plan
2. Build Community Support – it is critical to build support throughout the city for cycling improvements, which should include the business community, general public and of course the cycling community
3. Elect a Political Champion – having a political champion to set the course, build partnerships and demand results greatly assists cities in becoming more cycle-friendly in short periods of time
4. Innovate – it is important to be bold, challenge the status quo and implement innovative solutions and treatments to create more cycle-friendly communities
5. Take action – while cycle planning can take a while to result in any changes ‘on the ground’, do not let the long term be the enemy of the short term and strive to find ways to streamline bureaucracy and implement pilot initiatives to test new cycle facilities
6. Spread the word – once your community becomes more cycle-friendly, assist other communities with similar aspirations by sharing valuable information, technical resources and other relevant advice

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