

# Improving Active Transportation in the City of Waterloo

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# 1.0 Introduction

The proportion of Canadians living in metropolitan areas is increasing faster than ever. The cost of road congestion in Canada is estimated at billions of dollars per year, but in most cases the only safe and convenient option for Canadians to get from point A to point B is through driving a private vehicle (Lamb, 2011). The urban design of many Canadian cities puts the automobile at the highest priority, and as a result active commuting such as walking and biking is perceived as dangerous. For active transportation to become a common mode of transportation, Canada's urban environment needs to be improved.

Active transportation is environmentally sustainable, as increasing the amount of people that commute through walking and cycling reduces air pollution, smog, GHG emissions and traffic congestion (Heinen, 2012) and conserves energy and land (Pucher & Dijkstra, 2003). Active transportation incorporated into daily commutes offers benefits for public health by increasing resident's levels of physical activity (Heinen, 2012). Active commuting also improves the look and feel of our cities, because the urban design is executed at a human scale. The public acknowledges these benefits, as the use of environmentally sustainable transportation modes is increasing. With the addition of proper infrastructure, this type mobility will be feasible in Canadian cities. For example, 60% of adults own a bicycle and 80% live within 8 kilometers of a common destination. Furthermore, designing spaces to facilitate active transportation involves negligible economic costs (Winters, 2010).

Encouraging walking and cycling is both an urban design and a policy issue. Through improving urban design, cities provide better facilities for walking and cycling, with the intention to design places for people instead of vehicles. Through changing policies, compact mixed use development should be encouraged to facilitate shorter trip distances that do not require a private automobile. Before implementing policy and urban design, there must be funding and incentives. In Canada, owning and driving a private automobile is too easy: there is abundant free parking, fairly low gas taxes and few road tolls (Pucher & Dijkstra, 2003). To increase levels of active transportation substantially, driving needs to become less accessible. Municipalities also need to establish policies that initiate plans to encourage active transportation. While there are many considerations when promoting active commuting, this paper will focus specifically on urban design.

This research paper will focus on cycling and walking as the forms of active transportation, because these are the most common active modes and are often used in combination with public transit. The principal research question of this paper is what are the main factors deterring people from active commuting, and how can the City of Waterloo use best practices to improve the design of the intersection of Erb and Caroline. International and national best practice precedents will be used to enhance the pedestrian realm and cycling experience at this specific intersection. The goal of these improvements will be for active transportation to become a more common, convenient and pleasant mode of commuting for residents of the City of Waterloo. Secondary research through literature review of journal articles was used to determine the leading design principals and deterring

factors of active commuting. Primary research was conducted through the collection of photographs of the current state of the intersection. Finally, an areal view site plan was designed of the new improved pedestrian and bicycle-friendly intersection using Adobe Illustrator.

## **2.0 City of Waterloo Case Study**

Municipalities that are suburban in nature are difficult for residents to navigate without a personal vehicle. Distance from the centre of the city and low-density neighbourhoods are factors that lead to residents taking more trips by car than people that live in dense urban neighbourhoods. Residents of medium sized metropolitan areas (population under 250,000) took more trips by car than residents of large metropolitan areas, because larger cities typically have better public transit, less free parking and higher densities. Canadians' dependence on cars is largely influenced by the physical characteristics of their urban neighbourhoods (Turcotte, 2008).

The City of Waterloo is a mid-sized metropolitan area with a population of 97,475. With the exception of student housing and Uptown condominiums, Waterloo is primarily comprised of single-detached low-density housing. The City is well serviced by transit but has an abundance of free parking at all major destinations. The City of Waterloo encourages cycling by providing 50 kilometers of bike lanes and 130 kilometers of bike trails. Policies that encourage active commuting include the Transportation Master Plan and an Active Transportation Committee that advises City Council. In 2011, the City of Waterloo received the silver Bicycle Friendly Communities award from the Share the Road



Cycling Coalition (City of Waterloo, 2013). While the City has put policies in place to encourage active commuting, the design of the majority of pedestrian and cycling facilities are not as satisfactory as alternate best practices around the world. Without an improvement to urban design, I believe residents of the City of Waterloo will continue to rely on their private vehicles to get around. Waterloo's low-density development, lack of inadequate infrastructure and unaccommodating connectivity for pedestrians and cyclists continues to deter active commuting.

## **3.0 Active Transportation**

### **3.1 Intimidating Factors of Active Commuting**

To encourage active transportation, first an understanding of the deterring factors of cycling and walking must be established. Whether or not people choose a transportation mode that is active is typically explained by factors such as weather conditions, climate, socio-economic factors, distance travelled, built environment, available infrastructure and the public's attitude towards walking and cycling. Factors that facilitate other modes of transportation, such as free vehicle parking (Heinen, 2012), segregated land uses, low population density (Winters et al, 2010), long trip distances, and low cost of car ownership and use (Pucher & Dijkstra, 2003) further discourage active transportation. Specific urban design deterrents of cycling include slippery and snowy areas on the route when icy or cold, poor lighting on the route after dark and heavy traffic on the route that is faster than 50 km/hr (Winters, 2010). The most dangerous street to cycle is one that is busy with parked cars and no bike lanes (Badger, 2012). The absence of pedestrian and cycling facilities makes

walking and cycling slow, inconvenient, unpleasant, unsafe and in some areas unfeasible (Pucher & Dijkstra, 2013). Cycling, especially, is not perceived in many areas in Canada as being a safe and mainstream way to commute.

Safety is the highest deterrent of cycling, and even walking in some cases. Cycling injuries are more common in countries such as Canada, where cycling for transportation is atypical (Teschke et al, 2012). Unfortunately, the perceived risks of walking and cycling are based on real dangers, as cyclists are 7-70 times more likely to be injured than drivers (Reynolds et al, 2009). In Canada, 7,500 cyclists are injured every year, and most collisions occur during rush hour (CAA Bike Safety, 2006). North American safety regulations for cycling emphasize the regulation of helmet use, but helmets do not prevent injuries and can discourage cycling (Reynolds et al, 2009). Built environment, not helmet use, influences how safe pedestrians and cyclists are from traffic (Delmelle et al, 2011). Cities need to implement preventative safety measures through design to reduce the risk of cycling and walking before these become commonly used modes of transportation.

One-third of cycling fatalities happen at intersections because of high speed limits, no bike lanes or signage and large distances to cross. If intersections are unsafe, the bicycle route network will become disconnected and fewer people will cycle (Berg, 2012). Walking can be inconvenient and dangerous in cities where there are lack of sidewalks and large distances between safe intersections to cross. For these reasons, people choose to use their personal vehicles for all trips, even short ones that could easily be taken by bicycle or foot (Benfield, 2013). The prevailing issue in Canadian cities is safety: urban design that caters

primarily to the private automobile creates cities that people find unsafe, unpleasant and inconvenient to walk and cycle in. Walking and cycling should be accessible and safe to all members of the population, including seniors, women and children. Cities in Northern Europe have best practice design examples that have allowed all demographics to safely commute actively.

### **3.2 Best Practices Internationally**

Mode share of trips made by cycling or walking is a much higher proportion in German, Dutch and Danish cities than North American cities. For example, in 2001, Amsterdam had 21% share of trips by bicycle and 21% share of trips by foot, while Chicago, had 1% share of trips by bicycle and 5% share of trips by foot (Gilbert & Perl, 2010), similar to Canadian cities. This is because these Northern European countries recognized the importance of cyclist and pedestrian safety years ago and invested in better pedestrian and cycling facilities while they placed more restrictions on car use (Pucher & Dijkstra, 2000). Urban spaces should be designed for pedestrians first, not automobiles. The improved safety of active commuting provides residents with greater mobility options, independence, exercise and fun. European countries with the highest rates of active transportation modes also have the highest rates of public health, allowing people to get exercise throughout the course of daily life (Pucher & Dijkstra, 2003). Most importantly, residents of cities with a high mode share of cycling have positive attitudes towards cycling (Heinen, 2012). Canada can use decades of successful experience from these cities as design precedents for proposed



pedestrian and cycling infrastructure.

Germany and the Netherlands implemented policies to encourage walking and cycling, which lowered pedestrian and cycling fatalities substantially. Taxes were raised on automobile use and investments were made on facilities for walking and cycling such as:

- Car-free zones covering most of the city centre,
- Well-lit and wide sidewalks on both sides of every street,
- Pedestrian refuge islands for people to use when crossing the street,
- Clearly marked and raised crosswalks,
- Pedestrian activated crossing signals at intersections and midblock,
- Expanded and connected network of bike paths and lanes, covering both urban and rural areas,
- Bike turn lanes leading directly into intersections,
- Separate bike traffic signals with advanced green lights for cyclists at intersections,
- Traffic signals that are activated by cyclists at intersections, and
- Safe and attractive pedestrian and cyclist crossings over highways and railroads.

Other measures were put in place, such as traffic calming of residential neighbourhoods through speed limits and physical barriers, requiring motorists by law to yield for pedestrians even if they are jaywalking, raising the price of parking, requiring that right turns on red lights are illegal, requiring rigorous traffic education of both motorists and non-motorists and strictly enforcing traffic regulations that protect pedestrians and cyclists (Pucher & Dijkstra, 2003). Best practices for intersection design include: restricting turns

for cars when allowed for cyclists, advanced waiting areas for cyclists in front of cars in a “bike box”, realigning bike paths further from sidewalk when approaching intersections to avoid collisions with automobiles turning right, intersection traffic bollards to sharpen turning radius of cars and visible green-coloured bike lane crossing at intersections (Pucher & Buehler, 2008). To summarize, all policies and designs that were implemented put the private automobile at the lowest priority to enhance the safety of pedestrians and cyclists.

### **3.3 Best Canadian Practices**

Despite a colder climate, Canadians cycle three times more than Americans, because of higher urban densities, more mixed-use developments, shorter trip distances, higher cost of owning, driving and parking a car, and more extensive cycling infrastructure (Puschler & Buelher, 2006). This is a good start, but the mode share for cycling in two large Canadian cities, Toronto and Vancouver, is only 1.7% and 3.7%, respectively (Badger, 2012). There is a growing trend, however, of Canadian cities that focus on improving their active transportation statistics through policy and design implementations. For example, the City of Vancouver has seen a 180% increase of bicycle trips in the past decade (Canadian Cyclist, 2012). Canadian cities have begun to understand the importance of investing in pedestrian and cycling infrastructure, and the City of Waterloo should use the best practice design precedents when expanding its networks.

To create walkable and bikeable neighbourhoods, cities must stop emphasizing the importance of planning for the private vehicle and start planning for the active commuter

first. Safety measures such as traffic calming and curb parking to buffer the sidewalk from moving traffic should be implemented. Shaping spaces to provide a sense of enclosure and planting street trees to provide natural cooling would make pedestrians feel more comfortable. Minimizing the amount of free parking, and putting parking in the back of buildings so the car is not visible would encourage people to commute actively and discontinue the practice of planning for the car first (Benfield, 2013). Enforcing stricter traffic regulations towards motorists would create a safer environment for non-motorists (Puschler & Buelher, 2006). A good strategy is to focus on the most significant areas first: downtowns and corridors that connect neighbourhoods (Benfield, 2013).

With regards to cycling in particular, research shows that bike-specific facilities reduce the amount of collisions (Reynolds et al, 2009). The factors that have the most influence on whether people choose to cycle are safety, ease of cycling, connectivity, route conditions, bike parking and interactions with motor vehicles (Winters, 2010). Infrastructure matters when protecting cyclists: the chance of cyclist injury drops 50% when riding on a road with a bike lane and no parked cars or on local streets with designated bike routes, and drops 90% on streets with barriers protecting cyclists from traffic. People that cycle tend to plan their routes using the safest infrastructure available (Badger, 2012). To drastically increase the safety of cycling, cities need to create an integrated network of separated bike lanes. Painted bike lanes offer little protection from car traffic and will not get regular people who are not passionate cyclists on the road (Goodyear, 2012). The ideal bike lane should be painted green to caution vehicles and should be protected from traffic

through bollards, parked cars, raised pavement or separation. This type of infrastructure will transition cyclists from being a small subset of the population to all generations of residents using a bicycle as just something to get around (Goodyear, 2013).

Different cities have taken different approaches to implementing bicycle friendly infrastructure. Montreal has implemented a network of separated bike lanes on main roads that facilitate two-way cycling. This approach prioritizes cycling over driving, because it closes down traffic lanes, makes cyclists visible and gives them easy access to amenities on main streets. However, it can cause controversy and opposition from drivers. In Vancouver, most bike routes are on designated residential streets behind major roads that have lots of signage and reduced traffic speeds. There is safety in numbers, because drivers are used to seeing cyclists on these streets and know to look out for them. Cyclists still need to watch out for parked cars opening doors and pedestrians, as they are sharing the road. The issue with this mode is that it brings cyclists off the major road, and consequently commercial uses will not benefit from bicycle traffic. Another issue is when bicycles are hidden on minor streets, the city is planned for the car first (Moos, 2013). This approach works well in Vancouver, but it would be difficult to implement in Waterloo because of the lesser amount of grid residential streets.

## **4.0 Intersection Design: Erb and Caroline**

This intersection is widely used by both pedestrians and cyclists because it is the connection point between Uptown Waterloo and Waterloo Park. It is a pedestrian and cyclist connection from Uptown Waterloo to both the University of Waterloo and Wilfred

Laurier University.

This intersection's most prominent issue is that Laurel Trail, a trail that both pedestrians and cyclists use to get through Waterloo Park, ends abruptly at this intersection, with no connection to the other side.



Pedestrians use the crosswalk to continue onto Laurel Trail towards Uptown Waterloo.

Cyclists are forced to walk their bikes when passing through this intersection, because there is no safe way for them to turn from or turn onto the trail.





Some cyclists choose to cycle on the sidewalk, which is dangerous to both the cyclist and to pedestrians.



Google Maps, 2013

The only designated bike lane at this intersections begins at a point where Caroline Street changes from being a one-way street to a two-way street. There is no way to reach this bike lane on bicycle without cycling in regular traffic or on the sidewalk.





On Caroline Street going southbound, there is a right turn only lane where cars turn without looking out for pedestrians. While taking pictures, I tried to cross the street when I had the right of way and it was difficult to get the right turning cars to stop for me.



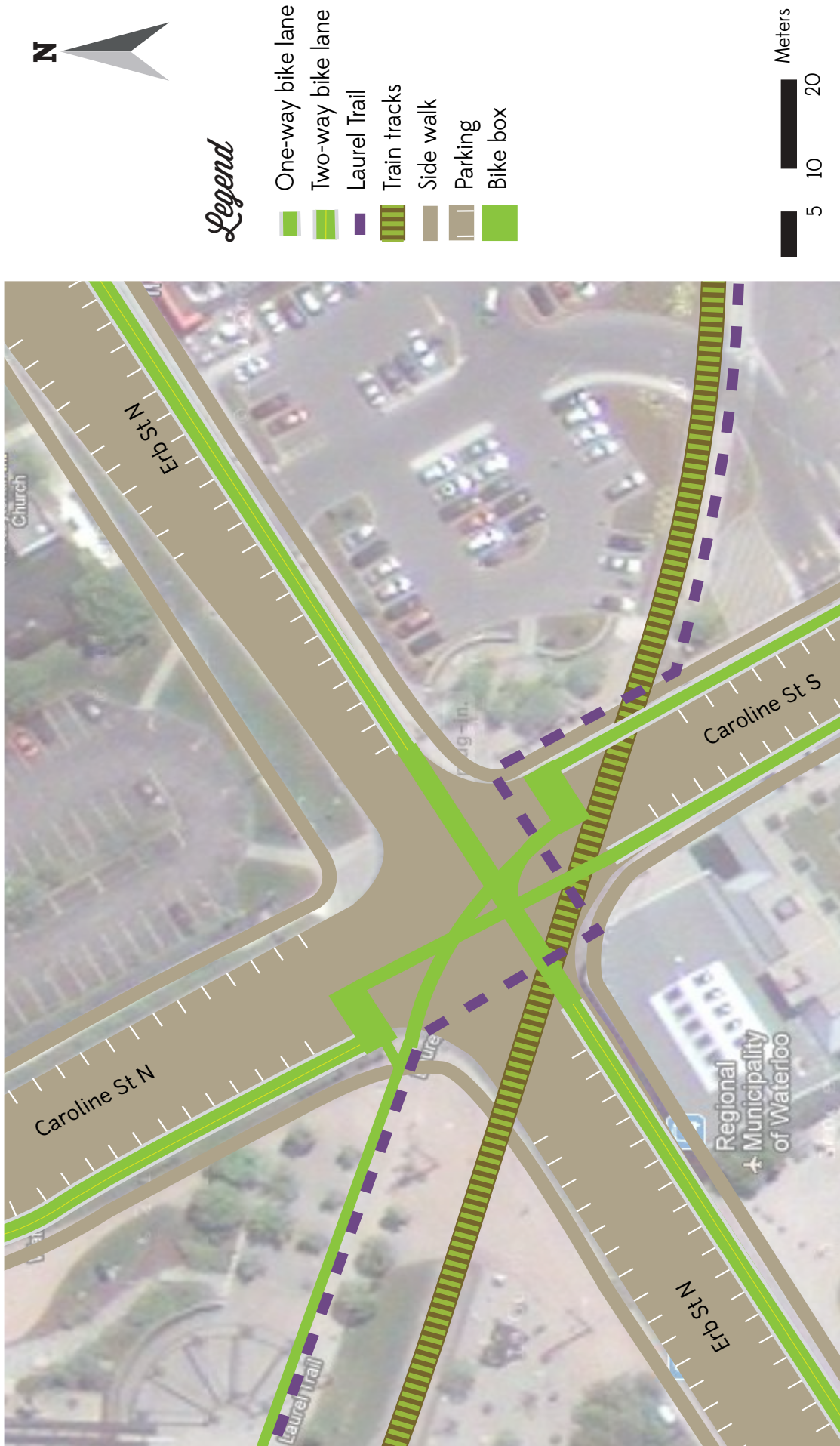
This is an intersection where cars, buses, trains, pedestrians and cyclists all converge, and is a place where both Caroline Street and Erb Street become one-way streets.



Most importantly, it is a key connection point for the pedestrian and cyclist trail between some of the City of Waterloo's most important destinations: the two universities, Waterloo Park and Uptown Waterloo.

Taking into account best practice research, I have created a site plan of potential methods to produce an intersection that is safer and more pleasant to move through by bicycle and on foot. The intersection should be improved through incorporating separated bike lanes on both Erb and Caroline Street, so cyclists are protected from moving vehicles. When the streets are one-way, there should be wider separated bike lanes with two-way bicycle traffic, as per the Montreal precedent. The bike lanes should be painted green so that drivers can decipher where cyclists have the right of way. There should be bike boxes on Caroline Street both northbound and southbound for cyclists to wait for at the red light in front of vehicles. Turning lanes for bicycles through the intersection shall also be painted green, and there shall be an advanced green for cyclists to go before automobiles. The pedestrian realm shall be improved through on street parking to buffer pedestrians from fast moving traffic and paved crosswalks. See page 17 for a representation of the improved intersection.





## 5.0 Conclusions

The best strategy to get people of all ages and abilities to commute actively is through providing safe infrastructure that is easy to use and is well connected throughout the city. Improving an intersection in Waterloo that functions as the main connection of a trail between Uptown Waterloo and Waterloo Park may seem trivial, but these connection points are integral in encouraging active transportation among residents of the City. It is naïve to believe that people will choose to cycle from one destination to another when they cannot safely and conveniently do so. The benefits of active commuting are numerous, and there are many best practices that the City of Waterloo can use as examples when designing pedestrian and cyclist infrastructure. With the Region of Waterloo's proposed construction of the Light Rail Transit (LRT) system, the contemporary focus of planning in the region has been on smart growth and sustainability. With the improved transit network, it is time for the City of Waterloo to begin to consider how to upgrade its pedestrian and cycling networks. The cost of this type of infrastructure is relatively low, and since the City of Waterloo encourages cycling, improving this specific intersection would be a cost-effective way to increase the amount of people commuting actively.



The Region of Waterloo's vision for the LRT station area plan near Erb and Caroline. Source: Region of Waterloo. <http://rapidtransit.regionofwaterloo.ca/en/multimedialibrary/photogallery.asp>

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