

Cycle Track Concepts for Burlington ON: Design Lessons from Apeldoorn NL

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ABSTRACT

Burlington (ON) has just completed an update to their Cycling Master Plan but with a Dutch twist—their twin city Apeldoorn, the Netherlands, sent one of their bikeway traffic engineers, Mr. Wim Mulder, to assist in defining improvements to get more people cycling. A concept for a “quality framework” for the cycling network was developed. This concept focuses on improving cycling quality of two existing linear trails that traverse the City, creating a new crossing of the QEW freeway, introducing cycle tracks on a future rapid transit corridor along the northern boundary of the City, and filling in the framework with bike lanes and bicycle priority streets.

Mr. Mulder’s experience and impressions of Burlington are outlined. The design concept of European cycle tracks is introduced. These are intended to address increasing the comfort of cyclists along busy, higher speed roads. The design quality, maintenance standard and legislative environment that are required to make them work in Burlington ON are discussed. The presentation will compare and contrast photos of existing conditions in Burlington with Apeldoorn, and provide North American examples of similar design elements.

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1. INTRODUCTION

During the week of October 13, 2008, Wim Mulder, a transportation engineer from the City of Apeldoorn, the Netherlands, visited Burlington as part of a Twin City delegation. The week included events to focus on Burlington’s Cycling Master Plan including informal tours of the City; meetings with City and Regional staff; a cycling tour with staff, consultants and Burlington Cycling Committee members to discuss issues in the field; and a public Open House to present on the differences and similarities of the two cities,

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A public Open House was held on October 15, 2008 during Mr. Mulder's visit to Burlington. The purpose of the Open House was to provide an opportunity for members of the public to meet Mr. Mulder, find out what makes Apeldoorn bicycle-friendly, and discuss how Burlington can become a bicycling city.

One element that was discussed was the high level of government support to encourage and support cycling in Apeldoorn—cycling is not just a cultural preference among the Dutch but government policy:

- Design comfortable infrastructure and visible space for cyclists on roadways
- Enact legislation that protects cyclists
- Support cycling education for all school children
- Host cycling events to promote the cycling culture
- Encourage large employers to provide end-of-trip facilities for cyclists
- Provide secure bicycle parking at destinations

In Apeldoorn, most, if not all, drivers are cyclists so drivers are sensitive to cyclists' needs. More cyclists means more safety and more visibility of cycling.

Based on his experience in Burlington, Mr. Mulder concluded that there is a large potential for cycling in Burlington: distances are reasonable for trips by bicycle, the network provides a lot of possibilities for attractive cycle routes and the City is flat. The main concern why people do not cycle has primarily to do with road safety. Recommendations regarding a cycling network for Burlington based on his experience were integrated into Burlington's Cycling Master Plan with a focus on a "quality framework" with improved access and crossings, and introducing the concept of European cycle tracks.

2. MR. MULDER'S FINDINGS

Mr. Mulder prepared a memorandum for the City outlining his impressions and recommendations in the hope that they will inspire Burlington to "get cycling". A summary of his impressions is provided below

"First, I must say that I was impressed with the beauty of this City. The people are friendly, the surroundings are very green as is also the urban areas of the City. Looking at its size and density, it very much looks like Apeldoorn.

What did I notice?

- The city is flat
- Distances are comparable to Apeldoorn
- There are some cyclists
- A lot of employment destinations are located parallel to the QEW
- On several roads, bicycle lanes were implemented, even along the very busy roads
- A few beautiful cycle routes exist through parks and along the waterfront
- The grid street network in the older neighbourhoods gives a lot of parallel routes for cycling in Burlington

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- Many roads have a wide layout with green boulevards
- I saw only a very few facilities that allowed cyclists to cross busy roads
- There are few to no facilities for cyclists at intersections
- The main roads are especially busy during the rush hours; after rush hours they are clearly quieter
- The style of driving is more friendly than I experience in the Netherlands

Based on what I noticed I can only conclude that in this City there is a large potential for cycling. Distances are reasonable for trips by bicycle, the network provides a lot of possibilities for attractive cycle routes and the City is flat. The main concern why people do not cycle has primarily to do with road safety.”

Photos from the cycling tour of Burlington with Mr. Mulder are presented in Exhibit 1.

Exhibit 1 Photos from the Cycling Tour of Burlington



Maple Avenue cycle lanes end and paved boulevards begin



Good local street – trail connection



Quieter street comfortable for cycling



Other trails could be better connected to the local streets

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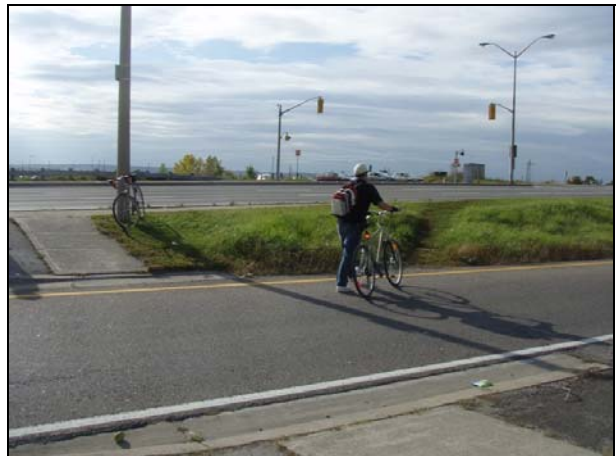
The sea of cars parking for free at the Burlington GO Station



Inside the Burlington GO Station



The Walker's Line/QEW interchange



Cyclist know where they would like to cross the QEW ramp



Older, narrow bike lanes on Walker's Line south of Fairview Street – traffic is not as busy



Nice signalized trail crossing, Centennial Trail and Walker's Line

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Centennial Trail



Centennial Trail at the parking lots near Downtown

2.1 Some Recommendations

In his recommendations, Mr. Mulder refers to the main goal being: to encourage people to use the bicycle more often. In order to achieve this we must be familiar with the needs or so-called requirements of the cyclist. In Holland, these requirements are defined as follows:

- **Coherence:** The network consists of cycle routes. It is important that these routes are well connected with each other and with the main destinations.
- **Safety:** This is a starting point. Road situations must always be safe. The safety applies also to situations in parks where public safety can be an issue.
- **Directness:** Cyclists want to move on. Stopping is costing them energy and results in delays. There are many situations where cyclists take a high risk on road safety in order to save travel time.
- **Comfort:** The road surface must be smooth and comfortable.
- **Attractiveness:** Along the route an attractive surrounding is desired.

Cyclists are social people and they like to cycle side-by-side to talk and to enjoy each other's company. Most of all people cycle because they like it and because they enjoy it. All the other reasons why people cycle are true but for engineers, we must meet the needs of cyclists and make cycling fun.

2.1.1 NETWORK

Most of the existing network runs along the main roads of Burlington. These roads are busy and less attractive for cycling. It is not necessary that the cycle network only consist of routes with specific cycle facilities like on-road cycle lanes and off-road trails. In fact, quiet and peaceful routes through residential areas can be far more attractive than routes along a busy main street. These routes basically need signing to make cyclists aware of the route. The road network in Burlington offers a lot of possibilities. In particular, roads that do not provide a through route for car traffic can be very attractive and friendly for cyclists. Spruce Avenue is a good example. But of course, there are more.

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The main shopping centres and the transit stations are important to add to the cycling network map, and then examine how the cycle routes can be connected to them. Special attention must be paid to the crossing facilities of busy roads and other barriers near these destinations.

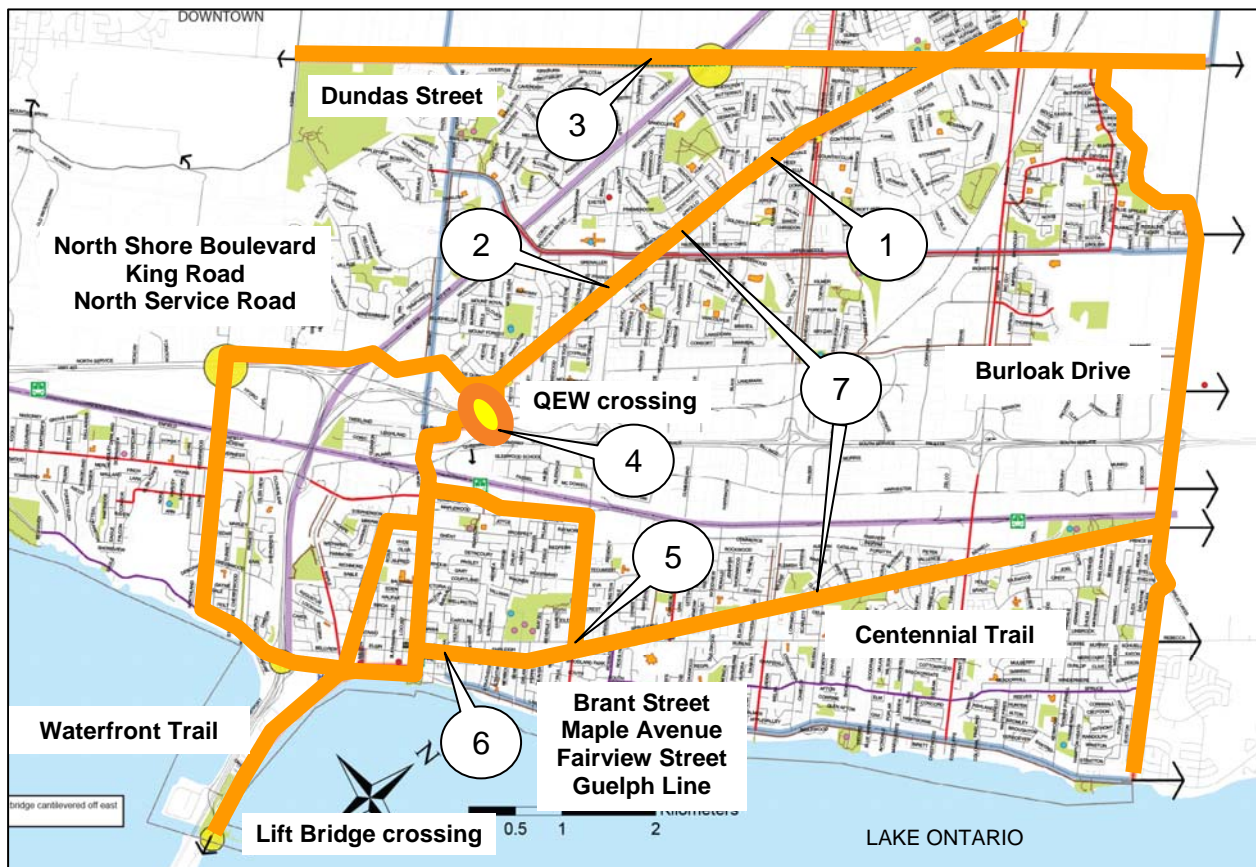
2.1.2 A QUALITY FRAMEWORK FOR THE CYCLING NETWORK

As a priority, a framework of main cycle routes is strongly recommended, as shown in Exhibit 2:

- **The Centennial Trail** from the City's eastern boundary to the Downtown
- **The Hydro Corridor Trail** north of the QEW from Dundas Street to Guelph Line
- A new QEW crossing and existing bike lanes on Brant Street connecting the two corridors named above
- **Dundas Street** across the northern boundary of the urban City

With these routes connected, large parts of the city are connected with the center of the City. **It is important to increase the cycling quality on these routes.**

**Exhibit 2
A Quality Framework for a Cycling Network**



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Measures to make these routes meet the requirements of cyclists (i.e., coherent, safe, direct, comfortable, attractive) consist of:

1. Making sure the trail surface is smooth and wide enough for many types of users
2. Implement safe and convenient crossing facilities where the Hydro Corridor Trail meets major roads such as Guelph Line
3. Provide well-designed and highly functional segregated cycle tracks on Dundas Street
4. Create a new crossing of the QEW freeway to join the Hydro Corridor Trail to the bike lanes on Brant Street
5. A nice crossing facility already exists for the Centennial Trail at Guelph Line. Improve the other roadway crossings
6. Extend Centennial Trail through the parking lots in the downtown with pavement markings. It will then have a clear destination in the downtown
7. Implement signing on Centennial Trail and the Hydro Corridor Trail so that it is clear where they are going

2.2 Design Considerations

In Holland, traffic volumes of more than 10,000 vehicles/day are considered high. But for Burlington this can be different. Cycling in the traffic lanes on Appleby Line, Walkers Line and Guelph Line was not comfortable. Mainway and Cumberland Avenue were very comfortable. South of Fairview Street to the Waterfront, the volumes were clearly less high than north of Fairview Street. Funny enough, if cyclists don't feel comfortable, they themselves will start cycling on the sidewalks.

Along the busy roads, off-road cycle tracks are simply a must. It has everything to do with road safety. On-road cycle lanes might even create a feeling of false road safety. Cyclists are too vulnerable. A car moving with a speed of 70 km/h and who doesn't pay sufficient attention to the cyclist might easily hit them. To avoid awkward situations like these, the two traffic modes must be separated physically. But this separation must be well-designed such that cyclists are still provided with the same directness as if they were travelling on the main road. Off-road cycle tracks are only needed along the busiest roads, i.e., the ones that are crossing the QEW and north of Fairview Street, and along Dundas Street.

It is very important that traffic laws make it possible for cyclists to have the right-of-way on the cycle track. Changes required to make it possible need to be understood further in terms of both local by-laws that the City could pass along with Provincial rules of the road required to support it. Burlington should consider a pilot case on this issue, examining the conditions (design and laws) required to make off-road cycle tracks comfortable, safe and direct. **This could easily turn Burlington into the most bicycle-friendly Canadian city!**

3. EUROPEAN CYCLE TRACKS

Cycle tracks or segregated cycle paths are bikeways that have the following characteristics:

- The space is intended to be used, generally, by cyclists only
- The space is separated from motor vehicle lanes, parking lanes and sidewalks by pavement markings, pavement colouring, bollards, curbs, raised medians, or a combination of these elements
- They generally operate in one direction and are provided on both sides of the street, but can also operate two-way or contra-flow on just one side of the street

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Design guidelines from various Northern European countries recommend segregated cycle tracks when motor vehicle traffic volumes and speeds are higher, as illustrated in the Danish example shown in Exhibit 3 and the London UK example in Exhibit 4. The London guidelines indicates that the two main options are either better mixed cycling conditions (on calmed roads with limited space and with low/slow flows) or better segregation (on highly trafficked/higher speed roads). These examples suggest that cycle tracks would be appropriate as traffic volumes rise above 10,000 vpd with speeds of 30 km/h, and above 5,000 vpd when speeds are at 55 km/h.

There are differences between the Northern European cycle tracks and the boulevard bikeways or boulevard pathways that have been built in Burlington such as along Upper Middle Road, Walker's Line, Appleby Line, and Maple Avenue. The design, maintenance and legislative environments differ:

- **Design quality**—Cycle tracks are often built on both sides of the roadways and operate one-way with traffic. This avoids the “wrong-way” cyclist risk of not being expected by or visible to motorists. In addition, the quality of the surface, width, drainage, traffic control, signage and overall layout are well thought-out, not just an asphalt strip paved in the boulevard. For example, the cycle track can be offset 5 m from the main roadway at side street intersections allowing a motorist to queue between the cycle track and the main roadway without blocking the path of the cyclist. In Burlington, the boulevard bikeways or pathways are typically located such that side street motorists block the cyclist's path while waiting to turn onto or cross the main roadway.

Attention to design is of particular importance at main intersections. Design elements may include separate traffic control signals for cyclists, fully-protected left-turns only, setback stop bars, bike boxes, prohibition of right turns on red, “jug-handle” left turn designs for cyclists, etc. Interaction with transit also requires design considerations, particularly where passengers are boarding and alighting.

- **Maintenance quality**—Cycle tracks along busy routes are afforded the level of summer and winter maintenance that permit them to be used 24 hours a day, 7 days a week, 365 days a year. The Danish *Collection of Cycle Concepts* specifies three levels of winter maintenance: category "A" tracks must be kept clear of snow 24 hours a day, category "B" tracks are swept or cleared daily, and category "C" receives less regular winter maintenance. Specialized equipment may be required to fit the width and surface material of the cycle track.
- **Legislative environment**—Some Northern European countries, including Germany, France, Denmark, Belgium and the Netherlands have defined liability legislation regarding vulnerable road users, i.e., cyclists and pedestrians. Motorists are automatically considered liable in law for any injuries that occur if they collide with a cyclist or pedestrian, unless the motorist can prove that the vulnerable road user behaved recklessly. The law recognizes that vulnerable road users are far more likely to be injured or killed if hit by a motor vehicle, thus motorists have a greater duty of care for their safety. This may significantly affect the behaviour of motorists when they encounter cyclists, particularly in higher risk locations such as intersections.

In the Netherlands, the cycle track is defined as part of the main roadway and cyclists using the cycle track are provided with the same rights-of-way as motorists on the main roadway. Thus side street and driveway traffic must yield to cyclists in the cycle track. Cyclists that ride on sidewalks or boulevard bikeways / pathways in Burlington are expected to behave like pedestrians at side street crossings, dismounting to use crosswalks as per Ontario's *Highway Traffic Act*. In addition, motorists commonly do not yield the right-of-way to users on the sidewalk, and typically block their path when yielding to traffic on the main roadway.

Examples of cycle tracks in Burlington's twin city Apeldoorn NL are provided in Exhibit 5.

Exhibit 3
Danish Bikeway Type Selection Criteria from *Collection of Cycle Concepts* (2000)

Example of separation principles

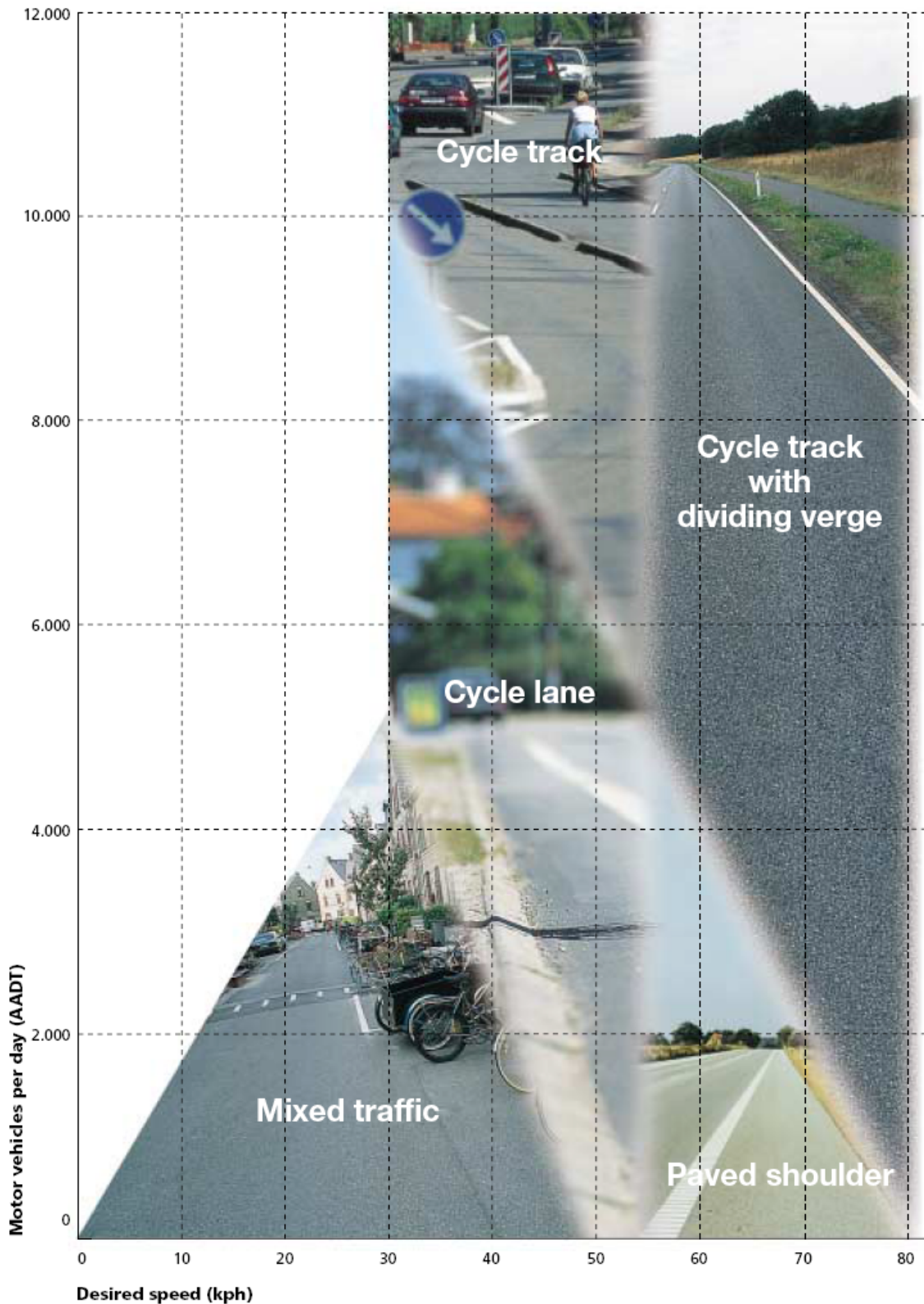
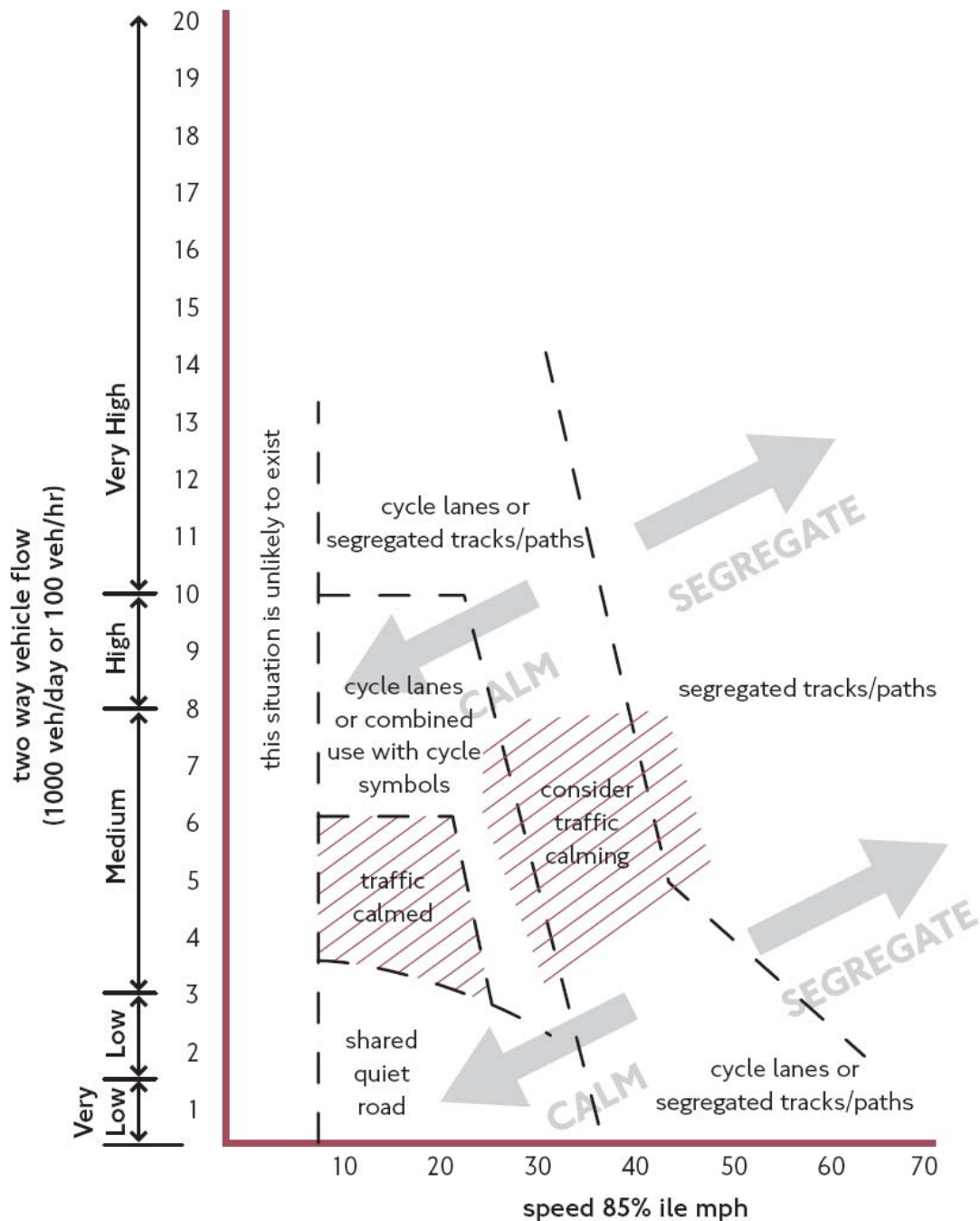


Exhibit 4
 Transport for London Diagram of Cycle Facility Solutions based on Motor Traffic Volume and Speed from *London Cycling Design Standards*



Notes:

1. Each route will need to be judged in the light of its specific situation
2. Cycle lanes or tracks will not normally be required in traffic calmed areas
3. Congested traffic conditions may benefit from cycle lanes or tracks
4. Designs should tend to either calm traffic or segregate cyclists

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Exhibit 5 Cycle Tracks in Apeldoorn NL

Various types of cycle tracks—One-way operation on both sides of the street, two-way operation on one side of the street, between parking and sidewalk, various separators / buffers ↓ Photo credits: Wim Mulder



Winter Maintenance—And bicycle traffic control signals at an intersection with push-button activation ↓



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Mid-block Crossings with Median Refuge ↓



Cycle Track Crossings of Side Streets and Driveways—Motorists on the side streets yield to cyclists on the cycle track ↓



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Cycle Tracks and Signalized Intersections—Separate bicycle traffic control signals ↓



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Bike Box and Bicycle Traffic Signal—Cyclists receive green signal in advance of motorists ↓



Cycle Track at Roundabout—Motorists yield to cyclists crossing the approaches ↓



Cycle Track at Transit Stop ↓



The increased comfort on a busy road that cyclists expect with a cycle track makes them a desirable type of bikeway in North America. Some cities are implementing this type of bikeway, and a few with such great care and attention to detail that the results are considered successful for cyclists, pedestrians, transit and motorists. A North America case study is presented in Exhibit 6. Cycle tracks are currently being implemented in BC in Richmond (Road 3) and Vancouver (Carrall Street). Cambridge MA has cycle tracks near the MIT campus on Vasser Street. Montreal has installed separated, bi-directional bike lanes throughout the City for a couple of decades. However, the bi-directional operation on one side of the street complicates the design, requiring additional traffic signals, signage and pavement markings to address conflicts between cyclists riding against traffic in the adjacent lane, particularly at intersections. These are illustrated in Exhibit 7.

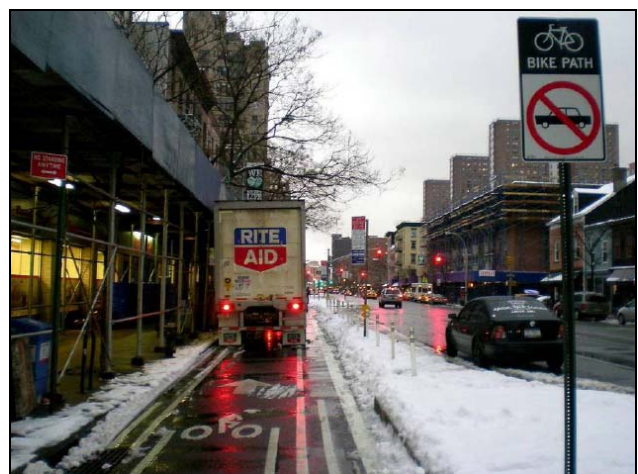
Exhibit 6

North American Cycle Track Case Study—9th Avenue Cycle Track in New York City

9th Avenue, New York

- A one-way “buffered bike lane” on the left side of a one-way street; cyclists are not exposed to the motorist right-turn “hook” or cut-off conflict
- Bicycle traffic control signals stop cyclists during the protected motor vehicle left-turn only green signal, so that conflicts with left-turning traffic are separated in time; motor vehicle left-turns are from a protected bay
- Mid-block, on-street parking is between the cycle track and the motor vehicle lanes, with an additional painted buffer and bollards; prevents double parking in bike lane; car doors open into the buffer not the bike lane
- There are generally no driveways
- Islands between the cycle track and the travel lanes at intersections provide a refuge for pedestrians crossing the street
- Heavy by-law enforcement initially required to deter delivery vehicles from using the cycle track
- Conventional street maintenance vehicles are accommodated; snow is cleared from the cycle track in winter
- Cyclist volumes increased by 40% in 9 months

Photo credits: NYC DOT



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Exhibit 7
Cycle Tracks in North America

Road 3 under the Canada Line Elevated Rapid Transit, Richmond BC ↓



Carrall Street, Vancouver BC ↓



Photo credits: John Luton



Vasser Street, Cambridge MA ↓



Photo credit: Straightedge217

Boulevard de Maisonneuve, Montreal QC ↓



Photo credit: Vélo Québec

3.1 Design Lessons from Apeldoorn NL

3.1.1 WHERE ARE BIKE LANES AND CYCLE TRACKS NEEDED IN BURLINGTON?

The following are general guidelines for selecting various types of bikeways assuming traffic volume and speed are the key elements:

- Roadways with speeds up to 50 km/h and up to 5,000 vehicles/day do not necessarily need any special bikeway. However, depending on other context such as the role of that route in the overall cycling network, adjacent land-use, importance of nearby destinations, etc., cyclists and other roadway users may benefit from creating a bicycle priority street (traffic calmed local street) or adding bike lanes
- Bike lanes are needed when the speed of motorists is 50 or 60 km/h and traffic volumes are over 5,000 vehicles/day. They are also applicable to city centres and larger destinations areas that may have operating speeds below 50 km/h but higher traffic volumes, say above 7,000 vpd
- Segregated cycle tracks are recommended when motorists are operating at 70 km/h or higher, and traffic volumes are more than 12,000 to 15,000 vpd

3.1.2 THE CASE FOR CYCLE TRACKS IN BURLINGTON

Implementing segregated cycle tracks requires providing cyclists the right-of-way through design and legislation at side streets and at driveways.

The rationale for introducing cycle tracks in Burlington includes:

- These bikeways provide cyclists with the best physical protection in traffic. This protection is needed most when volumes and speeds of motorists is high. For example, a motorist driving 80 km/h is covering 22 metres in one second. This provides very little time or space to react to a vulnerable road user should there be conflicts.
- The higher speed and size of a vehicle in a collision results in serious injuries or death. The probability of a vulnerable road user, a pedestrian or a cyclist, surviving a crash with a motor vehicle travelling at 70 km/h is very low. The segregated cycle track can assist in preventing some collisions, particularly between intersections.
- Large vehicles create wind drag behind the vehicle particularly at higher speeds. This can put cyclists out of balance, therefore more distance between the cyclist and truck traffic is needed.
- When the volumes are high and the speed increases, the driving task becomes more complex. Removing cyclists from the motorists travel lane reduces the stress and makes the task of driving more comfortable for them.
- Cycling is much more comfortable for cyclists. This is very important. Instead of trying to survive heavy and speeding traffic, they will start to enjoy cycling. When people do not feel safe they will not cycle. The moment they feel safe they will try cycling. And when they notice that the routes are direct and fast they will cycle even more.

The reasons for segregated cycle tracks in Burlington are clear: they are needed because the most direct routes for cyclists are along the higher speed, arterial roads, in particular the northern commuter route Dundas Street, and those north of Fairview Street that cross the QEW—Brant Street, Guelph Line,

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Walker's Line, and Appleby Line. There are no alternatives for crossing the QEW other than using these routes.

Metrolinx, the Greater Toronto Transportation Authority, released the draft Regional Transportation Plan, *The Big Move: Transforming Transportation in the Greater Toronto and Hamilton Area* in September 2008. One of the eight "Big Moves", i.e., high priority recommended actions that have the largest, most transformational impact on the GTHA transportation system, is "a complete walking and cycling network with bike-sharing programs." The 15-year plan includes Dundas West rapid transit (BRT / LRT / AGT) corridor from Waterdown to Kipling Station through Burlington. "Quick wins", with a total budget approval of \$750 million in the 2008 Provincial Budget, include the early phases of the Dundas Street Bus Rapid Transit spine. This would be an appropriate corridor to improve cycling route connection to and along. A pilot project to develop cycle tracks on Dundas Street as part of the Rapid Transit Corridor project would fit with Metrolinx's support for active transportation access to transit.

3.1.3 CYCLE TRACK DESIGN ISSUES

Based on the experience of Mr. Wim Mulder, an effective and safe cycling network in Burlington will depend on how well the busy roads, intersections and crossings are designed.

In order for a segregated cycle tracks to be an effective part of the cycling network, they must be considered still part of the main road. That is, cyclists traveling along the cycle track must be given the same right of way as the main traffic, and not be stopped or slowed at every driveway and intersection. This involves good design, changes to traffic laws, and communication campaigns to change the behaviour of motorists at these intersections.

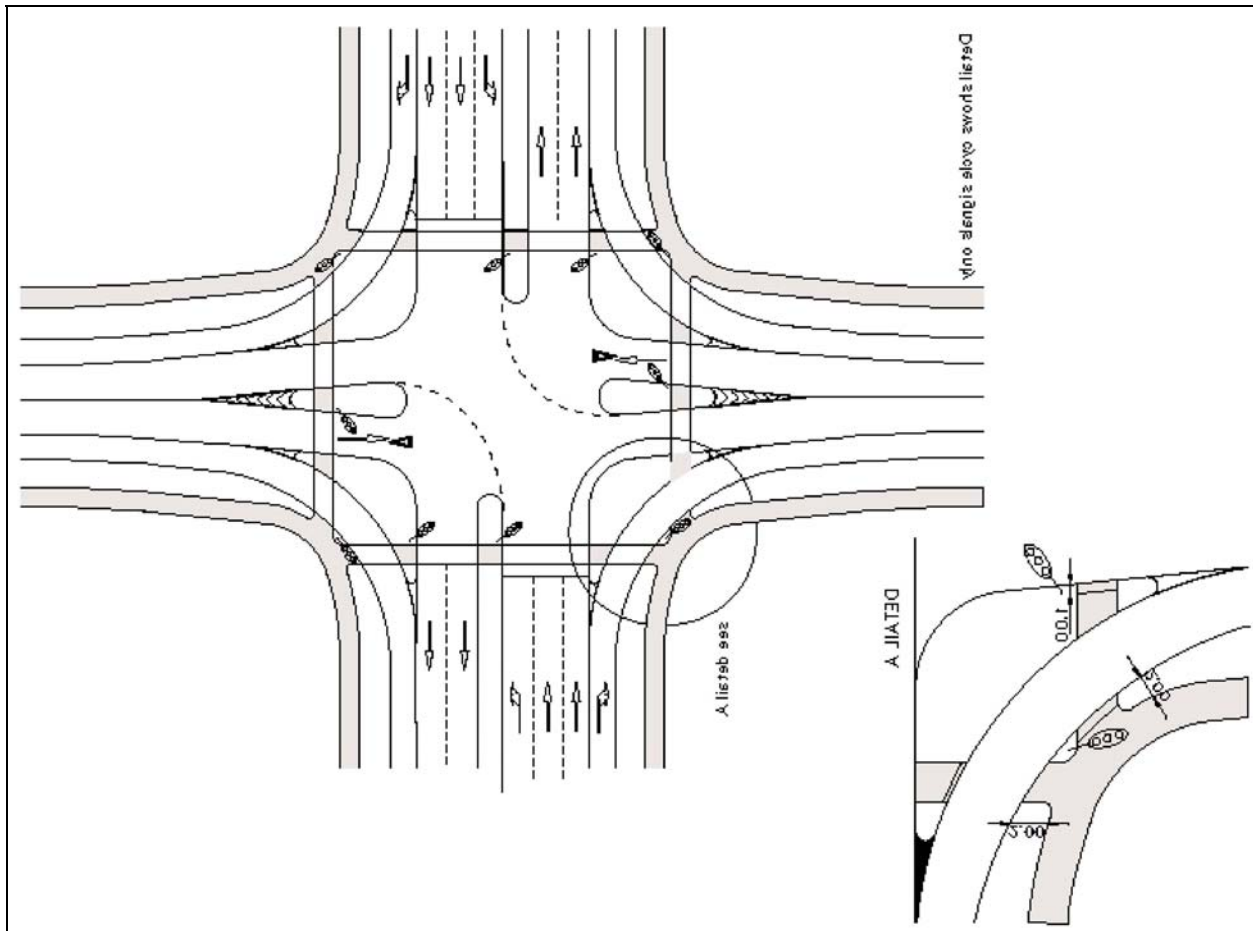
At minor side roads, traffic signals are generally not needed. Cyclists on a cycle track right beside the main road should have the same right of way over traffic traveling from and to the side road, just as the motorists have on the main road. If cyclists do not have this right of way, they are constantly delayed and will prefer the main road because it will be more direct for them. A good design is needed to indicate to motorists that cyclists on the cycle track have the right of way over side street traffic, such as clear pavement markings, signage or measures such as a raised crossing. Traffic laws must also make it possible for cyclists to have right of way on the cycle track.

At busy intersections there are usually traffic signals. There are design options that can greatly improve the safety of cyclists at these intersections such as bicycle traffic control signals, bike boxes, etc. Examples from the Dublin Transportation Office *Provision of Cycling Facilities | National Manual for Urban Areas* are shown in Exhibit 8.

Exhibit 8
Examples of Cycle Track Design Concepts from
Dublin Transportation Office *Provision of Cycling Facilities* | *National Manual for*
Urban Areas

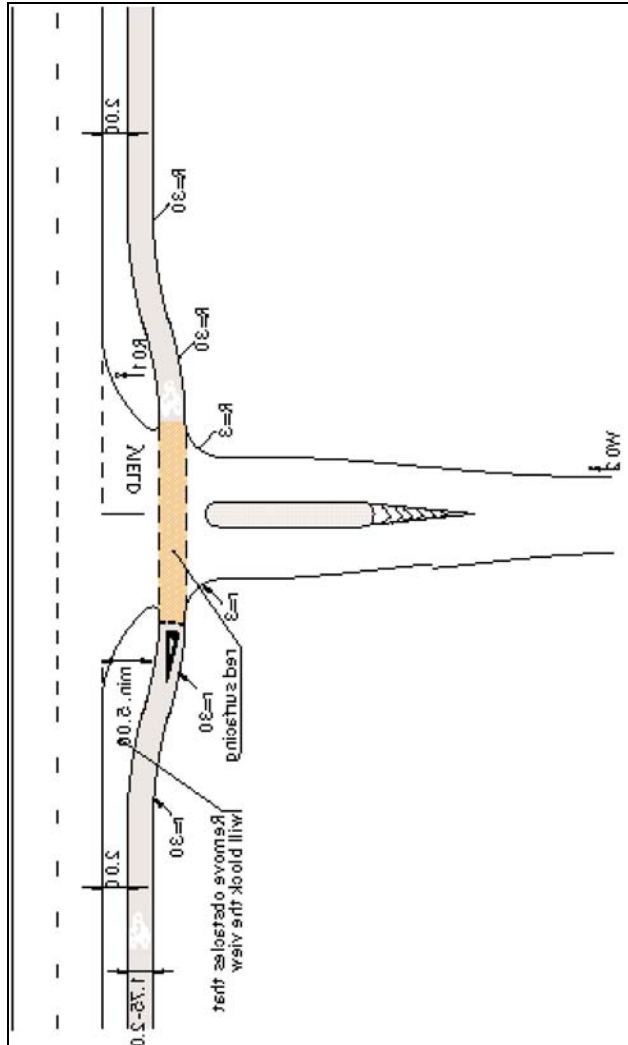
Note: Illustrations have been inverted for driving on the right

Traffic Signals for Cyclists at Major Intersections (only extra signal facilities for cyclists are shown, not the complete traffic signal layout for the intersection) ↓

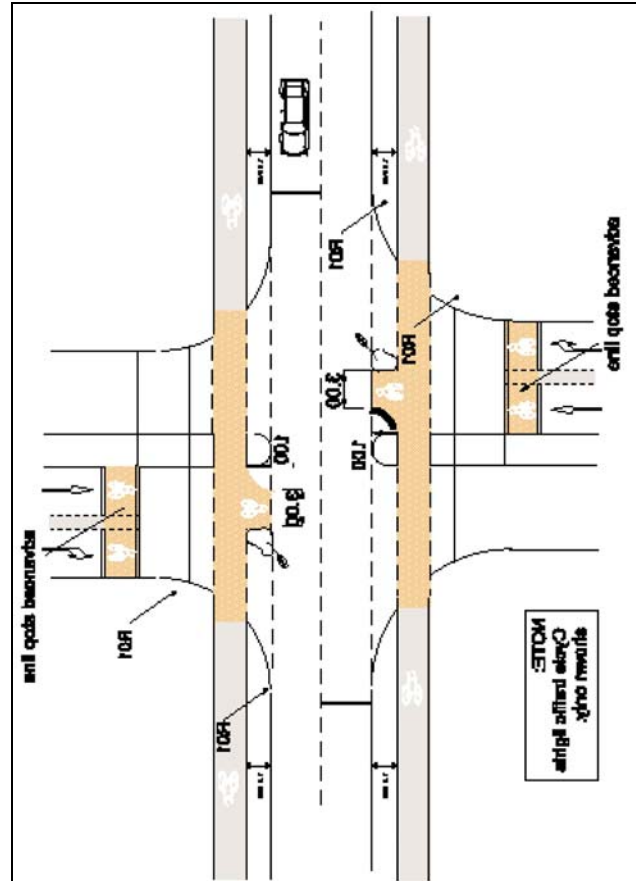


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Bending Out of Cycle Track at a minor street or driveway ↓



Facility for Cyclists to Turn Left from Cycle Track at Major Intersection (only extra signal facilities for cyclists are shown, not the complete traffic signal layout for the intersection) ↓



4. CONCLUSION

The involvement of Burlington's Twin City Apeldoorn NL in their Cycling Master Plan has enabled staff and stakeholders to think beyond the conventional bikeway design tools used in North America to consider the applicability of European cycle tracks in the City. With this comes the need to understand the design quality, maintenance standard and legislative environment required to create highly functional, safe, comfortable cycle tracks along busier roads. An opportunity to pilot a cycle track project is on the horizon through the Metrolinx Regional Transportation Plan that includes the expansion of rapid transit along Dundas Street, requiring the re-design of this commuter corridor.

REFERENCES

Jensen, Søren Underlien, ed. Collection of Cycle Concepts. Denmark: Road Directorate, 2000. Available at: <http://www.vejdirektoratet.dk/dokument.asp?page=document&objno=17291> April 2009.

London Cycling Design Standards. Transport for London, 2005. Available at: <http://www.tfl.gov.uk/businessandpartners/publications/2766.aspx> April 2009.

Provision of Cycling Facilities | National Manual for Urban Areas. Dublin Transportation Office, 2001. Available at: <http://www.dto.ie/web2006/publicdown.htm> April 2009.

Regional Transportation Plan—The Big Move: Transforming Transportation in the Greater Toronto and Hamilton Area, Metrolinx, November 2008. Available at: <http://www.metrolinx.com/thebigmove/default.aspx> July 2009.