Planning for the Provision of Bike Parking at Light Rail Transit Stations

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ABSTRACT. This paper documents the development of the approach to the provision of the bike parking infrastructure associated with the Eglinton Crosstown Light Rail Transit (LRT) Project underway in the City of Toronto, Ontario.

The Eglinton Crosstown LRT will span approximately 19 kilometres, between Weston Road and Kennedy Station, with a ten kilometre underground section. It will have a combination of up to 25 stations and surface stops, as well as link with 54 bus routes, three subway stations and various GO Rail Transit Lines. This project represents a significant government investment, delivered by Metrolinx, together with Infrastructure Ontario, using the Alternative Financing and Procurement model. Metrolinx is the province's transportation agency for the Greater Toronto and Hamilton Area.

Although the City has official bike planning and policy guidelines, there are gaps in the context of their application to transit facilities. Accordingly, a combined analytical and strategic approach to the provision of indoor and outdoor bike parking was developed, guided by a detailed literature review and the goals of both the City and Metrolinx. The approach considers the synergy between forecasted demand, station function, bike route connectivity, proximity to other bike facilities, and the character of the surrounding area, as well as the principles of *Crime Prevention through Environmental Design*. Further, given that a finite amount of space was available within the station footprints, a balance was targeted between bicycle parking and other competing needs, specifically pedestrian access and retail.

The paper also discusses options for operation of the indoor bike parking. This is an evolving field, and the paper will provide guidance to agencies considering the provision of such facilities at new major transit facilities.

INTRODUCTION: FACILITATING THE SHIFT TO ENHANCED BIKE-AND-RIDE

Bicycle parking is not a new concept for the City of Toronto. In fact, the City is a leader in North America, having approximately 17,000 bicycle parking spaces via post and ring installations, and over 200 bike locker spaces. However, it was only as recently as 2009 that the City opened its first bike station at its primary transit hub, Union Station, providing controlled paid access for nearly 200 bike spaces adjoined by a changing room and vending machine, and offering 24 hour surveillance and staff. A more basic indoor facility was also newly integrated into the Victoria Park Subway Station.

Insight into the bike-and-ride modal split is provided through the *Transportation Tomorrow Survey* (TTS), a comprehensive travel survey of the Greater Toronto and Hamilton Area (GTHA) by the Data Management Group of the University of Toronto. Based on data extracted from the TTS, the overall bike mode for work-destined trips originating from the City of Toronto increased by about 78 percent from 2006 (1.34 percent) to 2011 (2.38 percent); those trips specifically accessing transit presented a 52 percent increase in the cycling mode (from 0.24 percent in 2006 to 0.36 percent in 2011).

A survey conducted in 2009 by Ipsos Reid on behalf of the City of Toronto showed that about 15 percent of utilitarian cyclists reported combining cycling and transit either "somewhat or very often," 32 percent responded "rarely," and the remaining portion indicated "never." The survey also revealed that many cyclists already combining the two modes would be more inclined to do so if more secure bike parking was provided at transit facilities (74 percent indicated either "somewhat" or "much more often"). Although dated, it is interesting to note that a predecessor of this survey conducted on behalf of the City in 1999 demonstrated that 63 percent of utilitarian cyclist respondents that had not previously combined transit and cycling trips would try doing so if improved facilities were offered.

The above evidence supports that a continued shift towards good quality bicycle facilities is well founded in the City of Toronto. Although there is a clear impetus for the implementation of such facilities in the City, there was no formal approach available through the City at the time for defining the required bike parking supply and operations at new major transit facilities.

The approach discussed herein was developed for the Eglinton Crosstown LRT, and reflects two primary steps: forecasting the bike-and-ride parking supply, and strategically identifying where it would be best accommodated along the corridor.

BACKGROUND: THE EGLINTON CROSSTOWN LRT PROJECT

Metrolinx is the transportation agency for the GTHA. In September 2008, they introduced their regional transportation plan "The Big Move." The $50 billion plan identifies various transportation initiatives throughout the GTHA for implementation over an approximately 25 year period. The Eglinton Crosstown LRT is among the first priority projects currently being implemented, and represents the largest transit expansion in the history of the City at approximately $5 billion.

Project delivery is primarily through the Alternative Finance and Procurement (AFP) model. Generally, this involves a scope / objective that is defined by the public sector, but financed and carried out by the private sector. A key benefit is that it allows for risks to be transferred to those most ideally equipped to manage them.

As shown in **Figure 1** (source: Metrolinx), the Eglinton Crosstown LRT will extend about 19 kilometers between Mount Dennis Station (Weston Road) and Kennedy Station. Ten kilometres

of the Project Corridor will be underground, with the remaining portion in a separated median along Eglinton Avenue. It will have a combination of up to 25 stations and surface stops, as well as link with 54 bus routes, three subway stations and various GO Rail Transit Lines. Thirteen of the stations are underground, with station buildings at the surface. Bike lanes will be provided along Eglinton Avenue where possible within the available allowances.

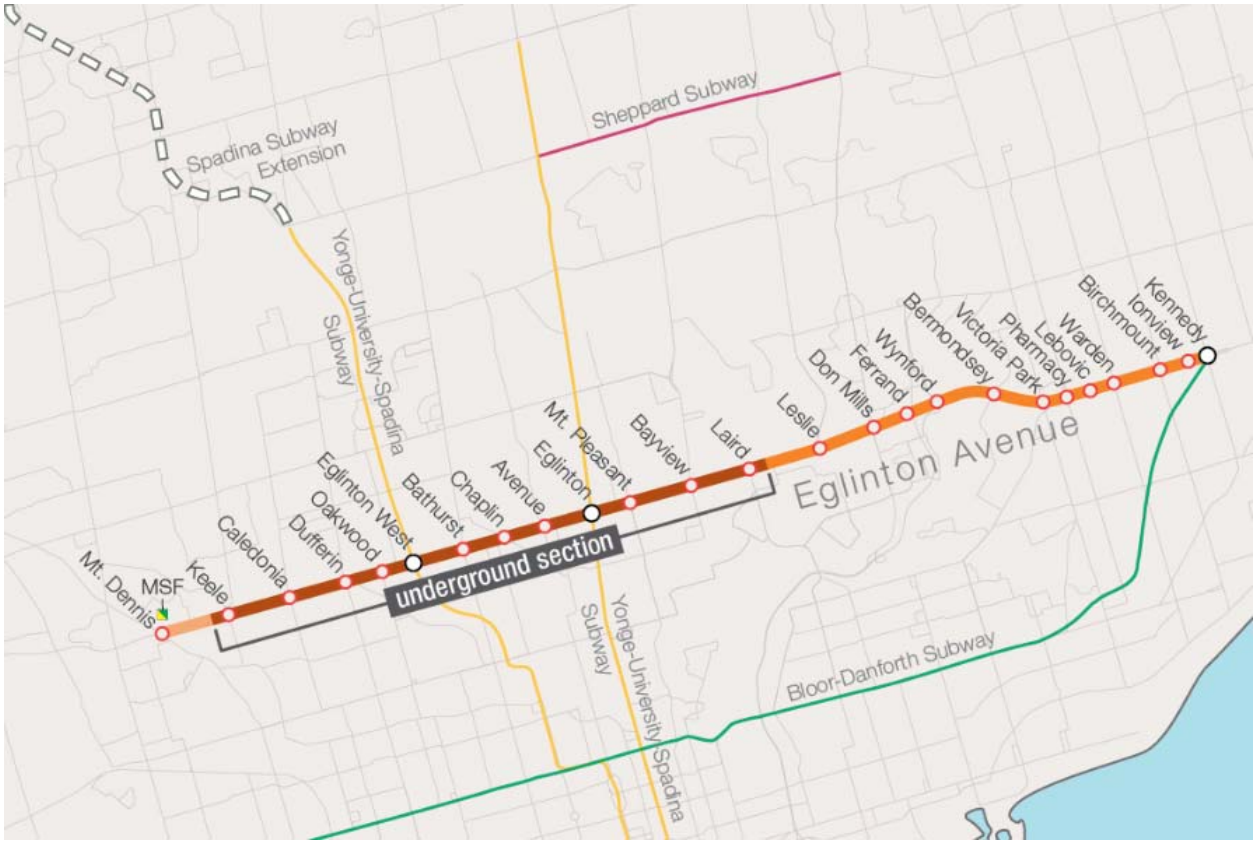

Figure 1 – Eglinton Crosstown LRT Alignment, Stations and Stops

DEFINITION OF BIKE PARKING

As discussed below, two primary classifications of bike parking have been defined for the purpose of this assignment: indoor and outdoor.

Indoor parking represents a secure, controlled paid access model to an enclosed room supporting a two-tiered assembly of parking bays. Such facilities tend to be well suited to locations that are relatively isolated with low pedestrian activity and minimal direct passive surveillance ("eyes on the street"). They are also well-matched to locations looking to promote even higher quality bicycle-transit integration as a priority. Although bike lockers were also considered as a semi-comparable means of more secure parking, they were determined to not align with the Design Excellence Program defined for the Project.

In addition to providing a free alternative to the indoor parking model, the provision of good quality outdoor parking can help to capture the full spectrum of demand, not just trips with short durations. Generally, good quality outdoor parking should be in a convenient, easy to locate area that is proximate, visible and accessible to the station accesses. Ideally that parking should be within view of any surveillance cameras, and subject to adequate lighting and wayfinding signage; access barriers, such as stairs, should be avoided.

For added security, quality outdoor bicycle parking should provide stability by locking the frame and at least one wheel of the bike (supporting two points of the horizontal plane). Further, it is important that the placement of outdoor bike parking does not create obstacles or hazards for general pedestrian-transit circulation or obstruct the accessible path to travel for persons with disabilities. Added quality is also provided by the outdoor bike parking taking advantage of the covering offered by overhanging roofs / canopies where this is possible.

FORECASTING DEMAND FOR BIKE-AND-RIDE

Based on a comprehensive literature review, the *Bicycle Parking Guidelines, 2nd Edition* by the Association of Pedestrian and Bicycle Professionals (APBP) was selected as the basis for projecting the bike parking supply associated with each of the stations and surface stops of the Eglinton Crosstown LRT.

The APBP suggests the provision of short term bike parking at a rate of up to two percent of the projected a.m. peak period transit daily ridership for urban / high mode share areas (interpreted for this assignment as outdoor, covered if possible). Similarly, a rate of seven percent is indicated for long term parking (indoor). A reduced, basic rate of 1.5 percent for short term and five percent long term is suggested elsewhere by the APBP.

The higher, urban rates of the APBP were applied to all stations associated with the Eglinton Crosstown LRT. With the exception of the Victoria Park Surface Stop, a reduced rate of two percent to calculate the total bicycle parking demand was used for the surface stops. It is noted that higher rates were assumed for the Victoria Park Stop because it is a key transfer point located within the “Golden Mile” where redevelopment may increase bike demand. The horizon 2051 a.m. peak walk-in, boarding ridership forecasts developed for each of the stations and stops of the Eglinton Crosstown LRT was used as the basis for the calculation. Note that at major interchange stations, transfers were excluded from the projections.

Overall, the results of the analysis suggest approximately 1,100 bike spaces distributed among the stations and surface stops of the Eglinton Crosstown LRT, consisting of approximately 300 outdoor bike parking spaces and 800 indoor spaces. This initial proposal was then modified using various factors as described below.

STRATEGIC REVIEW OF BIKE PARKING IN THE ECLRT CONTEXT

Metrolinx, as articulated in its Mobility Hub Guidelines and other planning policies, strongly supports a high level of bicycle integration with the Eglinton Crosstown LRT as a way to improve transit connectivity, increase patronage and minimize the impact of the transit system on the environment. It is also noted that the seamless integration of the transit and bike modes provides an opportunity to promote a higher level of mobility by enhancing the connection between often shorter distance bicycle trips, and longer distance transit trips.

The forecasted ridership-based bike supply was reallocated in order to achieve a realistic strategy, based on:

- Station function (i.e. is it a terminal station, does it service a residential or commercial neighbourhood).
- Available space at each station (recognizing the dense urban environment along most of Eglinton Avenue).
- Proximity to the bike parking at other stations / stops (accounting for the spacing between them).
- Connectivity with the surrounding bike network (existing and planned).
- The character of the surrounding area in terms of the form of development and the principles of *Crime Prevention through Environmental Design* (CPTED).
- Input from representatives of the City.

A simplified overview of the overall strategic assessment is provided in **Table 1**. The forecasted bike supply developed in the previous section is presented here as a general scale of magnitude ranging from low to high. **Figure 2** superimposes the strategic locations for indoor bike parking onto the 2013-2017 City Cycling Infrastructure and Programs map (showing bike lanes, signed routes, etc.). Again, it is noted that bike lanes will also be provided along the Eglinton Avenue Corridor connecting stations, where possible, within the available road allowance.

Table 1
Strategic Refinement of the Forecasted Bike Parking Supply

Station / Stop	Forecasted Bike Supply (Overall) Low Medium High	Strategic Bike Paking: Outdoor (Indoor)
Mount Dennis		40 (**80**)
Keele		60
Caledonia		60
Dufferin		60
Oakwood		45
Eglinton West		40 (**80**)
Bathurst		60
Chaplin		32
Avenue		50
Yonge		40 (**120**)
Mount Pleasant		60
Bayview		60
Laird		60
Leslie		8
Don Mills		30 (**30**)
Ferrand		3
Wynford		15
Bermondsey		12
Victoria Park		30 (**20**)
Pharmacy		5
Lebovic		0
Warden		11
Birchmount		15
Ionview		8
Kennedy		40 (**80**)
	Total	**844 (410)**

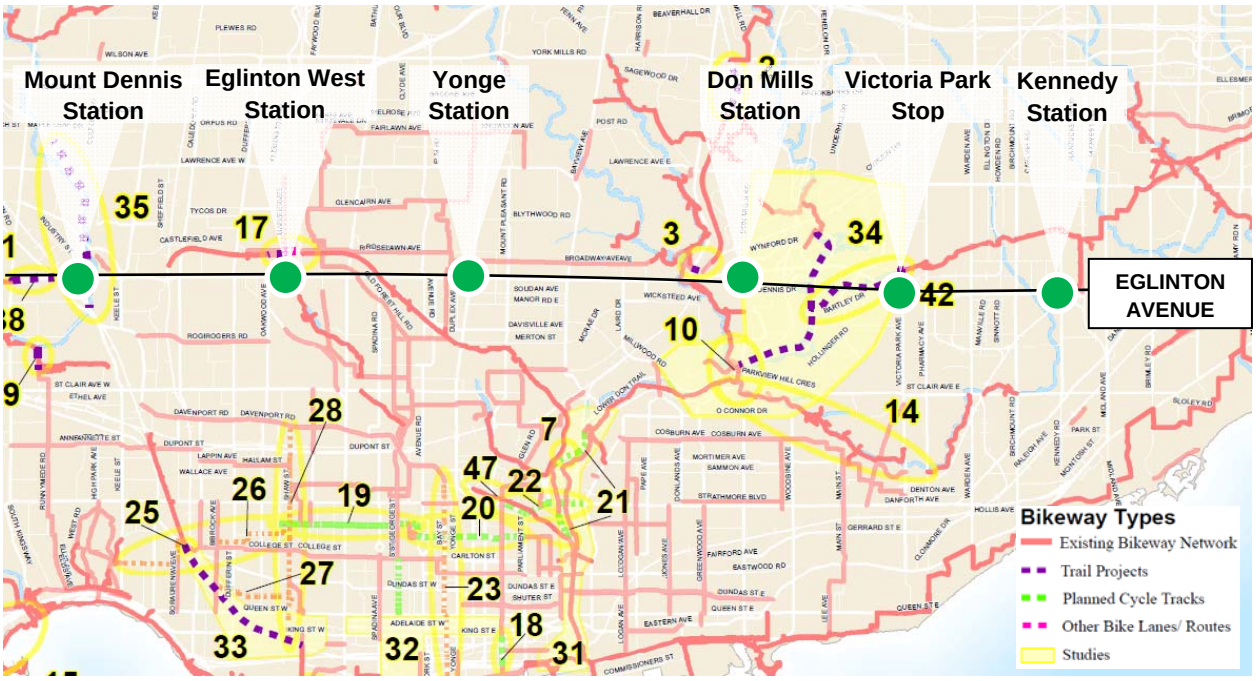

Figure 2 – Indoor Bike Parking Superimposed on the City Cycling Infrastructure and Programs Map (2013 – 2017)

A total of 1,254 bike spaces are proposed in Table 1, around 14 percent higher than that suggested by the forecasted demand (1,100 spaces). Although the indoor parking is approximately half of that which was projected based strictly on a numerical assessment (410 rather than 800 spaces), the strategic allocation of outdoor parking almost triples that of the forecasted number (844 instead of 300). Again, it is noted that a significant portion of the outdoor parking will include quality-enhancing features, such as cover via an overhanging roof / canopy at the stations.

The surface stops (from Leslie to Ionview) consist of platforms located in the roadway median. Although positioning some bicycle parking on the platforms was considered in the early stages, it was determined to be impractical from a functionality and safety perspective. Accordingly, it was recommended that the outdoor parking at these locations be instead implemented by the City within their directly adjacent boulevards. It was also recommended that the City implement the proposed indoor parking at Victoria Park Surface Stop at the adjacent parkette on the southeast corner of the intersection of Eglinton Avenue at Victoria Park Avenue.

For some stations, bike parking was simply not feasible due to spatial constraints, but a balance was sought between nearby stations. In some cases, indoor parking was supplemented with the provision of quality outdoor bike parking. It is noted that there was no space for any of the proposed indoor bike parking within the footprint of Yonge Station in the context of the Metrolinx initiative; however, a bike parking facility is being considered on the adjacent abandoned bus terminal site as part of the development initiative of the Build Toronto Program (City).

Some of the stations with the highest forecasted demand for bike parking were not in the end designated to have secure parking. Opportunities to consolidate the provision of indoor parking were prioritized for proximate stations having similar levels of connectivity with the existing / expanding cycling network of the City. Focus was also given to locations with high potential for bike-transit integration (e.g. mobility / gateway hubs).

CONCEPT OF INDOOR BIKE OPERATION

The discussions in this section pertain to the indoor bike parking defined in the previous section for the Mount Dennis, Eglinton West, Don Mills and Kennedy stations of the Eglinton Crosstown LRT. The other two facilities, Yonge Station and the Victoria Park Surface Stop, are proposed for further investigation and action by the City.

The existing indoor bike facility at Union Station, the primary transit hub of the City, offers nearly 200 bike spaces in a controlled access area with changing rooms, vending machines, 24-hour surveillance and staff. Although the more basic, approximately 50 space facility at Victoria Park Subway Station also has controlled access, it is unstaffed and has fewer amenities. **Figure 3** provides photos of both facilities, obtained from the official website of the City. The indoor bike parking for the Eglinton Crosstown LRT initiative will likely be most comparable to the features of the Victoria Park Subway Station.

Figure 3 – Existing City of Toronto Bike Stations at Union (Left Hand Side) and Victoria Park (Right)

Some of the key challenges of defining the operational structure for the indoor bike facilities related to the intrusion access control system, which is comprised of local elements (e.g. lock, sensor, communications and power) and remote elements (control software, fobs, etc.). The following lists some of the bike facility activities that were defined for assignment to the AFP Contractor (Project Co), the City and / or regulating agencies based on the categories of "accountability / responsibility," to be "consulted" and "to be informed."

- Specification of separate access control system.
- Design of Bicycle Facilities.
- Review of design for Bicycle Facilities.
- Construction of the Bicycle Facilities (including procurement / installation of bike racks).
- Procurement and installation of the remote elements of access control system.
- Procurement and installation of the local elements of intrusion access control system.
- Provision of power supplies and communications.
- Testing and commissioning.
- Maintenance of the remote intrusion access control system equipment.
- General maintenance (other than remote intrusion access system).
- Indemnification for uninsured losses caused by failures to maintain remote intrusion access control system.
- Monitoring performance.
- Operation and administering access (including remote control of intrusion access control system software/hardware), collecting revenue, issuing fobs, answering customer queries.
- Lifecycle for all elements, including local intrusion access control.
- Lifecycle for remote intrusion access control system.

Various opportunities to allocate the accountability / responsibility between the parties were considered throughout the process highlighted above. Some of the key challenges that arose from this approach related to resolution of disputes. For example, disputes regarding improper installation versus wear-and-tear if one party installs an element, but it is operated by another. Similarly, vandalism of a local element of one party if there is a perceived failure by a remote element operated by another.

CAPITAL AND NET OPERATING SUBSIDIES

Although the design of the infrastructure for the outdoor bike parking is yet to be defined, the associated cost to acquire and install it is anticipated to be minimal compared to that of the indoor facilities. As an example, the City of Toronto pays approximately $100 for each cast aluminum bike post and ring (including two tamper-resistant fasteners), and compensates a

contractor about $150 to assemble each ring to a pipe and install it. As the outdoor bike parking within the facility footprints will be integrated into the overall Eglinton Crosstown LRT construction (and placed in bulk), it is conceivable that installation fee could be less if applied to this assignment. It is noted that these estimates exclude the cost of other associated features, such as overhanging roofs / canopies, wayfinding signage, etc.

Generally, the cost to design, construct and operate indoor bike parking facilities can vary widely depending on the capacity, utilization, length of the ramp-up period associated with the usage, certainty of revenue flow, level of complementary services offered (changing rooms, etc.), staffing vs. automated access, capacity / size, value of land, integrated or standalone, and architectural quality / features. It is also important to acknowledge that larger capacity facilities can allow for economies of scale (i.e. generally, a decrease in the cost per space as the overall quantity of those spaces increases).

Based on input from staff at the City of Toronto, the capital cost of the existing indoor bike facilities at Victoria Park Subway Station (around 50 spaces) and at Union Station (nearly 200 spaces) were each around half of a million dollars. The Union Bike Station has an annual operating cost of about $50,000, including staffing, as well as security, utilities, cleaning and maintenance. Station security manages an electronic access system, and provides regular patrols (several times a day). It is estimated that the facility generates $10,000 in average annual revenue, for an estimated net operating subsidy of $40,000. While this overall cost is not directly comparable to the facilities contemplated for the Eglinton Crosstown LRT (unstaffed, etc.); the breakdown of the individual components of that cost did provide some guidance for this exercise.

A representative of BikeLink (Third Party) also offered preliminary / non-binding direction regarding their Group Parking Facilities assuming a standard operating plan. Their estimates indicate that it may be possible to achieve an operating cost to the owner of around $500 per space for very small facilities, and around $250 per space for larger ones. A lower operating cost to the owner (even $0) may also be achievable, but this is highly dependent on a number of factors, such as annual utilization realized, membership fees / payment method, agreed rental rate, ability of the operator to adjust for escalation / inflation, etc.

The preliminary capital cost and net operating subsidy estimates developed for the bike parking associated with the Eglinton Crosstown LRT were guided by various example facilities and internal due diligence, with conservative factors applied as appropriate. Recognizing that both Metrolinx and the City have an interest in promoting bike-transit integration, a split was determined to be appropriate with Metrolinx covering capital costs, and the City the majority of the operating costs.

CONCLUSIONS

While there is continued impetus for enhance bicycle-transit integration throughout the City of Toronto, the approach to defining the associated requirements for the capacity and operation of new major transit facilities is still an evolving discipline.

The Eglinton Crosstown LRT approach to the bike parking supply drew upon demand forecasts combined with a strategic review of multiple high level considerations. This resulted in a total of over 1,200 bike spaces at the various stations and surface stops (approximately 33 percent indoor). The remaining 67 percent represents outdoor parking, a significant portion of which will include quality enhancing features, such as canopies over the parking.

The operational structure of the indoor parking facilities presented a number of challenges, gravitating around the dispute resolution process for the intrusion access control system. In order to address such challenges, generally, specific roles were articulated for a breakdown of the activities associated with the facilities.

The provision and operation of bike parking at new transit facilities is a developing field. However, it is hoped that the experience gained through the Eglinton Crosstown LRT will provide guidance to other agencies considering similar opportunities for bike parking.

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