Planning for Secure Surface Bus Stops in Toronto

by

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Abstract

This paper evaluates the ways spatial planning understands and engages with personal security through a study of inner-suburban surface transit stops in Toronto, Ontario, Canada. Although often considered by planning, personal security does not appear to be subjected to the same level of attention as other design and planning priorities. The foundation for this study was a review of security focussed criminological, spatial planning, and a small quantity of legal texts in order to analyze overlaps and deviations. This was followed by analysis of relationship between personal security and the city's public transit operator, the Toronto Transit Commission, through a review of historical texts and current policy documents guiding surface transit stop placement and design. The final component of this paper is a discussion of an audit of the design and placement of a selection of conventional bus stops in inner-suburban areas. Overall, there are indications that some progress is being made in addressing personal security but there is still significant room for improvement.

Keywords: Spatial Planning, Surface Transit Stops, Public Transit, Personal Security, Toronto Transit Commission

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Foreword

My decision to research public transit surface stops stems from a general interest in public transit and a desire to ensure the continued, and hopefully increased, viability of public transit for all users and at all periods of time. Additionally, public transit continues to be positioned as a key tool towards ensuring the sustainability and competitiveness of urban communities.

This major paper served to expand my knowledge of the issues of transportation planning, spatial planning, and personal security beyond the curriculum of FES. This firstly took the form of knowledge derived from North American and limited amounts of Western European academic and professional literature. Secondly, this paper was informed by both historical and contemporary pieces of literature specific to the issues and history of Toronto, Canada. Combined, these helped to satisfy learning objectives 1a, 2a, 2b 3a, 3b on my plan of study. Additionally, this paper attempts to fill niches in existing literature and contemporary literature on the subject from a general and Toronto-specific context.

This major paper also examines spatial planning in order to fulfill the requirements of the Ontario Professional Planner Institute (OPPI) recognized Master of Environmental Studies planning stream degree. Within the constraints of this paper, I strove to develop an understanding of the environmental, financial, transportation and other diverse considerations for planners through my study of the planning of bus stops and their surrounding urban form. Additionally, this also entailed critical thinking with regards to the significance and importance of these considerations when they conflicted. My review of policy, and planning texts specific to the City of Toronto were directed towards OPPI's emphasis on education and subsequent awareness of the history of planning from a general and context specific perspective. As stated previously, this paper is also directed addressing objective 1b, and the skills envisioned by OPPI as being fundamental aspects of a registered professional planner.

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Fear of crime at the hands of strangers remains as an ongoing concern in the management and utilization of contemporary public environments and surface public transit by extension. As these problems occur in and are mapped onto these spaces, spatial planning and urban planning, may serve as a means of modifying these physical environments in order to mediate these negative interactions and reduce fear. These efforts, however, must compete with other context-specific planning considerations, and in cases like Toronto, Ontario, Canada, may be subject to both intermittent and uneven attention, analysis, evaluation, and general documentation. The purpose of this paper is to develop a more comprehensive and contemporary understanding of the history and futures challenges of securing the inner-suburban portions of Toronto's surface transit network.

Why is Public Transit Considered to be Insecure?

Personal security may be extremely relevant to public transit due to a combination of its inherent characteristics that fall within and outside the control of public transit operators. These factors were identified as falling within one of two main themes, the fact that public transit trips involve a relatively high amount of uncertainty, and the fact that these uncertainties may make it susceptible to contemporary crimes and acts that may elicit fear or discomfort.

The first, and arguably lead-up theme to the issue, is the fact that public transit may introduce travellers to a relatively greater number of uncertainties when compared to more private forms of transportation such as automobiles. At its most basic level, conventional public transit systems often utilize fixed timing and routing for trips, with users needing to traverse, wait, transfer, and occupy both familiar and unfamiliar public spaces at varying hours of the day[1]. Aside from the fact that these spaces themselves may change due to temporary or permanent

[1] This issue is said to be especially relevant to female transit patrons (Scarborough Women's Action Network and Metropolitan Action Committee on Violence Against Women and Children, 1991)

route changes, the timing of a transit user's journey is also uncertain due to mechanical, crowding, and customer-related issues that may delay or disrupt a patron's journey. The second main form of uncertainty facing public transit users consists of the potentially unpredictable strangers that are encountered when riding and accessing public transit. Examples of these strangers include passerbys on the street, individuals loitering or otherwise occupying space near stops, and fellow transit passengers onboard vehicles and in transit facilities. Wariness and fear of strangers is both an old and documented phenomenon (Jacobs, 2002; European Conference of Ministers of Transport Economic Research Centre, 2003), with a presumption that strangers are an unknown variable, if not a potential attacker. Exposure to strangers may be increased due to the uncertain times and spaces associated with public transit trips, especially for patrons that are unfamiliar with the transit system or route(s) in question. Although these types of uncertainty are arguably an inseparable aspect of urban life, they nevertheless appear to remain relevant for the issue of security in conventional public transit systems.

The second main theme encountered in the literature was the fact that contemporary forms of crime and unrest may be perceived to be applicable to public transit. This phenomenon appears to result from the need to address continued public apprehension of violent crimes that involve strangers in public spaces, such as street crimes (Atlas, 2008; Transportation Research Institute: Carnegie-Mellon University, 1975; Walkate, 2005). Unsurprisingly, these types of crime have also been consistently viewed as being extremely relevant for both public transit patrons and operators (Di Serio, 2003; Feltes, 2003; Perone and Tucker, 2003; SWAN and METRAC, 1991). In order to develop a better understanding of insecurity on public transit, criminological literature and literature on personal security in public spaces and public transit was consulted, and this topic serves as the starting point for the following section. Three types of behaviour were identified as being unconducive to personal security: "traditional" crimes that target riders; signs of disorder and indiscriminate crime; and the unsettling and unpleasant types of behaviour that are captured by anti-social behaviour.

Traditional Crime

Traditional crimes are both the most severe and feared types of security-compromising behaviour for public transit patrons and include both violent and non-violent forms of behaviour directed towards property and pople. These forms of behaviour have long been the subject of study by societies, and in particular the discipline of criminology, in order to understand the reasons for their occurrence and devise preventative strategies. Possibly due to its interconnections and status as a public or semi-public space[2], traditional crimes that are relevant to public transit primarily consist of petty and violent face-to-face crimes between strangers rather than domestic or white-collar crimes. Seven general criminal acts were noted as consistently appearing through the course of the literature review and these were categorized into five types based on their characteristics (Table 1). Categorization was carried out for the purposes of analysis, and to also compensate for similar crimes that may not have been included in the literature or omitted during the literature review.

[2] The “public” nature of public transit environments, especially in regards to privately operated/contracted service is a debate that will not be touched upon in this paper.

Table 1 Types and examples of passenger-directed traditional crime.

Type of Crime (Directed Against Passengers)	Examples of Criminal Event
Non-violent property	Pickpocketing [a,b,b1] /Theft [a, c]
Violent personal (and potentially property)	Assault [a, e, d, e, n, b1, d1] Sexual assault [d, g, h, i, k, n, g1] Certain forms of harassment* [a, e, f] Robbery [d1,c,d,e, n]
Terrorism	Terrorist acts [j, k, m, b1, h1, i1, o, p]

*Harassment remains a broad, evolving category during the time of writing and cannot be accurately represented by its inclusion in a single category

[a] Poyner, 1983
[b] European Conference of Ministers of Transport Economic Research Centre, 2003
[c] Welsh and Farrington, 2009
[d] Transportation Research Institute: Carneige-Mellon University, 1975
[e] Gladwell, 2002
[f] Metropolitan Action Committee on Violence Against Women and Children, 1992
[g] City of Toronto Planning and Development Department and Wekerle, 1992
[h] Metropolitan Action Committee on Violence Against Women and Children, 1992
[i] Scarborough Women's Action Network and Metropolitan Action Committee on Violence Against Women and Children, 1991
[j] Atlas, 2008
[k] Feltes, 2003
[l] Welch and Yayuz, 2010
[m] Perone and Tucker, 2003
[n] Ligget, Sideris, and Iseki, 2003
[o] Litman, 2005
[p] Taylor, Fink, and Liggett, 2006

Footnotes that include "1" are sources that did not specifically address public transit but were deemed to be relevant

[a1] Cozens, 2008
[b1] European Conference of Ministers of Transport Economic Research Centre, 2003:
[c1] Zelink and Brennon, 2002
[d1] City of Toronto Planning and Development Department and Wekerle, 1992
[e1] Di Serio, 2003
[f1] Walkate, 2002
[g1] Wagers, Sousa, and Kelling, 2008
[h1] Walkate, 2002
[i1] Welsh and Farrington, 2009

Violent personal and violent property crime. Violent personal crimes are the most consistently discussed type of crime among researchers, public transit users, and members of the general public[3]. Prime examples of these crimes are assault, sexual assault, and robbery. As per Canada's *Criminal Code* (1985B), assault refers to physical and non-physical interactions that successfully or unsuccessfully harm or threaten harm to an individual. This definition encompasses a variety of acts including threatening gestures, verbal assault, and physical altercations. Sexual assault, being assaults that occur in circumstances of a sexual nature or violate sexual integrity of the victim, technically falls under the crime of assault in Canada (Hoddenbagh, Zhang, and McDonald, 2014), but is listed separately in this paper in recognition of the attention paid to it as well as its unique characteristics. Examples of this crime include voyeurism, sexual touching, and forced penetration. It appears that sexual assault is a gendered crime (Bornstein, Fink, Germai, Loukaitou-Sideris, Loukaito-Sideris, 2014; Bornstein, Fink, Germai, Loukaitou-Sideris and Samuels, 2009; Loukaitou-Sideris and Fink, 2009), being feared most by women (City of Toronto Planning and Development Department [City Planning] and Wekerle, 1992; Metropolitan Action Committee on Violence Against Women and Children [METRAC], 1989; Scarborough Women's Action Network [SWAN] and METRAC, 1991) and this appears to be partially reflected by their higher sexual assault risk (METRAC, 1992). Robbery refers to the act of assaulting or threatening to assault other person(s) in order to deprive them of their property (Criminal Code, 1985C) and includes crimes such as swarming and weapon related robberies. Robberies are noted in at least one text as being the crime most feared by men (METRAC, 1991).

Violent crime's high-profile nature in public transit security does not appear to be dissimilar from its perception in other circumstances. At its most basic level, its infamy may stem from its direct violation of personal security, specifically the right for individuals to not be a victim of crime and the perceived responsibility for governments to safeguard this right (Transportation Research Institute: Carnegie-Mellon University, 1975; Tulemello, 2016). As noted previously, sexual assault arguably goes even further than its peers as its entails the

[3] As per the views expressed in the primary and secondary surveys encountered during the literature review.

violation of an individual's sexual integrity, while robbery is distinguished by the fact that it is centred on the forcible removal of property from an individual. Taken together, violent crimes may be particularly alarming due to relatability of the personal and property harms suffered by victims, as well as the disruptive nature of their aftermath on local communities. Harm aside, violent crime's notoriety also appears to be partially attributable to the increased speed and geographical dissemination afforded by modern technology and the media. Knowledge of criminal incidents and rates now extends beyond local users of a space, with actual, sensationalized, and fictional depictions of these crimes being captured in news, television, and other media (Walkate, 2005).

Terrorism. Notwithstanding its occurrence throughout history, terrorism is a relatively recent and varyingly important personal security concern for public transit in North America. Contemporary concern regarding terrorism, at least in the United States, arguably began in earnest following the September 11, 2001 attacks (DiSerio, 2003; Feltes, 2003). At face value, terrorism consists of acts that endanger persons or property and intimidate the public or a government in order to further a religious, ideological, or political cause (Criminal Code, 1985A). In the context of the North America and Western Europe, these acts may use vehicles as rams, explosive or harmful packages, and weapons such as firearms.

Public transit, possibly due to its public nature and importance to the functioning of urban areas, has also been targeted by terrorist attacks. Previous high-profile attacks include the 1995 Tokyo subway sarin gas attack (Feltes, 2003) and the 2005 London 7/7 bus and subway bombings ("7 July bombers", 2010). The relevance of terrorism in discussions of security on public transit, however, appears to be inconsistent depending on the audience in question. Concern regarding terrorism appears to be highest among practitioners and researchers (Atlas, 2008; European Conference of Ministers of Transport: Economic Research Centre, 2003), and relatively low among transit users if it is mentioned at all (Perone and Tucker, 2003).

Terrorism's compatibility with general crime prevention measures has been a subject of debate for researchers and practitioners. The most basic controversy concerns the fact that terrorism's methods and motivations have been argued as being more similar to political action and military strategy rather than conventional crime (Atlas, 2008). As noted by Di Serio (2003),

this presents a resource and jurisdictional challenge at the very least, as it arguably falls under the purview of national security rather than municipal governments and agencies. Furthermore there has also been wariness surrounding the applicability of crime-prevention measures to terrorism's comparatively unique root causes, actors, and strategies (Feltes, 2003). This distinction, however, may matter little to the potential victims of these types of events who may suffer material and personal harm. Overall, terrorism appears to be an inconsistent and controversial facet of conventional personal security strategies.

Non-violent property crime Non-violent property crimes directed against passengers, namely theft, appear to be a less controversial public transit security violation. These acts generally do not result in personal injury, may go unnoticed by victims until a later point in time, and thus remain simply unexplained or unreported. These forms of crime are not a new phenomenon, with notable examples including non-violent distraction based swarmings and pickpocketing of patrons waiting at surface stops in England (Poyner, 1983). Despite its low profile and lack of resulting personal harm, theft appears to be a common issue affecting public transit systems (ECMTERC, 2003; Poyner, 1983; Welsh and Farrington, 2009) but a lower priority for public transit patrons compared to public transit operators.

Signs of Disorder

Signs of disorder will be used to refer to a host of behaviours that do not necessarily harm patrons in the same way as traditional crimes, but nevertheless promote feelings of insecurity. The following discussion is partially informed by research on public space based on its similarity to public transit environments. While they may be less severe than traditional crimes, many of these acts may be codified and punishable through bylaws. Three categories of signs of disorder were identified: disruptive acts that are not directed at other individuals or property; personal or property crimes directed at public transit employees or property; and acts that affect the quality of life of patrons (Table 2). Aside from differences in characteristics, these acts appear to be perceived in varying degrees of significance by patrons, operators, and professionals,

Table 2. Types and examples of signs of disorder.

Type of Behaviour		Example
Quality of life crimes	Directed quality of life crimes	Public intoxication [a1] Panhandling [f] Unwanted attention/Certain less severe types of harassment
	Undirected quality of life crimes	Loitering [a, b1] Mutual disorderly conduct/Rowdiness [b] Nuisance behaviour (ie: excessive noise)
Directed at transit property/employees		Assaulting (including robbery) of a transit employee [a, c] Littering [d] Graffiti/Tagging/Scratchitti [b1, c1, d, e, f, g] Postering [b1] Vandalism [a, b1, c, e, h, i, j, k] Fare evasion [c, e, f, h]

[a] Poyner, 1983
[b] Perone and Tucker, 2003
[c] ECMTERC, 2003
[d] Atlas, 2008
[e] Gladwell, 2002
[f] Wagers, Sousa and Kelling, 2008
[g] Feltes, 2003
[h] Transportation Research Institute: Carnegie-Mellon University, 1975
[i] Scarborough Women's Action Network and Metropolitan Action Committee on Violence Against Women and Children, 1991
[j] Caire, 2003
[k] Stafford, 2003

Footnotes that include "1" are sources that did not specifically address public transit but were deemed to be relevant
[a1] Clarke, 2008
[b1] Zelinka and Brennon, 2001
[c1] City Planning and Wekerle, 1992

Quality of life crimes. Quality of life crimes (QOL crimes) includes a wide variety of acts that differ from traditional crimes as they may generally produce discomfort or fear rather than personal or property harm. A wide variety of acts fall into this category ranging from situations that either border on or have the potential to escalate to traditional crime, and minor infractions that serve as nuisances, but infractions nonetheless. This subsection will focus on more severe examples of QOL crimes and their relationship with traditional crimes, with discomfort and fear being the subject for the next section. Historically, the topic of QOL crime has been discussed in research on "anti-social behaviour" (Cornish and Clarke, 2008), broken windows policing (Gladwell, 2002; Wagers, Sousa, and Kelling, 2008; Welch and Yavuz, 2010), and incivilities in public space. Two types of QOL crime appear to exist, QOL crimes that are explicitly directed at a specific individual, and QOL crimes that have a more undirected audience.

Directed quality of life crimes. Directed QOL crimes, such as public intoxication, panhandling/begging, appear to be the second most common and notorious cause of concern for public transit patrons and professionals after violent traditional crime. This dubious honour appears to stem from the fact that these crimes may share similarities with traditional crime, with select ones also being reasonably capable of escalating into traditional crime.

The most serious form of directed QOL crime is public intoxication, which has been documented as causing irregular and violent behaviour (Ekblom, 1995; Zelinka and Brennon, 2001) and subsequently problems for public spaces (City Planning and Wekerle, 1992; Cozens, 2008; Ekblom, 1995) and transit patrons (Gladwell, 2002). Public intoxication is also highly relevant to public transit due to its official, and reasonable, advertisement as an alternative to impaired driving by advocacy groups and police forces (Pelley, 2016). Panhandling has also been subject to a fairly sustained amount of attention by both public transit professionals (Wagers et al., 2008) and patrons (Gladwell, 2002; Welch and Yavuz, 2010). Although a range of explanations exist, some of which will be discussed in the next section, extremely aggressive forms of panhandling that impede or threaten patrons may be perceived as bordering on, or being analogous to robbery (Gladwell, 2002). Lastly unwanted attention and less-serious forms of harassment is intended to capture a wide range of behaviour that may be perceived by victims or are reported as being threats to personal security. Justifications for this include the fact that these

acts may very well border on being criminal forms of harassment or threats, and their potential to be used by offenders to identify and target suitable victims. One issue specific to harassment is the fact that the term has been used on occasion to refer to all forms of targeted QOL crime (Gladwell, 2002) and this suggests that the term may be more appropriately used as an overarching definition of disorder rather than as a distinct subcategory.

Non-directed quality of life crimes. Non-directed quality of life crimes consist of comparatively benign forms of behaviour that presumably do not, or are not, intended to directly threaten general transit patrons. That being said, these acts have been documented on occasion as being problematic in the eyes of transit patrons and professionals.

Non-directed QOL crimes do not appear to have a ranked hierarchy and thus are not listed in any particular order. Loitering has been frequently listed as a concern (Transportation Research Institute: Carneige-Mellon Univeristy, 1975; Welch and Yavuz, 2010; Zelinka and Brennon, 2001) and may be differentiated on the basis of whether it involves suspicious persons, or suspicious locations. The former refers to loitering by particularly suspicious, and possibly undesirable, types of people (Lewington, 2000; Zelinka and Brennon, 2001), while the latter refers to loitering in areas with no reasonable or legitimate reason to do so (Poyner, 1983). The root cause for both of these appears to lie in loitering's potential to be the prelude for traditional crimes as it facilitates a potential or motivated offender's search for and encounter with a suitable victim or an opportunity. Disorderly conduct and rowdiness between consenting parties is the final type of indiscriminate disruptive behaviour that is particularly relevant to public transit. Although this behaviour may be mutual and may not necessarily involve traditional crimes, it nevertheless may be alarming and potentially harmful to bystanders or their surroundings. This may occur directly when these individuals or property become inadvertently involved or harmed (Ekblom, 1995; Gladwell, 2002), or indirectly as it demonstrates the willingness of its participants to carry out seemingly violent behaviour (Transportation Research Institute: Carneige-Mellon Univeristy, 1975). Nuisance behaviour is the final form of non-directed QOL crime that is relevant to public transit and it involves activities that may agitate other individuals and potentially escalate to other forms of crime. Instances of this would include crowded, stressful environments and their associated interactions (Wortley, 2008), and

possibly include unwanted broadcasts of loud vigorous music which may incite excitement and anxiety (Zelinka and Brennon, 2001).

Acts Directed Against Transit Property/Employees. Traditional crimes that are directed at transit property and personnel are another potential sign of disorder and cause of concern for public transit operators and professionals and possibly for patrons as well. Displays of a public transit operator's inability to even keep their own employees and assets secure may undermine the faith transit patrons have in the degree to which their own security is actually safeguarded (Transportation Research Institute: Carneige-Mellon Univeristy, 1975). These acts presumably follow a same scale of severity as traditional crimes, with employee assaults being most severe and property crimes being perceived as less severe to varying lesser degrees. Aside from undermining faith, acts directed against transit operators may also affect transit patrons through the demoralization of employees (Caire, 2003) as well as the possible facilitation of traditional crime and other behaviour (Gladwell, 2002).

Considerations for Signs of Disorder. A general shortcoming that was noted with signs of disorder was concerned the actual degree to which they affect personal security and the degree to which they should be policed. Barring extraordinary cases of directed QOL crime and crime directed against transit property and employees, it may be difficult to determine whether an act should be treated as criminal offence that is worth pursuing, or should be treated, and possibly dismissed as being minor or benign[4]. While underpolicing and its potential security ramifications have been discussed, overpolicing may be difficult, expensive, and also viewed as heavy-handed and controversial in a western context (Transportation Research Institute: Carnegie-Mellon University, 1975). Excess attention and resources towards incivilities may also backfire by attracting attention away from actual or more serious security concerns (Transportation Research Institute: Carnegie-Mellon University, 1975). As will be discussed in the next section, this trend remains persistent, especially between public transit patrons and public transit operators, and may be a cause for further controversy.

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[4] As with any form of policing, discretion plays a key role in these determinations

Indirect fear . Indirect fear represents the fact that individuals may feel insecure even in the absence of an ongoing or prior experience of threatening behaviour in a particular scenario. Public transit, as with other public spaces, continues to be subject to fear due to its accessible nature and the significant amount of uncertainty attached to it. It should also be stressed that this usage of fear does not refer to the fear of (re)victimization of individuals who have directly been harmed or borne witness to a security incident. This uncertainty may be felt through aspects such as the timing a patron's trip, and what an individual may encounter while travelling on public transit.

Fear of strangers is not a particularly new phenomenon and arguably runs the gamut of being a natural reflex or a coping mechanism. At its most basic level, strangers may be feared as they are unknown variables who may act in a variety of unpredictable ways including criminal activities. Explanations for this phenomenon include its nature as a response to the relatively high population density and the subsequent anonymity of urban residents (Jacobs, 2002), as well as strangers being symbolic of the constant physical and societal change (Di Serio, 2002; Feltes, 2002; Transportation Research Institute: Carnegie-Mellon University, 1975) experienced by cities. Additionally, certain strangers may be perceived as warranting extra attention based on a variety of actual and perceived characteristics that they exhibit. Aside from similarities to reported offenders, these may be based on spontaneous appraisals of attributes such as physical ability, numbers, their relationship to the surrounding space, societal conceptions, opinions, and biases (such as "usual suspects"). Examples of spontaneous appraisals include specific cases such as teenagers being a cause of concern for seniors (Perone and Tucker, 2003), and more general cases such as apprehension twoards individuals that appear to be homeless (Zelinka and Brennon, 2001). Certain appraisals may be particularly problematic, as shown by Perone and Tucker (2003) where at least one response used perceived ethnicity and creed as indicative of individuals who were "foreign elements" and thus potential threats. As such, fear based on strangers may not necessarily be a problem that can be adequately addressed by public transit operators.

Uncertainty is also experienced by public transit patrons in the form of the spaces, and the respective timings, that they must travel through in order to access public transit. Conventional, fixed-schedule and fixed-route bus network dictate when and how an individual may reach their destination, and understandably offer significantly less control than private modes of transportation (SWAN and METRAC, 1991; Zelinka and Brennon, 2001) and demand-responsive-transit. Examples of this uncertainty include travel at earlier and later times to account for longer travel times, service unreliability, temporary route diversions, route restructurings, service star and end times, the first mile/last mile of trips, and transfers between routes. A fairly well known instance of timing's relevance concerns the usage of public spaces, such as public transit, during after-dark periods (Feltes, 2002; Levine, Rodriguez, Wallace, and White, 1999; Perone and Tucker, 2003; SWAN and METRAC, 1991). Aside from timing, uncertainty may also be experienced in the form of the locations that a transit patron will be forced to interact with as part of their trip. Certain types of space may also be, or perceived to be, attractive to motivated offenders or activities that are associated with potentially threatening types individuals. Heavily trafficked areas (Cozens and Hilier, 2012) such as shopping malls for thieves (Bratingham and Brattingham, 2008), areas in the vicinity of major sporting facilities with especially rowdy fans (Bratingham and Brattingham, 2008), and adult entertainment areas (Anselin, Griffiths, and Tita, 2008; City Planning and Wekerle, 1992; Zelinka and Brennon, 2001) are all examples of this phenomenon. As was the case with the previous section, these ideas may also be communicated via the authorities, the media, and other channels.

Indirect fear occupies a consistently recognized, but controversial position among the literature that was reviewed. Two debates were encountered, the first being around the legitimacy of indirect fear, and the second being around the utility of indirect fear. For the purposes of this paper, both ideas will be treated as both possessing some level of merit due to the highly context specific nature of indirect fear.

The legitimacy of indirect fear appears to be the longest-standing debate concerning fear and appears to be heavily divided on the basis of the questioned party's relationship to public transit operations.

The supportive position in this debate argues that the indirect fears of patrons should be treated as a legitimate source of information for transit agencies. This perspective is argued on the basis that fears are the direct result of the actual day-to-day experiences of public transit users (Di Serio, 2003; METRAC, 1992; SWAN and METRAC, 1991) and may be indicative of unfamiliarity on the part of transit operators and professionals. These fears may not be supported by statistical evidence due to underreporting as there is indication that crimes may be reported unevenly (Atlas, 2008; Walkate, 2005), with sexual assault being a prominent example of purported underreporting (City Planning and Wekerle, 2002; SWAN and METRAC, 1991). As such, these strategies may provide a more accurate understanding of public transit's operations, if not an effective way of directly addressing the most pressing issues of patrons and promoting increased ridership.

Detractors base their position on the belief that the indirect fears of patrons may be inaccurate and must be verified prior to being acted upon as it may be disproportionate to statistical evidence of crime and the actual likelihood of victimization (ECMTERC, 2003). This phenomena has been noted as not being exclusive to public transit and instead being a general societal trend (Tulumello, 2016) that is at least partially attributable to the increased speed and reach of contemporary forms of media (Transportation Research Institute: Carnegie-Mellon University, 1975; Walkate, 2005;) that portray high-profile uncommon crimes. Indirect fear's vulnerability to misreadings also appears to be reflected by its relationships with assumptions, as demonstrated by fear on the basis of relatively uncontrollable traits such as age, ethnicity, and creed (Perone and Tucker, 2003). Proponents of this view generally state that inaccurate knowledge, on the part of riders and the general public, of the actual state of security on transit is the root cause of indirect fear. As such, strategies based off of indirect fear will be an inefficient usage of resources and may do more harm than good.

A second, smaller debate that was encountered was centered on the utility openly acknowledging indirect fear and fearful scenarios. Compared to the previous debate, the opposing positions on this view do not appear to be based on the lines of patrons versus officials such as staff and professionals. Supporters argue that advertisement of fearful situations fear may help guard individuals from falling into a false-sense of security and inadvertently

becoming targets (City Planning and Wekerle, 1992; Welsh and Farrington, 2009; Zelinka and Brennon, 2001). Additionally, these advertisements may serve as public service advisories that aid patrons in responding to security incidents as well as deterring offenders. Detractors argue that this can function as negative advertising for public transit by stoking fears and ultimately turning passengers away from transit (Transportation Research Institute: Carnegie-Mellon University, 1975). Indirect fear, however, is a difficult and controversial issue to address due to these noted divides in the literature concerning the accuracy of fear and the wisdom of acting upon these concerns.

What Are The Main Theoretical Approaches To Explaining Crime On Public Transit?

The theoretical roots for understanding crime and public transit appear to be best described by western criminology from the 1960s up to the present day. For the purposes of context, the early half of this period was marked by increased societal alarm regarding street-crime[5] in inner areas of both American (Cozens, 2008) and British (Cornish and Clarke, 2008) cities. In response, some theorists in this period began placing greater re-emphasis on treating crime as an active, individual decision making process as opposed to being the result of longer term biological or structural factors (Lilly and Cullen, 2007; Walkate, 2005). To a certain extent, emphasis shifted away from the study and pursuit of (potential) offenders and was instead placed on understanding and preventing criminal acts. This focus on criminal acts rather than criminal offenders is particularly important as public transit authorities may have limited resources, jurisdiction, or will, to pursue longer-term crime prevention methods that identify and address potential offenders through social programs or targeted punishment. These individual-centred theories share a belief that offences are carried out when the benefits of offensive behaviour are actively or subconsciously perceived as outweighing their costs and potential risks. As will be explained in the following section, this had a pronounced effect on modern society's understanding of crime, and crime prevention tactics that have developed as a result or concurrently with this knowledge.

Individual-centred theories are thematically linked due to their focus on individuals may be contemplating or outright committing security violations. Three general categories of individuals exist relative to potential and actual actions that threaten personal security: offenders; victims; and third parties that are nearby enough to witness the event. An additional category, individuals and groups that have ownership or otherwise have control over a space, was also

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[5] This alarm may be attributed to either increased crime rates or reporting of crime, but this is another academic debate in itself and is only mentioned in the interest of brevity and not misconstruing this occurrence

encountered in select pieces of literature as being expected (but not necessarily required) to help safeguard the occupants of their space.

The offender. Offenders, unsurprisingly, are a constant subject of focus in the literature that was reviewed. Consensus appears to exist concerning the idea of offenders as decision makers, although the exact nature of their decision making process has been a subject of debate that falls into one of the following three theories:

1. Offenders are calculating decision makers who seek to offend;
2. Offenders are opportunistic, calculating decision makers; and
3. Offenders are opportunistic decision makers who operate within bounded rationality and can make irrational decisions.

Offenders are rational decision makers that aim to carry out offensive behaviour. The first, and arguably most stereotypical, perspective argues that offenders are rational individuals who purposely seek situations that maximize the benefits and minimize the risks of their offensive behaviour. The earliest roots of this theory arguably date back to classical criminology in the 1800s, which sought crime prevention through the creation and advertisement of appropriately scaled punishments for offensive behaviour (Walkate, 2005). In contemporary times, this is captured in its simplest form by Rational Choice Theory, which was developed in Britain in the 1960s in response to discontent with social preventative and rehabilitative treatments for offenders and potential offenders (Cornish and Clarke, 2008). In its simplest form, Rational Choice Theory argues that individuals who intend to offend will seek spaces and targets that they have identified through a purposive decision making process (Atlas, 2008; Walkate, 2005).

As it specifically relates to this paper's topic, rational explanations of crime not only view public transit as not only a means but also a destination for motivated offenders to commit their acts. In regards to the former, public transit is a mobility tool that allows individuals, including offenders, to travel to comparatively distant targets, and areas accessible by public transit theoretically may experience greater levels of crime (Ceccato and Newton, 2015B). A second approach argues that public transit itself functions as a space for motivated offenders to stake out, identify, and ultimately victimize their targets. Documented examples of this include

swarm-based, distraction pickpocketing of individuals queuing for public transit in Britain (Poyner, 1983) as well as the women waiting for or disembarking from TTC buses who were targeted by the "Scarborough Rapist"[6] (SWAN and METRAC, 1991). Moving to specific acts, characteristics that may be reasonably presumed as being indicative of these rational offences include money-based instrumental crimes, and pre-planned attacks targeting a specific victim. Although it did not appear to be explicitly mentioned in the literature that was reviewed, offences that require specific implements such as purpose-built weapons and spray paint, may be other examples of these premeditated crimes.

Rational choice theory is not without its drawbacks, and arguably is the most critiqued of the aforementioned three theories. This appears to be primarily attributable to the theory's continued popularity and potential likelihood to be misapplied on a more frequent basis (Cornish and Clarke, 2008). An example of this would be the theory's stronger applicability to specific crimes such as instrumental money-based crimes, and presumably other high-risk, high-reward crimes that require more planning, when compared to others such as physical assaults and sexual crimes (Cornish and Clarke, 2008). Considering the types of crimes, many of which may be classified as petty crime, that may be associated with public transit, rational choice theory may not be the most comprehensive way of planning against crime. That being said, it arguably persists as a fairly conventional societal understanding of crime up to this day and serves as a foundation for more contemporary theories.

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[6]The "Scarborough Rapist" was later identified as Paul Bernado following a series of murders and sexual assaults.

Offenders are opportunistic, rational decision makers. A second theme that emerged in the literature was the idea of offenders as rational individuals that act on opportunities that they have encountered rather than actively sought out. By extension, this may mean that spaces frequented or consistently travelled through by potential and motivated offenders may be more liable to personal security incidents. Cohen and Felson's routine activities theory was the earliest documented example of this theory, and views crime as a convergence in space between a motivated offender and a suitable target outside of the presence of a capable guardian (Cozens and Hillier, 2012; Felson, 2008; Lilly and Cullen, 2007; Walkate, 2005). This theory of convergence is also a key point in Brattingham's (2008) crime pattern theory, which views crime being geographically "patterned" around the spaces they offenders travel through or occupy during the course of their daily routine.

Opportunity based theories appear to be a fairly relevant explanation for offences that have been documented as being related to public transit. Public transit serves as an important role in the daily routines of its users by connecting them with their destinations and this relationship is equally applicable to offenders. Public transit and its surroundings appear to be examples of crime pattern theory's traverse and occupied spaces as well as routine activities theory's convergence spaces. Offences that are captured by this theory most likely differ from conventional rational choice theory based on a lack of pre-planning and pre-designated victim and a reduced targeting phase on the part of the offender. A possible example of this type of offence would be the 1984 New York Subway shooting, where both of the involved parties met by chance, and their respective robbery attempt and retaliatory shootings being prepared for but not premeditated (Gladwell, 2002).

No specific criticisms of these opportunism based theories were found in the literature that was reviewed. The exact reason behind this unknown and at the very least, it is assumed that these theories are still limited by their emphasis of rationality as a cornerstone of crime.

Offenders are semi-rational, opportunistic individuals. The final offender-oriented theory argues that offenders are constrained by the natural limits of human rationality and as a result are both impulsive and opportunistic in sating their desires. Potential and actual offenders may not necessarily be calculating decision makers, but instead may be acting in a spur-of-the-moment fashion on imperfect decisions.

The first commonly held explanation of these types of crimes sees them as the result of the mental effects caused by chemical stimuli. The most obvious examples of these stimuli include drugs as well as alcohol, both of which have can have effects on the restraint, and decision making process of individuals and their subsequent actions. This appears to be at least partially supported by a pervasive wariness, if not stigma, towards drug users (Perone and Tucker, 2003) and individuals indulging in alcohol (Poyner, 1983), as well as the spaces they are perceived as commonly occupying (Cornish and Clarke, 2008; Zelinka and Brennon, 2001).

Stress has also been suggested as being another cause of impairment and crime by extension. This theory states that stressful conditions, be they physical or social, can alter an individual's decision making process and encourage offensive behaviour. As noted in Wortley's situational crime precipitators theory, a space's design and operations may produce stresses such as crowding and environmental irritants such as odours, noise, and temperature (Clarke, 2008; Transportation Research Institute: Carnegie-Mellon University, 1975; Wortley, 2008). These conditions may be conducive to expressive crimes that are primarily focussed on the release or satisfaction of an emotion, including stress, as opposed to obtaining an instrumental reward (Wortley and Mazerolle, 2008). Unplanned physical assaults by unimpaired individuals that are unrelated to robbery, and themselves are unrelated, could be perceived as being a likely candidate of stress based crimes.

Although it was not directly noted in any of the literature that was consulted, semi-rational opportunistic theories may also be particularly relevant for public transit. Needless to say, stressful conditions such as uncertainty, crowding, noise, uncomfortable temperature, and poor ventilation may be especially relevant, if not dubiously stereotyped, as an expected condition of public transit trips. Passengers themselves may be another stressing factor, with expressive crime possibly being triggered by actual or perceived interactions between patrons.

Bounded rationality may also be particularly apparent in intoxicated individuals of which public transit may be one of their only legal transportation options.

The victim. Victims, as they are the second "constant" of most personal security incidents, have also been the subject of some research aimed towards understanding the scenarios and locations in which crime takes place. Strategies that fall under this approach suggest that individuals can take measures to avoid making themselves attractive to motivated and opportune offenders. The basis for this approach appears to lie in knowledge of the target-selection process of offenders[7], as well as statistics and societal conceptions of individuals that are more likely to become victims of crime (Walkate, 2002).Victim oriented strategies may draw attention to the occurrence of certain types of crime on public transit and potential forms of behaviour that may make an individual an attractive target (Walkate, 2002). Common examples of this "attractive" type of behaviour include the open display of valuables, travelling through tertiary routes that are less trafficked and well-lit areas (City Planning and Wekerle, 1992), not being aware of one's surroundings, and not supervising one's possessions.

A common critique of these theories lies on its emphasis of a victim's culpability in the harm that befell them. The biggest critique of these theories is centred on "victim-blaming" and its potential alienation of the intended recipients of the message, especially victims, which may do more harm than good (SWAN and METRAC, 1991). This is of particular note for public transit based on the importance of presenting a favourable public image, and attracting or maintaining rather than turning away riders (Transportation Research Institute: Carnegie-Mellon University, 1975).

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[7] This was not explicitly stated in criminological texts but was extrapolated from treating crime as a rational decision making process. Target selection, however, is discussed comparatively more in urban and architectural studies

The third party: witnesses and bystanders. Bystanders may play a role in both the occurrence and the course of personal-security incidents by serving as outside factors. These individuals may serve as immediate deterrents, de-escalators, interveners, casual police (Jacobs, 2002), and ultimately risks for offenders and have been noted as a deciding factor in preventing or stopping victimization (City Planning and Wekerle, 1992). Offenders conducting more "rational" crime grounded in the costs and benefits of their actions may see bystanders as a variable that increase the effort they will have to expend, the risk of failure, or the risk of capture during or after the fact (Stanley, 1977). In these instances, the potential existence of a witness may be sufficient. Bystanders theoretically may also play a role in countering less rational acts of crime, by serving as interveners (City Planning and Wekerle, 1992) that presumably de-escalation or break up interactions, or assist in an offender's apprehension. Bystanders, and activity, may also serve as general fear reduction measures (Hennessy, Kim, and Ulfarsson, 2007)

It must be remembered, however, that bystanders are also human beings and may react in a variety of expected and unexpected and undesirable ways. Inaction has been noted as not being out of the ordinary (City Planning and Wekerle, 1992; Cozens and Hilier, 2012; Newman, 1973), with the acknowledgement that bystanders may not necessarily intervene on the behalf of a complete stranger. This problem is possibly best captured by the 1964 murder of Kitty Genovese in New York City, which was allegedly witnessed by at least 38 individuals, none whom acted on the grounds of apathy, not wanting to get involved, and assumptions that someone else would have intervened (Gladwell, 2002). One potential explanation that was not encountered in the literature, but may be relevant in contemporary times, is a fear of being defrauded, or otherwise entrapped, during or following one's involvement in an orchestrated incident. Aside from the likely continued prevalence of skepticism of strangers, there also appears to be an increasing number, or reporting and awareness, of cases of rescuers being harmed by their rescuees. One example of this is cases of rescuees launching post-incident lawsuits for harms that they actually or allegedly suffered at the hands of their voluntary rescuer (or Good Samaritan Fraud) (Bu, 2016), and the possibility of orchestrated fraud through these means.

North American criminal and civil law texts were briefly explored in order to develop a better understanding of the role and responsibilities of bystanders. One legal commentary discussed this issue and noted that strangers outside of a special relationship have no duty to rescue in respect of individual rights and the unpredictability of human behaviour (Klar and Jefferies, 2017). Duties to rescue exist to limited degrees in the cases involving special relationships, and in other jurisdictions, with the latter only being applicable to situations that do not place the rescuer in harm. The concept of special relationship does not appear to include the relationship between a TTC employee and a TTC patron. Moving on to the issue of rescuers being harmed by their rescuees, bystanders that decide to come to the assistance of a stranger may be protected from liability through Good Samaritan laws. As noted by the province of Ontario's iteration of this type of law, the Good Samaritan Act, voluntary rescuers cannot be held liable for damages that are caused by reasonable actions associated with their rescue attempt (Good Samaritan Act, 2001). While this does not remove the possibility of a rescuer being directly harmed or defrauded through other means, it at least protects would-be-rescuers from civil litigation for alleged accidental harms caused by reasonable rescue efforts. Overall, it bears noting that bystanders in the context of a North America should only be presumed to be potential, rather than dependable, sources of aid for victims of crime.

The third party: property Owners, manager, and occupiers. Property owners and managers, who will be referred to as "occupiers", were also examined in order to gauge their actual responsibility for safeguarding the security of individuals on their respective property. The basis for this decision lies in the concept of private property rights, and the fact that occupiers not only have the greatest, but sometimes the only, degree of control over the design and operation of their property (Atlas, 2008; Zelinka and Brennon, 2001). This control may be applied to discourage potential offenders, allow potential victims to identify and avoid threats, and assist in providing aid to victims or apprehending offenders. I would also argue that occupiers, barring extenuating or monopolistic circumstances, also have a vested interest in safeguarding their patrons, and avoiding situations that may generate negative publicity. This belief also appears to be complemented by the continued prevalence of a societal expectation that an individual's security will be protected in contemporary, post-modern society (Feltes, 2003). Finally, this practice has also been theorized as being popularized by increasing security litigation in the United States (Atlas, 2008), where established third-party occupiers may be a more certain source of financial compensation to victims when compared to (often petty) criminals (Osborne, 2015).

Legal commentary on an occupier's duty, more specifically know as occupier's liability, is convoluted and the following remarks are largely exploratory at best. At its most basic level, occupier's liability states that occupiers must safeguard entrants and their property from harm at the hands of the condition, activities, and possibly the conduct of third parties by extension (Klar and Jefferies, 2017; Occupiers Liability Act, 1990; Osborne, 2015). Clarity issues appear to be the result of the fact that occupier's liability traditionally has been handled by ever-evolving common law (Klar and Jefferies, 2017; Osborne, 2015), as opposed to standardized by statute as is the case in the province of Ontario (Ministry of the Attorney General, 1980). Compared to case law, which has covered incidents such as trespassing followed by a questionably intentional arson (Klar and Jefferies, 2017), Ontario's occupier's liability act is noticeably silent on its applicability to crime-related incidents. Case law on occupier's liability appears to be overwhelmingly associated with negligence resulting in safety related incidents such as slips and falls rather than security related incidents. This may be justified by the fact that occupiers may neither reasonably foresee, nor control the actions of a third party and thus cannot be held

responsible for third parties (Fridman, 2012; Klar and Jefferies, 2017). At least one of the consulted authors, however, argues that occupiers may be held responsible in failing to properly take preventative measures against acknowledged, targeted serial offenders or offences, and that premises-security litigation has continued room for growth (Osborne, 2015). Overall, it may be safest to presume that occupier's liability does not necessarily apply to criminal activities, but may be relevant depending on the nature of the case at hand.

How Do These Theories of Crime Relate to Our Topic?

Public transit operators, even when given the authority to operate their own police service, arguably have limited ability, and possibly little desire, to engage in longer-term crime prevention programs[8]. Additionally, the discussed theories have a long-standing relationship with the prevention of petty crime and street-level violent crime, both of which have been identified as being particularly important for public transit patrons. As such, situational explanations of crime, and their salient, smaller scale solutions, may be an especially relevant and appealing means of planning against security incidents.

Common Ground: The Spatial Environment and Personal Security

Spatial planning, the discipline from which this paper is structured, may play an important role in safeguarding the security of public transit patrons. At its most basic level, spatial planning concerns the ways the design of a physical environment can promote, facilitate, and inhibit different types of behaviour. Consequently, spatial planning is similar, if not closely associated, with disciplines such as urban and environmental studies, environmental psychology, urban planning, urban design, and architecture. The first type of physical elements that may be planned for are "direct" as they are necessary assets, or literal barriers, to certain types of behaviour. An oft-cited example of barriers and assets would be a park bench with a centrally

[8] This could take the form of hiring programs or collaborations with local marginalized populations

mounted armrest, which encourages individuals to take a seat and loiter in a space, but also impedes them from lying down. A second type of physical element consists of more indirect physical elements that focus on indirectly influencing behaviour by modifying a space's conditions, and an individual's perception and usage of such space. Returning to the previously mentioned park bench, usage may vary on other factors such as whether it is covered with graffiti or cosmetic damage, overly exposed to an environmental element, or installed in a manner that provides it with a poor interface to its surroundings[9]. The various parties involved in potential or actual personal security incidents, and crime and offensive behaviour by extension, may also be affected by the direct and indirect effects of physical elements.

Three researchers can be credited as being the earliest, key thinkers of contemporary efforts aimed at safeguarding security through spatial planning. Chronologically, these researchers were urban theorist Jane Jacobs, criminologist Ray Jeffrey, and architect and city planner Oscar Newman, all of whom were studying inner city crime in American Cities in a period roughly starting in the 1950's.

Jane Jacobs was an American urban theorist who most notably penned *The Life and Death of Great American Cities* in the 1960's, which critiqued modernist urban development and supported preceding forms of development. As it relates to the topic, Jacob's most important concept concerned casual policing by residents of their surroundings which she termed "eyes on the street". This theory was based on the ability of certain types of pre-modernist North American urban development to generate activity and casual surveillance of public spaces, and thereby deterring crime, by their occupants and surrounding individuals (Jacobs, 2002/1962; Wortley and Mazerolle, 2008). Jacobs attributed this phenomenon to two main design aspects: small, mixed blocks of residential and other land uses (fine-grained mixed use) and urban design that provided good visibility. Fine-grained mixed residential use has also been theorized as providing a scale that strikes a balance between being small enough to foster a sense of

[9] William Whyte's 1979 documentary "Social Life of Small Urban Spaces" elaborates upon this through its analysis of public plazas in downtown areas

community (City Planning and Wekerle, 1992), while also being diverse enough to generate a relatively consistent amount of activity throughout the day (City Planning and Wekerle, 1992; Cozens and Hillier, 2012; Jacobs, 2002/1962). Additionally, it could be presumed that this pattern of development also distributes these responsibilities over a population that is not excessively high and mitigates the bystander effect. One note about casual surveillance that must be stressed is the fact that it is not only contingent on the provision of physical sight lines (Cozens and Hillier, 2012) but also requires sufficient activity in order to attract observers (Cozens and Hillier, 2012; Jacobs, 2002/1962).

Although the concept of eyes on the street, and Jane Jacobs by extension, remain as key elements in urban planning, its presumptions have not gone without critique. Aside from the previously mentioned issue of whether bystanders will actually come to the aid of others, eyes on the street has also been questioned due to its assumption that certain types of land uses, such as residences, will always be occupied and provide bystanders (Cozens and Hillier). Although it was not directly stated in any of the reviewed literature, the theory itself also appears to treat crime as a monolithic construct that is at least partially deterred by activity. Looking at this shortcoming, certain types of crime, such as pickpocketing, have been shown to benefit or be attracted to public spaces with high activity (Cozens, 2008; Loukaito-Sideris, 1999). Finally, the concept has been criticized for being context specific as it was based on Jacobs' analysis of an inner-city area of a single American city (Cozens, 2008). That being said, this final critique appears to be levelled against contemporary usage of the concept as it was acknowledged by Jacobs herself as a limitation (Fraser, 2012). Nevertheless, eyes on the street remains as an influential theory in North American urban design and land-use planning.

Ray Jeffrey, by direct contrast to his two aforementioned peers, was a criminologist who created the concept of crime prevention through environmental design (CPTED) in 1971 (Atlas, 2008) and also notably differs based controversy surrounding the contemporary relevancy of his work. Jeffrey, viewed criminality as being the end result of a combination of deeper-rooted social issues and situational opportunities for otherwise unremarkable individuals, and thus advocated for a variety of measures ranging from broader social policies and changes to physical design (Wortley and Mazerolle, 2008). Elaboration on contemporary CPTED, however, is

problematic based on the fact that it has been noted, even by Jeffrey himself (Wortley and Mazerolle, 2008), as having been redeveloped and thus more closely attributable to other researchers, (Atlas, 2008; Wortley and Mazerolle, 2008; Zelinka and Brennon, 2001) most notably Oscar Newman. Critical analysis of this theory is also difficult as Jeffrey's CPTED appeared to advocate for a more multi-disciplinary approach that did not heavily utilize a pre-determined set of solutions. Ultimately, Ray Jeffrey was included on the basis of his relatively common inclusion in the reviewed texts.

Oscar Newman, also an American, was an architect and planner who developed the concept of defensible pace in the 1970s following his research of lower income housing developments in the United States. As a whole, defensible space operates on the basis that personal security can be promoted through spatial elements that incorporate the four elements of territorial influence; surveillance opportunities; perception (image); and surroundings (milieu) (Newman, 1973). Territorial influence refers to the usage of physical elements that symbolically, or literally, divide a space and can be utilized by legitimate users against potentially or verified illegitimate users. Surveillance opportunities is extremely similar, if not a direct extension (Wortley and Mazerolle, 2008), of Jane Jacob's work and is focussed on the provisioning, or consolidation, of natural surveillance and casual self-policing opportunities (Newman, 1973). Perception refers to the ways an area's design, construction, upkeep, and its consistency with its surroundings can provide positive and negative connotations to individuals and their behaviour (Newman, 1973). This point ideally aims to strike a balance between expensive high-quality, but high upkeep environments, and heavily fortified environments that are cheaper and low maintenance but may alienate users (Newman, 1973). Finally, milieu refers to a pair of concepts, the ability for certain types of land uses to be conducive (or unconducive) to safety through their activities and character, and the diffusion of these characteristics based on interface with surroundings (Newman, 1973). Oscar Newman also differed from Jane Jacobs through the attention he paid to the design and planning of interior spaces. Defensible space ultimately merged with and became the primary basis for contemporary understanding of CPTED.

Criticisms of Oscar Newman's defensible space theory are largely centred on its emphasis of spatial elements. At its most basic level, concern has been levelled against the

theory's "simple" understanding of social processes (Atlas, 2008) and its emphasis of a seemingly deterministic relationship between spatial design and human behaviour (Cozens, 2008). Similarly to eyes on the street, Newman himself has attributed these problems to misapplications of his theory (Atlas, 2008), and also acknowledged the need for social factors to be taken into consideration (Cozens, 2008). Context specificity is another issue, with the relevancy of these strategies to more transient residential areas being questioned (Atlas, 2008; Stanley, 1977) and arguably extendable to public transit environments due to their reduced access control and transient nature (Ceccato and Newton, 2015A). Defensible space's understanding analysis and compatibility with the multi-faceted of crime also appeared to be somewhat limited in the texts that were evaluated.

At least four other American researchers, Elizabeth Wood, Schomo Angel, James Wilson and George Kelling, also engaged the topic during the same period but have been quoted to a comparatively more inconsistent degree. Elizabeth Wood and her security design work for public housing (Cozens, 2008; Cozens and Hilier, 2012) and Schlomo Angel and his study of the relationship between land-use intensity and crime (Cozens, 2008; Cozens and Hilier, 2012; Zelinka and Brennon, 2001) were two theorists who were also cited by some sources being influential, but possibly to a lesser degree. A multitude of smaller references to contemporary theories and researchers building off of the previously mentioned key three thinkers were also encountered as part of my research. A comprehensive review of these newer theories will not be included due to the constraints of this paper, the generally singular nature of these references, and the lack of critical analysis that was encountered.

Security-Oriented Spatial Measures

As their name implies, security-oriented spatial measures are designed to foster personal security and combine aspects and recommendations of the aforementioned criminological and planning research. These measures may function in a variety of ways, but are generally oriented towards facilitating security conducive behaviour, policing non-conducive behaviour, or creating an image of security. Many of these measures explicitly or implicitly influence the behaviour of one or more of the participants in actual and potential security incidents. Potential shortcomings and concerns associated with these measures will be discussed prior to moving to further discussion of these measures and their relevance to public transit.

Potential shortcomings and concerns. Although they offer potential benefits, security-oriented spatial measures are not without their weaknesses, which need to be accounted for in order to better apply them. These drawbacks can be broadly divided into two categories, weaknesses that are specific to these design based strategies, and universal weaknesses for any attempt at preventing crime.

Security-oriented measures cannot be presumed to be universally applicable to every form of threatening behaviour or in every context. A general problem associated with all measures is their ability to potentially foster a false sense of security when misapplied and inadvertently make them suitable targets for victimization (City Planning and Wekerle, 1992; Zelinka and Brennon, 2001). The second, and arguably most notable shortcoming, is the ability for these measures to be counterproductive. Excessive use of measures, particularly explicit measures, can create a sense of fortification and an impression that crime is rampant in said space and thereby generate fear (City Planning and Wekerle, 1992; Cozens, 2008; Zelinka and Brennon, 2001). Lastly, certain measures may also produce negative side effects, risks, or operational issues for public transit.

A second category of shortcomings, general issues, are neither exclusive nor easily solved, and have been included for cautionary purposes. Escalation is the first example and refers to the potential for motivated offenders to use more serious means to compensate for measures that successfully impair, deprive, or challenge them from using lesser means (Feltes,

2003; Stanley, 1977; Welsh and Farrington, 2009). Displacement is the second potential outcome and it refers to the potential for motivated offenders to shift their activities to less well defended spaces and softer targets (Cornish and Clarke, 2008; Feltes, 2003). A clear counter argument to both of these issues was encountered in the reviewed text and considers that only a small segment of the population, likely already motivated offenders, would be willing to escalate or displace their offensive activities (Clarke, 2008). Nevertheless, both of these types of shortcomings of security-oriented spatial measures appear to be relevant considerations.

How is security-oriented spatial design relevant to public transit? Security oriented spatial design measures may be both highly relevant and attractive for public transit operations due to a variety of underlying strategic and operational reasons. Public transit can be described as being a publicly-accessible private space (or semi-public space) at the very least and their surface networks may be particularly so as their stops often are located on public streets. Additionally, the continued discourse on the right-to-public space in a North American context (Atlas, 2008)[10] presumably also applies to public transit, and limits denials of service to individuals with significant, repetitive infractions[11]. Moving to security, there is also a societal expectation that individuals will be reasonably safeguarded from harm, be it from private property owners for their legal entrants (Atlas, 2008; Ministry of the Attorney General, 1980), or the state with regards to its citizens in public spaces (Atlas, 2008; Feltes, 2003). Overall, this combination of expectations serves as underlying priorities for public transit operators and also presents operational issues.

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[10]Without going too far back, a historical example of this discourse is Henri Lefebvre's right to the city. Contemporary examples of this could human rights cases and policy measures such as the Accessibility for Ontarians with Disabilities Act.

[11] Examples of these presumably would include restraining orders and outstanding warrants.

Security measures may also be necessary to ensure the viability and competitiveness of public transit in an expedient and reasonable manner. Aside from being a societal expectation, personal security has been cited as being a significant concern for existing and potential public transit patrons and may to their discontinuation of transit usage (ECMTERC, 2003; METRAC, 1989; METRAC, 1992; Transportation Research Institute: Carnegie-Mellon University,1975). This loss of ridership and revenue may be particularly important for for-profit operators, and government affiliated operators may also heed this in order to achieve sustainability and congestion oriented policy goals. Although it is not a definitive fact, the financial threats of liability for victims of security incidents could also be a relevant motivation for transit operators to pursue security measures.

Operationally, security-oriented spatial measures may serve as practical and attractive means for protecting public transit patrons and employees. Public transit operators may not be afforded the resources, jurisdiction, or possibly have the will, to engage in conventional longer-term forms of crime-prevention. These latter measures[12] also suffer from their lack of expediency and salience (Walkate, 2005), which may be especially noticeable and detracting to the perceptions and modal choices of existing and potential transit patrons. Independent policing via of a corps of transit police, may be an equally if not more visible alternative to spatial measures, but requires not only state sanction[13] but also significant financial and manpower resources to even reach partial policing of all but the smallest transit networks. Spatial measures such as changes to surface vehicles and stops, on the other hand, may not be constrained to the same degree by these issues yet also offer concrete signs of change.

For the purposes of this paper, only a selection of these measures will be discussed based on their perceived relevancy or their existing usage by public transit operators in Ontario. Seven

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[12] This could take the form of skilled-trades training and employment programs, or quotas, drawn from the surrounding community but may be restricted to the procurement of large scale, higher-order transit projects such as Metrolinx's Eglinton Crosstown LRT.

[13] The Toronto Transit Commission's special constable program, for instance, required provincial sanction.

different categories of spatial strategies were identified in the literature and in the practices of the Ontario public transit operators. These categories were created on the basis of on their primary recipient(s), and the degree to which they affect said primary recipient:

- Passively increasing the risks for offenders;
- Actively increasing the risks for offenders;
- Passively deterring offenders;
- Passively reducing the risks for potential victims;
- Actively reducing the risks for potential victims/allowing them to seek help;
- Passive third-party based strategies; and
- Reducing fear on the part of existing and potential patrons.

Strategies that were encountered in the reviewed literature or prior experience were classified on the basis of the above categories using Table 3. Certain strategies were noted as being relevant to more than one category and subsequently listed more than once.

Table 3 Spatial measures that are relevant to public transit

Purpose	Strategy	Specific Examples
Passively increase the risk for offenders	Improved lighting	Bus shelter lights Streetlights and exterior light fixtures Translucent wall/roof surfaces
	Unmonitored CCTV	Vehicle cameras Station/stop cameras Public street/private property cameras
	Improved sightlines	Translucent wall/roof surfaces Convex security mirrors Removal of sight barriers and obstacles Siting stops to near/with good interfaces
	Territorialisation by operator	Prohibitory signage and codes of conduct Public service advisories High quality design and branding[a, a1]
	Target hardening	Vandal resistant elements Postering resistant elements Barriers (fences/walls/gates) Upkeep and repair of damaged/vandalized assets
Actively increase the risks for offenders	Monitoring/surveillance equipment	Monitored vehicle interior cameras Monitored station/stop cameras Monitored public/private cameras
Reducing behaviour that may make individuals attractive targets	Reducing risky situations	Public service announcements Awareness campaigns Limiting/discouraging access to risky areas [a1] Improved lighting and sightlines Service information/limiting waiting [b,c]
Allow victims to seek help		Vehicle interior/station passenger assistance alarms Pay phones/public telephones Siting stops to near/with good interfaces
Passive third-party based	Facilitating third party intervention	Improved lighting Improved sightlines Siting stops to near/with good interfaces
	Encouraging third party intervention	Public awareness campaigns
Reducing fear in transit patrons		Improved lighting Improved sightlines Presence of CCTV cameras Passenger alarms Upkeep/repair of damaged elements

a Dixon, 2017
b City Planning and Wekerle, 1992
c SWAN and METRAC, 1991

Footnotes that include "1" are sources that did not specifically address public transit but were deemed to be relevant

a1 City Planning and Wekerle, 1992

Overall, spatial security measures play a passive role due to their limitations compared to actual policing as well as the limited potential to strengthen access-control on public transit. Additionally, a noticeable number of measures were identified as being applicable to more than one, if not all, of the participants of personal security incidents. In order to avoid repetition, these measures were further categorized and eight basic components were noted in the majority of the identified measures.

- Closed-circuit television (CCTV) cameras;
- Interior, exterior, and street lighting;
- Public service advisories;
- Visibility measures;
- Wayfinding and trip planning measures;
- Alarms;
- Interface/siting relative to land uses; and
- State of repair and target hardening.

Closed-circuit television (CCTV) cameras. Closed-circuit television (CCTV) cameras are arguably the most iconic and increasingly utilized security oriented spatial element in North American public and private spaces (eg: Atlas, 2008). CCTV cameras are presently implemented in one of two ways: cameras that solely record their video feeds (unmonitored); and cameras that route their video feeds to a monitoring station for viewing by an occupier or an appointed individual (monitored) and may or may not be monitored. CCTV's popularity primarily lies in its ability to provide evidence that may aid in the apprehension of offenders (Transportation Research Institute: Carnegie-Mellon University, 1975), and may also allow for the detection and addressing of to in-progress or potential offenders when monitored (Welsh and Farrington, 2009). These investigative and responsive capabilities have been considered to not only serve as a deterrent for potential offenders (Welsh and Farrington, 2009), but also serve as a source of reassurance for legitimate users of a space (Di Serio, 2003; Welsh and Farrington, 2009). CCTV has also been popularized due to its application towards terrorism investigations (Cavoukian, 2008) as well as counter-terrorism strategies (Atlas, 2008). Finally, it should be noted that CCTV's popularized is likely affected by its utility towards personal safety, specifically providing evidence for issues regarding occupiers' liability[14]. CCTV appears to be most closely linked to contemporary CPTED (Atlas, 2008) and presumably rational choice theory as well.

CCTV's justification and popularity also hold true in the context of North American public transit. At present, CCTV has been installed in the interior, and increasingly the exterior of revenue service vehicles as well as in transit terminals and higher-order transit stops[15]. As cited by the Information and Privacy Commissioner of Ontario (IPCO) (2015) CCTV has been seen in a positive light and associated with decreases in criminal behaviour, disorderly behaviour,

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[14] Based on the TTC's usage of video surveillance under the authority of the Occupiers Liability Act.

[15] Examples noted firsthand by the author include York Region Transit as well as commuter buses (GO Transit). The TTC has also opted to install new buses with external cameras and began activating them in January 2018.

and perceived insecurity by transit agencies, and improved investigative capabilities by transit agencies and law enforcement personnel. CCTV also remains a staple, and possibly a best practice, in professional and academic texts from North America (Atlas, 2008; Transportation Research Institute: Carnegie-Mellon University, 1975; Welch and Yavuz, 2009) and Western Europe (Poyner, 1983; Welsh and Farrington; 2009). Their utilization in public spaces, however, may be dependent on local laws and regulations that determine the jurisdiction and power afforded to governments and their associated bodies.

CCTV's actual effectiveness at reducing crime is somewhat more unclear as relatively few statistical studies were documented in the reviewed texts. This dearth appears to be attributable to the difficulty of performing high-quality studies that are able to account for extraneous factors of crime (IPCO, 2015; Welsh and Farrington, 2009). Only two sources (IPCO, 2015; Wortley and Mazerolle, 2008) were noted as having appreciable discussion of the actual effectiveness of CCTV. Of the studies that were cited, CCTV's effectiveness at reducing crime has varied significantly and also appears to be tied to the spaces where it was deployed. These range from marginal effectiveness in downtown public spaces (IPCO, 2015; Welsh and Farrington, 2009) and public housing (Welsh and Farrington, 2009) to high effectiveness in parking lots (Cavoukian, 2008; Welsh and Farrington, 2009). CCTV's effectiveness on public transit, however, is more uncertain, having mixed but modest effects in underground metro systems such as Montreal; London; and New York (Welsh and Farrington, 2009), but questionable effects in other public transit environments (Cavoukian, 2008). Elsewhere, CCTV appears to be consistently effective in parking lots (Cavoukian, 2008, Welsh and Farrington, 2009), and only marginally effective in public spaces located in urban centres (Cavoukian, 2008, Welsh and Farrington, 2009) and public housing (Welsh and Farrington, 2009). These findings appear to be at least partially supported by findings that CCTV is effective at reducing pre-mediated and property crimes (Cavoukian, 2008, Poyner, 1983), not very effective against public order crimes (Cavoukian, 2008), and relatively ineffective against impulsive crimes and violent crimes (Cavoukian, 2008). There, however, appears to be some belief that CCTV has a universal, but varying, deterrent effect on criminal behaviour (Cavoukian, 2008). What is notable, however, is the fact that federal ministries such as the United Kingdom's Home Office and the United States Department of Justice are nevertheless supportive of CCTV as a general security measure

(Cavoukian, 2008). The effectiveness of CCTV for counter-terrorism is unknown, but not unheard of as was the case of the investigations such as the London 7/7 ("7 July bombers", 2010). There is also some indication that patrons may not share the same confidence as operators and professionals CCTV's ability to safeguard their security (Welch and Yavuz, 2010).

CCTV has also been consistently critiqued for its potential threats to personal privacy. As summarized by the Information and Privacy Commissioner of Ontario (2015), CCTV is in its simplest form is an indiscriminate form of surveillance of all individuals even if they are behaving in a law-abiding manner. Cited problems include the infringement of the right to anonymity in public space (Cavoukian, 2008, Welsh and Farrington, 2009), the right to be secure against unreasonable searches (Welsh and Farrington, 2009), and causing individuals to adjust even non-offensive behaviour for fear of censure or other reprisal (IPRC, 2015). Additionally, concerns have been raised regarding the protection of data from unnecessary or inappropriate access and distribution by employees, the authorities, and third parties (Cavoukian, 2008). Monitored CCTV, especially cameras that can be adjusted in pan and zoom by their operators, presumably pose a greater risk due to their potential to be abused by operators and monitors. Taken together, CCTV should not be taken lightly as a course of action for public bodies.

Interior, exterior, and street lighting measures. Lighting arguably was the simplest transit relevant design element that was encountered in the reviewed literature. Overall, security oriented lighting builds off of and generally goes beyond conventional, minimum visibility-based[16] lighting in a four tier spectrum. The first, and lowest, tier calls for the removal of lighting, or appreciable lighting, from routes and spaces that are potentially dangerous or not intended for usage in order to divert activity to a somewhat safer location (Atlas, 2008; City Planning and Wekerle, 1992, Cozens, 2008). A second, higher tier, sets facial identification from a reasonable distance of 20-30 feet at the bare minimum (Atlas, 2008, City Planning and Wekerle, 1992) and this presumably is to allow for viewers to gauge intent, determine whether their subject is a potential threat, and take appropriate action (SWAN and METRAC, 1991). The highest, and arguably most stereotypical, application of security lighting is designed to provide maximum visibility, possibly bordering on over-lighting, in order to draw attention and facilitate easy surveillance to the occupants of a space. Theoretically, this latter strategy arguably also facilitates surveillance by casual observers as well as CCTV cameras. Lighting, whether by instinct or actual effects on a person's sense and ability to navigate space, has also been attributed as being an important factor in determining whether a space is secure or insecure (City Planning and Wekerle, 1992; Welch and Yavuz, 2010). Ambient light levels may also be increased or adjusted through the application of light-reflective surface treatments (City Planning and Wekerle, 1992; METRAC, 1989, SWAN and METRAC, 1991).

Lighting may be particularly significant for public transit patrons, especially those with travel needs that entail transit usage during after-dark periods of the day. Lighting has been consistently viewed as an important element of security for public transit by both professionals (City Planning and Wekerle, 1992; Transportation Research Institute: Carnegie-Mellon

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[16] Including standards set by professional bodies such as the Illuminating Engineering Society of North America (IESNA) (City of Toronto's Best Practices for Effective Lighting (2017), and local government bodies such as the City of Toronto's City of Toronto's Best Practices for Effective Lighting and the Ontario Building Code.

University, 1975; Welch and Yavuz, 2010) as well as patrons (METRAC, 1989; METRAC, 1992; Perone and Tucker, 2003; SWAN and METRAC, 1991).

Compared to other measures, lighting appeared to have the greatest uncertainty between its perceived and actual effectiveness at reducing crime. Aside from SWAN and METRAC (1991) that cite lighting as a security best practice, relighting projects did not appear to cause an appreciable reduction in crime in the environments they occurred in (Atlas, 2008;; City of Toronto Planning Division, 2017; City Planning and Wekerle, 1992; Ekblom, 1995). There is even at least some indication that lighting may inadvertently assist potential offenders in selecting targets and impairing victims and potential witnesses (Welsh and Farrington, 2009). Although no direct explanation of this significant discrepancy between perceived and actual effectiveness was found in the literature, several potential explanations exist. Personal security encompasses both the actual risk as well as the fear of being victimized, and lighting appears to be an effective fear reduction measure (Atlas, 2008; City Planning and Wekerle, 1992). This may be based on its ability to offer at least some level of control to individuals in their navigation of darker and limited visibility conditions and areas.

Lighting can also be problematic for a variety of security and non-security related side effects. The former category is based on the ability of lighting to impair the eyesight, especially night-vision, of non-offenders when it is deployed in extremely inconsistent and high-contrast manners (City Planning and Wekerle, 1992). One specific form of this the production of one-way glare on transparent surfaces such as the “fishbowl effect” for transparent bus shelters (SWAN and METRAC, 1991). Additionally natural surveillance by adjacent properties may be discouraged by excessive light intrusion or glare (City of Toronto Planning Division, 2017), and offenders may also be aided in their target selection process by over-illumination (Welsh and Farrington, 2009). The main non-security related issue with lighting concerns its potentially pollutive effects on surrounding human and non-human life (see Atlas, 2008; City of Toronto Planning Division, 2017) when over-applied or when using non-downward facing fixtures (City of Toronto Planning Division, 2017).

Public service advisories. Public service advisories (PSAs) consist of patron, and general public by extension, oriented messages that may be distributed through audio and visual means. For the purposes of this paper, three broad categories of these measures were identified in academic and professional literature. A fourth, potential category was also identified in the practices of the Toronto Transit Commission. The first type of PSA is aimed at the deterrent of potential offenders. These measures primarily consist of rules and prohibitions that prevent offenders citing ignorance as an excuse of their behaviour (Atlas, 2008; Wortley and Mazerrolle, 2008; Zelinka and Brennon, 2001) and presumably also serve as deterrents through the advertisement of punishments[17]. Potential victims are the main audience of the second type of PSA which are intended to help reduce their likelihood of victimization. Examples of the targets of this type of PSA highlight behaviour that may attract or deter offenders (Cozens, 2008; Walkate, 2005), available security programs (METRAC, 1989), and unsubstantiated fears (Transportation Research Institute: Carnegie-Mellon University, 1975). The final type of PSA found during the literature review is the blanket advertisement of security measures to both potential offenders and the general public. The basis for this type of PSA lies in the deterrent of offenders through the advertisement of the increased riskiness of their behaviour (Clarke, 2008) and the assuaging of the potential fears of non-offenders (Transportation Research Institute: Carnegie-Mellon University, 1975). One final type of PSA was noted in personal observations prior to and during this research and was aimed at encouraging bystanders to actively or passively intervene in security incidents when safe to do so. These PSAs may use a variety of draws including altruism, self-interest such as the ability to prevent a service disruption via de-escalation, or potential monetary compensation.

Security PSAs appear to be applicable to public transit based on their relative ease of implementation. The limited infrastructure required for PSAs may already exist and be used for personal safety, service reasons, or commercial advertising onboard vehicles, in facilities, and on

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[17] As discussed earlier in the paper, the advertisement of punishments is seen by classical criminology as being a deterrent to rational offenders.

transit or street related elements. Additionally, the material costs of these programs may be comparatively low as well.

The actual effectiveness of PSAs cannot be accurately commented on due to a dearth of previous research. PSAs were briefly alluded to in one source as one of a series of ineffectual measures utilized in England that necessitated a drastic shift in crime prevention measures (Ekblom, 1995). Although it was not stated in any literature, PSA's may also be considered as serving a secondary, passive, role primarily directed at non-offenders that is not expected to bring about drastic changes in crime by itself. By comparison, the effect of PSAs, namely patron-focussed cautionary PSAs, on fear of crime has received slightly more attention but has likewise drawn unclear findings. PSAs that offer information on the incidence of crime along with prevention and response strategies have been considered as being acknowledgements of rider experiences and ultimately positive steps by riders who have been victimized or are concerned (Feltes, 2003; METRAC, 1992; Transportation Research Institute: Carnegie-Mellon University, 1975). That being said, this strategy is also problematic as it may serve as negative press that may stoke fears and negatively affect public transit usage (Transportation Research Institute: Carnegie-Mellon University, 1975).

Visibility. As a design measure, visibility refers to the removal or mitigation of visual barriers in the physical environment. Visual barriers are significant as they may provide hiding spots for offenders (City Planning and Wekerle, 1992; ECMTERC, 2003;SWAN and METRAC, 1991; Zelinka and Brennon, 2001), and impair the awareness of bystanders and non-offenders (City Planning and Wekerle, 1992; Zelinka and Brennon, 2001). Although a significant amount of flexibility exists as to how this achieved, visibility improving measures may be described of a hierarchy of three "Re-'s" in the form of **re**moval; **re**location; and **re**design. Removal, as its name implies, consists of the outright removal of the offending visual obstacle and appears to be best suited for non-essential elements such as pillars and foliage (City Planning and Wekerle, 1992). Relocation, while applicable for non-essential elements, may be more relevant for essential elements such pedestrian-level utility infrastructure (SWAN and METRAC, 1991). Redesign likewise shares a similar relationship with non-essential and essential elements, but was the most-discussed and broadest strategy in terms of the measures it is comprised of. Examples include the substitution of translucent material for vertical surfaces (SWAN and METRAC, 1991), mitigation for blind corners with corner mirrors, and the compensation of unrectifiable issues using technology such as CCTV (Atlas, 2008; Cavoukian, 2008).

Visibility measures were noted as having an established relationship with public transit operations through their consistent inclusion in transit focussed texts and sections of text. Visibility, or the lack thereof, has also been previously noted by survey recipients as being a key reason explaining why riders largely felt more comfortable riding surface vehicles than below-grade subways after dark (SWAN and METRAC, 1991). In a similar vein, visibility's popularity also appears to be attributable to its relevance in below-grade terminals and stations that lack natural surveillance opportunities and have may have restricted or confined spaces.

There did not appear to be any significant discussion on the effectiveness of visibility measures. Presumably, visibility measures may enhance the ability of offenders to monitor and ultimately select a target (Atlas, 2008). Although further discussion will be saved for *Target Hardening and State of Repair*, certain visibility measures such transparent surfaces made of glass and plastic-derived materials carry the side effect of being more susceptible to both minor and major forms of vandalism.

Wayfinding measures, public service advisories, and service information. Wayfinding measures attempt to minimize the amount of time individuals-especially those who are new or unfamiliar with a space-are unnecessarily exposed to potentially risky conditions via maps, directional signage, and informational signage. Although this concept was generally only alluded to in the majority of the reviewed works (City Planning and Wekerle, 1992; SWAN and METRAC, 1991), the intent of this measure can be described as providing individuals with the means to control their navigation through a space (Zelinka and Brennon, 2001). The following consists of reasonable assumptions as to the value of these measures. Wayfinding measures include directional signage, maps in public spaces, and publicly accessible private spaces (City Planning and Wekerle, 1992; Zelinka and Brennon, 2001) that aid individuals in understanding and navigating their surroundings. Public service advisories (PSAs) consist of advertisements or releases that raise awareness of information that is in the public interest and may be produced and displayed by public entities as well as private entities for the benefit of their entrants. Personal security is an example of a matter that arguably is in the public interest and PSAs may include information on crime prevention measures, potential security concerns, and contingency responses to security incidents (City Planning and Wekerle, 1992; SWAN and METRAC, 1991; Zelinka and Brennon, 2001). PSAs may also be directed at potential or motivated offenders and stress the criminality, and associated punishments of offensive behaviour, or the existent security measures and procedures that are ready to frustrate offensive behaviour (Atlas; 2008; Clarke, 2008).

As it relates to transit, both wayfinding measures and PSAs may be particularly important for public transit patrons. Wayfinding is relevant as patrons may often have to occupy or travel through unfamiliar public spaces in order to access public transit. PSAs may be useful in countering fear of crime on public transit and better equipping passengers for any such scenarios (SWAN and METRAC, 1991). Information measures may serve as means for passengers to more easily or rationally navigate public transit systems and plan trips. These latter measures include on-site and electronically accessible information sources for public transit service such as routes, operating periods, schedules, and next vehicle arrival times. With the exception of route information, which plays a similar role to conventional wayfinding measures, these trip planning measures provide a means for patrons to minimize the amount of time they spend waiting at

transit stops. Schedule and next vehicle arrival times can provide reasonable estimates, especially in the case of the latter, as to when a patron actually has to leave their origin point in order arrive at their stop in order to catch the next vehicle. Real-time information may also decrease waiting times by allowing passengers to modify their trips in order to account for unplanned service disruptions. Both hard and real-time service information may also reduce the likelihood of passengers waiting for vehicles that will not show up due to service period changes such as peak-service routes and branches, or routes with no overnight service. All of these measures may lessen the likelihood of a potential or a motivated offender coming into contact with a suitable target or suitable opportunity to commit offensive behaviour.

No research on the effectiveness of these measures was cited or conducted in any of the surveyed pieces of literature. Considering the fact that uncertainty has been noted as being a significant source of fear, these measures may be more oriented towards fear-reduction and only serve as extremely passive crime prevention measures at the very best. A number of potential weaknesses, however, were noted as being worthy of attention. Non-real time information may be difficult or cumbersome to update and serve as potential sources of misinformation or misdirection. Compared to all other measures, wayfinding and service information may also be at least partially shift responsibility onto the general public by posting information electronically (Spurr, 2016). Although it is not necessarily a transit operator's problem, there is no guarantee that individuals will or will always have access to such electronics and this directing of patrons towards the open display of expensive personal electronics somewhat conflicts with oft-cited PSAs on robbery and theft prevention.

Alarms. Alarms are design measures that can be activated by individuals in order to summon assistance. Two main types of purpose-built passenger activated alarms exist, "signal" alarms that do not facilitate any form of two-way communication, and alarms that utilize two-way intercoms. In addition to these specific measures, public telephones and payphones may also serve as ways for individuals to summon help (City Planning and Wekerle, 1992; SWAN and METRAC, 1991; Transportation Research Institute: Carnegie-Mellon University, 1975). Compared to all but monitored CCTV, alarms appear to be the most reliable way for victims and targets to get help in a relatively quick manner regardless of their location.

A total of three concerns may affect alarms and other assistance measures, one of which affects both alarms and payphones, two that are exclusively applicable to payphones, and one that was not found in literature but may be relevant to alarms. The first concern is design focussed and stresses the need for a balance to be struck between ease of access and use, and resistance against vandalism and misuse (Transportation Research Institute: Carnegie-Mellon University, 1975). The second concern is specific to payphones and posits that they may also serve as a facilitators or meeting points in various illicit activities such drug deals and loitering and thus a potential threat to security (Zelinka and Brennon, 2001). Additionally, pay phones, may be presumed as being privately installed and operated[18], and their inclusion into public transit environments is largely contingent collaboration with private operators (SWAN and METRAC, 1991) and may be less than guaranteed considering their continued decline. The final concern that appeared to be unstated, concerns the difficulty and costs of installing and manning a system of alarms over even a small portion of a surface network.

[18] For instance, payphones in Toronto, Canada are both owned and operated by the Bell telecommunications company.

Interface/siting relative to safe land uses. Certain types of land uses can have or be perceived to have positive or negative effects on personal security in their surroundings. This determination may firstly be based on the types of users and activities associated with their legitimate activities. Examples of these problematic side effects include conditions that may escalate interactions into signs of disorder, serves as activity generators for unattractive behaviour such as loitering or more illegitimate behaviour such as crime. Respectively, these include sporting facilities and drinking establishments with rowdy or intoxicated individuals (Poyner, 1983); public streets with loitering youth (Zelinka and Brennon, 2001); and adult entertainment districts with drug deals (Cozens, 2008; Loukaito-Sideris, 1999). Land uses may also have ramifications on personal security by sheer virtue of the amount of activity that they may or may not generate at different times of day and their subsequent effects on surrounding public space. This characteristic is of particular relevance to concepts emphasizing the need for active public spaces and interfaces for security, including eyes on the street and CPTED.

Interface and siting can be important factors in the placement of public transit stops, and waiting patrons by extension, and the identification of potentially suitable and problematic sites. Taken to extreme levels, this strategy of giving consideration to adjacent land uses has been previously advocated for as a means of better protecting and reassuring female public transit patrons (Ligget, Loukaitou-Sideris, and Iseki, 2003; SWAN and METRAC, 1991). Fear reduction for a more general target audience has also been viewed as a potential consideration for land uses in transit stop planning (City Planning and Wekerle, 1992; Zelinka and Brennon, 2001). Conventionally, however, this attention has been largely devoted to minimizing distances between stops and activity generators (City Planning and Wekerle, 1992), especially those that are most active during after-dark periods (Poyner, 1983).

Although it was not as widespread as study of CCTV, interface and siting strategies appear to be supported, if not viewed in a favourable light. There is at least some study of common environmental factors in sexual assault sites (City Planning and Wekerle, 1992), and at least one study determined associations between certain land use characteristics and crime rates at bus stops (Ligget et. al, 2003). That being said, rigour and sample size both appear to be issues for analysis and the risk of correlation not being indicative of causation also remains. A

potential general drawback of these measures may be their reliance on location and relocation by extension. Existing transit stops may embody a significant amount of investment that is associated with their passenger amenities and less noticeable investments such as concrete stop pads, bus bays, and passenger alighting areas. Location can also notably conflict with other priorities such as stop spacing, and is arguably also contingent and slow to respond or adapt to the comparatively more fluid changes of surrounding land-uses.

Target hardening/state of repair. Target hardening and state of repair concerns the caused financial, operational, and image issues caused by vandalism and disrepair. In regards to the latter, damage may be viewed as signs of tolerance of disorder and opportunity for motivated and potential offenders (Cozens, 2008; Walkate, 2005), and be subsequently feared by non-offenders (Cozens, 2008; Gladwell, 2002), Although state of repair technically is more of a policy and operational issue, design and planning can have an impact through the ability of certain types of materials and designs to be more resistant or vulnerable to wear and damage.

The public nature of public transit means that its environments and facilities are often occupied by individuals that neither have the responsibility nor the authority to manage them. Signs of disrepair may be symbolic of neglect (Heimsath, 1977) on the part of transit operators, or related operating bodies, and the legacy of previous instances of offensive behaviour. Certain forms of damage, such as seat-slashing (Transportation Research Institute: Carnegie-Mellon University, 1975), may also interfere with the functionality of transit environments or passenger comfort, if not serve as sources of fear (ECMTERC, 2003).

Target hardening measures are controversial as they have widely differing levels of support among professional and non-professional literature. Outside of reducing vandalism, target hardening's actual effectiveness in reducing crime is unclear as no primary or secondary references to statistical evaluations were encountered. Target hardening's utility to fear reduction is also contested but at the very least appears to be supported on a somewhat greater basis. Overall critiques of the theory include its alienating effect on users of a space (Cozens, 2008) and its vulnerability to misapplication, and its financial prudency (Zelinka and Brennon,

2001). More seriously, excessive, explicit applications of target hardening have been cited to actually raise doubts and generate fear (Atlas, 2008; City Planning and Wekerle, 1992) and escalate offences by serve as challenges to offenders (ECMTERC, 2003).

Context: Public Transportation in Toronto

Toronto in the 20th Century: The Toronto Transit Commission and Surface Routes

Public transit service in Toronto is a comparatively more recent development that has nevertheless been subject to variety of radical reorganizations. Service first began in 1861, under franchise, by a private company utilizing horse-drawn streetcars and sleighs, and by 1920 service was provided by a plethora of private electric streetcar companies. (Toronto Transit Comission, n.d.B). This arrangement appears to have been inadequate, as a 1920 municipal election referendum would see the consolidation of public transit under the banner of the newly created municipally controlled transit authority known as the Toronto Transportation Commission on September 1, 1921 (Filey, 1997). Although streetcars would remain as the main mode of public transit, buses would be introduced on an experimental basis in 1922 and would increasingly be used in the 1930s for routes serving outlying areas of Toronto-proper (Filey, 1997) as well as surrounding communities (TTC, n.d.B). As will be discussed later, buses would experience continued, if not increased, utilization and become increasingly important in serving the city. 1954 would see the service being renamed to its present day name of Toronto Transit Commission (TTC, n.d.B) and in a coincidental call back to 1921, the TTC would also assume sole responsibility for public transit in Toronto's neighbouring suburban communities as part of the creation of the regional municipality of Metropolitan Toronto (Figure 1) (TTC, n.d.B). The final relevant developments in the TTC's history would be creation of the overnight blue night surface network in 1987, and the amalgamation of the municipalities making up Metropolitan Toronto in 1998 to form the present day City of Toronto (TTC, n.d.B).

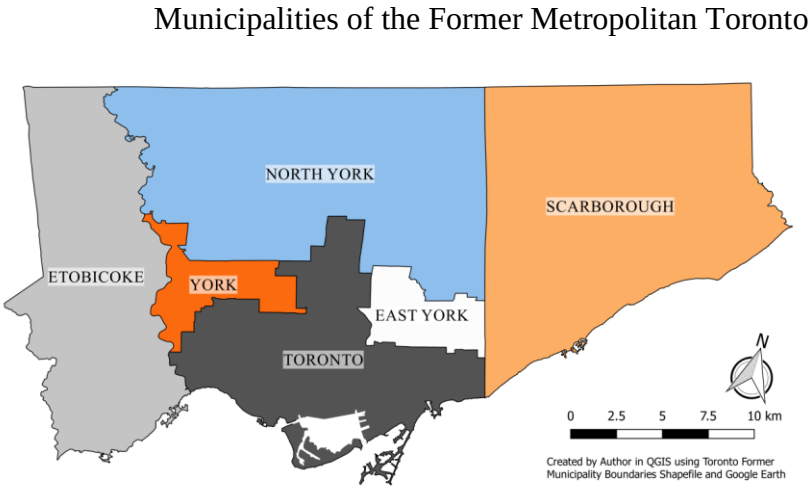

Figure 1. A map of the various communities that made up Metropolitan Toronto just prior to amalgamation

Contemporary Surface Public Transportation in Toronto

Bus operated surface transit makes up a significant portion of the TTC's contemporary network. Buses are particularly important to Toronto's former inner suburbs, especially in their geographical extremes, where rapid transit and streetcar lines only make limited ingresses. Currently, the TTC operates over 140 bus routes (Toronto Transit Commission, n.d.A) that span a combined distance in excess of 6,000 kilometres over the entire city (Toronto Transit Commission, 2017A) (Appendix B: Toronto Transit Commission System Map (TTC, 2018)). These routes serve over 10,000 on-street surface transit stops, of which roughly 67% are on the approach to intersections (near-side), 22% are after intersections (far-side), and 11% are between intersections (mid-block) (Toronto Transit Commission, 2006). Surface bus stops are largely consistent in Toronto, being located streetside along mixed-traffic thoroughfares. The stops themselves are relatively conventional in nature, possessing stop markers in varying combinations with averaged sized transit shelters and general street furniture. Additionally, all but two of the TTC's daytime bus routes connect with at least one subway or rapid transit station. As will be discussed later, the TTC's daytime bus network is structured so as to ensure that 90%

of Toronto's inhabitants and employers are within 400m, or roughly a 5 minute walk, of a bus stop (TTC, 2017B). Taken together, buses are the most used vehicle mode in the TTC system, accounting for just under 49% of the network's 533 million riders in 2017 (TTC, 2017B). Streetside bus service is also particularly important for the TTC's overnight network, which lacks rapid transit service and sees buses serving 27 of the city's 31 overnight routes. In addition to providing overnight service on the system's backbone in the form of the line 1 and line 2 subway lines, all but one of the overnight routes serving the city's inner suburbs are operated using buses.

Personal Security and the TTC

Relatively little literature has been written about the TTC's historical security levels. The only, and possibly most infamous, incident that was encountered was the Scarborough Rapist's activities in the Scarborough district of Toronto during the mid-late 1980's. The culprit, serial rapist and later serial killer Paul Bernado, carried out a series of successful and unsuccessful sexual assaults of young women and girls, many of whom were travelling alone at night and had recently disembarked from a TTC bus (SWAN and METRAC, 1991). This incident spurred action on the issue of personal security, especially for female transit users, by residents, non-profit organizations, the TTC, and the Toronto Police Service, and included security audits of surface and rapid transit stops. The most notable products of this research include the Designated Waiting Area at rapid transit stations, and the request stop program (METRAC, n.d.), which allows patrons travelling alone by bus during late-night and overnight periods to disembark between regular stops if they feel vulnerable (Toronto Transit Commission, n.d.D).

Moving to contemporary times, discussions of personal security levels on the TTC have generally been restricted to reports of smaller cases of assault, sexual assault, and harassment through the local media. The most significant contemporary development was the TTC's launch of its "This Is Where" anti-harassment campaign and associated smartphone reporting application on September 6th of 2017 (TTC, 2017B).

Information on the incidence of offensive behaviour on the TTC system is difficult to access. At the most basic level, TTC statistics on crime and offensive behaviour are occasionally released to the general public through the media via investigative reporting, requests for

comments, and official statements by TTC representatives. Otherwise, data is only publicly accessible, outside of a Municipal Freedom of Information Request, through the TTC's annual reports on transit enforcement rather the commission's standard annual reports. This data, however, is somewhat constrained based on its presentation in largely aggregate form as well as year-to-year stylistic and reporting changes. Statistics were not found in the publicly accessible and academic subscription-based databases that were consulted.

As the intent of this paper is not based on the statistical analysis, data on crime and offences will only be briefly discussed. Overall, the TTC has consistently experienced an increasing number of reported and documented security incidents from 2015 to 2017 (Toronto Transit Commission, 2016; Toronto Transit Commission, 2017A; Toronto Transit Commission, 2018). Starting with the latter, the TTC has consistently experienced occurrences and apprehensions over this three-year period, having 3,050 occurrences and 403 apprehensions during the latest annum (Table 4). This increasing trend also exists with regards to security related calls, which differ as they are divided by transit mode. Although surface transit only makes up 14% of the total 15,919 calls, the figure has consistently increased over this 3 year period when compared to all other modes (Table 5).

Table 4 Security occurrences on the TTC in 2015-2017 (TTC 2016; TTC 2017A; TTC 2018A)

	2015		2016		2017	
	Total Occurrences	Arrests and Apprehen.	Total Occurrences	Arrests and Apprehen.	Total Occurrences	Arrests and Apprehen.
System wide	2,022	240	2,511	306	3,050	403

Table 5 Security occurrences on the TTC by mode (TTC 2016; TTC 2017A; TTC 2018A)

	2015	2016	2017
SRT	181	126	204
Subway	11,581	11,502	13,420
Surface	1,184	1,898	2,295
Total	12,946	13,526	15,919

Offences that were previously identified, or presumed to be, particularly relevant for surface transit patrons constituted up to 2,573 (84%) of total occurrences in 2017 (Appendix A: Reported Offences on the TTC (2016, 2017A, 2018)). In respective order, assault, fraud, vandalism, and theft were identified as being the most common offences (Figure 4) reported on the TTC (2016; 2017A; 2018A). Fraud[19] of patrons and the TTC, surprisingly was the second most common relevant offence on the TTC following a drastic increase between 2016 and 2017. Vandalism, theft and crimes outside of the system's top 4 categories appear to have remained relatively stable and the frequency of the former two is not particularly surprising.

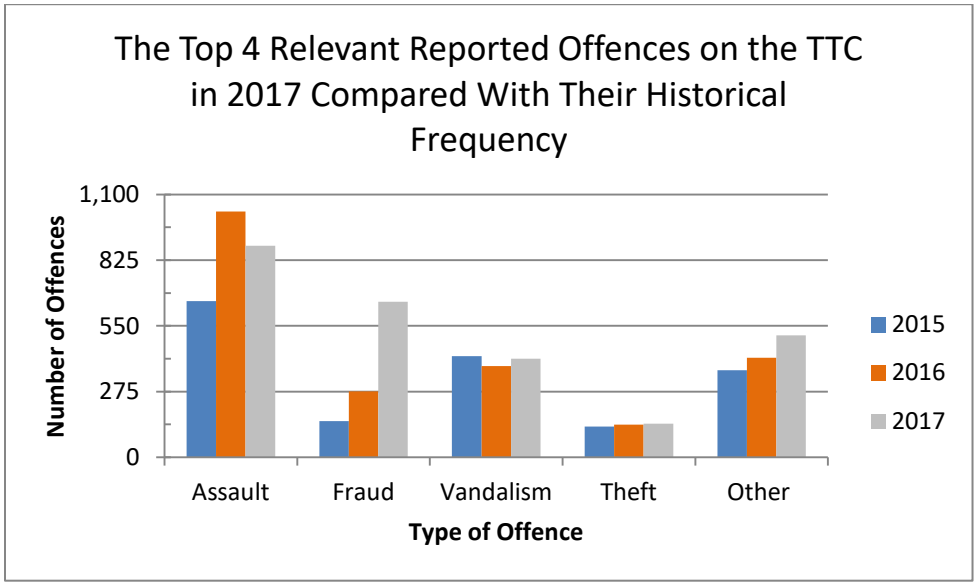

Figure 2. The Top 4 Relevant Reported Offences on the TTC (TTC 2016; TTC 2017A; TTC 2018A)

The hierarchy of less-frequent crimes on the TTC contained several surprising statistics. While sexual assault's frequency relatively matches the level of infamy attached to it, robbery is a surprisingly infrequent crime by comparison (City Planning and Wekerle, 1992) (Figure 5). Quality of life crimes, although they could include disturbances of the peace, and employee related crimes comprised a surprisingly small share of offences. Moving on to the relevance of

[19] Fraud is presumed to refer to fraudulent monetary transactions, including the usage of fraudulent fare media, with the TTC and possibly include the defrauding of TTC patrons.

crimes, the top 4 types of offences that directly affect passengers are assault, theft, disturbances of the peace, and sexual assault.

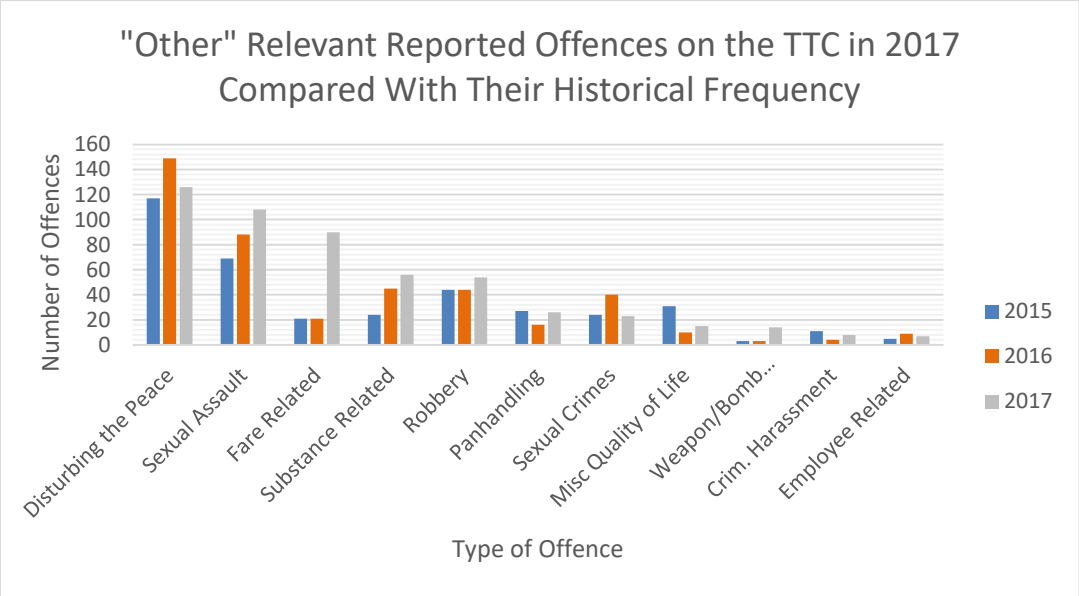

Figure 3 Other offences that may be particularly relevant to perceptions of personal security (TTC 2016; TTC 2017A; TTC 2018A)

Two points should be stressed in regards to the interpretation of these figures. Firstly, these crimes are categorized on the basis of interpretation and discretion rather than official convention or best practices. Simply put, crimes may have been grouped or separated crimes in non-standard or potentially incorrect manners. Additionally, and as oft-cited in literature, the discrepancy between reported figures and transit user sentiment may be attributable to underreporting (Walkate, 2005) or partially conflated perceptions of insecurity.

Policy Context

As dictated in the *City of Toronto Act*, a statutory document that sets out the powers of the City of Toronto, the TTC is classified as a City board that has been provided exclusive authority[20] for the management of local passenger transportation in the City of Toronto. That being said, a variety of both municipal and private partners are involved in the planning and provisioning of streetscape elements that are directly attributed or indirectly contribute to streetside stops. Public transit has also increasingly been posited as a vital component of sustainability and competitiveness in the Greater Toronto Area, and the City of Toronto by extension (see: Metrolinx, 2008; Ontario Ministry of Public Infrastructure Renewal, 2017; Ontario Ministry of Transportation, 2012).

General stop placement standards. The TTC, presumably in a similar fashion to other transit operators, considers stop placement to be a balancing act between the needs of passengers and transit operators. TTC (2017C) service planning standards dictate key considerations, including convenient access, efficiency, safety, and community impacts, which are put into practice via minimum standards for coverage and access. The TTC's day-time network is designed so that 90% of Toronto's inhabitants and employers are within 400m-roughly a 5 minute walk-of local bus stops that are be spaced roughly 300 to 400 metres apart (TTC, 2017C). This emphasis on coverage and walking times can be traced back to the weighting system used in the TTC's transit modelling process (TTC, 2017C), and data that implies that walking is viewed by riders as the second most inconvenient component of their trip. As was previously stated however, a stop may not be implemented if the weighted benefit of this change does not outweigh or match the additional travel time added to other riders' trips.

Aside from ensuring a basic level of access, the facilitation of seamless transfers between routes and modes is the other major factor that informs TTC surface stop planning (TTC, 2017C). This is reasonably presumed as increasing the likelihood of stops being located in the vicinity of

[20] A small number of exceptions exist, primarily towards different modes (eg. Rickshaws and pedicabs) or services with affiliations to schools or other levels of government are excepted

intersecting streets that have transit service. As it relates to our topic, basic level of connectivity is the fundamental feature of surface stop planning.

Land-use and stop placement. Land use has been factored to varying degrees during service planning and placement of surface transit stops. The service standard's discussion network connectivity, for instance, emphasizes the need to ensure that transit service is provided in a manner that meets customers' travel needs by connecting residential, employment, and institutional land uses (TTC, 2014; TTC, 2017C). It can be reasonably assumed that stop planning will be partially informed by surrounding land uses, and route and stops may be located in the vicinity of access points to major trip generators. This appears to be supported to a degree by the inclusion of certain civic institutions, secondary and post-secondary schools, regional transportation stations, and large shopping facilities by electronically accessible route schedules as well on-board next stop announcements. An additional instance of service planning directly acknowledging land use concerns differences in stop placements between high-speed arterial roads and residential areas. Bus routes operating in residential areas, are stated to be warranted exceptions to minimum stop spacing standards as they are expected to emphasize connectivity rather than operate at an high overall speed (Toronto Transit Commission, 2014). Although this document predates the service standards, the traffic characteristics of residential streets have remained relatively unchanged and the document appears to remain relevant. Overall, land use may dictate how service is routed, the type of service that will be provided, and the specific locations of stops.

Technical considerations. The final set of considerations guiding surface transit planning are largely technical in nature and concern the ways bus stops may negatively impact the operations of surrounding land uses and traffic flows. Three broad concerns regarding vehicular traffic, pedestrian traffic, and physical space were identified in the materials that were consulted.

The TTC has historically planned bus stops in the interest of minimizing situations that may result in unsafe vehicular traffic movements. This firstly can be seen in their avoidance of farside non-bus bay stops due to their potential to create intersection blocking queues of motorists behind stopped buses (TTC, 2001A). That being said, farside stops have more recently

been viewed by the commission as being more conducive to vehicle travel times (TTC, 2003), possibly due placement after traffic signals. Of the two points, it could be argued that the former drawback may have more to do with driving etiquette and a police concern as opposed to a public transit operator priority.

Pedestrian safety, specifically a bus stop's interface with pedestrian crossing points on roadways, has been another factor in the positioning of surface transit stops. Midblock stops are preferably placed in the vicinity of existing traffic signals and pedestrian crossovers, or pedestrian refuge islands in order to discourage unnecessary, unprotected midblock crossings by transit users (TTC, 2006; TTC, 2014). In the case of pedestrian crossovers, there is also a further requirement to place stops in buffered nearside orientations in order to prevent buses from obscuring crossing pedestrians from approaching motorists (TTC, 2006).

Finally, the TTC appears to give some regard for the availability of space for stops and their elements where possible during their siting. Historically, the TTC has preferred to locate stop markers within reasonable distance of transit shelters (TTC, 2006), which themselves are preferably placed in areas with sufficient non-sidewalk municipal property. Although it was not find in any of the consulted sources, bus stops also have consistently been observed to be sited in locations that will not result in stopped buses blocking private driveways.

Legal Responsibility for Passenger Well-Being

As will be discussed later, surface transit and its various environments are owned or maintained by a variety of bodies whose involvement may not be readily apparent at face value. While the TTC is responsible for its stations, properties, and occurrences that are directly related to its vehicles and their occupants, streetside transit stops and their shelters are not the TTC's responsibility and instead are managed by the City, and in rare cases by private property owners. For the purposes of this paper, attention will primarily be focussed on the question of whether the TTC is liable for the security of its patrons.

As noted by then-Ontario Privacy Commissioner Cavoukian (2008), safety and security are fundamental components of the TTC's operations and fulfillment of its duty as set out in the *City of Toronto Act*. This criterion was also observed as basis of the deployment of CCTV on

transit properties in York Region[21] and is presumably a standard phenomenon for public transit operators. An operator's liability to transit patrons that become victims of crime, however, is far less straightforward as it is comparatively less discussed. Rudimentary, exploratory research of this topic was conducted in order to develop a marginally better understanding of the topic.

The first step is an evaluation of the powers and immunities granted to the City of Toronto and its public bodies through the *City of Toronto Act* (2006). Section 398(2) of the Act states that the TTC is not immune to being sued and can be sued due to its activities, such as the maintenance, operation, and management of its properties. Ontario's *Occupier's Liability Act* (OLA) was the next consulted document as it is prominent displayed on external vehicle decals as the justification for the usage of CCTV cameras on TTC buses. As noted previous, the existence of the OLA codifies certain aspects such what constitutes occupier, regulated premises, types of entrants, and the duty of care owed to the respective classes of entrants when compared to common law. No specific remarks on liability for personal security were found in the act, although an occupier's duty is ensure that entrants are reasonably safe from the condition of their premises or an activity carried out on it (Occupier's Liability Act, 1990). No further elaboration was found on the topic and it is presumed that the act is more oriented towards liability for personal safety incidents including accidents such as slips and falls.

Only one publication on this topic was found and it placed significant emphasis on context specificity. Various rulings have previously been made on the basis of differing relationships between the agency and victim, responsibility and the nature of the exact failure or omission, as well as the foreseeability of the security incident in question (Waite, 2006). Overall, liability for third party crime involves a significant division of labour between multiple stakeholders and a high degree of context specificity. Erring on the side of caution, it may be prudent for TTC and the City to audit and take preventative measures in areas with documented reoccurring incidents and concerns. Ultimately, however, this issue may be more effectively,

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[21] Based on observations of CCTV related signage in York Region Transit properties such as BRT stations and their connecting pathways.

and responsibly, addressed by a legal scholar or professional, and will also be contingent on the scenario or case at hand.

What Spatial Elements May Affect Security at TTC Surface Stops?

Although the ultimate responsibility for stop elements arguably falls under the City of Toronto, responsibility is actually divided among a variety of both public and private entities that notably include:

- Astral Media (advertising company);
- The City of Toronto: Transportation Services Division;
- Toronto Hydro Energy Services (Toronto Hydro); and
- The Toronto Transit Commission (TTC).

Further elaboration on these arrangements will be provided during individual analysis of each of the security relevant surface stop elements. One point that will be noted now to avoid repetition is the relationship between Astral Media and the City of Toronto. These parties have entered into a 20 year contract whereby Astral purchases, installs, and maintains street furniture elements, and also provides a series of monetary and other benefits[22] for the duration of their contract in exchange for advertising rights (City of Toronto, 2015). This style of agreement has historically been used in Toronto (TTC, 2001B) and is also used in other municipalities both in Canada and elsewhere in North America (York Region Transit, 2009).

[22] These benefits include designated payments, a designated amount of free advertising space, and funding for community programs.

Stop Lighting

Ambient street lighting. Stop lighting can be divided into two components, ambient light levels associated with streetlights and light levels associated with shelter specific lighting fixtures. Ambient street lighting, as in other jurisdictions, is primarily intended to facilitate the visibility and safety of road users (City of Toronto, n.d.A). Toronto Hydro Energy Services Inc. (Toronto Hydro) has owned and operated Toronto's street and expressway lighting ever since it entered into purchase and service agreements with the City in December 2005 (City of Toronto, 2009). Toronto's streetlights include a variety of wattage and light distribution patterns (Toronto Hydro, 2016)[23], which are optimized on the basis of road type, pole location and predominant surrounding land use (Toronto Hydro, n.d.). Variations also exist with regards to mounting height and fixture style. Although no direct allusions were found, Toronto's streetlights appear to be primarily focussed on providing oblong illumination patterns that are focussed on their respective right of way as well as a small portion of their immediate vicinity (Saskpower, 2017). Further information regarding streetlighting standards could not be found and may not be publicly accessible or in publicly digestible formats.

Although critiquing of technical lighting standards falls outside of the scope of this paper, some brief commentary will be given to the ramifications of streetlighting standards. While reasonably limiting light intrusion on adjacent properties, streetlights may not be as effective for sidewalks that are heavily buffered from streetlights and even less effective on public and private areas beyond them. Additionally there may be discrepancies between light levels that are conducive to road safety versus personal security.

[23] Toronto follows the Illuminating Engineering Society's (IES) standards for wattage and light distribution patterns.

Shelter specific lighting. Transit shelters in Toronto may also include lighting elements that are intended to supplement ambient street light levels and to provide interior illumination. Dedicated shelter mounted lights and illuminated shelter advertisement panels were both considered to be forms of shelter specific lighting. Three different patterns of shelter lights, and two different types of shelter advertisement technology are currently employed in Toronto's transit shelters. The two organizations that play key roles in the deployment of shelter specific lighting are Toronto Hydro Energy Services and Astral Media via the coordinated street furniture program (CSFP).

Toronto Hydro's involvement in shelter lighting stems from its responsibility for managing electricity distribution in the city, including the supply of electricity to hard-wired lighting fixtures and advertisement panels (City of Toronto, 2013). Toronto Hydro's current importance is somewhat unclear, and possibly decreased, following its refusal to provide electrical connections to its street lighting system (City of Toronto, 2013). No resolutions to this impasse were found in future status updates, although hardwired fixtures, particularly ad panels, continue to exist and this suggests that some form of resolution may have been reached. That being said, the introduction of solar panels on shelters also suggests that at least some efforts are being made to compensate for difficulty in obtaining hardwired electricity.

The design, installation, and maintenance of shelter lighting, similarly to all CSFP elements, are the responsibility of Astral Media up until the expiration date of its 20-year contract. Possibly in response to the aforementioned problems with securing hardwired electricity, Astral appears to have transitioned from hardwired dual-light shelter lights to two different patterns of solar powered shelter light fixtures. The City has stated that all non-canopy shelters are to be provided with illumination (City of Toronto, 2013), although the existence of fixture-free shelters imply that this policy may not actually be in effect or is a goal for the final years of the CSFP.

Shelter advertisement panels were also considered to serve as lighting fixtures as a means of offering the CSFP the benefit of the doubt. Although it may be an unintentional circumstance, three different types of advertisements were encountered: conventionally lit hard-copy advertisements (Figure 4), as of yet unlit hard-copy advertisements, and static copy digital

advertisement panels. Digital advertisement panels are the rarest of the patterns and have only seen limited deployment due to their increased regulations, relative newness, (City of Toronto, 2013; City of Toronto, 2014) and presumably higher capital and operational costs. Advertisement panels are generally powered via hardwired electrical connections (City of Toronto, 2013), although a select number of conventional advertisements are inexplicably in shelters equipped with solar panels but lacking lighting fixtures.

Figure 4. An illuminated hard copy shelter advertisement panel

Wayfinding

Wayfinding measures assist individuals in navigating the public transit system and public streets in a relatively confident, expedient, and accurate manner. Similarly to other transit systems, the TTC uses a mixture of both hard and electronic based wayfinding measures for its patrons. Hard measures utilized by the TTC at transit stops include stop markers, shelter maps, and public notices. Electronic measures have increasingly been deployed by the TTC and include direct measures such real-time next vehicle information screens in shelters and indirect measures such as notices advertising SMS and data accessible next vehicle predictions and tracking.

Stop markers. Stop markers are the essential element of all surface transit stops in Toronto and are installed and maintained by the TTC[24]. Two main types of stop markers are currently being used by the TTC. The first consists of legacy markers that indicate the stop's mode of service (bus or streetcar), whether the stop receives overnight service, and whether the stop is accessible. Certain legacy models also include the number of the route(s) serving the stop, along with advertisements of trip planning services and the TTC's request stop program (Figure 5a). The TTC's belief in these stop marker information advertisements appears to have diminished and motivated redesigns on the grounds that legacy markers "give useless information" (Kalinowski, 2012). The TTC appears to have attempted to rectify this perceived problem via an incremental update using decals that indicate routes that serve the stop in question, and a phone textable stop number that for next vehicle arrival times (Figure 5b). These updated markers are relatively uncommon and will be considered to simply be a limited-deployment interim design. Contemporary-style stop markers are a fairly substantial shift from pervious legacy models (Figure 5c). These markers eschew route mode[25] and general service detail advertisements in favour of a standardized template of stop specific service information. This information includes the routes serving the stop in question, a more explicit explanation of overnight service, and phone textable information for next vehicle arrival times.

[24] Based on the TTC's stop marker modernization program.

[25] Route mode is technically signified through a route's number, with streetcar lines having 3 digit route numbers starting with a 5 such as 501.

Figure 5a, b, c. Three styles of stop markers, in order of age, are currently used by the TTC. The newest stop marker (7c) includes the stop's respective routes and textable next-vehicle information as standard features.

A portion of the stop markers on the TTC surface system are also accompanied by an information placard holder (Figure 6). These holders historically contained service information for their respective routes, such as a map and schedules, as well as general information regarding the request stop program and TTC contact information. The TTC has largely completed a modernization program that replaces these placards with standardized models list contact information for the TTC as well as third-party trip planning applications. As noted by Spurr (2016) this change directs passengers to service information sources that are both easier and cheaper to maintain with frequent service changes, but is contingent on individuals possessing cellular texting or data. That being said, this problem may be somewhat isolated as cell ownership appears to continuing to grow, with up to 92% of Canadian households owning cellular phones (Statistics Canada, 2017). A small, and somewhat ironic, additional consequence of this change is its deviation from the oft-recommend security PSA of avoiding the use and display of valuables such as cell phones (Poyner, 1983; TTC, n.d.D).

Figure 6a, b. Stop marker placards are installed at a number of TTC stops and have transitioned from providing routing and scheduling information (6a) to directing passengers to first and third-party trip planning services (6b).

Shelter maps. Shelter maps offer less-stop specific but wider ranging service information of the TTC system and consist of large format printouts of the TTC's system map (Figure 7). These maps include information on the routing and service levels of TTC routes within Toronto, interregional transit hubs, commuter rail routes, and points of interest/landmarks within or adjacent to the city's borders (Figure 7). Shelters maps may be intended to be a standard feature of transit shelters as they are included in the cross-sectional diagrams of all shelter types in the City's (n.d.B) manual of comprehensive street furniture program elements. A transition towards stop specific shelter maps that provide information on the shelter's respective route, connecting routes, and the local street grid were trialled in 2013 (TTC, 2013) but were ultimately not implemented. Shelter maps have arguably become more important for trip planning following the aforementioned discontinuation of route information placards (Pelley, 2016). Although the maps are created and published by the TTC[26], Astral Media is responsible for their maintenance, and the maintenance of their displays[27].

Figure 7. Transit shelter maps provide an overview of the TTC's ystem.

[26] Based on copyright information and changes made and trialled by the TTC.

[27] Based off of prior knowledge from communications with TTC staff.

Next vehicle information system screens. Next vehicle information system screens (NVISS), provide real-time information on the routes serving the transit stop in question (Figure 8). This includes information on routes and route branches that are in service and real-time information on their next vehicle. Additionally, these screens also intermittently provide the telephone number for the TTC's information phone line. NVISS are the responsibility of the TTC, but are contingent on the installation of a transit shelter through the CSFP and an available hard-wired electrical supply.

Figure 8. An image of a next vehicle information system screen installed in a bus shelter. Note that only a portion of the screen's orange text is visible due to the technical limitations of the photographing camera.

Methods

Subjects of Analysis

The primary-research portion of the paper evaluates the design of surface transit stops with respect to their strengths, shortcomings, and effectiveness relative to documented concerns and policies. This was accomplished via stop audits that were partially inspired by the stop audits previously conducted by METRAC (1992; SWAN and METRAC, 1991), but designed to collect more detailed information. Three main aspects were covered by the audit: ambient street lighting levels at stops; stop assets and their state of repair; and finally the interface between stops and their surroundings. Interviews with representatives of advocacy groups, such as METRAC, and city staff were initially also planned but these were eschewed due to a lack of interest from any of the parties.

Ambient street lighting levels at stops. Lighting evaluations were conducted for both streetlight-based ambient lighting and shelter specific lighting fixtures. These evaluations were qualitative in nature due to a lack of access and unfamiliarity with lumen meters. A preparatory set of observations were undertaken in order to familiarize myself with sufficient lighting levels. The starting point for these observations was an evaluation of the feasibility of the 15-20 metres facial visibility, or Canadian Standards Association .4 foot candles value, advocated for by a previously reviewed municipal document (City Planning and Wekerle, 1992). In the absence of a volunteer, a printout of Toronto Mayor John Tory's face on a standard piece of A4 paper was the benchmark for testing facial visibility. The first finding of this preparatory exercise was that visibility from 15m for open-air areas may be possible, but visibility from 10m appears to be a more realistic expectation as it also accounts for facial visibility of individuals occupying transit shelters. This exercise also provided qualitative benchmarks for sufficient, passable, and insufficient ambient street lighting levels in the absence of a waiting transit patron. The distribution of these qualitative ambient light levels in a streetlight's footprint were roughly measured at another streetlight and were assigned basic range bands up to the threshold of sufficient lighting, which was identified as being over 25 metres. This range band was later utilized during the data verification stage in order to gauge the accuracy of recorded stop lighting ratings relative to their actual distance to their nearest streetlights.

It was impossible to determine the actual IES Light Distribution pattern and wattage of the streetlights illuminating the stops that were evaluated. That being said, the two patterns that are used in Toronto (Toronto Hydro, n.d.) share an elliptical light footprint that is wider to areas left and right of a light when compared to areas in front and behind of a light (Saskpower, 2017).

Stop assets and state of repair. The stop audit also accounted for the various dedicated lighting and wayfinding stop elements that were identified in the previous section and included:

- Dedicated shelter lighting;
- Shelter advertisement panels;
- Stop markers;
- Shelter maps; and
- Next vehicle information system screens.

The stop survey also accounted for the model or type of asset in question (where applicable) as well as their state of repair (with regards to signs of vandalism). Shelter lighting fixtures had their operability recorded where possible due to the differing technologies that are used to activate them. While it was a relatively straightforward process, a small concession had to be made with regards to certain stop assets such as shelter maps, dedicated shelter lighting, and electricity related shelter components. Depending on the facing their shelter, these elements were sometimes obscured and were thus sometimes counted on the basis of mounting hardware and structural components. Conversely, electricity related components were difficult to catalogue on the basis of functionality due to the aforementioned facing issue (NVISS) or due to a lack of patrons (motion sensor dedicated shelter lighting). Additionally, it was impossible to differentiate between malfunctioning illuminated advertisement panels and non-illuminated advertisement panels.

Interface. The interface between surface transit stops and their surroundings was divided into four separate elements in order to compensate for its complexity. These included the surrounding property's land use type, its buffering from its respective stop, its relative facing, and the existence of any barriers between it and said stop. The land use categories that were utilized during observations were based on a combination of the City's zoning and a property's perceived attributes. A condensed list of 10 broad land use categories and 53 distinct subcategories of land use were created in order to simplify the land use designation process (Table 6).

Table 6 Land-use designation table

Residential	
RD	Single-detached/semi-detached
RCC	Single-detached/semi-detached/duplex with commercial use
RM	Duplex/townhouses
RA	Residential apartment
RS	Senior's residence
Commercial	
CG	Gas station
CA	Auto-related uses (dealership/garage)
CO	Office building
CR	Retail operations and eating establishment
CS	Commercial strip/small multi-unit commercial property/strip plaza
CSM	Commercial strip mall
CM	Indoor/ outdoor shopping mall
CP	Professional building
CSN	Casino
CF	Religious building/place of worship
CL	Hotel/motel
CLR	Hotel/motel with ground-floor commercial operations
CPC	Professional building with ground-floor commercial operations
COC	Office building with ground-floor commercial operations
SPEC	Public attraction (Ontario Science Centre)
Mixed residential-commercial use	
MCR	Low-rise mixed commercial residential building
MCRS	Low-rise mixed commercial residential multi-unit property/strip.
RAC	Residential apartment with ground-floor commercial operations
Open areas intended/programmed/easily capable of supporting use	
O	Grassy open area/sections of lots
OP	Public park
OA	Urban farm/allotment garden
UTR	Utility corridor with recreational trails
OG	Golf course
OC	Cemetery
OR	Private recreation facility (basketball and tennis courts)
Industrial	
I	Industrial property in standalone or multi-unit format
IC	Standalone industrial property with commercial functions and areas (sales)
ICS	Multi-unit industrial property with commercial functions and areas (sales)

(continued)

Table 6 (continued)

Vehicular	
PL	Parking lot
PG	Parking garage/structures
ROW	Public/private roadways
HWYA	Highway on-ramp/off-ramp
ROWA	Roadway on-ramp/off-ramp
ROWI	Intersection
Community	
SCH	Elementary/secondary school
SCHY	Elementary/secondary schoolyard
PSCH	Post-secondary institution
COM	Community centre/library/public/ theatre/recreation center
COME	Emergency services facility (fire hall/police stations/ambulance station)
HOSP	Hospital
Public transit	
GO	GO (commuter) rail/bus Station (and their related facilities)
TTE	TTC rapid-transit station entrance
TTC	Inaccessible facing of a TTC bus terminal/rapid transit station
Other	
UB	Utility building (ie: electrical substation)
DVL	Development parcel/construction site
Open areas that are not intended for or comprehensively able to facilitate use	
OH	Man-made stormwater management channel/culvert
ON	Wooded area or area with medium-heavy foliage
ONR	Ravine land
UT	Utility corridor

Distance buffering was based on a combination of estimated distances and perceived characteristics such barriers that would reasonably and impair visual and audio recognition (Table 7).

Table 7 Land-use buffering categorization table

Barrier Class	Acronym	Basis
Adjacent	ADJ	Property is located directly beside public sidewalk
Slightly Buffered	SLB	Property is distanced far enough from public sidewalk to permit line abreast movement of one to five individuals
Buffered	BUFF	Property is more than five abreast individuals from its sidewalk but is still perceived to be within range for audio recognition and facial recognition
Setback	SBK	Property is a significant distance from sidewalk and is perceived to be out of range of audio recognition and all but the most basic levels of visual recognition

Facing was perceived to be relatively straightforward and was determined on the basis of building characteristics. Front facings would possess the primary entrance(s) for a property, back facings would possess servicing areas or be opposite of a front face and side facings would represent all remaining faces and presumably be perpendicular to front faces. As will be discussed later, categorization was somewhat less straightforward and ultimately several changes were made to account for these developments.

Barriers were categorized based on their perceived origin, effects on movement, and effects on sightlines. 10 different classes of barriers were identified and ultimately used during the course of this research (Table 8).

Table 8. Land-use barrier categorization table

Barrier Class	Acronym	Examples
Hard Movement	HM	Low (shin-height) concrete walls Picket fences Metal fences Crash barriers Guardrails/bridge edges
Hard Movement Potential Sight	HMPS	Medium height walls (knee height or greater) Medium height wood slat fences
Hard Potential Movement Sight	HPMS	Parking lots (with cars serving as barriers)
Hard Movement Sight	HMS	High wooden slat fences High walls
Soft Movement	SM	Slopes Low foliage
Soft Potential Movement Sight	SPMS	Medium height foliage (weeds, grasses)
Soft Movement Sight	SMS	Hedges Thick foliage
Combination Movement Potential Sight	CMPS	Light-medium shrubbery/hedges with see-through fences
Combination Potential Movement Sight	CPMS	Light-medium shrubbery and foliage in enclosed planting beds
Combination Movement Sight	CMS	High walls with foliage See-through fences with heavy foliage

The final type of observations that were made were of patrons and any physical observations of the stop in question that could be relevant to perceived and actual personal security. These observations were recorded and categorized during data entry and analysis.

General Aspects

At least two sets of observations, one daytime and one after dark, were made from a TTC bus for each of the routes. Where possible, after dark audits were conducted during periods of good visibility with no-to-low levels of snowfall and from the rearmost, curb side seat in order ensure the greatest possible viewing distance from a stop[28]. Certain observations were also made from other seats on the raised rear area vehicles[29], and in certain cases the first (set) of driver's side seat(s)[30], in order to compensate for crowding, differing interiors associated with different models of vehicles, and dirty windows. These observations had viewing angles through the front windows of the bus in question and had similar viewing distances.

Observations utilized a prepared form (Table 9) that included columns for the subjects of analysis as well as all of the stops for the relevant branches of the respective routes. These stop lists were compiled from the TransSee web application (O'Connor, n.d.) in the interest of expediency and were verified for accuracy through comparisons to route information from the TTC website.

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[28] This provided a stationary viewing distance of approximately 11 metres for conventional buses and 17 metres for articulated vehicles.

[29] The original series/generation of Orion VII buses with 38 seats restricts visibility from the rearmost curb side seat, but this contingency was also enacted for other models on an as needed basis.

[30] For standard length (40ft) and articulated (60ft) Novabus LFS buses with dirty windows or to account for crowding.

Table 9 The layout used for stop audit sheets

	Lighting rating	Shelter location	Shelter type	Shelter lighting	Advertisement panel	Shelter map	Next vehicle information screen	Stop marker information	Interface with surrounding land use (distance)	Surrounding land use/ nearest property	Barriers between street and property?	Other observations	Patron behaviour during data collection
Stop Location and Number													

Data was verified using the after dark verification, additional trips along the route, and satellite and streetview imagery from Google Maps. Google Maps was used due to its relatively lower time costs as well as the significant amount and detail of the information it offered. This imagery was used to verify survey sheet entries, better gauge the interface of adjacent properties, and the previously mentioned distance measurement between stops and their nearest streetlights. This method had a clear limitation in its reliance on secondary data that could be susceptible to accuracy issues through outdated images or other imagery errors but was ultimately used as no reasonable alternatives were available.

Route Selection

A selection process was created in order to account for the fact that it would extremely difficult to survey every single TTC bus operated surface route running in Toronto's inner suburbs within the constraints of the MES program. A basic set of rules was used to select routes and is listed in order of relative importance:

- Avoiding routes that operate along borders or areas where other municipalities are responsible for stops or adjacent land uses;
- Not choosing express routes;
- Prioritizing routes that have overnight (blue night) service on at least a portion of their route;
- Not choosing the Eglinton East or Eglinton West bus routes on the basis of their upcoming (partial) replacement by Light Rail Transit;
- Ensuring that the chosen routes are geographically distributed, and spaced, among Toronto's inner suburbs;
- Choosing routes that have been documented as experiencing significant amounts of criminal and other by-law offences;
- Choosing routes that provide a cross-section of the City's land uses, as well as major trip generators/attractions;
- Ensuring that chosen routes are distributed between low-ridership and high-ridership routes;
- Preferring routes where the majority of the route serves areas outside the "old" City of Toronto; and
- Preferring routes that serve or are located in the vicinity of Neighbourhood Improvement Areas.

15 routes were subsequently chosen through a combination of the above criteria and discretion (Table 10) (Figure 9). Criteria that require further explanation, and selected routes that may not fully conform to them, will follow.

Table 10 The routes and route branches that were selected for study.

#	Route Number and Branch Letter	Route Name	Origin (Rapid Transit Station)	Terminus and Routing for Branches
1.	36	Finch West	Finch	Humberwood Loop
2.	52A	Lawrence West	Lawrence	Pearson Airport Terminal 3
3.	54A	Lawrence East	Eglinton	Starspray Loop
4.	35A	Jane	Jane	Pioneer Village Station
	35B			Pioneer Village Station via Hullmar Rd.
5.	25	Don Mills	Pape	Freshmeadow Rd. at Don Mills
6.	39A	Finch East	Finch	Neilson Rd./Baldoon
	39B			Old Finch Rd. and Morningview Ave.
7.	37A	Islington	Islington	**Humberwood Loop** via Bergamont Ave., Rexdale Ave, Queen's Plate Dr, Woodbine Racetrake, Humberwood Blvd.
	37B			Islington Loop (Steeles Avenue West)
8.	129B	McCowan North	Scarborough Centre	Steeles Avenue East
9.	86A	Scarborough	Kennedy	Toronto Zoo Loop
	86C			Meadowvale Loop (Sheppard Avenue East)
10.	16	McCowan	Warden	Scarborough Centre Station
11.	110C	Islington South	Islington	Lakeshore Boulevard West
12.	112C	West Mall	Kipling	Carlingview Road at Disco Road
13.	113	Danforth Rd.	Main Street	Kennedy Station
14.	97C	Yonge	Lawrence	Yonge Street at Steeles Avenue
15.	15	Evans	Royal York	Sherway Gardens Bus Terminal

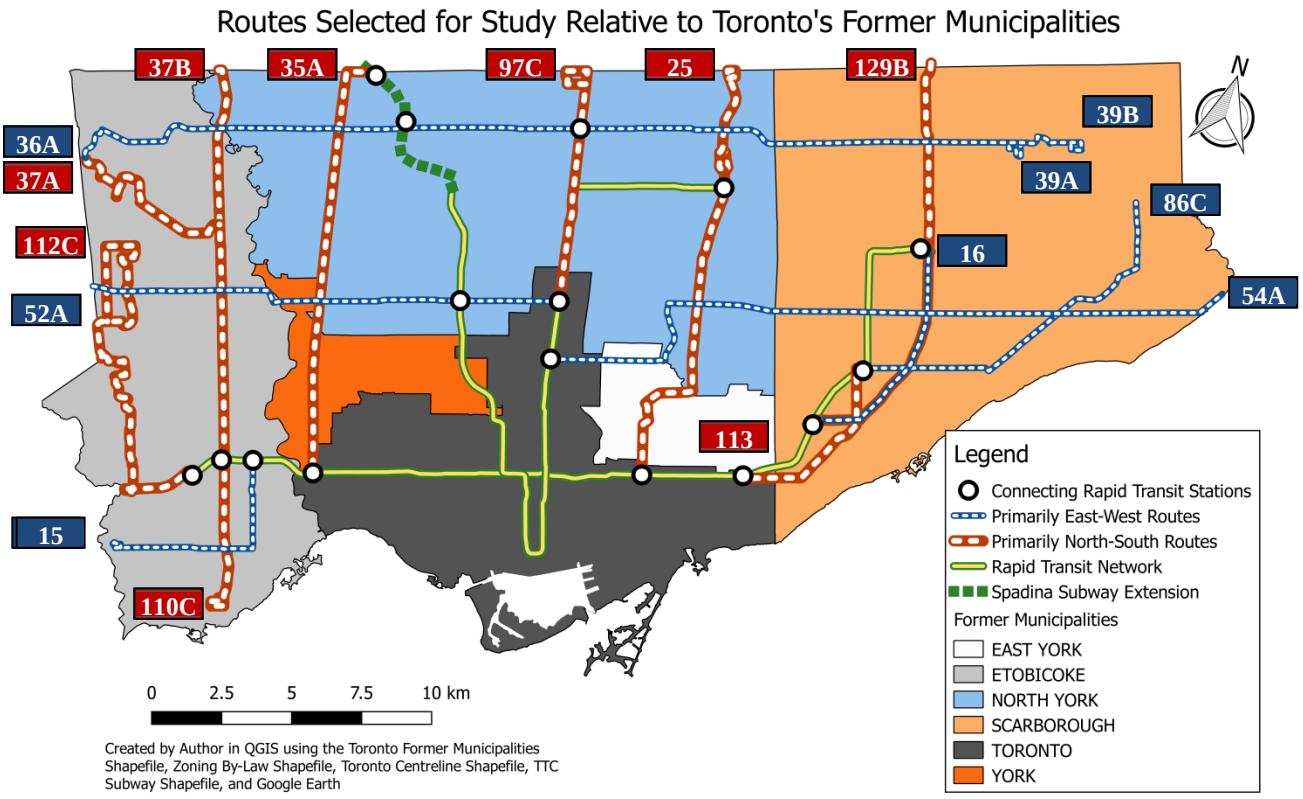

Figure 9. The routes that were selected for the study relative to the boundaries of Toronto's former municipalities.

Avoiding routes that operate along or outside of municipal borders. This criterion was designed to mitigate the inclusion of stops and adjacent areas that are outside the jurisdiction of the City of Toronto and its respective partners. This rule also disqualified of secondary route branches that operate outside of Toronto, routes that primarily operate along Toronto's borders, as well as the exclusion of bus stops on or outside of municipal borders. That being said, a comparative analysis between the planning of bus stops and their amenities between municipalities of the Greater Toronto Area could be a topic of further research.

This rule disqualified bus routes operating on Steeles Avenue, the city's northernmost east-west arterial road, which serves as its municipal border with the neighbouring municipality of York Region. As will be discussed in the route spacing discussion, this, along with the Eglinton exclusion, had significant effects on the spacing of the chosen east-west routes. The

exclusion of route branches that operate outside the city was fairly straightforward with the exception of the 52 Lawrence West, that has a main branch terminus in the adjacent city of Mississauga. In this instance, and other instances, where routes had a small number of stops along or outside of municipal borders, the offending stops were excluded from inclusion and analysis.

Not choosing express routes. Notwithstanding their significance for public transit riders and the surface transit network, express routes were not included due to their service characteristics. The first of these is the fact that express routes only serve a limited number of stops that are highly trafficked by transit users, along major thoroughfares, or are in vicinity of major activity generators. Compared to local routes, express routes can be described as providing service to a smaller proportion of the city and its population through their omission of local stops that are less-trafficked or in lower activity areas of the city. All of these characteristics presumably make these stops preferred sites for investment in stop elements and amenities due to their ridership and their visibility in the case of on-street advertising. Another potential shortcoming associated with these routes is the fact that they are generally in operation for fewer service periods of the day, if not peak-period exclusive, compared to their local counterparts. There were no notable issues with the enforcement of this criterion.

Preferring routes that also have overnight service on at least a portion of their route. This criterion was added due to the fact that after-dark periods of the day have consistently been associated with increased feelings of insecurity. The TTC provides overnight service[31] through its "Blue Night network", which is a simplified transit network operated exclusively using surface vehicles (Figure 10). Compared to its daytime network, the Blue Night network has a somewhat looser access standard, being structured so that 95% of the city's population and employment is within a 1,250 (15 minute walk) as opposed to the daytime standard of 90% within a 400m (5 minute) walk (TTC, 2017C). This simplification and service standard also mean that routing in certain areas differs from the daytime network. Additionally, the Blue Night network has significantly less frequent service, with virtually all routes save for those replicating the Yonge portion of Line 1 and Line 2 BD having 30 minute service possibly due to their relatively low ridership[32]. Overall, the Blue Night network merits attention due to its after-dark nature, reduced number of routes and stops, lower coverage, and generally reduced service frequency.

[31] With trips starting after 02:00 and last trips generally departing between 06:00 and 07:00.

[32] As with other "chicken or the egg" transit planning issues, whether this is representative of lower overnight commuting/travel or overnight transit being less competitive and thus having a lower modal share is debatable.

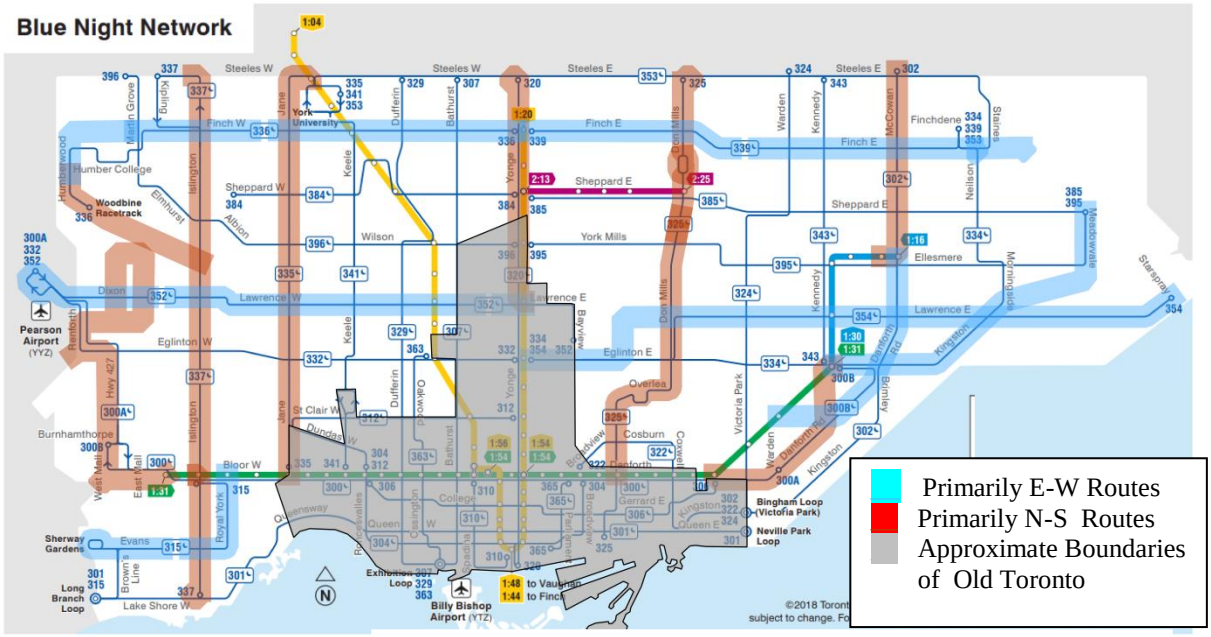

Image created by author in QGIS using the February 2018 Toronto Transit Commission Blue Night Network Map

Figure 10. The routes that were elected for study relative to Toronto's overnight bus network.

The Blue Night Network was a particularly problematic aspect that ultimately required concessions. At its most basic level, a dedicated survey of the network was questionably feasible due to the amount of time that would be required to reach and travel on routes selected for study and the limited duration of the service period. Additionally, the timing of this service period presented compatibility issues with other academic and non-academic commitments. Finally, certain stops, particularly Bloor Street, do not have daytime service and would be comparatively more difficult to survey during the daytime. As such, it was decided that preference would be given to routes, and areas, that receive overnight service and could be evaluated during after-dark hours. Certain routes and branches were included due to routing discrepancies between the TTC's daytime and overnight transit systems. Finally, and as previously mentioned, it should be noted that the blue night network has comparative lower ridership than most daytime routes (Table 11) (City of Toronto, 2016).

Table 11. Routing and ridership information for the TTC's overnight bus routes

#	Surface Route Ranking	Route Number	Route Name	Equivalent Daytime Route(s)	Typical Business Day Ridership (2016)*
1.	131	300	West Mall	112, 113	1,577
2.	138	320	Yonge	97	1,285
3.	152	336	Finch West	36	338
4.	157	335	Jane	35	233
5.	159	325	Don Mills	25	222
6.	160	334	Eglinton East	86	215
7.	161	337	Islington	37, 110	205
9.	163	354	Lawrence East	54	196
10.	168	302	McCowan	16, 129	125
11.	169	339	Finch East	39	122
12.	173	352	Lawrence West	52	79
N/A	N/A	315	Evans	15	New Route

***City of Toronto, 2016B**

Ensuring that the final list of routes is as evenly spread out as possible (at least one arterial road of spacing) and covers both fringe and core areas. This criterion was included to compensate for the unfeasibility of carrying out a comprehensive survey of every single daytime and blue night route within Toronto's inner suburbs. As such, selected routes would preferably be geographically spaced out from one another by a distance of at least one arterial road where possible. A second priority was to include routes that reached or ran along the furthest stretches of Toronto's inner suburbs[33] without encroaching on municipal borders.

Two issues were encountered with regards to the even distribution of the routes selected for surveying. Convoluted routes, such as the 16 and 86, that operate north-south as well as east-west both broke this rule but were included as they satisfied other requirements. The minimum spacing rule inadvertently also created larger than normal gaps between the selected routes, specifically between routes running on Finch Avenue and Lawrence Avenue. A maximum

[33] The "gap" in the north eastern portion of Toronto, and Scarborough by extension, is due to the Rouge River National Park.

spacing of one arterial road could have been beneficial to avoid similar situations if this study was revisited or further research was carried out.

Choosing routes that have been documented as experiencing significant amounts of criminal and other by-law offences. Targeting routes with the greatest incidence of crime and disorder was deemed to be an effective and efficient way of understanding and addressing insecurity on surface transit. Route-based incidence data, however, does not appear to be open data and may only be accessible through a Municipal Freedom of Information request. The only readily available publicly accessible source of data was a slightly dated local newspaper article, which only provided aggregate statistics (Robinson and Davis, 2016). This data is summarized in

Table 12 and Table 13.

The routes with the highest total number of criminal and by-law offences were given preference on the grounds that they could be the most efficient target for resources and preventative strategies. Three of the identified five routes 35; 36; and 52, were ultimately chosen following the application of other route selection rules. Routes with the highest rate of offences on a passenger basis proved to be more problematic as many of them appeared to only gain their status due to their extremely low ridership. Although this issue also applies to the 300-series blue night routes on this list, they also warrant further attention based on their overnight nature and crime as well as fear of crime. The daytime equivalents of the 300, 320, 352, 354 were subsequently chosen on these grounds. Rates with high numbers of offences in tandem with high rates of offences such as routes 35 and 36 were also further prioritized due to their reappearance on this list.

Table 12 Criminal and by-law offence data for TTC bus routes (Robinson and Davis, 2016)

Routes with the highest total number of criminal and by-law offences				
Rank	Route	Number of Offences	Most Frequent Offence	Other Offences
1	36 Finch West	322	Fraud	12 assaults of patron 36 Assaults on operator
2	35 Jane	260	Fraud	20 assaults of patron 36 Assaults on operator
3	32 Eglinton West	164	Operator Assault	Not listed
4	41 Keele	161	Fraud	Not listed
5	52 Lawrence West	123	Fraud	Not listed

Table 13 Criminal and by-law offence data on a per rider basis for TTC bus routes (Robinson and Davis, 2016)

Routes with the highest number of criminal and by-law offences on a per rider basis					
Rank	Route	Number of Offences	Offences Per 10,000 Riders (2014 Ridership)	Most Frequent Offence	Number of Assaults on a Patron or Operator
1	354 Lawrence East	9	92	Not listed	1 Assault on patron 1 Assault on operator
2	316 Ossington	5	79	Not listed	2 Assaults of an operator
3	307 Eglinton West	8	74	Not listed	1 Assault on patron 0 Assaults of an operator
4	352 Lawrence West	2	63	Not listed	Not listed
5	320 Yonge	54	52	Fraud	7 Assaults on patron 13 Assaults on operator
6	171 Mt. Dennis	1	44	Not listed	1 Assault on patron
7	161 Rogers Road	60	41	Fraud	23 Assaults on operator
8	35 Jane	260	40	Fraud	36 Assaults on operator 20 Assaults of a patron
9	139 Finch-Don Mills	8	40	Not listed	3 Assaults on patron
10	329 Dufferin	5	40	Not listed	1 Assault on patron 1 Assault of an operator
11	145 Downtown/ Humber Bay	1	40	Not listed	Not listed
12	300 Bloor-Danforth	31	37	Not listed	5 Assaults on patron 5 Assaults of an operator
13	319 Wilson	3	35	Not listed	1 Assault of an operator
14	36 Finch West	322	36	Fraud	12 Assaults on patron 36 Assaults of an operator
15	89 Weston	115	34	Operator Assault	5 Assaults on patron 19 Assaults on operator

One potential shortcoming of this criterion is the fact that its data is both relatively incomplete as well as dated. Additionally, many offences, specifically fraud in the context of altered and counterfeit fares, may only be viewed as being signs of disorder at best by passengers when compared to more violent or passenger specific crimes such as passenger assaults.

Choosing routes that provide a cross-section of the city's land uses, as well as major trip generators/attractions. Toronto's land uses were also factored into route selection process due to their likely influence on ridership and their interactions with adjacent stops. Considering the urban structure of Toronto's inner suburbs, emphasis was placed on including routes that serve large employment, mixed-use, commercial, and residential apartment areas, all of which could be considered to be activity generators. Additionally, some prioritization was given to routes that serve major destinations such as Woodbine Racetrack/Casino Woodbine; the Toronto Zoo; the Toronto Science Centre; and Toronto Pearson International Airport (located in the neighbouring municipality of Mississauga). Post-secondary facilities were not explicitly chosen as an unaffiliated major postsecondary student focussed research project (Student Move TO) was in progress at the time of research and writing.

No significant limitations were associated to the inclusion of varied land uses. Finer detailed, rudimentary, non-scale transects of the land uses surrounding the selected routes were created to compensate for the large scale of Figure 11, and are included in Appendix C: Land Uses in the Vicinity of the Selected Bus Routes.

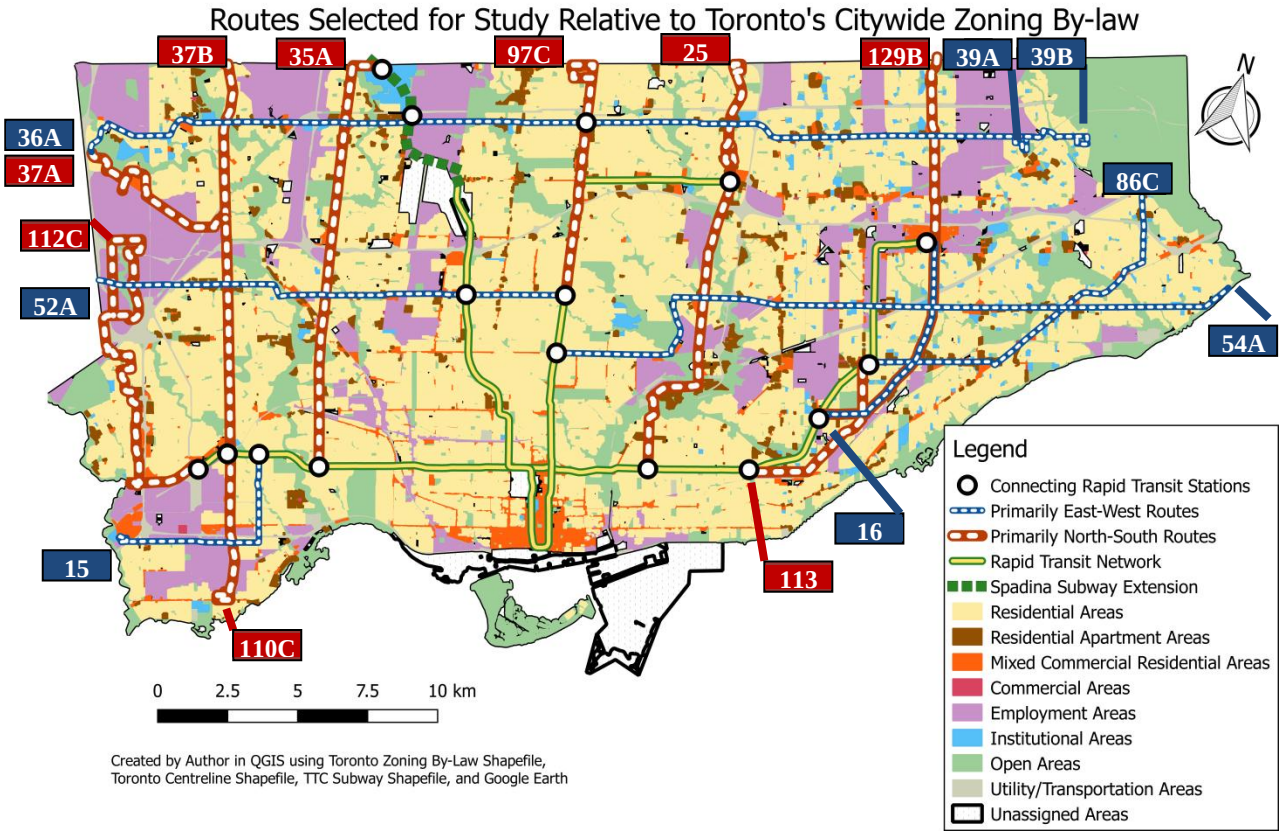

Figure 11. The bus routes selected for study relative to Toronto's land-use zoning.

Ensuring that chosen routes are distributed between low-ridership and high-ridership routes. The final criterion was chosen to gauge whether my research was overly focussed on routes of a specific level ridership; as there were merits to including routes at both ends of the ridership spectrum. Lower ridership routes may be presumed to be in lower density and traffic areas with limited varieties of human-oriented land uses and may have comparatively less service and thus longer waiting times to match. Taken together, these points of isolation and limited activity, and extended periods of waiting in public spaces are potential causes of concern from a security perspective. Conversely, high ridership routes may also be a financially efficient target for improvements due to the sheer number of riders that could benefit or be brought into problematic interactions with one another. Some effort was made to ensure that the selected routes were somewhat distributed among high and lower ridership routes (Table 14).

Table 14. Selected routes relative to their typical weekday ridership

	Surface Route Ranking	Route #	Route Name	Typical Business Day Ridership*	Area(s) Served
1.	3	36	Finch West	43,952	North York, Etobicoke
2.	4	52	Lawrence West	43,882	Old Toronto, North York, Etobicoke
3.	10	54	Lawrence East	36,277	Old Toronto, East York, Scarborough
4.	11	35	Jane	32,479	Old Toronto, York, North York
5.	21	25	Don Mills	39,066	Old Toronto, East York, North York
6.	25	39	Finch East	23,745	North York, Scarborough
7.	33	37	Islington	17,087	Etobicoke
8.	39	129	McCowan North	14,787	Scarborough
9.	40	86	Scarborough	13,717	Scarborough
10.	46	16	McCowan	11,279	Scarborough
11.	58	110	Islington South	9,168	Etobicoke
12.	67	112	West Mall	7,297	Etobicoke
13.	86	113	Danforth Rd.	5,272	Old Toronto, Scarborough
14.	96	97	Yonge	4,175	Old Toronto, North York
15.	114	15	Evans	2,810	Etobicoke

***City of Toronto, 2016B**

The low priority of this rationale was due to the difficulty in consistently balancing routes, specifically east west routes. Virtually all of the city's east-west routes, especially those with overnight service, are within the highest ridership routes in the city. Lower ridership routes also appear to be provided with overnight service less frequently, presumably for the purposes of efficient resource allocation.

Results and Analysis

Initial Findings

1,324 bus stops within the city of Toronto's borders were surveyed during the course of this research. Of these, 1,294 were identified as actually being unique, street-side, or street-related, stops that were eligible for inclusion in my research and further analysis (Table 15).

Table 15 The types and number of stops for the selected routes

Route	Actual Number of Stops Within Toronto	TO Road - side Stops	TO Loop	Station	TO Special	Stops Shared By A Preceding Route (Non-Unique Stops)	Total Number of Unique, Non-Station Stops (Total Number of Stops)
15	69	68	0	1	0	0	68
36	125	121	1	3	0	0	122
37	139	136	1*	1	2	1 Loop	137
52	114	111	0	3	0	0	111
110	41	40*	0	1	0	1 Road	39
25	109	106	0	3	0	0	106
35	109	107	0	2	0	0	107
97	67	65	0	2	0	0	65
16	67	65	0	2	0	0	65
39	119	118	0	1	0	0	118
54	171	166	1	3	1	0	168
86	91	89	1	1	0	0	90
113	57	55	0	2	0	0	55
129	45	44*	0	1	0	1 Road	43
Totals	1324	1291	3	26	3	3	1294

* Indicates that one stop is shared with a preceding route in the list

Shelters

Stops with shelters. Fewer than 71% (916 of 1294) of the surveyed stops were provisioned with their own transit shelter and 17 of these shelters were non-standard or slated to be replaced in the coming future. Of these, one longer-than average CSFP style shelter and thirteen to-be-replaced legacy shelters were included for analysis. The seeming existence of two private shelters, respectively at a casino and a commuter rail station, was surprising but was explainable in hindsight as they were identified as were both located along private roads and on private property. The final deviating shelter was a large, fully enclosed high-order shelter (86 WB) associated with the TTC's Access Hub project for transfers between the conventional and paratransit network (TTC, 2018B). These latter three shelters were excluded from the calculations made in this section and will be discussed where appropriate. Total results are listed in Table 16.

Table 16 Shelter information for the selected routes

Route	Shelters												Yes	No
	Basic	Res.	Narr.	Mini	Half	Wide	Half (B)	Wide (B)	OFL	OBL	Spec	Priv-ate		
15	12	20	0	0	1	0	3	2	0	0	0	0	38	30
36	22	77	0	0	0	1	1	1	0	2	0	0	104	18
37	43	31*	2	0	1	2	0	0	0	0	0	1^	80	57
52	41	15	8	1	3	5	0	0	1	0	1	0	75	36
110	3*	9	0	0	4	3	0	0	1	0	0	0	20	19
25	29	38	2	0	1	3	1	2	0	0	0	0	76	30
35	30	40	0	0	2	2	0	0	0	1	0	0	75	32
97	25	2	1	0	0	2	0	2	0	1	0	0	33	32
16	12	32	0	0	3	1	0	0	0	0	0	0	48	17
39	50	37	1	0	2	1	1	0	0	0	0	0	92	26
54	53	66	2	1	0	1	0	0	1	3	0	1	128	40
86	23	43	1	0	0	1	0	0	0	1	1	0	70	20
113	14	15	3	1	2	0	0	0	0	1	0	0	36	19
129	31	9	0	0	0*	0	0	0	0	1	0	0	41	2
Total	388	434	20	3	19	22	6	7	3	10	2	2	916	378

* Indicates that one stop has been omitted as it is shared with a preceding route in the list
^ Indicates that one stop has been omitted as it is shared with two of the route's stops

Only two observations were made concerning general shelter characteristics. Contemporary models of transit shelters have consistently minimized non-advertisement visual barriers (Figure 12a, b) that were previously cited as being concerns (SWAN and METRAC, 1991). These shelters also appeared to offer higher interior lighting levels than older legacy models possibly due to their use of less opaque roofing materials.

Figure 12a, b. Contemporary CSFP transit shelters (12b) have notably done away with the potentially problematic opaque skirting (SWAN and METRAC, 1991) found on previous designs such as the over 50-year old Ancaster model (12a.).

Transit shelters were noted to be the most consistently vandalized TTC surface stop element and were subject to graffiti, scratchitti, and postering. As vandal resistant materials and surface treatments are presumably already applied to these elements, these issues may be more attributable to maintenance policy rather than design.

Advertisements. Advertisements were the most prolific shelter element encountered during surveying. Just under 65% of all transit shelters had advertisement panels, with all but one route having an advertisement rate at or above 50% (Table 17). This finding was not altogether unexpected considering the fact that these elements are vital to the sustainment and viability of the CSFP, and other Astral supported city programs.

Table 17. Shelter advertisement installation information

Route		Left	Back	Back Towards Street (Front)	Yes	None	N/A
15	68	20	0	2	22	16	30
36	122	65	1	1	67	37	18
37	137	54	2	0	56	23*	58
52	111	62	5	0	67	8	36
110	39	5*	3	0	8	12	19
25	106	57	3	2	62	14	30
35	107	45	2	0	47	28	32
97	65	26	0	3	29	3	33
16	65	23	1	0	24	24	17
39	118	50	1	1	52	40	26
54	168	86	1	0	87	40	41
86	90	36	1	0	37	33	20
113	55	24	0	0	24	12	19
129	43	22	0	0	22	19*	2
	1294	575	20	9	604	309	381

* Indicates that one stop has been omitted as it is shared with a preceding route in the list

Two potential problems were noted with regards to contemporary shelter advertisements. The first of these concerns the placement of certain types of shelters equipped with advertisements due to their ability to visual obscure important sections of bus stops. Non-canopy shelters with advertisements should ideally not be sited in locations that are in between a street's sidewalk and vehicle travel area and are in the immediate vicinity of stop markers (Figure 13a). Additionally, canopy style shelters with advertisements should not back onto roadways (Figure 13b) as they appeared to have greater than normal negative effects on pedestrian and transit patron visibility. An additional problem was noted in narrow model shelters as their advertisement panel mounts were larger than normal and had a far greater impediment on the sightlines of individuals waiting in their vicinity (Figure 14a,b).

Figure 13a, b. Shelter advertisements continue serve as visual obstructions for waiting transit patrons and pedestrians, especially when placed in close proximity to stop markers (13a) and parallel back facings to streets (13b).

Figure 14a, b. Narrow transit shelters (14a) had notably obtrusive advertisement panels when compared to all other contemporary shelters (14b).

Ambient Street Lighting

Lighting evaluations were divided into ambient levels around stop markers and shelter-specific levels as these two stop elements were not necessarily adjacent to one another. Furthermore, even transit shelters comprised of translucent materials were noted as reducing the amount of light travelling into their interior and potentially having higher requirements for lighting. Ambient street lighting of transit stop markers was largely sufficient (Table 18), with roughly 98% (1272) of stops having ambient light levels that were sufficiently high to identify a streetside person's face from 15m. Additionally, these stop marker areas did not appear to be overlit compared to their surrounding streetscapes. Of the stops that were not guaranteed to provide visibility of an individual's face from 15m, approximately 2% (20) were deemed to passable as they bordered on providing sufficient ambient lighting, while less than 0.2% (2) were unsatisfactory. These results were unsurprising considering the amount of emphasis paid towards after-dark lighting levels by both general literature and Toronto-specific texts.

Table 18 Perceived ambient lighting levels of the selected routes

Route	Total Number of Stops	Perceived Lighting Rating		
		Fair	Passable	Dim
15	68	68	0	0
36	122	118	4	0
37	137	134*	3	0
52	111	110	1	0
110	39	38*	1	0
25	106	106	0	0
35	107	104	2	1
97	65	65	0	0
16	65	65	0	0
39	118	114	4	0
54	168	168	0	0
86	90	89	0	1
113	55	54	1	0
129	43	39	4*	0
Total	1294	1272	20	2

* Indicates that one stop is excluded as it is shared with a preceding route in the list

Passable and unsatisfactory stops could be improved via the installation of streetlights within 25m of their stop markers (Appendix D: Rectifiable Potentially Problematic Stops). Six passable stops and one unsatisfactory stop are good candidates for streetlight installation as they are already within 25m of an existing utility pole of suitable height. Additionally, five passable stops are in close proximity of an existing pole of unsuitable height or perceived carrying capacity, that could replaced with a streetlight compatible pole. Four stops were not in sufficient proximity of existing streetlights or poles and would likely be best improved via the erection of streetlights. Finally, five stops were in locations that could be improved via either the erection of a streetlight or even their relocation to the immediate vicinity of an existing streetlight. That being said, all of these final stops already have sunk costs such as bus bays or bus shelters, which could serve as barriers to relocation.

Limitations associated with ambient lighting observations consisted of foreseen universal problems and unforeseen seasonal limitations. The former category consisted of "fishbowling" from the interior lighting of the surveying bus, and was a constant and unavoidable factor that may have reduced the perceived lighting of stops. This limitation was taken into account and partially mitigated by the ambient lighting familiarization process. Moving to the latter category, the first limitation consisted of the occasional accumulation of winter related dirt and grime on the surveying vehicle's windows and this further exacerbated fishbowling. A second limitation was the fact that the research was conducted in the absence of foliage on deciduous street trees, which may interfere with street-lighting in temperate seasons. Both of these were unavoidable due to the timing of the research.

Shelter Specific Lighting

Shelter specific lighting was gauged on the presence, or absence, of dedicated lighting fixtures as opposed to their perceived adequacy. "Bar" and "rib" style shelter elements were occasionally observed as being installed without actual lighting fixtures, and the varied placement and facing of shelters meant that their respective totals are maximum values. 31% of all city transit shelters have a dedicated lighting fixture and no routes had an individual rate exceeding 50% (Table 19). Five routes have dedicated lighting fixture rates below 30%. At face value, this falls significantly short of the City's intention for comprehensive shelter lighting, but is should be noted that this goal may only be directed to enclosed shelters associated with the CSFP (City of Toronto, n.d.B). Non-enclosed and to-be-condemned transit shelters, however, only make up only slightly more than 7% of the surveyed municipal transit shelters and their removal only had a limited effect on dedicated lighting fixture rates. Even after excluding them, the dedicated lighting fixture installation fixture rate for enclosed to-be-retained shelters only increased to 33% (Table 20).

Table 19 Shelter specific lighting

Route	Total Num. of Stops	Shelter Lighting			Shelter Lighting Fixture Types			Advertisements Number of Shelters With Illuminated Advertisements (Total Number of Shelter With Advertisements)			
		Yes	No	N/A	Rib	SolM	SolB	Left	Back	None	N/A
15	68	12	26	30	2	8	2	14 (21)	0 (2)	15	30
36	122	41	63	18	6	25	10	46 (65)	1 (2)	37	18
37	137	16*	63	59	3	10*	3	40 (54)	1 (2)	23*	59
52	111	8	67	36	3	3	2	44 (62)	5 (5)	8	36
110	39	7	13*	19	0	7	0	4 (6)	2 (3)	11*	19
25	106	13	63	30	2	8	3	24 (57)	3 (5)	14	30
35	107	26	49	32	6	18	2	32 (45)	0 (2)	28	32
97	65	1	31	33	1	0	0	19 (26)	0 (3)	3	33
16	65	18	30	17	1	16	1	17 (23)	1 (1)	24	17
39	118	45	47	26	23	15	7	33 (50)	2 (2)	40	26
54	168	41	86	41	17	20	4	31 (86)	1 (1)	40	41
86	90	34	36	20	15	15	4	31 (36)	0 (1)	33	20
113	55	6	30	19	0	5	1	17 (24)	0 (0)	12	19
129	43	19	22*	2	14	4	1	3 (22)	0 (0)	19*	2
Total	1294	287	627	382	93	154	40	355 (577)	16 (29)	307	382

* Indicates that one stop is excluded as it is shared with a preceding route in the list

Table 20 Shelter lighting fixture installation rates

Route	Percentage of Shelters Equipped With a Lighting Fixture	Percentage of Shelters That Will Retained and are Equipped With a Lighting Fixture
15	32%	38%
36	39%	42%
37	20%	21%
52	11%	9%
110	35%	50%
25	17%	17%
35	35%	34%
97	3%	4%
16	38%	39%
39	49%	50%
54	32%	34%
86	48%	49%
113	17%	18%
129	46%	48%

Moving to discussion of the fixtures themselves, “Bar” and “mid” shelter fixtures were noted as being motion-sensor operated and effective at clearly illuminating their occupants while also not excessively powerful to impair said occupants from observing their surroundings. By direct contrast, the “rib” style fixtures associated with Enseicom model shelters were automatically illuminated and consistently noted as having little, if any effect, on interior shelter lighting levels. Although state of repair was not thoroughly analyzed, “rib” fixtures were also noted as malfunctioning on a more frequent basis, although this could be due to their age rather than design. A universal finding for shelter lighting fixtures was their usage of white, daylight, hue bulbs, which starkly contrasted with the yellow hue cast by Toronto’s streetlights[34] (Figure 15).

Figure 15. Dedicated shelter lighting fixtures cast a sufficient, but distinct hue compared to ambient streetlighting in Toronto.

[34] Daylight hued streetlights are utilized in Toronto on an extremely limited basis in the city’s LED streetlight pilot project areas, none of which are in the vicinity of the surveyed routes.

Shelter advertisement panels were also considered as part of a broad, liberal interpretation of shelter-specific illumination elements. Advertisement panels appear to be a fairly common shelter element as 76% of the surveyed public transit shelters were equipped with at least one advertisement panel (Table 21). Additionally, advertisement installation rates outstripped lighting fixture rates on a route per route basis, with all but one route having a rate below 50% and also had a higher average installation rate of 65%. That being said, only 60% (365) of advertisements were actually lit after-dark, and thus roughly 40% of all surveyed transit shelters were equipped with a lit advertisement. Overall, the surveyed routes had an average illuminated advertisement installation rate of 28%.

Table 21 Shelter advertisement and lighted advertisement installation rates

Route	Percentage of Shelters Equipped With Advertisement Panel(s)	Percentage of To-Be-Retained Enclosed Shelters Equipped With Advertisement Panel(s)	Percentage of Shelters Equipped With Illuminated Advertisement Panel(s)	Percentage of To-Be-Retained Enclosed Shelters Equipped With Illuminated Advertisement Panel(s)
15	61%	66%	27%	44%
36	64%	63%	31%	45%
37	71%*	71%	34%	53%
52	89%	94%	40%	67%
110	45%*	42%	23%	25%
25	82%	83%	26%	35%
35	63%	60%	31%	46%
97	91%	93%	37%	68%
16	50%	52%	27%	39%
39	57%	57%	28%	38%
54	69%	69%	20%	25%
86	53%	54%	23%	31%
113	67%	73%	32%	52%
129	54%*	55%	13%	15%

*Indicates that one stop is excluded as it is shared with a preceding route in the list

Shelter advertisements are illuminated using one of two technologies, with fluorescent tube backlights being more commonly used and LED screens being less frequently deployed and

only found in three shelters. Although hardwiring serves as the conventional means of powering advertisements, there is potential evidence of fluorescent advertisements being powered by the same models of solar panel as used for rib and back style light fixtures. Fluorescent advertisements were extremely inconsistent on an overall basis and often were only capable of indicating the presence of occupants within a shelter. LED advertisements, by direct contrast, offered consistently high brightness. That being, said, the sideward facing of advertisements meant that were not necessarily able to facilitate facial recognition compared to downward facing lighting fixtures. Additionally, particularly bright advertisements, namely LED adverts, reflected off of other shelter panels and seemingly caused a fishbowling effect on the vision of shelter occupants (Figure 16).

Figure 16. Example of a fairly well illuminated shelter advertisement.

After accounting for shelters that had both illuminated advertisements and dedicated fixtures, just under 71% of all of City of transit shelters had shelter-specific lighting. If all existing advertisements were illuminated, almost 94% of all City transit shelters would technically have some form of illumination. (Table 22) Although this situation suggests that the City and Astral Media are on-track to satisfying their shelter lighting goal, this would only be in a somewhat effective fashion.

Table 22 Maximum illumination rate of shelters

Route	Shelters Equipped With Any Illumination	Percentage of To-Be-Retained Enclosed Shelters That Have Any Illumination	Shelters That Could Have Illumination If Advertisements Were Illuminated	Percentage of To-Be-Retained Enclosed Shelters That Could Have Illumination If Advertisements Were Illuminated
15	66%	78%	87%	97%
36	85%	88%	98%	99%
37	71%	73%	90%	90%
52	75%	74%	97%	100%
110	60%	75%	75%	92%
25	53%	52%	97%	99%
35	80%	80%	93%	93%
97	68%	71%	94%	96%
16	75%	77%	88%	91%
39	85%	85%	98%	99%
54	57%	59%	95%	97%
86	77%	79%	97%	99%
113	64%	70%	83%	91%
129	61%	63%	98%	100%

Both of the private shelters and the TTC access hub shelter did not have advertisement panels and only the latter was equipped with dedicated shelter lighting fixtures. This shelter was well lit enough to the point of bordering on indoor lighting levels and somewhat overlit when compared to the undeveloped areas to the rear of the shelter (Figure 17). As with other shelters the lighting fixtures associated with this higher-order shelter emitted a white-hued light that starkly contrasted with the yellow-hue of streetlights in Toronto.

Figure 17. Example of a high-order TTC owned access hub shelter.

A variety of potential courses of action can be carried out for shelter specific lighting. At the very least, the underperformance, if not seeming rampancy of operational issues, of rib lights should be investigated and may necessitate the retrofit of Enseicom model shelters with better performing fixtures. Additionally, installation of bar and mid style solar fixtures in shelters must be aggressively pursued if the city intends to meet its shelter lighting goal.

Advertisement panels should also be improved as they are likely to remain as a component of transit shelters. Despite their extremely limited benefits to shelter interior lighting, the city and Astral should continue to pursue lighting for existing and future shelter advertisements. Considering the documented problems with providing hardwired power, alternative off-grid the solutions such as solar panels and energy storage should be considered if they are financially more efficient.

Brightness is another issue that should be addressed with advertisement panels. Contrary to face value, lower-medium advertisement brightness may actually more conducive to security due to reduced reflections on shelter walls. Finally, it may be beneficial to convert shelter lighting fixtures to yellow-hued light bulbs fixtures in order to reduce their glare when compared to conventional streetlights.

Shelter Features: Shelter Maps

Shelter maps appeared to be the second most common transit shelter element, with at least 72% (652) of the surveyed transit shelter, and 50% of surveyed TTC stops by extension, being equipped with a system map (Table 23). All but 6 routes had installation rates at or above 50%, with the lowest rate being just under 25%. Compared to all other stop elements, state of repair appears to be a particularly problematic issue for system shelter maps. Up to 12% (110) of all transit shelters have visible remnants of a previously installed map display, such as grey backing surfaces or glue residue or a fallen map display, or were equipped with an empty map display (Figure 18a, b). Although the exact cause of these missing maps is unknown, the existence of intact fallen displays appears to suggest natural wear-and-tear as opposed to vandalism. Less frequent maintenance issues included illegal third-party postering, such as adhesive posters or advertising handouts slipped into map displays, which obscured maps and the continued prevalence of outdated system maps.

Table 23 Shelter map installation rates

Route	Shelter Map		
	Yes	Missing	No
15	30	1	7
36	66	21	17
37	54*	15	10
52	57	14	4
110	15*	3	2
25	62	8	6
35	50	18	7
97	16	6	10
16	31	8	8
39	61	19	12
54	101	14	12
86	45	17	8
113	31	3	2
129	35	3*	4
	654	146	112

At the very least the City of Toronto should explore, or more widely implement, map displays that are more securely fixed to shelters. The prevalence of postering also suggests that postering-resistant map display surfaces and better secured map display housings may be necessary changes.

Figure 18a, b. Examples of shelter map issues.

Shelter Features: Next Vehicle Information System Screens

Next vehicle information system screens were undoubtedly the least common shelter element included in the surveyed surface stops. Just over 8% (76) of all shelters were equipped with a NVISS display, and on a stop-wide basis, less than 6% of all surveyed stops had a NVISS (Table 24). This phenomenon does not appear to be specific to the surveyed routes as the TTC's latest statistics, from 2016, indicated that only 106 shelters were equipped with a next vehicle screen (TTC, n.d.C). NVISS were primarily deployed on high-ridership frequent service routes and this is arguably both sound and problematic from a security perspective. This strategy is reasonable due to the ability of these screens to serve the greatest number of riders and the fact that their overnight counterparts, with the exception of routes served by the 300 Bloor and 320 Yonge blue night routes, generally see far less-frequent service. Less frequent routes, however, have the greatest likelihood of passengers being forced to wait for their vehicle at all times of day and potentially having less trafficked stops due to their lower ridership base.

Table 24 Next vehicle information system screen installation rates

	Next Vehicle Information Screens (NVISS)	
Route	Yes	No
15	0	38
36	12	92
37	1	77*
52	19	56
110	0	20*
25	9	67
35	9	66
97	4	28
16	1	47
39	4	88
54	12	115
86	2	70
113	0	36
129	0	41*
	76	841

NVISS were also noted as never being installed in tandem with dedicated shelter lighting fixtures. In the event that these two types of elements are mutually exclusive, due to electrical or engineering considerations, this would pose a problem if the stated policy of universal lighting fixtures in transit shelters remains in effect. The relevancy of NVISS to security, however, may be less important when compared to NVISS' importance to non-security considerations such as passenger experience and convenience.

NVISS should continue to be deployed in order to further assist transit patrons. Aside from continued deployment, the seeming mutual exclusivity of these screens with dedicated lighting fixtures may need to be addressed if it is in fact true. At least one other municipality in the Greater Toronto Area, York Region, has conventional transit shelters that sport both next vehicle information screens and dedicated lighting fixtures (Figure 19). The City should explore revisions to one or both of the elements in order to ensure compatibility.

Figure 19. York Region's shelter mounted next vehicle information system screens can be mounted simultaneously with shelter lighting fixtures and appear to be powered to some degree by solar technology (top right corner).

Stop Markers

82% (1064) of the surveyed stops had modernized stop markers, with a route average of 77% (Table 25). This average was heavily skewed by three routes (110, 97, 86) that largely still utilize generic, legacy stop markers that lack route or stop information. The existence of nine stops that were missing stop markers was surprising. A revisit at a later date suggested that this removal was temporary as eight of the nine stops were subsequently equipped with contemporary markers, although one stop marker, 25 SB at Rochefort, was still inexplicably missing.

Table 25 Stop marker installation rates.

Route	Stop Markers			
	Modern	Modified Legacy	Legacy	None /Missing
15	63	0	5	0
36	119	0	1	2
37	136*	0	1	0
52	111	0	0	0
110	1*	0	38	0
25	105	0	0	1
35	89	1	16	1
97	2	1	62	0
16	64	0	1	0
39	115	0	0	3
54	145	0	22	1
86	15	2	73	0
113	55	0	0	0
129	43*	0	0	0
	1064	4	219	8

No significant recommendations could be offered for stop markers. If they are determined to be useful or necessary, the TTC could divert its advertising of its request program to transit shelters, stop placards, or onboard vehicles. If the contemporary stop marker installation process has stalled, legacy markers should be updated to the modified legacy standard through next-vehicle prediction and route number decals.

Surrounding Land Use

As noted during the literature review, land use can influence the types of interactions that occur in surrounding public space and contribute to perceptions of security (ie: Loukaito-Sideris, 1999). Just over 94% of the surveyed surface stops were adjacent to land uses that were either designed for or easily capable of accommodating human activity. The three most common land use categories adjacent to the surveyed transit stops were residential (46%), commercial (29%), and open uses intended or easily capable of supporting use (5%) (Table 26). Approximately 6% of all surveyed stops were adjacent to land uses that are neither designed for nor particularly conducive to human activity. As noted in

Table 27, residential detached, low-rise multi-residential and commercial properties are the most numerous neighbouring land use subcategories to the surveyed transit stops.

Table 26 Stop adjacent land uses.

Route	R	C	O Use	O Not	MCR	I	VHL	COM	TRNS	Other
15	32	14	1	1	2	12	2	3	0	1
36	54	34	5	8	3	4	2	9	2	1
37	62	32	8	10	4	8	4	5	2	2
52	54	33	5	0	4	2	5	7	0	1
110	15	10	5	1	0	6	1	1	0	0
25	44	30	5	8	6	1	5	4	0	3
35	59	27	6	5	5	0	0	3	1	1
97	11	28	1	1	17	0	3	0	4	0
16	41	11	4	2	1	0	2	3	1	0
39	75	19	4	4	0	8	0	4	0	4
54	72	56	8	11	8	0	3	6	1	3
86	37	40	3	2	2	0	3	2	1	0
113	12	29	4	1	7	0	0	1	0	1
129	22	7	3	2	0	4	3	1	0	1
1294	**590**	**370**	**62**	**56**	**59**	**45**	**33**	**49**	**12**	**18**

Table 27. The three most common land uses for each land use category

R	C	O Use	O Not-use	MCR	I**	VHL	COM	TRNS**
46%	29%	5%	4%	5%	3%	2%	4%	1%
RD (317*) RM (93) RA3 (82)	CR (89) CS (87) CG (46)	OP (24) O (20) OC (8)	ONR (32) UT (11) ON (8)	MCRS (22) RAC3 (17) MCR (13)	I (37) ICS (6) IC (2)	PL (17*) HWYA (6) ROW (3)	SCH (27) COM (10) SCHY (7)	TTE (8) GO (3) TTC (1*)

* Indicates that one repeated value has been omitted

** These land-use categories only have three subcategories

Exterior lighting levels. Land uses were also anecdotally observed to correlate with a property's after-dark exterior lighting levels as well as their activity levels at various points of the day. Although it may not be a dependable policy (City Planning and Wekerle, 1992), certain types of land uses may be conducive and unconducive to security through their contributions to ambient lighting conditions. Average lighting ratings for all land-use subcategories were developed on the basis of the existence and brightness of their exterior illumination. The respective benchmarks for lighting were recognition of a person's silhouette for low-sufficient, and facial recognition for sufficient-good. Observations of the lighting conditions of stop adjacent land uses were recorded and are summarized in Table 28.

Table 28 Rough exterior lighting conditions for each land use subcategory

Generally Low		Inconsistent, Average & Sufficient		Generally Good	
O OA OH ON ONR UT UTR OG OC OR* DVL	RD RCC OP UB SCHY PL	RM CA* CF	RA RS CS CP OR* MCR RAC CPC I ICS IC PL HWYA SCH	CG CA* CO CR CSM CM CSN CL CLR MCRS COC SPEC	PG ROW* ROWA* ROWI PSCH COM COME HOSP GO TTE TTC
110	363	Up to 156	406	Up to 291	
9%	28%	Up to 12%	31%	Up to 22%	

*These lands uses had significant variation

The most immediate and unsurprising finding was the fact that outdoor natural recreation and utility land uses were poorly lit. More specifically, these consisted of virtually all O uses, schoolyards, and utility corridors. Two exceptions were noted in the form of one OR (a private outdoor tennis facility) and OG uses that had sufficient lighting, albeit only in a small portion of their property. Overall, these uses served as benchmarks for poor lighting.

Residential uses were characterized by the fact that their lighting levels had a positive correlation to density. Single detached residential uses (RD and RCC) often had more extreme variations but generally poorer lighting, while townhomes and duplexes (RM) had modestly more consistent and sufficient lighting. Residential apartments and seniors residences generally had consistent all-around lighting of sufficient brightness.

Public access, for individuals that neither live nor work at a property, appeared to be another determining factor for the sufficiency of a property's external lighting. Commercial, mixed commercial-residential, and community oriented uses were among the best lit uses that were encountered during the survey. This phenomenon may be attributed to occupiers liability and the need to exercise a duty to safeguard a property's entrants from threats to their well-being and their property. This by extension also appears be applicable to residential apartments and seniors residences, where occupiers must maintain communal areas that fall outside the control of residents. The most significant outliers to this trend consisted of places of worship (CF) and auto-repair garages (CA), which generally had poorer lighting. By stark contrast, automobile dealerships (CA) had lighting levels and directed lighting fixtures that starkly contrasted with streetlighting levels and thus overlit.

Vehicular areas were generally sufficient with the exception of large dedicated or distant parking lots (PL). Roadways (ROW, ROWA, ROWI, HWYA) more consistently had better lighting than open areas and low-density residential but were sometimes surpassed by commercial and community uses. Of note for roadways, major arterials appeared to have better lighting than highway accesses and lower order collector and local roads.

Activity levels. Relative activity was gauged on the basis of three aspects, intra-traffic, inter-traffic, and visible signs of traffic. Intra-traffic was constituted by visible activity restricted to a property's interior and exterior areas, while inter-traffic refers to be vehicular and pedestrian movement to and from a property. Visible signs of traffic referred to objects that symbolized the occupation of space such as parked vehicles and unsupervised possessions. For discussion purposes, days were divided into three periods: daytime (Table 29); evenings (Table 30); and late night (Table 31).

Table 29 Relative activity (weekday working hours and daytime) [08:00-19:00]

Generally Low		Inconsistent but Sufficient		Generally High	
OH	O	RD	RM	ICS	CG	COC
ON	OA	RCC	RA	IC	CA	ROW
ONR	OC	CF	RS	PL	CO	HWYA
UT		SPEC	CL	PG	CR	ROWA
UB		UTR	RAC	DVL*	CS	ROWI
DVL*		OG	OP	SCH	CSM	PSCH
			OR	SCHY	CM	COM
			I		CP	COME
					CSN	HOSP
					CLR	GO
					MCR	TTE
					MCRS	TTC
					CPC	

*These land uses had significant variation

Table 30 Relative activity (weekday evening) [19:00-22:00]

Generally Low			Inconsistently Sufficient		Generally High	
OA	CO	UTR	RD	I	RM	CG	ROW
OH	CP	OG	RCC	ICS	RA	CR	HWYA
ON	CF	OC	CA	IC	RS	CS	ROWA
ONR	CPC	DVL*	COC	PL	CL	CSM	ROWI
UT	SPEC	SCHY	OP	PG	RAC	CM	HOSP
UB	O		OR		PSCH	CSN	GO
SCH					COM	CLR	TTE
DVL*					COME	MCR	TTC
						MCRS	

*These land uses had significant variation

Table 31 Relative activity (weekday late night) [22:00-00:00]

Generally Low		Inconsistently Sufficient				Generally High		
CA	All O	RCC	ICS	RD	ROW	MCR	PSCH	CG
CO	UB	RS	IC	RM	ROWA	MCRS	COME	CR*
CR*	DVL	I		CSM	ROWI	RA		CSN
CP	SCH			CS		CL		HOSP
CF	SCHY					CLR		TTE
CM	COM					RAC		TTC
COC	PL					ROW*		
CPC	PG					ROWA*		
SPEC						HWYA*		

*These land uses had significant variation

The most immediate finding was the fact that open land uses and utility land uses had the least overall activity during the course of a standard weekday. This finding for late-night observations was not particularly surprising due to both the documented lack of lighting in most of these spaces as well as the fact that overnight usage of parks is criminalized by Toronto's municipal code (Toronto Municipal Code, 2004).

Moving on, the nature of the activity that was observed on a property appeared to be strongly linked to their physical design. Properties that were directly accessible from ground level access points were more likely to have all three types of activity through internal activity in interior and exterior spaces, traffic with surrounding spaces, and markers of activity. Higher-density uses that had accesses mapped along interior corridors, such as malls and communal hallways in both apartments and offices, were more likely to lack internal activity in their exterior spaces. Parked vehicles were often the most visible marker of activity at a property.

Residential uses were characterized by their somewhat unstable but constant activity throughout the day. This could be linked to conventional working hours that generally left these uses less occupied during weekday daytime periods.

Commercial properties were one of the most animated weekday land uses. Four subtypes were noted as being activity generators throughout the day: most gas stations (CG); restaurants, particularly quick-service restaurants (part of CR); lodging establishments (CL and CLR): and the city's sole casino (CSN). The vast majority of these uses were 24-hour operations and they addressed basic functions such as food, accommodation, and mobility. Standard commercial

uses (CR in both standalone and MCR variants), and commercial automotive (CA) uses were observed as having somewhat reduced hours of activity that generally subsided during the evening period. Additionally, indoor malls were noted as having earlier cut-offs in activity, generally before the late evening, when compared to outdoor facing commercial strips and commercial strip malls. Professional offices and employment based offices often experienced reduced activity outside of conventional working hours (09:00-17:00). Places of worship were characterized by the fact that only a limited number of them saw activity, and this appeared to be concentrated in short bursts.

Industrial land uses were generally less active than commercial uses during the daytime and were similar to employment and professional offices as they often also experienced a drop in activity following standard working hours. That being said, a portion of industrial uses were still active during the evening and a smaller portion also appeared to be active during the late night period.

The categorization of the outstanding land uses was fairly straightforward and reasonable although a select few exceptions bear some further explanation. Development parcels (DVL) were not necessarily undergoing construction at the time of surveying, with some appearing to still be locked in the application process, and thus experienced significant differences in activity. The amount of activity associated with vehicle right of ways also had differing levels of activity that correlated with their relative capacity and role they play in the road network, with local roads having less activity and vice-versa.

Similarly to lighting, density appeared to have positive correlation with activity for residential and commercial properties. While this phenomenon operated in a blanket fashion for all higher density residential uses throughout the day, higher density commercial properties were more contingent on the nature of their use.

Summary. Two general themes were noted in the above comparison of lighting levels and activity. The first of these was the fact that exterior lighting is not necessarily synonymous with activity. This was evidenced by observations that open uses and most commercial uses often had drastically different lighting levels yet equally low activity during the late night period. Conversely, low-density residential uses had low-medium average exterior lighting levels but generally had signs of internal activity. Secondly, density appears to have a positive correlation to lighting and activity levels, with higher density generally equating to more lighting and more activity.

Returning to theoretical discussion from earlier sections of this paper, lighting has been criticized as being incorrectly viewed as a preventative measure for general crime as opposed to property crime. This discrepancy, however, may stem from the fact that lighting often is a necessary component for actual usage of a space after-dark and serves as an important fear reduction measure. At the very least, lighting can draw attention to a space and serve as a means of making a means of increasing the visibility of both legitimate and illegitimate uses. Moving to practical matters, lighting from private properties may contribute, and sometimes supplement ambient street light levels and aid users of public spaces such as pedestrians on public streets. There are limits, however, as excessively higher powered or misdirected lighting may interfere with the night vision of pedestrians and casual observers of public space.

Similarly to lighting, activity appears to be another popular security measure that has also been questioned on the grounds of its actual, universal effectiveness against crime. At its most basic level activity is sought after for its potential introduction of interveners or witnesses that may frustrate offenders and also serve as sources of help for victims. Conversely, this concentration of individuals may also provide more opportunities for other forms of crime such as theft as well as conflicts that may escalate into expressive assaults or quality of life issues.

Prior to providing recommendations, several limitations associated with this analysis must be stated. At the most basic level, analysis was based on the combined averages of both extremely short-term and qualitative observations. Additionally, it must be stressed that the bulk of these observations occurred in fairly conventional suburban environments and may thus differ from higher density environments. The emphasis placed on adjacent land uses also means that these observations do not account for non-adjacent surrounding land uses, land uses across the street from bus stops, and the right of way of which the bus stop is on the streetside of.

Without making sweeping statements, certain land uses may not be the best neighbours for waiting transit patrons. Open and utility uses are the most obvious example due to their limited lighting, activity and visual barriers. Schoolyards and dedicated parking facilities are also candidates due to their limited night time activity. Finally, car dealerships often bordered on or were overlit and had poor night time activity and may be problematic.

165 stops were identified as having potentially problematic adjacent land uses, with 86 of these stops being improvable via relocations or removals. 80 of these stops could be relocated a short distance away, either to the opposite side of their respective intersection or further on to another midblock location, to be adjacent to a better lit or more active land use. Breaking this figure down with regards to their expected benefits, 44 of these movements would be marginal, 30 of these movements could have noticeable changes and 7 could offer significant improvement (Appendix D: Rectifiable Potentially Problematic Stops). 13 of these movements, 12 marginal; and 1 noticeable, could introduce potentially problematic side effects on the basis of adjacent property facing or buffering and would require further analysis. A further 5 stops, 3 marginal; 1 noticeable; and 1 significant, appear to be potentially good candidates for removal as they do not have suitable alternative sites nearby and were within 500m of an existing stop that could, or be made to, take over their function (Appendix D: Rectifiable Potentially Problematic Stops). 3 of these removals, 2 marginal and 1 noticeable, require further review as they could have problematic side effects. 79 stops did not have any nearby suitable alternative sites and are better oriented for spatial measures or policing and are listed in Appendix E: Unrectifiable Potentially Problematic Stops.

Several considerations, both public and private, must be made with respect to any attempt at implementation. These locations will likely have to be reviewed in order to determine their compliance with transportation services standards, impact on transit service, and in order to prioritize resources on stops of problematic and concerning stops. Additionally, property owners adjacent to proposed stops will have to be consulted for concerns and general feedback and to determine whether the benefits of these moves will outweigh their costs. In particular, changes would entail increased contact between transit services, transit users, and properties that are hoped to have diffusive, positive benefits on the operation, and surveillance, of transit stops.

Interface with Surrounding Land Use: Facing

A land use's relative orientation can also affect the levels of lighting, casual surveillance, and activity afforded to and around its surroundings. Roughly 44% of all stops were in front of their adjacent property, 29% were on a side face, and 13% were to the rear of their respective property (Table 32). Additionally approximately 14% of the surveyed stops were beside land uses that didn't have a specific facing, or structures for that matter.

Table 32 The facing of general stop adjacent land uses

Route	R	C	MCR	I	COM	O-USE	O	VHL	TRNS	OTHER	Totals
F	142	165	40	14	7	n/a	n/a	n/a	4	0	372
FC	100	71	9	7	8	n/a	n/a	n/a	0	0	195
S	170	71	9	9	11	n/a	n/a	n/a	8	1	281
SC	57	27	0	8	13	n/a	n/a	n/a	0	0	105
B	99	17	0	4	2	n/a	n/a	n/a	0	0	120
BC	22	19	1	3	1	n/a	n/a	n/a	0	0	46
N/A	n/a	n/a	n/a	n/a	7	64	56	32	0	17	174
Totals	590	370	59	45	49	64	55	32	12	18	

Front facings were relatively straightforward to categorize and were based on the existence of a main, or publicly, accessible entrance. Front facings were the most common facing, fronting 44% of the surveyed stops. These facings were consistently the most active facing with regards to inter-traffic through their entrance, and intra-traffic as seen through their often high number of windows. These faces were also generally better lit at night. Some land uses such as commercial malls and strip malls, and high density uses with commercial podiums had multiple, or separate entrances and had more than one front facing.

Side facings and back facings proved to be somewhat more difficult than expected to differentiate. Side facings were conceived to be either perpendicular to the main entrance or possess a secondary entrance on an extensively multifaceted building. Back facings were presumed to be directly opposite of a building's front facing and house servicing areas. These distinctions, particularly for back facings, proved to not always be true in real life and some discretion was exercised for labelling building faces. Low-to-high rise commercial and

residential buildings, for instance, often had similar faces and side and back facings were assigned on the basis of structural elements.

Side facings were the second most common stop facing and were found along roughly 29% of the surveyed stops. These facings often had the least inter-traffic due to their lack of entry ways but nevertheless often had a respectable number of windows compared to back faces and generally had sufficient lighting. Certain land uses such as (M)C(R)S and I(C)(S), and residential uses on rare occasion, had blank side facades. Additionally, residential uses often had poor or no lighting for side faces that lacked public or common accessways.

Back facings surprisingly were not only the least common facing, at 13%, but also had the greatest amount of variation. Six different "tiers" of backs differentiated by their combinations of entryways, viewing-height windows, and servicing areas were encountered (Table 33). Windows, entryways, and service areas anecdotally appeared to be superior in both lighting and activity when compared to covered façade openings and blank facades. As with side and front faces, low density residential back faces generally had drastically inferior lighting, and higher density residential uses had somewhat inferior lighting. Certain land uses such as CSN, SPEC, COME, HOSP were excluded due to their extremely small sample size.

Table 33 Types of back facings by land use subcategory

Back Facings with Usable Windows and Entryway	Back Facings with Usable Windows, Entryways, and Servicing Areas	Back Facings With Usable Windows	Back Facings with Entryways and Servicing Areas	Back Facings with Blank Facades (With or Without Opaque Emergency Exits)	Back Facings with Covered Windows and Entryways
RD RCC RM	RA(C) RS CO(C) CP(C) CL(R) MCR(S)	CF	CG CR* CM I(C)(S) COM*	CR* CM COM CF* COM*	CR* CS CSM

*These land uses had significant variation

Figure 20 An example of a isolated stop at the back corner of a commercial mall.

One final observation was the apparent correlation between the facing of certain types of land use and the installation of barriers. In the case of low-density residential, barriers were only absent in siting arrangements where a stop was adjacent to the front of a RD property and was only slightly reduced for side facings. Barriers, aside from HPMS, were also anecdotally observed as being less frequently installed or having access ways when installed along front facings.

The majority of surface stops in Toronto are sited beside land uses with potentially conducive interfaces. Aside from offering a blanket recommendation that attention be paid to stops with back facings to adjacent land use and stops with documented concerns and problems, it may be useful to pay attention to back facings with entryways and servicing areas, blank facades, and covered facades. Approximately 42 stops were located at the rear face of their adjacent property, with 21 of these stops having alternative sites for stops (Appendix D: Rectifiable Potentially Problematic Stops) and the remainder not being easily rectifiable (Appendix E: Unrectifiable Potentially Problematic Stops).

Interface with Surrounding Land Use: Barriers

Just under 58% (749) of all surveyed stops had some form of barrier between them and their adjacent land use (Table 34). The three most common barriers were HPMSs at 28% of all barriers (213), HMs at 22% of all barriers (167), and HMSs at 20% of all barriers (148). While

all barriers could impair mobility, 77% (579) of all barriers, could potentially impair the lines of sight between individuals at bus stops and occupants of the adjacent property.

Table 34 Breakdown of barriers between surface stops and their adjacent land uses

HM	HMPS	HPMS	HMS	SM	SPMS	SMS	CM	CMPS	CPMS	CMS	No Barriers
167	54	213	148	3	54	11	0	59	2	38	545

Barriers were noted to have effects depending on their inherent characteristics. Barriers with definite obstructions to movement and sight, such as HMS; SMS; and CMS, were largely perceived to have the strongest negative effect on pedestrians. Conversely, HPMS were not always in effect and technically were the only form of barrier that was directly linked to, or a generator, of activity (Figure 21). Soft barriers made up of plants were also considered to be a potentially problematic in light of concerns in the literature regarding the permeable but partially opaque nature of foliage.

Figure 21. Parking areas were noted as creating potential movement and sight barriers for pedestrians and patrons waiting at transit stops but also housing activity.

The contexts in which barriers are installed also appear to have ramifications on their performance and perception. Negative side effects were fairly easily noticed and more prevalent. ADJ barriers were noted as having a significant ability to limit the mobility of pedestrians, especially in areas with limited sidewalk width and buffering from their adjacent street. Adjacent and slightly buffered placements for sight-obscuring hard barriers were also noted as being particularly effective at fully obscuring pedestrians from their adjacent properties. The same hold true for soft-foliage based sight obscuring barriers, which could be feared as being potential hiding spots for motivated offenders. Positive ramifications were also noted in certain deployments of barriers. Hard barriers appeared to buffer pedestrians from potentially threatening or fearful spaces such as poorly lit sections or isolated sections of adjacent properties, and open areas not designed for use (Figure 22). Additionally, these barriers were anecdotally perceived to actually have small positive effect, possibly due to light reflection, on ambient lighting when placed in close proximity to sidewalks.

Figure 22. Hard barriers may serve as buffers between transit patrons and potentially insecure surroundings.

While the design and implementation of barriers on private and public land uses are not the focus of this paper, some basic recommendations may be made for surface stop siting. Hard barriers that only have limited or no negative effects on sight lines are preferable and barriers with at least some buffering are preferable. If visually obscuring and soft barriers are necessary, they may be best deployed at buffered to setback distances (Figure 23).

Figure 23. Hard-movement-sight barriers often created a visibly isolated interface for transit stops.

Land use appears to be a supplementary means of identifying existing and proposed stop locations that may require more attention and investment due to their potential isolation or restriction via barriers. Certain types of barriers appear to be correlated with both general categories (zones) and specific uses (zone categories). Residential zones accounted for the largest share of all barriers, at 52% (390) and also had the greatest barrier installation rate at 66% (590). Particularly problematic examples of barriers that were generally found in R zone areas include 87% (129) of HMS barriers, 89% (34) of CMS barriers, and 66% of CMPS barriers. Moving to specific uses, HMS and CMS were primarily found in RD areas (Figure 24), while CMPS were somewhat better distributed but often found in RD and RA3 areas. Commercial land uses were the both the second largest owner of barriers, accounting for 28% (210) of all barriers, and had the second highest installation rate at 57% (370). That being said, 69% (145) of their barriers were of the HPMS barriers and as such may be less problematic from a security perspective. All other land uses accounted for a relatively smaller percentage of barriers and also had substantially lower installation rates and are not particularly noteworthy.

Figure 24a, b Examples of combination-movement-sight barriers found on residential-detached properties.

Notwithstanding their potential negative side effects, it must be borne in mind that barriers have utility value for the properties on which they are installed. At their most basic level, all barriers may serve as access control measures for both pedestrians and vehicular traffic and may serve aesthetic purposes. Level-grade sight impeding measures go further in their ability to provide visual privacy, serve as a buffer for noise pollution[35], or to provide screening for utility areas and other potentially unappealing areas. Sight impeding measures based on differences in grade, such as retaining walls and slopes, may be an unavoidable effect of geography or be associated with slightly or fully below grade structures or sections of a property. As such, barriers may not feasibly be fully removed on a comprehensive basis.

Barriers are arguably the most fluid of all the examined land use aspects and it may be questionably valuable to focus on stops possessing these elements. Basic recommendations on stop placement and planning will be offered in lieu of a comprehensive list of stops that may benefit from reworking. These recommendations will firstly be from an as-of-right perspective where stops are sited in isolation of changes to the urban fabric. Overall, lower-density residential areas may be presumed to require further attention for site placement if barriers, particularly sight-blocking barriers, are to be avoided. If stops are to be sited near these areas,

[35] Based on an instance where sound-barrier walls were erected along a section of right-of-way and its respective stop.

they would benefit from being placed adjacent to the front or front-side area of a property due to the decreased likelihood of sight obstructing barriers and barriers. Although HPMS barriers were the second most common barrier, their characteristics suggest that they may not be the most problematic type of barrier and the same may likewise be said for commercial areas. Sufficiently buffered hard movement barriers in the vicinity of poorly lit, utilized, or generally inducing spaces may also be fairly benign or even somewhat beneficial. Soft-foliage based barriers were not particularly correlated with any specific use but did not appear to be particularly conducive to perceived security. Land use planning controls, while in a separate sphere, could also mitigate the occurrence of barriered facings by ensuring that front and other active frontages do not face public streets or higher order streets.

Interface with Surrounding Land Use: Distance

Buffering was the final aspect of land use that was considered to impact a property's interface with its surrounding public spaces and surface transit stops by extension. The classification process deviated somewhat during the surveying phase, with discretion being used to account for the design and level of activity in physical setbacks, the scale of the property's main uses, and the existence of barriers. Land such as open-not-for-use that had no clearly demarcated activity areas or structures were generally counted as adjacent unless they possessed a visible maintained buffer of grass or man-made material. In respective order, buffered setbacks were the most common physical setback at 39% (508); followed by slightly buffered at 34% (442); adjacent at 15% (191) and setback at 12% (153) (Table 35).

Table 35 Breakdown of buffering between transit stops and their adjacent land uses

Route	Distance			
	Adjacent	Slightly Buffered	Buffered	Set back
15	8	36	16	8
36	12	44	49	17
37	14	51	58	14
52	8	75	24	4
110	6	19	12	2
25	19	30	38	19
35	25	19	42	21
97	34	8	12	11
16	7	24	32	2
39	8	45	53	12
54	28	30	86	24
86	5	29	49	7
113	16	25	13	1
129	1	8	24	10
	191	443	508	152

Distance setbacks were host to a number of relatively surprising negative findings. The most obvious observation was the fact that setback bufferings could be unconducive to security as they could impair both hearing and sight between the property's occupants and pedestrians. Additionally, certain properties such as residential high-rise buildings more frequently had perimeters enclosed with barriers the further they were from their surrounding streets, with setback examples being the most notable offenders. Extremely close proximity was surprisingly also noted to not be without its faults. Adjacent multi-unit high-rises provided sightlines between pedestrians and a comparatively limited number of units when compared to slightly or fully buffered properties. There also does not appear to be a correlation between proximity and facing for single and multi-unit low-rise commercial operations, with a notable number of these uses actually having worse interfaces as they would turn their backs onto their adjacent street in order to better cater to their rear parking areas (Figure 25). Finally, adjacent and slightly buffered land uses were noted to occasionally have situations where their occupants would encroach on surrounding public space on extremely temporary or longer-duration periods of time. Although this phenomenon could be fairly benign, the consulted literature appeared to indicate

that this appropriation of space could border on being as anti-social or potentially threatening behaviour depending on the individuals involved and the observer.

Figure 25. Proximity does not always translate to good interfaces as this slightly buffered commercial building turns its back to its adjacent stop.

The respective benefits of land use facings were relatively straightforward. Setback properties did not appear to offer any tangible benefits with the exception of natural not-for-use open areas. In these instances setbacks and buffering actually appeared to be beneficial to perceived security as they helped to increase a pedestrian's awareness space as they isolated pedestrians from visually obscuring foliage and geographical features and also allowed for further light distribution. Barring the aforementioned possible issues, adjacent bufferings were generally perceived to reduce feelings of isolation and thus be a security conducive interface (Figure 26). Close bufferings could theoretically also bring stops and their surrounding public realm into the monitoring area of CCTV cameras on private properties and this phenomenon persisted would likely diminish with increased buffering. Although buffering was primarily based on perceived distance, barriers (specifically sight obscuring ones) were found to influence the perceived distances of the land uses beyond them.

Figure 26. Land uses with little buffering, such as this high-rise residential apartment with ground floor retail, provide casual surveillance opportunities and activities in close proximity with surface transit stops.

114 stops were identified as being potentially problematic. 12 of these stops could be improved through a short distance relocation to another property in their vicinity, with 8 of these possibly producing noticeable changes and 4 of these producing marginal changes (Appendix D: Rectifiable Potentially Problematic Stops). 26 stops could be provided with a better interface at the cost of a less-conducive land use or facing, with 4 producing noticeable changes and 22 producing marginal changes. 1 stop could be removed and replaced by a nearby existing stop with noticeable improvement (Appendix D: Rectifiable Potentially Problematic Stops). 75 stops could not be improved via relocation and potentially require further analysis and investment (Appendix E: Unrectifiable Potentially Problematic Stops).

Observed Occurrences

A limited number of incidents that either were a documented cause of concern or could be viewed as potentially threatening were encountered during surveying (Table 36). For the purposes of this study, discussion will be limited to general comments. Incivilities made up the bulk of observed occurrences and may the most common form of negative interaction encountered on the TTC. The utility of prohibitory signage in discouraging petty offences appears to be somewhat questionable as certain acts such as illegal entry at terminals and smoking occurred in the immediate vicinity of their respective prohibitory signs. In these instances, active policing by police officers, peace officers, or other employees may be the only

solution. Only four of the encountered scenarios, being aggressive panhandling; touching; unwanted attention; and smoking, had interactions between patrons and an a clear basis for passengers to become involved.

Table 36 Observed occurrences

Scenario	Frequency	Potential Class of Incident
Group of youths loudly talking about firearms, gangs, and gang activity in a favourable light	Once	Potentially threatening behaviour Disturbing the peace/nuisance behaviour
Escalated fare dispute and verbal exchange between an operator and a boarding patron which resulted in the calling of transit enforcement/police	Once	Fare Dispute Common operator assault Potentially threatening behaviour
A patron boarding from the rear door of a bus and being ordered off the bus	Once	Fare evasion Nuisance Behaviour
Patrons illegally boarding from the rear doors	Several	Fare evasion Nuisance Behaviour
A pair of youths aggressively panhandling by the stairs of Kennedy Station (obstructing path during solicitation)	Once	Panhandling Potentially threatening behaviour Nuisance Behaviour
Loud broadcasts of music	Numerous	Nuisance Behaviour
Scenario	Frequency	Potential Class of Incident
Passengers illegally entering and exiting bus terminals	Numerous	Fare Evasion TTC Bylaw
A passenger being ordered off a bus due to their previous illegal entry into the bus terminal	Once	Fare Evasion
Passengers seating in manners that resulted in them touching or nearly touching the seated passenger in front of them	Several	Nuisance Behaviour
Male passenger talking to themselves, purposely moving to stand beside a female passenger and carrying out an increasingly one-sided conversation with said female passenger	Once	Interfere with enjoyment
Passengers illegally smoking at bus terminals	Numerous	Smoking on TTC property
Medium-large groups of youths loitering/waiting in the vicinity of stops	Numerous	Potentially threatening behaviour Disturbing the peace/nuisance behaviour

Remedial Measures for Potentially Problematic Stops

175 stops were deemed to remain as potential problems due to a lack of nearby security conducive or technically feasible alternative sites. These stops could benefit from further evaluation in order to determine whether they suffer from actual or perceived insecurity presently from the perspective of their users or from the perspective of a reasonable observer or occupant. If they require improvement, one of three spatial elements should be explored based on the nature of their insecurity, the amount of traffic they experience, and available funding.

Surface stops, at the time of this study, were one of the only locations on the TTC that consistently lacked any form of security oriented PSA. Although these PSAs could theoretically help to deter crime, they presumably would be more reasonably effective at better equipping passengers on the best course of action for mitigating and responding to security issues that they either experience first-hand or witness. An example of this form of PSA was the TTC's "This is Where" campaign which was aggressively advertised onboard vehicles using advertisements and decals from a period of roughly 2017-2018 (Figure 27a). Shelter decals have also been used to provide information regarding personal security on transit as part of a long-term campaign in the neighbouring municipality of York Region (Figure 27b). Shelter PSAs could utilize decals similar to York Region and could potentially use a share of the free shelter advertisement panels provided to the City by Astral Media. Their conspicuity to the general public could potentially serve as negative, but arguably necessary, advertising, and the recommendation should be subject to further analysis. As noted earlier, these measures may have limited impact or perceived value but they may be the least cost-intensive and most expedient upgrade for potentially problematic as well as general surface stops.

Figure 27a, b. The TTC's security PSA campaign, as shown on one of its various advertisements onboard a TTC bus (27a), is solely absent at surface transit stops. Additionally, basic security information, such as but not necessarily including prohibitions in this instance at York Region bus stop (27b), is also absent at surface stops.

In the context of remedial measures, alarms and other assistance summoning measures primarily refer to public payphones and two-intercom systems. These are relatively higher-order solutions and may only be appropriate for stops with more pressing issues. The basis for these elements is their identification in previous studies as being conducive to security (METRAC, 1989, SWAN and METRAC, 1991) and their standard-issue nature at the designated waiting areas at TTC rapid transit stations. Emergency two-way intercoms are also used outside the city, particularly at and in the vicinity of higher-order transit stops and terminals (Figure 29). Both of these elements could be considered as already being supplanted by cellular phones, particularly after the introduction of the TTC's harassment and crime reporting phone app. That being said, these measures may still be able to have a significant effect on the perceived security of surface transit stops. Notable barriers to deployment, however, will have to be overcome with payphones needing to be justifiable expenses by their operating company and emergency alarms requiring higher expenditures and potential logistical issues.

Figure 28. Payphones may useful amenities or reassuring sights to passengers at isolated stops.

Figure 29a, b. Emergency assistance measures, such as these installations at a bus rapid transit stop (29a) and at a walkway linking sections of an intermodal hub (29b) in York Region.

CCTV cameras are the final security element that could be deployed but may be restricted to extenuating circumstances or private areas due to their drawbacks. Currently, unmonitored CCTV cameras are deployed on the interior of most TTC vehicles and increasingly on the exterior of newer surface vehicles. Monitored CCTV is restricted to rapid transit stations, and the commission's new fleet of streetcars as an operator aid. CCTV cameras appear to be deployed in a similar manner in neighbouring municipalities, and were also noted at higher-order surface transit stops such as BRT stops in York Region (Figure 30).

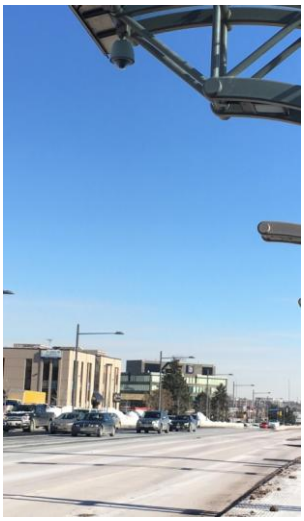

Figure 30. This security camera (top of image) is one of several cameras that are standard equipment at York Region's bus rapid transit stops .

CCTV surveillance of surface stops may be significantly more complicated due to their nature as general public spaces as opposed to public transit properties. As noted previously, this measure may only be reasonable in circumstances where all other reasonable options have been exhausted in order to satisfy Ontario's privacy regulations. Additionally, this measure may be more closely with the Toronto's police service and their policing of the city, themselves having only used unmonitored cameras with a now-finished pilot project. CCTV cameras installed on the basis of occupier's liability could theoretically also contribute to security but are also presumed as having to satisfy privacy regulations. Overall, security cameras may be deployed at some point in the future but they are not as recommended as the two previous remedial measures.

Conclusion

Security oriented spatial planning in Toronto's suburban transit stops continues to be oriented towards the facilitation of patron awareness, visibility, and fear reduction. Personal security continues to be a challenge affecting the Toronto Transit Commission and its patrons. Transit specific elements have undergone noticeable, albeit not yet comprehensively implemented, changes. Significant advancements and improvements have been made to surface stop elements but they are being rolled out in a comparatively more piecemeal manner. Additionally, it is somewhat questionable as to whether progress has been made in evaluating and accounting for neighbouring land use interfaces in the siting of stops. Further research with transit users, their advocates, and stakeholders should be carried out in order to analyze the contemporary effectiveness of elements and potential shortcomings that may be improved.

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Appendices

Appendix A: Reported Offences on the TTC (2016, 2017A, 2018)

Act	Target	Act	2015	2016	2017
Assault	Against patron	Aggravated Assault-Patron	2	/	/
		Assault Bodily Harm or W/Weapon-Patron	13	22	/
		Common Assault - Patron	148	225	/
	Against employee	Assault Peace Officer	6	8	15
		Assault with Intent to Resist Arrest	/	/	1
		Assault Bodily Harm or W/Weapon-Operator	1	2	/
		Assault to Resist Arrest	/	1	1
		Common Assault - Misc. Employee	1	1	/
		Common Assault - Operator	123	75	/
		Common Assault - Route Supervisor	3	1	/
	Unknown victim	Assault	239	385	442
		Aggravated Assault	1	1	1
		Assault Bodily Harm	1	1	18
		Assault with a weapon	10	30	/
		Common Assault	/	/	182
		Consensual Fight	/	/	1
		Fight on TTC Property	1	/	/
		Uttering Threats	/	170	180
		Uttering Threats To Cause Death or Bodily Harm	22	/	/
		Non-Capital Murder	/	1	/
		Uttering Threats(Threatening for 2015 and 2016)	82	106	45
Sexual assault	Unknown victim	Sexual Assault	6	16	14
		Sexual Assault	63	72	94
Sexual crimes	Unknown victim	Voyeurism	2	2	2
		Potential Sex Offender	/	1	/
		Indecent Act	16	34	19
		Voyeurism	6	3	2
Robbery	Patron	Armed Robbery Patron	1	1	/
		Attempt Robbery Patron	5	5	/
		Attempt Armed Robbery Patron	/	2	/
		Robbery Patron	4	12	/
		Robbery Patron - Mugging	7	4	/
		Robbery Patron - Swarming	9	7	/
	Employee	Robbery Employee	/	2	/
	Unknown victim	Attempt Robbery	1	2	/
		Robbery	/	/	32
		Robbery	6	9	15
		Attempted Robbery	/	/	7

(continued)

Reported Offences on the TTC (continued)

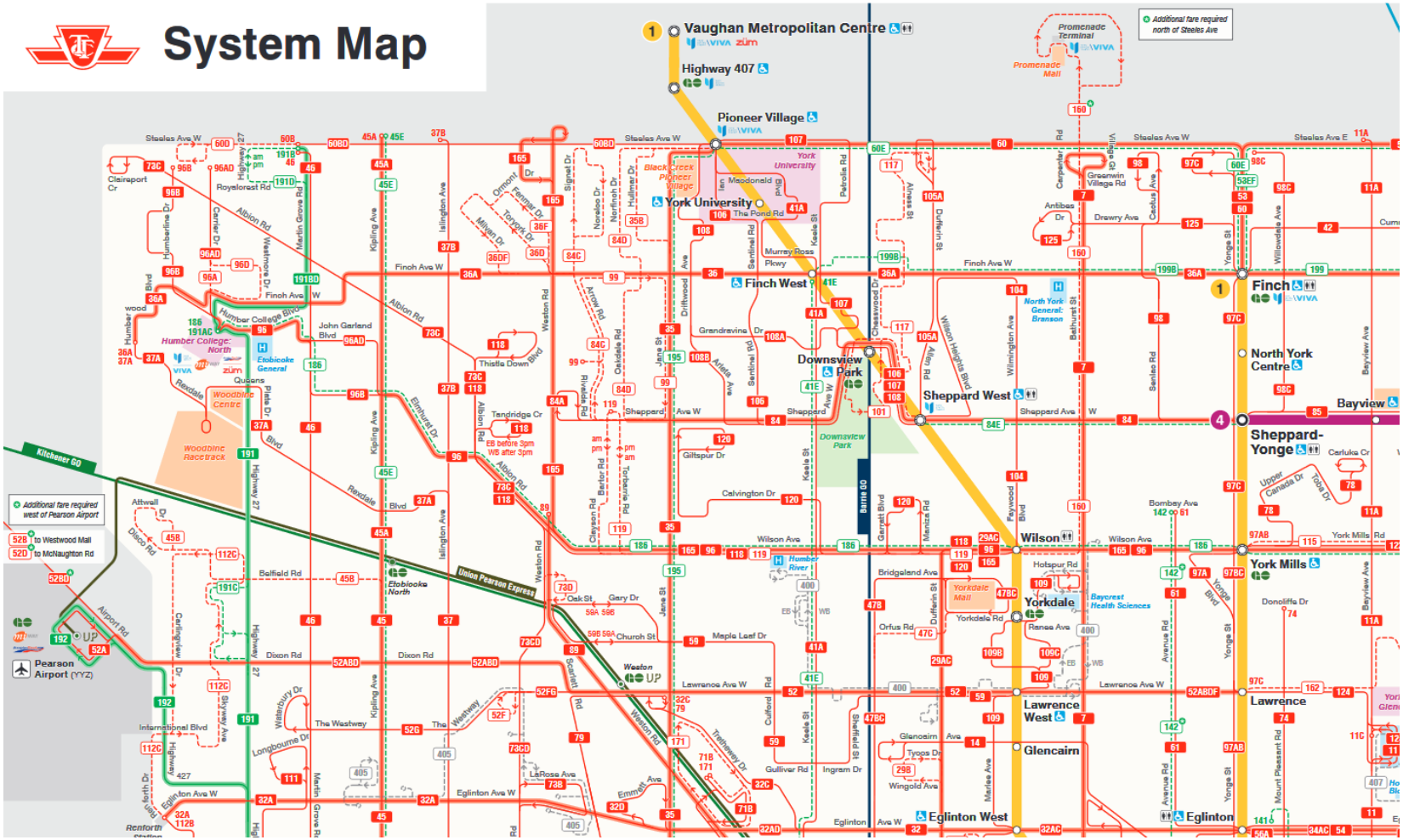
Act	Target	Act	2015	2016	2017
Criminal harass-ment	Unknown victim	Contact with a Vulnerable Person	/	1	/
		Criminal Harassment	9	3	5
		Criminal Harassment	2	1	3
Theft and fraud	Patron	Attempt Purse Snatch	1	/	/
		Purse Snatch	2	1	/
		Theft from Patron <$5k	17	28	/
		Theft from Purse <$5k	5	3	/
		Theft of Bicycles	/	/	2
		Pickpocket <$5k	2	4	/
	Employee	Theft from Employee <$5k	13	5	/
	Unknown victim	Fraud Transportation	/	1	1
		Fraud Transportation 393(3)	4	11	10
		Attempt Fraud (under$5k for 2016)	2	17	1
		Theft	/	/	43
		Theft >$5k	/	1	1
		Theft <$5k	87	94	89
		Theft <$5k Attempt	/	/	1
		Attempted Fraud	1	12	4
		Attempt Theft	1	/	5
		Fraud	145	235	635
Employee related	Employee	Obstruct Peace Officer	3	2	1
		Fail to Comply with Instructions of a Proper Authority	/	1	/
		Fail to Comply	2	6	6
Substance related		LLA Intoxicated in Public Place	16	39	49
		LLA Open Container	2	1	3
		Possession for the Purposes of Trafficking	1	/	/
		Possession of Cocaine	/	1	1
		Possession of Hashish Under 1 Gram	/	2	/
		Possession of Marihuana under 30g	1	/	1
		Possession of Methamphetamine	/	/	1
		Smoke on TTC Property	1	/	/
		Pos. of Cocaine	1	1	1
		Possession Controlled Drugs	1	/	/
		Possession of Narcotic	1	/	/
		Trafficking Controlled Drugs	/	1	/

(continued)

Reported Offences on the TTC (continued)

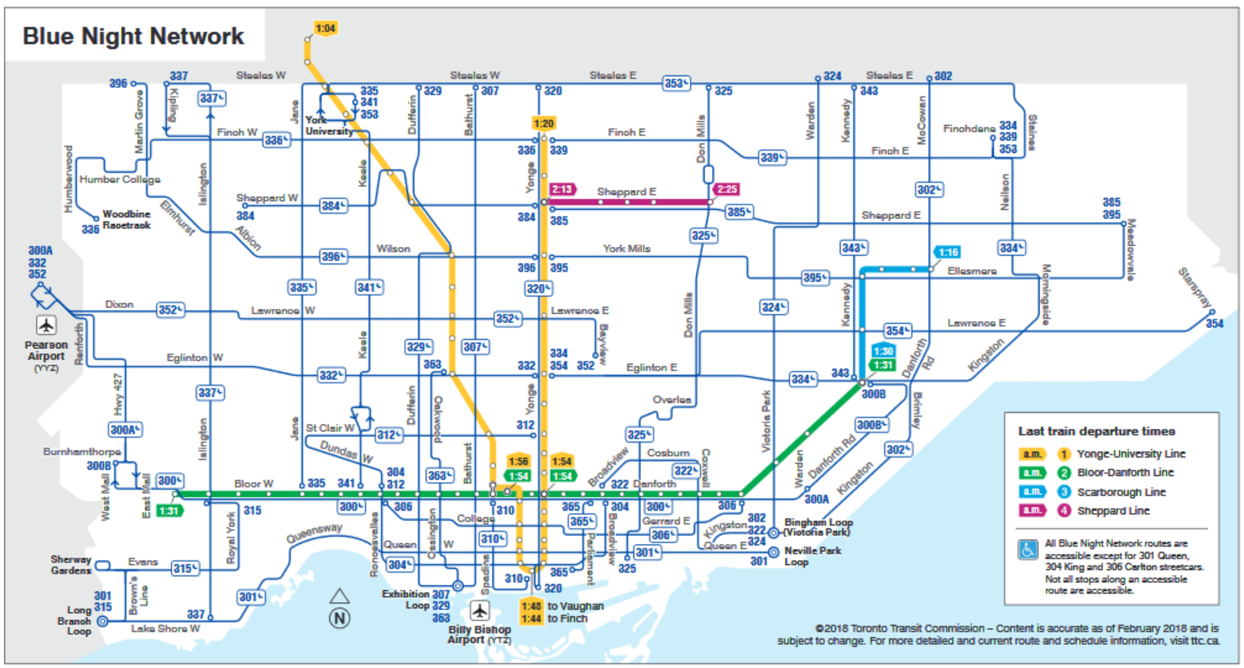
Act	Target	2015	2016	2017
Vandalism	Arson: Damage to Property	1	/	1
	Mischief	188	59	121
	Mischief <$5k	15	107	134
	Mischief >$5k	2	5	2
	Mischief Endangering Life	/	1	1
	Possession of Coin-operated Device Breaking instrument	3	4	12
	Arson	4	1	/
	Mischief	209	205	142
	Poss. Instrmts Break Into Coin Op Device	1	/	/
Disturbance related	TPA Fail to Leave When Directed	13	13	17
	Cause a Disturbance	18	3	8
	Common Nuisance	/	/	1
	Cause a Disturbance	5	6	5
	Fail to Control Animal On Transit System	/	1	/
	Improper Language	1	/	/
	Behave in Indecent (Offensive) Manner on TTC Property	/	1	2
	Interfere with Ordinary Enjoyment of Transit System	6	2	1
	Cause Disturbance	60	101	80
	Indecent Exposure	14	22	12
Fare related	Bylaw Enter Premises Where Entry is Prohibited	10	5	5
	Bylaw Fare Related	11	16	85
Panhandling	Unauthorized Solicit	27	16	26
Misc. quality of life crimes	Urinating	/	1	2
	TPA Engage in Prohibited Activity on Premises	20	5	7
	Fail to Comply With Posted Sign	9	3	4
	Lying Down on TTC Property	1	/	1
	Travel on Exterior of Vehicle	/	1	/
	Unauthorized Use of Transit System Equipment	/	/	1
	Personate Peace Officer	1	/	/
General threats (weapons and non- specific	Possession of a Weapon for Dangerous Purpose	2	2	13
	Possession of Offensive Weapon Dangerous to the Public Peace	1	/	/
	Non-specific Threat	/	1	/
	Possession of Prohibited Weapon	/	/	1
	Bomb threat	6	9	6

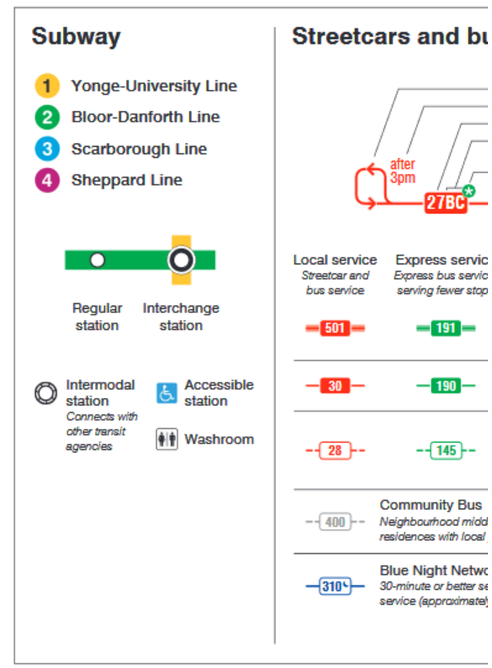
Appendix B: Toronto Transit Commission System Map (TTC, 2018)

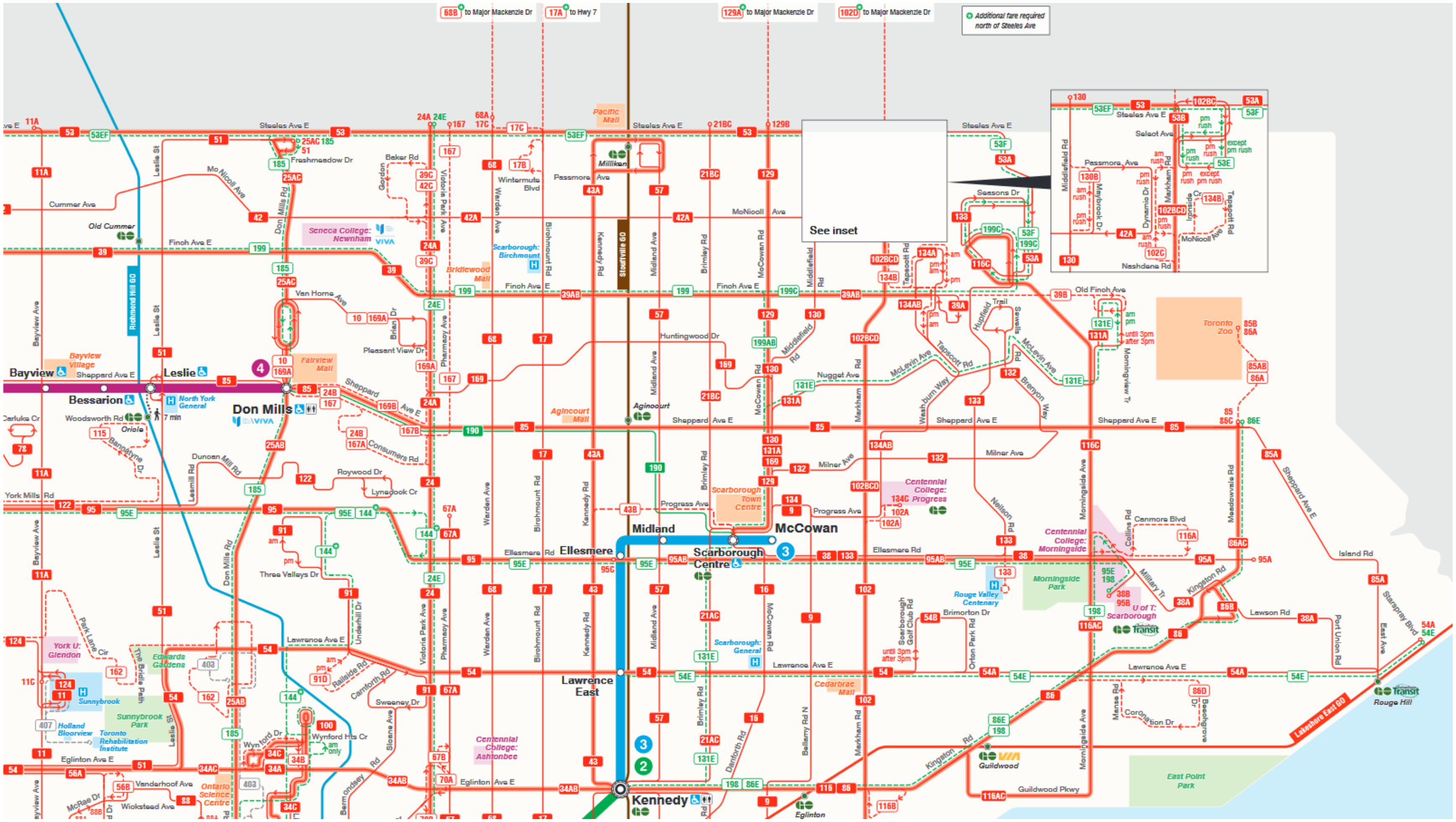


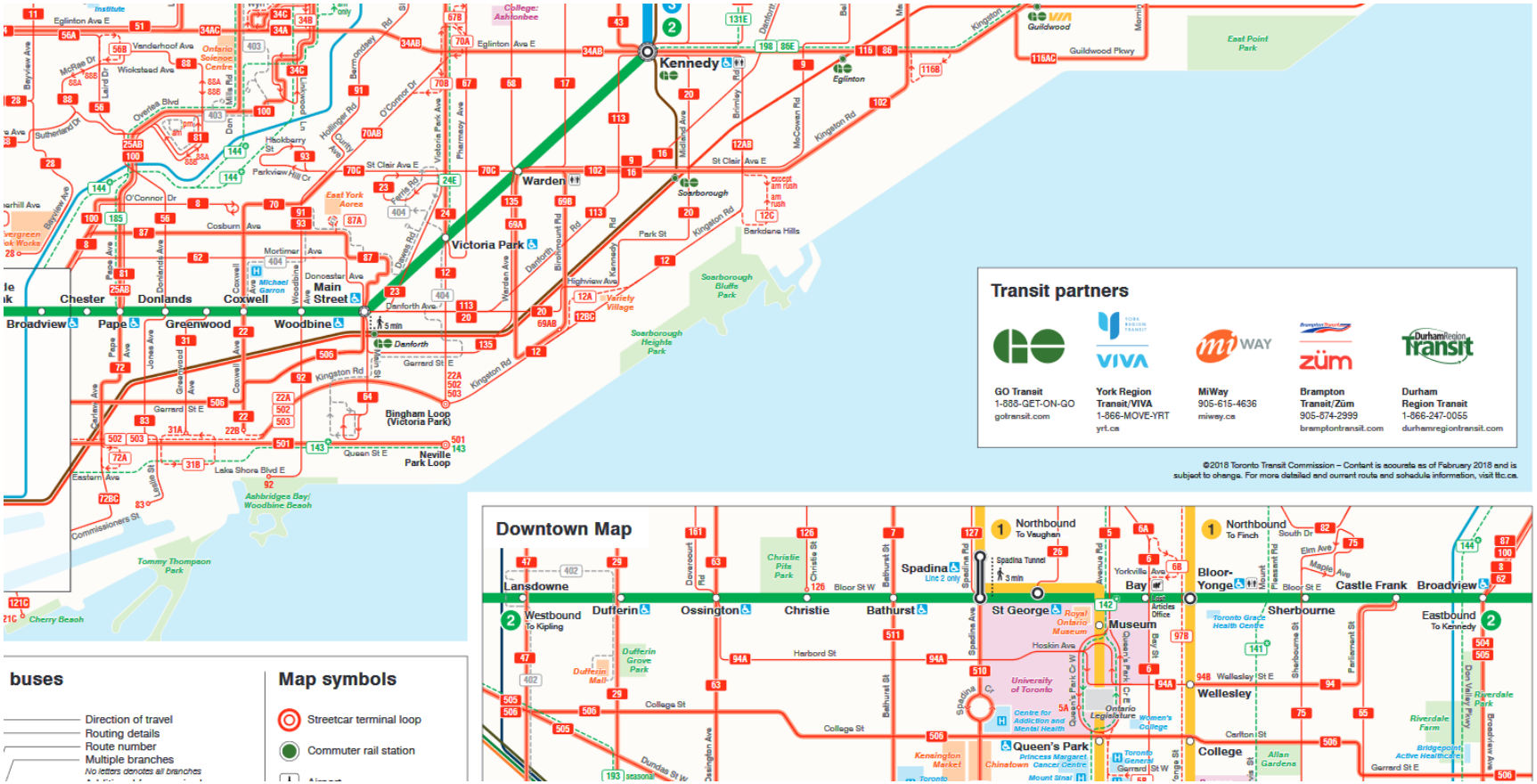

192 Airport Rocket
Provides 10-minute or better all-day accessible express bus service between Kipling Station and Pearson Airport. Luggage racks are available on this route.
Lake Ontario
See Downtown Map
Billy Bishop Airport (YTZ)
Kipling
Islington
Royal York
Jane
High Park
Dundas West
Dufferin
Christie
St George
Spadina
Bathurst
Lansdowne
Ossington
Museum
Queen's Park
St Patrick
Osgoode
St Andrew
Union
Bay
Sherbourne
Wellesley
College
Dundas
Queen
King
Bloor-Yonge
Castle Frank
Eglinton West
Eglinton
St Clair West
St Clair
Davisville
Summerhill
Rosedale
Dupont
Old Mill
Runnymede
Keele
Blue Night Network
Subway
1 Yonge-University Line
2 Bloor-Danforth Line
3 Scarborough Line
Streetcars and buses

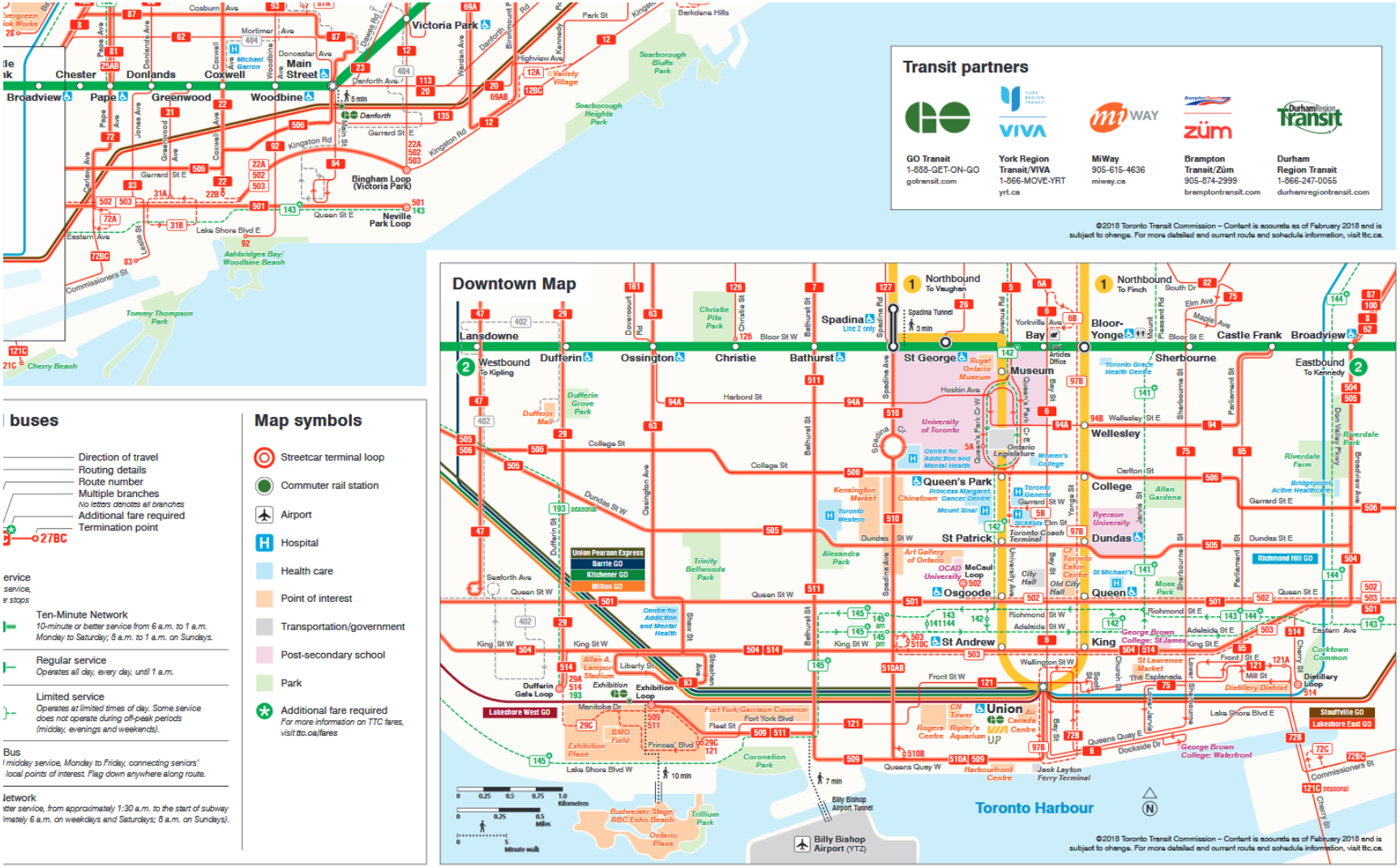

192 Airport Rocket
Provides 10-minute or better all-day accessible express bus service between Kipling Station and Pearson Airport. Luggage racks are available on this route.
Kipling
Islington
Royal York
Old Mill
Jane
Runnymede
High Park
Keele
Dundas West
Lansdowne
Dufferin
Ossington
Christie
Bathurst
Spadina
St George
Museum
Bay
Bloor-Yonge
Sherbourne
Castle Frank
Wellesley
Queen's Park
College
St Patrick
Dundas
Osgoode
Queen
St Andrew
King
Union
Exhibition
Lake Ontario
See Downtown Map
Billy Bishop Airport (YTZ)
Humber College: Lakeshore
Long Branch Loop
Sherway Gardens
Lakeshore West GO
Milton GO
Humber Loop
Mimico
High Park Loop


Blue Night Network
Last train departure times
Yonge-University Line
Bloor-Danforth Line
Scarborough Line
Sheppard Line
All Blue Night Network routes are accessible except for 301 Queen, 304 King and 306 Carlton streetcars. Not all stops along an accessible route are accessible.
Pearson Airport (YYZ)
Billy Bishop Airport (YTZ)
Bingham Loop (Victoria Park)
Neville Park Loop
Long Branch Loop
Exhibition Loop
©2018 Toronto Transit Commission – Content is accurate as of February 2018 and is subject to change. For more detailed and current route and schedule information, visit ttc.ca

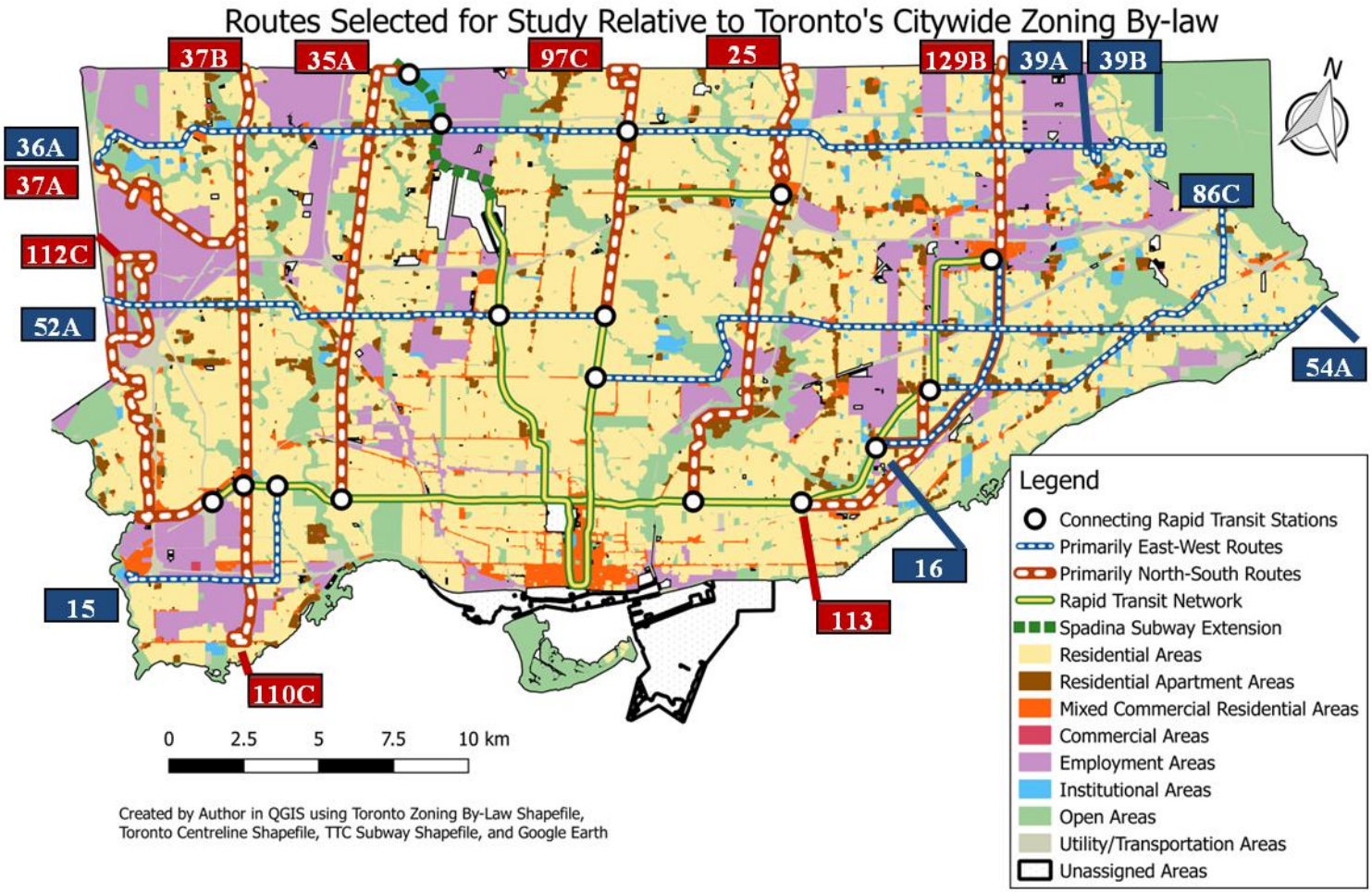

Subway
Yonge-University Line
Bloor-Danforth Line
Scarborough Line
Sheppard Line
Regular station
Interchange station
Intermodal station
Connects with other transit agencies
Accessible station
Washroom
Streetcars and bu
Local service
Streetcar and bus service
Express servic
Community Bus
Blue Night Netwo


Additional fare required north of Steeles Ave
See inset
Steeles Ave E
Finch Ave E
Sheppard Ave E
Ellesmere Rd
Lawrence Ave E
Eglinton Ave E
Bayview
Leslie
Bessarion
Don Mills
Midland
McCowan
Ellesmere
Scarborough Centre
Lawrence East
Kennedy
Toronto Zoo
Centennial College: Progress
Centennial College: Morningside
East Point Park
Rouge Hill
Guildwood
Eglinton
Lakeshore East GO


Transit partners
GO Transit
1-888-GET-ON-GO
gotransit.com
York Region Transit/VIVA
1-866-MOVE-YRT
yrt.ca
MiWay
905-615-4636
miway.ca
Brampton Transit/Züm
905-874-2999
bramptontransit.com
Durham Region Transit
1-866-247-0055
durhamregiontransit.com
©2018 Toronto Transit Commission – Content is accurate as of February 2018 and is subject to change. For more detailed and current route and schedule information, visit ttc.ca.
Downtown Map
buses
Direction of travel
Routing details
Route number
Multiple branches
No letters denotes all branches
Map symbols
Streetcar terminal loop
Commuter rail station
Kennedy
Warden
Victoria Park
Main Street
Broadview
Chester
Pape
Donlands
Greenwood
Coxwell
Woodbine
Danforth
Bingham Loop (Victoria Park)
Neville Park Loop
Lansdowne
Dufferin
Ossington
Christie
Bathurst
Spadina
St George
Bay
Bloor-Yonge
Sherbourne
Castle Frank
Broadview
Eastbound To Kennedy
Westbound To Kipling
Northbound To Vaughan
Northbound To Finch
Museum
Queen's Park
Wellesley
College


Transit partners
GO Transit
1-888-GET-ON-GO
gotransit.com
York Region Transit/VIVA
1-866-MOVE-YRT
yrt.ca
MiWay
905-615-4636
miway.ca
Brampton Transit/Züm
905-874-2999
bramptontransit.com
Durham Region Transit
1-866-247-0055
durhamregiontransit.com
©2018 Toronto Transit Commission – Content is accurate as of February 2018 and is subject to change. For more detailed and current route and schedule information, visit ttc.ca.
buses
Direction of travel
Routing details
Route number
Multiple branches
No letters denotes all branches
Additional fare required
Termination point
27BC
Ten-Minute Network
10-minute or better service from 6 a.m. to 1 a.m. Monday to Saturday; 8 a.m. to 1 a.m. on Sundays.
Regular service
Operates all day, every day, until 1 a.m.
Limited service
Operates at limited times of day. Some service does not operate during off-peak periods (midday, evenings and weekends).
Bus
midday service, Monday to Friday, connecting seniors' local points of interest. Flag down anywhere along route.
network
better service, from approximately 1:30 a.m. to the start of subway imately 6 a.m. on weekdays and Saturdays; 8 a.m. on Sundays).
Map symbols
Streetcar terminal loop
Commuter rail station
Airport
Hospital
Health care
Point of interest
Transportation/government
Post-secondary school
Park
Additional fare required
For more information on TTC fares, visit ttc.ca/fares
Downtown Map
Toronto Harbour
Billy Bishop Airport (YTZ)
©2018 Toronto Transit Commission – Content is accurate as of February 2018 and is subject to change. For more detailed and current route and schedule information, visit ttc.ca.

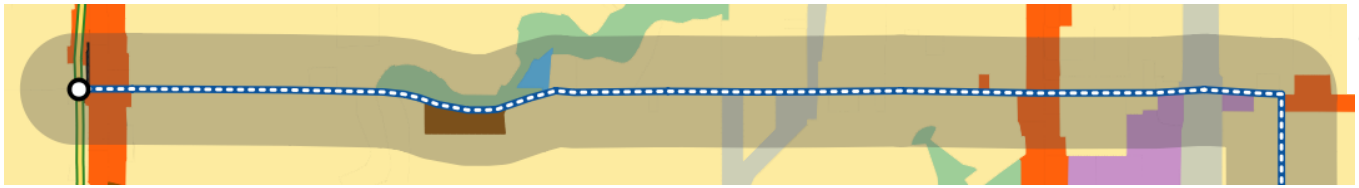
Appendix C: Land Uses in the Vicinity of the Selected Bus Routes

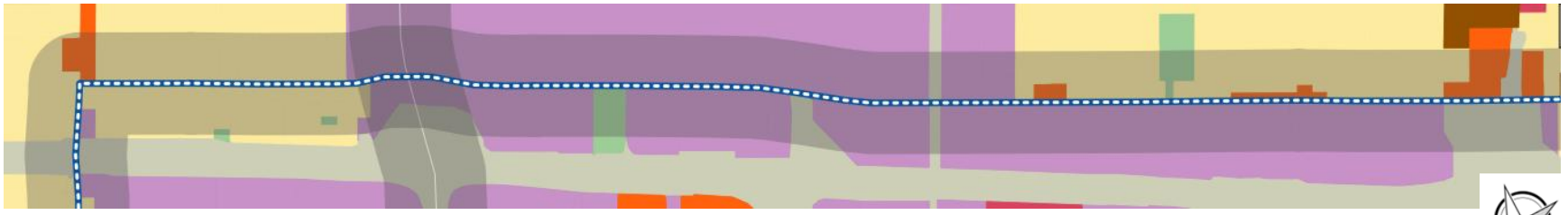


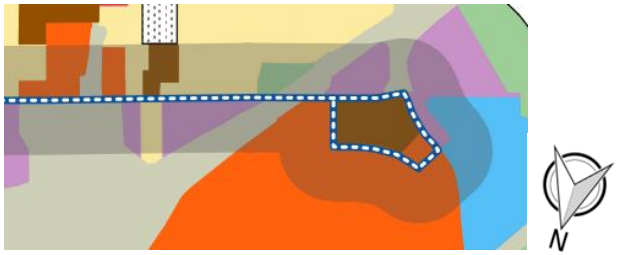
The following images (of unknown but relatively consistent scale) in Appendix C were created by the Author in QGIS using Toronto Zoning By-Law Shapefile, City of Toronto Centreline Shapefile, TTC Subway Shapefile and Google Earth.

The shaded buffer around routes represents areas that are within a roughly 200m direct line distance of the respective route

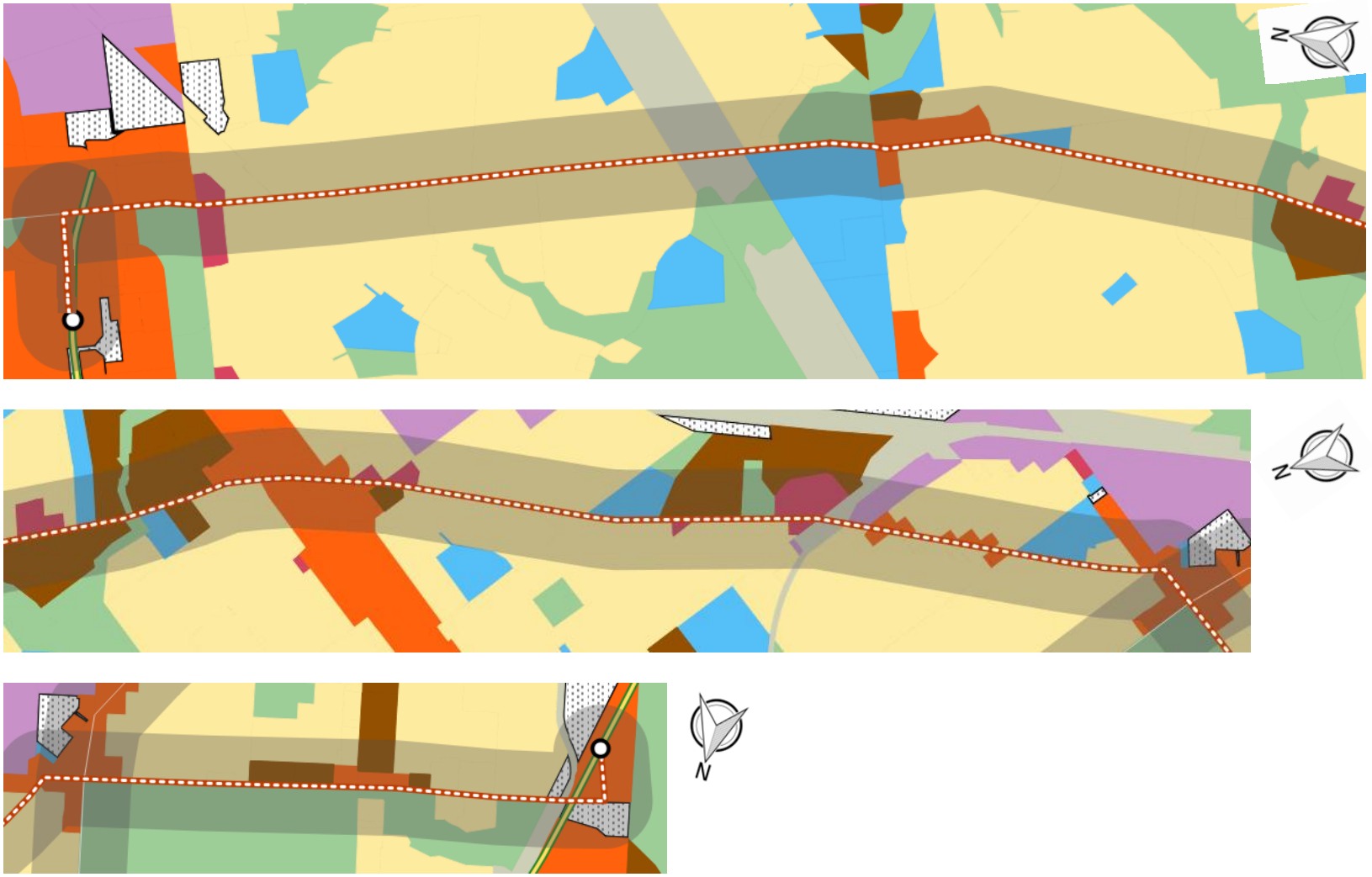
15 Evans



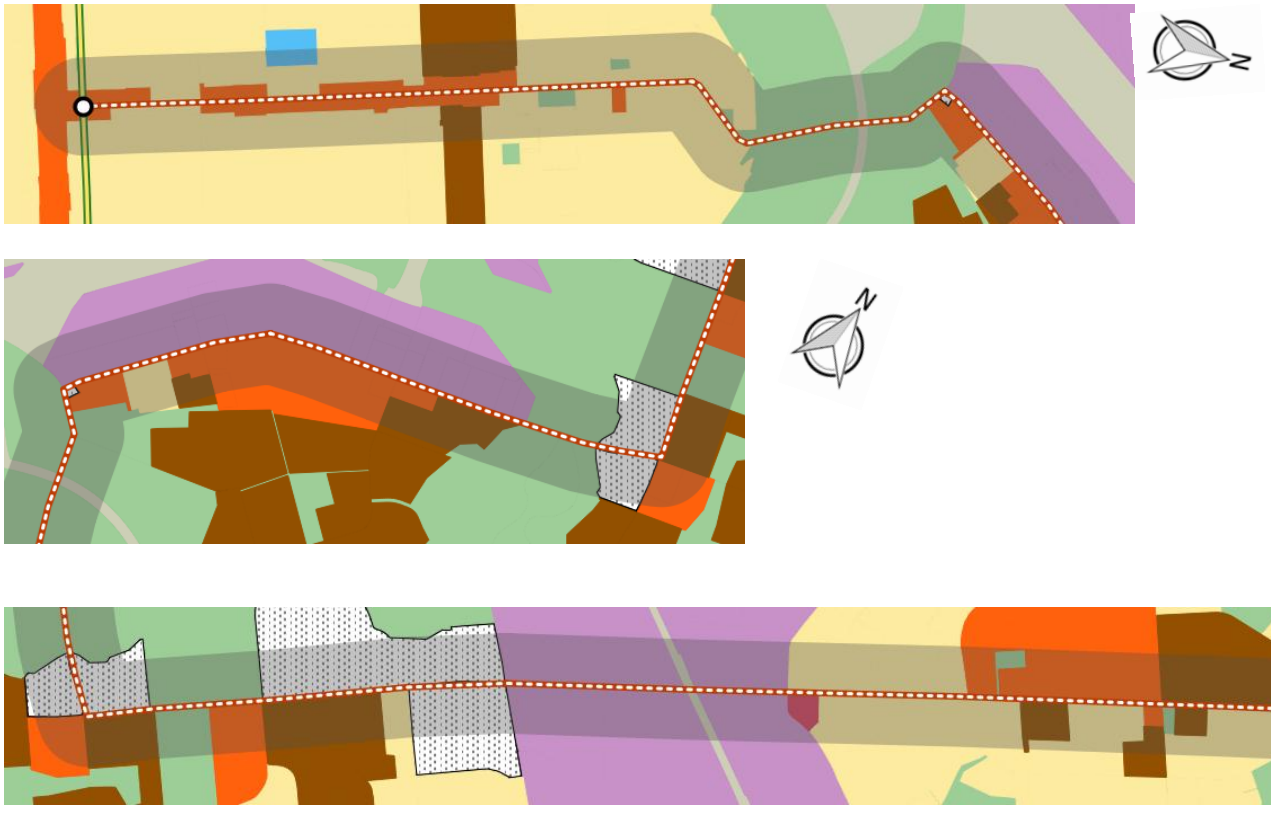




16 McCowan

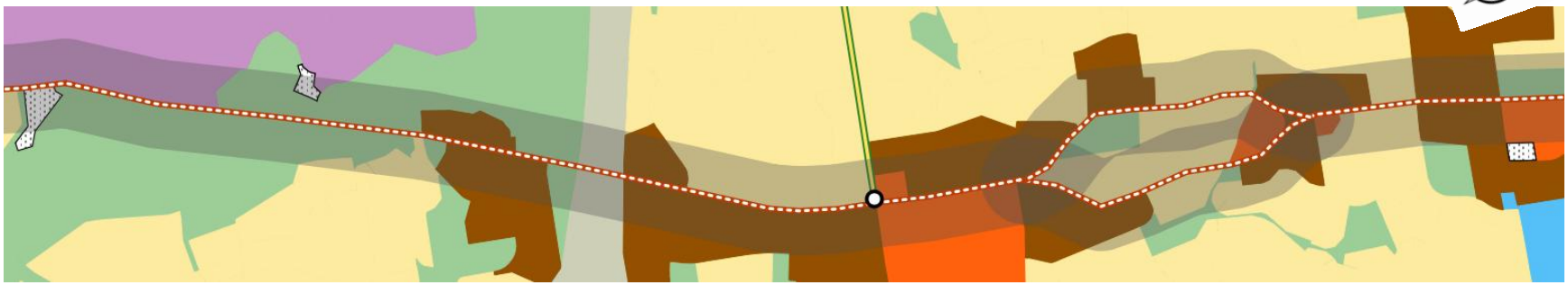


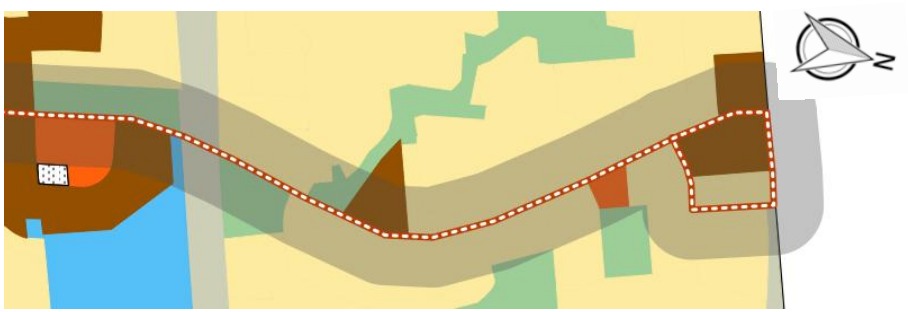
25 Don Mills



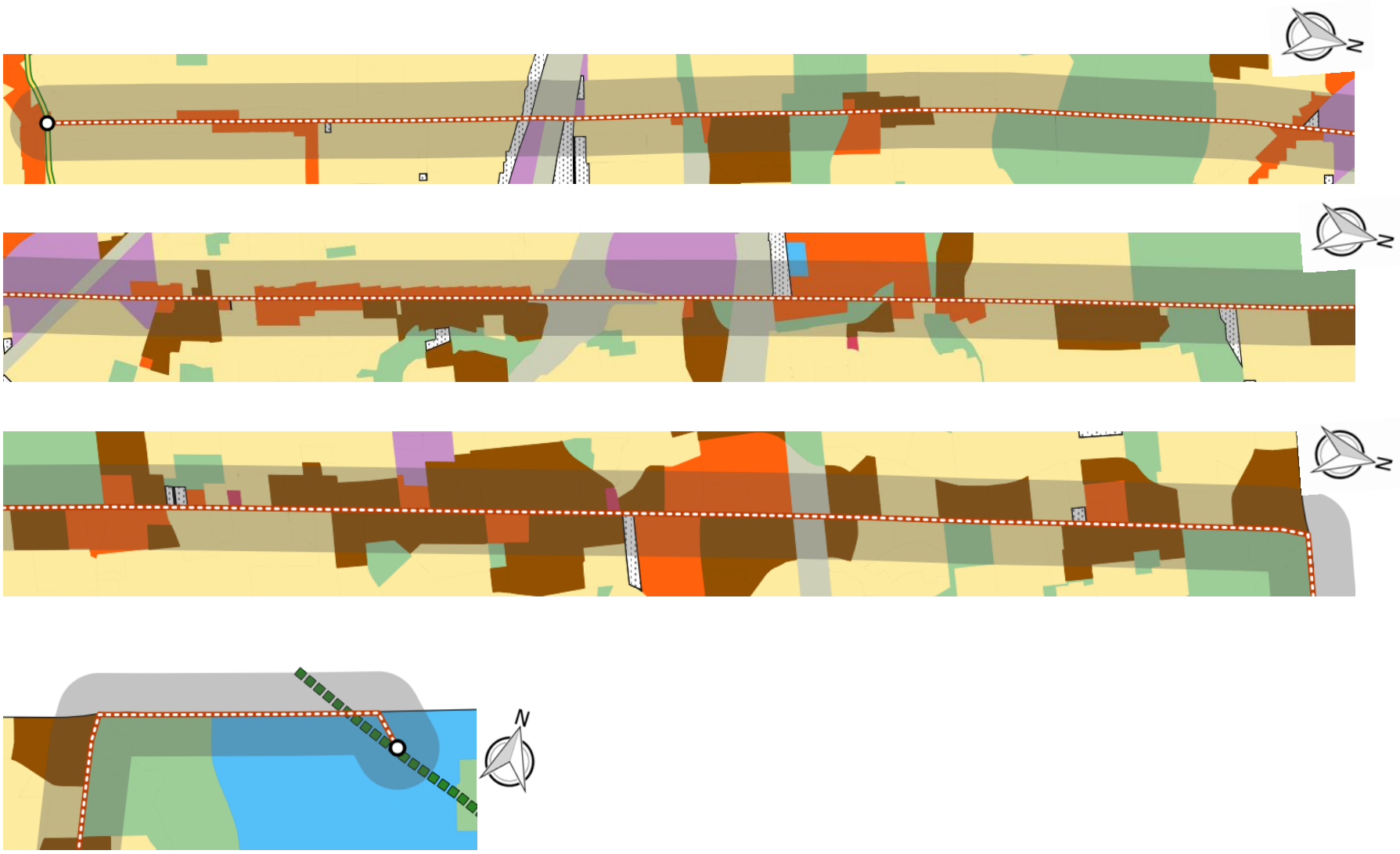
(continued)

25 Don Mills (continued)

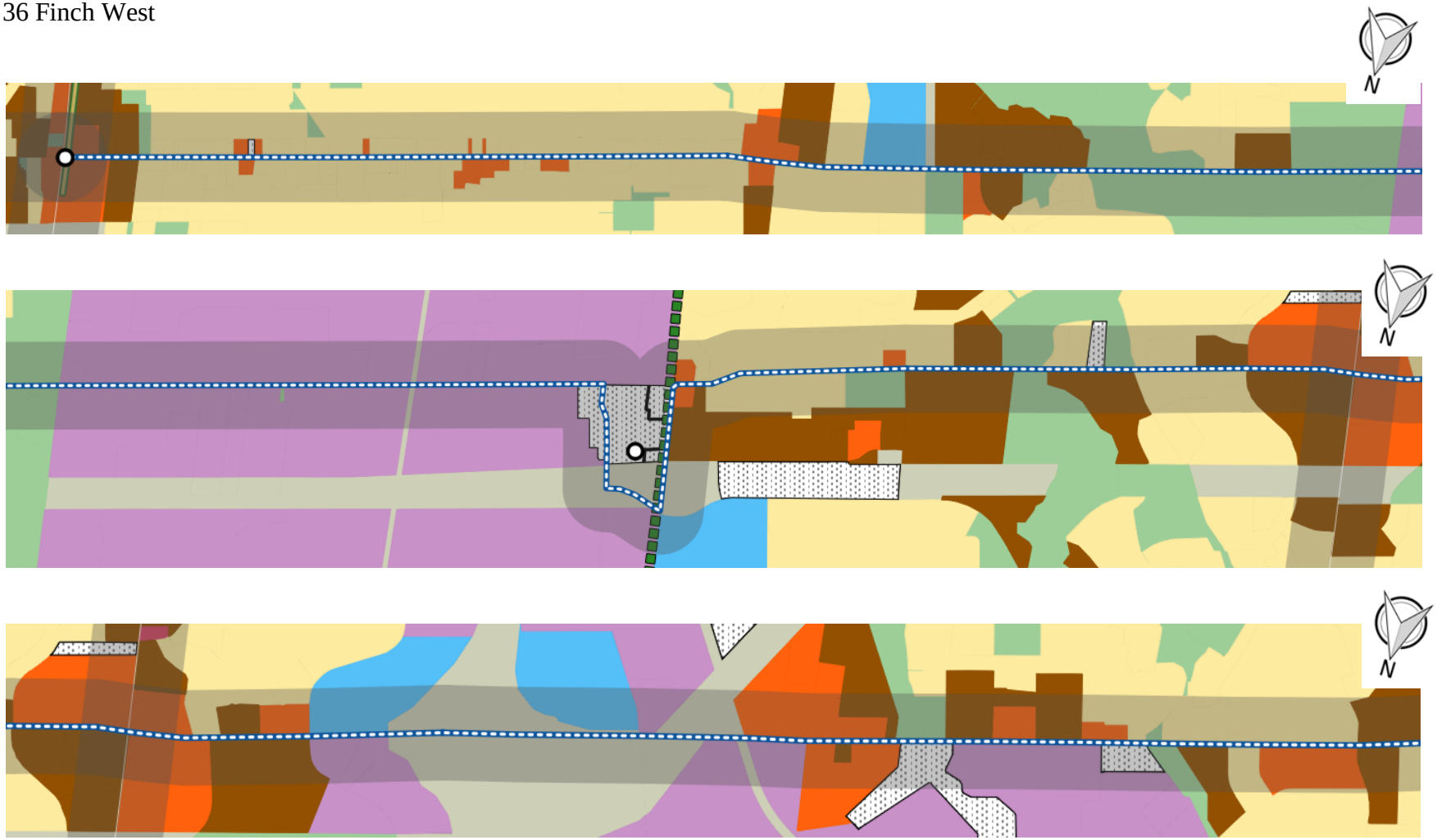




35 Jane



36 Finch West



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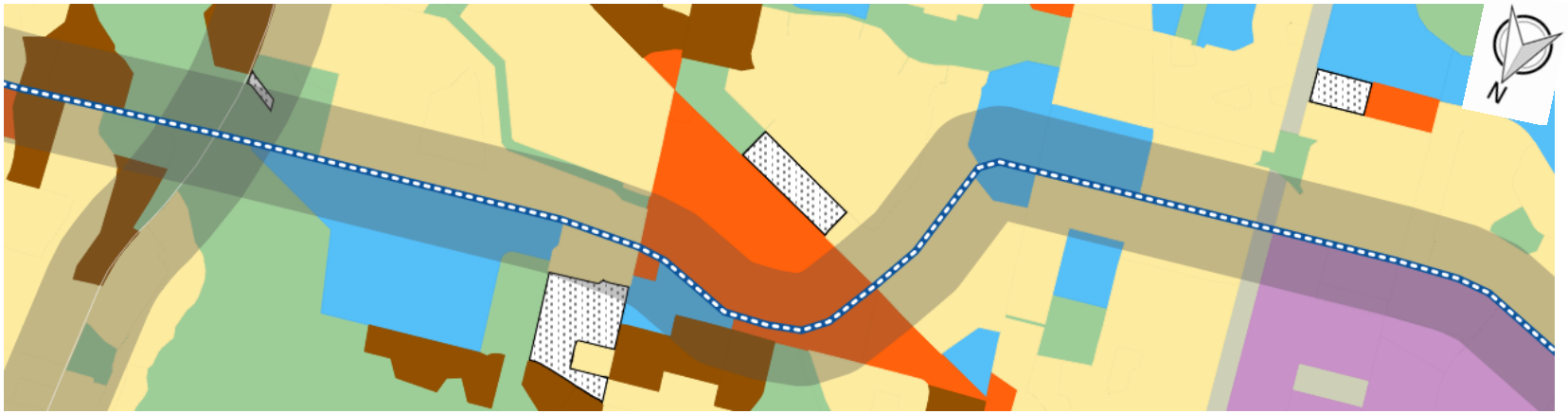
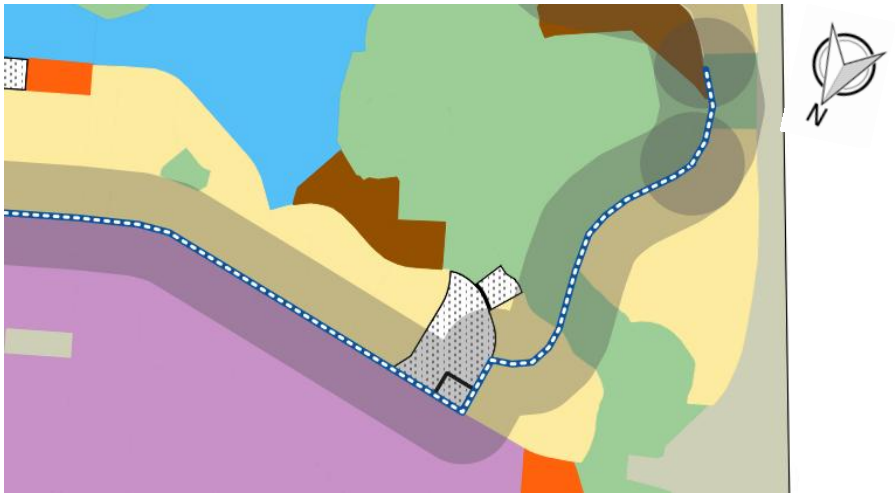
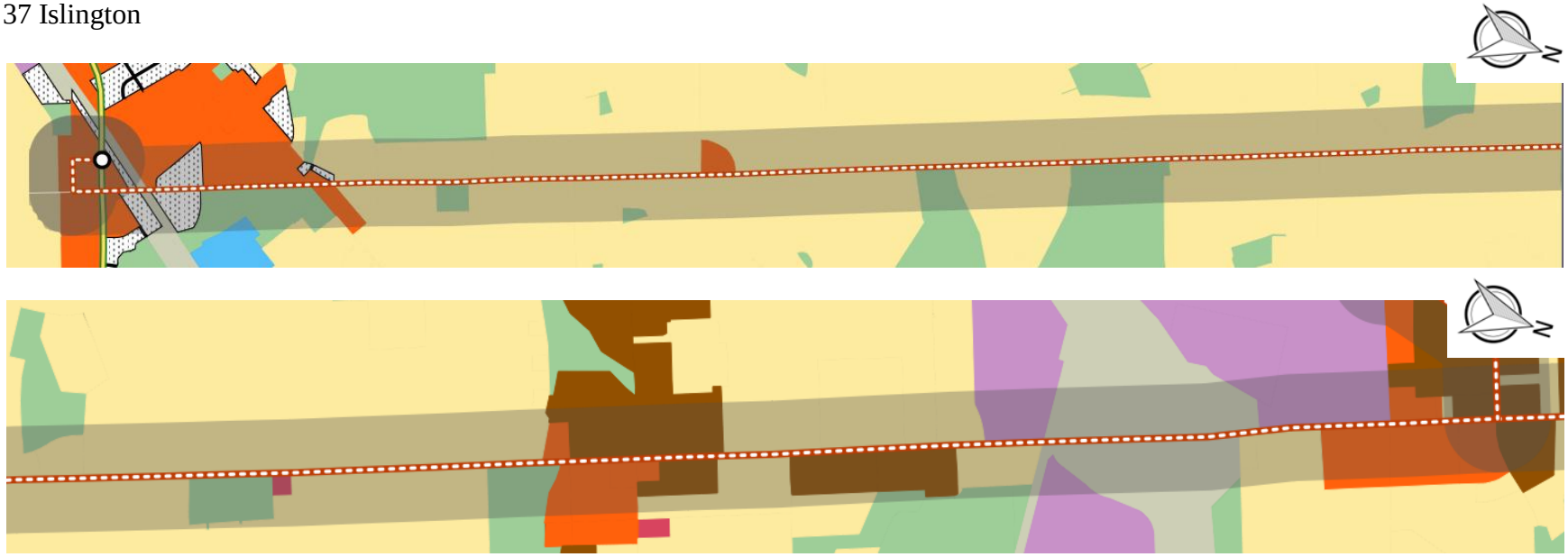
36 Finch West (continued)





37 Islington



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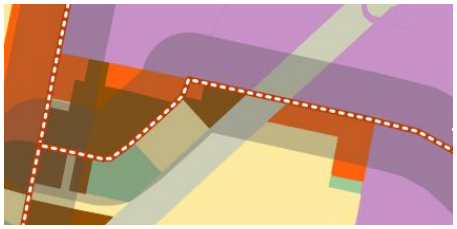
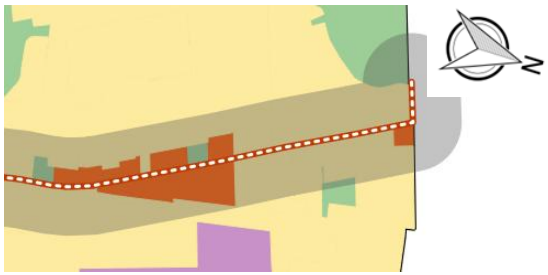
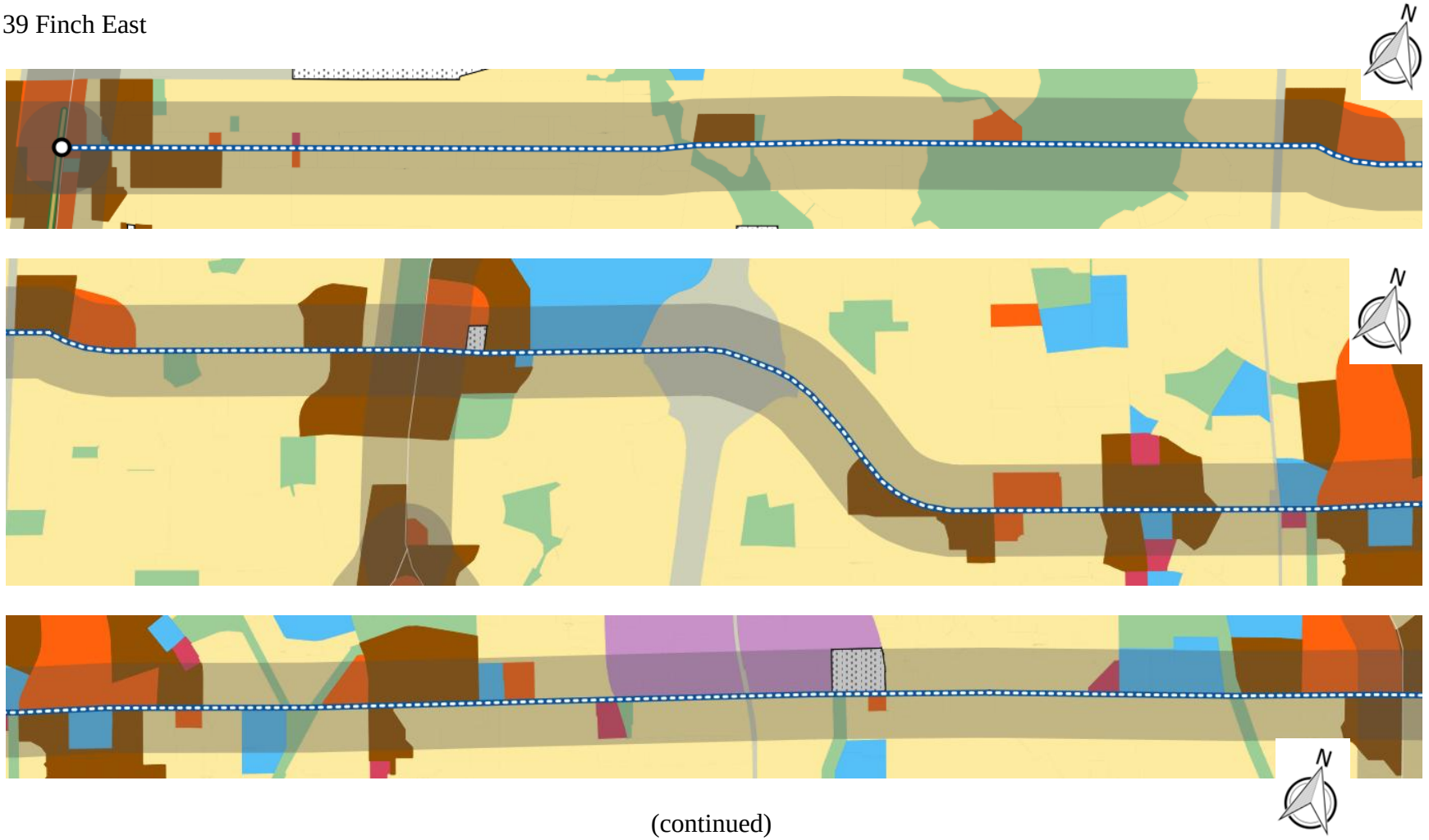
37 Islington (continued) “A” branch



37 Islington (continued) “B” branch



39 Finch East



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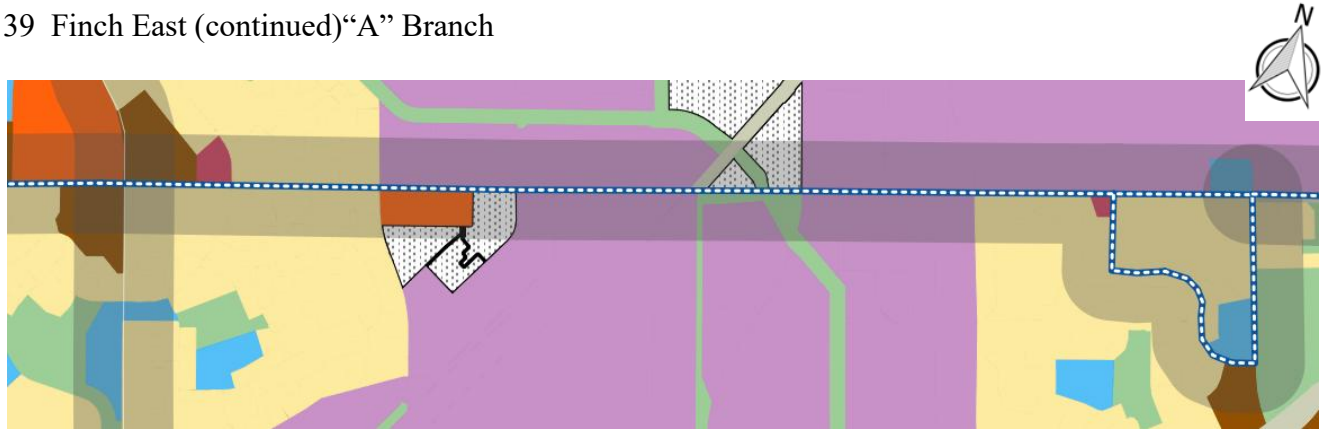
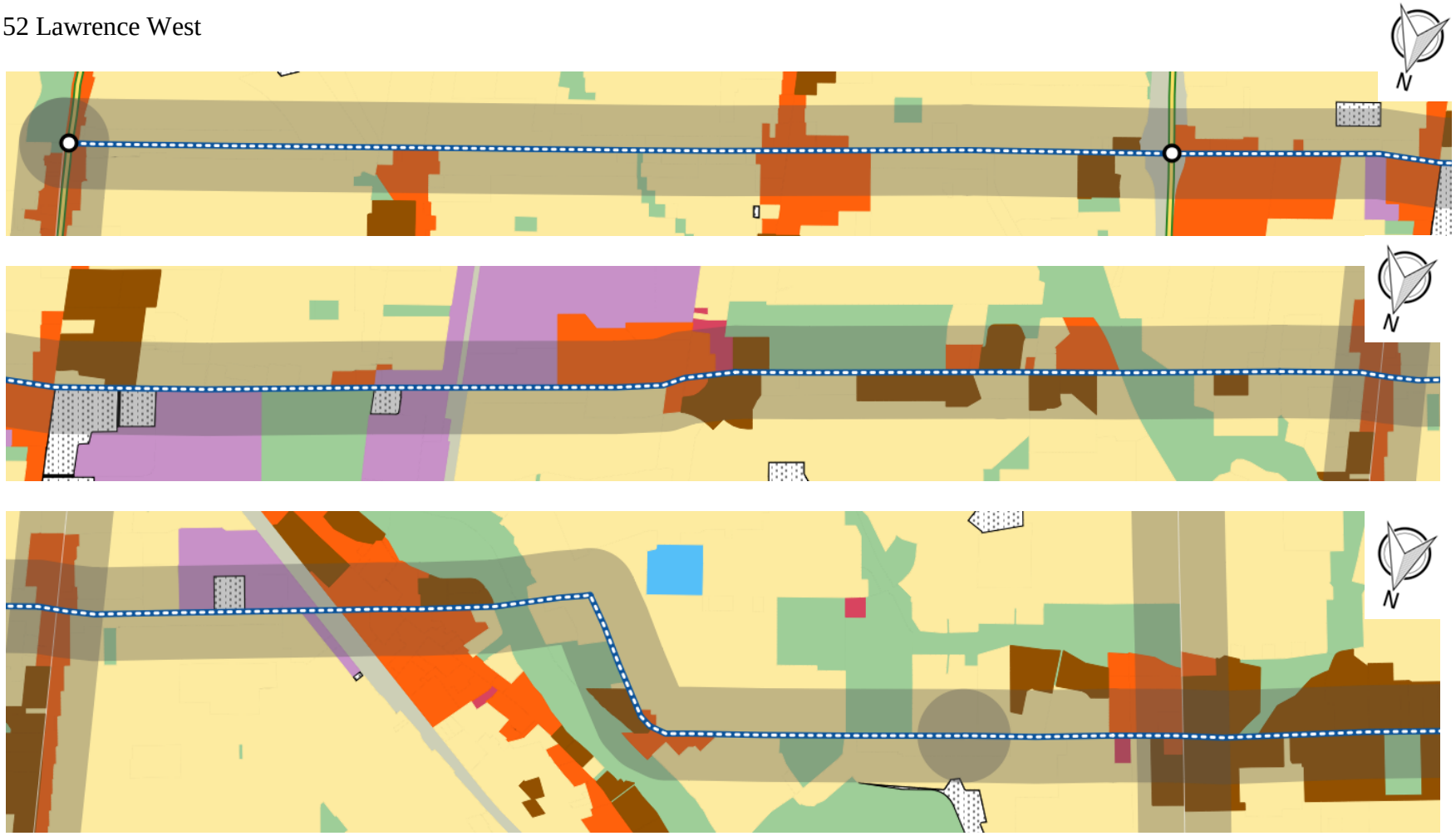
39 Finch East (continued)“A” Branch



39 Finch East (continued)“B” Branch

52 Lawrence West



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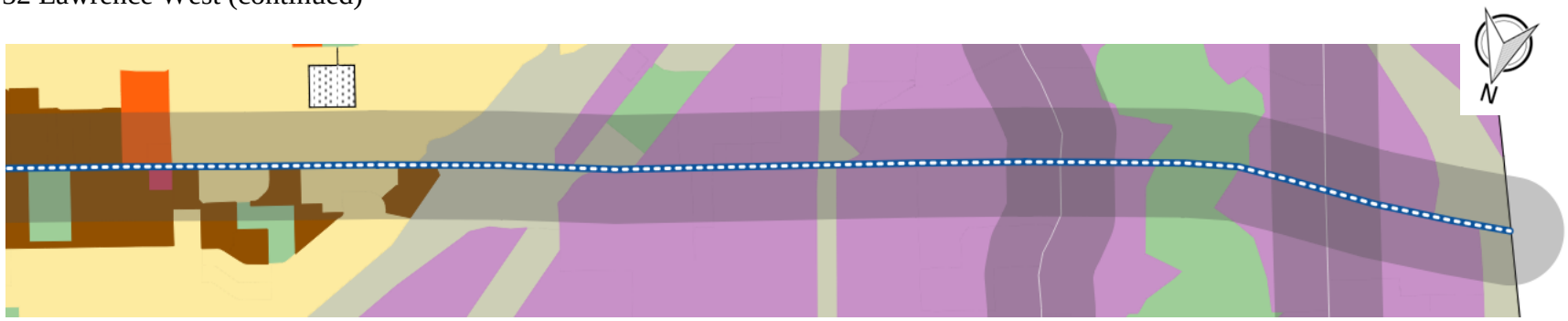
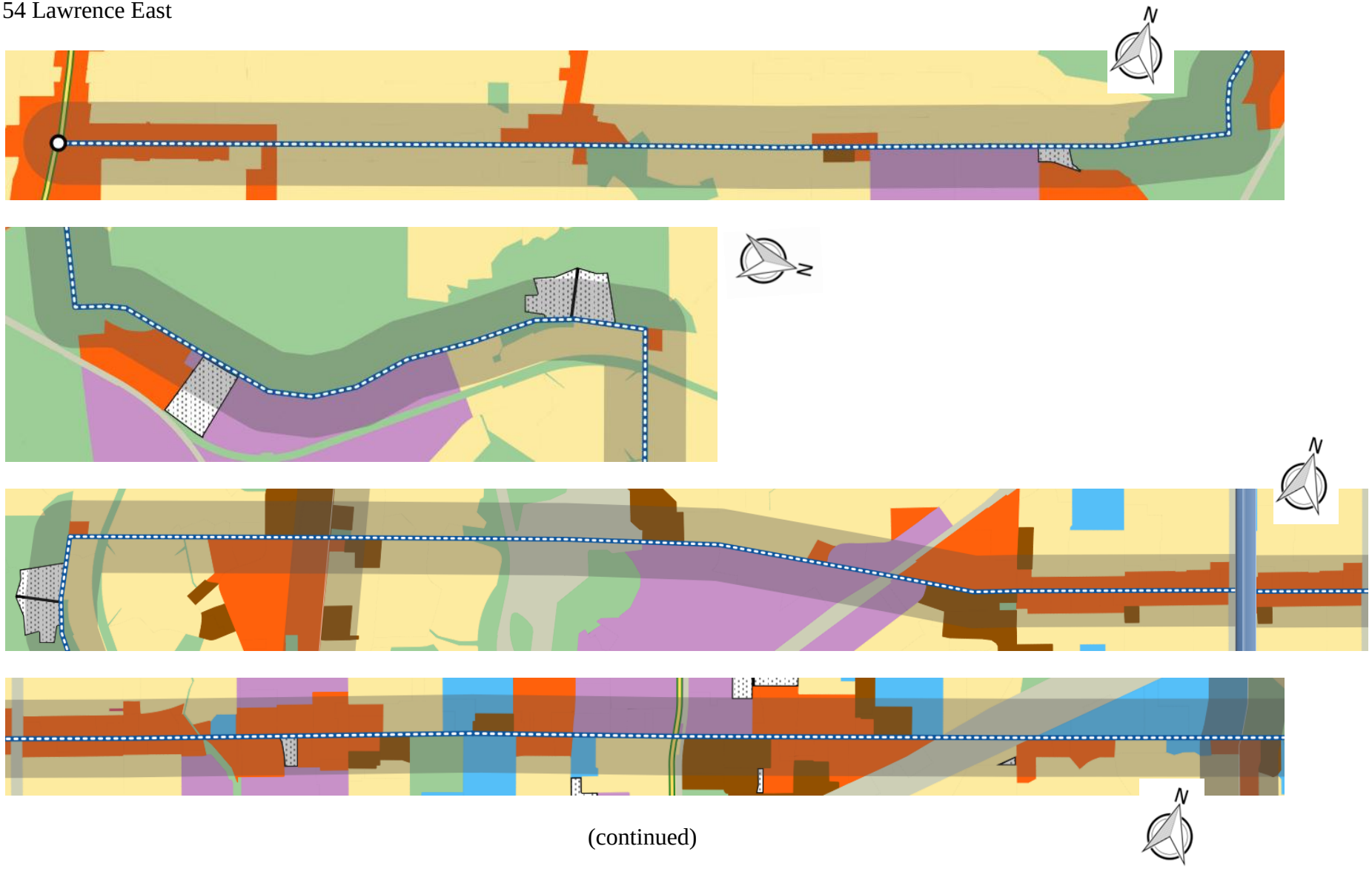
52 Lawrence West (continued)



54 Lawrence East



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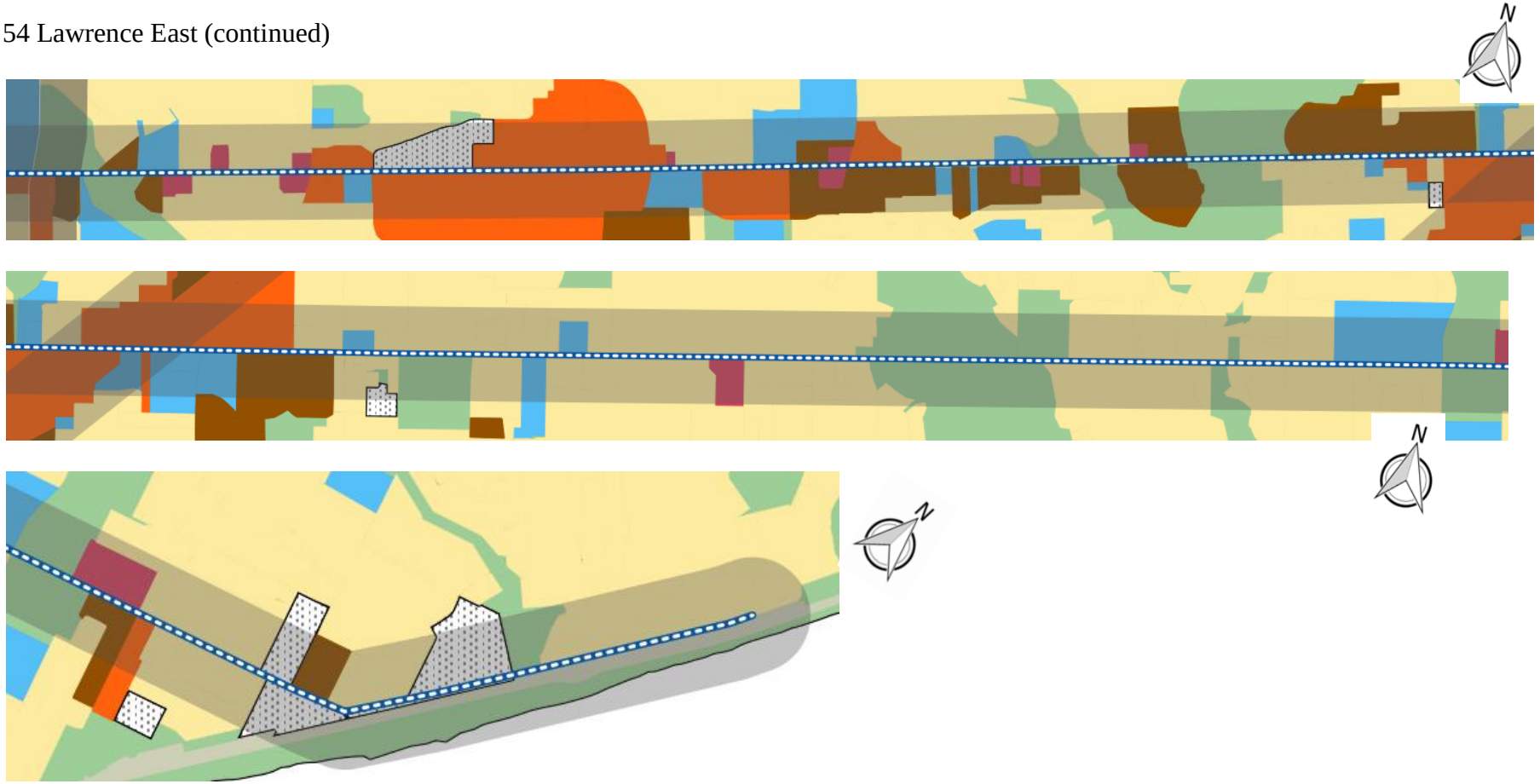
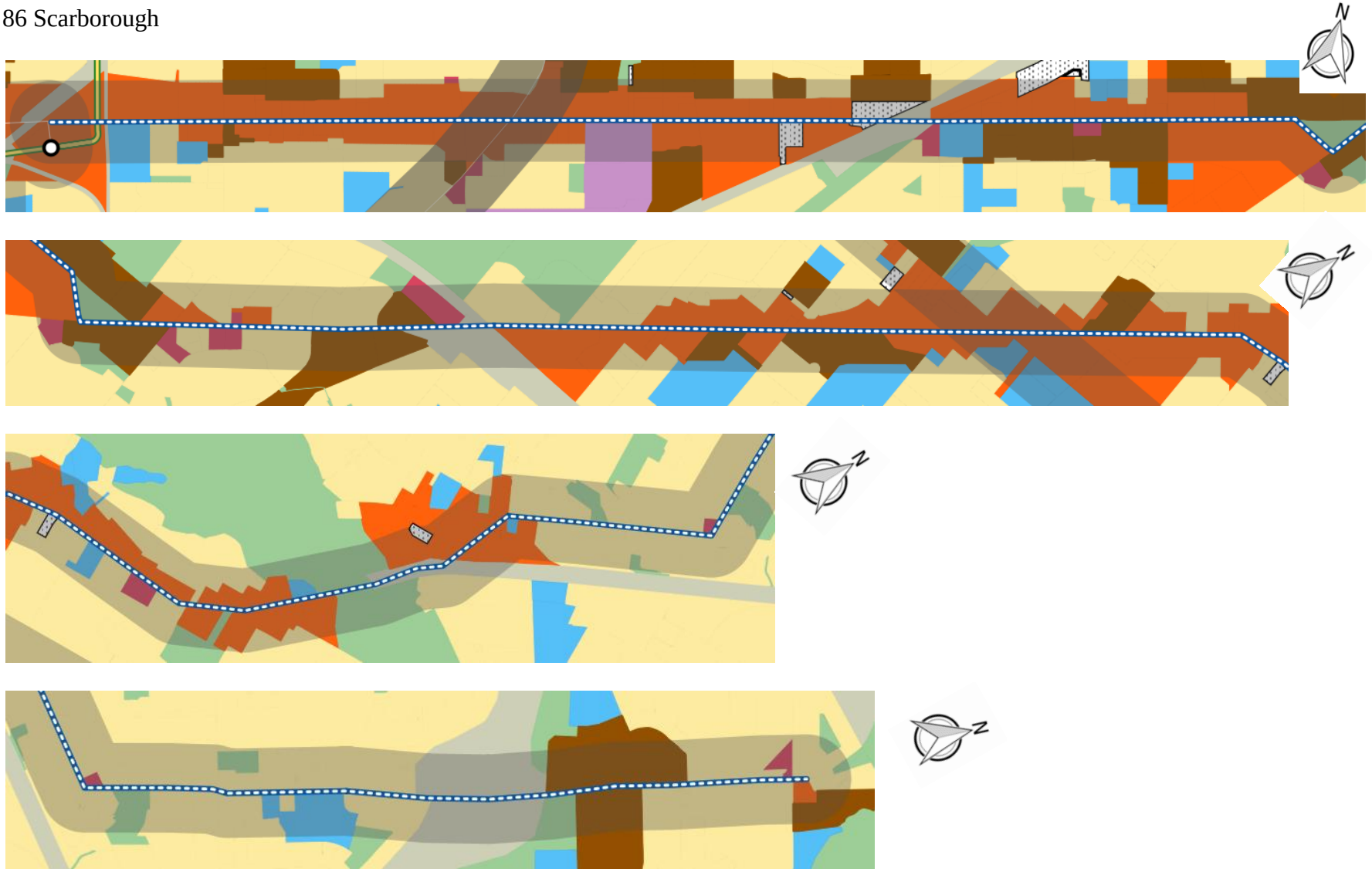
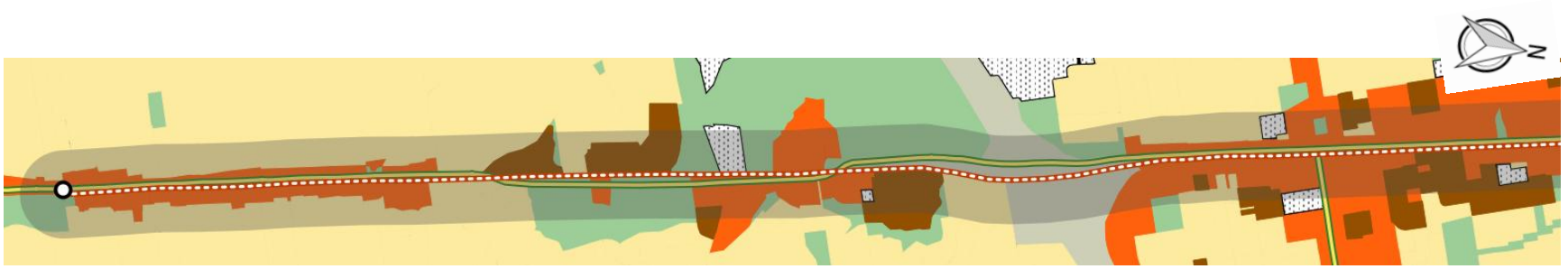
54 Lawrence East (continued)



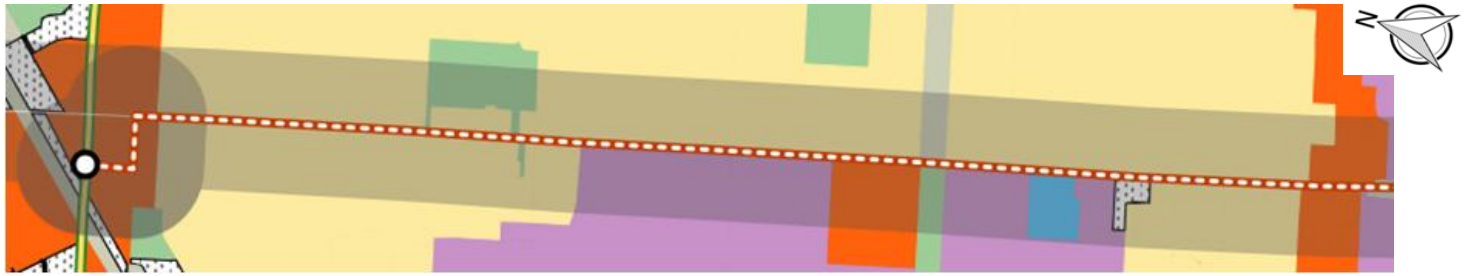
86 Scarborough

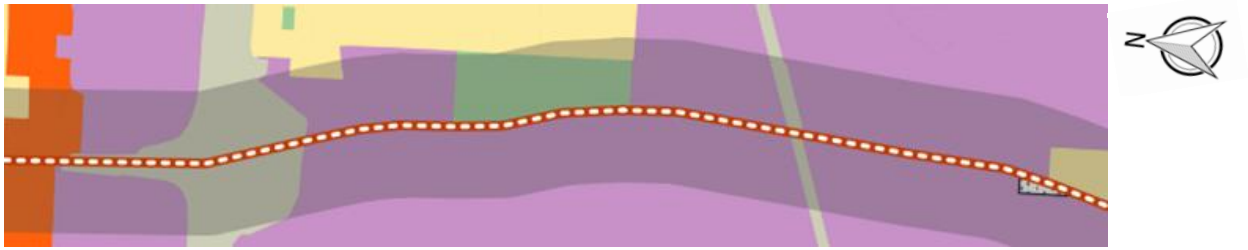


97 Yonge

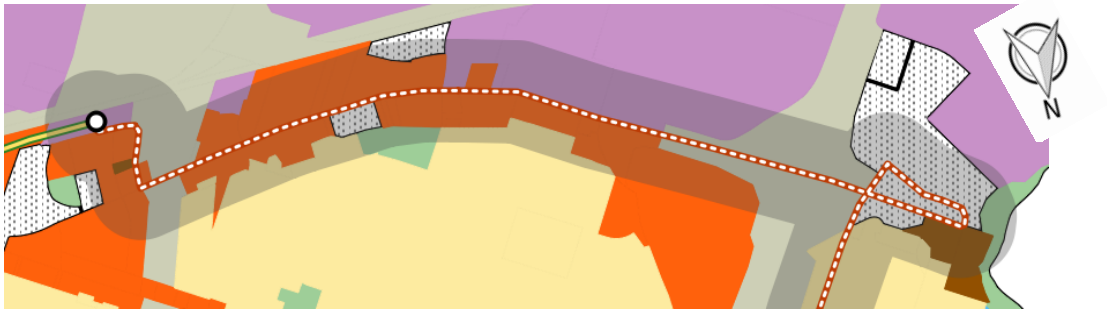


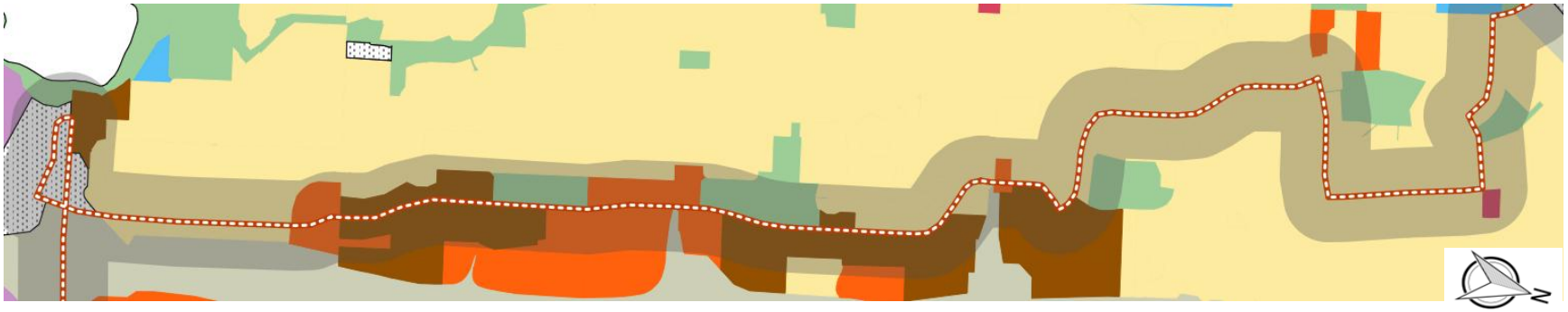
110 Islington South





112 West Mall





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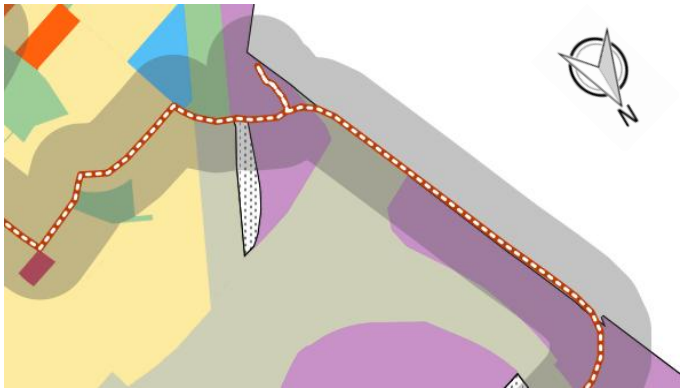
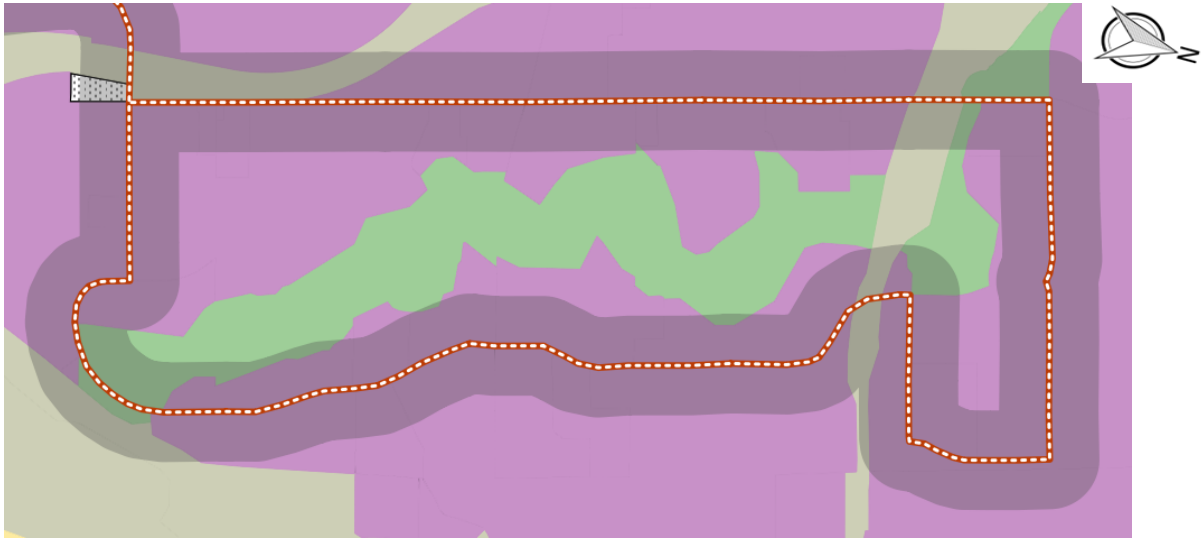
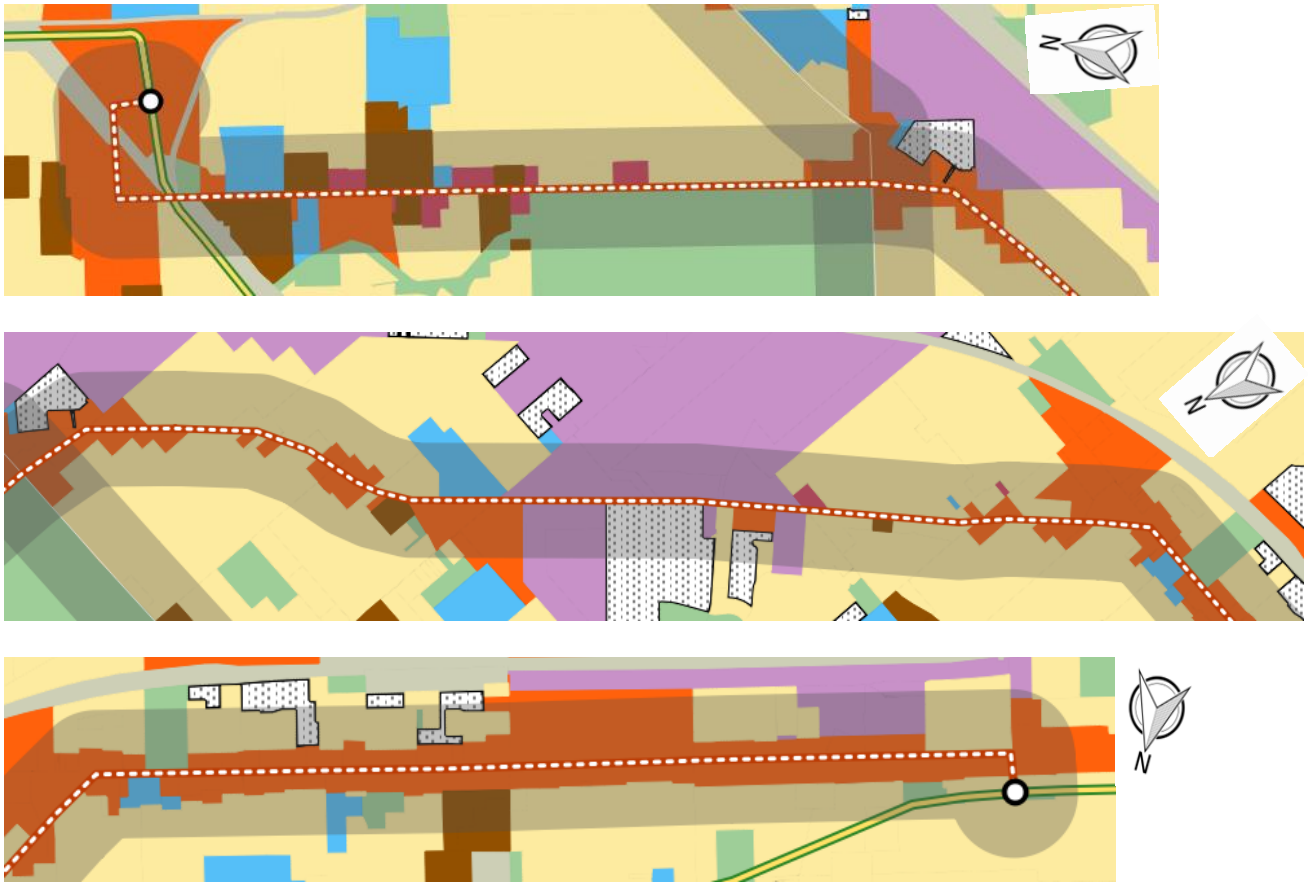
112 West Mall (continued)

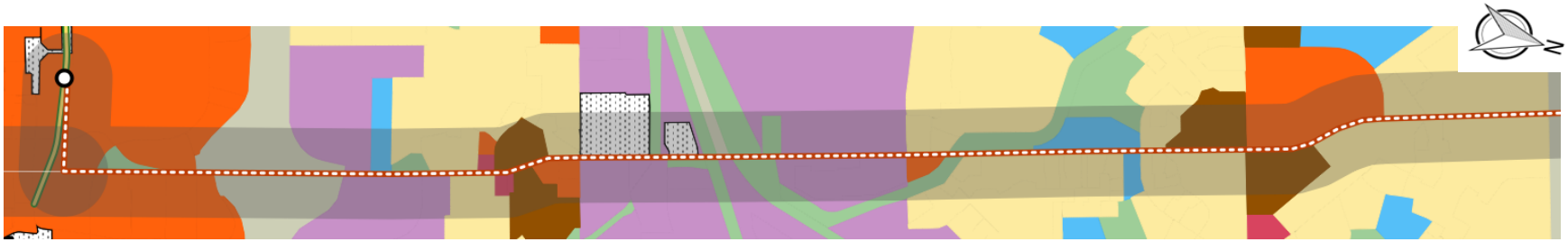


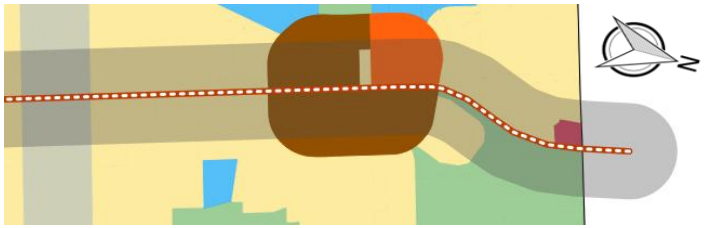


113 Danforth



129 McCowan





Appendix D: Rectifiable Potentially Problematic Stops

Ambient Streetlighting Changes

Change	Available existing pole?	Sunk Costs Bay/ Shelter	Rating	Route	Stop	Comments
Install	Yes	Yes	DIM	35 SB	Alliance Avenue	Nearest pole offset across street 30m away.
Install	Yes	Yes	PASS.	35 NB	Lambton Avenue North Side	Nearest streetlight offset over 25m away.
Install	Yes	Yes	PASS.	37 NB	Allenby Avenue	Nearest pole sameside 25m away.
Install	Yes	No	PASS.	37 SB	Riverbank Drive	Nearest pole same side roughly 25m away, in evenly spaced 1-none-1 gap.
Install	Yes	Yes	PASS.	39 WB	Finchdene Square West Side	Nearest poles offset across street roughly 20-25m away.
Install	Yes	Yes	PASS.	39 EB	Scottfield Drive	Nearest pole offset across street 25m away.
Install	Yes	Yes	PASS.	110 NB	Bering Avenue North Side	Nearest pole offset across street 20m away.
Erect	No	Yes	PASS.	36 EB	Kipling Avenue	Random gap in opposite pole spacing, nearest opposite pole more/about 25m away, same side pole just under 25m away.
Erect	No	Yes	PASS.	37A NB	Queens Plate Drive at Janda Court	Nearest pole across street roughly 25m away.
Erect	Yes	Yes	PASS.	39 WB	Winlock Park	Nearest pole offset across street 20m+ away.
Erect	Yes	Yes	PASS.	52 EB	Glen Rush Boulevard	Nearest poles offset across street 20m+ away.
Erect	No	No	DIM	86 WB	Kingston Road at Beechgrove Drive	Roughly between 35m spaced median streetlight poles.
Erect	Yes	Yes	PASS.	129 NB	Kenhatch Boulevard	Streetlight pole directly across over 25m away, no available height poles in vicinity of stop but traffic light pole could be swapped.

(continued)

Ambient Streetlighting Changes (continued)

Change	Available existing pole?	Sunk Costs Bay/ Shelter	Rating	Route	Stop	Comments
Erect	Yes	Yes	PASS.	129 NB	Sandhurst Circle South	Streetlight pole directly across over 25m away, no available height poles in vicinity of stop but traffic light pole could be swapped.
Erect	Yes	Yes	PASS.	129 SB	Commander Boulevard	Nearest pole offset across street by 20m+.
Erect	No	Yes	PASS.	129 SB	2050 McCowan Road	Nearest pole offset across street 25m away.
Relocate/ Erect	No	Yes	PASS.	36 WB	1150 Finch Avenue West	Middle of evenly spaced same-side poles but recessed, roughly 25m, shelter far but near pole.
Relocate/ Erect	No	Yes	PASS.	36 WB	Albion Road South Side	Pole directly across street but 7 lanes of traffic and median.
Relocate/ Erect	No	Yes	PASS.	36 EB	Ancona Street	In between same side poles, 25m+ one, just 20-25 other.
Relocate/ Erect	No	Yes	PASS.	39 WB	Old Finch Avenue at Baffin Court	Streetlight pole angled across at/ just under 25m away.
Relocate/ Erect	No	Yes	PASS.	113EB	Danforth Road at Landry Avenue	Streetlight poles angled across at/just under 25m away No poles nearby.

Land Use Change

Route (Direction)	Stop (Side of intersection)	Rating	Recom.	Impact of Action	Existing Condition *Location, Adjacent LU/ Opposite LU*	Recom. Condition *Location, Adjacent LU/ Opposite LU*	Sunk Costs (Shelter/ Bay)
25 SB	Duncan Mills Rd (South)	Yes	Move	Sig.	Farside, ONR/ON	Nearside, RA3/RA3	Yes
36 WB	Dufferin St	Yes	Move	Sig.	Nearside, O/ON	Farside, CPO2/CG	Yes
37B NB	Elmhurst Dr	Yes	Move	Sig.	Nearside, UT,CF	Farside, RA2/CR	Yes
37B SB	Golfdown Dr	Yes	Move	Sig.	Nearside, UT/RD	Farside, RA1/RD	Yes
39B WB	Old Finch Ave at Baffin Crt (West)	Yes	Move	Sig.	Far-farside, ONR/ON	Farside, RD/ON	Yes
52 WB	Dixon Rd at Carlingview Dr	Yes	Move	Sig.	Nearside, PL/CL	Farside, CLR PL/CL	Yes
52 EB	Hickory Tree Rd	Yes	Move	Sig.	Far-nearside, OP/ONR PL	Farside, RD/RD	Yes
54 EB	Victoria Park Ave (East)	Yes	Remove	Sig.	Nearside, OC/CR	/	Yes
16 NB	Danforth Rd at Savarin St	Yes	Move	Notic.	Far-farside, O/RA2	Nearside, RD/RA2	Yes
16 NB	St Andrews Rd	Yes	Move	Notic.	Nearside, UT/UT	Farside, UT/RD	No
25 NB	Graydon Hall Dr	Yes	Move	Notic.	Nearside, ONR/ONR	Farside, RA3/RA3	Yes
25 NB	Sheppard Ave East (North)	Yes	Move	Notic.	Far-farside, PG/CG	Nearside, RA3/RM	No
25 SB	Finch Ave East	Yes	Move	Notic.	Farside, OP/RA3	Nearside, CG/RA3	Yes
25 SB	York Mills Rd	Yes	Remove	Notic.	Nearside, ONR/ONR	/	Yes
35 NB	Lambton Ave (North)	Yes	Move	Notic.	Farside, ON/SCHL	Nearside, CS/RD	Yes
35 SB	Troutbrooke Dr	Yes	Move	Notic.	Far-nearside, O/O	Farside, ON/RM	Yes
35 SB	Haney Ave	Yes	Move	Notic.	Nearside, OP/RA2	Farside, MCRS/RA2	Yes
36 WB	Wilmington Ave	Yes	Move	Notic.	Nearside, ONR/RD	Farside, ONR/RA2	Yes

(continued)

Land Use Change (continued)

Route (Direction)	Stop (Side of intersection)	Rating	Recom.	Impact of Action	Existing Condition *Location, Adjacent LU/ Opposite LU*	Recom. Condition *Location, Adjacent LU/ Opposite LU*	Sunk Costs (Shelter/ Bay)
36 EB	Beecroft Rd	Yes	Move	Notic.	Nearside, OP/RD	Farside, RA3/RAC3	No
37A NB	Queens Plate Dr West at Janda	Yes	Move	Notic.	Nearside, PL/CM PL	Farside, RM/PL	No
39 EB	Bridletowne Circle West	Yes	Move	Notic.	Nearside, OH/CF	Farside, RA2/CS	Yes
39 EB	Warden Ave	Yes	Move	Notic.	Nearside, OC/PL	Farside, CP1/RA2	Yes
39B EB	Neilson Rd	Yes	Move	Notic.	Nearside, O/CF	Farside, RM/CO1	Yes
52 WB	Varna Dr (West)	Yes	Move	Notic.	Farside, SCHY/RD	Nearside, RM/RD	Yes
52 WB	Jane St	Yes	Move	Notic.	Nearside, CA/CSM	Farside, CSM/CS	Yes
52 WB	Dixon Rd at St Phillips Rd	Yes	Move	Notic.	Nearside, OC/CF	Farside, OP/OC	Yes
52 EB	Brookview Dr	Yes	Move	Notic.	Nearside, SCHY/RA1	Farside, RD/RA1	Yes
54 WB	Opposite 4125 Lawrence Ave East	Yes	Move	Notic.	Midblock, OP/CP1	Midblock (West) RA2/CO1	Yes
54 WB	Brimley Rd (West)	Yes	Move	Notic.	Farside, UT/UT	Nearside, UTR/CR	Yes
54 WB	Gooderham Dr	Yes	Move	Notic.	Nearside, CA/CSM	Farside, RS2,CSM	Yes
54 EB	1125 Leslie St	Yes	Move	Notic.	Midblock, ON/ONR	Midblock, CO2/ONR	Yes
54 EB	Bellamy Rd North	Yes	Move	Notic.	Nearside, CA/CS	Farside, CS/CG	Yes
86 EB	Eglinton Ave at Midland Ave	Yes	Move	Notic.	Nearside, CA/CSM PL	Farside, RA1/CSM	Yes
110 NB	Titan Rd	Yes	Move	Notic.	Nearside, UT/CSM PL	Farside, UT/CR	Yes
113 WB	Kennedy Rd at Kenmark Blvd	Yes	Move	Notic.	Far-nearside, UT/CS	Nearside, RA2/CS	Yes

(continued)

Land Use Change (continued)

Route (Direction)	Stop (Side of intersection)	Rating	Recom.	Impact of Action	Existing Condition *Location, Adjacent LU/ Opposite LU*	Recom. Condition *Location, Adjacent LU/ Opposite LU*	Sunk Costs (Shelter/ Bay)
113 EB	Danforth Rd at Warden Ave	Yes	Move	Notic.	Nearside, CA/CA	Farside, CA/RD	Yes
113 EB	375 Danforth Rd	Yes	Move	Notic.	Midblock,	Nearside, CA/RD	Yes
129 NB	McNicoll Ave	Yes	Move	Notic.	Nearside, UTR/UTR	Farside, RD/RD	Yes
25 NB	Leith Hill Rd (North)	Yes	Move	Marg.	Farside, PL/RA2	Nearside, PG/RA3	Yes
25 NB	Bedle Ave	Yes	Move	Marg.	Far-nearside, UT/UT	Nearside, OR/RD	Yes
35 NB	Weston Rd	Yes	Move	Marg.	Nearside, CA/CR	Farside, RCC/CS	Yes
35 NB	Troutbrooke Dr (North)	Yes	Move	Marg.	Farside, ONR PL/ONR	Nearside, RM/O	Yes
35 NB	Driftwood Ave (North)	Yes	Move	Marg.	Farside, SCHY/RA2	Nearside, COM/RA2	Yes
35 NB	Hullmar Dr	Yes	Move	Marg.	Far-nearside, OA/RM	Farside, OA/RA2	Yes
36 WB	Alness St	Yes	Move	Marg.	Nearside, CA/CS	Farside, CS/CM	Yes
36 EB	Humberwood Blvd at Morningstar Dr	Yes	Move	Marg.	Nearside, ONR/OP	Farside, ONR/RM	Yes
36 EB	Humberwood Blvd at Upper Humber Dr	Yes	Move	Marg.	Far-nearside, ONR/RD	Far-farside, PL/RD	Yes
36 EB	Humberwood Blvd at Topbank Dr (North)	Yes	Move	Marg.	Farside, ONR/RD	Nearside, SCHY/RD	Yes
37 NB	Fairway Rd (North)	Yes	Move	Marg.	Farside, OP/RD	Nearside, RD/RD	No
37B NB	Golfdown Dr	Yes	Move	Marg.	Far nearside, O/RA1	Nearside, RD/	Yes

(continued)

Land Use Change (continued)

Route (Direction)	Stop (Side of intersection)	Rating	Recom.	Impact of Action	Existing Condition *Location, Adjacent LU/ Opposite LU*	Recom. Condition *Location, Adjacent LU/ Opposite LU*	Sunk Costs (Shelter/ Bay)
37B NB	Finch Ave West	Yes	Move	Marg.	Far nearside, ONR	Farside, OP/ONR	Yes
37A SB	Queens Plate Dr East at Rexdale	Yes	Remove	Marg.	Far-nearside, O/PL	/	No
37A SB	Rexdale Blvd at Precision Rd	Yes	Move	Marg.	Nearside, CA/CA	Farside, CA/Ca	Yes
37A SB	Rexdale Blvd at Brydon Dr	Yes	Move	Marg.	Nearside, PL/CO1	Farside, CA/IC	Yes
37 SB	Eglinton Ave West	Yes	Move	Marg.	Nearside, ON/SMS (OA)	Farside, SCH/ON	Yes
37 SB	Princess Margaret Blvd (South)	Yes	Move	Marg.	Farside, O/RD	Nearside, RD/RD	Yes
52 WB	Scarlett Rd at Lockheed Blvd North	Yes	Move	Marg.	Farside, OP/RD	Far-farside, RD/RD	Yes
52 WB	Opposite 327 Dixon Rd	Yes	Move	Marg.	OR/RA2	Far-farside, RA3/RA2	Yes
54 Eb	Brimley Rd	Yes	Move	Marg.	Nearside, UTR/UTR	Farside, CR/UTR	Yes
54 EB	Morningside Ave	Yes	Move	Marg.	Nearside, PL/CSM	Farside, RA2/CR	Yes
54 EB	Stotts Terr	Yes	Move	Marg.	Far-nearside, ON/RM	Nearside, ON/RM	No
86 WB	Meadowvale Rd at Sheppard Ave East	Yes	Move	Marg.	Nearside, RM/ON	Farside, CG/RD	Yes
86 WB	Kingston Rd at Amiens Rd (West)	Yes	Move	Marg.	Farside, SCHY/CS	Far-nearside, CA/RM	Yes
86 WB	Kingston Rd at Old Kingston Rd	Yes	Move	Marg.	Nearside, CA/RD	Farside, OP/CS	Yes
86 EB	Kingston Rd at Galloway Rd	Yes	Move	Marg.	Nearside, CA/CA	Farside, RA3/RM	Yes

(continued)

Land Use Change (continued)

Route (Direction)	Stop (Side of intersection)	Rating	Recom.	Impact of Action	Existing Condition *Location, Adjacent LU/ Opposite LU*	Recom. Condition *Location, Adjacent LU/ Opposite LU*	Sunk Costs (Shelter/ Bay)
97 NB	Mill St	Yes	Move	Marg.	Far-nearside, OR/ON	Farside, CR/RA2	Yes
97 NB	William Carson Cres	Yes	Move	Marg.	Nearside, PL/CR	Farside, COC2/CF	Yes
97 SB	5800 Yonge St	Yes	Move	Marg.	Farside, UT/RA3	Nearside, CO1/CP2	Yes
110 SB	Birmingham St at Eighth St	Yes	Remove	Marg.	Nearside, OP/DVL	/	No
113 WB	Kennedy Rd at St Clair Ave	Yes	Move	Marg.	Nearside, OC/RA1	Farside, CS/CG	Yes
113 EB	Danforth Ave at Emmott Ave	Yes	Move	Marg.	Nearside, CA/CF	Farside, CPC1/MCR	Yes
113 EB	Danforth Ave at Elward Blvd	Yes	Move	Marg.	Nearside, CA/MCR	Farside, CA/MCR	Yes
37 NB	Cordova Ave (North)	Potent.	Move	Marg.	Far-farside, OP/RA2	Nearside, RA2/RA2	Yes
37A NB	Rexdale Ave at Humberwood Blvd	Potent.	Move	Notic.	Nearside, ON/OA	Farside, ON/CS	Yes
16 SB	St Clair Ave East at Birchmount Rd (West)	Potent.	Move	Marg.	Far-farside, ONR/CS	Nearside, ONR/CG	Yes
25 NB	McNicoll Ave	Potent.	Move	Marg.	Nearside, OP/RM	Far-farside, RD/ RM	Yes
25 SB	Pape Ave at Hopedale Ave (West)	Potent.	Move	Marg.	Farside, OP/RD	Nearside, RD/RD	Yes
36 WB	Sentinel Rd	Potent.	Move	Marg.	Nearside, OP/CG	Farside, RA3/RA1	Yes
36 WB	Islington Ave (West)	Potent.	Move	Marg.	Farside, ONR/ON	Nearside, OP/ONR	Yes
37 SB	Milady Rd	Potent.	Move	Marg.	Nearside, OP/RD	Far-farside, RD/RD	Yes

(continued)

Land Use Change (continued)

Route (Direction)	Stop (Side of intersection)	Rating	Recom.	Impact of Action	Existing Condition *Location, Adjacent LU/ Opposite LU*	Recom. Condition *Location, Adjacent LU/ Opposite LU*	Sunk Costs (Shelter/ Bay)
39 WB	Old Finch at Morningside Ave	Potent.	Move	Marg.	Far-nearside, ONR/RD	Near/farside, ONR/RD	No
54 EB	Prudential Dr (East)	Potent.	Move	Marg.	Farside, OH/RAC3 PL	Nearside, ROW/CS	No
54 EB	Opposite 5450 Lawrence Ave East	Potent.	Remove	Marg.	Midblock, OP/PL	/	No
86 EB	Highland Creek Overpass	Potent.	Move	Marg.	Nearside, OP/CS PL	Far-farside, OP/RD	Yes
110 SB	Garnett James Rd at Twelfth St (East)	Potent.	Remove	Marg.	Far farside OP/RM	/	Yes
129 NB	4325 McCowan Rd	Potent.	Move	Marg.	Midblock OP/RD	Midblock (North) CM/Rd	Yes

Land Use Facing Changes

Route	Stop (side of intersection)	Rating	Recom.	Impact of Action	Existing Condition *Location, facing land use*	Recom. Condition *Location, Buffering Land Use*	Sunk Costs
16 SB	Danforth at Eglinton	Yes	Move, Consolidate with Horton Blvd	Sig.	Nearside, Back corner CR	Farside, Front CR	Yes
97SB	Florence Avenue	Yes	Move	Notic.	Nearside, Back corner CG	Far nearside, Side CG	No
15 EB	Islington Avenue	Yes	Move	Notic.	Nearside, Back corner I	Far farside, Side CO1	Yes
16 SB	Ellesmere Road (South)	Yes	Move	Notic.	Far far farside, Back CG	Farside, Front CG	Yes
25 SB	Mallard Road	Yes	Move	Notic.	Nearside, Back CS	Far nearside, Side CS	Yes
35 NB	Yewtree Boulevard (North)	Yes	Move	Notic.	Farside, Back CM	Nearside, Front Corner RA	Yes
35 SB	William Cragg Drive	Yes	Move	Notic.	Far nearside, Back corner CR	Nearside, Front CS	Yes
36 WB	Highway 27 West Side	Yes	Move	Notic.	Far farside, Back CR	Far nearside,. Front CSM	Yes
36 WB	Woodbine Downs Boulevard	Yes	Move	Notic.	Nearside, Back CS	Farside, Front of IC	Yes
36 EB	Tobermory Drive	Yes	Move	Notic.	Nearside, Back corner COM	Far far farside, Side COM	Yes
37 NB	Dixon Road	Yes	Move	Notic.	Far farside, Back CG	Far nearside, Front corner CSM PL	Yes
39 WB	Ravel Road	Yes	Move	Notic.	Nearside, Back CF	Farside, Front CSM	Yes
54 EB	Greencedar Circuit (West)	Yes	Move	Notic.	Farside, Back CR	Far nearside, Side RA2	Yes

(continued)

Land Use Facing Changes (continued)

Route	Stop (side of intersection)	Rating	Recom.	Impact of Action	Existing Condition *Location, facing land use*	Recom. Condition *Location, Buffering Land Use*	Sunk Costs
16 SB	Danforth Road at Horton Boulevard	Yes	Move, consolidate with Eglinton Ave	Marg.	Nearside, Back/Side CR	Far nearside, Front CR	No
97 NB	Cummer Avenue	Yes	Move	Marg.	Nearside, Back corner CS	Far far nearside, Side CS	No
25 NB	Gateway Boulevard North	Yes	Move	Marg.	Nearside, Back CS	Far nearside, Front CR	Yes
54 WB	Tower Drive	Yes	Move	Marg.	Nearside, Back corner CS	Farside, Front of CS	Yes
129 NB	Milner Avenue (North)	Yes	Move	Marg.	Far farside, Back I	Nearside, Side CR	Yes
129 SB	Sheppard Avenue	Yes	Move	Marg.	Nearside, Back corner CG	Far nearside, Side CG	Yes
25 SB	Lawrence Avenue East	Potent.	Move	Marg.	Nearside, Back corner CR	Farside, Front COC2	Yes
39B WB	5910 Finch Avenue East	Potent.	Move	Marg.	Nearside, Back I	Farside, Back I Opp. Side RD	Yes

Land Use Distance

Route (Direct.)	Stop (Side of intersection)	Rating	Recom.	Impact of Action	Existing Condition *Location, Buffering Land Use*	Recom. Condition *Location, Buffering Land Use*	Sunk Costs (Shelter/ Bay)
25 NB	Overlea Blvd (East)	Yes	Move	Notic.	Farside, SBK CM	Far-Nearside, BUFF CM	Yes
35 NB	Grandravine Dr	Yes	Move	Notic.	Nearside, SBK RA3	Farside, BUFF RA2	Yes
35 NB	Shoreham Dr	Yes	Move	Notic.	Nearside, SBK RA1	Farside, BUFF RA2	Yes
36 EB	Oakdale Rd	Yes	Move	Notic.	Nearside, SBK CP2	Farside, SLB CP1	Yes
36 EB	Jane St (East)	Yes	Move	Notic.	Farside, SBK CM	Nearside, BUFF CG	Yes
39 WB	Birchmount Rd	Yes	Move	Notic.	Nearside, SBK RA3	Farside, BUFF RA2	Yes
54 EB	Cherryhill Ave	Yes	Move	Notic.	Nearside, SBK RD	Farside, BUFF RD	No
97SB	Elmhurst Ave	Yes	Move	Notic.	Nearside, SBK CO2	Farside, ADJ CS	Yes
25 NB	Deerford Rd	Yes	Move	Marg.	Nearside, SBK RD	Farside, BUFF RA2	Yes
52 WB	Dixon Rd at Chetta Pl	Yes	Move	Marg.	Nearside, SBK RA3	Far-farside, SLB RA3	Yes
54 EB	Orton Park Rd	Yes	Move	Marg.	Nearside, SBK RM	Far-farside, BUFF RA1	Yes
86 EB	Kingston Rd at Franklin Ave	Yes	Move	Marg.	Nearside, SBK RD	Far-Farside, BUFF RD	No
36 WB	Westmore Dr	Potential	Move	Notic..	Nearside, SBK CG	Far-farside, BUFF CSM	Yes
37A SB	Queens Plate Dr West at Rexdale Blvd (North)	Potential	Move	Notic.	Far-farside, SBK CM	Farside, BUFF CG	Yes
54 WB	Don Mills Rd	Potential	Move	Notic.	Nearside, SBK RA2	Farside, BUFF CR	Yes
54 EB	Victoria Park Ave	Potential	Remove Replace	Notic.	Nearside, SBK RA3	Existing Far-farside, BUFF CS	Yes
129 SB	Pitfield Rd	Potential	Move	Notic.	Nearside, SBK RA3	Far Farside, SLB CG	Yes
16 SB	Lawrence Ave E	Potential	Move	Marg.	Nearside, SBK HOSP	Farside, BUFF CG	Yes

(continued)

Land Use Distance Change (continued)

Route (Direct.)	Stop (Side of intersection)	Rating	Recom.	Impact of Action	Existing Condition *Location, Buffering Land Use*	Recom. Condition *Location, Buffering Land Use*	Sunk Costs (Shelter/ Bay)
25NB	Fairview Mall Dr (North)	Potential	Move	Marg.	Farside, SBK RA3	Nearside, BUFF CP1	Yes
25 NB	Finch Ave East	Potential	Move	Marg.	Nearside, SBK RA3	Farside, SLB CG	Yes
25 NB	Cliffwood Rd (North)	Potential	Move	Marg.	Nearside, SBK SCH	Farside, SBK CS PL	No
35 NB	Trethewey Dr	Potential	Move	Marg.	Nearside, SBK CS	Far-nearside, BUFF CS	Yes
35 SB	Eddystone Ave	Potential	Move	Marg.	Nearside, SBK RA2	Farside, SLB CA	Yes
35 SB	Sheppard Ave West	Potential	Move	Marg.	Nearside, SBK CM	Far-nearside, SBK CL	Yes
36 WB	Duncanwoods Dr	Potential	Move	Marg.	Nearside, SBK RA2	Farside, BUFF RD	Yes
36 EB	Wilmington Ave	Potential	Move	Marg.	Nearside, SBK RA2	Far-nearside, RA2	Yes
37A NB	Rexdale Blvd at Kipling Ave	Potential	Move	Marg.	Nearside, SBK CR	Farside, SLB CR	Yes
37 SB	1738 Islington Ave	Potential	Move	Marg.	Midblock, SBK SCH	Midblock south, BUFF COME	Yes
39 EB	Bayview Ave	Potential	Move	Marg.	Far-nearside, SBK RM	Far farside, SLB RM	Yes
52 EB	Dixon Rd at Skyway Ave	Potential	Move	Marg.	Nearside, SBK CL	Far-nearside, SBK CL	Yes
54 WB	Overture Rd (West)	Potential	Move	Marg.	Farside, SBK RA3	Far-nearside, BUFF CR	Yes
54 WB	Centennial Rd	Potential	Move	Marg.	Nearside, SBK RM	Farside, SLB RD	Yes
54 WB	Scarborough Golf Club Rd	Potential	Move	Marg.	Nearside, SBK CS	Far-nearside, BUFF CS	Yes
54 WB	The Donway West	Potential	Move	Marg.	Nearside, SBK CR	Farside, BUFF CM	Yes
86 WB	Beechgrove Dr (West)	Potential	Move	Marg.	Nearside, SBK RD	Far-nearside, BUFF RD	Yes

(continued)

Land Use Distance (continued)

Route (Direct.)	Stop (Side of intersection)	Rating	Recom.	Impact of Action	Existing Condition *Location, Buffering Land Use*	Recom. Condition *Location, Buffering Land Use*	Sunk Costs (Shelter/ Bay)
86 WB	Eglinton Ave at Bellamy Rd South	Potential	Move	Small	Nearside, SBK RA3	Far-farside, SLB CR	Yes
86 EB	Kingston Rd at Beechgrove Dr	Potential	Move	Small	Nearside, SBK CS	Farside, SLB RM	No
97NB	Sheppard Ave East	Potential	Move	Small	Nearside, SBK RAC3	Farside, ADJ COC3	No
97 SB	Park Home Ave	Potential	Move	Small	Nearside, SBK RAC3	Farside, ADJ CO3	Yes

Appendix E: Unrectifiable Potentially Problematic Stops

Land Use

Route	Stop (side of intersection)	Land Use
15 WB	400 Evans Avenue	CA
16 SB	Danforht Road at Midland Avenue	CA
37A NB	Rexdale Blvd at Precision Road	CA
37A SB	Queens Plate Drive East (East Side)	CA
39 WB	Markham Road	CA
86 EB	Eglinton Avenue at Barbados Boulevard	CA
86 EB	Kingston Road at Celeste Drive	CA
113 WB	Danforth Road at Hubert Avenue	CA
113 EB	Danforth Avenue at Leyton Avenue	CA
129 SB	2050 McCowan Road	CA
25 SB	Seneca Hill Drive	O
35 NB	Steeles Avenue West at Murray Ross Parkway (East Side)	O
36 WB	Norfinch Drive	O
52 WB	Sage Avenue	O
54 WB	Starspray Loop	O
54 EB	Walkway to Ridgewood Road	O
86 WB	Meadowvale/Sheppard Loop	O
129 NB	Steeles Avenue East	O
15 WB	Horner Avenue	OC
16 SB	St Clair Avenue East at Marsh Road	OC
16 SB	St Clair Avenue East at North Woodrow Boulevard	OC
113 WB	Opposite 519 Kennedy Road	OC
113 WB	Kennedy Road at Summer Drive (South Side)	OC
25 NB	Opposite 1450 Don Mills Road	OG
35 SB	Sheppard Avenue West (South Side)	OG
35 SB	Giltspur Drive	OG
37 NB	The Kingsway (North Side)	OG
35 NB	Wilson Avenue (North Side)	OH
129 NB	Nugget Avenue	OH
129 SB	Kenhatch Boulevard	OH
35 SB	Eglinton Avenue West (South Side)	ON
37 NB	Eglinton Avenue West	ON
54 WB	Opposite Walkway to Ridgewood Road	ON
86 EB	Lawson Road at Highway 2A Overpass	ON
15 EB	Opposite 810 Royal York Road	ONR
25 NB	York Mills Road	ONR
25 NB	Moatfield Drive	ONR
25 SB	Moatfield Drive South Side	ONR
25 SB	Millwood Road at Overlea Boulevard South Side	ONR

(continued)

Land Use (continued)

Route	Stop (side of intersection)	Land Use
35 NB	Steeles Avenue West	ONR
36 WB	Opposite 685 Finch Avenue West	ONR
36 EB	Islington Avenue (East Side)	ONR
39 EB	Opposite 636 Finch Avenue East	ONR
37A NB	Humberwood Boulevard at Hullrick Drive South	ONR
37B SB	Finch Avenue West	ONR
37B SB	Sandhill Drive	ONR
37B SB	Barker Avenue	ONR
54 WB	Leslie Street at Overland Drive	ONR
54 WB	Opposite 1105 Leslie Street	ONR
54 WB	Opposite 1103 Leslie Street	ONR
54 WB	Leslie Street at Eglinton Avenue East	ONR
54 EB	Meadowvale Road East Side	ONR
36 WB	Humberline Drive at Viewcrest Circle	OP
39 WB	Yonge Street	OP
54 WB	Meadowvale Road	OP
110 NB	Judson Street (North Side)	OP
110 SB	Garnett Janes Road at Coin Street	OP
110 SB	Ninth Street at Birmingham Street	OP
37 NB	Dundas Street West	OR
25 NB	Sheppard Avenue East (North Side)	PG
25NB	Leith Hill Road (North Side)	PG
15 WB	The West Mall at Sherway Drive	PL
16 SB	Triton Road at McCowan Road	PL
16 SB	Town Centre Court	PL
25 SB	Rochefort Drive	PL
25 SB	Gateway Boulevard	PL
36 EB	Yonge Street	PL
37A NB	Queens Plate Drive West at Janda Court	PL
37A SB	Rexdale Boulevard at Brydon Drive	PL
52 WB	626 Dixon Road	PL
52 WB	Dixon Road at Carlingview Drive	PL
52 EB	Opposite 950 Dixon Road	PL
54 WB	Leslie Street at Lawrence Avenue East (South Side)	PL
54 EB	Morningside Avenue	PL
86 WB	Eglinton Avenue East at Bellamy Road North	PL
97 NB	McGlashan Road	PL
97 NB	William Carson Crescent	PL
129 SB	Triton Road	PL
15 EB	Royal York Road at Oakfield Drive (North Side)	SCHY
35 NB	Driftwood Avenue (North Side)	SCHY
52 WB	Varna Drive (West Side)	SCHY

(continued)

Land Use (continued)

Route	Stop (side of intersection)	Land Use
52 EB	Brookview Drive	SCHY
52 EB	Rosewell Avenue East Side	SCHY
86 WB	Kingston Road at Amiens Road (West Side)	SCHY
37 SB	The Westway (South Side)	UB
16 NB	St Andrews Road	UT
25 NB	Bedle Avenue	UT
25 SB	Au Large Boulevard	UT
36 WB	Signet Drive West Side	UT
37B NB	Elmhurst Drive	UT
37B SB	Golfdown Drive	UT
54 WB	Brimley Road (West Side)	UT
54 EB	Marcos Boulevard	UT
97 SB	5800 Yonge Street	UT
110 NB	Titan Road	UT
113 WB	Kennedy Road at Kenmark Boulevard	UT
16 SB	Benleigh Drive	UTR
54 EB	Brimley Road	UTR
129 NB	McNicoll Avenue	UTR

Land Use Facing

Route	Stop (side of intersection)	Facing	Land Use
39 EB	Kennedy Road	Back	CG
86 EB	Kingston Road at Celeste Drive	Back	CA
16 SB	Danforth Road at Eglinton Avenue East	Back	CR
37A SB	Opposite 237 Queens Plate Drive East	Back	CR
37A SB	Queens Plate Drive East at Harness Road (South Side)	Back	CR
54 EB	Cedarbrae Mall	Back	CR
54 WB	Port Union Road (West Side)	Back	CS
86 EB	Eglinton Avenue at Cedar Drive	Back	CS
86 WB	6070 Kingston Road	Back	CSM
97 NB	Lord Seaton Road	Back	CF
110 NB	Opposite 730 Islington Avenue	Back	COM
37A NB	Opposite 225 Rexdale Boulevard	Back	I
39 EB	5373 Finch Avenue East	Back	I
110 SB	Judson Street	Back	I
16 NB	Danforth Road at St Clair Avenue East (North Side)	Back corner	CG
36 EB	Albion Mall	Back corner	CR
54 WB	Morningside Avenue	Back corner	CR
110 NB	The Queensway (North Side)	Back corner	CR
52 EB	Avenue Road	Back corner	CF
37 SB	Summitcrest Drive	Back corner	COM
15 EB	Eastwick Road	Back corner	I

Land Use Distance

Route	Stop (Side of intersection)	Distance	Land Use
35 NB	Raven Road (North Side)	SBK	RD
54 WB	Eglinton Avenue East at Bessborough Drive (West Side)	SBK	RD
54 EB	Leslie Street at Marshfield Court	SBK	RD
54 EB	Paulandar Avenue	SBK	RD
86 EB	Kingston Road at Manse Road	SBK	RD
129 NB	Walkway to Historic Terrace	SBK	RD
25 NB	Steeles Avenue East	SBK	RM
25 SB	Goodview Road	SBK	RM
39 WB	Leslie Street (West Side)	SBK	RM
54 EB	Ling Road	SBK	RA1
36 EB	Finch Avenue West	SBK	RA2
37 NB	2825 Islington Avenue	SBK	RA2
97 NB	Hilda Avenue at Green Bush Road	SBK	RA2
97 SB	McGlashan Road South	SBK	RA2
15 EB	Sherway Gardens Road at Sherway Gate	SBK	RA3
25 NB	St Dennis Drive	SBK	RA3
25 NB	Graydon Hall Place	SBK	RA3
25 NB	Parkway Forest Drive	SBK	RA3
25 NB	Au Large Boulevard	SBK	RA3
35 NB	Exbury Road (North Side)	SBK	RA3
35 NB	Eddystone Avenue	SBK	RA3
35 NB	Yorkwoods Gate	SBK	RA3
35 N B	Finch Avenue West (North Side)	SBK	RA3
35 NB	San Romanoway (North Side)	SBK	RA3
35 NB	Stong Court	SBK	RA3
35 SB	Steeles Avenue West (South Side)	SBK	RA3
35 SB	Hullmar Drive	SBK	RA3
35 SB	Chalkfarm Drive South (South Side)	SBK	RA3
36 WB	Torresdale Avenue (West Side)	SBK	RA3
36 WB	Opposite 1685 Finch Avenue West	SBK	RA3
36 WB	Tobermory Drive	SBK	RA3
37A NB	Humberwood Boulevard at Kingsplate Crescent (West Side)	SBK	RA3
37 SB	Dixon Road	SBK	RA3
37 SB	1300 Islington Avenue	SBK	RA3
37 SB	Central Park Roadway (South Side)	SBK	RA3
39 EB	Bayview Avenue	SBK	RA3
39 EB	Don Mills Road	SBK	RA3
39 EB	Pharmacy Avenue	SBK	RA3
54 EB	Carnforth Road East Side	SBK	RA3
129 NB	Finch Avenue East	SBK	RA3

(continued)

Land Use Distance (Continued)

Route	Stop (Side of intersection)	Distance	Land Use
129 NB	Finch Avenue East (North Side)	SBK	RA3
129 NB	Alton Towers Circle North	SBK	RA3
97 SB	Hilda Avenue at Steeles Avenue West	SBK	RA3
97 SB	Steeles Avenue West at Tangreen Court	SBK	RA3
36 EB	685 Finch Avenue West	SBK	RS1
54 WB	Barrymore Road	SBK	RS2
25 SB	Wynford Drive	SBK	CO1
25 NB	Green Belt Drive (North Side)	SBK	CO3
86 WB	Eglinton Avenue East at Brimley Road	SBK	CR
54 EB	Fortune Gate (East Side)	SBK	CS
54 EB	Bennett Road	SBK	CS
86 WB	Kingston Road at Lawrence Avenue East	SBK	CS
54 EB	Eglinton Avenue East at Laird Drive (East Side)	SBK	CSM
25 NB	Overlea Boulevard at East York Town Centre	SBK	CM
25 SB	Clock Tower Road	SBK	CM
36 WB	York Gate Boulevard	SBK	CM
36 EB	Kipling Avenue	SBK	CM
37A SB	Queens Plate Drive West at Janda Court	SBK	CM
37A SB	Queens Plate Drive at Highway 27	SBK	CM
39 WB	Sandhurst Circle West	SBK	CM
97 SB	Steeles Avenue West (South Side)	SBK	CM
97 SB	Abitibi Avenue (South Side)	SBK	CM
35A NB	Woodbine Race Track Loop	SBK	CSN
25 SB	St Dennis Drive	SBK	SPEC
15 EB	185 Evans Avenue	SBK	I
36 WB	1150 Finch Avenue West	SBK	I
37 SB	2200 Islington Avenue	SBK	I
39B WB	Neilson Road	SBK	I
129 NB	Commander Boulevard (North Side)	SBK	IC
15 EB	Arnold Street	SBK	ICS
36 WB	Opposite 1111 Finch Avenue West	SBK	ICS
15 EB	Royal York Road at Coney Road (North Side)	SBK	SCH
36 WB	Romfield Lane	SBK	SCH
129 NB	Sandhurst Circle South	SBK	SCH
36 EB	Humberline Drive at Humber College Boulevard	SBK	PSCH
39 WB	Au Large Boulevard	SBK	PSCH