The pursuit of cycling equity: A review of Canadian cycling plans

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ABSTRACT

Cycling continues to be prioritized as a mode of transport with multiple environmental and health benefits. However, the benefits associated with cycling are not always equitably distributed throughout society meaning that some people (people with low income, members of minority groups) may not have access to safe and convenient spaces in which to cycle. Furthermore, cycling infrastructure does not always accommodate the varying needs of all members of society across gender and age categories. Based on a systematic review of the literature, we identify four key themes to examine the degree to which Canadian transport plans have (1) considered of equity in projects and priorities, (2) incorporated equity-oriented funding mechanisms, (3) incorporated accessibility, design and safety measures and (4) conducted socio-spatial network analysis to determine where cycling investment is needed. While many Canadian plans do address issues related to equity, there is room for improvement, for example, further work to meaningfully engage with disadvantaged groups throughout the planning process could help to improve cycling for everyone.

Keywords: Cycling Equity, Transportation Plans, Canada

1. INTRODUCTION

As a low cost and healthy mode of transport, cycling can play an important role in a region's overall transport system and help reduce the emission of greenhouse gasses as well as decrease congestion, and improve public health. As a result, many transport plans and policies have focused on promoting cycling (*1; 2*). However, a large body of literature has identified discrepancies in access to safe, comfortable, and convenient places to cycle in North American cities, and notes that this access can vary by income level and minority status (*3*). Further, disadvantaged groups become increasingly at risk of facing additional problems such as less healthy, inactive lifestyles, and socio-economic disadvantage (*4*). By failing to effectively incorporate equity into planning and policy-making, municipalities risk disproportionately burdening, and inadequately accommodating the needs of disadvantaged groups who are oftentimes more reliant on these less-costly modes of travel (*5-7*). This body of literature has pointed out the importance of incorporating equity into the core of planning and policy-making, as well as the processes by which plans and policies are generated. In doing so, planners are better equipped at putting forward plans and policies that support not only a healthier environment and economy, but also a healthier society overall.

The 2016 Report prepared for the FHWA (U.S. Federal Highway Administration) *Pursuing Equity in Pedestrian and Bicycle Planning* states that a central goal of transport equity is "to facilitate social and economic opportunities through equitable levels of access to affordable and reliable transportation options based on the needs of the populations being served, particularly populations that are traditionally underserved" (*8*). Our research seeks to address how Canadian transport plans are conceiving of the provision of cycling policies and infrastructure, by first reviewing the literature on cycling equity and then examining contemporary Canadian transport plans pertaining to cycling and addresses the following research questions:

- What are the current themes in academic literature that pertain to cycling equity?
- To what extent are Canadian cities both incorporating and operationalizing cycling equity into transport plans?
- Based on these findings, what directions might research and practice take to advance the pursuit of cycling equity?

2. LITERATURE REVIEW

A systematic review of the literature on cycling equity (*9*) revealed five key themes that help provide a comprehensive understanding and definition of cycling equity, and how planning practice can provide for it: (1) Disadvantaged Groups, (2) Politics and The Economy, (3) Safety and Security, (4) Enforcement, Racial Profiling, and Harassment, and (5) (In)adequacies in Planning Tools and The Planning Process.

Disadvantaged Groups

Any concept of equity depends on a clear understanding of what "good" is being distributed and to whom, *i.e*. which individuals and groups are identified as the recipients of a societal good? Key groups acknowledged in the literature as having been ignored or overlooked in terms of the provision of convenient, safe cycling infrastructure are people with low-income, minority groups and immigrants, seniors, children, and women.

People with Low-Income

Many people with low-income cannot afford a car, and are dependent on active transport as a mode of travel (*10*). Unfortunately, in many urban contexts, transport plans and projects often exclude or negatively affect low-income neighbourhoods (*11; 12*). As well, lower income areas

are often exposed to negative transport-related externalities (*13*) such as noise and air pollution from nearby auto-dominated roadways and unsafe walking and cycling conditions (*10*). Furthermore, while increasing investment in low-income areas can help improve mobility and accessibility, a growing concern is fear of gentrification associated with cycling investments (*10; 14*). Researchers have noted that recent evidence suggests that bicycle infrastructure is emerging "disproportionately in gentrified neighbourhoods or is itself a driver of gentrification" (*14*).

Minority populations and Immigrants

Immigrant and minority groups in the U.S. are often ignored and overlooked in planning and policy-making despite the fact that immigrant and minority populations have been found to cycle more than their U.S.-born counterparts (*15; 16*). This has arguably been worsened by a surge in cycling advocacy groups that are dominated by white, wealthier groups that tend to exclude and overlook the needs and concerns of communities of colour (*16*). Accordingly, the history of advocacy for a more 'liveable city' by and for communities of colour becomes overshadowed by the contemporary practices and advocacy of predominantly, white, wealthier groups (*16*).

Seniors and Children

Aldred, Woodcock and Goodman (*17)* claim that promoting cycling should be a priority as the net health benefits of cycling tend to rise with age. Populations of senior cyclists tends to be higher in countries with a well-established cycling culture (*17*). The literature also suggests that those at either end of the age spectrum tend to be more dependent on certain conditions for cycling to be considered both a feasible and desirable mode of travel (e.g. access to safe, high-quality infrastructure, short travel distances, and safety). Seniors and children may be less able (e.g.: physically, mentally, and legally restricted) to participate in the planning process, and are therefore less able to effectively communicate their concerns and barriers.

Women

With the exception of countries with well-established cycling cultures such as The Netherlands, Germany and Demark, the proportion of women cyclists is consistently lower than that of men (*17-20*). For example, in the UK women are approximately half as likely as men to cycle (*19*). A number of studies reveal that concerns of safety and personal security are the primary reason for which women are less apt to engage in cycling (*17-23*). Concerns of safety and personal security most often relate to quality of infrastructure or collisions with other road users, and concerns of crime and violence (*17-23*). Additional factors can relate to cultural differences and assigned gender roles such as having to travel with children and household responsibilities that require trip chaining (e.g. commuting, shopping for groceries, picking up children) (*23*) as well as harassment and abuse (*24*).

Safety and Security

Cycling-related concerns pertaining to physical safety and personal security are felt universally, not just to those who are disadvantaged. However, in countries and cities with less-established cycling cultures (such as Canada and the US), issues relating to physical safety and personal security often disproportionately affect disadvantaged groups compared to their more affluent counterparts (*5*). Concerns pertaining to safety and personal security are often the most prominent barriers to cycling (*13; 15; 23*).

Physical safety primarily concerns the presence and quality of infrastructure that provides, a safe, well-connected network that links travellers with desired destinations. The presence of a bike lane is not enough to ensure safe cycling if it is (a) not part of a well-connected system linking residents to desired destinations, (b) fails to be accompanied by adequate traffic calming measures, and (c) lacks community outreach initiatives to encourage

cycling(*13*). Different types of bicycle infrastructure tend to elicit greater or worse feelings of safety, with a painted bicycle lane on a busy road being the worst, and a fully separated bicycle path the greatest. Unfortunately, often low-income, minority and immigrant neighbourhoods are provided with the least safe forms of infrastructure (*5; 11; 13; 15*). A study from New York City found that census tracts with larger populations of immigrants experienced higher rates of both pedestrian and bicycle crashes after controlling for characteristics of the built environment (*15*). This can be attributed to lower investments in infrastructure for people cycling (and walking) in such areas (*25; 26*).

Racial Profiling, Policing and Harassment

Important cycling-related barriers and concerns pertaining to enforcement, profiling, policing, and harassment felt by immigrant and minority groups (particularly in the US) are another key theme in the literature. In addition to barriers and concerns facing immigrants, a phenomenon sometimes referred to as 'Biking While Black" demonstrates how people identified as black are disproportionately subject to racist profiling and harassment from not only police, but other road users (*27; 28*). Research on profiling and police bias in SQF [stop, question, frisk] encounters finds that almost uniformly Black and Latino/a populations are subject to higher rates of SQF than population benchmarks (*28*). In a well-publicized case, The Tampa Police Department issued 2,504 bicycle citations - a total greater than the cities of Jacksonville, Miami, St. Petersburg, and Orlando combined, and of those ticketed, 80% were black yet only a quarter of Tampa's population is black (*28*).

Politics and the Economy

Political and economic forces shape plans, projects and investment priorities in local contexts. For example, Stehlin and Tarr (*16)* note that while the development of plans can often include a multitude of stakeholders, such as elected officials, consulting firms, community organizations and bicycle advocacy organizations, plan implementation often "rests on the spatialization of these networked powers". For these reasons, planners must work to ensure all members of the community are able to effectively participate and contribute to the planning process. For example, Sagaris and Arora (*29)* note that participation, if not done democratically, can bring its own set of issues where decisions on investment can easily overlook needs and concerns of low-income and other disadvantage groups.

Recent research has examined the ways in which investment in, and promotion of bicycling correlates with processes of gentrification that may undermine the bicycles' potential to be a truly sustainable and egalitarian practice (*14*). For example, a recent study from Portland, Oregon argues that bicycle promotion is predominantly rooted in neoliberal urban development and economic growth paradigms, and that Portland is primarily concerned with promoting the image of bicycling as a symbol of city livability, progressivity and sustainability (*14*). The authors conclude that while cycling certainly has the potential to serve as a less-costly, sustainable mode of travel, bicycling seems to be fuelling processes of gentrification and displacement while depoliticizing policies of bicycle promotion under the banner of sustainability and equity (*14*).

How cyclists are portrayed in bicycle promotion/marketing materials and planning documents has been thought to contribute to the relationship between cycling and fear of gentrification (*30; 31*). Cyclists are often portrayed as white, male, slim, muscular , and affluent rather than female, working class or poor, and/or people of colour (*31*). The authors hypothesized that the dominance of representations of MAMIL (Middle-Aged Men in Lycra)

cyclists in policy documents may make cycling less accessible to other groups (e.g.: women, lower-income and fat people) as those in the "other" groups do not conform to what's portrayed as the common "cycling citizen" (*31*). As a result, such groups risk becoming excluded from bicycle planning and policy decisions (*31*).

Theme Five: (In)adequacies in Planning Tools

To generate the conditions that provide for cycling equity, attention must be given to the types of methods, data, and tools being employed to assess it (*12; 13*). For example, relying on peak-hour counts and data collected from smartphones could ignore many cyclists (*12*). In recent years, several methods of analysis have been well regarded for their ability to assess equity, including accessibility and Level of Traffic Stress (LTS) analysis. Accessibility and LTS can be combined to provide a fairly robust equity analysis and can serve to prioritize projects by assessing the extent to which proposed projects could improve equitable outcomes**.** Researchers are increasingly using LTS to quantify how comfortable a bicycle network is for cyclists, and accessibility to quantify how useful the network is for reaching destinations (*12*). For example, Kent and Karner (*12)* employed an "equity of accessibility" assessment that prioritized projects in areas home to the most disadvantaged residents in Baltimore, Maryland. Similar methods have been used to study Brazilian and Canadian cities (*11; 13*)

Methods and tools used to assess equity in other studies include Systems Dynamic Modelling (*32*), descriptive analyses of imagery found on cycling-related promotional materials and planning documents (*20; 31*), and qualitative interviews that investigate local barriers and concerns to cycling from a more in-depth perspective (*15*). However, Xie and Spinney note that the "absence of difference in Cycling Level of Service tools (CLoS) "may be symptomatic of a professional ethnocentrism related to the overwhelming male domination of transport engineering, design and planning professions in the UK" (*20*). While CLoS tools have their strengths, these tools can inadequately account for certain concerns (e.g.: personal security/social safety) that are critical barriers for some of the most vulnerable groups.

To incorporate cycling equity in the planning for cycling the literature suggests the following:

(1) Consideration of equity in projects and priorities,
(2) Incorporate equity-oriented funding mechanisms,
(3) Incorporating accessibility, design and safety measures which includes
a. Accessibility,
b. Universal Design for All-Ages and Abilities (AAA)/Complete Streets, and
c. Personal Security, and
(4) Conduct socio-spatial network analysis.

3. METHODS

In order to understand how Canadian transport plans are incorporating and operationalizing cycling equity we sought to find a representative sample of current plans. The scope of the review is limited to the municipal planning context and sought to investigate two of the most populous cities within each of the Canadian provinces with the following inclusion criteria:

- Presence of a city-level active transport and/or cycling plan no older than 2008, and
- If no active transport or cycling plan, presence of a city-level transportation master plan that is no older than 2008.

This resulted in the identification of 25 plans from 17 cities, including a mixture of active transport, cycling, and transport master plans. For each of the 25 plans, the following review process was applied to assess the extent to which equity is incorporated:

1. "Keyword in Context": Do the words Equity, Justice or Fairness appear, in context, anywhere throughout plan?
2. Is equity incorporated into the plans overarching (i.e.: not pertaining to any particular mode of travel) principles, goals or objectives?
3. Is equity incorporated more specifically into cycling-related material (e.g.: cycling-related principles, goals or objectives)?

If the plan did not meet any of the above criteria, it was eliminated from further evaluation. Of the 25 plans preliminarily selected for review, 17 plans incorporated at least some degree of equity, 8 were excluded from further evaluation. The 17 plans were subject to further evaluation to assess the extent to which cycling-related principles, goals or objectives are paired with policies/actions/measures to operationalize it. Table 1 includes the list of cities preliminarily selected for review, including the city's population and area (km^2) and whether the relevant plans were selected for further review. Figure 1 depicts the location of each of the studied cities to give a sense of the geographic scope of the analysis.

1 Table 1: Canadian Cities Preliminarily Selected for Review
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City & Province	Population (2016)	Area (km²)	Plan	Included
Saint John's, Newfoundland	108,860	446	Cycling Master Plan, 2009 (*31*)	☐
Halifax, Nova Scotia *Now formally known as Halifax Regional Municipality (HRM)*	403,000	5,490 km² (HRM)	Integrated Mobility Plan, 2018 (*32*)	☐
			Centre Plan, 2017 (*33*)	☐
			Halifax 2014-19 Active Transportation Priorities Plan (*34*)	
Fredericton, New Brunswick	58,220	132.6	Active Transportation Connections Plan, 2017 (update)	
Quebec City, Quebec	531,900	484.1	Plan de Mobilité Durable, 2011 (*35*)	☐
			Vision des Déplacement a Vélo, 2016	
Montreal, Quebec	1,705,000	431.5	Cycling Master Plan, 2016	
			Transportation Plan, 2008 (*36*)	☐
Ottawa, Ontario	934,240	2,778	Ottawa Transportation Plan, 2013 (*37*)	☐
			Ottawa Cycling Plan 2013	
Hamilton, Ontario	536,915	1,138	Transportation Master Plan, 2018 (*38*)	☐
London, Ontario	383,825	420.6	Cycling Master Plan, 2016 (*39*)	☐
			Transportation Master Plan, 2013	
Kingston, Ontario	123,795	450.4	Active Transportation Master Plan, 2018 (*40*)	☐
Toronto, Ontario	2,732,000	630.2	Cycling Network 10 Year Plan (*41*)	☐
Winnipeg, Manitoba	705,245	464.1	Pedestrian and Cycling Strategies, 2014 (*42*)	☐
Regina, Saskatchewan	215,105	180	Transportation Master Plan, 2017 (*43*)	☐
Saskatoon, Saskatchewan	246,375	228.1	Active Transportation Plan, 2016 (*44*)	☐
Calgary, Alberta	1,239,000	825.3	Transportation Master Plan, 2009 (*45*)	☐
			City of Calgary Cycling Strategy, 2011	
Edmonton, Alberta	932,550	684	Transportation Master Plan, 2009 (*46*)	☐
Vancouver, British Columbia	631,490	115	Vancouver Transportation Master Plan, 2012 (*47*)	☐
			Active Transportation Promotion and Enabling Plan, 2016	
Kelowna, British Columbia	127,380	211.8	Pedestrian and Bicycle Master Plan, 2016 (*48*)	☐

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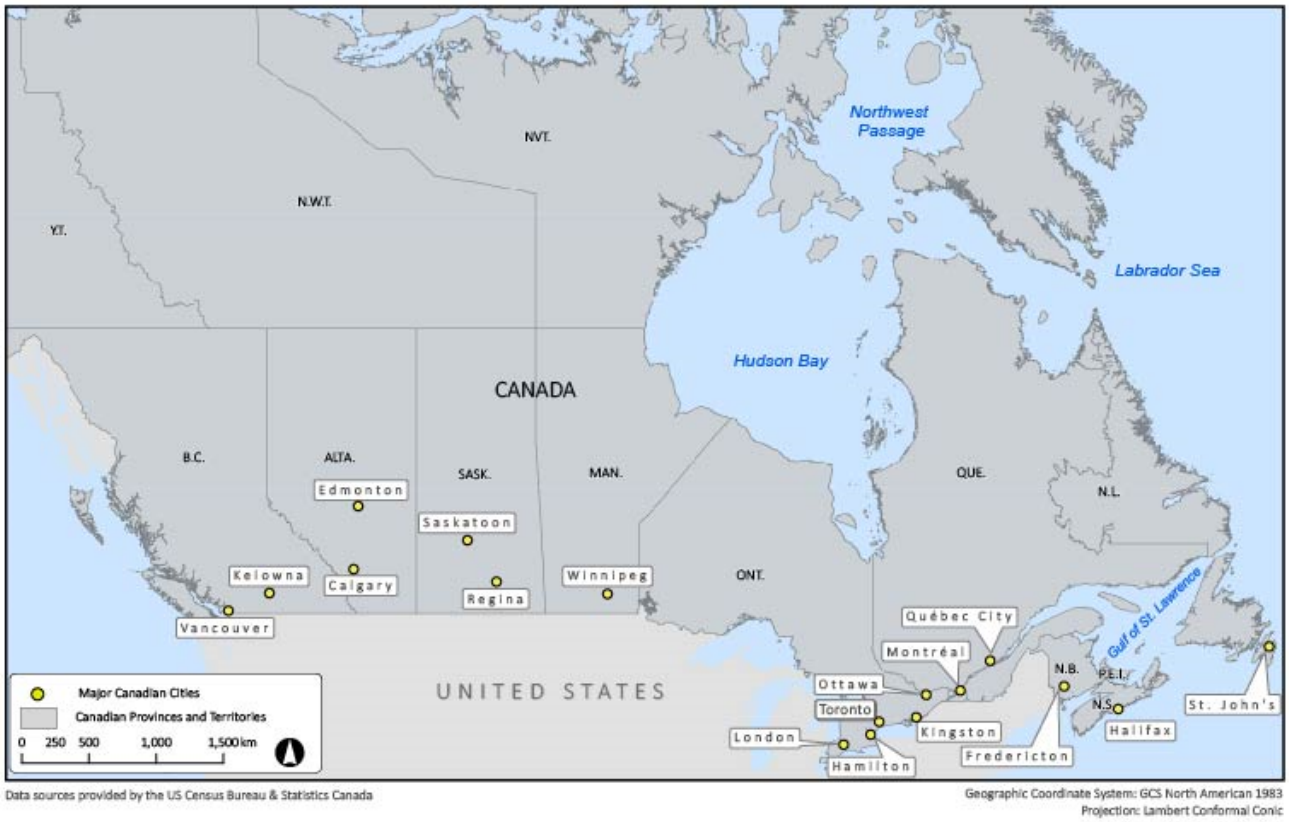

Figure 1: Location of Canadian Cities Preliminarily Selected for Review

4. ANALYSIS

The plan review focused on the four key areas identified from the literature. A summary of key findings is presented in Table 2 and Table 3

Theme One: Consideration of Equity in Projects and Priorities

This refers to the extent to which individual projects can provide for equitable outcomes, and by prioritizing those projects which have been assessed to provide for equitable outcomes. Plans deemed to have *addressed* this theme include Halifax's Centre Plan 2017 (*33*), Montreal's Transportation Plan 2008 (*34*), Hamilton's Transportation Master Plan 2018 (*35*), Kingston's Active Transportation Plan 2018 (*36*), Winnipeg's Pedestrian and Cycling Strategies 2014 (*37*), Regina's Transportation Master Plan 2009 (*38*) and Saskatoon's Active Transportation Plan 2016 (*39*). From these plans, Winnipeg and Saskatoon most effectively *operationalized* this theme (*37; 39*).

Winnipeg operationalized the inclusion of equity by prioritizing network improvements using a Multiple Account Evaluation (MAE). The MAE assessed each pedestrian and bicycle facility based on the following criteria: 1. Network Connectivity 2. Generators 3. Access to Transit 4. Level of Protection 5. Walking & Cycling Potential 6. Equity 7. Safety and 8. Network Spine (*37*). Priority was given to projects that had the potential to contribute to the creation of equitable outcomes. Similar to Winnipeg, Saskatoon operationalized the inclusion of equity by identifying priority improvement locations based on a list of variables, including Network Connectivity, Trip Generators, Access to Transit, Level of Protection, Equity, Safety,

Network Spokes and Potential. Each variable was scored on a five-point scale. After scoring each variable on a five-point scale, results were aggregated to generate an overall score for each new facility. The city then developed a transparent project-ranking list. Areas with the greatest equity potential were given the highest score (*39*).

Theme Two: Equity-Oriented Funding Mechanisms

This theme focuses on evaluating funding mechanisms for their potential to minimize the financial burden of transport costs on those who are least able to pay. Plans deemed to have *addressed* this theme include Québec's Plan de Mobilité Durable 2011 (*40*), Ottawa's Transportation Plan 2011 (*41*)and Kelowna's Pedestrian and Bicycle Master Plan 2016 (*42*). From these plans, Kelowna most effectively operationalized this theme.

Kelowna operationalized equity in funding by establishing criteria to assess the extent to which potential funding sources are equitable. More specifically, Kelowna asked, "is this revenue source equitable in terms of the geographic distribution of those who pay, relative to the area that will benefit, and in terms of income, by avoiding drawing overly upon those that can least afford to pay?" (*42*). Kelowna identified two types of funding that reflect at least some degree of equity, including General Funds/Taxation and Local Area Service Taxes. The former tends to be equitable as lower valued properties pay less tax, and the latter the potential to promote spatial equity. Importantly, however, Kelowna notes that the latter mechanism risks imposing income inequity if those who vote "no" to project due to financial constraints are forced to contribute to the wishes of the majority (*42*).

Theme Three: Accessibility, Design and Safety

This includes three sub-themes: Accessibility, Universal Design for All-Ages and Abilities (AAA)/Complete Streets, and Personal Security. Plans deemed to have addressed this theme are Halifax's Integrated Mobility Plan 2018 (*43*), Québec's Plan de Mobilité Durable 2011 (*40*), Kingston's Active Transportation Master Plan 2018 (*36*), Toronto's Cycling Network 10 Year Plan 2016 (*44*), Winnipeg's Pedestrian and Cycling Strategies 2014 (*37*), Regina's Transportation Master Plan 2009 (*38*), Saskatoon's Active Transportation Plan 2014 (*39*) and Kelowna's Pedestrian and Bicycle Master Plan 2016 (*42*). In terms of operationalization, however, none of the plans that addressed this concept proposed an explicit method of measuring accessibility despite the existence of employable measures (*45*).

Universal Design for All-Ages and Abilities (AAA)/Complete Streets

All plans addressed this theme. From these plans, however, Hamilton, Regina, Vancouver, London, Toronto and Halifax most effectively *operationalized* this theme.

In every plan, cities operationalized this theme by adopting, or recommending the adoption of a Complete Streets policy and/or accessibility design standards. Currently, the City of Hamilton is in the process of adopting a Complete-Livable-Better Streets policy (*35*). As stated in their 2009 plan, Regina intended on adopting two policies, including a universal accessibility policy and a Complete Streets policy that is tailored to fit the context of the City of Regina (*38*). The city further intended on establishing evaluation criteria that helps monitor the progress of achieving objectives of the Complete Streets policy. Once developed, the city intends on reviewing the policy as part of any updates to the city's Transportation Master Plan to ensure any changes in user needs are accounted for (*38*). As of their 2012 plan, Vancouver intended on adopting and implementing plan and design guidelines that support a bicycle network that is comfortable for people of all-ages and abilities, as well as developing a cycling

comfort index to help identify bicycle routes that currently do not meet proposed guidelines. Through this index the city can be informed of where new routes need to be added, and which existing routes are in need of upgrade (*46*). London and Toronto have existing guidelines and standards pertaining to universal accessibility and complete streets (*44; 47*). The City of Toronto is currently working on developing on-street bikeway design guidelines to be released in 2019 (*44*). Lastly, Halifax intends on delivering their proposed Regional Centre all ages and abilities bicycle network by 2022, and intends on providing all ages and abilities bicycle connections to all Halifax transit terminals by 2022 (*43*).

Personal Security

Plans that addressed this concept are Saint John's Cycling Master Plan 2009 (*48*), Winnipeg's Pedestrian and Cycling Strategies 2014 (*37*), Regina's Transportation Master Plan 2009 (*38*), Saskatoon's Active Transportation Plan 2016 (*39*), Edmonton's Transportation Master Plan 2009 (*49*) and Calgary's Transportation Plan 2009 (*50*). All plans were deemed to have succeeded in operationalizing this theme.

In each plan, cities most effectively *operationalized* this concept by recommending, or continuing to ensure Crime Prevention through Environmental Design (CPTED) principles are implemented into pedestrian and bicycle facility design. Key principles of CPTED include improving visibility of underpasses with lighting and/or open design concepts and illuminating sidewalks, crosswalks, pedestrian corridors and pathways (City of Winnipeg, 2014). As acknowledged in Saint John's Cycling Master Plan, CPTED is an important consideration as "the fear produced by the possibility of crime can be at times as much of a barrier to cycling and AT activities as any physical barriers and depending on the situation, can be more difficult to address. This psychological barrier becomes even more pronounced within certain groups such as women, children, the physically challenged and senior citizens" (*48*).

Theme Four: Socio-Spatial Network Analysis

This section deals with how plans identify spatial gaps in the existing cycle network, and identifies socio-demographic groups that *currently* benefit from the network, and those who *could* be given improvements. By performing a socio-spatial network analysis, cities are more adept at knowing what currently exists, for who, and therefore what could exist, and for who. Winnipeg's Pedestrian and Cycling Strategies 2014, Saskatoon's Active Transportation Plan 2016 and Kelowna's Pedestrian and Bicycle Master Plan 2012 all addressed this theme. From these plans, Winnipeg and Saskatoon most effectively *operationalized* it (*37; 39*).

Using spatial and Census data, Winnipeg performed an equity analysis that identified disadvantaged groups/communities that can benefit from having access to more transport options including low-income, indigenous and immigrant groups, and identified areas that are spatially deprived of infrastructure (*37*). Like Winnipeg, Saskatoon operationalized this theme by employing an equity analysis using spatial and Census Data. This analysis evaluated the current distribution of facilities and identified areas where limited access is present for disadvantaged groups. In other words, Saskatoon identified traditionally underserved and disadvantaged groups/communities that would benefit from having access to more transport options (*39*).

Table 2: Summary of Key Findings from Critical Planning Review

CITIES & PLANS	THEME ONE Consideration of Equity in Projects and Priorities	THEME TWO Equity-Oriented Funding Mechanisms	THEME THREE Inclusive Design and Safety			THEME FOUR Socio-Spatial Network Analysis
			Accessibility	Universal Design (AAA)/Complete Streets	Personal Security	
Saint John's, NL 1. Cycling Master Plan, 2009				Addressed	Addressed & Operationalized	
Halifax (Halifax Regional Municipality), NS 2. Integrated Mobility Plan, 2018 3. Centre Plan, 2017 (*31*)	Addressed		Addressed	Addressed & Operationalized Addressed		
Ville de Québec, QC 4. Plan de Mobilité Durable, 2011 (38)		Addressed		Addressed		
City of Montréal, QC 5. Transportation Plan, 2008 (34)	Addressed			Addressed		Operationalized
City of Ottawa, ON 6. Ottawa Transportation Plan, 2011 (39)		Addressed	Addressed	Addressed		
City of Hamilton, ON 7. Transportation Master Plan, 2018 (33)	Addressed			Addressed and Operationalized		
City of London, ON 8. Cycling Master Plan, 2016 (45)				Addressed and Operationalized		
City of Kingston, ON 9. Active Transportation Master Plan, 2018 (34)	Addressed			Addressed		

City of Toronto, ON 10. Cycling Network 10 Year Plan (*42*)			Addressed and Operationalized		
City of Winnipeg, MB 11. Pedestrian and Cycling Strategies, 2014 (35)	Addressed		Addressed	Addressed and Operationalized	Addressed and Operationalized
City of Regina, SK 12. Transportation Master Plan, 2009 (36)	Addressed		Addressed and Operationalized	Addressed and Operationalized	
City of Saskatoon, SK 13. Active Transportation Plan, 2016 (*37*)	Addressed		Addressed	Addressed and Operationalized	Addressed and Operationalized
City of Edmonton, AB 14. Transportation Master Plan, 2009 (47)			Addressed	Addressed and Operationalized	
City of Calgary, AB 15. Transportation Master Plan, 2009 (48)			Addressed	Addressed & Operationalized	
City of Vancouver, BC 16.Transportation Plan, 2012 (44)			Addressed & Operationalized		
City of Kelowna, BC 17. Pedestrian and Bicycle Master Plan, 2012 (40) 17. Pedestrian and Bicycle Master Plan, 2012 (40)		Addressed & Operationalized	Addressed		Addressed

1

Key Takeaways

Based on the analysis presented in the previous section, four plans emerged as exemplar in terms of the incorporation of equity ideals in cycling planning:

- **Winnipeg's Pedestrian and Cycling Strategies, 2014**
- **Saskatoon's Active Transportation Plan, 2016**
- **Regina's Transportation Master Plan, 2009**
- **Kelowna's Pedestrian and Bicycle Master Plan, 2016**

Table 3 presents (1) the four overarching themes discussed throughout this paper, (2) the plan(s) affiliated with the incorporation *and* operationalization of each, and (3) the practices employed by each plan to effectively do so. In summary, Winnipeg and Saskatoon's plans have most effectively addressed socio-spatial analysis and consideration of equity in projects and priorities (*37; 39*), Kelowna's plan was evaluated to have most effectively addressed the concept of equity-oriented funding (*42*), and collectively all four plans managed to address inclusive design and safety, apart from the concept of accessibility (*37-39; 42*). Overall, Winnipeg and Saskatoon's plans are considered best examples of how to incorporate and operationalize equity into plans.

1
2 **Table 3: Best Practices for Incorporating and Operationalizing Equity in Transport Plans**
3

KEY THEMES	PLAN(S)	BEST PRACTICE(S) FOR OPERATIONALIZATION
Socio-Spatial Network Analysis	Winnipeg's Pedestrian and Cycling Strategies, 2014	Equity Analysis using Spatial and Census Data 1) Identify disadvantaged groups/communities that would benefit from having access to more transport options including historically underserved groups such as low-income, indigenous and immigrant groups. 2) Identify areas that are spatially deprived of infrastructure to ensure infrastructure is distributed evenly across the city.
	Saskatoon's Active Transportation Plan, 2016	Equity Analysis using Spatial and Census Data 1) Examine current distribution of cycling facilities. 2) Identify areas where limited access to facilities is made worse by socio-economic challenges. In other words, identify traditionally underserved and disadvantaged groups/communities that would benefit from having access to more transport options.
Consideration of Equity in Projects and Priorities	Winnipeg's Pedestrian and Cycling Strategies, 2014	Multiple Account Evaluation (MAE) 1) Assess each pedestrian and bicycle facility on a set of criteria, including Network Connectivity, Generators, Access to Transit, Level of Protection, Walking & Cycling Potential, Equity, Safety, and Network Spine. 2) Give the highest level of priority to projects with the highest score and emphasize priority on projects with the highest equity potential.
	Saskatoon's Active Transportation Plan, 2016	Cumulative Factor Scoring 1) Identify priority locations based on a list of variables, including: Network Connectivity, Trip Generators, Access to Transit, Level of Protection, Equity, Safety, Network Spokes and Potential) 2) Combine variables to generate an overall score for each new facility. Develop project-ranking list by score. 3) Give areas/projects with the highest equity potential priority.
Equity-Oriented Funding Mechanisms	Kelowna's Pedestrian and Bicycle Master Plan, 2016	Equity Criteria Development 1) Establish criteria to assess the extent to which potential funding sources are equitable, asking questions such as "is this revenue source equitable in terms of the geographic distribution of those who pay, relative to the area that will benefit and in terms of income, by avoiding drawing overly upon those that can least afford to pay?" (City of Kelowna, 2016 p.49). 2) Brainstorm innovative and alternative funding mechanisms that best achieve this goal. Kelowna's top two recommendations include General Funds/Taxation and Local Area Service Taxes.

KEY THEMES	PLAN(S)	BEST PRACTICE(S) FOR OPERATIONALIZATION
Inclusive Design and Safety: *Accessibility*	Winnipeg's Pedestrian and Cycling Strategies, 2014 Saskatoon's Active Transportation Plan, 2016 Kelowna's Pedestrian and Bicycle Master Plan, 2016	N/A
Inclusive Design and Safety: *Universal Design (AAA)/Complete Streets*	Regina's Transportation Master Plan, 2009	Adopt a Universal Accessibility and Complete Streets Policy 1) Adopt a lead-by-example policy to meet universal accessibility needs in transportation infrastructure and services (City of Regina, 2009 p.23) 2) Create a Complete Streets Policy using the Framework for Complete Streets that fits the context of Regina to allow planners and engineers to consistently design and operate streets with all users in mind (City of Regina, 2009 p.24). 3) Establish evaluation criteria and monitor the progress of achieving the objectives of the Complete Streets Policy. Criteria should include factors such as access to multiple modes of travel and travel safety statistics (City of Regina, 2009 p.24). 4) Review the Complete Streets Policy as part of future updates to the Transportation Master Plan to reflect changing travel patterns, needs, and urban contexts (City of Regina, 2009 p.24).
Inclusive Design and Safety: *Personal Security*	Winnipeg's Pedestrian and Cycling Strategies, 2014 Saskatoon's Active Transportation Plan, 2016 Regina's Transportation Master Plan, 2009	CPTED - Crime Prevention through Environmental Design Recommend or continue to ensure CPTED principles are implemented into facility design. Key principles of CPTED include improving visibility of underpasses with lighting and/or open design concepts and illuminating sidewalks, crosswalks, pedestrian corridors and pathways (City of Winnipeg, 2014).

5. CONCLUSION AND RECOMMENDATIONS

Based on insights from research, it is recommended that planners and decision-makers direct their attention to a number of research areas that could help them more effectively incorporate and operationalize cycling equity. The review of academic literature and planning documents suggests the following recommendations to move towards cycling equity.

Disadvantaged Groups and The Planning Process While the plans evaluated discuss, to varying extents, the level of consultation that was undertaken in the generation of the plan, it is hard to know the extent to which planners managed to involve *disadvantaged groups* throughout *the entirety of the planning process*. For these reasons, it is recommended that planners not only establish who their disadvantaged groups are, but identify meaningful ways to engage with them throughout the entirety of the planning process, not simply at the beginning.

Politics and The Economy It is critical that planners and decision-makers be aware of the relationship between cycling investments and gentrification. None of the plans mentioned or evaluated concerns pertaining to gentrification. By being cognoscente of such a relationship, planners and decision-makers may be better able to address potential concerns (particularly from those at risk of displacement) and minimize the potential negative impacts of gentrification.

Racial Profiling, Policing and Harassment Nowhere in any of the Canadian plans was it expressly stated that profiling, policing and harassment was a factor considered throughout the planning process. Reasons for this may be two-fold. In one case, profiling, policing and harassment is not addressed as it is not considered to be an issue. In the other case, profiling, policing and harassment may very well be an issue, but planners did not think to consider it when developing their transport plan(s).

Inadequacies in Planning Tools Planners should evaluate whether, and to what extent they are employing methods and tools to assess equity, and what methods and tools can be employed into the future to provide a more robust equity assessment. Examples of methods and tools include accessibility and level of traffic stress analysis, and collaboration with local residents to better understand the needs and concerns of current and potential cyclists on a local scale.

As cities increasingly focus on promoting the use of cycling, it is critical that planners and decision-makers ensure the needs and concerns of its most disadvantaged residents - those who are, or who could be most reliant on cycling as a less-costly mode of travel - are effectively recognized and addressed. To do so, planners and decision-makers must have a clear understanding of what cycling equity *is*, *why* it is important, and *how* it may be achieved.

CONCLUSION

At present, several Canadian transport plans have incorporated and operationalized equity. These plans include Winnipeg, Saskatoon, Regina and Kelowna's active transport plans. It is critical that researchers and practitioners, including planners and decision-makers at all levels of government continue to learn from one another and work collectively to advance the pursuit of cycling equity. It is also critical that planners and decision-makers either begin, or continue to recognize both the benefit and importance of collaborating with local residents so to provide more effective, context-specific solutions to local needs and concerns.

AUTHOR CONTRIBUTIONS

The authors confirm contribution to the paper as follows: study conception and design: A. Doran, A. El-Geneidy; data collection: A. Doran; analysis and interpretation of results: A. Doran, A. El-Geneidy, K. Manaugh; draft manuscript preparation: A. Doran, A. El-Geneidy, K. Manaugh. All authors reviewed the results and approved the final version of the manuscript

REFERENCES

[1] Boschmann, E., and M. Kwan. Toward socially sustainable urban transportation: Progress and potentials. *International Journal of Sustainable Transportation,* Vol. 2, No. 3, 2008, pp. 138-157.
[2] Manaugh, K., M. Badami, and A. El-Geneidy. Integrating social equity into urban transportation planning: A critical evaluation of equity objectives and measures in transportation plans in North America. *Transport Policy,* Vol. 37, 2015, pp. 167-176.
[3] Flanagan, E., U. Lachapelle, and A. El-Geneidy. Riding tandem: Does cycling infrastructure investment mirror gentrification and privilege in Portland, OR and Chicago, IL? *Research in Transportation Economics,* Vol. 60, 2016, pp. 14-24.
[4] Lucas, K. Transport and social exclusion: Where are we now? . *Transport Policy,,* Vol. 20, 2012, pp. 105-113.
[5] Golub, A., M. Hoffmann, A. Lugo, and G. Sandoval. Introduction.In *Bicycle justice and urban transformation: Biking for all?*, Routledge, London, United Kingdom, 2016.
[6] Gössling, S. Urban transport justice. . *Journal of Transport Geography,* Vol. 54, 2016, pp. 1-9.
[7] Zimmerman, S., M. Lieberman, K. Kramer, and B. Sadler. At the intersection of active transportation and equity.In, 2015.
[8] Sandt, L., T. Combs, and J. Cohn. Pursuing equity in pedestrian and bicycle planning.In *U.S. Department of Transportation, Federal Highway Administration*, Washington DC, 2016.
[9] Doran, A. The pusuit of cycling equity: Linking academic research to planning practice through a comprehensive review.In *School of Urban Planning, No. MUP*, McGill University, Montreal, QC, 2019.
[10] Houde, M., P. Apparicio, and A. Séguin. A ride for whom: Has cycling network expansion reduced inequities in accessibility in Montreal, Canada? *Journal of Transport Geography,* Vol. 68, 2018, pp. 9-21.
[11] Grisé, E., and A. El-Geneidy. If we build it, who will benefit? A multi-criteria approach for the prioritization of new bicycle lanes in Quebec City, Canada. . *Journal of Transport and Land Use,* Vol. 11, No. 1, 2018, pp. 217-235.
[12] Kent, M., and A. Karner. Prioritizing low-stress and equitable bicycle networks using neighborhood-based accessibility measures. *International Journal of Sustainable Transportation*, 2018.
[13] Tucker, B., and K. Manaugh. Bicycle equity in Brazil: Access to safe cycling routes across neighborhoods in Rio de Janeiro and Curitiba. *International Journal of Sustainable Transportation,* Vol. 12, No. 1, 2018, pp. 29-38.
[14] Ibsen, M., and K. Olesen. Bicycle urbanism as a competitive advantage in the neoliberal age: the case of bicycle promotion in Portland. *International Planning Studies,* Vol. 23, No. 2, 2018, pp. 210-224.
[15] Barajas, J. Supplemental infrastructure: how community networks and immigrant identity influence cycling. *Transportation*, 2018.
[16] Stehlin, J., and A. Tarr. Think regionally, act locally Gardening, cycling, and the horizon of urban spatial politics. *Urban Geography,* Vol. 38, No. 9, 2017, pp. 1329-1351.
[17] Aldred, R., J. Woodcock, and A. Goodman. Does more cycling mean more diversity in cycling? . *Transport Reviews,* Vol. 36, No. 1, 2016, pp. 28-44.
[18] Frater, J., and S. Kingham. Gender equity in health and the influence of intrapersonal factors on adolescent girls' decisions to bicycle to school. . *Journal of Transport Geography,* Vol. 71, 2018, pp. 130-138.
[19] Goodman, A., and R. Aldred. Inequalities in utility and leisure cycling in England, and variation by local cycling prevalence. *Transportation Research Part F: Traffic Psychology and Behaviour,* Vol. 56, 2018, pp. 381-391.
[20] Xie, L., and J. Spinney. "I won't cycle on a route like this; I don't think I fully understood what isolation meant": A critical evaluation of the safety principles in Cycling Level of Service (CLoS) tools from a gender perspective. *Travel Behaviour and Society,* Vol. 13, 2018, pp. 197-213.

[21] Abasahl, F., K. Kelarestaghi, and A. Ermagun. Gender gap generators for bicycle mode choice in Baltimore college campuses. *Travel Behaviour and Society,* Vol. 11, 2018, pp. 78-85.
[22] Aldred, R., B. Elliott, J. Woodcock, and A. Goodman. Cycling provision separated from motor traffic: A systematic review exploring whether stated preferences vary by gender and age. *Transport Reviews,* Vol. 37, No. 1, 2017, pp. 29-55.
[23] Prati, G. Gender equality and women's participation in transport cycling. *Journal of Transport Geography,* Vol. 66, 2018, pp. 369-375.
[24] Joshi, R., and Y. Joseph. Invisible cyclists and disappearing cycles: The challenges of cycling policies in Indian Cities. *Transfers,* Vol. 5, No. 3, 2015, pp. 23-40.
[25] Rebentisch, H., R. Wasfi, D. P. Piatkowski, and K. Manaugh. Safe Streets for All? Analyzing Infrastructural Response to Pedestrian and Cyclist Crashes in New York City, 2009–2018. Vol. 2673, No. 2, 2019, pp. 672-685.
[26] Rothman, L., M.-S. Cloutier, K. Manaugh, A. W. Howard, A. K. Macpherson, and C. Macarthur. Spatial distribution of roadway environment features related to child pedestrian safety by census tract income in Toronto, Canada. 2019, pp. injuryprev-2018-043125.
[27] Goddard, T., K. Kahn, and A. Adkins. Racial bias in driver yielding behavior at crosswalks. *Transportation Research Part F: Traffic Psychology and Behaviour,* Vol. 33, 2015, pp. 1-6.
[28] Mitchell, O., and G. Ridgeway. Assessing the fairness and effectiveness of bicycle stops in Tampa. *Police Quarterly,* Vol. 21, No. 4, 2018, pp. 461-485.
[29] Sagaris, L., and A. Arora. Cycling for social justice in democratizing contexts: Rethinking "sustainable" mobilities.In *Urban Mobilities in the Global South*, Routledge, London, UK, 2017. pp. 19-40.
[30] Aldred, R. A matter of utility? Rationalising cycling, cycling rationalities. *Mobilities,* Vol. 10, No. 5, 2015, pp. 686-705.
[31] Osborne, N., and D. Grant-Smith. Constructing the cycling citizen: A critical analysis of policy imagery in Brisbane, Australia. *Journal of Transport Geography,* Vol. 64, 2017, pp. 44-53.
[32] Macmillan, A., J. Connor, K. Witten, R. Kearns, D. Rees, and A. Woodward. The societal costs and benefits of commuter bicycling: Simulating the effects of specific policies using system dynamics modeling. *Environmental Health Perspectives,* Vol. 122, No. 4, 2014, pp. 335-344.
[33] City of Halifax. *Centre plan draft* City of Halifax, Halifax, Canada. https://www.shapeyourcityhalifax.ca/1041/documents/6261 Accessed July, 2019.
[34] City of Montreal. *Transportation plan.* City of Montreal, Montreal, Canada. http://ville.montreal.qc.ca/pls/portal/docs/PAGE/TRANSPORTS_FR/MEDIA/DOCUMENTS/TRANSPORTATION%20PLAN%202008_COM.PDF. Accessed July, 2019.
[35] City of Hamilton. *Transportation master plan.* City of Hamilton, Hamilton, Canada. https://d3fpllf1m7bbt3.cloudfront.net/sites/default/files/media/browser/2018-10-24/tmp-review-update-final-report-oct2018.pdf Accessed July, 2019.
[36] City of Kingston. *Active transportation plan.* City of Kingston, Kingston, Canada. https://www.cityofkingston.ca/documents/10180/17995653/Projects_WalknRollKingston_DraftReport.pdf/fec89519-a0ac-424b-ae31-4db4c425a049. Accessed July, 2019.
[37] City of Winnipeg. *Pedestrian and cycling strategies.* City of Winnipeg, Winnipeg, Canada. http://winnipeg.ca/publicworks/pedestriansCycling/strategiesActionPlan/pdf/strategy.pdf. Accessed July, 2019.
[38] City of Regina. *Transportation master plan.* City of Regina,, Regina, Canada. http://www.designregina.ca/wp-content/uploads/TransportationMasterPlanNOV201.pdf Accessed July, 2019.
[39] City of Saskatoon. *Active transportation plan.* City of Saskatoon, Saskatoon, Canada. https://www.saskatoon.ca/sites/default/files/documents/2016-06_atp_summary_report_final_08-26_submission_-_combined_rfs.pdf Accessed July, 2019.
[40] Ville de Quebec. *Plan de mobilité durable: Pour vivre et se déplacer.* Ville de Quebec, Ville de Quebec, Canada. https://www.ville.quebec.qc.ca/apropos/planification-orientations/transport/docs/PlanMobiliteDurable.pdf Accessed July, 2019.
[41] City of Ottawa. *Ottawa transportation plan.* City of Ottawa, Ottawa, Canada. https://documents.ottawa.ca/sites/default/files/documents/tmp_en.pdf Accessed July, 2019.
[42] City of Kelowna. *Community climate change action plan update* City of Kelowna, Kelowna, Canada. https://kelownapublishing.escribemeetings.com/filestream.ashx?DocumentId=7055. Accessed July, 2019.

[43] City of Halifax. *Integrated mobility plan.* City of Halifax, Halifax, Canada. https://www.halifax.ca/sites/default/files/documents/about-the-city/regional-community-planning/IMP_report_171220-WEB.pdf. Accessed July, 2019.
[44] City of Toronto. *Cycling network 10 year plan.* City of Toronto, Toronto, Canada. https://www.toronto.ca/services-payments/streets-parking-transportation/cycling-in-toronto/cycle-track-projects/cycling-network-10-year-plan/ Accessed July, 2019. [
45] Hansen, W. How accessibility shapes land use. *Journal of the American Institute of Planners,* Vol. 25, No. 2, 1959, pp. 73-76.
[46] City of Vancouver. *Transportation plan.* City of Vancouver, Vancouver, Canada. http://vancouver.ca/files/cov/Transportation_2040_Plan_as_adopted_by_Council.pdf Accessed July, 2019.
[47] City of London. *Cycling master plan.* City of London, London, Canada. https://www.london.ca/residents/Environment/EAs/Documents/London%20ON%20Bikes%20-%20Full%20Report%20-%20Final%20September%202016.pdf.
[48] City of Saint John's. *Cycling master plan.* City of Saint John's,, Saint John's, Canada. https://www.stjohns.ca/sites/default/files/files/publication/Cycling%20Master%20plan%5B1%5D_0.pdf. Accessed July, 2019.
[49] City of Edmonton. *Transportation master plan.* City of Edmonton, Edmonton, Canada. https://www.edmonton.ca/city_government/documents/land_sales/TransportationMasterPlan.pdf. Accessed July, 2019.
[50] City of Calgary. *Transportation master plan.* City of Calgary, Calgary, Canada. http://www.calgary.ca/_layouts/cocis/DirectDownload.aspx?target=http%3a%2f%2fwww.calgary.ca%2fTransportation%2fTP%2fDocuments%2fCTP2009%2fcalgary_transportation_plan.pdf&noredirect=1&sf=1. Accessed July, 2019.