Goal and Project Description

The transportation sector is in the midst of a revolution spurred by advancements in transportation technologies, such as self-driving vehicles, bicycle-sharing systems, ride-hailing apps, electrification, and demand-responsive transit (Benevolo et al., 2016; Lyons, 2018; Sperling, 2018). While some academics and policymakers envision new mobility utopias—in which technology will drive improvements in efficiency, CO_2 emissions, and social inclusion (Pettigrew et al., 2019; Sperling, 2018)—and others predict dystopias—where private vehicles control more of the public realm, mobility benefits are concentrated among the wealthy, and public transportation services erode due to ill-fated public–private partnerships (Ferdman, 2020; Lane, 2019; Wiig, 2015)—there are currently more than a million structurally marginalized Canadians (e.g. recent immigrants, low-income families, racialized populations) who already live in communities with significant transportation barriers. These limit their ability to access healthcare (Boisjoly et al., 2020; Mayaud et al., 2019; Paez et al., 2010; Shah et al., 2016), education (Allen & Farber, 2018; Bierbaum et al., 2020; Palm & Farber, 2020), employment (Allen & Farber, 2019b; Deboosere & El-Geneidy, 2018; Páez & Farber, 2013), and other opportunities (Farber et al., 2018; Farber & Páez, 2011a; Páez et al., 2010; Reyes et al., 2014; Widener et al., 2017), thereby reducing their participation in essential activities and aggravating existing social inequalities (Allen & Farber, 2020). Scholars refer to the confluence of socioeconomic and transport disadvantages as **transport poverty**, and to the supressed participation of those experiencing transport poverty as **transport-related social exclusion (TRSE;** Kenyon, 2006; Lucas, 2004, 2012; Lucas et al., 2001; Páez et al., 2009). These issues have been further magnified by societal upheavals caused by the COVID-19 pandemic and the historic and ongoing marginalization of racialized voices within Canada's transportation sector (Kobayashi, 1990; Mohamud, 2020; Palm et al., Submitted)

Through its Insight and Connection components, the proposed five-year **Mobilizing Justice** partnership project will provide Canadian scholarly, planning, and stakeholder communities with critical evidence and tools so they can understand and plan for the needs of people experiencing transport poverty. Our achievable, albeit ambitious, five-year timeline (see **Description of Formal Partnership)** is designed to advance research into practice urgently demanded by partners and other stakeholders. It will provide community advocates and transportation policymakers with the knowledge and tools they have asked for to ensure that unmet transportation needs do not burden Canada's vulnerable residents. Our actionable research findings and integrated knowledge mobilization (KMb) plan will help government and community stakeholders ensure that future transportation advocacy, planning, decision-making, and implementation meets the needs of all Canadians. In addition to developing a sustainable research and knowledge sharing partnership across sectors, geographies, and multiple levels of government, **Mobilizing Justice** will:
- Document, describe, and assess the causes, scale, and effects of transport poverty in Canada;
- Develop and empirically validate transportation equity standards and equitable planning processes to be used by transport planners, decision-makers, and community advocates; and
- Evaluate solutions to address transport poverty by conducting field experiments and socioeconomic evaluations of smart mobility and transportation policy pilots across Canada.

The Mobilizing Justice partnership developed from extensive collaborations among our confirmed partner organizations, including via our 2018 SSHRC PEG and our 2019 Connections workshop, where industry, non-profits, academics, and representatives from six of Canada's largest cities met to identify a vision for transportation equity in Canada and the research needed to achieve it. Since July 2020, our co-applicants and collaborators have met at 14 workshops and planning meetings to co-design a detailed plan of research and engagement. We all agreed that a major barrier to the development and adoption of transportation equity policy among agencies is the lack of strong connections between academics and practitioners; only a multi-sectoral partnership will effectively co-create knowledge and translate it into policy. Therefore, our partnership leverages the scholarly and practice expertise of **14 government agencies, 12 universities, 7 industry partners, and 7 non-profit organizations** from six provinces

(PQ, ON, AB, MB, NL, and BC) and two states (TX and OR) to address critical gaps in knowledge, theory, and measurable equity standards.

Transportation is expected to play an increasing role in worsening social problems as rapid population growth and rising home prices continue to push structurally marginalized Canadians to the urban periphery (Hulchanski, 2010; Wachsmuth & Weisler, 2018), where public transit service and active travel infrastructure can be expensive and difficult to provide (Aldred, 2019; Filion & Saboonian, 2019; Firth et al., 2021; Guerra & Cervero, 2011). We urgently need to identify the causes and extent of transport poverty in Canada along with policies and interventions that can reverse it. Transport poverty will put millions more Canadians at risk of losing out on opportunities to better their lives (Allen & Farber, 2020), while also threatening economic productivity (Banister & Berechman, 2000; Deboosere et al., 2019) and social cohesion in our cities (Kamruzzaman et al., 2014), so effective solutions are urgently needed. Cities also face the significant challenge of evaluating the potential benefits, costs, and unintended consequences of integrating a heterogeneous mix of private-sector technologies with existing infrastructures and mobility services (Docherty et al., 2018). Within this context of uncertainty, it is vital to engage in evidence-based research to guide transportation policy (Siemiatycki & Farooqi, 2012). Our work will help maximize the potentially positive aspects of emerging technologies and minimize the risks of technology-induced disruption for those experiencing and at risk of transport poverty. Mobilizing Justice will coordinate and focus Canada's transportation research and policy communities on the accessibility, participation challenges, and lived experiences of structurally marginalized people.

Academic and Canadian Policy Contexts

Social Exclusion and Equity Standards: A fundamental purpose of an urban transportation system is to enable participation in the activities of daily life, but, perhaps surprisingly, this is rarely the focus of transportation planning research and practices (Allen & Farber, 2020; Cass et al., 2005; Cullen & Godson, 1975; Hine, 2003; Kamruzzaman & Hine, 2011; Kenyon, 2003; Páez et al., 2009; Preston & Rajé, 2007; Stanley et al., 2011). Instead, planning has generally focused on improving easier-to-measure goals such as congestion reduction, economic development, and urbanization, while reducing externalities such as emissions and the number of recorded collisions (Handy, 2008). It has proven exceedingly challenging to incorporate human-centered goals, such as the equitable freedom to participate in daily life activities, directly into the planning process as they are difficult to measure and model (Martens, 2016). This has had negative consequences for structurally marginalized groups for whom traditional forms of socioeconomic disadvantage often combine with transport-related disadvantages to create significant barriers to participation in out-of-home activities (Lucas, 2012). Given the automobile-oriented urban forms in the US, addressing these issues has often focused on making private car ownership more available for people living in poverty (Blumenberg & Pierce, 2012; Blumenberg & Smart, 2014; Ong & Blumenberg, 1998; Smart & Klein, 2016). But scholars have debated the ethics of serving the needs of people experiencing transport poverty by increasing access to private automobiles (Farber & Páez, 2011b; King et al., 2019) versus more targeted investments in public transportation (Allen & Farber, 2020; Martens, 2016). Recently, researchers have begun to consider the opportunities that could be provided by new mobility technologies such as subsidies for ride-hailing apps, that may put the benefits of automobility into the hands of more people (Boone et al., 2018; Cohen et al., 2017; Palm, Farber, et al., 2020; Sweet et al., 2020). But without the knowledge our partnership will produce, these could exacerbate TRSE.

In Canada, TRSE is a challenging problem given the country's high degree of urbanization (Statcan, 2019c), increasing inequality and income polarization (Statcan, 2019a), consistently high levels of population growth through immigration (Statcan, 2019b), and the ongoing spatial dispersion of structurally marginalized and racialized groups away from transit-rich and walkable downtowns and into automobile-oriented suburbs (Hulchanski, 2010; Mohamud, 2020). Millions of Canadians are already experiencing or at risk of transport poverty (Allen & Farber, 2019b; Walks, 2001) but, if left unchecked, these socio-spatial trends will have extreme negative effects on the health, economic status, and wellbeing of millions more in the upcoming decades (Mayaud et al., 2019).

Despite increasing inequality within Canadian cities, we lack a shared definition of what equitable transportation means, and we have no quantifiable standards to ensure that equitable and adequate transportation is provided. As we confirmed during our extensive planning workshops, few jurisdictions have developed standards that will ensure the equitable provision of sufficient transportation, and no standards have been developed to enable equitable participation in the activities of daily life across urban populations. Governments expressed a lack of knowledge over how to measure equity, and how to measure and communicate the benefits of a more equitable transportation system to decision makers. As a result, Canadian transportation planning practices vary greatly in terms of whether transport equity is even recognized as a planning objective, how community needs and transport equity are embedded into planning goals and processes, and what metrics are used to assess marginalized populations' transportation needs in urban environments of various sizes (Golub & Martens, 2014; Karner & Niemeier, 2013; Linovski et al., 2018; Manaugh et al., 2015; Martens et al., 2012; Sanchez & Wolf, 2005). Mobilizing Justice will fill this gap: defining what transportation equity means within Canada and developing comprehensive transportation equity metrics, standards, and planning processes.

To this end, our team will engage with global **theoretical debates** about how the costs and benefits of transportation systems should be measured and distributed justly (Banister, 2018; Garrett & Taylor, 1999; Pereira et al., 2017; Sanchez & Brenman, 2007; Sanchez & Wolf, 2005). Some scholars have drawn from sufficientarian ethics, according to which every traveler's most basic needs should be met – in practice, this would involve a minimum standard of transport supply for all (Martens, 2016). One such standard is a minimum service standard for public transit vs. the benefits provided by the automobile (Golub & Martens, 2014); another is a basic guarantee that every resident can reach key activity destinations within a certain travel time, referred to as the "20-minute city" concept (Capasso Da Silva et al., 2020; Clark, 2019; Stanley & Stanley, 2014). Others, have drawn from Nussbaum and Sen's capability approach to distributive justice (Nussbaum & Sen, 1993; Sen, 1992), which prioritizes policies that unlock the greatest amount of supressed travel by recognizing and attending to different people's unique needs and barriers. Some scholars have applied this framework to transport planning through the lenses of TRSE (Lucas, 2012; Lucas et al., 2001), needs-based transport planning (Di Ciommo et al., 2018), and the measurement of how transportation affects wellbeing and life satisfaction (De Vos et al., 2013; Spinney et al., 2009). An example of an equity standard rooted in the capability approach might include vehicle and transit fare subsidies that are geared to income.

These different theoretical foundations have led to disparate ways of quantifying and assessing transport poverty within the last decade in Canada and elsewhere. For example, gaps analyses attempt to locate places in cities where socially derived demand for public transportation coincides with lower levels of transit service provision (Currie, 2010; Fransen et al., 2015); vertical equity ratios try to assess how justly transport benefits are distributed across socioeconomic strata (Allen & Farber, 2019a); and Gini coefficients help determine if transport benefits are evenly distributed (Delbosc & Currie, 2011). The metrics used for assessing the equity of transportation systems lack empirical validation in terms of whether improving on these metrics actually improves participation and wellbeing (e.g. Allen & Farber, 2020; Deboosere et al., 2019; Roorda et al., 2010). They also lack verification by community stakeholders to ensure they address real transportation problems experienced by people in transport poverty (Karner & Marcantonio, 2018). Mobilizing Justice will bring clarity to these theoretical debates by empirically assessing sufficientarian and capability-based equity metrics against the travel patterns, travel needs, and socioeconomic outcomes of people experiencing transport poverty.

Lack of Transport Poverty Data in Canada: While existing transportation datasets, such as regional household travel surveys, trip diaries, and new forms of mobility big data, are helpful in identifying and describing differences in travel behaviour, there are four main challenges to their use in effective transport poverty research: (1) it is difficult to determine whether differences in travel patterns are due to barriers in the system or to the personal preferences of respondents (Páez & Farber, 2012); (2) those at risk of transport poverty in any large city are a diverse minority, so large sample surveys seldom capture enough information on structurally marginalized populations to yield statistically robust findings on the causes and potential solutions to transport poverty; (3) most surveys collect data on the trips that

are taken and neglect important data gathering about the trips that *are not* taken (Farber et al., 2018); and (4) surveys have not collected information about the perceived needs and potential shortcomings of the transportation system (Di Ciommo et al., 2018). Combined, these challenges hinder researchers' ability to adequately situate transport poverty solutions within either the sufficientarian- or capability-based understandings of distributive justice, significantly hampering our ability to generate and assess effective transport equity standards and processes. We will address these challenges by conducting community case studies and collecting a national survey of transport poverty (n=20,000) to investigate and compare theoretical underpinnings, and better inform policies that can succeed in eliminating barriers to daily travel and activity participation.

Experimenting with Solutions for Transport Poverty: During our many planning workshops, governments from across Canada expressed their need for clarity on the equity impacts of new mobility services (e.g., ride-hailing apps, e-bike sharing), smart mobility management (e.g., dynamic congestion pricing), and other publicly debated transport policies (e.g., free fares). Existing evaluations failed to emphasize, and lacked clarity about, the effects of such technologies on structurally marginalized groups. (Palm, Farber, et al., 2020). Members of our team have begun to experiment with these innovations and how they might be used to improve accessibility for those experiencing transport poverty (e.g. Brown, 2020; Golub et al., 2019; Young & Farber, In Press; Zhang et al., 2020). Mobilizing Justice will contribute scaled-up, expertly designed research to compare the relative effects of policy innovations and mobility technology pilots on structurally marginalized populations; pilots will represent a diversity of travel modes, population groups, and geographic contexts across Canada. They will serve as an integrated testing ground for situating different transport solutions within our theoretical frameworks, and will represent tangible examples for how communities and transport practitioners can assess transport equity problems, design and test solutions, and evaluate their performance in addressing transport poverty and TRSE. By synthesizing learning across a national assortment of pilot projects, we will develop a shared understanding of best practices when working in partnerships involving private-sector mobility offerings, governments, and academic evaluation teams.

Research Program

Our research program will be structured into six working groups: three **research activities groups,** each aligned with one of Mobilizing Justice's primary aims, and three **cross-cutting thematic groups**, which will conduct supporting and evaluative research actions integrated across the activity groups. Under the coordination of Project Director Steven Farber and guided by our diverse partner needs, each group has developed integrated workplans, including research questions, training schedules, and detailed timelines of milestones and knowledge mobilization over the 5-year project (See the *Partnership Timeline* table in the **Description of Formal Partnership** section). Each working group will be co-led by an academic Co-applicant (CoA) and a non-academic representative.

Thematic Working Groups (TWGs)

TWG1*: Prioritizing Populations* – Leads: Widener (UofT); Cantin (Autorité Régionale de Transport Métropolitain). The Prioritizing Populations TWG will identify which populations are most at risk of TRSE and provide guidance about who in Canada needs to be prioritized within an equitable transportation planning practice. Year 1 will begin with (i) a review of transportation in relation to COVID-19, including reviews of advocacy efforts, funding and revenue crises, and scientific accounts of mode-shifting and remote-work. The review will culminate in a brief report that will inform the team as to how best to adapt our research strategies in light of the pandemic and its impact on Canadian transportation systems and communities. Year 1 will also include (ii) a systematic review of whether and how existing transportation surveys collect social (e.g. race, age, ability, immigration status, gender) and economic identifiers (e.g. education, employment, and income) that are theorized to be relevant to the measurement of TRSE. These practices will be compared to existing survey instruments, like the long-form census and the General Social Survey of Canada, which have been designed to capture diverse social and economic identities and conditions. This comparison will lead to design recommendations for our national survey (Activity 1 below) and new standards for transport data collection across Canada, which will support evidence-based transport equity policy. In addition to identifying priority populations,

our government partners have articulated the need for specialized transport poverty metrics to identify geographic areas of concern, like neighbourhoods and census tracts. TWG1 will address this need in Years 1–4 by developing, testing, and refining (iii) a national dataset of transport poverty metrics by combining multidimensional metrics of neighbourhood socioeconomic deprivation with state-of-the-art measures of transport supply. These will be developed alongside the equity benchmarking activities carried out by Activity 2's working group so that they can be validated against observed travel outcomes, and included in equity assessments of proposed investments in new transport infrastructure.

According to the capability approach, TRSE is not only place-specific, but also person-specific. This means that what individuals need from transportation systems varies by sociodemographic status, but it is not yet clear how different people perceive barriers in the transportation system or how they experience TRSE. Our municipal partners have identified the need to better understand how structurally marginalized people interact with transportation systems so that their heterogeneous needs can be addressed. In Years 3–5, TWG1 will address this need by (iv) conducting 5 mixed-methods case studies on specific priority populations. For example, CoA **Ross** might conduct a case study concerning children with disabilities; or CoA **Newbold** might focus on recent newcomers. The case studies will be strategically selected at a workshop in Year 3, based on national survey results, early policy pilots, and input from partners and communities. Each case study will compare sufficientarian and capability frameworks to further our understanding of the pros and cons of each theory in practice. They will deepen our understanding of the diversity of transport poverty experiences.

TWG2*: Transportation Modes* – Leads: Winters (SFU); Smith-Lea (The Centre for Active Transportation). This theme is designed to clarify the barriers to using different modes of transportation (e.g. car, bike, transit) and how those experiencing transport poverty manage or fail to use a mix of travel modes to meet their travel needs. It will interrogate the value of sufficientarian standards for multi-modal transport provision, and contrast this against the capability-based measures of individual needs, barriers, and coping strategies. Work will begin with (i) a systematic review of existing knowledge on modal barriers across Canada. This review will include barriers related to specific population groups, as well as overall disparities in the supply of different modal infrastructures. This review will inform the design of (ii) 3 qualitative case studies, carried out by TWG2 in Years 2–4, which will address knowledge gaps related to motivators, barriers, and adaptation processes for different modes of transportation among the transport poor; it will also support Activity 1 (below) in the analysis of the national survey. In Years 3–5, TWG2's case studies will be combined with quantitative analysis of the national survey (Activity 1) to clarify whether modal substitution can overcome mode-specific transportation barriers; this will help policymakers support households with poor access to their preferred travel modes. Findings will also yield recommendations for mode-specific providers (e.g., transit agencies, ride-hailing companies, bike-share system operators) – on how to make their services more accessible – and for public policies to enforce this.

The provision of infrastructure also varies by mode in terms of planning, funding, data standards, and regulation. TWG2 will support the other working groups in navigating these considerations, and will identify and construct appropriate mode-specific transport networks and associated service levels and accessibility scores. For example, theme lead **Winters** will lead the (iii) creation of a standardized national cycling infrastructure dataset with geospatial data partner **Esri Canada**; and CoA **Shalaby** will (iv) generate new measures of transit accessibility with **Toronto Transit Commission** and **Canadian Urban Transit Association**, which will incorporate real-time and historical performance characteristics like on-time performance and crowding. These data products will be used as inputs across the partnership, and will yield new insights into the establishment of transportation data standards for adoption by industry and government partners. Finally, TWG2 researchers will provide expertise to each mobility pilot (Activity 3), (v) collaborating on pilot design/evaluation and assessing the relevance of findings for mode-specific planning and regulation.

TWG3: *Equitable Community Planning and Engagement* – Leads: Linovski (UofM); Pitter (Community Planner). TWG3 will examine the spectrum of professional and political actors who facilitate or hinder efforts to reduce transport poverty, using collaborative research methods to

understand how the activities of community groups, planners, and decision-makers can better support equitable planning processes. Existing transportation planning processes in Canada tend to exclude input from marginalized populations, contributing to unequal or ineffective allocations of resources (Linovski et al., 2018). Little academic research or professional practice has focused on community-based advocacy related to transport – an omission that discounts the substantial grassroots work being done to overcome TRSE. In Years 1–2, co-leads **Linovski** and **Pitter** will facilitate (i) the creation of case studies of community-based transportation-justice mobilization efforts across Canada, co-produced with community groups and supported through micro-grants (30 case studies, $500/group; see **Budget Justification**). Pitter, Linovski, and many other members of our partnership maintain regular working relationships with community advocacy groups across the country (see **Potential Partners**). Community groups will be invited to participate in the case studies so as to ensure a diverse representation of locations, social identities, and economic conditions (e.g. unemployed, students, residents in community housing). In this way, we will document the advocacy work being done and ensure our research is informed by community-based knowledge and shared within and across regions, thus offering reciprocal benefits to the participating organizations.

Starting in Year 2, **Linovski** will lead (ii) a survey of elected officials serving on transport-related committees at all levels of government (n=40) on barriers and opportunities for more equitable transport planning processes and outcomes. Recruitment will be facilitated by local governments and national professional organizations, **Federation of Canadian Municipalities, Canadian Institute of Planners, Canadian Urban Transit Association**. Follow-up (iii) focus groups and interviews in Year 3 will build on these finding by examining decision-makers' use of evidence and data (like that collected in the Activity 1 survey), their support for equity standards (like those developed in Activity 2), and their implementation of innovative transportation solutions (like those explored in Activity 3). They will be asked to comment on the desirability and feasibility of implementing equity standards that find their roots in sufficientarian versus capability-based conceptualizations of distributive justice, thus contributing to our ability to reach consensus on a set of recommended standards.

In Years 3–5, **Linovski** and Craig Lametti, a Partner at **Urban Strategies** will engage in a series of workshops with community groups, planners, funders, and decision makers, to (iv) produce a transportation planning process map that clearly identifies when and how equity-focused activities should be integrated into the transport planning process. This work will culminate in an accessible planning tool, which will be disseminated widely to professional, political, and community-based actors, and serve as a benchmark for equitable transportation planning processes and outcomes.

During our project planning workshops, government and community partners repeatedly expressed concerns over the lack of integration between transport, land-use, and housing policy, resulting in gentrification, unaffordability, and potential displacement of communities for whom improvements were intended to serve. Accordingly, transport poverty cannot truly be addressed without aligned work within the housing and land-use domains. Research is needed to better understand when and where transit-oriented development will induce gentrification and displacement, what the effects are on marginalized populations who are displaced, and what strategies and policies, such as affordable housing provisions, are needed (Zuk et al., 2018). CoA **Higgins,** Julia Markovich a Senior Specialist at **CMHC,** and Mark Brown a Chief at **Statistics Canada** will (v) conduct longitudinal, quantitative research investigating relationships between transport development, land-values, and population dynamics. This will provide our partners with a refined understanding of the scope and magnitude of the transport-induced displacement problem within Canada, and will support efforts to incorporate affordable housing policy into a more holistic and equitable transport planning practice.

Research Activity Working Groups

Activity 1 (A1): *National Survey of Transport Poverty and TRSE* – Leads: Morency (Polytechnique); Hassan (City of Edmonton). The A1 working group (A1WG) will design and implement a state-of-the-art survey on transport poverty and TRSE in Canada, drawing on the capability framework for understanding transportation barriers and supressed demand, and the sufficientarian framework to explore what combination of transport provision might be considered a necessary baseline.

We will work with professional survey firms to target and collect data from 20,000 low-income households, with the understanding that these households (which are considered priority populations within this partnership) are subject to multiple sources of structural marginalization, including but not limited to: age, recent immigration, racialization, lone-parent families, and food-insecurity. A1WG will select Census Metropolitan Areas across Canada for inclusion; the results will yield important information about the scale, causes, and effects of transport poverty within different structurally marginalized groups and across different metropolitan regions of Canada. We have identified the following potential survey sections, which will be confirmed/refined prior to the survey's launch: demographic information; barriers and attractors to travel at the individual level (e.g., language, driver's licenses, smartphone ownership, fear of personal safety or COVID transmission), household level (e.g., vehicle ownership, lack of income), and at the neighbourhood level (e.g., crime, transit availability); space-time constraints (e.g., how time pressures such as work/childcare discourage participation in activities); effects of transport poverty on participation and wellbeing in the long (e.g., labour force participation, education, self-assessed health and wellbeing) and short term (e.g., ability to get to doctor appointments and grocery shopping); and travel and activity patterns over a representative period of time. Unlike previous research involving travel diaries, our survey will collect novel information about the supressed demand for travel by asking respondents to consider what trips or activities they **did not** make over the specified period, and why. The working group will use stated-preference experimental designs with which CoAs **Silver** and **Habib** have extensive experience.

A1WG will (i) develop, program, and (ii) pilot the survey in Year 1. Following post-pilot refinement and consultation with project partners, we will begin (iii) collecting data at the end of Year 1 and continue recruitment and collection in Year 2. In Year 3, A1WG will (iv) validate and weigh the survey responses based on custom cross-tabs from the Canadian Census, (v) producing a data summary report, documentation, and anonymized datasets for researchers and stakeholders. A synthetic population version of the dataset will be created and shared publicly, adhering to strict privacy and ethical protocols. In Year 4, respondents' (v) records will be linked by **Statistics Canada** with their "T1 Family File/T1FF," which contains each respondent's last five years of income, residential mobility, and employment locations; this will enable unprecedented longitudinal analysis of the relationship between transportation resources and broader trends in income and neighbourhood changes (e.g., gentrification, suburbanization of poverty, displacement). This version of the dataset will be made available to researchers at all 32 Canadian universities where Statistics Canada operates Research Data Centres.

A2: Data-Driven Equity Standards – Leads: Páez (McMaster); Hain (City of Toronto). A2WG will develop, analyse, and compare equity standards rooted in the sufficientarian and capability frameworks of transport justice. The findings will reveal how thresholds should be defined, and whether and how they should be varied across different modal mixes, sociodemographic groups, and geographic areas, as informed by research from the TWGs. Few established models of equity standards have incorporated operational or real-time data in examining transportation service levels (Palm, Shalaby, et al., 2020), so this work will innovate by developing and examining equity standards by time of day and season, using real-time data streams. This is useful to understand the effects of, for example, time of day on acceptable crowding and time of year on sufficient bus wait-times. A2WG will co-create standards for transportation resources with partner agencies and municipalities by testing the relationships between transport provision (supply and performance) and revealed activity participation, social and economic outcomes, and self-stated levels wellbeing and supressed demand for travel. In Year 1, the working group will (i) engage in a conceptual review of the academic and planning literatures. In Years 2–3, it will (ii) develop accessibility measures of transport supply and (iii) model relationships between supply and travel behaviour outcomes using existing household travel surveys. Through collaboration with government, industry, and non-profit partners, A2WG will (iv) develop initial standards in Year 3 and then (v) further refine them in Years 3–4, based on analysis of the A1 national survey results and through their application to A3 pilot evaluations. (vi) Decision-support tools will be developed, tested, and disseminated in Year 5, allowing project partners, advocates, and the public to use equity standards to evaluate and advocate for local transportation projects and plans. Tools will be open-sourced and

platform agnostic, recognizing the diversity of needs and capabilities of their intended government and public users. Partner **Esri** is contributing software development resources to incorporate tools into their widely used ArcGIS Online platform, to facilitate easier adoption by stakeholders and the general public. The working group will beta-test tools in collaboration with TWG3 to support community input into design and to encourage uptake by advocacy groups. In Year 5, A2WG will produce technical documentation of standards and tools and host training events to further facilitate uptake.

A3: Evaluate Mobility Technology and Innovative Policy Pilots – Leads: Hall (UofT); Khany (City of Vancouver). A3WG will experiment with and document how innovative policy pilots and emerging technologies can be used to support the needs of people experiencing transport poverty. The results will clarify behavioural responses to changes in the transportation system, and provide much-needed evidentiary support for planners and decision makers grappling with how best to apply new technologies to solve transportation problems. This work will evaluate innovative policies (e.g., congestion pricing, bus-only lanes) and new mobility technologies (e.g., on-demand bus service, ride-hailing, e-bike sharing systems in low-income suburban neighbourhoods), and synthesize the findings across all project themes and activities in online story maps, briefs, and reports.

In Year 1, A3WG will (i) develop governance documents for pilots, including research ethics board applications, data-sharing agreements, and intellectual property agreements. In collaboration with non-profits and advocacy groups working with the communities affected, they will devise pilot evaluation checklists along with formal criteria for pilot selection and community oversight. These criteria will ensure a diversity of geographic, socioeconomic, and modal representation (e.g. transit, bikeshare, congestion charge) across a total of 8 pilots to be conducted in Years 1–4. Each project will include an academic lead, a government partner, community group, and, for tech pilots, a technology partner. The selection criteria will also ensure that pilot teams include participation from researchers drawn from the three cross-cutting themes (e.g. an appropriate expert from the population, transport mode, and the community planning groups), in addition to the A3WG member. Preference will be given to projects that incorporate novel experimental designs within transportation research, including randomized control trials, pre-post designs, and pilots that incorporate cutting-edge topics stemming from behavioural economics. For example, we might conduct a pre-post study where carless, night-time shift workers were incentivized to use new on-demand vanpool service, delivered by partner **Via**, **Spare Labs**, or **Pantonium**.

(ii) The 8 two-year pilots will launch according to a staggered schedule: one launch in Year 1, three in Years 2 and 3, and one in Year 4. Each will involve co-creation of analysis plans and research methods with communities, as well as post-evaluation debriefs with stakeholders and the communities affected. Beyond academic publications, practitioner-oriented policy briefs and multi-media presentations will be developed after each pilot evaluation. In Year 5, A3WG will (iii) synthesize the results across case studies and distribute the findings as a report and an interactive story map. In Year 5, it will also update pilot governance documents for continued use by academics and governments across Canada and globally – a need specifically identified by government members of our partnership.

Conclusions

This innovative and comprehensive research program, coupled with our extensive KMb strategy and genuine multisectoral collaborations, will significantly improve how government agencies plan and operate transportation systems and programs. Ultimately, this will result in improved outcomes for structurally marginalized populations: it will ensure that equity considerations become central to transportation planning practice and research in Canada, and in doing so, it will influence planners globally. The project will also help clarify the risks and benefits that new transportation technologies might bring to those experiencing transport poverty in the Canadian context, adding rigorous experimental evidence to a global debate that is currently lacking empirical validity. We anticipate the project will help create cities that will make it easier, rather than harder, for the nation's transport poor to empower themselves by accessing education, employment and other opportunities more easily. Taken together, our activities will transform how Canada plans its transportation infrastructure and, by extension, impact how transportation justice is incorporated into cities around the world.