**Variation in Public Perceptions Across Sustainable Transport Projects in Montréal, Canada**

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**Abstract:**

Public opinion is one of the main drivers of political action in relation to sustainable-urban transitions. However, little research has been conducted to understand how the characteristics of different sustainable-transport projects influence public opinions. Drawing from both quantitative and qualitative data from Montréal's 2021 Mobility Survey, this paper analyzes three transport projects – a light-rail (LRT), a bus-rapid transit (BRT), and an express-cycling network (REV)– to evaluate the characteristics that contribute to positive and negative social perceptions. Quantitative statements pertaining to six different project impacts were summarized and compared between projects, showing statistically significant differences between the projects. Qualitative data was pulled from open-ended questions for each project and analyzed using thematic analysis. Negative perceptions associated with the LRT were related to aesthetics and governance issues, whereas perceived detrimental impacts on businesses were more commonly associated with the REV and the BRT. The BRT was found to be exemplary in governance due to the inclusive consultation, the REV was praised for its speed and construction in phases, and the LRT was praised for providing higher accessibility to individuals. The findings from this research can be of benefit to practitioners and policy makers as they shed light on the various characteristics that positively and negatively impact public perceptions of three different sustainable-transport projects.

Key words: Sustainable Transport, BRT, LRT, Cycling Network, & Public Perceptions

## 1. INTRODUCTION

Public opinion has been identified as one of the main drivers of political action in relation to sustainable-urban transitions (*1-3*), making the study of social perceptions of transport infrastructure an imperative research topic. The majority of recent studies on the social acceptability in the field of transport have been focused on autonomous and electric vehicles (*4-6*) with little on bus-rapid transit (*2*) or light-rail transit (*3*).

This article assesses and compares public opinions of three under-development transport projects of different scales in Montréal, Canada. Drawing from both quantitative and qualitative data from Montréal's 2021 Mobility Survey (n=4,064), we aim to provide a deeper understanding of public perceptions towards a light-rail (LRT), a bus-rapid transit (BRT) and an express-cycling network (known with its French name "réseau express vélo" or abbreviated as REV). More specifically this paper tries to answer the following research questions: [1] What factors contribute to positive and negative social perceptions of sustainable transport projects? [2] What can we learn by comparing public opinions of three different infrastructure projects at different scales? [3] How can these findings be used to support policies and public-outreach campaigns to reduce car dependency while fostering higher rates of active travel?

## 2. LITERATURE REVIEW

This paper builds on the literature on social perceptions of urban infrastructure (*1-3*), understanding public engagements with transport systems as complex socio-cultural phenomena (*7*). Multidisciplinary research continues to demonstrate the importance of public-outreach initiatives in helping to demystify common stereotypes of public transport and influence public perceptions of sustainable transport modes (*8*). Public participation in planning processes has also been shown to have a positive impact on the adequacy of sustainable transport projects for local needs and on their social acceptability (*2; 9*). Still, past research has highlighted the need for balance between disruptiveness (which is required to force changes in behaviors) and implementability (a combination of social acceptability considerations and project-completion goals) in policy packages aiming to foster sustainable urban mobilities (*10*). This notion of sustainable-transport policy as disruptions was also elaborated in the context of the public's adaptability to changes in transport systems, and how a transparent approach embracing such disruptions can facilitate the implementation of policies by minimizing overall public frustration (*11*).

The majority of recent research on public perception and overall social acceptability of transport policies and projects has been primarily centered on autonomous vehicles (*4-6*). Still, some research has also been conducted around cycling infrastructure and how changes that promote overall improved public perceptions can lead to higher cycling mode shares (*12; 13*). BRT initiatives have also been considered through the lens of social acceptability to see how public perceptions can lead to the effective implementation of projects based on the integration of local needs (*2*). The acceptability of light rail projects, to our knowledge, has only been sparsely considered (*3; 14*).

Overall, there is a clear gap in the literature in term of factors promoting social acceptability for specific transport projects, especially LRT and BRT systems. As such, the

present paper aims to assess and compare public perceptions of three transport projects of different scales and modes in Montréal, Canada. It further highlights the primary concerns that can be considered and addressed to promote increased social acceptability with the aim of fostering sustainable-transport transitions.

## 3. CASE STUDY AREA

Montréal is Canada's second-largest city, with a metropolitan population of over four million residents in 2021(*15*). The Montréal metropolitan area is being served by an extensive public-transport network operated by four different agencies. The Société de transport de Montréal (STM) operates the bus system on the island of Montréal as well as its 69.2 km of underground Metro system, which extends off the island to the nearby suburbs where the Société de transport de Laval (STL) and Réseau de transport de Longueuil (RTL) operate the bus systems. Finally, EXO operates the commuter-rail system on the island of Montréal and the bus systems serving the far suburban areas. With the goal of reaching 35% mode share of public transport during peak morning commute by 2031 (*16*), Montréal has been heavily investing in public transport through building a new LRT system (*Reseau Express Metropolitain* (REM)) and a BRT line *(Pie-IX Bus Rapid Transit)*. Figure 1 is a map of Montréal showing the existing, under construction, and planned public-transport projects.
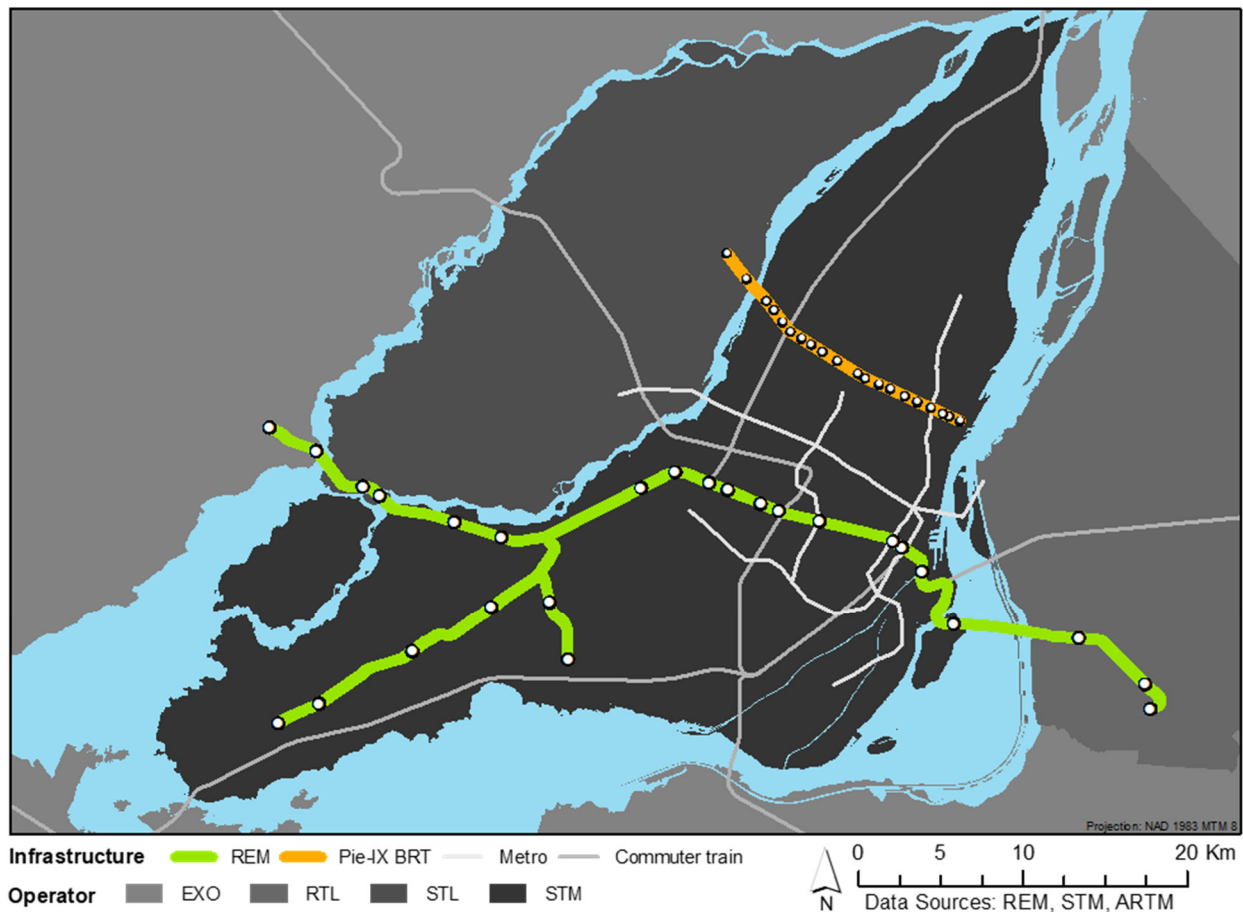


*Figure 1 Public transit infrastructure and operators in the Greater Montréal Region*

Montréal has been simultaneously investing heavily in its cycling network over the past decade, with more than 700 Km of separated bicycle lanes placing it as one of the most cycling friendly cities in North America. Recently the city of Montréal announced the building of a new set of connected and separated bicycle lanes named the *Reseau Express Velo* (REV). Figure 2 is a map showing the existing cycling infrastructure in Montréal as well as the planned new network.
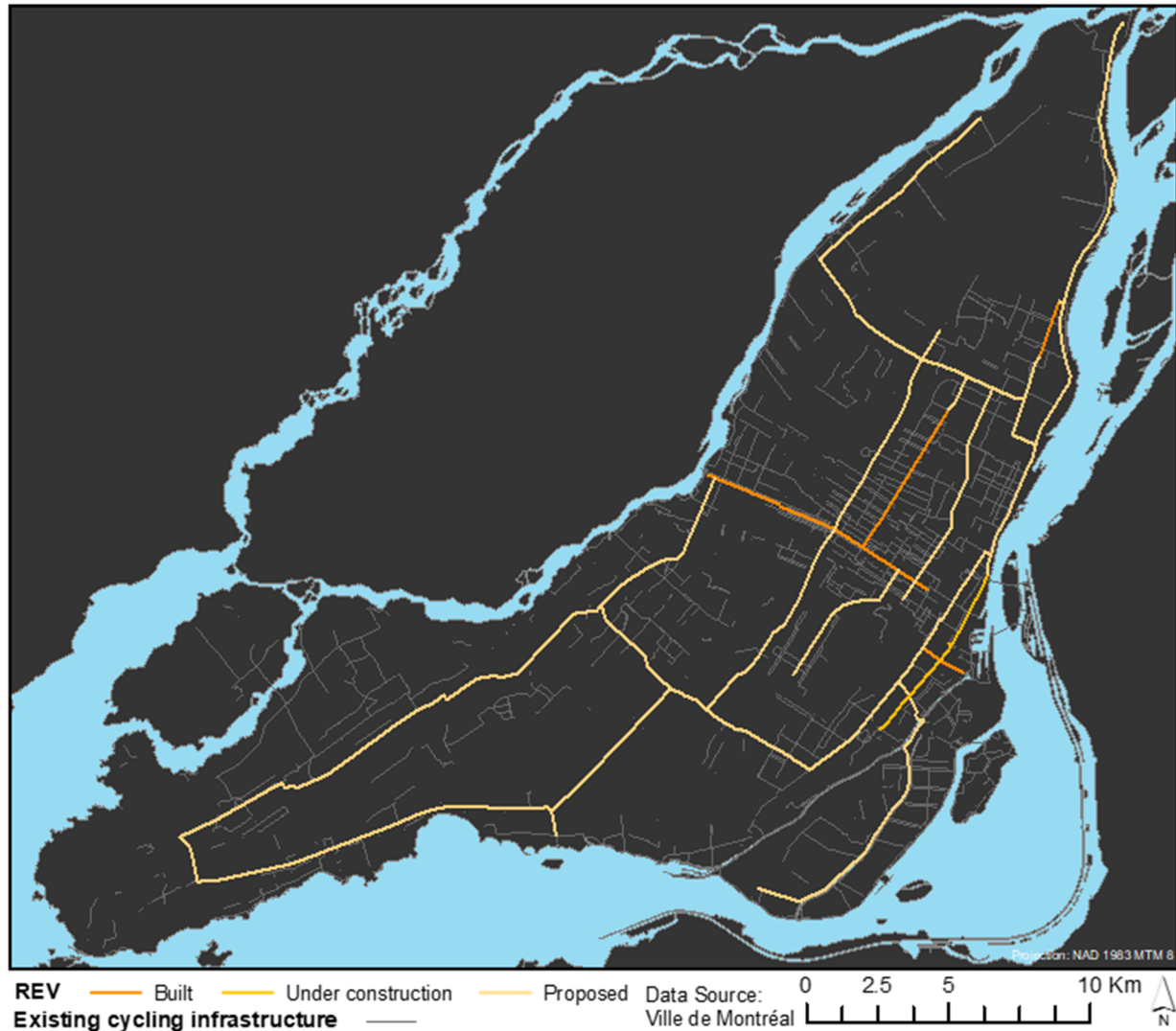


*Figure 2 Cycling infrastructure on the Montréal Island*

This study concentrates on comparing the public perceptions towards three different sustainable-transport projects: REM, BRT, and REV. Table 1 includes details of each project to better understand the context in which the project is proposed or constructed.

*Table 1 Project description for the Reseau Express Metropolitain (REM), Pie-IX Bus Rapid Transit (BRT) and Reseau Express Velo (REV)*

| | REM | Pie-IX BRT | REV |
|---|---|---|---|
| **Description** | Automated Light Rail Train (LTR) running on grade separated tracks | Bus Rapid Transit (BRT) running on dedicated lanes in the middle of the road | Unidirectional, raised protected bike lanes[1] |
| **Length (km)** | 67 | 17 | 184 (proposed in total) 18.5 (finished) 5.4 (in construction) |
| **Number of stops** | 26 | 20 | - |
| **Cost (CAD)** | $6.9 billions | $650 million | $214 million |
| **Finance source** | Public – Government of Quebec, Government of Canada  Private – Caisse de dépôt du Quebec (CDPQ) | Public – City of Montréal, ARTM (Agence Régionale de Transport Métropolitain) | Public – City of Montréal |
| **Promoter / Operator** | CDPQ infra | STM (Société de Transport de Montréal) | City of Montréal |
| **Public Consultation** | None / Minimal | Extensive | None / Minimal |
| **Announcement** | 2016 | 2009[3] | 2019 |
| **Start of construction** | 2018 | 2009 | 2020 |
| **Opening** | Fall 2022 | End 2022 | Summer 2021 |
| **Completion** | End 2024 | 2023 | 2027 |
| | | [3]Project Existed in a different iteration between 1989-2002 | [1]Infrastructures are first built temporarily at street level with bollard separation  [2]Budget includes the REV along with other extensions of the cycling network. Currently built REV tracks account for around $17 million. |
| **Sources** | CDPQ Infra (*17*), | STM (*18*),  CTV Montréal (*19*) | Ville de Montréal (*20*); (*21; 22*) |

## 4. DATA AND METHODS

### 4.1 Montréal Mobility Survey

In 2021, the Transportation Research at McGill (TRAM) group conducted the Montréal Mobility Survey (MMS). Following Dillman et al.'s suggestion for online surveys (*23*), multiple recruitment methods were applied to ensure a large and representative sample (i.e. marketing company, social-media advertising campaign, fliers distribution and invitation emails). In total, 4,064 valid survey entries were available for this analysis. All respondents were asked whether they knew about each of the projects of interest for this paper (REM, BRT and REV). Those who indicated some knowledge about any of the three projects were then asked a series of detailed questions regarding the expected impacts of each project that they had some knowledge about and their agreement with these impacts. For this study, we only use data from respondents who mentioned having some knowledge about one or more of the projects. Open-ended questions were posed at the end of each section asking about the impacts of each project separately with the questions worded as follows: *"Is there anything else you would like to share about the anticipated impacts of the [project]? If you do not have any suggestions, you do not need to respond to this question."* Responses were filtered with all none-answers being removed. None-answers were defined as answers that did not provide either a comment or a question on the given transport project on which the research was focused. Around 3,884 respondents indicated being familiar with the REM of which 750 also answered the open-ended question. Regarding the BRT and the REV, 2332 and 2,157 respondents indicated being familiar with these two projects respectively, with 387 responding to the open-ended question for the REV and 200 for the BRT.

### 4.2 Analysis

For the quantitative data, chi square tests of independence were generated for each of the six statements that were presented to respondents in the MMS to verify whether there was a statistically significant variation in the level of agreement with the statements between the projects. For the qualitative data collected in the open-ended questions, thematic analysis was used to categorize elements of responses in relevant themes. An inductive process was chosen rather than a theoretically driven one to ensure that the themes were relevant for the given dataset independently from one project to another (*24*). Common themes were then uniformized between all three project to allow for comparison of their prevalence.

## 5. RESULTS

Table 2 displays the level of agreement per project for the six statement that were presented to respondents. A Chi-Square Test of Independence was performed to assess the relationship between the level of agreement (i.e., strongly agree, agree, neutral, disagree and strongly disagree) and the public transport project (i.e. REM, REV, BRT) for each of the six statements. All Chi-squares were statistically significant at the 0.001 level, showing that the level of agreements with each statement varied between projects.

*Table 2 Distribution of agreement level on statements pertaining to the impacts of the transport projects*

| Survey items | REM | BRT | REV |
|---|---|---|---|
| **When complete, the project will be a good thing for the greater Montréal area.** | | | |
| *Strongly Agree* | 40.47% | 26.42% | 52.53% |
| *Agree* | 39.88% | 49.79% | 24.01% |
| *Neutral* | 12.28% | 17.97% | 11.40% |
| *Disagree* | 4.27% | 3.86% | 6.63% |
| *Strongly Disagree* | 3.09% | 1.97% | 5.42% |
| Chi square results: | $X^2(8, 8373) = [498.37]$, p =.001 | | |
| **When complete, the project will be a good thing for my neighborhood.** | | | |
| *Strongly Agree* | 17.51% | 10.72% | 39.13% |
| *Agree* | 21.50% | 19.04% | 19.15% |
| *Neutral* | 41.40% | 51.03% | 25.13% |
| *Disagree* | 11.02% | 10.03% | 8.95% |
| *Strongly Disagree* | 8.57% | 9.18% | 7.65% |
| Chi square results: | $X^2(8, 8373) = [680.73]$, p =.001 | | |
| **When complete, the project will be good for the environment.** | | | |
| *Strongly Agree* | 29.15% | 21.53% | 59.16% |
| *Agree* | 42.53% | 45.80% | 25.31% |
| *Neutral* | 20.29% | 25.73% | 9.69% |
| *Disagree* | 4.81% | 5.06% | 2.92% |
| *Strongly Disagree* | 3.22% | 1.89% | 2.92% |
| Chi square results: | $X^2(8, 8373) = [846.66]$, p =.001 | | |
| **When complete, the project will be good for businesses.** | | | |
| *Strongly Agree* | 19.70% | 14.19% | 33.29% |
| *Agree* | 40.01% | 37.99% | 24.62% |
| *Neutral* | 31.28% | 38.94% | 21.79% |
| *Disagree* | 6.44% | 6.56% | 11.27% |
| *Strongly Disagree* | 2.57% | 2.32% | 9.04% |
| Chi square results: | $X^2(8, 8373) = [619.67]$, p =.001 | | |
| **When complete, the project will be good for Montréal's culture and heritage.** | | | |
| *Strongly Agree* | 14.26% | 9.95% | 35.51% |
| *Agree* | 28.40% | 24.31% | 25.68% |
| *Neutral* | 37.95% | 50.17% | 24.90% |
| *Disagree* | 11.84% | 11.11% | 7.60% |
| *Strongly Disagree* | 7.54% | 4.46% | 6.31% |

Chi square results: $X^2(8, 8373) = [711.23], p = .001$

I am concerned about whether I will be able to remain in my neighborhood after the completion of the project due to rising housing costs.

| | | | |
|---|---|---|---|
| *Strongly Agree* | 5.25% | 2.83% | 3.20% |
| *Agree* | 11.66% | 5.53% | 3.11% |
| *Neutral* | 34.17% | 41.85% | 29.44% |
| *Disagree* | 26.93% | 20.93% | 22.58% |
| *Strongly Disagree* | 21.99% | 28.86% | 41.68% |

Chi square results: $X^2(8, 8373) = [439.10], p = .001$

Table 3 displays the summary of the thematic analysis conducted on the responses to the open-ended questions. Themes are organized in broader categories akin to those in the quantitative data to better conceptualize the results. Table 3 also presents the prevalence of each theme for each given project for which they apply. To be counted as a theme, an arbitrary benchmark of 2.5% respondents having engaged with it was established. Such a low number is justified by the broadness of the question, which did not orient respondents towards any particular theme. Directionality is also indicated next to each theme with (+) meaning that the theme relates to a positive perception, (-) a negative perception and (+/-) a mix of both. The following section will discuss each theme in more details and link the information in Table 1 and Table 2.

*Table 3 Prevalence of themes mentioned in open-ended questions by project*

| Section | Theme (directionality) | REM | BRT | REV |
|---|---|---|---|---|
| **Regional impacts** | Need to be expanded / Regional network (+) | 4.27% | 5.00% | 16.28% |
| | Inadequate choice of technology / mode (-) | 1.60% | 21.00% | 0.00% |
| | Competition with existing PT / end-of-service impacts (-) | 13.07% | 2.50% | 0.26% |
| | Accessibility to opportunities (+) | 7.20% | 5.50% | 3.10% |
| | Will lead to urban sprawl (-) | 4.27% | 0.50% | 0.00% |
| **Neighborhood** | Nuisance of construction (-) | 2.67% | 13.50% | 1.04% |
| | Construction / planning timeline (-) | 0.67% | 19.50% | 2.08% |
| | Quality of life impacts (i.e. comfort, noise, safety) (-) | 9.86% | 0.00% | 1.82% |
| **Environment** | Favourable to the environment (+) | 2.93% | 1.50% | 3.10% |
| | Not favourable to the environment (-) | 7.73% | 4.50% | 4.39% |
| | Modal shift / Decrease in car use (+) | 2.67% | 0.50% | 2.58% |
| | No modal shift / no decrease in car use (-) | 3.47% | 4.00% | 8.01% |
| **Business** | Parking removal / absence (-) | 10.13% | 1.00% | 9.04% |
| | Effects on businesses (-) | 0.66% | 2.00% | 6.20% |
| **Culture** | Visual aspect (-) | 18.80% | 1.00% | 1.29% |
| **Gentrification** | Gentrification, Increase in home values / rent(-) | 8.40% | 2.00% | 3.10% |
| **Equity** | Geographical distribution of benefits (-) | 6.13% | 5.50% | 3.36% |
| | User inclusivity (+/-) | 2.67% | 1.50% | 8.79% |
| **Governance & planning** | Lack of public consultation / acceptability (-) | 5.87% | 0.00% | 4.17% |
| | Conflict of interest (-) | 7.07% | 1.00% | 0.00% |

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### 5.1 Regional impacts

As demonstrated in Table 1, statistically significant differences in the level of agreement were observed between the three projects regarding their impacts on the Greater Montréal region. Looking at the proportion of residents answering "Strongly Agree" to this question, the REV (53%) has the highest level of support for perceived regional benefits; more so than the REM and BRT, with 40% and 26% respectively. This observation can be partly explained by the perceived ability for each project to encourage urban sprawl, an issue that was engaged with for the REM, but not the other two projects. Another potential explanation as to why the REV has stronger support than the REM in regard to positive regional impacts pertains to the current and predicted negative impacts of the REM on the rest of the public-transit network in Montréal, which was a common theme amongst respondents. One respondent summarized the issues at play as follow:

> "*I think the entire REM idea was not well planned and am skeptical it will work (sic) stated. Also worried about existing services I now use, given the 'non-compete clause' that the REM has. Overall, I wish the REM did not exist, it may bring more problems than it solves.*"

The non-compete clause mentioned by this respondent refers to a legal agreement between the government of Quebec and the company building and operating the LRT, stipulating that the later cannot incur any competition from other existing public-transport agencies. This could have strong implications on existing public-transport services and users' daily life as exemplified by the following comment:

> "*I am very concerned that [sic] the continued availability of service. The REM stations are not conveniently located for us. Our current [commuter train] station is a 15 min walk to our front door. Hard to beat that. Reduction of our current service will mean that we will be driving 1hr each way to work instead of taking the train.*"

Another primary issue with the REM in relation to its impact on the rest of the transport service is the high royalty per passenger-kilometer that the regional public-transport agency will have to pay to the operator. This issue takes even more importance when considering that some existing riders will be switching to use the REM, since it will be replacing some of the most efficient public-transport services, thus further driving up the overall costs of public transport in the region. This integration issue with existing services is in stark contrast with the BRT which, while it was criticized for taking long to plan and build, it was praised for its harmonious integration with existing public-transport infrastructure.

Still, the previous pathways do not fully explain why the LRT has stronger support than the BRT in term of perceived positive regional benefits. One potential explanatory factor behind this issue pertains to the perceived adequacy of the mode of transport chosen for Pie-IX boulevard, which was the most mentioned theme for this project. One of the respondents summarized this issue by saying:

> "*I wonder if, a few years after its opening, ridership will be so high that we will have to transform it into a tramway.*"

This reflects a concern that some of the public have that a BRT might not represent a large enough capacity to have an effect on the Montréal region when considering that it will be

operating in an underserved and overcrowded portion of the public-transport network, and that it took over a decade to complete.

Finally, it is important to consider the combined level of agreement. The LRT received the highest overall support in relation to regional impacts with 80%, followed by the REV at 77%, and the BRT at 76%. This indicates a generally high agreement that these projects will have a positive impact in the region overall. The large scale of the REM project allows for a bigger expansion in the set of potential destinations a Montréal resident can reach than the REV and the BRT, which can explain why the REM received higher overall agreement, as the following comment illustrates:

> "*I can't wait to have the opportunity to visit new places in the West Island and on the South shore that I've never been to as I do not drive*".

Overall, the scale of a given project as well as its impact on overall public transport in a region seems to be the primary drivers behind the variations observed in relation to perceived regional impacts. Promoting an integrated vision for each project is one potential pathway to promote increased social acceptability, as it will address some of the negative concerns observed in relation to this question.

### *5.2 Neighborhood Impacts*

The REV has both the highest proportion of people strongly agreeing with its positive benefits on the neighborhood (39%) but also the highest overall level of agreement (58%). This is significantly higher than the REM and BRT with 39% and 30% of overall agreement respectively. These latter two projects also have high level of respondents that stated being neutral in regard to neighborhood impacts, with 41% for the REM and 51% for the Pie-IX BRT potentially pointing out to respondents living outside of the impacted areas.

One of the potential factors that can first explain the difference between the REV and the BRT relates to the perceived negative impacts of the construction, a theme that was predominantly mentioned for the BRT. This included primarily detours as well as air and noise pollution. However, what can further amplify these negative effects of construction are the extended planning and construction timelines – an element that was frequently mentioned by respondents for the BRT. The Pie-IX boulevard has been under construction since 2009, with the project supposed to open later in 2022 and to be completed in 2023. The effect of this combined reality on local residents is captured in the following response received for the BRT:

> "*Construction has been going on for well over a decade if I remember correctly. This has impacted my travels and caused lots of stress and confusion for well over 5 years.*"

The perceived impacts of the projects on residents' quality of life were also significant, – especially regarding the REM. The most mentioned impacts in relation to the REM were primarily the level of noise expected from frequent trains, reduced privacy from the aerial structure, and safety issues from the increased number of cars moving to and from stations. The following response captures the frustration of some residents living around the new REM stations with the rapid changes the project is bringing:

> *"[The] environmental impacts on my neighborhood (Grand-Moulin station) are already incredibly harmful. Our small almost rural neighborhood life is now a thing of the past thanks to the monster that is the REM."*

While the impacts of increased car traffic locally were also mentioned for the REV – this time as stemming from diverted traffic from arterial roads where the REV is built towards previously calmer residential roads – it remained a less prevalent theme than for the REM. The positive impacts of all three projects on their neighborhood were always shadowed with negative impacts stemming from car-related traffic, either through diversion of traffic towards calmer streets or attracting more traffic to the area. This indicates an overall need for better public communication regarding the impacts on car traffic either during construction or after operation.

It is important to note that the REV, contrary to the REM and the BRT, is an on-going project with smaller phases opening at closer intervals, meaning that segments of the project do not remain under construction for too long. This not only enables residents to rapidly benefit from the improved infrastructure, but it minimizes the strain of the construction and disturbances. Whilst cycling infrastructure such as the REV will always remain less time and cost intensive than public transport projects, the development approach using smaller phases done more rapidly could be transposed to public-transport development. This would likely lead to improved public perceptions given that benefits would be more rapidly experienced.

### 5.3 Environmental impacts

The REV has both the highest proportion of respondents that strongly believe it will have positive environmental benefits (59%) as well as the highest overall agreement level (84%) compared to the REM (29% strongly agree, 72% agreement overall) and the BRT (22% strongly agree, 68% agreement overall). Negative responses on this issue have highlighted specific adverse environmental effects that pertain to the construction of a transport project. For the REM, the primary concern was related to the materials used – mainly concrete – as well as the destruction of natural habitats (e.g., destruction of local forests, accidental drainage of portions of the last wetland on the Montréal Island). This theme was summarized by one of the respondents:

> *"Grossly overpriced when a less expensive more environmentally friendly surface option was available. The REM has destroyed acres of farmland, wetlands and other natural habitat. [...] All this and the amount of concrete used offsets any environmentally friendly aspects."*

The environmental mediation efforts undertaken by the implementors of the REM project were rarely mentioned in the comments. Negative environmental impacts pertaining to the construction of the BRT were also a theme that was elaborated upon by some respondents of the open-ended questions:

> *"Projects like this one have caused the destruction of a high number of decades-old trees and did not take into consideration the need for a canopy to fight the heat island that the boulevard has now become."*

These discussions exemplify how issues such as tree canopies, green spaces and wetlands are particularly sensitive environmental issues in a mature urban context and can represent a major hurdle to social acceptability of public-transport projects.

Another major theme pertaining to the potential environmental effect of each project was centered around their ability to generate a modal shift or decrease in car usage. This theme was predominantly mentioned for the REV. Some respondents argued that the new project enabled them to transition away from car usage thanks to an increased feeling of safety from the new bike infrastructure, as described in the following comment:

> *"To my knowledge the REV is free. I use it a lot and it is thanks to the security it provides that I can now travel by bike with my 4-year-old son in the city. Without the REV, the bike lanes were rarely safe. I really like the Rev, it enabled me to greatly reduce my car usage."*

However, a more vocal opposition was expressed by some respondents who argued that the removal of car lanes will lead to increased traffic congestion. This claim was also made to a lesser extent for the BRT, as it also required the removal of car lanes. Even though the REM has its own right of way and does not directly change the number of lanes available to cars, it was not exempted from critiques on its potential to create a modal shift away from cars. One respondent from the West Island of Montréal – the wealthier part of the island which is concurrently the primary served area by the REM in term of rail transit – summarized the logic as followed:

> *"As a West Island resident for whom money is not a concern, I essentially drive my car EVERYWHERE. Public transportation for those who have strong incomes is completely not viable out here. Period. […] [F]or the REM to succeed in the West Island, it is imperative that the stations have ample parking available. It is pure folly, and regrettable ignorance, if organizers and central Montréal politicians believe that adult suburbanites will cycle or take buses to access the REM. This simply will not happen."*

This comment highlights a common perspective in the open-ended questions emphasizing that parking at public-transport stations and being able to access them without too much inconvenience are perceived as must-haves for many suburban residents to achieve a mode switch. These dynamics create uncertainty concerning the potential of public-transport projects to spur a meaningful shift towards sustainable-transport modes in suburban areas as car culture is extremely strong there.

### 5.4 Impacts on business

Overall, more respondents perceived the REV as having a negative impact on local businesses (20%), compared to the other two projects (both 9%). The primary argument put forth by some respondents in the open-ended questions relates to the reduction in the number of parking spots resulting from the presence of the new cycling infrastructure. These concerns were expressed to a smaller extent in relation the BRT, which some respondents believe will deter people from shopping along adjoining streets. For example, some respondents expressed concerns about how the flow of cyclists could in some cases reduce access to businesses, as expressed in the following comment:

> *"The REV makes crossing the street difficult for people with reduced mobility and for elderly people. I used to cross from one side to another of St-Denis in the Plateau to go run errands but now I prefer going elsewhere"*

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Overall, these findings suggest that the perceived effects of transport projects on businesses are often influenced by the removal of parking spots and other spaces for motor vehicles.

### 5.5 Impacts on culture and heritage

Despite the REV performing the best on this issue with 62% overall agreement level compared to the REM (42%) and the BRT (34%), cultural or heritage impacts were not a primary theme that appeared in the open-ended question for this project. Cycling is a less resource-intensive mode of transport; new cycling infrastructure does not require significant changes to the visual aspect of local streets thus partially explaining the results observed. The BRT was also rarely linked to cultural or heritage impacts as it was generally perceived as a simple extension of the bus network, rather than a transformative change to the city. However, such a neutral attitude was not present for the LRT, which had the highest overall disagreement level for this question with 20%. Indeed, the imposing concrete pillars of the LRT's predominantly aerial structures were a primary grievance of respondents as captured by one of the respondents:

> "I noticed along Highway 40 that the structures are at many points very high. I believe that this will deteriorate the aesthetical aspect of these neighborhoods and maybe even lead to a loss in home values. I am also worried of seeing tags and graffiti appear on the pillars."

The negative perceptions related to the visual aspect of the LRT can be related to the fact that the city has not seen aerial transport project like this before with existing rail system in Montréal being either underground or hidden in areas that are less visible to the public.

### 5.6 Gentrification

Due to the phrasing of the statement pertaining to this issue (i.e., *I am concerned about whether I will be able to remain in my neighborhood after the completion of the project due to rising housing costs*), agreement with the statement entails a perception that gentrification will take place due to the transport project. The REM is the project for which respondents were the most worried regarding gentrification and displacement with an overall agreement level of 17%, compared to 9% for the BRT, and 6% for the REV and the lowest overall disagreement level (49%), compared to the BRT (50%), and REV (65%). These results show a gradation along the scale of the transport projects. Bigger projects (LRT) represent larger investments, meaning that some residents expect a higher level of local benefits. At the same time, these benefits will tend to be collected by municipalities, transport authorities, and developers through land-value capture which can translate to tax and rent increases in the newly served areas. This concern was voiced by multiple respondents, as exemplified in the following comment:

> "I hope the Municipal Governments won't use this as another push for more exorbitant tax raises as Montréal and my neighbourhood have already reached too high rental prices for normal incomes. I hope the surrounding areas will not become also unliveable for anyone but the large income earners."

Overall, while every transport project is likely to have an impact on the land-use surrounding it, the scale of a project can influence how the public perceive them as catalysts for gentrification. Accompanying transport projects, especially large-scale ones such as LRT, with clear land-use policies and rent-price controls can be a good prescription to avoid negative perceptions of gentrification and displacement.

### 5.7 Other common themes from open-ended questions

Aside from the themes covered in the quantitative questions, responses to the open-ended questions highlighted additional considerations through which the projects can be compared. These can be organized into two categories: [1] equity and [2] governance and planning.

### 5.7.1 Equity

On the matter of geographical equity, the REM was the project for which this issue was the most discussed. One important consideration on the prevalence of this theme in the open-ended questions pertains to the demographics of the survey sample. Indeed, the Montréal Mobility Survey's sample population is skewing towards a wealthier demographic. Such disparities can be partly explained by the fact that the predominant project of interest behind the survey – the REM – has been mainly implemented in significantly wealthier areas than the Greater Montréal Area average (*25*). This was aptly captured by several respondents, including one stating that:

> *"This only is a project serving the interests of the wealthier communities of the West Island, it is not a project for the metropolis in general."*

Such sentiments were also present for the BRT with some respondents highlighting that the main time savings would be for the users at the end of the line in Laval – which is predominantly suburban – and not in Montréal North or Saint-Michel – two of the most dense and underserved neighborhoods in term of public transport in Montréal. The REV again faced the same critique for prioritizing first phases in already well served areas such as the Plateau and Rosemont borough rather than dense underserved communities in Parc-Extension and Montréal North.

### 5.7.2. Governance and planning

The last important category to cover is that of project governance and overall transport planning. Several respondents for both the REM and the REV open-ended questions mentioned having issues with the lack of consultation and transparency in the planning of the projects. Indeed, both projects were developed using a more rapid planning process in comparison to typical transport projects, such as the BRT. Respondents further mentioned for the LRT that they perceived conflict of interest to be taking place where the promoter might be putting their own financial interests before public benefits. Overall, these perceived issues can lead to erosion of social acceptability which could translate into reduced usage of the new infrastructure as well as stronger opposition to any additional phase or extension.

## 6. DISCUSSION

Overall, this paper demonstrates that the characteristics of sustainable-transport projects have a strong impact on their social acceptability, which in turn can have an impact on the ability to realize a sustainable-transport transition. To start, the better public perceptions of the REV compared to the other two projects can be attributed, at least in part, to the cycling expressway's faster implementation in smaller stages, which helped to minimize disruptions stemming from construction and accelerated the time when users can benefit from the project. This finding is in accordance with previous research on the importance of multi-stage planning for new cycling infrastructure (*26*). The remarkably slow roll-out of the BRT, combined with concerns about the system's capacity to service areas with high and increasing public-transport demands, suggest the need to better prioritize and expedite transport improvements in underserved areas. Our

findings point to the importance of efficient project implementation in smaller stages, with greater attention to improving services in underserved areas to allow residents to benefit equitably from new transport infrastructure. Ensuring proper integration with the urban form – especially near patrimonial sites, green spaces and wetlands – could help to ease concerns and frustrations with new transport projects, such as those relating to the LRT. Previous research has confirmed the need for extensive public outreach as a core component of socially acceptable transport projects (*2; 9*), including inclusive and equitable public-consultation processes (*26*);  as well as related activities that work to foster new cultural norms and travel behaviors (*8*). Our study contributes to this literature by illustrating how fast public outreach and consultation initiatives are linked to negative perceptions of transport projects. We also suggest consideration of clear land-use policies and price-control measures along with sustainable-transport projects, as a means to address public concerns regarding gentrification and social displacement which are common with transport projects.

Moving into areas of discordance between the core themes observed in this study and the literature, several respondents expressed concerns about the effects of cycling lanes on businesses. Yet, a recent systematic review provides strong evidence to the contrary, showing that, at worst, new cycling infrastructure has no effect on businesses, while at best they lead to increase in overall customer levels and revenues (*27*). A similar discordance was also observed with the desire for parking space around the LRT stations in suburban settings to make commuting as easy as possible and to avoid the use of active transport to reach the stations. Nevertheless, past research has demonstrated that having parking directly next to stations is detrimental to Transit Oriented Developments – which are themselves beneficial to transport networks (*28*). While some residents will continue to request increased parking-space availability to facilitate access to light-rail stations, the literature linking land-use and transport planning has demonstrated that significant land-use changes, and a reduction of parking spaces, are necessary to achieve a significant modal shift away from automobility (*29; 30*). However, there seems to be resistance on the part of some respondents, particularly in suburban areas, to changes in their neighborhood following the development of the LRT. These issues raise questions on the extent to which LRT infrastructure, which effectively prioritizes expanding transport options for suburban commuters, will be capable of spurring a meaningful shift away from car dependency. While these issues merit additional research and analysis, better communication and public outreach strategies could be devised to address misconceptions and ease resistance to new sustainable-transport projects.

Overall, this paper presents a few core pathways through which project characteristics can influence their social acceptability. There are some limitations to the conclusions reached that should be mentioned. First, the REV – which has the highest level of public acceptability – is the only project of the three considered with at least a portion that is already in usage. Additionally, despite having a large sample, the survey respondents tended to skew towards a wealthier, older, white-male demographic, which is not representative of the Montréal population. These biases can be partly explained by the fact that the REM – which was the primary project of focus of the MMS – will serve primarily wealthier and suburban areas (*25*). While the relative importance of the primary themes of concern might differ from the general public, the concerns will still exist.

## 5. CONCLUSION

The present study demonstrate how public acceptability can be shaped by project characteristics, and how these elements vary depending on the mode of the transport project. The primary takeaway from the comparison of the three projects was that smaller project phases with faster implementation enable a minimization of the inconveniences generated by construction while allowing users to more rapidly benefit from the new infrastructure. In turn, this process can contribute to a more sustained level of social acceptability for a long-term development. Exemplary governance through inclusive population consultation, transparent communications as well as the promotion of an integrated and equitable transport system with the users as the primary focus were also found to be drivers of positive public perceptions.

This study also presents findings that challenge the "appeal to the wealthier suburbanites to use their cars less" strategy with new LRT. The findings suggest that such a strategy is not only perceived as inequitable by the public, but also that the land-use changes required in suburban settings to enable these projects to be efficient are overwhelmingly resisted by local populations, thus potentially limiting potential environmental benefits from such transport projects. We also point to a discordance between academic research and public perceptions on the matter of cycling lanes' impact on businesses as well as the benefits of parking lots right next to rail stations. This suggest that better communication strategies on these issues should be devised conjointly by researchers and municipalities to address dominant misconceptions and ease resistance. Lastly, disturbances to car travel were also mentioned widely as critiques to the construction and operation of sustainable-transport projects. Providing clear alternatives and communicating them widely can help in mitigating some of these negative perceptions. Future research could focus on exploring further the link between project characteristics highlighted and public perceptions. This could be further complemented by analyzing variations in the link between project characteristics and social acceptability within and between populations to understand the influence that socio-demographic as well as cultural factors might have on perceptions of sustainable-transport projects to ensure their future acceptability and success.

## 7. AUTHORS CONTRIBUTION

The authors confirm contribution to the paper as follows: Study conception and design: Rodrigue El-Geneidy, Soliz, Manaugh; Data collection: El-Geneidy, Rodrigue & Kestens; Analysis and interpretation of results: Rodrigue, Soliz, Manaugh, & El-Geneidy; Draft manuscript preparation: Rodrigue, Soliz, Manaugh, Kestens, & El-Geneidy. All authors reviewed the results and approved the final version of the manuscript.

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