

Driverless Cars in the Greater Toronto and Hamilton Area:

Focus Group Findings

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Errors and omissions are exclusively the responsibilities of the authors.

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Executive Summary

Automobiles rely on their drivers less than ever before and fully driverless cars represent a potentially impactful change in urban transportation. Changes in car technology have enabled vehicles to perform safety-critical functions in more circumstances, ranging from cruise control and lane-keeping to fully-autonomous cars in which no driver is necessary. In this report, this broad spectrum of vehicles are referred to as “driverless” cars. This report presents findings from five focus groups conducted in May and June 2017 and in January 2018 on Greater Toronto and Hamilton Area residents’ interest and responses to driverless cars; their possible household location responses to this technology; and their thoughts on desired policy responses.

Policy Uncertainty

Driverless cars appear poised to challenge the foundations of the current Greater Golden Horseshoe transportation and land use policy context. Provincial policy currently prioritizes public transit and active transportation over single-occupancy driving. These mode priorities are indirect indicators of more fundamental social goals. But how driverless cars support or undermine this policy hierarchy is unclear. For one, it is unclear what “mode” driverless cars represent due to differences in how they might be used. For another, it is unclear how driverless cars will be used and whether they will support or undermine more fundamental social goals related to economic efficiency, environmental

sustainability, quality of life, improved safety, etc.

Consumer Uncertainty

There is little clarity in how consumers are likely to adopt and use driverless cars should they become widely available. Two driverless car ownership models are plausible:

- Private driverless cars – whereby vehicles are owned and operated by individuals.
- Shared (for-hire) driverless cars – whereby there is a market in for-hire driverless cars which are hailed electronically and may include individual use or carpooling using “shared” fleets.

Despite indications that both ownership models are likely to be supplied, there is considerably less certainty about how consumers will react. Some expect that if private ownership of driverless cars becomes pervasive, suburban sprawl will increase. Others expect that if shared ownership of driverless cars dominates, more urban living could emerge in neighbourhoods conducive to such services. This study explores whether and how people may use driverless cars with particular emphasis on the underlying motivations behind their stated intentions.

Study Approach

This focus group study is part of a larger research initiative, *Automated Vehicles in the Greater Toronto and Hamilton Area: Consumer Outlook and Policy Opportunities*. The focus groups augment a quantitative survey to explore issues in

more detail. In May and June of 2017 and in January of 2018, the research team hosted five focus groups with residents of the Greater Toronto and Hamilton Area (GTHA) to explore their attitudes toward driverless cars. In each focus group, three main topics were discussed:

1. What is the general interest in driverless cars?
2. How might people use driverless cars?
3. What are the broader policy implications of driverless cars?

Focus Group Results

- Most (but not all) focus group participants were interested in driverless cars, but were also apprehensive of them.
- Participants imagined they would use driverless cars occasionally but were not prepared to commit to broader behavioural or residential changes should this technology be more widely available.
- Participants anticipated that significant behavioural changes and benefits could accrue through more independent travel for seniors and people with disabilities.
- Participants favoured a strong role for public policy in regulating and managing the deployment of driverless cars.

Conclusions

- Focus group participants were very curious about driverless cars and their

views of this technology are still evolving.

- Most focus group participants expected significant benefits from driverless cars but were reluctant to pay more to use them compared to current options.
- With the exception of the suburban focus group, participants indicated significant interest in using shared driverless cars, provided prices are low.
- Participants did not expect to change their residential or work locations but may travel more should driverless cars be available.

Policy Considerations

There are significant opportunities for transportation planners and policymakers to manage the implications of driverless cars. Driverless cars do not fit neatly in the existing policy context, which is based on modal prioritization. To best leverage this new technology for broader social good, the policy context may need to evolve.

This report offers five short-term public policy considerations based on the focus group findings:

1. Public policymakers, transportation planners, and public regulators should focus on driverless vehicles and their potential impacts.
2. Transportation planners should learn about driverless cars and disseminate information to other planners, policymakers, and the public. Learning about the implications of this technology can enable better-

informed decision-making in a range of contexts.

3. Learn about who is likely to benefit from driverless cars under different ownership models – particularly with respect to users, non-users, and groups with different needs (e.g. people with accessibility needs)
4. Open a dialogue about the public role with respect to regulating, providing, or subsidizing a shared or private driverless car market.
5. Identify and consider opportunities to leverage driverless car policy to advance broader policy objectives. In light of the uncertainty related to driverless cars and their implications, leveraging this technology for public good may require a shift from a public policy framework of modal prioritization towards an outcome-oriented framework rooted in identifying more fundamental social goals in an environment of uncertainty.

Introduction

This report presents findings from five focus groups conducted to explore Greater Toronto and Hamilton Area residents' interest in driverless cars; their possible behavioural responses to this technology; and their thoughts on policy responses expected from the public sector. Focus groups were completed between May, 2017 and January, 2018 and findings have been synthesized by the study team. The research was conducted by Leah Birnbaum of Leah Birnbaum Consulting and by Matthias Sweet, Elyse Comeau, and Tyler Olsen of Ryerson University's School of Urban and Regional Planning and the TransForm research laboratory. Eva Shi, of Ryerson University, assisted in coordinating the Vaughan focus group in January 2018. This research was funded by both the City of Toronto Transportation Services Division and by Metrolinx¹, and also benefited from start-up funds provided by the Centre for Urban Research and Land Development at Ryerson University.

Background

Current automobiles rely on their drivers less than ever before. Many suspect that a future may come in which cars are fully automated and humans no longer have a role to play in driving. These vehicles are sometimes called "autonomous vehicles" or "AVs" or "self-driving vehicles," and range from partly self-driving to fully autonomous.² Semi-autonomous vehicles—vehicles with driver assists such as

automatic lane control or vehicles that operate without a driver in select circumstances (e.g. the Tesla) are already available. However, fully driverless cars represent a potentially more impactful shift in how transportation systems function, are used, and are planned. Given that the primary focus of this initiative is on fully self-driving vehicles, for the sake of consistency throughout the report, each of these terms is generically replaced by "driverless car".

Despite the seemingly relentless advancement of driverless car technology, there is significantly less certainty about the regulatory and policy context of driverless cars, as well as potential consumer responses to this technology. Of these two, the former is discussed briefly while the latter is the focus of this report. For Ontario's transportation planners—who are already managing competing public priorities and policy hierarchies—these two sources of uncertainty are palpable.

Policy Uncertainty

Driverless cars may challenge the foundations of the current land use policy context in the Greater Golden Horseshoe. Based on the Growth Plan for the Greater Golden Horseshoe (2017) and the Provincial Policy Statement (2014), planning for some modes is prioritized over planning for others, notably public transit over single-occupancy driving. But where driverless cars enter this equation is less clear. Do they represent a new form of public transit? Or do they simply

¹ Metrolinx is the Crown Agency responsible for regional transportation planning in the Greater Toronto and Hamilton Area. See www.metrolinx.com.

² Completely autonomous shuttles have only been used in protected environments; not on public roads.

represent a new type of car, potentially leading to more vehicular travel? One may simplistically interpret shared driverless cars as being a form of public transit and privately-owned driverless cars as being conventional vehicles, but the validity of this approach is unclear in light of potential underlying policy goals. The blurred boundaries between public and private transit underscore the broader challenge in interpreting policy directions in the absence of rationale for such mode priorities. Presumably, public transit is prioritized to advance other social and environmental objectives. Should driverless cars not fit neatly in existing mode typologies (this implication appears very likely), this could leave driverless cars outside of the existing policy context — effectively exempting them from a requirement for policy compliance. Mode-agnostic policy guidance on what deeper outcomes are to be prioritized (e.g. mitigating climate change; facilitating efficient goods movement; ensuring equity) may need to be more explicit.

Consumer Uncertainty

Little is known about how consumers are likely to adopt and use driverless cars should they become widely available. Driverless cars are likely to be supplied based on two types of ownership models. First, they may be privately purchased and used by an individual or household. Second, a shared, for-hire market is likely to emerge, according to which driverless cars are hailed electronically like taxis and each vehicle can meet the needs of multiple users (though not necessarily at the same time for the same trips). Despite indications that both ownership models

are likely to be supplied, there is uncertainty about the demand for these services, how they will be adopted and used, and the impact of both on existing travel.

Several studies have already used quantitative surveys to explore user interest in and policy implications of driverless cars (Bansal & Kockelman, 2016; Bansal, Kockelman, & Singh, 2016; Kyriakidis, Happee, & De Winter, 2015; Lavieri, et al., 2017; Robertson, Meister, & Vanlaar, 2017; Schoettle & Sivak, 2014). The studies include different research designs, methods, and focus on different underlying populations. For example, Daziano, Sarrias, and Leard (2017) find that consumers are willing to pay \$5,000 more for a self-driving car. Others, such as Bansal and Kockelman (2016), have found a higher average willingness to pay. Implications of interest in shared driverless cars may have broader impacts – notably Bansal and Kockelman (2016) expect such vehicles, if adopted, to lead to more vehicular travel but fewer overall cars and fewer emissions (due to reduced congestion and more efficient acceleration and deceleration). Many of these studies have found more interest in driverless cars (regardless of ownership model) among the male, highly-educated, urban, affluent residents who already know about technology and have environmentally-conscious values. Evidence is still emerging on both the level of consumer interest and on implications for public policy.

Research Initiative

This focus group study is part of a larger research initiative, *Automated Vehicles in the Greater Toronto and Hamilton Area*:

Consumer Outlook and Policy Opportunities. Two other reports from that initiative, *Automated Vehicles in the Greater Toronto-Hamilton Area: 2016 Consumer Survey - Initial Descriptives* and *Automated Vehicles in the Greater Toronto-Hamilton Area: 2016 Consumer Survey - Forecasting the Outlook for AVs* provide insight on consumer interests in driverless cars, based on quantitative survey data.

Several key survey findings from these initiatives are highlighted.

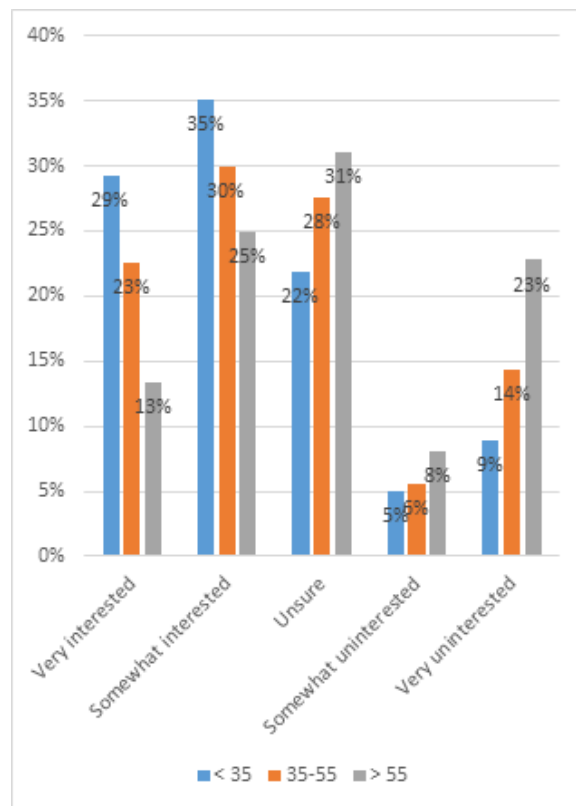
Age

Survey data indicate significant age-related differences in interest in driverless cars. Half as many individuals over 55 were “very interested” compared to under 35-year olds, while more than twice as many over 55 individuals indicated they were “very uninterested” compared to those under 35.

Similarly, approximately 30% of those over 55 indicated, “I would not purchase an automated vehicle,” while only 13% and 18% of under-35 and 35-55-year olds gave the same response.

Age-related differences are also reflected in questions related to for-hire driverless car services. For example, while 43% of those under 35 indicate they would be willing to travel with others in a shared driverless car; just 33% and 24% of respondents aged 35-55 and over 55 respectively, agreed.

Interest in Regularly Using Driverless Cars (by Age)



Driverless Cars and Adults with Disabilities

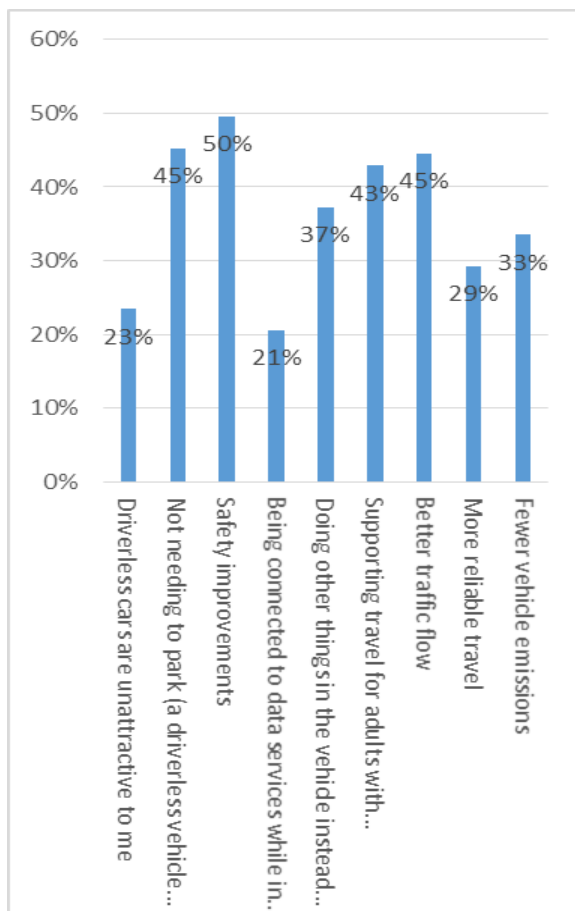
While assisting people with disabilities was viewed as a strong theoretical benefit of driverless cars by survey respondents, people with physical disabilities influencing their travel did not indicate any more or less interest in using driverless cars than others. This disconnect spurred the research team to further explore interest or concerns surrounding driverless cars – particularly among those with accessibility needs.

Four expected benefits were most frequently identified by survey respondents. These include parking convenience, safety improvements, better traffic flow, and support for people with disabilities. Adults over 55 in particular

viewed driverless cars as potentially delivering benefits to people with disabilities although those identifying as having a mobility constraint were no more interested in driverless cars than others.

Approximately 54% of survey respondents with a mobility constraint stemming from disability were either “somewhat” or “very uninterested” in using a driverless car while 52% of all other participants responded similarly.

Driverless Car Benefits of Interest



Suburban/urban

Survey findings also suggest modest differences in driverless car preferences depending on neighbourhood context. Based on survey data, there are some attitudinal differences between different cities or regions. In Toronto 55.6% of respondents indicated some level of interest in regularly using driverless vehicles while interest was less pronounced in other regions, ranging from 44.2% in Durham to 52.9% in Peel. Likewise, over 39% of Toronto participants were interested in neighbourhoods with high-quality shared for-hire driverless cars; an interest shared by only 29% in Durham and 36% in Peel. Similarly, about 50% of Toronto and Hamilton residents indicated that they would be interested in traveling further to work if a driverless car were available; between 43% and 45% responded similarly in other regions. Over 17% of Toronto residents indicated a willingness to pay a \$15,000 (or higher) premium for a driverless car while just 2% of those in York and 9% of those in Hamilton felt the same.

Within the Greater Toronto and Hamilton Area, City of Toronto consumers appear to be most interested in driverless cars – prompting further questions about the geography of driverless car use and its implications.

Study Approach

In designing the focus group portion of the study, the research team planned for thematically distinct focus groups: a group from the general public, a group of seniors (defined as those over 55), a group of people with accessibility needs

(e.g. people who are visually impaired or who use a mobility device), a group of individuals who regularly walk and cycle, and a group from Vaughan to provide a suburban perspective.

Focus groups were facilitated by Leah Birnbaum, RPP and observed by Dr. Matthias Sweet and graduate students Élyse Comeau and Tyler Olsen and, in one case, by Eva Shi. Each group involved a two-hour discussion (see Appendix A: Focus Group Program).

1. Focus Group 1 — Over 55 sample: May 23, 2017, seven participants.
2. Focus Group 2 — General sample: May 24, 2017, six participants.
3. Focus Group 3 — Sample of active transportation users in the Let GO Know advisory group: June 9, 2017, three participants.
4. Focus Group 4 — Sample of Metrolinx Accessibility Advisory Committee members: June 16, 2017, four participants.
5. Focus Group 5 — Suburban sample (Vaughan, Ontario): January 19, 2018, nine participants.

Groups 1 (over-55) and 2 (general) were more likely to come from the City of Toronto relative to the broader region. With the exception of the Vaughan focus group, participants expressed significant travel patterns oriented towards downtown Toronto (even if they do not live there). For example, the Let GO Know group comprises regular and occasional GO Transit users who are familiar with

the downtown and who use multiple travel modes on a daily basis. Likewise, the over-55 group included many who have taken continuing education courses at Ryerson University's downtown Toronto campus and therefore regularly traveled into downtown Toronto. Similarly, Metrolinx's Accessibility Advisory Committee regularly engages with Metrolinx staff for regional planning purposes – making them aware of broad transportation issues. An additional focus group with Vaughan residents was held in January of 2018 in order to collect qualitative data pertaining to a more suburban perspective.

Each focus group explored three main topics:

1. What is the general interest in driverless cars?
2. How might people imagine using driverless cars?
3. What role do participants think public policy should play?

Half-way through the focus group, a three-minute video was shown, featuring a person using a driverless car. Contrasting participants' reactions to driverless cars before and after watching the video³ provided guidance on how participants' views evolved after exposure to more information on this technology.

Recruitment

The following steps were taken to recruit participants for the focus groups:⁴

³ A version of the video in *described video* was played in one of the groups with visually impaired participants.

⁴ The participants for the Vaughan focus group held in January 2018 were recruited through public posters in library and community centres.

1. A recruitment email was sent (either by the research team or by Metrolinx depending on the group) to potential focus group participants to invite them to participate in the study. See Appendix B: Recruitment Email.
2. Interested participants responded by completing a short survey. See Appendix C: Recruitment Survey. The survey was available in fillable PDF format and also in text-only format.
3. For those groups where more than eight prospective participants indicated an interest in participating, the information from the recruitment surveys was used to prioritize a balance in gender, age, and location across the GTHA (using a stratified random selection).
4. Selected participants were sent a confirmation email inviting them to the group. See Appendix D: Confirmation Email. This email also included a copy of the consent form that participants were asked to sign when they arrived for the focus group. See Appendix E: Consent Form.

As participants arrived for the focus group discussions, they were introduced to the research team and asked to sign consent forms. The discussions followed a semi-structured format (see Appendix A: Focus Group Program) and were audio recorded. The audio recordings were later transcribed without including the names of the participants.

Focus Group Results

This report summarizes the key findings from participants across the five focus groups. Quotes that appear in this report are not attributed to participants in order to preserve their anonymity. Quotes are transcribed as closely as possible to participants' statements but may differ slightly based on auditory quality or clarity.⁵

Focus groups are not designed to be representative of the broader Greater Toronto and Hamilton population. Instead, the stories, concerns, questions, and debates that arose from the group discussions are offered as qualitative insights to some individuals' thinking about driverless cars.

Topic 1 Findings: What is the general interest in driverless cars?

All focus group participants were aware of driverless cars, either from their own research and interest or from the media. All were curious about them and, while most had concerns about safety and questions about how they might work, only a few participants had already made up their minds that they wanted to use driverless cars as soon as they become readily available.

"Driverless cars are a bit scary for me."

"I'm curious to see one and test one myself."

"I'd be cautious. I need to know about the technology."

⁵ For consistency in terminology, quotes are edited such that any references to "autonomous

vehicles," "AVs," "self-driving vehicles," etc. are generically replaced by the term, *driverless cars*.

“To sit there and have a vehicle make all those decisions it’s a leap of faith. I’d do it but I’d be nervous.”

Participants had many questions about the safety of driverless cars.

Most focus group participants had questions about the safety of driverless cars. Questions and concerns about safety were frequently introduced by participants in the opening minutes of the discussions as one of their chief considerations.

Participants also had many questions about how driverless cars operate. They had questions about how to interact with and direct the car, as well as questions about how the car would behave in an emergency situation. Some expressed a desire to take over control of a semi-autonomous car if they felt it to be necessary.

“I would want to know first if I can take over if something goes wrong. Otherwise I’m all for it.”

“I have a lot of questions about how they really work. If it looks like an accident is going to happen, what happens?”

“What happens when a child runs out in the middle of the road or when an animal runs out into the road? What’s the reaction time for a driverless car?”

Participants were wary of embracing this technology right away due to the novelty and uncertainty surrounding driverless car technologies:

“I need to make sure the safety issues have been worked out first. I don’t want to feel like I’m a test pilot.”

One safety concern that many participants shared – which may be unique to driverless cars – was hacking. In each focus group, someone mentioned a fear that these cars could be hacked, either for mischief or for more sinister reasons.

“There are enough hackers out there that would consider this a challenge... can you imagine someone taking control of these vehicles?”

“What if they suddenly stopped everybody’s cars on the road as a protest or something?”

Despite incomplete answers regarding many safety-related questions, several participants felt that driverless cars would improve safety, for example by reducing or eliminating the dangers of drunk or distracted driving.

“You can text now and do all those things that now you’re not supposed to be doing in the car.”

“If it’s controlled by a computer, not by a human, I think that’s more trustworthy.”

“Driving is the most dangerous thing that I do on a regular basis. [...] if it will make me safer I can see that as an overall benefit.”

Not all participants agreed that driverless cars would improve safety:

“I’m flabbergasted hearing people say they’re going to text, read the newspaper. This is like suicide! [...] to put your entire life in the technology and just look at the scenery: I think that’s crazy.”

Participants speculated that using a driverless car would impact their driving experience.

Participants discussed the experience of driving — or the experience of being driven — and how these experiences may change with driverless technology. Those who felt that the roads would be safer with driverless cars also indicated that driverless cars could eliminate road rage. They felt that this would make driving less stressful.

“Think of the absence of road rage — when one party has no feelings.”

“It should calm down some of this aggressive and distracted drivers that are causing the problems.”

“The city is very unsafe for cycling. Cyclists are [seen as] an obstruction to drivers; an impediment. A driverless car wouldn’t have that same attitude.”

The experience of being in a driverless car or encountering one while using another mode of transport sparked significant discussion in all focus groups. One participant noted that if they were to see a driverless vehicle driving next to their car, they might speed up to get out of its way. Another noted:

“[It would] be a shock seeing a driverless car next to me; seeing nobody driving in the driver’s seat.”

Participants expressed interest in learning how to be driven by a driverless car. Many drivers felt that it might be a challenge to allow a semi-autonomous car to drive itself:

“I think sitting in the driver’s seat with a steering wheel in front of me without touching it would feel really weird. It might

be a little bit easier to get used to on the passenger side.”

“You’ll have the instinct to grab the wheel. Even being in the passenger seat sometimes you see something and your foot wants to press the brake. It will take time to adapt. I’m worried I might grab the wheel in the event of something happening and screw things up. It’s tough to unlearn.”

As the discussion encouraged participants to imagine themselves using or interacting with driverless cars, there was some discussion of the style of the cars themselves and the extent to which they could be customized — both aesthetically and to someone’s style of driving. If they cannot be customized, some bemoaned the loss of individual expression through driving style or the aesthetics of the car while others felt this was irrelevant. This prompted some participants to wonder whether the cars could be adjusted to perform in ways that were less safe but still within the limits of traffic laws.

“Could you program your own driverless car? For example, to be more aggressive off the stoplight? ...so it doesn’t become just like a vanilla experience. There’s no rush, there’s nothing different. Everything’s all vanilla.”

“Would you really want a Porsche if it’s staying within the same parameters as any other car?”

Participants discussed the role of the car in one’s life. Some felt that the style of a car projects a particular image and speculated that people may not want to forego the car as an extension of their own image and identity if driverless cars were all standardized in terms of appearance and performance. Certain

segments of the population — notably young men — were expected by some participants to value a car's individual style more highly.

"The vehicles of Google and Uber look pretty bad. They look clunky to me. I like sleeker cars but you don't see that yet at the consumer level."

"Some people will always want to have the 300+ horsepower engine."

"A car is just a box which gets me somewhere. The part about the image of it will fade away."

After watching a video in which a man with vision loss is driven in a driverless car, participants were asked to consider once again how they felt about driverless cars. Some reacted strongly to the idea of a non-driver (e.g. a visually impaired person) behind the wheel. Others pointed out that the video only shows the driverless car on empty roads so they cannot evaluate how well the car interacts with other road users. Most participants were eager to learn more.

"When I realized he was blind I thought 'what's this guy doing driving the car?' But then looking at him as a driver is problematic because he's not really a driver even though he's behind the wheel. And then I thought to myself he's fine. He's not driving the car. Then I thought it's safe."

"I'm more accepting now."

"I'm more afraid of people driving cars now than I am of a driverless car."

Participants were interested in how driverless cars would impact traffic flow.

Some participants speculated that driverless cars would impact traffic flow. Some felt that traffic flow would improve, as driverless vehicles could drive "faster and closer." A few participants felt confident that traffic would be "more efficient," while others questioned the impact on traffic flow while driverless cars and conventional cars are on the roads together in a mixed setting:

"Would there be an advantage or would I still be stuck in traffic? In 20 or 50 years maybe if everybody is using a driverless car maybe it becomes more worth it but if it's just me in mixed traffic, I'm not sure."

Participants were interested in how driverless cars will share the road.

How driverless cars might interact with conventional cars and with pedestrians and cyclists was a topic that participants were eager to discuss. Most had questions about how such interactions might function and many speculated that learning to interact with driverless cars would take considerable energy and time.

"I think it might make me a little more cautious if I'm a pedestrian — making sure they stop before I cross."

"How does the car know if somebody is at the crosswalk? And if there's a person at the sidewalk how does it know that person wants to cross or they're just standing there waiting for someone?"

In discussing how driverless cars might share the road, participants discussed their own habits when interacting with cars, either as a driver or as a pedestrian or cyclist. This led to questions about how

driverless car interactions might differ and whether the practices that they feel keep them safe in interactions with conventional cars will be effective when cars are driverless.

“When you see children playing [by the side of the road] you’ll slow down a bit to see what they do. All those things that are not necessarily programmable in a driverless car. How do these things get resolved?”

“If there’s a stop sign and a car is coming up I’ll look at the driver and make sure he [sic] knows I’m crossing the street. If I were to see no driver in the vehicle that would be a little freaky.”

“If I look the driver in the eye... I have a good chance that he’s [sic] not going to do something stupid. But with an anonymous, unseen driver I don’t have that same kind of reassurance. I’m concerned as a pedestrian and a cyclist. Removing the driver from the fray — is the pedestrian or cyclist safer? I’m worried about that.”

However, while some expressed concerns over the ease of car-non-car interactions, others anticipated some benefits with safer interactions:

“I’m anxious for them to be implemented and available. I spend a lot of time walking downtown. Drivers are getting more and more on my nerves — disrespecting pedestrians; disregarding traffic rules; running lights. I think [driverless cars] is a fantastic technology. Society will be a lot safer.”

“If I knew I’d be getting 1.5m of clearance — I’d have more confidence walking or cycling. [Driverless cars] would seem less likely to have a collision with me. If they’re

safer I might be more inclined to bike because it’s safer.”

In fact, one participant wondered whether cyclists might become more aggressive in their movements, taking advantage “if the driverless car is programmed not to hit them.”

Topic 2 Findings: How do people imagine using driverless cars?

Participants preferred a shared ownership model for driverless cars, provided that prices are low.

Participants from the first four focus groups, which were more Toronto-centric, generally did not want to own driverless cars. Once they were invited to speculate on ownership models, most participants preferred the idea of using a driverless car based on a shared model at low prices. However, it is unclear whether these preferences are rooted in a desire to experiment during early deployment before committing to purchasing a driverless car, or whether these preferences are likely to be retained over time and translate into broader changes in travel behaviour.

“No, I don’t want one parked in my driveway. I want to call one up.”

“When I think about these driverless cars constantly picking people up or driving around well-used routes, that makes sense to me. You’re not storing a vehicle back home.”

On the other hand, participants from the suburban focus group communicated a preference for the private ownership model. When probed with the question of carpooling, all participants indicated that

they would prefer a private experience over a shared one.

Several participants identified the avoidance of parking fees as a motivating factor in preferring the shared ownership model over the private ownership model. In discussions about how participants currently use private vehicles, many stated that they regularly avoid driving into the centre of the city because of congestion and the high cost of parking. For example, some participants indicated that they prefer to use private vehicles for trips outside the central city and use transit, taxis or car-sharing for downtown trips.

“If I’m going downtown, the car stays home. If I’m going outbound I’m going by car.”

“When I come downtown I always take TTC⁶ or walk. If there was a driverless car and I didn’t have to park I might take that. I would be more inclined to go somewhere.”

The perceived cost savings associated with using on-demand vehicles appealed to many participants.

“You may not need insurance, no need to arrange for parking. You are more mobile, you are more flexible.”

Carpooling with others in a driverless vehicle appealed to some, as long they saved money compared to getting an individual ride.

The idea of sharing vehicles appealed to those who were concerned that a shift to driverless vehicles might result in more vehicular trips.

“I don’t like the idea of all the roads being full of driverless cars with just one person in them. That could happen, especially if people bought them.”

“I don’t like that the car would be sent back home instead of parking. It would be doubling the cars on the road.”

Other ownership models were discussed, including using a private vehicle for ride sharing for part of the day and having a fleet of publicly owned driverless cars.

“Ten years from now there’d be this network of these autonomous cars going around. You would order it like you order an Uber now. They would either be owned by the city or owned by TTC [...] and they’re just darting around like a taxi but more efficient.”

“Maybe they have mixed ownership. Maybe people allow them to be used between 9am and 5pm as shared vehicles because they don’t need them.”

Participants indicated that driverless cars may induce small changes in their travel habits.

While the research team was interested in exploring the possibility of changing location choices or travel behaviour as a result of driverless cars, focus group participants indicated only limited intentions to change travel behaviour. The impact of driverless cars on travel habits varied but most participants said that their habits would not change.

“I can’t see myself using a car more with this technology.”

⁶ The TTC is the Toronto Transit Commission, which oversees operation of most intra-city public

transit services in the City of Toronto, see www.ttc.ca.

“Would I drive to work more? No, because I’m not paying for that parking.”

Based on *Automated Vehicles in the Greater Toronto and Hamilton Area: Overview from a 2016 Consumer Survey*, approximately 15% indicated no interest whatsoever in using a driverless car. However, based on the focus groups, comparatively fewer people explicitly indicated an aversion to using driverless cars even when the technology becomes more mature. Most participants thought they might use driverless cars occasionally — similar to current use of taxis or ride-sharing cars, or for special trips. Given their evolving understanding of driverless cars’ possibilities and realities, participants were not prepared to voice a strong interest in increasing their commuting distance with the availability of driverless cars. People also discussed whether they would use driverless cars for long trips:

“I would end up in a car more often than I do now because it’s a more pleasant experience. The fatigue and boredom of long drives would be gone for me.”

“Am I going to go 120 kilometres an hour down the 401 to Montreal with my hands on my knees? I don’t think so.”

“I’d still rather go to Montreal on the train.”

Participants from the accessibility focus group provided the most detailed responses regarding how they would use driverless cars, such as the potential to have more space available to bring along supplies and equipment on specific trips.

“There’s no public transit to anywhere in cottage country. Currently, the public

transit doesn’t bring the supplies that you need. I’d be perfectly happy to rent a cottage for a couple of weeks and stay there on my own but I can’t get any supplies there. So this type of technology would change my horizons.”

“I am an artist. [...] I tend to load everything up on my chair but I can’t get on the bus with all of that - like I have a table in between my feet. But I’m limited with how much stuff I can take with me. [...] If I can’t carry it and take it on the bus, I can’t do anything.”

Participants indicated a lack of willingness to pay more for driverless technologies.

While many focus group participants were interested in driverless car technologies, few were interested in paying more to purchase or use driverless cars. Some participants even expected the cost to be less:

“I wouldn’t be willing to pay a whole lot more than for a traditional car. The cost would have to be similar to traditional cars.”

“Driverless shared cars should be cheaper. There’s no driver to pay.”

“I would be looking to pay less than for a taxi ... because there’s no driver — there’s no salary.”

Others felt that a price reduction was not realistic:

“You will not pay less. It’s never going down.”

Participants embraced the idea of using the car to pick something or someone up.

Focus group participants expressed interest in the idea of using driverless

cars to pick someone or something up, to have someone or something delivered, or to go on a special trip.

Should driverless cars be available, focus group participants anticipated sending their vehicles to complete trips on their behalf:

“I would send them to my parents for medical appointments. [...] It would help me with my time; I wouldn’t have to take time off work to drive them there and back. That aspect would be appealing.”

Similar use of driverless technology appealed especially to participants with mobility constraints.

Nevertheless, some participants were concerned about children or non-drivers being alone in the car.

“Would you allow children to be left alone in a driverless car? ...I’m not comfortable with it “

“I’m comfortable with it as long as there are no available controls in the car. If it’s totally autonomous I think it’s a great idea.”

Sending the car to pick things up appealed to many participants. They viewed such a service as a way to expand their current shopping options by carrying more supplies or by increasing travel range.

“If I don’t want to make a special trip or it’s too far or it’s too hot out I could let the car do things for me. I’d pay good money for that.”

“If there was a car with lots of room where I could take things back with me I might shop differently.”

“I like the idea of it fetching things. Lots of stores now have a service where you order online and pick it up. Well I can’t pick it up because I don’t have a car but I can get a service to go there and pick it up and bring it to me.”

“For me it won’t be for travel. I view it as a tool or a service rather than as a means of traveling.”

Participants expected driverless cars to improve accessibility for people with disabilities.

All five focus groups expressed interest in opportunities for driverless cars to increase independence and mobility for people with disabilities. This interest was expressed by people with and without disabilities. In quantitative survey results from the *Automated Vehicles in the Greater Toronto and Hamilton Area: Overview from a 2016 Consumer Survey*, results suggest that while there is significant interest in using driverless cars to improve opportunities for individuals with disabilities, people who self-identified with having a mobility constraint appeared neither less nor more interested in using driverless cars compared to other survey participants. The reasons for the differences between the results from the quantitative and qualitative portions of the study are unclear. They may stem from the fact that these specific accessibility focus group participants are already regularly consulted for transportation planning discussions, making them particularly effective at exploring potential opportunities or pitfalls involved in a particular transportation policy action. It may also stem from differences between quantitative and qualitative research

approaches – whereby focus group participants (in contrast to online survey participants) were better able to qualify their views while highlighting expected challenges with the driverless car travel experience.

“There are so many reasons why a person might not be able to drive a regular car and why public transportation can be really annoying. So this is a really great way for people who can’t drive normally to be able to get around.”

One participant who had expressed apprehension towards driverless cars during the discussion expressed more interest after the group watched a three-minute video of a visually impaired man using a driverless car:

“This hit a chord with me. [A relative] is blind. She’s so reliant on her husband. This would give her some freedom, some independence. It would change her life.”

Looking to driverless cars as a solution for people with mobility constraints or who are dependent on others to get around appealed to participants across all focus groups.

“It resonates with me very personally. My [relative] has very advanced Multiple Sclerosis and uses a scooter.” [Another relative] has to work very hard to support that family. She can’t be available to take him where he would like to go and he doesn’t like the [accessible transit] where a big van comes up. If something that was much more a two-person or single-person vehicle... if it was properly equipped, he could navigate himself in and it could be driverless. That would be wonderful.

Focus group participants with disabilities were both enthusiastic and hesitant about

new possibilities involving driverless cars. Some discussed taking trips that are not currently feasible, including going to a cottage, visiting friends in another city, navigating around new places, and reaching destinations beyond those independently accessible by public transit. They listed the drawbacks of accessible public transit — needing to be ready well ahead of time; not being able to count on the service to run on time or to have space for mobility devices when needed — and viewed driverless cars as advantageous for increasing travel independence.

“This type of technology would change my horizons.”

“You can’t take anything with you on public transit. If a shared vehicle system were available it would aid me in grocery shopping. I would go to the grocery store and load up everything I need — for weeks! — and put it in the car and take it home. As it is now I get a friend, or I take the bus and walk. So I depend on somebody else.”

“This would change things for me like crazy ... I’d be able to go to places on the outskirts or places I can’t get to by bus.”

“I wish I was a little bit younger but I think it’s an awesome thing we have to look forward to.”

Visually impaired participants and those who use mobility devices had many questions about the driverless car experience. There were questions about whether a currently unlicensed individual would be able to use them independently.

“Could I travel in one alone as a totally blind person? To me that’s the ultimate

improvement ... is to be able to travel independently."

Practical elements of the driverless car journey were a key concern. Participants wanted to know how they would direct the car to their destination, and the logistics of a journey's beginning and end. Participants with visual impairments noted that they would need a voice interface. Some participants using mobility devices would require the vehicles to be equipped with ramps or lifts for chairs.

"I don't understand the last 100 feet and the first 100 feet of the trip. Sure, the car can get from Montreal to Toronto but how do I park it in my driveway?"

"I can't be let out at the other end of the parking lot. I have a wheelchair and need [the accessible parking space.]" "If you're visually impaired, you might have no idea where you were. Are you at the end of the lot or the front? How do you get out and find the mall or where you're going to? How do you know where you are?"

While there was general enthusiasm for driverless cars among participants – particularly in the group focusing on accessibility-related considerations – there were equally strong concerns about affordability. For example, participants voiced concerns that individuals supported by the Ontario Disability Support Program would not be able to afford trips in driverless vehicles if the cost is comparable to existing taxis and ride-share programs. One participant mentioned that public transport for people with disabilities in her city is free and that for-fee driverless cars would be prohibitively expensive.

Some participants expressed concerns about how the public might react to a scenario in which people with disabilities can travel by (driverless) car independently. Some participants shared misconceptions they have experienced about what people with disabilities can and cannot do. However, they also shared the hope that increased independent mobility for people with disabilities could break down barriers and in turn challenge these misconceptions.

The tangibility of driverless cars was most apparent with participants experiencing accessibility and mobility constraints.

For most focus group participants, the regular use of driverless cars remains a distant, almost idealized 'pie-in-the-sky' scenario. Despite this, findings suggest that a future where driverless cars are commonplace is most tangible to individuals from the accessibility group. This group communicated very detailed applications of how they would use driverless cars, whether it is the ability to pick up groceries, to travel greater distances to a cottage with room for baggage and supplies, and the opportunity and physical space to bring equipment and supplies to work related events. Related to the nature and complexity of their conditions, individuals with physical disabilities must consider the fine-grained details of every trip, from entering the vehicle to getting through the front doors of their final destination.

Participants expect driverless cars to improve mobility options for people as they age.

Participants expect driverless cars to function as a transportation solution as they age. Several participants were

hopeful that driverless cars would be available when they are ineligible to drive due to age. They anticipated that driverless cars would preserve their mobility.

“At some point they will take away my license but I’ll still be able to go where I want. This is a great solution for older people.”

“My dad is getting older. This is something that I would be interested in getting for him.”

“This would allow people to live in their houses longer and maintain that independence rather than relying on family members.”

Participants expected a wide range of links between driverless cars and public transit, ranging from complementary relationships to competition with one another.

How driverless cars will integrate with or compete with public transit became a topic of interest. Most felt that driverless cars would not replace public transit since transit has a much higher ridership capacity. However, some were concerned that riders would leave public transit in favour of driverless vehicles, further eroding a strained transit system. In suburban Vaughan, for-hire driverless cars were viewed as a potentially more viable alternative to poor and low-ridership transit services. Participants raised concerns about an increase in car use.

“Public transit is a complement to driverless cars [...] I don’t see these vehicles carpooling with a million people. There’s still a need for mass transit.”

“It seems counterproductive to say here’s a driverless car, now abandon all the transit we’ve built up over the years. People stepping back into cars — that makes me feel conflicted.”

“More people who used to take transit might take the driverless car. That would create more congestion with less people riding the trains. I think people would drive more.”

“I think that transit will be impacted by this technology if the technology is similarly priced or cheaper than transit.”

Participants expected considerable opportunities for driverless cars to be integrated with public transit. One person suggested that “Metrolinx could buy a fleet of them”.

“[Metrolinx] could have driverless cars in the area so people don’t have to drive to the station at all. They could have driverless cars pick people up at home and drop them off at the station and then the car goes to pick somebody else up.”

“Why shouldn’t municipalities start running driverless cars as transit?”

Many participants viewed public ownership of driverless vehicles as being an advantage that would ensure equitable coverage of vehicles across the region. Participants surmised that ridership statistics could allow transit system operators to monitor user needs and flexibly provide driverless cars to meet those needs.

Topic 3 Findings: What role do participants think public policy should play?

Each group discussed the extent to which the public sector should be involved in regulating driverless cars. Focus group participants acknowledged that public policy can and will shape how driverless cars are introduced and used in the region.

Focus group participants favoured regulation of the use of driverless cars.

Participants were supportive of regulation on the use of driverless cars, while being wary of too much government intervention. There was some consensus that during the early phases, when driverless cars are new, the government would need to play a strong regulatory role. Participants expected regulations to cover minimum age requirements and restricting use to currently-licensed drivers who have the capacity to take control over a semi-autonomous vehicle. Participants generally agreed that young children should not be alone in the vehicles due to concerns over minors' ability to respond to emergencies. Participants were more uncertain about whether older children or teenagers who are not licensed drivers should be allowed to use driverless cars unaccompanied. Participants indicated interest in requiring a basic level of training in directing the vehicle, even if cars are fully autonomous and do not require the driver to perform safety-critical functions.

The same issue was raised among participants with disabilities who were not drivers. In discussing possible use restrictions, one person remarked:

"You have to be careful there because the whole point is to give more independence [...] I don't like the idea of restricting anyone but maybe there has to be a way to assess people's capability to use the vehicle."

Regulating when and where driverless cars can travel was also a topic of interest. Participants had questions about how driverless cars and conventional cars might interact. Participants suggested that the government could play a role in either separating driverless and conventional cars – by allowing only driverless cars on major highways for example – or by encouraging the shift to more driverless vehicles on the road by restricting the use and licensing of conventional cars.

Some cautioned against too much regulation and preferred a more unfettered approach.

"What do you want the government to oversee? Safety. There should be no regulation of the marketplace."

"If there's a void, free enterprise is going to flow in there and try to make profits. If you have too much regulation it will become inefficient."

Participants anticipated that the public sector may need to regulate the built environment for driverless cars.

Many participants felt strongly that the public sector would need to regulate the built environment to support driverless car navigation. In discussing how driverless cars read the environment, participants expressed concerns about how the car will recognize features as it moves through different cities or even different parts of one city, including the

change in the role of parking infrastructure.

“Governments need to play their part to standardize things. If it’s lines on the road, stop signs, municipalities have to play their role.”

Participants expected the public sector to regulate and standardize driverless car technology.

Perhaps echoing the general concerns and questions about driverless cars, participants expressed strong interest in the topic of regulating or standardizing the technology. Participants felt that the cars need to be standardized and compatible.

“You couldn’t have Ford program it one way and GM program it another way and Tesla another way... there needs to be some kind of universal interface.”

While acknowledging an incomplete understanding of driverless car operations, participants expressed concern that safety-critical systems be compatible with one another.

“If you drive from Mississauga into Toronto the technology should be able to work and play well together. Lane sizes and stop signs; are they all going to fit together?”

“If Ontario has a policy but Québec doesn’t acknowledge that, then can you drive to Montreal anymore? Is your driverless car only valid in Ontario? And who is responsible for that? Who is the universal body who creates these rules and guidelines?”

“Even the light controls for people with vision loss — the chirps and the cuckoos — are inconsistent even within one region...”

there are terrible inconsistencies that make traveling even in your own community difficult. We’ve always fought for consistency. I would be interested in knowing how they can work out all those inconsistencies. At a bigger scale it’s really hard.”

Participants expressed significant uncertainty about what it means for technologies and the built environment to be standardized and/or compatible. As the pace of the technology is advancing quickly, participants felt some apprehension about how dramatic the change would be and whether the public regulatory bodies could keep up and ensure safe and efficient travel.

Focus group participants expected the public sector to provide information about driverless cars.

There was consensus in the groups that governments have a role to play in educating the public about driverless cars. Participants felt that the public sector should help people learn what driverless cars are, how safe (or unsafe) they are, and how to use them. After watching a video of an individual using a driverless car, many agreed that driverless cars should be identified as such.

“I think the public needs to be aware that the car is different from a standard car.”

“[...] like a student driver, yes.” It would be nice for people to know.”

Participants preferred the cars to be identified for several reasons: they might choose to be more cautious around them, and the increased visibility for driverless

cars would, over time, make people more comfortable with them.

Some participants who felt that they stood to benefit from driverless cars were concerned that their access to them might be disrupted or delayed by public opposition to the technology. In that case, participants expected the government to educate the public about driverless cars. Several of these participants were fearful that their access to driverless cars could be blocked by others who might object to the technology.

“Some people may not trust these things. For example, in school zones ... they’ll start picketing because driverless cars show up on their streets. We don’t like driverless cars; they’re threatening our kids!”

Participants expected the public sector to make insurance rules clear and address liability to manage risk.

Each focus group explored moral considerations of collisions with driverless cars. This led to discussions about the insurance implications for driverless cars.

“If there is an accident between a [driverless car] and another normal car the insurance company might say you hit an [driverless car], it must be your fault.

“The insurance burden may move entirely to the manufacturers.”

“I fully believe that if we make it to driverless cars, the cost of insurance is going to drop dramatically. I know there will be accidents, and people will be outraged, but ultimately down the road, it is going to greatly reduce distracted driving and all forms of accidents.”

While speculation about the impact on insurance varied widely, most participants indicated interest in governments playing a role in defining the rules for insuring driverless vehicles. Participants surmised that because people’s appetites for increased transportation costs are low, their willingness to buy or use driverless could be affected by insurance rates.

Participants also shared concerns about liability. If the person in the car is not a licensed and insured driver, participants wondered how liability issues would be addressed.

“What would the liability be for a driverless car? ... Who gets the demerit points? If companies can’t increase insurance rates and demerit points, the revenues from insurance might be reduced. The public sector needs to define the rules for this. Everyone would say that they are not at fault, but the public sector would need to define the rules.”

Participants wrestled with questions about morality and driverless car operations.

Moral dilemmas associated with allowing technology to make decisions that could impact safety were addressed in each group. Participants were generally concerned about the moral and safety implications of relying on technology to make split-second decisions.

“Does the car protect its riders at all costs?”

“If a biker or pedestrian steps out in front [of the car], the car has to make a decision. Is it going to protect what’s inside and hit the person? Or [is] it going to swerve, miss the pedestrian or biker and roll the car?”

“This is a really big issue. Because which way is the car going to swerve? Towards the motorcycle or towards the SUV with a top safety rating? You’d kill the motorcyclist but if you hit the SUV they could survive.”

“So is the car’s programmer responsible for a homicide?”

While participants recognized the legal basis for navigating moral decisions in driverless cars, concerns related to technology and morality were discussed in depth.

“Legally correct and morally correct are different.”

Participants raised equity concerns and opportunities as they relate to AVs for individuals with physical disabilities.

Participants from the accessibility focus group discussed the potential for driverless cars to create more equitable travel environments for people with mobility constraints. Common experiences of service rejection or discriminatory fare charging were shared among participants, such as being charged more to store a scooter in the trunk of a taxi.

“No more taxi drivers rejecting your service animal.”

“Or taking off without letting you know they’re there. Locking the doors and not letting you in. There’s lots of advantages [to driverless cars].”

Discussions in the accessibility focus group highlight that people with disabilities face discrimination. Some participants felt that the elimination of the driver in driverless cars could

improve equitability in transportation services.

Conclusions

Several key conclusions emerged from the focus group discussions. These are based on overall lessons from focus groups but do not necessarily reflect the opinions of individual focus group participants or of the project funders.

Conclusion 1. Focus group participants were very curious about driverless cars and their views of this technology are still evolving.

Focus group participants — regardless of whether they were interested in adopting this technology — were very keen to learn more about its broader public implications. Key questions surrounded road safety, data/hacker safety, traffic flow, the travel experience, licensing, sharing the road with non-users, and changes in intrinsic value of vehicles if all are programmed uniformly

The extent to which participants were eager to learn about driverless technology — how it works, its safety record, and how soon they might be available, indicates that there is role for further learning about the technology and disseminating that information to the public.

Conclusion 2. Most focus group participants expected significant benefits from driverless cars but are reluctant to pay more to use them compared to current options.

Most focus group participants expected considerable benefits from accessing

driverless cars. They perceived personal benefits in terms of increased transportation choice, increased mobility, and better safety. They anticipated a more appealing in-car experience with the option of undertaking other activities while riding in the car. Participants with disabilities were more likely to see the immediate personal benefits of access to driverless cars.

"I'm first in line. I have thought about this for years. It's a boost in independence. Why wouldn't I want it?"

"I hope I can be around when this technology starts to be part of my reality."

Participants also saw broader community benefits if driverless cars are widely adopted. If there are enough driverless cars on the road, traffic flow could potentially be meaningfully affected; reducing congestion, decreasing travel times, and improving the safety of travelers in all modes.

Conclusion 3. With the exception of the suburban focus group, participants indicated interest in using for-hire driverless cars, provided prices are low.

Many participants indicated interest in using for-hire driverless cars, though on an infrequent basis. This suggests that they see value in this technology but that it does not override their reluctance to change broader travel patterns – perhaps due to uncertainty surrounding the technology. As such, it is unclear whether the interest in for-hire driverless cars represents interest in exploring the technology before committing to it more fully (e.g. by purchasing a driverless car) or whether this represents a broader intent to change travel behaviour.

Participants in the suburban focus group expressed more interest in using privately-owned driverless cars rather than for-hire vehicles. Most participants expected consumers other than themselves to be more interested in purchasing privately-owned driverless cars. Despite general interest in for-hire driverless cars, focus group participants indicated very little willingness in using such technologies unless the prices are very low. Generally, focus group participants expected future transportation systems to include a mixed fleet of conventional vehicles, fully driverless cars, and semi-autonomous vehicles, in addition to public transit and infrastructure to support pedestrians and cyclists.

The focus group research suggests significant interest in using for-hire driverless cars, but only for some trips. Participants viewed driverless cars as being a good option for special trips — to places they might not access otherwise or to carry out an errand that is difficult without a car. Nevertheless, participants expected the price of shared driverless cars to be low and a significant motivation to move to driverless cars would be the ability to avoid the cost of parking.

Participants who did not drive due to disability, and who foresaw a time when they would become unable to drive voiced optimism for this technology to maintain their mobility needs.

Conclusion 4. Participants did not expect to change their residential or work

locations but may travel more should driverless cars be available.

If the adoption of driverless cars were widespread, one commonly hypothesized impact could be increased suburbanization as people might choose to increase their commute times in a driverless vehicle.

The focus group findings do not provide strong evidence that consumers are prepared to commit to changes in residential or job location choices based on their expected use of driverless cars. Focus group participants indicated that the reasons they live in a certain place are varied and include the transportation services currently provided and the habits they've developed to meet their daily needs. Participants communicated some potential willingness to travel further from destinations but balked at prospective changes to residential or work locations (longer-term choices) – in large part due to broader uncertainty over the implications of the technology.

"I would drive further with driverless, but I must feel comfortable."

"I would go to a cottage. I can't get to a cottage now. There's no public transit to anywhere in cottage country."

"It's still time. Unless these [driverless cars] are going way faster; time matters. There are other factors to where we live — to be close to family and that sort of thing."

"I live right next to the GO station on purpose. I really want to live near the station."

Discussions about location choice led to some participants voicing concerns about reliability and the limits of the technology (e.g. how they would operate when there is snow on the roads). While focus group participants expressed interest in testing this new technology, uncertainty about its utility, price, and service quality appeared to prevent them from committing to changing their daily habits.

Policy Considerations

There are significant opportunities for transportation planners and policymakers to manage the implications of driverless cars. Planners will need to actively limit and manage uncertainty (by professionals and the public) and integrate such uncertainty in decision-making processes. Likewise, driverless cars are likely to challenge the nature of and rationale for current mode-based policy priorities.

Most fundamentally, privately owned or shared driverless cars do not fit in the current Ontario and Greater Toronto and Hamilton Area policy framework. Driverless cars represent a blurring of transportation modes: are they private cars? Or are they part of a public transit system? As such, they cannot be easily assessed on the basis of the current mode-based policy hierarchy. Moreover, how driverless car services align with more fundamental social goals is unclear. While the current policy context is based on prioritizing modes, leveraging driverless cars through public policymaking hinges on identifying and operationalizing how driverless cars (independent of their mode membership) advance the public good and more

fundamental social or environmental goals, however they may be defined.

This report offers five short-term public policy recommendations based on focus group findings. Policy influence over this emerging technology can be shaped to support long-term public policy goals if planners are committed to learning about and adapting to driverless car technologies and its implications:

1. Public policymakers, transportation planners, and public regulators should focus on driverless vehicles and their potential impacts. The big question is *how* to plan for and regulate, not *whether* to plan for and regulate driverless cars.
2. Learn about driverless cars and disseminate information to other planners, policymakers, and the public. Focus group participants were eager to learn more about driverless cars. Learning about the implications of this technology can enable better-informed decision-making in a range of contexts. Such an approach will entail a programmatic approach to policy – ranging from applied research, knowledge dissemination, visioning, contingency and scenario planning, public engagement, and both hard (e.g. physical infrastructure) and soft (e.g. information, regulation, and prices) policy actions.
3. Learn about who is likely to benefit from driverless cars under different ownership models. Are users the primary beneficiaries? Or do non-users also benefit (e.g. through safety improvements or reduced greenhouse gas emissions)? In

particular (as highlighted by these focus groups), there are unique challenges and opportunities in leveraging driverless cars to increase mobility for people with disabilities and for seniors. These opportunities underscore a normative policy challenge in balancing whether, and under what conditions, transportation policy should seek to influence individual travel.

4. With an understanding of who the possible beneficiaries of driverless cars are, open a dialogue about the public role with respect to regulating, providing, or subsidizing a shared or private driverless car market.
5. Identify and consider opportunities to leverage driverless car policy to advance broader policy objectives such as climate change mitigation, maximizing public infrastructure investments, or improving economic productivity. In light of the uncertainty related to driverless cars and their implications, leveraging this technology for public good will hinge on shifting from a public policy framework of modal prioritization towards an outcome-oriented framework rooted in identifying more fundamental social goals in an environment of uncertainty.

Works Cited

- Bansal, P., & Kockelman, K. (2016). Forecasting Americans' Long-Term Adoption of Connected and Autonomous Vehicle Technologies. *95th Annual Meeting of the Transportation Research Board*. Washington, DC: National Academies.
- Bansal, P., Kockelman, K., & Singh, A. (2016). Assessing Public Opinions of and Interest in New Vehicle Technologies: An Austin Perspective. *95th Annual Meeting of the Transportation Research Board*. Washington, DC: National Academies.
- Daziano, R. A., Sarrias, M., & Leard, B. (2017). Are consumers willing to pay to let cars drive for them? Analyzing response to autonomous vehicles. *Transportation Research Part C*, 78, 150-164.
- Kyriakidis, M., Happee, R., & De Winter, J. C. (2015, July). Public opinion on automated driving: results of an international questionnaire among 5000 respondents. *Transportation Research Part F*, 32, 127-140.
- Lavieri, P., Garikapati, V. M., Bhat, C. R., Pendyala, R. M., Astroza, S., & Dias, F. F. (2017). Modeling Individual Preferences for Ownership and Sharing Autonomous Vehicle Technologies.
- Robertson, R. D., Meister, S. R., & Vanlaar, W. G. (2017). *Automated Vehicles: Driver Knowledge, Attitudes, and Practices*. Ottawa, Canada: The Traffic Injury Research Foundation. Retrieved from <http://tirf.ca/wp-content/uploads/2017/01/Automated-Vehicles-Driver-Knowledge-Attitudes-and-Practices-ExecutiveSummary-3.pdf>
- Schoettle, B., & Sivak, M. (2014). *A Survey of Public Opinion about Autonomous Vehicles and Self-Driving Vehicles in the U.S., the U.K., and Australia*. Ann Arbor, Michigan: University of Michigan Transportation Institute.

Appendices

Appendix A: Focus Group Program

Appendix B: Recruitment Emails

Appendix C: Recruitment Survey

Appendix D: Confirmation Email

Appendix E: Consent Form

Appendix A: Focus Group Program

Hour 00:00: Introductions

- Start audio recording
- Study team introduces themselves

Hour 00:05: Discussion Theme: General Interest in Driverless Cars (30 minutes)

Leah to facilitate discussion going around the table one by one first and then open format.

Intro question: Please tell us your name, and whether or not you're familiar with driverless cars. Tell us either something you know about driverless cars or one question you have about them.

1. Are you familiar with driverless cars? What do you know about them?
2. Would you travel in one? Why or why not?
3. If you used a driverless car, how would your travel habits change? For example, would you bike or take transit less often? Would you travel further to work or for other trips if you didn't have to drive yourself?
4. If you wouldn't use a driverless car would your travel habits change knowing that driverless cars were on the road?
5. How do you imagine driverless cars functioning on our streets with other traffic, people on bicycles, and people walking?

Hour 00:35: Theme: ownership models (30 minutes)

1. Would you be interested in buying a driverless car for yourself or your family? Why or why not?
2. Some driverless cars may be available for-hire, similar to a taxi. These may be shared with other people going to the same places at the same times. Would you be interested in using a driverless car in this way?
3. Would you be more interested in using a for-hire shared driverless car? For example, by paying a little more?

Scenarios to prompt discussion:

- Imagine you call a taxi or an Uber. The car arrives as expected, on time, and there's no one in it. It's empty. Do you get in? Or, the car arrives and there's still no driver but there's another passenger in it — someone going to a location that's on the way to the place you're going. How do you feel about that?

- Would you order a service like this for someone else — to pick up your child at school and take them to soccer practice? To pick up an elderly parent from a doctor’s appointment and bring them home?
 - If you’d use this service would you pay the same as you pay now for taxis? More? Would you pay only what you currently pay for transit?
- How do you feel as a driver or a pedestrian or a cyclist when a car with no driver passes you on the road?

Hour 01:05: BREAK (10 minutes)

Hour 01:15: Video (5 minutes)

Play 3-minute video of people using a driverless Google car:

<https://www.youtube.com/watch?v=cdgQpa1pUUE>

Hour 01:20: Discussion about the video (15 minutes)

- Invite participants to share their thoughts on the video and invite them to comment on whether it changed their opinions or attitudes
- Re-visit Theme 1: After seeing that video, would you ride in a driverless car? Why or why not?

Hour 01:35: Theme: public policy (20 minutes)

- What should governments be doing to prepare for the potential arrival of driverless cars?
- Should they be educating the public about them? Regulating them? Preparing guidelines for how they can be used?
- Should the government spend more money to regulate driverless cars?

Hour 01:55: Final comments and thank you

- Hand out compensation (VISA gift cards)

Appendix B: Recruitment Emails

Hello,

You are invited to participate in a research study on driverless cars by researchers at Ryerson's School of Urban and Regional Planning.

We are holding a focus group to explore people's perceptions about driverless cars with a particular focus on individuals with [INSERT TOPIC HERE]. Participants must live in the GTHA (City of Hamilton, City of Toronto, Region of Halton, Region of Peel, Region of York, or Region of Durham).

During the focus group discussion, we will be asking questions about your general interest, concerns, and reactions to driverless cars and how they might affect your daily life.

Focus group participants will receive a \$60 VISA gift card as compensation for their participation.

The focus group will take place at [INSERT LOCATION HERE] on [INSERT DATE HERE] and will last approximately 1.5 to 2 hours.

If you are available on [INSERT DATE HERE] and are interested in participating in the focus group discussion, complete the attached preliminary survey and send it to driverlesscars@ryerson.ca. We will be in touch to confirm your participation.

Driverless cars represent a potentially big change in how people and goods travel. This may have both significant benefits and potential consequences. To better design public policy to plan for this technology, we need to understand whether and how people may use them. The results from the focus group discussions will help to inform transportation planning and policymaking as well as contribute to the City of Toronto's and Metrolinx's understanding of how driverless cars will impact travel behaviour in the GTHA. This research is funded by the City of Toronto and Metrolinx.

If you have any questions about the research, you may contact Dr. Matthias Sweet, Assistant Professor at the School of Urban and Regional Planning at Ryerson University, matthiassweet@ryerson.ca, 416-979-5000 Ext. 6774.

We look forward to hearing from you,

Elyse Comeau, Graduate Researcher

and

Dr. Matthias Sweet, Assistant Professor

Appendix C: Recruitment Survey



FOCUS GROUPS FOR THE GTHA DRIVERLESS VEHICLE STUDY

Preliminary Recruitment Survey: Accessibility

This information is important for the purposes of collecting information only to determine the structure of the focus group and to ensure diversity within the group. Please send your completed form to driverlesscars@ryerson.ca. This personal information will not be used in the final reports.

1. Age range:
 - 34 or under
 - 35-55
 - 56 or over

2. Region of residence:
 - City of Hamilton
 - City of Toronto
 - Region of Halton
 - Region of Peel
 - Region of York
 - Region of Durham
 - Other

3. Gender:
 - Female
 - Male
 - Other

4. Have you heard of driverless vehicles prior to learning about this study?
 - Yes
 - No
 - Unsure

5. Will you require any accommodations in order to facilitate your participation in the focus groups?

**Thank you for taking the time to complete this survey for recruitment purposes.
Please return your completed form to driverlesscars@ryerson.ca.**

Appendix D: Confirmation Email

Hello,

Thank you for your interest in participating in focus groups related to driverless cars. We would like to invite you to participate in the focus group on [INSERT DATE AND TIME HERE]. Please arrive by [INSERT TIME HERE] to check in. The focus group will take place at [INSERT LOCATION HERE]. A member of the study team will be available in the [INSERT LOCATION HERE] to direct you to the room.

During the focus group discussion, we will be asking questions about your general interest, concerns, and reactions to driverless cars and how they might affect your daily life. Focus group participants will receive a \$60 VISA gift card as compensation for their participation.

We have attached the consent form to this email for your review and will have a paper copy available for you on the day of the focus group. Your group will have up to eight participants and discussion will be guided by a facilitator.

We look forward to meeting you on [INSERT DATE HERE]. Should you have any questions or concerns, please let us know.

Thank you,

Elyse Comeau, Graduate Researcher

Matthias Sweet, Assistant Professor at the Ryerson University School of Urban and Regional Planning (416-979-5000 ext. 6774)

LETTER OF INFORMATION / CONSENT AGREEMENT

You are being invited to participate in a research study. Please read this consent form so that you understand what your participation will involve. Before you consent to participate, please ask any questions to be sure you understand what your participation will involve.

FOCUS GROUPS FOR THE GTHA AUTOMATED VEHICLE STUDY

This research study is being conducted by graduate student Elyse Comeau and Assistant Professor, Dr. Matthias Sweet from Ryerson University's School of Urban and Regional Planning. Leah Birnbaum will also be facilitating the focus groups as an independent consultant.

If you have any questions or concerns about the research, please feel free to contact the research team at driverlesscars@ryerson.ca or Dr. Sweet at 416-979-5000 (ext. 6774).

PURPOSE OF THE STUDY:

Through focus group discussions, this research will explore how driverless cars may be used by Greater Toronto-Hamilton Area residents and what these potential changes may mean for policymakers. The research is funded by the City of Toronto and Metrolinx and will be used to inform both institutions' planning and policy-making efforts.

This study is conducting focus group discussions lasting approximately 100-120 minutes in length, with 6 participants per group. Participants must be over 18 years of age and must currently reside in the Greater Toronto Hamilton Area. The research results will contribute to Elyse Comeau's Major Research Paper for her graduate degree in urban planning.

WHAT PARTICIPATION MEANS: If you volunteer to participate in focus group discussions for this study, you will be asked to meet with study facilitators and approximately five other focus group participants.

Location: Focus group discussions will take place at the Union Station West Wing (97 Front Street West, Room Number 3B, 3rd Floor).

Duration: Focus group discussions will take approximately 100-120 minutes and will be audio recorded and transcribed.

Questions: Focus groups will begin with a short informational introduction to driverless cars given by the researchers. You will then be asked questions regarding interest, familiarity, and reactions to driverless car technology and how this may affect your daily lives. A short Youtube

video will be shown. You will have access to the publically available study results at transformlab.ryerson.ca/projects/.

Question Examples:

- How do you think you or others could benefit from driverless cars?
- What are your concerns about using driverless cars?

INCENTIVES FOR PARTICIPATION: You will receive a Visa gift card of \$60 for your participation in the focus group discussion.

POTENTIAL BENEFITS: The results from the focus group discussions will benefit our research efforts and ongoing transportation planning efforts by the City of Toronto and Metrolinx.

Your involvement in this study is important to our research, but we do not expect that you will individually receive any direct benefits from participating in this study.

WHAT ARE THE POTENTIAL RISKS TO YOU AS A PARTICIPANT:

There is a low risk in participating in this study. Reports from the focus group discussions will not include any names or uniquely identifiable information. However, the audiofiles and abbreviated transcripts will be shared with Metrolinx and the City of Toronto. It is possible that someone might identify your voice and/or circumstance you describe. Please keep this in mind when you are sharing in the focus group.

In addition, your identity may be revealed by other focus group members outside of the discussion, even though we firmly ask you for their cooperation in not disclosing the identity of other participants. Additionally, you may feel self-conscious or unfamiliar about the topic of driverless cars. **Your familiarity with the topic of driverless cars is not expected.** You have the right to refrain from answering questions or withdrawing from the focus groups at any time without any repercussions.

The meeting minutes and voice recordings from the focus group discussions will be saved on computing space available at TransForm (<http://www.transformlab.ryerson.ca/>) to be used by the research team and abbreviated transcripts and audio recordings will be shared with project funders.

CONFIDENTIALITY:

Your identity will be known by the researcher as they will be present during the focus group discussions. However, your identity will remain confidential in the sharing of data. Names will not be used in the published reports.

Dr Matthias Sweet, Elyse Comeau, and Leah Birnbaum will have access to the research data, and the funders (Metrolinx and the City of Toronto) will have access to audio recordings and abbreviated transcripts.

You will not be able to review or edit the audio-recording of the focus group discussions. Should you elect to withdraw from the focus groups, your recorded contributions up to that time cannot be eliminated from the research findings because focus group participants cannot conclusively be identified based on recorded material.

Data will be stored and shared between research partners on a hard drive. Data will be retained for a period of 10 years. For the purpose of this study, 10 years is sufficiently long to allow for peer review processes for publications and secondary publications. Moreover, should the implications of this technology accelerate, destroying the data too early would not be prudent.

COSTS TO PARTICIPATION:

There are no significant costs to participation in this study. The only anticipated costs are related to travelling to the location of the focus group discussion on Ryerson University's Campus in downtown Toronto on the day of the meeting (perhaps including transit or parking fares).

VOLUNTARY PARTICIPATION AND WITHDRAWAL:

Your participation in this study is completely voluntary. You can choose whether to be in this study or not. You may stop participating at any time during the focus group discussion without a penalty. If you decide to withdraw from the focus group discussion at any time, we will not be able to take your comments out prior to your withdrawal since we will not be able to distinguish your comments from others in the audio recordings. If you withdraw from the discussion at any time, you will still receive the full incentive and reimbursements. Your choice of whether or not to participate will not influence your future relations with the study team, Ryerson University, the City of Toronto, or Metrolinx.

QUESTIONS ABOUT THE STUDY: If you have any questions about the research, you may contact Dr Matthias Sweet, Assistant Professor at the School of Urban and Regional Planning at Ryerson University, matthiassweet@ryerson.ca, 416-979-5000 Ext. 6774.

This study has been reviewed by the Ryerson University Research Ethics Board. If you have questions regarding your rights as a participant in this study, please contact:

Research Ethics Board
c/o Office of the Vice President, Research and Innovation
Ryerson University
350 Victoria Street
Toronto, ON M5B 2K3
416-979-5042
rebchair@ryerson.ca

FOCUS GROUPS FOR THE GTHA AUTOMATED VEHICLE STUDY

CONFIRMATION OF AGREEMENT:

Your signature below indicates that you have read the information in this agreement and have had a chance to ask any questions you have about the study. Your signature also indicates that you agree to participate in the study and have been told that you can change your mind and withdraw your consent to participate at any time. You have been given a copy of this agreement. You have been told that by signing this consent agreement you are not giving up any of your legal rights.

Name of Participant (please print)

Signature of Participant

Date

I agree to be audio recorded for the purposes of this study. I understand how these recordings will be stored and destroyed.

Signature of Participant

Date