FEBRUARY 1, 2022

OUTCOME EVALUATION

Performance Measurement & Evaluation
ICBC

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Executive Summary

In spring 2018, ICBC deployed a pilot using telematics-based apps to address distracted driving. The pilot focused on the customer experience, the customer's acceptance of telematics technology, and privacy considerations. ICBC has since developed a telematics strategy showing how this technology could be used to change driving behaviour and improve road safety outcomes among higher-risk motorists in British Columbia. The strategy aims to reduce the crash cost in the system and drive behavioural change through reduced rates and/or rewards.

As part of the telematics strategy, then, ICBC launched Techpilot in January 2020 to explore the potential of telematics to improve driving behaviour, help reduce crashes and create a safer driving culture in BC. The pilot targeted new drivers: those having less than five years driving experience, regardless of their age.

The objectives of Techpilot were to develop a greater understanding for the potential of incentivised telematics to:

- Improve driver behaviour and influence crash frequency among newer drivers, both Novice drivers in the Graduated Licensing Program (GLP) and fully licensed drivers with less than five years of unsupervised driving
- Develop a baseline set of information to inform any future use of telematics at ICBC.

Evaluation Design

The evaluation uses a randomised post-test control group, incorporating mixed methods in its design. The focus was to compare the difference between participants in the control and treatment groups across select post-test measures (behaviour events and crash occurrence), and in addition capture how drivers experience and use telematics to monitor and improve driving behaviour.

This report documents the key findings from the Techpilot outcome evaluation.

Recruitment and Participation

In total 3,039 drivers were successfully recruited and of these, 2,147 were eligible to take part in the pilot. Eligible drivers were randomly assigned to one of two groups, the control group (n=1,073) or the treatment group (n=1,074).

Of the 2,147 drivers who were eligible, 66% or 1,143 were active during the pilot. The number of active drivers was comparable across both the treatment (n=704) and control group (n=709). Over time the number of active drivers in both groups declined.

Impact of Telematics Use on Driving Behaviour

Overall, Techpilot had a positive influence on the driving behaviour of new drivers. Drivers receiving telematics feedback with incentives had,

- lower frequencies of rapid acceleration and harsh braking per 100km driven; including an observed difference in rates of 11% and 14% , respectively,
- a lower frequency of speeding per 100km driven, including an observed 8% difference in the rate of speeding and
- a lower frequency of hard cornering per 100km driven, accounting for a 6% difference.

Except for cornering, observed changes in the driving behaviour events, were statistically different, $p < 0.05$.

There were no observed changes, however, in the severity of these behaviours. Regardless of telematics use or not, most behaviour events were of low severity with fewer occurrences of medium and high severity events.

There was also little to no change in the positive delta speed (change in speed limit exceedance). Speed exceedance ranged between 6 and roughly 24km/hour over the posted limit, with a mean of 14km/hour. It is unlikely that telematics feedback had an influence on speeding severity. Despite speeding less, drivers in the treatment group continued to speed more than the posted limit at a similar rate.

Norms and attitudes of speeding in British Columbia likely play a role. During the interviews, participants talked about the unwritten rule of speeding, its acceptability, and the pressure sometimes felt to conform.

Improvements in driving behaviour were immediate and for the most part sustained over the pilot term. Driving behaviour neither further improved nor got worse following initial adjustments. This was consistent with how participants described the changes they had made. Moving from awareness of the behaviours they needed to work on, making the necessary adjustments based on driving feedback, to sustaining such changes by being more mindful while driving.

Factors influencing behaviour change included the,

- aggressive drivers, friends, and significant others and,
- established or accepted norms around speeding and distracted driving.

These influences were experienced in different ways, depending on the participant's background and/or characteristics.

Influence on Crash Reduction

Considering the limitations imposed by the data (insufficient exposure base) along with small effect sizes observed across targeted behaviours, telematics use did not have an attributable impact on crash rates. Crash rates were fairly comparable between the treatment and control group when looking at all liable and non-liable crashes, liable crashes only, and liable property damage only crashes. Although differences up to 13% in the rate per kilometre travelled were observed, this was not statistically significant, $p > 0.05$.

Change in Engagement

Gamification successfully stimulated interest and engaged participants to adjust or change their driving behaviour. Completing driving challenges and earning rewards for driving well, was a key to this success.

More often than not, participants mentioned earning rewards as part of their motivation to not only adjust their driving but also sustain the improvements they had made. Driving feedback in the form of driving scores, trip details, rankings and the like, were also important in this regard, from adjusting driving to sustainment efforts thereafter.

Monthly driving challenges, while engaging initially, became less so as time went on. Initial engagement was replaced by complacency wherein participants showed more interest in collecting rewards than taking notice of the challenges they had achieved. This was partly due to how the challenges were structured and used to engage and reward driving behaviour.

There was also less need to engage with and refer to their driving feedback over time. Driving feedback provided no added information that could be used to tweak or further improve their driving behaviour.

Acceptance of Telematics Use

Participants reported an overall positive Techpilot experience. Having the opportunity to not only improve their driving but also earn rewards while doing so was a paramount part.

Based on that experience, participants were accepting of telematics technology and were open to using it in the future. Both its capability to improve driving behaviour and potential use as part of a usage -based insurance (UBI) program was recognised. Improving road safety in British Columbia and promoting fairer insurance rates, respectively, were the main reasons given.

Concerns were also raised. These were related to the technology itself, and some of the issues that arose during its use, including connection issues, and the inaccurate and/or inconsistent capture of driving events. Participants felt strongly that these issues would need to be resolved if offering another telematics-based program.

Moreover, concerns were raised around privacy and the potential use or misuse of telematics data by ICBC and other potential third parties. Consensus among drivers seemed to show a possible sticking point if this was not addressed at the forefront of a telematics program.

Barriers to Telematics Use

Barriers to telematics use were related to problems with the telematics technology, including pairing issues between the app and smart tag (unstable connection), finicky or inaccurate tracking /capture of driving events (mostly distracted driving), and other in app glitches (e.g., slow, buggy). These issues were particularly frustrating to participants and in part, are responsible for dwindling rates of participation over the pilot term.

Limitations of the Findings

Limitations of study are related to the sample, undermining both the strength and generalizability of the findings. Participant attrition, sample representativeness and selection bias were identified.

Participant Attrition

Attrition of active drivers over the pilot term undermines the strength of the findings. Over the term of the pilot, the number of active participants in both the treatment and control group declined by 78% and 76%, respectively with only a small percent of participants contributing at least 12 months of data. Notably, the control and treatment group follow a similar attrition pattern, making comparisons at least probable.

Sample Representativeness

Techpilot took place during the COVID-19 global pandemic and therefore does not necessarily represent the “steady state” or what might be considered “normal” aspects of driving. Findings from the pilot then, must be situated in the context of the COVID-19 pandemic, its impact on driving (e.g., reduced traffic volumes and driving exposure), and driving behaviour (e.g., increased rates of speeding, decreased crashes).

Selection Bias

Although the sampling was targeted at the population of new drivers, selection bias cannot be ruled out. Drivers choosing to participate in the pilot may have been more safety-conscious than those who did not

participate. Evidence of this bias can be found in the stated motivations participants had for joining the pilot, descriptions about their driving style (safe and cautious, defensive or careful) and attitudes regarding speeding and distracted driving (rarely partaking in these activities or only when conditions are safe). Existing information about the population of all new drivers, however were not available to confirm.

Background

In spring 2018, ICBC deployed a pilot using telematics-based apps to address distracted driving. The pilot focused on the customer experience, the customer's acceptance of telematics technology, and privacy considerations. ICBC has since developed a telematics strategy showing how this technology could be used to change driving behaviour and improve road safety outcomes among higher-risk motorists in British Columbia. The strategy aims to reduce the crash cost in the system and drive behavioural change through reduced rates and/or rewards.

A recent review of the scientific literature conducted by Customer, Stakeholder, and Market Insights (CMSI) (2021) shows promise of telematics use in road safety. Driver monitoring combined with either feedback or feedback with incentives has shown some improvements in driving behaviour, including reduced speeding, abrupt braking, harsh acceleration, hard cornering, and in some cases distracted driving in both young drivers and fleet drivers. These findings relate to both immediate in-vehicle feedback and delayed retrospective feedback.

Less is known, however, about the impact of telematics use on crash reduction. Very few published studies were found which assessed the actual impact on crash rates. Of the few that did, there was no robust or reliable evidence to suggest an affect on crash rates. These studies tended to have methodological constraints, including self-selection bias, weak study designs, small sample sizes or lacked full details about the analysis (Tong 2015; CMSI 2021).

As part of the telematics strategy, then, ICBC launched Techpilot in January 2020 to explore the potential of telematics to improve driving behaviour, help reduce crashes and create a safer driving culture in BC. The pilot targeted new drivers: those having less than five years driving experience, regardless of their age. This group of drivers has consistently been shown to be at increased risk of crashes and would likely benefit the most from participating in the pilot.

The objectives of Techpilot were to develop a greater understanding for the potential of incentivised telematics to:

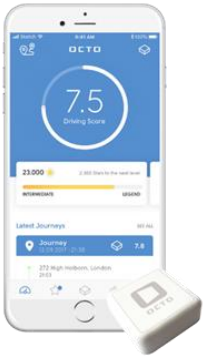
- Improve driver behaviour and influence crash frequency among newer drivers, both Novice drivers in the Graduated Licensing Program (GLP) and fully licensed drivers with less than five years of unsupervised driving
- Develop a baseline set of information to inform any future use of telematics at ICBC.

Techpilot was built in collaboration with ICBC leveraging OCTO's mobile insurance telematics offering, Digital Driver™; octotelematics.com. The chosen design applied retrospective driving feedback from telematics and included various gamification features to engage and incentivise behaviour change. A description of the telematics solution and gamification features is described in the following section.

Telematics Solution

An in-vehicle telematics sensor (Smart Tag) linked via Bluetooth to a smartphone application (Digital Driver) was selected for use in Techpilot. This solution automatically tracked and recorded real time driving data via Bluetooth and used the driver's cellular network to send data to the Octo server. Driving feedback was then made available to users via the Digital Driver application (aka Techpilot app) following each trip or collections of trips.

As part of the driving feedback, an overall DriveAbility® Score and an overall Distracted Driving Score were provided. These scores were based on driving event data augmented with other contextual data such as road type, km driven, and time of day. In addition to these scores, a trip profile and detailed log of driving events (rapid acceleration, harsh deceleration, cornering, speeding, and distracted driving) was captured for each trip. Neither the app nor the smart tag sent notifications or needed interaction during driving.



The set up of the technology consisted of four main steps and required drivers to: download the Digital Driver app to their smartphone, install the Smart Tag in their vehicle, and pair, and calibrate the Smart Tag with the Digital Driver application (app). To aid drivers with the process, in app instructions, as well as a link to a video demonstration were provided.

Capture of Driving Behaviour Events

GPS was used to capture all driving events that occurred during a trip. Events were based on comparisons made between pairs of consecutive GPS points. If the comparisons exceeded the minimum event type threshold, an event was recorded at the appropriate threshold (low, medium, and high).

The following thresholds were used to signify low, medium, and high severity events for each of the targeted driving behaviours.

Table 1. Behaviour Event Thresholds for Low, Medium & High Severity Events

Behaviour Event	Low	Medium	High
Acceleration (m/s^2)	2.7777	3.5316	150
Braking (m/s^2)	2.361	3.924	150
Cornering (m/s^2)	1.76	3.924	150
Speeding (m/s)	1.39 (5km/h)	5.56 (20km/h)	13 (46.8km/h)

Gamification

An integral part of the pilot was to use various gamification element to promote interest and engage participants to improve their driving behaviour and habits. These elements featured a scoring system wherein points could be earned for achieving driving challenges and maintaining driving scores, and achievement tracking in the form of driving scores, leaderboard rankings or position, and rewards.

The driving challenges were presented as monthly challenge themes and based on the driving event categories – as mentioned these were acceleration, deceleration (braking), cornering, distracted driving, and speeding. Each monthly theme consisted of a selection of challenges ranging in difficulty, type, and XP[1] (experience point) value for successful completion, table 2. All challenges were completed passively with drivers receiving a notification upon achievement. While not shown in the table below, XP were also

[1] Unit of measurement used in gamification to quantify experience and progression

assigned for maintaining or exceeding the previous months driving score. All earned XP were converted to virtual currency (1000 XP = $1) that could be redeemed for a choice of rewards.

Table 2. Challenge and Reward Structure

Difficulty Level	Challenge Type	XP Value
Level 1 (Beginner)	Single Trip	400
Level 2 (Intermediate)		1100
Level 3 (Master)		2000
Level 4 (Rock Star)	7 Days, 8 trips, 50% of trips	4000
Level 5 (Legend)	14 Days, 16 trips, 50% of trips	9000
Level 6 (Superhero)	30 Days, 30 trips, 50% of trips	18,000

The leaderboard was a built-in design feature of the application and drivers could choose to opt out from taking part.

In app Education/Resources

In app driving resources, in the form of videos and tips were available to help support and reinforce safe driving. The videos were short (<1 minute) and provided simple pointers about how to improve a specific driving behaviour or habit. The content and release of the driving videos coincided with each of the monthly challenge themes. Driving tips were auto generated and like the driving videos, targeted specific things that drivers could easily apply to improve their driving.

Following the extension of the pilot, improvements were made to these resources. This included a monthly email introducing the challenge theme for the month and enhancements to several of the driving videos.

Purpose of the Evaluation

In line with the business objective, this evaluation documents the delivery of ICBC's Techpilot to determine whether, and to what extent, telematics feedback along with the use of incentives promotes safer driving behaviours and better road safety outcomes for new drivers.

The specific objectives of the evaluation were to:

1. Determine what programmatic elements are required to support the application and use of in-vehicle telematics monitoring and use,
2. Assess whether the use of in-vehicle telematics with driving feedback and incentives leads to improved driving behaviours and/or habits; and improved road safety outcomes (e.g., crash reduction) among new drivers,
3. Understand how drivers experience and use in-vehicle telematics to monitor and improve driving behaviour and
4. Make recommendations for the potential adoption or application of telematics at ICBC.

Objective one is covered in two earlier survey reports and is not discussed as part of this report. See Appendix A and Appendix B for a summary of the key findings.

Methodology

Evaluation Design

The evaluation uses a randomised post-test control group, incorporating mixed methods in its design. The focus is to compare the difference between the control and treatment groups across select post-test measures, and in addition capture how drivers experience and use telematics to monitor and improve driving behaviour. Shown in figure 1, drivers were randomly assigned to one of two groups, the treatment group, or the control group.

Figure 1. Techpilot Evaluation Design

$R \rightarrow X \rightarrow O_2(\text{treatment})$ $R \rightarrow O_2\ (\text{control})$	R - random selection X- intervention (driving feedback, gamification and rewards) O_2-post test (driving behaviour, road safety outcomes)

The treatment group received detailed feedback about their driving behaviour, had access to in app driving videos and tips and completed driving challenges to earn points that could be redeemed for rewards. Points were assigned a $ value and drivers could earn as much as $425 over the 21-month term of the pilot. The control group was given a telematics device (Smart Tag) for tracking purposes only and did not receive any driving feedback or rewards. Drivers, however, did receive a monetary incentive to take part and stay in the pilot. Like the treatment group, drivers could collect up to a maximum of $425 over the course of the pilot.

Post-test measurement cover two key areas: change in driving behaviour and impacts on road safety outcomes. Table 3 provides a list of the specific measures that are considered.

Table 3. Focus of Post-test Measures

Driving Behaviour	- Driving Exposure (km driven, hours, trips taken) - Driving Events: acceleration, deceleration (braking), cornering, speeding and distracted driving - Driving Score and Distracted Driving Score
Road Safety Outcomes	- Motor vehicle violations (speed, red light running, distracted driving) - Crash counts, crash rate (liable)

To capture how drivers experience and use telematics, a mixed methods approach using a combination of surveys, an in-depth interview, and challenge/reward data are considered. Designed to look at various aspects of the driver experience, the surveys and interview were conducted at specific points along the pilot trajectory, table 4. For this report, we focus on the findings from Survey 3 and the in-depth interview.

Table 4. Focus of the Surveys and In-depth Interview

Survey 1	- Onboarding, technology set-up & in app navigation.	6 mos. post start
Survey 2	- Engagement and use of the app to monitor & improve driving behaviour; focus on gamification and rewards.	9 mos. post start
Survey 3	- Overall Techpilot experience; perceived behaviour changes and potential use of in-vehicle telematics.	Pilot end
Interview	- In depth case study of driving culture and attitudes, use of in-vehicle telematics & perceived implications.	Pilot end

Further details about Survey 2 and Survey 3 along with the key findings, are provided in the Appendices as noted above.

Recruitment & Assignment of Drivers

Driver recruitment began with a media launch on July 30th, 2019. Various marketing activities ranging from advertising to community outreach, as well as road safety and direct mail boosts were undertaken. The aim was to recruit 7000 new drivers who either had a

- a Class 7N (Novice) or Class 5 BC driver's licence, with less than four years of driving experience, or
- out of province experience, with either a BC Class 7N and/or Class 5 licence.

In either case, drivers had to have less than four years of unsupervised driving experience at the start of the pilot.

Drivers needed a smartphone with a data plan and Bluetooth capability (iOS 10 or higher, or Android 6.0 and higher) as well as access to a private passenger vehicle such as a car, sport utility vehicle, or pick-up truck. Motorcycles, motorhomes, and heavy commercial vehicles were not allowed for use in the pilot.

In total 3,039 drivers were successfully recruited and of these, 2,147 were eligible to take part in the pilot. Over the term of the pilot, 1,413 participants were active at some point and had recorded at least 1 trip.

Pilot Term

The Techpilot was originally fixed to run for one year, from January 2020 to January 2021 but was extended an added 9 months due to the COVID 19 pandemic. The evaluation term thus captures the period from January 21st, 2020, to October 15th, 2021.

Methods

This section describes the methods used to collect feedback from participants in the treatment group. Using mixed methods, both a survey and in-depth interview were undertaken and the findings integrated to inform and provide a more complete understanding of the participant experience.

Survey 3

Prior to the close of the pilot, drivers in the treatment group (n=649) were emailed a link to an online survey. The survey was open for 10 days with an email reminder sent three days prior to its close. In total, 89 participants completed the survey with a response rate of 14%. Slightly more females than males completed the survey.

Descriptive analyses were used to summarise all closed end survey items. Open-end items were analysed using content analysis; often-mentioned categories/themes were derived from participant comments.

The findings from the survey provide added feedback about overall participant experience. Given the small number of respondents, the findings however, may not represent the views of all treatment group participants who were active during the pilot.

In-depth Interview

Between September 30 and October 8, 2021, in depth interviews were conducted with 16 drivers recruited from the treatment group. Care was taken to recruit drivers from a variety of backgrounds and/or with different demographic characteristics.

- An equal # of females (n=8) and males (n=8) took part.
- Seven were between the ages of 18 to 24 years of age, with another seven between the ages of 25-34. Two interviewees were between 35-44 years of age.
- Eight interviewees resided in the lower mainland and 8 resided across other regions of BC.
- Prior to the interview eleven were active or had been active within the last four weeks, while the other eight had been inactive for more than 4 weeks.

The interviews were conducted over MS Teams/a teleconference line and lasted between 30-40 minutes. As a 'thank you' for their time, drivers were offered $125. Ipsos a market research company was contracted to complete this work.

The interview transcripts were analysed using content analysis, deriving common patterns or themes and noting differences in the driver experience. Driver quotes are used throughout the report as supporting evidence.

The findings from the qualitative interviews provide depth and added context and are not intended to be statistically representative. With that said, data saturation was reached with adequate information collected for a detailed analysis.

As aforementioned, the feedback collected from the interviews and survey was integrated to strengthen and provide a more complete understanding of the findings and key insights.

Post-Test Measurement

To support post-test measurement, data was retrieved from ICBC's Enterprise data warehouse (EDW), and from the data platform in Hadoop. Contravention and crash data were specifically extracted from ICBC's

EDW while Octo trip and event data are extracted from Hadoop platform. Of note, driving event data was restated by Octo in January 2021, and thus reported findings differ between the reporting periods.

Statistical Analyses

As part of the analysis, driving events were broken down into the following events: acceleration, deceleration (braking), cornering, speeding, and distracted driving. The weighted mean occurrence of each event type per 100km was plotted through time from mid month to mid month (e.g., Jan 15th – Feb 15th), to help identify any obvious trends or differences between the treatment and control group. Descriptive statistics of the behaviour events are also provided for comparison purposes. These are made on the basis of the overall events and are not weighted by how much each participant contributed. Finally, a negative binomial regression analysis was used to test whether there was a significant difference in driving events between the treatment and control group. An offset term was used to adjust for differences in driving exposure.

Insurance claims that occurred between the first and last trip recorded by participant were used to measure crash frequency. Crashes were categorised as overall liable and not liable crashes, liable property damage only (PDO), liable injury, and liable crashes. To test whether there was a significant difference in crash rates between the treatment and control group, a Poisson regression analysis was conducted. Injury crashes were not included in the analysis due to their low occurrence. An offset term was used to adjust for differences in driving exposure.

Limitations

Several limitations undermine the strength and generalizability of the findings. These are related to participant attrition/sample size, the sample representativeness, and selection bias.

Participant Attrition

Attrition of active drivers over the pilot term undermines the strength of the findings. Over the term of the pilot, the number of active participants in both the treatment and control group declined by 76% and 78%, respectively, with only a small percent of participant contributing at least 12 months of data. Notably, the control and treatment group follow a similar attrition pattern, making comparisons at least probable.

Sample Representativeness

Techpilot took place during the COVID-19 global pandemic and therefore does not necessarily represent the “steady state” or what might be considered “normal” aspects of driving. Findings from the pilot then, must be situated in the context of the COVID-19 pandemic, its impact on driving (e.g., reduced traffic volumes and driving exposure), and driving behaviour (e.g., increased rates of speeding, decreased crashes).

Selection Bias

Although the sampling was targeted at the population of new drivers, selection bias cannot be ruled out, and is likely given the research design of the pilot. Evidence of selection bias can be found in the stated motivations for joining the pilot, descriptions about their driving style (safe and cautious, defensive or careful) and attitudes regarding speeding and distracted driving (rarely partaking in these activities or only when conditions are safe). This may suggest that the drivers who chose to take part were generally more safety-conscious drivers who tended to follow the rules of the road. Existing information about the population of all new drivers, however were not available to confirm.

Findings

Participation

In total 3,039 drivers were successfully recruited and of these, 2,147 were eligible to take part. Eligible drivers were randomly assigned to one of two groups, the control group (n=1,073) or the treatment group (n=1,074) using a random number function in Microsoft Excel. Tests of equivalency were conducted and revealed no statistical differences between the two groups in driver demographics (gender, age, geographic region), or driving experience. Drivers in the treatment group had a slightly higher crash rate going into the pilot; however, this difference was not statistically significant.

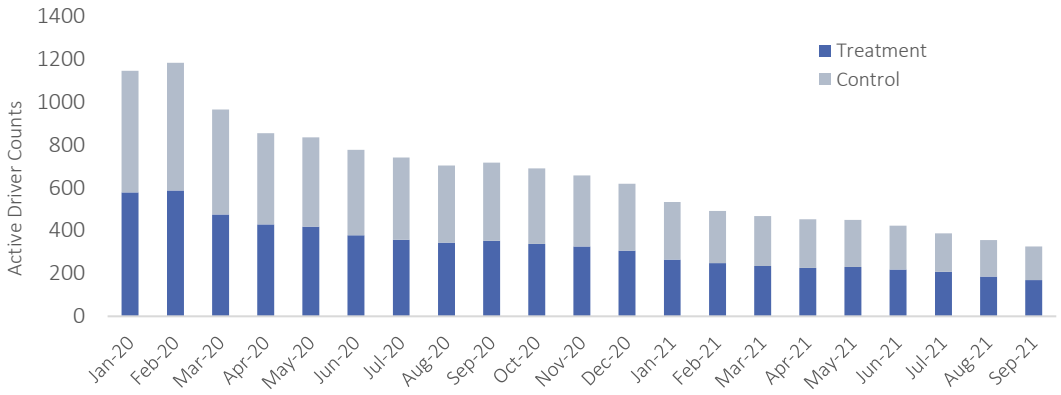
Feedback collected as part of the in-depth interviews provides some insight into the reasons drivers chose to take part in the pilot. These included and are not limited to the following,

- to assess or gauge their driving behaviour and improve, if necessary,
- try-out the technology because they were curious, had a keen interest in and/or worked in the tech field, and
- interest in taking part and contributing to a research or pilot study.

Change in Participation

Participation in the pilot changed over time and though 2,147 eligible drivers were successfully recruited, only 66% actively took part. The number of active drivers was highest at the start of the pilot followed by a gradual decline thereafter.

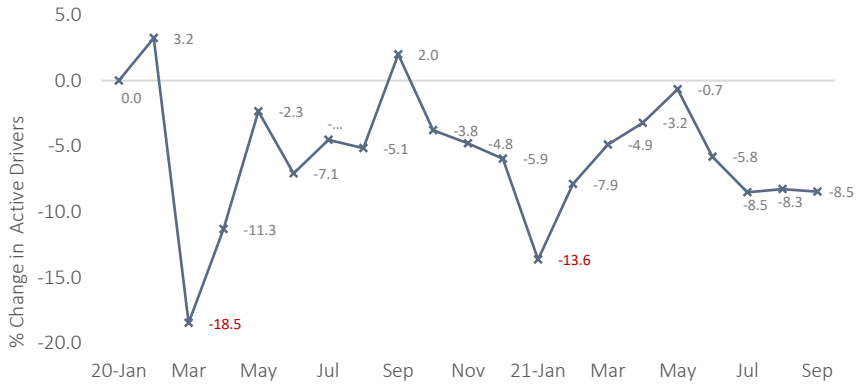
Figure 2. Count of Active Drivers over Pilot Term[2] (January 2020 – October 2021)



[2] See appendix for table of count data

March 2020 and January 2021, saw the greatest change, with the number of active drivers dropping by 19% and 14 %, respectively, figure 3.

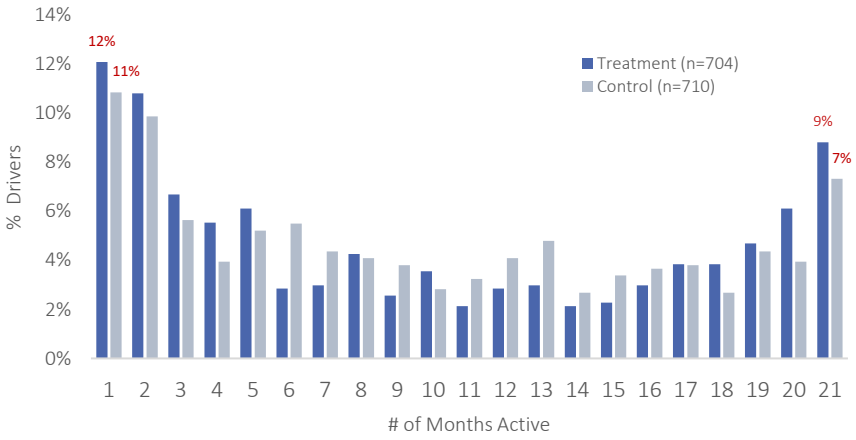
Figure 3. Percent Change in Active Drivers Month over Month, January 2020 to October 2021



The observed drop in March 2020, aligns with start of the Covid-19 pandemic and resulting public health measures put in place by the provincial health officer. The latter drop in January 2021 follows the announcement of the Techpilot extension and the choice to opt-out from further participation.

The total number of months[3] that any one driver was active during the pilot ranged between 1 month and the full 21 months, figure 4. For some drivers this meant that participation was sporadic and short-lived, actively logging trips over a one and/or two-month period, before taking a break or dropping out. For others, participation in the pilot was more regular and/or consistent, with drivers logging trips over consecutive months of either short (e.g., 3-6 mos.) or longer durations of time (e.g., > 6 mos.). Nonetheless, the number of active drivers over the entire 21-month term of pilot was proportionally small with less than 10% of drivers taking part.

Figure 4. Number of Months of Active Participation



[3] Includes driver activity over the pilot term, including sporadic and consecutive months of driving

Feedback from the surveys and interview provide some insight into to why participants dropped out, stopped, or limited their participation in the pilot. Internal factors related to the technology itself as well as external factors outside the control of the pilot were identified. Internal factors, as mentioned, were most often related to issues with the technology and/or its capability; including issues with set up, in app glitches, pairing and connectivity issues, as well as inconsistent logging of trips and/or inaccurate detection of driving events.

> *The app was difficult to use, and I got frustrated to bother. The technology also did not track my driving accurately and added to my frustration.*
>
> *There were other instances where it would log me out randomly. I would also cash in my points for a reward, and I wouldn't even get the reward. So, my points just would disappear. I'd spend a month on it and not get anything."*
>
> *The app had issues sensing when I was driving and wouldn't record. Another reason was with the Distracted Driving challenge. It would, again, either not record, or it would falsely sense that I touched my phone. That really got under my skin and is the reason I dropped off the app."*

External factors such as the Covid-19 pandemic and resulting public health measures also influenced the extent that drivers were able to take part, especially early in the pilot. Drivers reported driving less, more sporadically, or not at all.

> *I think in-between this COVID pandemic period, that's lockdown time, I didn't drive, so I can't even use it. But most of the time, I've been using it, unless I forgot.*

Even as public health measures eased, resulting changes to the work landscape and the ability to work remotely precluded the need to commute for work. As one driver, explains, it just didn't make sense to keep using the app.

> *I actually deleted it a few months ago. Seeing as I was going to be working from home the majority of time, and not even driving around as much, I was like, why keep it? I probably drive maybe two or three times a month now, whereas before it was every day, and it was a bit more worth it.*

Other external factors limiting participation included job loss, limited or no access to a vehicle, or new vehicle ownership in which the driver no longer had access to the telematics Smart tag.

Demographic Profile

Age, biological sex, years of driving experience and geographic region is captured as part of the demographic profile. As shown in the next section, active drivers in both the treatment and control group were comparable across all demographic measures with no significant differences between groups. Notably, however, more female than male drivers continued to take part over the term of the pilot.

Age

Most active drivers were between the ages of 18 and 21 with a mean age of 23.8 years old. The oldest driver was 67 years and the youngest was 17 years of age. As shown in table 5, driver age was comparable across both the treatment and control group (t= -1.735, p > 0.01)

Figure 5. Age Range of Active Drivers

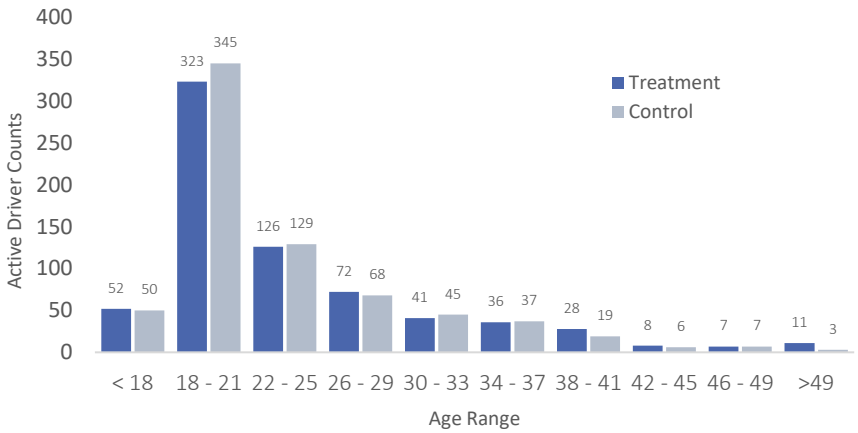


Table 5. Age of Active Drivers by Group Assignment (January 2020)

	Treatment	Control	Overall
Mean	24.1	23.5	23.8
Median	21	21	21
Mode	18	18	18
Std. deviation	7.9	6.8	7.35
Minimum age	17	17	17
Maximum age	67	63	67

Biological Sex

The percent of active female and male drivers were equally distributed between the two groups with slightly more females taking part overall, and in the last few months of the pilot term, table 6. (X^2=.047, p > 0.01)

Table 6. Biological Sex of Active Drivers

	Female		Male	
	n	%	n	%
Treatment	363	51.1	341	48.4
Control	362	51.6	347	48.9
Overall	*725*	*51.3*	*688*	*48.7*

Years Driving Experience

Active drivers had a mean of 2.2 years driving experience at the start of the pilot. As shown in table 7, driving experience was comparable between the control and treatment group with no significant difference between the two groups (t= 0.647, p > 0.01).

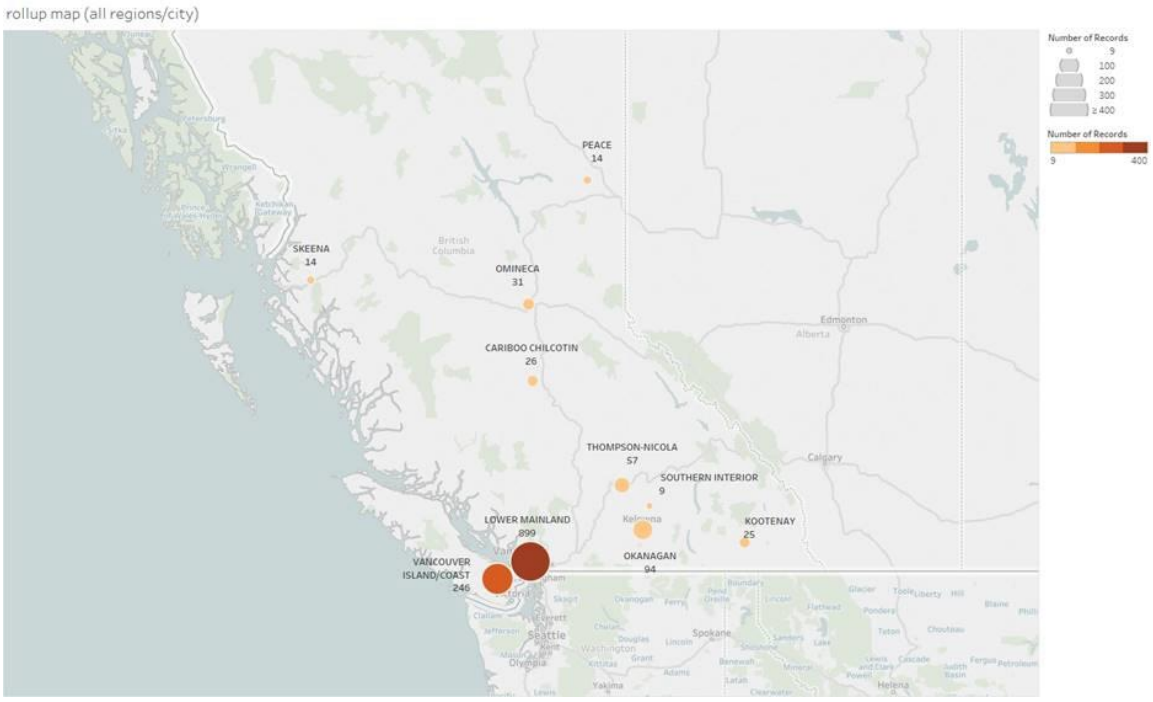
Table 7. Years Driving Experience of Active Drivers (January 2020)

	Treatment (n=704)	Control (n=709)	Total Drivers (n=1413)
Mean	2.20	2.23	2.22
Std. Deviation	1.13	1.13	1.13
Minimum yrs.	0.12	0.18	0.12
Maximum yrs.	4.17	4.18	4.18

Geographic Region

Active drivers represented all geographic regions in British Columbia. The majority however, lived in the Lower Mainland and Vancouver Island. This trend was consistent over the pilot term but with a more noticeable decrease in participants across the Peace, Skeena, and the Southern Interior regions, table 8. These regions from the start had a lower number of participants.

Figure 6. Pictorial Distribution of All Active Participant in Techpilot



More importantly, comparisons between the treatment and control group showed a similar regional distribution of participants, both initially and over the term of pilot.

Table 8. Distribution of Active Participants by Group Assignment and Period of Activity

Group	Region	Participated	Drove in 2021	Drove after Mar 31/21	Drove after Jun 30/21	Drove after Aug 31/21	Drove after Sep 30/21
Treatment	Lower Mainland	454	233	192	150	114	81
	Vancouver Island/Coast	123	54	45	37	31	23
	Okanagan	51	22	16	15	12	8
	Thompson-Nicola	24	10	7	5	4	4
	Kootenay	15	8	5	3	3	2
	Cariboo-Chilcotin	14	5	5	3	2	1
	Omineca	13	8	7	7	7	3
	Peace	8	4	3	2	2	2
	Skeena	5	3	2	2	0	0
	Southern Interior	4	0	0	0	0	0
Control	Lower Mainland	445	211	183	150	112	86
	Vancouver Island/Coast	123	63	50	44	34	25
	Okanagan	43	23	18	14	11	9
	Thompson-Nicola	33	17	16	14	10	8
	Kootenay	10	3	3	2	1	1
	Cariboo-Chilcotin	12	5	4	3	2	1
	Omineca	18	10	10	9	7	4
	Peace	6	4	3	2	2	2
	Skeena	9	4	4	3	1	0
	Southern Interior	5	2	2	2	2	1

Driver Characteristics

Additional insight about the drivers who took part in Techpilot was gathered from the participant interviews. Drivers were asked to describe their driving style as well as share their attitudes about speeding and distracted driving. Because the interviews were conducted with a small group of drivers in the treatment group only, the findings are limited in scope and therefore may not reflect the views of all drivers who took part in Techpilot.

Driving Style

Participants tended to view their driving style as "safe", and used words such as cautious, defensive, relaxed/calm, and vigilant to describe how they drove. For them, safe driving was characterized by,

- following the rules of the road including adhering to the speed limit (mostly but not always),
- exhibiting defensive driving skills (shoulder checking, giving way to merging traffic, keeping a 2 second following distance, coming to a complete stop, and using signals when turning or changing lanes),
- adjusting how they drove to the road/weather conditions, and
- being aware of their surroundings and predicting the actions of other road users.

Preventing a car accident and/or potentially avoiding one were the main reasons for adopting a safe and defensive driving style. Of the latter, participants described the few "bad apples" and carelessness of some road users. Several examples were given and included:

- aggressive behaviours of big trucks who "think they own the road",
- careless or absent-minded drivers who do not use signals or check before merging,
- impatient drivers who cut across or "zip in and out" of lanes or do not come to complete stops, and
- reckless drivers who drive beyond the speed limit to show off their expensive sports cars.

Despite viewing themselves as safe drivers, there was some variation in how strictly and consistently they followed through with their actions. From time to time, some felt pressure to conform to how other road users expected them to drive (e.g., keeping up with the flow of traffic), while others admitted to driving more carelessly because they were with friends, it was fun, or the conditions were right to do so (e.g., speeding on an open road with little traffic). Others meanwhile were adamant to stick to the rules of the road, including the posted speed limits.

Driving Attitudes

Speeding

Participants shared different viewpoints when it came to speeding. Some participants felt it was never okay to speed, citing that it was both reckless and dangerous to do so. In their mind, speeding was only acceptable in an emergency.

> *Because you never know what's around the bend coming up, and it could be a massive accident. Because I've seen it… it's that one equalizer, right, like I've seen it even on the highways where a semi-truck's broken down in the right lane, he's as far over as he can get, but then that one car comes around the corner and doesn't notice him and plows right into the back of him.*

> *If it's an emergency, like there's an ambulance or firetruck. They are allowed to go over speed. But other than that, if you're just doing normal things or it's not really like very important, like life threatening or something, then speeding is not acceptable at all.*

> *I think speeding is very reckless, and that's how accidents happen a lot, and how people do pass. I think the only time it'd be okay is if there was an emergency or something, like if you had someone bleeding out in your car.*

Other drivers were more accepting of and admitted to speeding, but only if conditions were optimal and if it was perceived as safe to do so. This included setting a speeding limit/threshold. For most, this meant never driving 10 to 15km/h above the posted speed limit.

> *Probably going 10 over would be mild speeding, I think. And then, anywhere from 20 and over the speed limit is definitely dangerous speeding. I don't know if there is really a safe speeding speed. I don't know how to say that. But yeah, I think if you do have to speed, going I guess under 10 over, is probably best.*
>
> *On the highways around here, the limit is around 100 kilometers. If the weather conditions are good and there's not very much traffic on the road, I might go say 100, 110, 115 on a good day. But there are people who will go into the passing lane and start gunning it going like 150, 160, and that I find is extremely dangerous. It doesn't take into account, you know, what if somebody has to swerve into the lane or something like that. There's no way that they could brake for that*.
>
> *When they're speeding, they think that they're invincible and can handle whatever happens. But they're not expecting, you know, that deer to dart out from the tree on the highway. For me, it's anything over ten percent of the speed limit, but that's just what I follow.*

When it came to the type of road, speeding was considered far less acceptable and safe on local/residential roads compared to main roads or highways. The chance of hitting something or someone was thought to be far greater and for that, reason participants were more hesitant to speed.

> *I think rural and city driving it is just too risky. There is just so much opportunity for something to miss something, or someone to come out of somewhere where I don't see them, and then cause an accident or some kind of other problem.*
>
> *Not these major roads, those tiny roads in-between different blocks. That's where people just park on the side, or people are walking their dogs, or people are going to school on the road, so you can't just speed over there.*
>
> *I've raced cars before, and obviously speed is fun, but in a controlled environment. But the public roads are not somewhere to do it for fun. It's a matter of public safety, and people around you, and the pedestrians, and that sort of thing*

Participants also noted the conditions in which speeding was more optimal and safer to do. Such conditions included driving on roads that more isolated and had plenty of space, and where there was less traffic or no cars. It was considered unsafe to speed at night, in inclement weather such as rain or snow, and if road conditions were poor.

> *If it is good weather conditions, if it is sunny, there's nothing on the road, there's no accidents or no congestion or anything like that, speeding is fine if you're driving the speed of traffic, like the flow of traffic, if you're keeping with everything and making sure that everything is like reasonable.*
>
> *Even now, that's fall, it's starting to rain. So, when it's raining, it's slippery, so when you over speed, it's a little bit risky actually. So, when it's always raining, I kind of slow down too.*
>
> *I'm in Saskatchewan and I'm driving for three hours in the middle of nowhere, I'm driving on the middle of the road in the middle of the line, and I might go 30 kilometres over. That is the only exception because it is bare from wherever you can see.*

If the weather conditions are good and there's not very much traffic on the road, I might go say 100, 110, 115 on a good day.

Other participants meanwhile were ambivalent or torn between following the rules of the road and meeting the expectation set by other drivers to speed. As mentioned, some drivers felt pressure to conform even though they felt uncomfortable doing so. This left some feeling frustrated – and as one driver commented, "if the speed limit is the speed limit and not a suggestion, then we should be policing it more or drop the speed limit another 10km.

Distracted Driving

Distracted driving [4](phone use) appeared to be more of a taboo than speeding. All participants understood the dangers of distracted driving and gave several examples to explain why.

It is absolutely dangerous and should not happen from nobody. It's just that level of distraction, you know, even as a college student, I'll look down at my phone in class and just look back up and I go, oh, even though I looked down at my phone for three seconds, I just had no idea what happened in those three seconds. And I just think that's so easy to happen on the road, as well, and that makes it incredibly dangerous, even at a stoplight where you just miss somebody.

A really great example is in the work truck. We were stopped at a light one time and an old granny in a walker, walked out right in front of the truck. I saw her and my co-worker who was driving at the time just didn't. He was looking around, checking out other stuff, and then the light went green, and the old granny was still right in front of the truck. And so, I had to like shout at him and be like, "Holy crap, there's still someone there, stop, stop, stop!" And so, fortunately, nothing bad happened, but just like, you know, even stopped at a light, it's so easy for something like that to happen, even if it's not a person; a dog, or a pet, or something, you know.

It is not really good to use during the driving. It's better to avoid. Let's say you are opening, just mobile unlocking, so that's one or two seconds, and during the two seconds, your car cross a place, 50 meters to 100 meters, you don't know. Yeah, it creates a lot of dangerous situations.

For the most part, participants were also unable to identify circumstances or conditions where distracted driving behaviour would be safe or acceptable. Most talked about pulling off to the side the road or waiting until they got to their destination to text, and/or make or take calls. The "Do not Disturb" while driving feature provided on some phones was also mentioned.

Most agreed that texting was absolutely not allowed, even at red lights. And, as one participant discussed in the following excerpt, advances in speech to text capability, while an attractive possibility, turned out to be a bad idea.

I know some cars have the text to speech, where you can say the text and then send it, all with your voice, so you don't have to take your eye off the road. I've used it before, and I'm not a big fan of it, because to me personally, I found myself focusing more on what the person sent to me, and then what I want to say, instead of focusing on the road. So, that's my experience with it.

[4] Phone use whether making, receiving calls, texting, or using other smart phone functions for navigation, or playing music.

Generally frowned upon by most, making and taking calls among some participants was thought to be acceptable if you use the hands-free feature on their phone (speaker) or though Bluetooth connections to their vehicles control panel. Even then, participants talked about only taking certain types of calls and limited these to quick or emergency calls. Making calls was mentioned less often.

> *Phone calls, like I said, if you have Bluetooth in your car, then okay, fine. But yeah, picking up your phone or using it, no. If you have it mounted on your dashboard with your GPS, that's one thing, but replying to a text, or scrolling through Instagram, or looking at an email, no.*

> *Quick calls, when they call me, but me calling them, no. I just usually put it on like speaker. Yeah, I have a magnet in my car where I can put my phone, so I don't usually… like handheld or something. But I don't usually call, I don't usually. If someone will call me in an emergency… like my boss or something, but for others, numbers that I don't really know, I don't accept the call.*

Still, there were a handful of instances where participants admitted to deviating from the strongly held view against distracted driving. In a couple of cases, participants who held an N licence admitted to changing songs on their phone or following GPS instructions via their car's dash. In another case, a participant was tempted to text at red lights since they were "technically not driving" or when driving on familiar routes.

Driving Exposure

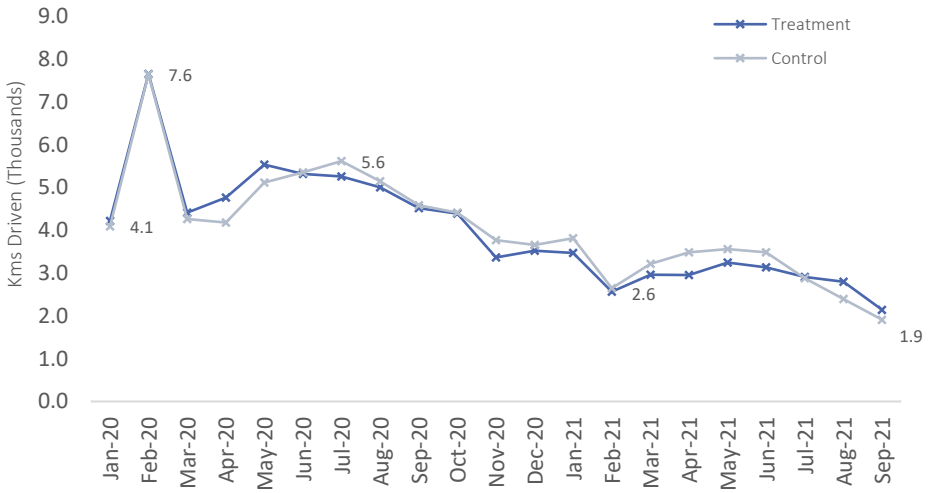
Driving exposure was captured using three measures, distance travelled (km), time (hours) on road, and number of trips taken. Comparisons across these measures show only slight differences in driving exposure between drivers in the treatment and control group, table 9.

Table 9. Measure of Driving Exposure over the Pilot Term (January 2020 – October 2021)

Group		Distance (km)	Time (Hours)	Trips (#)
Treatment	Mean	4,475.5	119.6	432
	Median	1,876.1	60.3	206
	Std. Deviation	6,029.2	144.3	515
Control	Mean	4,524.4	120.3	438
	Median	2,361.3	67.5	238
	Std. Deviation	5,503.7	140.7	516

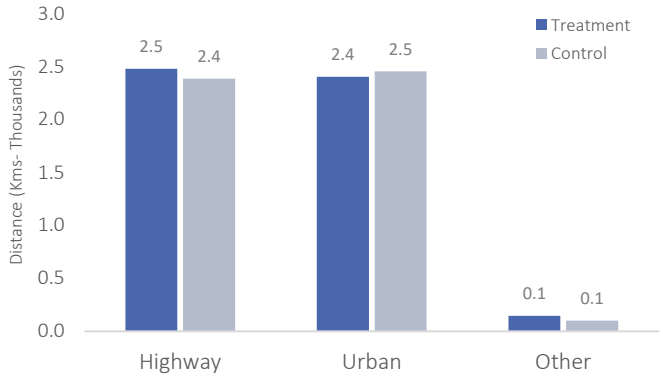
Month over month, driving exposure decreased across both groups. As shown in figure 7, a gradual decline was observed in the mean distance driven each month. A similar pattern was also observed across time and trips taken. Lower rates of participation month over month account for these observed decreases.

Figure 7. Change in Mean km Driven Over the Pilot Term, January 2020 to October 2021



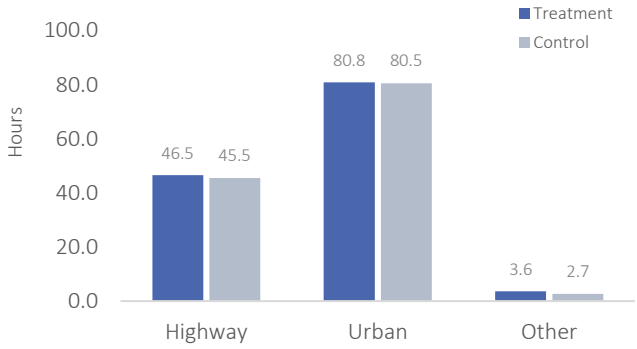
Driving exposure across time and distance were also captured by road type. As shown, both the treatment and the control group travelled similar distances and spent similar amounts of time driving on highways and urban roads figures 8-9.

Figure 8.Mean Distance (km) Travelled by Road Type (January 2020 - October 2021)[5]



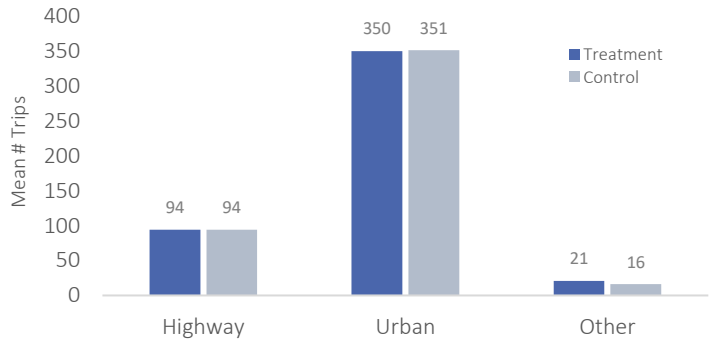
[5] Other – non motorized or sub-urban roads.

Figure 9. Mean Hours Spent Driving by Road Type (January 2020 – October 2021)



For both groups, the number of trips taken, and the time spent driving was greater on urban roads than on highways. In contrast, the mean distance travelled on either of these two road types was quite similar.

Figure 10.Mean Number of Trips Taken by Road Type (January 2020 – October 2021)



Driving Behaviour

Rapid acceleration, deceleration (harsh braking), hard cornering, speeding, and distracted driving events were used as surrogate measures of driving behaviour. The occurrence of these events was operationally defined by the sum of the event occurrence divided by the sum of km driven driver. Data was then adjusted to obtain a normalised rate per 100km driven to account for differences in total km driven by participants in both the control and treatment group.

Acceleration Events

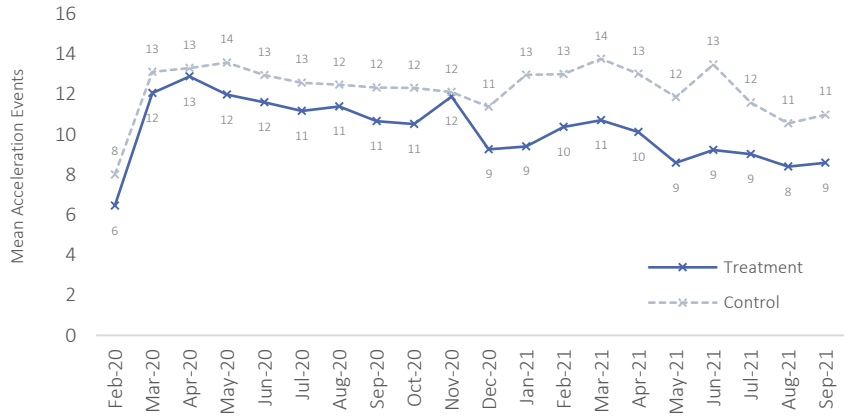
Rapid acceleration events tend to occur less often than all other driving event types. As shown in table 10, the overall rate and severity of these events were different between the treatment and control group. Notably, high severity events were extremely rare in both groups, with less than one event occurring per 1000km driven.

Table 10. Statistics of Overall Acceleration Events (January 2020 to October 2021)

Group		Acceleration Events	Low Severity	Medium Severity	High Severity
Treatment (n=704)	Mean	**8.2**	5.2	3.0	-
	Median	4.8	3.2	1.4	-
	Std. Deviation	9.9	6.0	5.5	-
Control (n=711)	Mean	**9.3**	5.9	3.3	-
	Median	5.9	3.6	1.7	-
	Std. Deviation	10.0	6.5	4.9	-

Tracked month over month, a wider spread in acceleration rates is observed between January 2021 and the end of the pilot. Over this period, the treatment group had an 11.8% lower rate compared to the control group, (8.2 events per 100km versus 9.3 events per 100km). Moreover, this difference was sustained over the rest of the pilot term.

Figure 11. Mean Acceleration Events per Driver per 100km Driven (January 2020 to October 2021)



Cornering Events

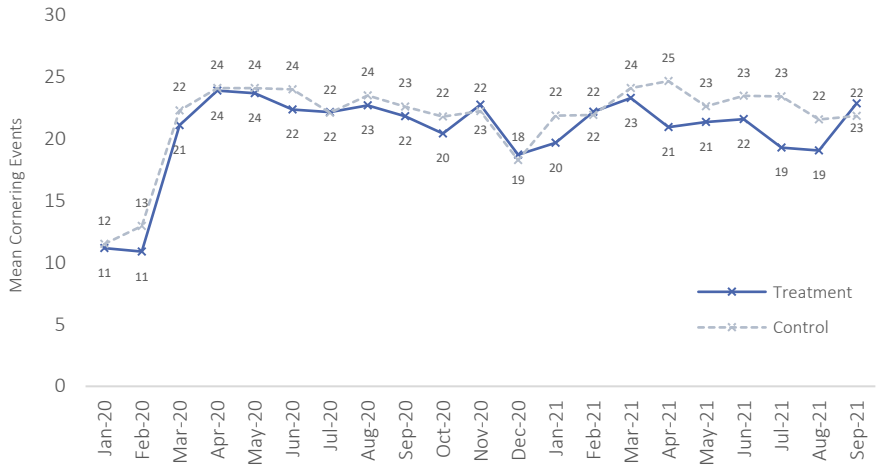
Overall, there was a small difference in both the rate and severity of cornering events between the control and treatment group. In either group, most hard cornering events were of low severity with very few to no high severity events among drivers.

Table 11. Statistics of Overall Cornering Events (January 2020 to October 2021)

Group		Cornering Events	Low Severity	Medium Severity	High Severity
Treatment (n=704)	Mean	**15.6**	15.0	0.6	-
	Median	12.9	12.3	0.3	-
	Std. Deviation	12.6	12.4	1.3	-
Control (n=711)	Mean	**16.6**	16.0	0.6	-
	Median	14.0	13.5	0.3	-
	Std. Deviation	12.6	12.3	1.1	-

Over the pilot term, rates of hard cornering, across both groups were relatively stable. A small downturn, however, is observed between April 2021 and August 2021, with the treatment group having a 6% lower rate compared to the control group: 19 events per 100km versus 21 events per 100km.

Figure 12. Mean Cornering Events per Driver per 100km Driven (January 2020 to October 2021)



Deceleration Events (Harsh Braking)

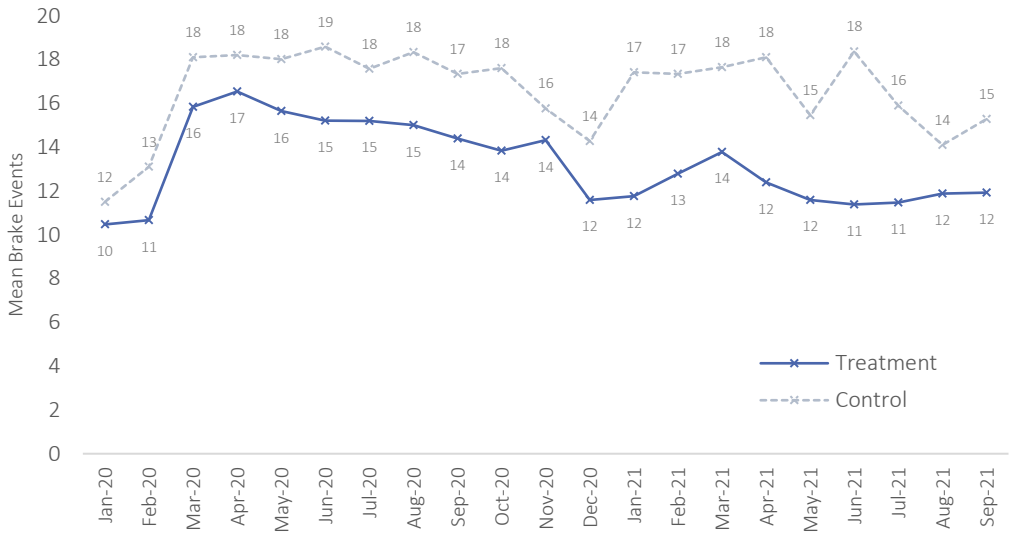
Overall, lower rates of deceleration (harsh braking) are observed in the treatment group compared to the control. This difference was most noticeable in the occurrence of low severity events.

Table 12. Statistics of Overall Deceleration Events (January 2020 to October 2021)

Group		Braking Events	Low Severity	Medium Severity	High Severity
Treatment (n=704)	Mean	**11.8**	**10.3**	1.4	0.04
	Median	8.7	7.6	0.4	0.00
	Std. Deviation	11.0	9.5	3.9	0.20
Control (n=711)	Mean	**13.8**	**11.9**	1.8	0.05
	Median	10.5	9.3	0.5	0.00
	Std. Deviation	12.3	10.5	3.7	0.24

Month over month rates of harsh braking were consistently lower in the treatment group. Between January 2021 and July 2021, the gap or difference in these rates widened, with the treatment group having a 14% lower rate of deceleration events compared to the control group.

Figure 13.Mean Deceleration Events per Driver per 100km Driven (January 2020 to October 2021)



Speeding Events

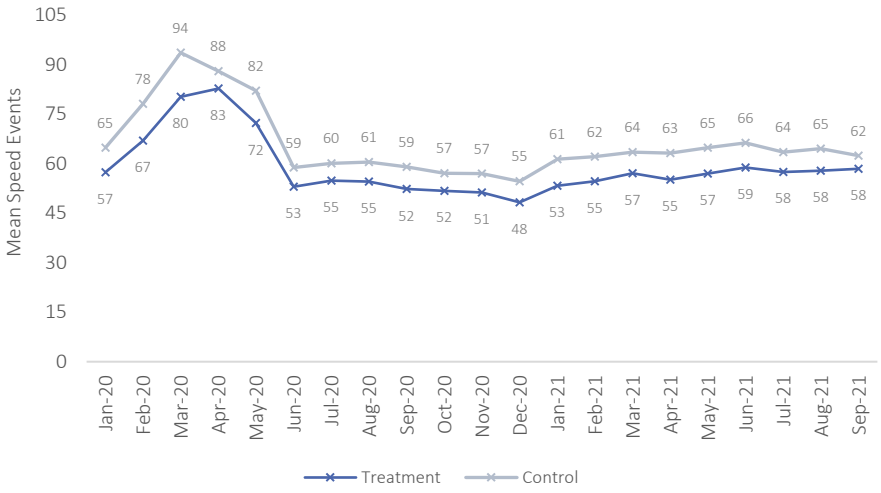
There was a modest difference in the overall rate of speeding between the treatment and control group. As shown, lower rates of speeding are observed in the treatment group, both in total events and in the occurrence of low severity speeding events. This was not the case, for high severity events. More of these events were observed among the treatment group drivers.

Table 13. Overall Speeding Event Statistics (January 2020 to October 2021)

Group		Speed Events	Low Severity	Medium Severity	High Severity
Treatment (n=704)	Mean	**65.7**	**41.9**	16.2	7.6
	Median	65.2	41.9	12.7	5.9
	Std. Deviation	36.8	20.9	15.1	8.2
Control (n=711)	Mean	**71.5**	**47.7**	17.2	6.6
	Median	70.7	46.0	14.6	5.0
	Std. Deviation	38.5	23.6	14.3	7.3

A similar pattern is seen month over month, figure 14. Differences in rates of speeding ranged between 8 and 15 percent with treatment group consistently having fewer total speed events than the control group. The occurrences of these events were also relatively stable with little movement up or down over the course of the pilot.

Figure 14. Mean Speed Events per Driver per 100km driven (January 2020 to October 2021)



An analysis of speeding events more than 5km/hour over the posted speed limit was also conducted to find the extent or amount that drivers exceeded the posted speed limit (positive delta speed). As shown in table 14, speeds more than the limit, overall, ranged between 6 and approximately 24km/hour with a mean of 14km/hour over. There was a slight decrease in excess speed rates across year 1 and year 2 of the pilot. This is seen in the mean rates and distribution of excess speed for both groups.

Table 14. Statistics of Speeds in Excess of the Posted Speed Limit (km/hour)

		Statistics			Percentile		1.5 X IQR	
	Group	Mean	Median	Std. dev.	25th	75th	Lower	Upper
2020	Control	14.4	13.3	6.3	11.0	16.1	6.0	23.8
	Treatment	14.4	13.1	6.8	10.7	16.2	6.0	24.6
	Total	14.4	13.2	6.5	10.8	16.2	6.0	24.2
2021	Control	13.6	12.5	5.8	10.3	15.4	6.0	23.0
	Treatment	13.4	12.0	6.3	9.9	14.9	6.0	22.5
	Total	13.5	12.3	6.0	10.1	15.1	6.0	22.7
Overall	Control	14.1	13.0	6.1	10.7	15.9	6.0	23.6
	Treatment	14.1	12.7	6.6	10.4	15.8	6.0	23.9
	Total	14.1	12.3	6.4	10.6	15.8	6.0	23.8

With little observed difference between the treatment and control group in excess speed rates, it is unlikely that telematics feedback has had an influence on speeding severity. Despite speeding less, drivers in the treatment group continued to speed more than the posted limit at a similar rate. This finding is consistent with driver attitudes or accepted norms about speeding in British Columbia. During the interviews, some participants admitted to driving between 10 and 15 km/hour over the limit, albeit only if conditions were perceived as safe to do so.

Distracted Driving Events

The finding presented here are for information only. Issues with telematics detection and tracking of these events made it difficult to draw any firm conclusions.

As shown, there was minor difference between the two groups in overall distracted driving rates and rates of these events over time. The control group, however, was observed to have slightly more handling events than the treatment group.

Table 15. Overall Distracted Driving Event Statistics (January 2020 to October 2021)

Group		Total Events	Handling	Hands-free	Handheld
Treatment (n=704)	Mean	21.2	19.7	1.2	0.3
	Median	13.3	11.6	0.3	0.1
	Std. Deviation	36.4	36.3	2.5	0.6
Control (n=711)	Mean	19.6	18.0	1.3	0.3
	Median	12.7	11.1	0.5	0.1
	Std. Deviation	33.9	33.6	2.1	0.6

Difference in Driving Behaviours

A Negative Binomial Regression analysis was also conducted to test whether or not there was a difference in the driving behaviours involving acceleration, deceleration, cornering and speeding between the control and treatment group. Based on that analysis, there was a statistically significant difference between the groups for all event rates except cornering: speeding ($\chi2=7.18$, $p<0.01$), accelerating ($\chi2=4.5$, $p<0.05$), decelerating ($\chi2=13.08$, $p<0.01$), and cornering ($\chi2=2.27$, $p>0.05$). These findings are not surprising given the observed differences between the treatment and control group across these behaviours. Details of the analyses are shown in tables 16 thru 19.

Table 16. Negative Binomial Regression Analysis – Speeding Events

	DF	Estimate	Std. Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	4.1913	0.0228	4.1465	4.2361	33684.7	<.0001
Control	1	0.0863	0.0322	0.0232	0.1494	7.18	0.0074
Treatment	0	0.0000	0.0000	0.0000	0.0000	.	.
Dispersion	1	0.3572	0.0138	0.3311	0.3853	0	0

Table 17. Negative Binomial Regression Analysis – Acceleration Events

	DF	Estimate	Std. Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	2.1169	0.0362	2.0460	2.1878	3427.33	<.0001
Control	1	0.1081	0.0510	0.0082	0.2079	4.5	0.034
Treatment	0	0.0000	0.0000	0.0000	0.0000	.	.
Dispersion	1	0.8652	0.0316	0.8055	0.9294	0	0

Table 18. Negative Binomial Regression Analysis – Deceleration Events

	DF	Estimate	Std. Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	2.4703	0.0329	2.4058	2.5349	5621.63	<0.0001
Control	1	0.1676	0.0463	0.0768	0.2584	13.08	0.0003
Treatment	0	0.0000	0.0000	0.0000	0.0000	.	.
Dispersion	1	0.7212	0.0262	0.6716	0.7744	0	0

Table 19. Negative Binomial Regression Analysis – Cornering Events

	DF	Estimate	Std. Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	2.7572	0.0288	2.7007	2.8136	9154.59	<0.0001
Control	1	0.0612	0.0406	-0.0184	0.1408	2.27	0.1319
Treatment	0	0.0000	0.0000	0.0000	0.0000	.	.
Dispersion	1	0.5551	0.0211	0.5153	0.5981	0	0

Driving Scores

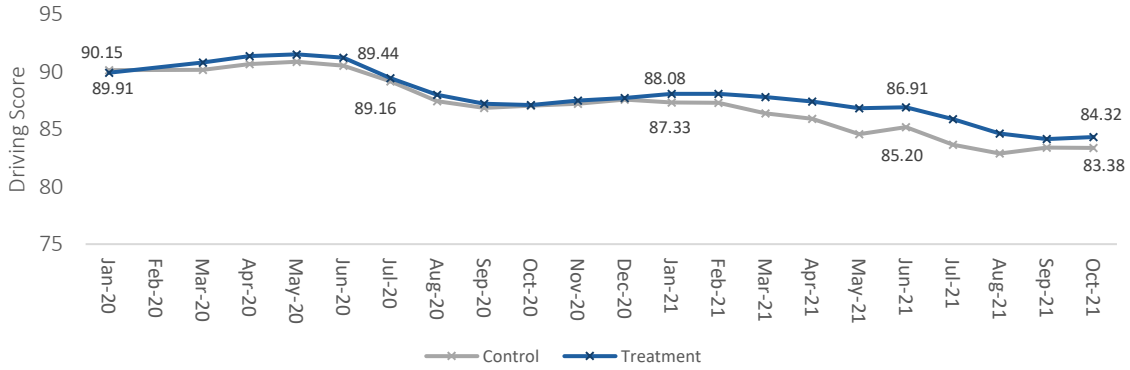
The driving scores for both the treatment and control group align well with the observed changes in driving behaviour. The treatment group as would be expected outperformed their control counterpart, but only slightly. Scores across distance, smoothness, time, and road were also similar. Again, these align with the reported exposure measures.

Table 20. Driving Score Statistics for the Period of January 2020 to October 2021.

Group		Driving Score	Distance	Smoothness	Time	Road
Treatment (n=704)	Mean	**86.0**	88.3	71	72.3	66.8
	Median	88	90	72	72	67
	Std. Deviation	8.7	7.8	10.5	1.3	5.4
	Minimum	22	25	1	50	35
	Maximum	99	99	94	81	86
Control (n=709)	Mean	**84.6**	87.9	69.8	72.2	66.8
	Median	86	89	71	72	67
	Std. Deviation	9.7	7.5	10.7	1.3	5.4
	Minimum	28	26	3	51	34
	Maximum	99	99	96	82	86

Viewed over time, driving scores tended to decline over the first few months but then stabilised over much of the remaining pilot term.

Figure 15. One hundred Day Rolling Driving Score – January 2020 to October 2021.



As mentioned, issues with telematics detection and tracking of distracted driving events makes it difficult to draw any firm conclusions about the distracted driving score. Thus findings related to the distracted score are not presented.

Driving Challenges

The influence of the monthly challenges on driving behaviour was also examined. Two measures were used as part of this analysis,

- change in event rates/100km before, during and right after the challenge month and
- percent of drivers with improvement in target behaviour during and 1 month following the challenge month.

In the interest of brevity, individual analyses for measure 1 are not included as part of this report. The main finding is reported only.

Change in Event Rates

Event rates showed some movement over each of the periods, before, during, and after the challenges across all target behaviours. Such changes, however, varied and were inconsistent. Event rates were shown to improve sometimes while at other times not so much around the challenge month. A similar pattern was also observed among the control group over these same periods. Thus, the challenges themselves had little effect on event rates.

Participants Showing Improvement

As shown in table 21 about 50% of participants, overall, showed or continued to show improvement in the targeted behaviours. Across each challenge month, the percent of drivers with improvement tended to vary, ranging between 38 and 63 percent. This fluctuation was random and did not appear to be dependent on the targeted behaviour.

Comparisons made between the control and treatment groups also show little to no difference either during or following the challenge month. Differences across challenge months were either non-existent or small. In some months, the control group outperformed the treatment group. Based on these findings, monthly challenges appeared to have limited influence on the targeted driving behaviours.

Table 21. Behaviour Change Observed during Challenge Month and 1 Month Following

Challenge	Month/Year	% Improved during Challenge Month			% Improved 1 Month Following		
		Tx	Control	Difference (Tx-C)	Tx	Control	Difference (Tx-C)
Acceleration 1	Jun. 2020	51%	51%	0%	52%	52%	0%
Acceleration 2	Oct. 2020	54%	54%	0%	44%	48%	-3%
Acceleration 3	Jan. 2021	45%	45%	-3%	41%	43%	-2%
Acceleration 4	Jun. 2021	50%	53%	-1%	53%	51%	3%
Braking 1	Apr. 2020	47%	45%	2%	48%	53%	-5%
Braking 2	Aug. 2020	47%	49%	-2%	53%	49%	4%
Braking 3	Dec. 2020	57%	59%	-2%	49%	42%	6%
Braking 4	Apr. 2021	50%	47%	3%	49%	61%	-12%
Braking 5	Aug. 2021	56%	50%	6%	49%	53%	-4%
Cornering 1	Feb. 2020	39%	38%	0%	19%	22%	3%
Cornering 2	Jul. 2020	52%	54%	-2%	47%	49%	2%
Cornering 3	Feb. 2021	47%	40%	7%	48%	40%	-8%
Cornering 4	Jul. 2021	54%	53%	1%	49%	56%	7%
Speeding 1	May 2020	63%	62%	1%	81%	84%	-3%
Speeding 2	Nov. 2020	57%	55%	1%	57%	53%	4%
Speeding 3	May 2021	48%	53%	-6%	44%	44%	1%
Total		**51%**	**51%**	**0%**	**50%**	**49%**	**1%**

Percent of Participants Completing Challenges by Difficulty

Over the pilot term more participants tended to complete lower-level challenges (1-3) than higher level challenges (4-6), independent of the challenge type. As shown in the table below, a wider spread or range in values is observed among the speeding challenges.

Table 22.Percent of Participants Completing Challenges by Difficulty Level (n=704)

Difficulty Level	Acceleration	Deceleration	Cornering	Speeding
1	60%	60%	59%	64%
2	60%	60%	59%	63%
3	60%	60%	59%	63%
4	50%	50%	51%	51%
5	48%	48%	49%	46%
6	44%	44%	51%	42%

Additionally, the overall percent of challenges completed by level of difficulty ranged between 14 and 19 percent for all challenge types, table 23. More challenges with a level 4 difficulty were completed relative to all others.

Table 23. Percent of Challenges Completed by Level

Difficulty Level	Challenges Completed (%)
1	16.70
2	16.54
3	16.41
4	19.23
5	16.75
6	14.38

Road Safety Outcomes

Motor Vehicle Violations

The number and percent of active drivers with Motor Vehicle Act violations (*MVA*) over the pilot term were comparable between the control and treatment groups, with only slight differences observed, table 24. A similar trend is also observed, pre-pilot but with approximately two times as more drivers having a violation. Over time, the number and percent of drivers with violations, regardless of group assignment tended to decline.

Table 24. Pre-pilot *MVA* Violations of Active Drivers - January 2018 to October 2019

	# Drivers with *MVA* violations	Average # *MVA* violations	% Drivers with *MVA violations*
Treatment (n=704)	102	1.50	14.5%
Control (n=711)	85	1.48	12.5%
Total (n=1,415)	187	1.49	13.2%

Table 25. Post-pilot *MVA* Violations of Active Drivers – January 2020 to October 2021

	# Drivers with *MVA* violations	Average # *MVA* violations	% Drivers with MVA violations
Treatment (n=704)	46	1.48	6.5%
Control (n=711)	41	1.46	5.8%
Total (n=1,415)	87	1.47	6.1%

Motor vehicle act violations among inactive drivers were also examined. Inactive drivers were those who signed up but did not record a single trip during the pilot term. Compared to active drivers, the percent of these drivers with a violation, was higher both pre pilot and post pilot, tables 26 and 27. This group also tended to have slightly more violations per driver than their active counterparts did.

Table 26. Pre-pilot *MVA* Violations of Inactive Drivers- January 2018 to October 2019

	# Drivers with *MVA* violations	Average # *MVA* violations	% Drivers with *MVA* violations
Treatment (n=370)	70	1.70	18.9%
Control (n=362)	64	1.41	17.7%
Total (n=732)	134	1.55	18.3%

Table 27.Post-pilot *MVA* Violations of Inactive Drivers - January 2020 to October 2021

	# Drivers with *MVA* violations	Average # *MVA* violations	% Drivers with *MV*A violations
Treatment (n=370)	36	1.86	9.7%
Control (n=362)	30	1.53	8.3%
Total (n=732)	66	1.71	9.0%

Like the observation made among active drivers, there was a substantial decrease in the number or percent of drivers with violations pre and post pilot. Such decreases were likely due to a multitude of factors including and not limited to enforcement levels, general and specific deterrence resulting from tickets and fines and/or road safety campaigns, and characteristics related to the driver such as age, level of maturity and driving experience.

The types of *MVA* violations served were similarly distributed among active participants in the treatment and control over both the pre-pilot and pilot term. Many of the violations were related to speeding and to a lesser extent red light running, tables 28 and 29. Speeding and red light violations also include those captured at intersections with automated enforcement.

Table 28. Type of *MVA* Violations Served, Pre-pilot (January 2018 to October 2019)[6]

Type of *MVA* Violation	Treatment (n=370)	Control (n=362)
Speed against a highway sign	32	20
Red light at intersection	30	18
Fail to display “N” sign	15	13
Speed in/outside municipality	16	9
Speed against municipal sign	3	11
Excessive speed	3	6
Speed against area sign	5	3
Speed in school zone	1	-
Speed in playground zone	1	2
Total Speed Violations	61	51

[6] Active drivers only, excludes participants with no trips

Table 29. Type of *MVA* Violation Served, Post Pilot (January 2020 to October 2021)[7]

Type of *MVA* Violation	Treatment	Control
Speed against a highway sign	18	13
Red light at intersection	5	9
Fail to display "N" sign	8	-
Speed in/outside municipality	7	13
Speed against municipal sign	3	1
Excessive speed	1	1
Speed against area sign	-	-
Speed in school zone	2	1
Speed in playground zone	-	-
Total Speed Violations	**31**	**29**

The treatment group tended to have slightly more speeding violations pre-pilot compared to drivers in the control group. At the end of the pilot term, total speed violations decreased across both groups and were comparable, with the number of violations changing by 49 and 43 percent, respectively. As aforementioned, various intervening factors likely contributed to the overall decrease (e.g., deterrence) more so, than the sole influence of telematics use on speeding behaviour.

Crashes

Claims that occurred between the first and last trip recorded by participant were used as a measure of crash frequency. All comp-only claims were excluded except for animal impacts. Crashes were categorised as all liable and non-liable, all liable, liable property damage only (PDO), and liable injury. Liable crashes are those where the driver shared some or full responsibility for the crash (≥25% liability).

Crash rates were calculated for liable crashes only and included rates based on a driver-year basis, per 100,000 trips and per 100,000km driven.

Comparisons of crash counts show slight differences between the treatment and control group. As shown in table 30, lower counts are observed in the treatment group across all crash categories, apart from PDO.

Table 30. Crash counts between the first and last trip recorded by Participants

	Treatment (n=704)	Control (n=709)	Count Difference
All crashes[8] (liable & non liable)	77	81	-4
All liable crashes	29	34	-5
All liable property damage only (PDO)	24	23	+1
All liable injury	5	11	-6

[7] Active drivers only, excludes participants with no trips
[8] Excludes comp-only claims with the exception of animal impacts.

A slight difference is also observed in the liable crash rates, with the treatment group having slightly lower rates. This is expected given the relative difference in the observed crash counts.

Table 31. Liable Crash Rates Between the first and last trip recorded by Participants

	Treatment (n=704)	Control (n=709)	Total
Driver-year basis	0.048	0.055	0.051
Per 100,000 trips	9.525	10.950	10.244
Per 100,000km Driven	0.920	1.060	0.991

To test whether there was a significant difference in the overall crash rates between the two groups, Poisson Regression analyses were conducted. Statistical analyses, however, were not completed for injury crashes given the small number of crash counts.

Based on these analyses, no statistically significant differences were found in the overall crash rate ($\chi2=0.08$, $p=0.7747$), the liable crash rate ($\chi2=1.08$, $p=0.2988$), and the PDO crash rate ($\chi2=0.17$, $p=0.6765$). Further details of the analyses are shown in tables 32 thru 34.

Given that there is minor difference in driving exposure, and crash counts are low and similar between group the treatment and control group, it is not surprising that the regression analysis did not find a statistical difference in the crash rates.

Table 32. Poisson Regression Analysis – All Crashes, Including Liable and Non-Liable

	DF	Estimate	Std. Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	0.8935	0.0818	0.7332	1.0537	119.41	< 0.0001
Control	1	0.0327	0.1142	0.1142	-0.1911	0.08	0.7747
Treatment	0	0.000	0.000	0.000	0.000		
Scale	0	0.7145	0.7175	0.000	0.7145		

Table 33. Poisson Regression Analysis – Liable Property Damage Only (PDO) Crashes

	DF	Estimate	Std. Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-0.2723	0.1015	-0.4712	0.0734	7.2	0.0073
Control	1	-0.0605	0.1451	-0.3448	0.2238	0.17	0.6765
Treatment	0	0.000	0.000	0.000	0.000		
Scale	0	0.4971	0.000	0.4971	0.4971		

Table 34. Poisson Regression Analysis – All Liable Crashes

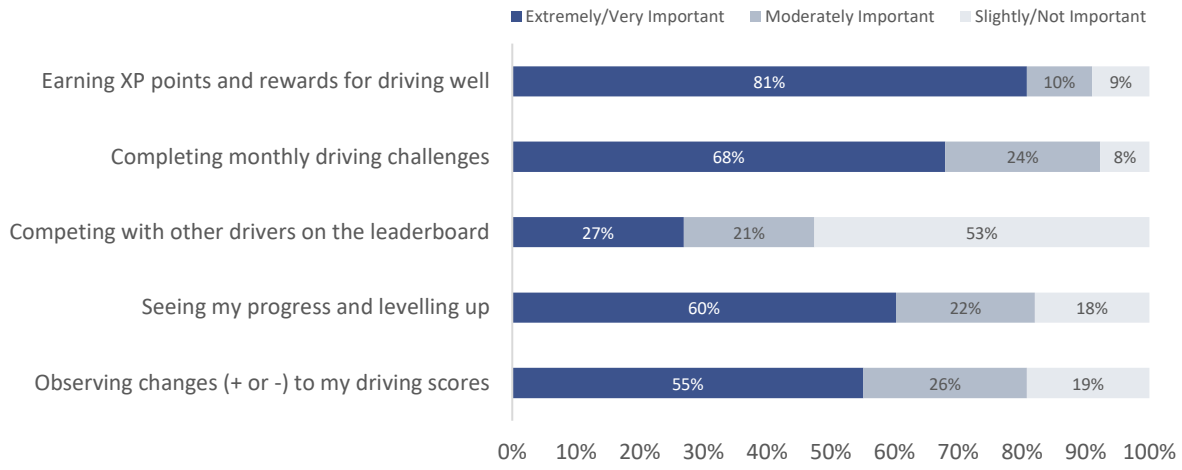
	DF	Estimate	Std. Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq
Intercept	1	-0.0830	0.0998	-0.2786	0.1125	0.69	0.4053
Control	1	0.1411	0.1358	-0.1251	0.4073	1.08	0.2988
Treatment	0	0.000	0.000	0.000	0.000		
Scale	0	0.5373	0.000	0.5373	0.5373		

Driver Engagement & Perceived Influence

Driver Engagement

Earning points and rewards for driving well were important aspects of driver engagement. Most drivers rated these as extremely or very important (figure 16).

Figure 16. Level of Importance of the Various Gamification Features



For many drivers these were the main source of motivation to continue taking part in the pilot.

> *If I had to be honest, I'd say the biggest motivator to use it are the incentives, like getting points and stuff, racking up points for doing the challenges and stuff like that, and being able to exchange those points for things like Amazon gift cards. That's pretty huge, like I'm basically getting paid just to do what I would normally do.*
>
> *The information is nice, and I do like checking it and seeing the events after my trip and stuff like that, and it does get me to look at the way that I'm driving. But I wouldn't say that that's the biggest factor. I think if it weren't for the incentives, I probably wouldn't have stuck on with it as long as I have.*

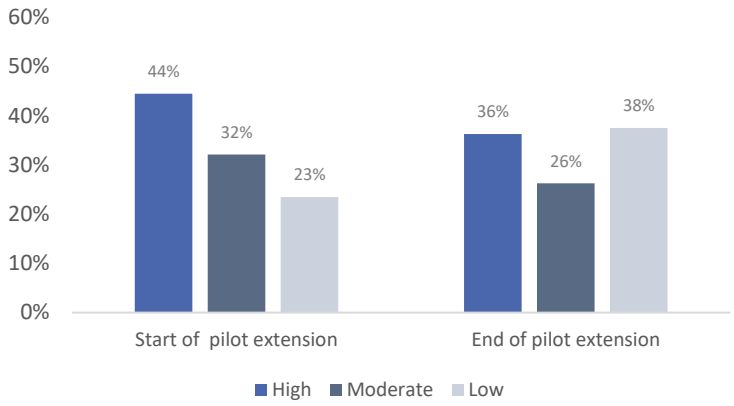
Other gamification features such as the driving challenges, participation in the leaderboard, and driver rankings were also considered important. Drivers found it both motivating and gratifying to complete challenges, compete with other drivers on the leaderboard, and view how they compared to others.

> *"I enjoyed logging trips and seeing my points compared to other people."*
> *"I liked that it was very gamified. It was very motivating to earn points."*
> *"It was motivating to try and accomplish all the goals"*
> *"The competitive part with the challenges was fun. 10/10 experience, I'll miss it."*
> *"Different monthly challenges keep you motivated."*

Change in Engagement

Over time, driver engagement with the app tended to change for many, but not all drivers. Shown in figure 17, higher levels of engagement were reported at the start of the pilot extension compared to somewhat lower levels reported at the end. Notably, some drivers said their level of engagement had remained the same throughout while in rare instance, others said it had increased.

Figure 17. Self Reported Change in Level of Engagement Over the Pilot Term



Changing levels of engagement were reflected in both the frequency in which participants engaged with app, and the reasons they had for doing so. Early in the pilot, drivers were keen to explore and use the app to monitor their progress and driving feedback. As time went on, drivers admitted to using the app less often.

> *I think I do check the app less. In the very beginning, I would drive, go to the app. But now, I might be like, three days, and then you can check three days' worth at the same time, instead of doing it right after.*
>
> *Yes. I would say that it definitely down. When it first started, and I first became a part of it, I was absolutely more engaged, and checking the app a lot more, and seeing my progress a lot more.*
>
> *Yeah, I think that I definitely used it a lot more at the beginning, because it was new and exciting, and I wanted to get those rewards, so I was always right at the beginning using it all the time, tracking. More recently, I probably haven't been using it as much, just I think because it's been going on for so long. I find that my passion to use it definitely diminished over time.*

For some drivers, the novelty of the app had simply worn off, was no longer interesting and thus forgotten. For others, use of the app became less important or relevant to their needs.

> *No novel feedback was given about driving behaviour. There was nothing much to learn from the feedback after repetition of the same things.*
>
> *My scores stayed very consistent, so I felt that there was not much to see on the app.*
>
> *It was good for a while, because I really tried to do the little challenges and stuff. And then, after a while, I kind of realized that my driving wasn't changing too much, but I was still doing, achieving the challenges. I kind of started to forget about it…*
>
> *I was already doing well, as far as the app's standards go. And so, then as time went on and I realized that while I was changing minute things about my driving, and just being overall more conscious about my driving, there was kind of less and less of a reason for me to keep checking in on the app, and so then I didn't do that as much."*

This complacency was also evident, in how drivers used the app to view challenges and collect the points they had earned.

> *I don't even read whatever the criteria are. There's a little button that says, "Complete and get the currency," or whatever it is. I can just click, click, click, and then get all the currency for the accomplishments, because it's the same accomplishment every month, and I know I've accomplished it, so I don't care what it is at this point.*
>
> *But now, it might be because I'm a decent driver, I accomplish everything. At the end of every month, I've met every single challenge or criteria, so it's not that exciting. I don't question whether or not I'll be successful, because every single month, I achieve every single challenge.*
>
> *I became uninterested. Rewards didn't change much whether I referred to it or not so there was no point.*

Again, participants lost interest because there was nothing new – challenges were the same, rewards did not change, and it had become relatively easy to meet the expected driving standards while still earning rewards.

Driving Feedback and Behaviour Change

Engagement with the app was also tied to the steps participants took to adjust or change how they drove – both early on and in the latter stages of the pilot, figure 18. This was discussed in both general terms and in relation to specific weak spots in their driving.

Figure 18. Steps taken to Change Driving Behaviour

As suggested, change in driving behaviour tended to progress through three main steps. In the first step, drivers talked about becoming more self-aware. Feedback from the app identified specific driving behaviours and habits, which were not always salient or thought about by drivers. As such, they were sometimes surprised, yet enlightened about the things they needed to adjust or improve about their driving.

> *Like I noticed right away, you know, I'd come back from a drive, and I looked at my phone, and went, "Oh crap!", you know, I was orange here and here and here, and I didn't even realize it. I was ten over here, you know, you get quite surprised by these things, and you don't even really think about it.*
>
> *I would see how often I would speed, where I would speed, that sort of thing. I noticed patterns of where I would speed, and it was usually on more busy roads, not residential.*
>
> *It gives you self-awareness, like a cold bucket of water. Hey, here's how you're actually driving", you know, this is not how you should be driving if you want to be a safe driver, right.*
>
> *And just now, with the app, it's definitely helped me realize, I need to be a safer driver, and I need to do better.*

In the second step, participants recalled reflecting on their driving feedback, noting the specific driving behaviours and habits that they could work on the next time they were driving.

> *Like if I brake too hard or if I'm speeding in certain areas and stuff like that, and it kind of gets me to look back on the way that I drive and kind of reflect, and say, "Hey, I probably could have done that better", or "Maybe that wasn't so safe", and stuff like that.*

> *I came back from a drive and then went, "Oh okay, this is what I need to work", and then the next time I sat down in my car, I was really mindful about going, "Oh yeah, I want to drive better this time, I want to get a better score when I get back".*

> *I can see my driving performance on each of the trips. Sometimes I might do something wrong with the brake and turning, so I know what I need to improve on my next trip.*

Motivation to do so was tied to the expectation of earning rewards for driving well and according to the "app standards". Drivers adjusted their driving behaviour almost at once to try to match these expectations.

> *Because the prizes give you motivation to drive safer and follow the rules of the road. And then, if you do all that, you will get a prize.*

Sustaining changes to how they drove was related to being mindful of their driving behaviour and the expectations set for themselves and by the app. Drivers reported being more aware or present when driving and for the most part chose to maintain a certain standard so they could continue to earn rewards.

> *If I started going a little bit faster than I am normally am comfortable going, and then I would remember, oh wait, the slower I go, the better I drive, the more points I get, the more challenges I win, and the more money I can make.*

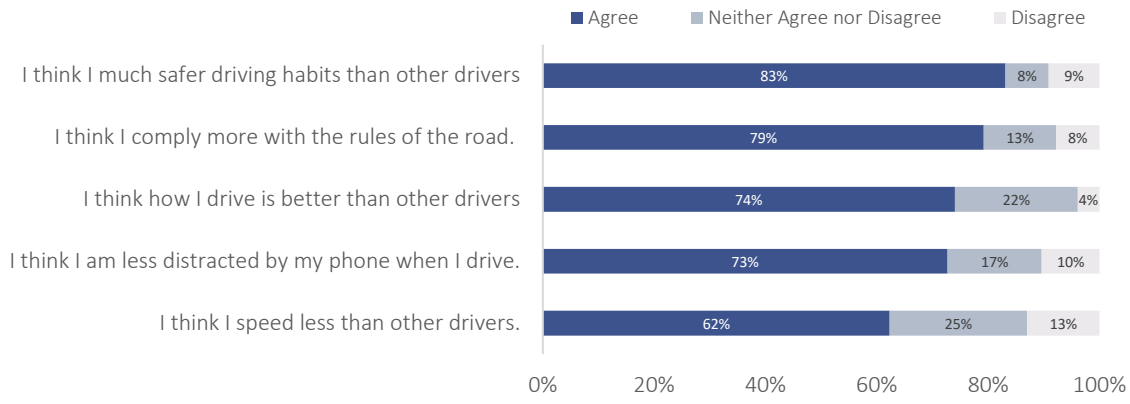
> *It's just more so that I'm aware that any sort of deviation from what it's expecting will result in a negative impact on the score. So, I don't go much over what it's expecting, if that makes sense.*

> *I could very well speed to get to Point A to Point B, like up a hill and turn or whatever. But I usually think in the back of my head, if I do this, I know that when I check the app, I'm going to get a flag, because I've done it before, and if I do it again, I know exactly what will happen. It usually stops that behaviour if I can think about it... I think it does definitely improve my driving, because I am more conscious of the repercussions of a negative score.*

Perceived Change in Driving Behaviour

Overall, participants felt that their driving had changed in some way, and for the better. Compared to when the pilot first began, participants reported feeling more confident in their driving ability and skills, said they took fewer risks while driving, and believed they had become a much safer driver. This held true when comparing themselves to other drivers. Not only did they drive better than other drivers did, but they also felt they had safer driving habits and greater compliance when it came to following the rules of the road, figure 19.

Figure 19. Perceived Driving Behaviour Compared to Other Drivers



Participation in Techpilot, however, did not affect all drivers in the same way or to the same extent. As such, participants held differing views about the level of influence participation had had on their driving behaviour. As shown in the table below, approximately 40% of participants felt telematics use had had at least a moderate influence on their driving, yet another 40% felt differently, and rated its influence less so.

Table 35. Perceived Level of Influence of Telematics Use on Driving Behaviour

Level of Influence	*f*	%
Extreme	11	14
Moderate	30	39
Somewhat	13	17
Slight	16	21
No influence	7	9

Other influences on driving behaviour were suggested such as safety considerations, both for themselves and for others, to avoid traffic fines or penalties for breaking the rules of the road and more importantly to avoid having a car crash.

Feedback collected from the participant interviews provides further insight and to some degree, points to how driver characteristics and beliefs, their intent, or expectations of participation, differentially influenced perceived behaviour change. As described in the excerpts below, participants had different expectations of behaviour change, ranging from making small adjustments to developing better driving habits.

> *It's been about tweaking the little things that I've noticed that have been flagged on some of the trips I've done. Compared to how I was driving before, that really hasn't changed. I've always kind of been that middle-of-the-road driver. Like I push to the limit, but I don't push over the limit for the most part. I figured that this would just help tune some small details, which it's been doing.*

> *I think before getting the app, I probably sped a lot more. I would leave a bit later if I was going to work. Versus when I had the app, I would give myself more time. I would leave 10 minutes earlier before I had to start work, rather than five minutes earlier, just so I could give myself that extra time, so that I wasn't speeding to get there. I think that's something that I've noticed.*

> *As you're just driving a little bit more calmly and a little bit more smoothly, and just doing everything with a little bit more care and mostly slowness, all aspects that are measured in the app, like braking, cornering, speeding, all those things just get better.*

Among participants themselves, some variation was also noted in how strictly and consistently participants followed through or kept changes to their driving behaviour. As previously mentioned, some drivers strictly adhered to the rules of the road, including the posted legal speed limits. This was in part attributable to a fear of driving fast (a couple of participants for example avoided highways altogether) but also, to prevent or avoid having a car crash. Yet others admitted that on occasion, they would drive more aggressively or in a way that was more fun. Some participants made the distinction between commuting mode versus pleasure driving mode and changing their behaviour accordingly. In some instances, this required turning off Bluetooth so they could enjoy driving around with friends without having to conform to the app driving standards.

The influence of other drivers or road users also had a negating affect on attempts to improve and/or sustain changes in individual driving behaviours, specifically speeding. Among drivers taking part in the interviews, several admitted to succumbing to pressure or aggressive behaviour from other drivers. These included being tailgated hard, being overtaken and honked at to drive faster or make left turns sooner than expected. These participants felt "guilty" or "bad" for slowing traffic and annoying other drivers. At the same time, some were of the view that it was safer for them to drive with the flow of highway traffic even if it meant going over the speed limit.

> *I do feel pressure […] Sometimes they'll start honking, and then I'll second guess of like, could I have gone in that space? […] I might take a slight risk if people are getting really agitated, because it's more agitating to wait than to go across the traffic.*

> *I've definitely [succumb to pressure] which does end up being speeding, if you look at it in black and white. But it's the flow of traffic, right? And there are even times where it's more dangerous to go slower, because if somebody is speeding, and they don't see you in one lane, and they're going 110, they switch into your lane […] and you're going 80, that's dangerous, right? To them, you're almost at a stop, if you compare the speeds.*

With that said, other participants were influenced less so by other drivers. Being safe or keeping others safe on the road was more important. This meant not succumbing to peer pressure and driving in a way that was comfortable to them.

> *That's not going to be a good defense if something goes wrong, so I have to be, I will rather have a clean conscience, and drive the way I feel comfortable driving, and maybe have people get mad at me, than drive the way people want me to drive, and potentially have some guilt later.*

> *I don't care if people get angry behind me and we're on a single lane road doing 20 and that's what's posted; I tend to go, "Whatever". I don't buckle to peer pressure, and do whatever they're telling me to do, even if they are getting closer and closer to my bumper. I'm doing what the speed limit is.*

Sustaining Change in Driving Behaviour

Participants felt their driving had changed over the course of the pilot. They mentioned having learned new driving skills and developing safe driving habits. Though the pilot was ending, most were optimistic that their driving would continue to improve or at the very least stay the same. None thought that their driving would get worse, table 36.

Table 36. Perceived Change in Driving Behaviour Following the End of Techpilot

	f	%
Driving will improve	45	58.4
Driving will stay the same	29	37.6
Driving will get worse	0	0
Don't know…	3	3.9

Such optimism was rooted in how drivers tended to view the changes they had made to their driving. Most reported having learned new skills and/or having developed safer driving habits. Because of this, they felt they were more apt to continue driving in an improved way.

> *I'm pretty sure I can keep with it, or I know areas where I could get even better, so yeah, I can still keep improving, even after the end of the Techpilot. I basically learned some skills during it, and there should be no reason why I shouldn't keep applying them in the future, yeah.*

> *I definitely think I'm going to keep some of the habits. It's all been good to know what I've needed to work on or what has been flagged, and keeping them is always a good thing, especially for me, just because I want to always keep trying to get to the point where it's always just the better driving, right.*

> *It helped me to set up just some good habits initially. I don't think I will forget those things, even without the feedback. But I'm going to miss that app.*

Though optimistic, not all were entirely certain or convinced that this would be the case. As expressed during the driver interviews, some participants felt that the impending absence of driving feeding back, and incentives would make it more difficult to maintain or further improve how they drive. Instead of certainty, they expressed hope that such changes would carryover.

> *I hope that I've gotten into that habit of driving not so quickly, hopefully that'll carry over. The only thing that I would be concerned about is that I would not have that extra incentive to really double-check my speed and rethink what I'm doing with that part.*
>
> *I hope it will stay the same. Although now that we've had this conversation, I actually feel more like I should really grab the device out of my old car and put it into my new one and use it a little bit before the project ends. I can just get a little refresher and double check that I'm really still doing as good as I can.*
>
> *I'm assuming I will keep this driving style for a while. Maybe just go back a little bit. Because if you don't receive feedback, you might just forget about it.*
>
> *I think there will definitely be the awareness that there isn't a sensor in my car anymore, but I don't think that I'll drive recklessly. I will maybe honestly speed more, but not to the point where it's dangerous, if that makes sense.*
>
> *I feel like if I'm not monitoring my trips every single time for those events, I won't be as aware of, yeah, the things that I'm doing as I'm driving. So honestly, if I had to say, I would like to say that things won't change and they'll get better, but realistically speaking, if I'm not checking, chances are I could be a little bit more careless.*

Future Application of In-vehicle Telematics

Based on their experience in Techpilot, drivers suggested two potential applications of in-vehicle telematics. In the first application, drivers talked about the benefits of driving with the technology and its potential use with other young or new drivers. Much like the current pilot, the aim would be to aid drivers in perfecting their driving skills and to encourage safer driving practices.

> *I definitely think it could benefit other drivers, especially new drivers with their N. I can remember with my N, I would, if I'm with my friends, I like to speed, that kind of thing. I think that if a younger audience had this application to use, then they would be a lot more conscious just like I was, which I think is a really good thing.*
>
> *I think it could definitely help people that are unconfident to get better, or at least know that they're doing things right…It could help change the way they drive, and it might show them what they're doing wrong or incorrect that could be fixed.*
>
> *I think an app like this is a good idea, because the younger generation, they are always on their phone, and if they can get feedback on their driving, I think that they can take it into account and have a good use for it… And it's for the greater good, in creating a safer driving environment for others, and also helping others drive safer.*
>
> *There's a lot of people who sneakily use their phone in BC, because of the fine. But if they understand that their phone is connected to the box in their car, which reports their cellphone usage, even though it's anonymous, like it was sold to me as anonymous data, there might be some way to use that for better phone safety.*
>
> *Sometimes it's pretty tough to think about, you know, am I doing things smoothly on the road instead of just like, oh my God, I have to merge, oh my God, I have to get over a lane,*

you know, oh my God, that car is doing something weird, oh my God, I didn't expect the light to go yellow. All this normal stuff causes panic in newer drivers. The app gives everybody a chance to reflect once they get back and go, oh, my instant response to all these problems happening on the road is one thing, but there's all these other factors like braking nicely before a corner or braking nicely before a light, which can really help driving and make you go, oh okay.

Use with other drivers was also mentioned but less often. In this latter instance, telematics use was seen to promote safer driving practices among the "bad eggs".

It would get people to be more self-aware when they're on the road. It would make people think about the way that they are driving, because if they get penalized – well they don't necessarily get penalized. If they're not incentivized, then they have no reason to drive safer in a lot of cases, like people will drive faster just because they can. So, I feel like incentivizing good driving can be nothing but beneficial.

Drivers also recognised the capability of in-vehicle telematics to distinguish between good and bad drivers, and its potential use to offset insurance rates based on how well one drives. Some drivers felt strongly about this – wanting more fairness in pricing as well as reward for driving well.

If you're more likely to cause an accident because of your own personal choices, then you should be paying more into insurance. I shouldn't have to pay a boatload of money as a safe driver because someone else might make a stupid mistake.

I definitely think that that could keep track of your driving, and then give you better rates on insurance. I think that would be great, because I think there's lots of people out there who definitely are good drivers and should be rewarded.

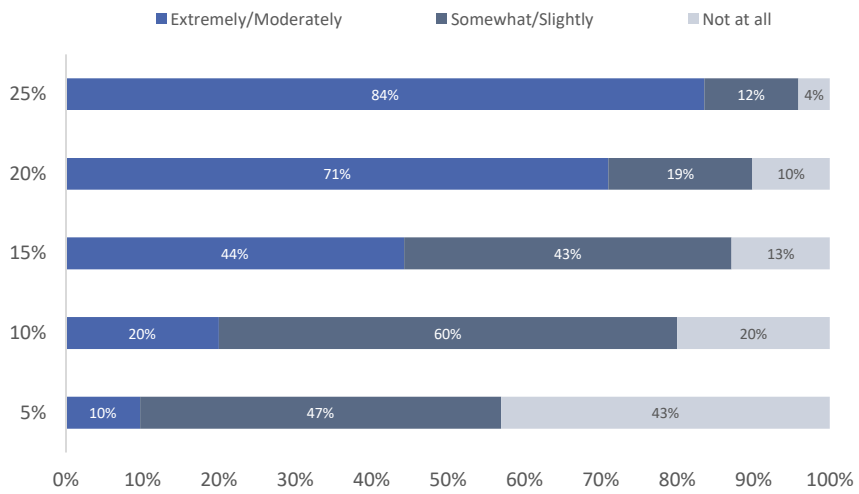
Likewise, 88% of drivers responding to the survey said they would be interested in user-based insurance (UBI) programs. Around 54% of these drivers were interested in a how you drive UBI program, with the other half preferring either distance based (19%) or manage how you drive (27%) programs. A description of these program types is shown in table 37.

Table 37. Type of User Based Insurance Programs

Insurance Program	Description
Distance	Insurance premiums are calculated based on kilometers driven; so, the more you drive the more you pay and the less you drive the more you save.
Manage how you drive	Insurance premiums are calculated based on driving behaviours and habits but with real time feedback and suggestions to improve driving; so, the better you drive the less you pay.
How you drive	Insurance premiums are based on driving behaviours and habits; so, the better you drive the less you pay.

Motivation to take part in such programs would be dependent on the amount of the premium discount and the availability of other reward options. Most drivers said they would expect at least 20 to 25 percent discount on their insurance premium, figure 20.

Figure 20. Expected Level of Discount on Insurance Premium



These same drivers were also interested in receiving other reward such as e-gift cards and fuel discounts but preferred that these be offered in combination with the discounts on their insurance premium. As for the type of telematics solution preferred, most drivers would opt for an app solution that either paired with a smart tag or a device that plugged into the vehicle's diagnostic port, table 38.

Table 38. Preferred Telematics Solution

Type of Telematics Solution	% of Respondents
A device that plugs into your car's diagnostic port and transmits data, but does not include an app	8%
None, I'd prefer to send a photo of my odometer reading only	10%
An app that pairs with a device that plugs into your car's diagnostic port	17%
A smartphone app that records any trips you take in any vehicle	18%
An app that pairs with a smart tag you keep in in your car	47%

While drivers were mostly open to using in-vehicle telematics as part of a road safety or UBI program, they did express some concerns with its use. These were related to their experience having used telematics during the pilot as well as existing attitudes or fears around the potential use or misuse of telematics data.

Table 39. Concerns Regarding Future Use of Telematics

Concern	*f*
Validity, accuracy of feedback from telematics	48
Fear that my insurance premiums would increase instead of decrease	37
Worry of personal data being shared with third parties (e.g., police)	36
Loss of privacy and control over location and personally identifiable information	29

As shown, in table 39, drivers reported being most concerned about the validity and accuracy of telematics feedback. This is not surprising, given the technical issues experienced when using the app and smart tag to track and monitor their driving behaviour. Drivers reported pairing and connectivity issues, as well as inconsistent logging of trips and/or inaccurate detection of driving events. As one driver summed up, *"I do think that an app like this is definitely useful, just maybe with not so many technical issues, and maybe a bit more reliable. But yeah, 100%, it's the right idea."*

Other concerns, as mentioned, were related to the use and potential sharing of telematics data with third parties, like the police. As such, drivers seemed to be less trustful of ICBC. Questions surfaced around whether ICBC could use this information against them when settling a claim and/or whether ICBC would be legally bound to share as part of a police investigation, or court case. Consensus among drivers seemed to indicate a possible sticking point if garnering further use and expansion of telematics to other drivers.

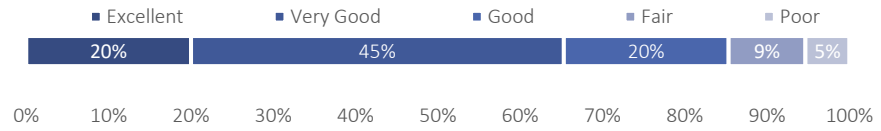
> *I have talked to a decent amount of people about the sensor, and a lot of their concern is that they say that it's not anonymous. Let's say you get into a car accident, and then the police are there, and they see, it's like a black box almost, they say. It's like, okay, now there's a sensor in your car, then they could use it against you in court. I've explained to the best of my knowledge that that's not how it would be applicable, but I don't know for sure legally. But I know that that's a huge concern that most of the adults that I talk to had, even if it means saving on insurance*

> *As long as they're aware that this information isn't going to be used against them. You know, I feel like people will welcome that kind of thing. I feel like this is a hard thing because, you know, a lot of people would be skeptical because technically it's a device that ICBC would be putting in their cars. If there is assurance that ICBC isn't going to use this against you - say if you get into an accident, I feel like people would welcome it more. But the fact that, you know, there's really no assurance that ICBC doesn't get this information, I feel like people would be hesitant to take it up.*

Overall Participant Experience

Overall, drivers reported having a positive Techpilot experience, figure 21. Having the opportunity to not only improve their driving but also earn rewards while doing so was a paramount part. Drivers often, mentioned these aspects when talking about their experience.

Figure 21. Overall Experience in Techpilot



Though having a mostly positive experience, participants also mentioned some negative aspects of participation. These were mostly related to problems with the telematics technology, including pairing issues between the app and smart tag (unstable connection), finicky or inaccurate tracking /capture of driving events (mostly distracted driving), and other app glitches (e.g., slow, buggy). These issues were particularly frustrating to drivers because it directly affected the points/rewards that they could earn.

Also contributing to a negative experience, but mentioned less often were,

- other drivers and their unsafe driving manoeuvres,
- feeling the need to do specific tricks (complete challenges) to get good scores,
- not enough updated content to keep engaged, and
- use of smartphone by passenger to play music, navigate, text, etc.

Overall, participants found participation in the pilot to be an impressive and rewarding experience. They enjoyed being part of a study and genuinely hoped that their feedback would be useful for ICBC. As a takeaway, participants were generally accepting of telematics use but also recognised that improvements were needed, if telematics was to be used more widely.

Key Findings

Impact on Driving Behaviour

Overall, findings suggest a positive influence of telematics use on driving behaviour. Drivers receiving driving feedback plus incentives (treatment group) tended to outperform those who did not, across all driving behaviours measured (rapid acceleration, harsh braking, and speeding) with the exception of hard cornering. Differences were observed both in the reduced occurrence of these behaviours over time, and in higher overall driving scores. Notably, greater differences or changes were observed in rates of rapid acceleration and harsh braking and to a lesser extent speeding. Compared to those who did not receive driving feedback, drivers who did had:

- lower frequencies of rapid acceleration and harsh braking per 100km driven; including a 11% and 14% difference in rates, respectively, and,
- a lower frequency of speeding per 100km driven, including an 8% difference in the rate of speeding.

While differences were noted in the occurrence of low severity events (as above), the same was not found among behaviour events of medium and high severity. The occurrence of these events was fewer across both groups and thus, rates for these events were comparable. This finding is likely suggestive of the type of drivers signing up for the pilot. Based on the qualitative findings from the survey and interview, participants tended to rate themselves as safe and/or cautious drivers–for the most part following the rules of road and only deviating when perceived as "safe".

Despite observed changes in speeding frequency, there was little to no change in the positive delta speed (change in speed limit exceedance), compared to those who did not receive driving feedback. Over the term of pilot, speed exceedance ranged between 6 and approximately 24km/hour over the posted limit, with a mean of 14km/hour. Norms and attitudes of speeding in British Columbia likely play a role wherein it is socially acceptable to drive between 10 and 20km per hour over the speed limit. During the interviews, participants talked about the unwritten rule of speeding, its acceptability, and the pressure sometimes felt to conform. In some instances, drivers admitted to driving between 10 and 15km/hour over the limit, albeit only when conditions were perceived as safe to do so. Notably, speeds more than 10 to 15km/hour were considered highly dangerous.

Improvements in driving behaviour tended to be immediate and for the most part sustained over the pilot term. Driving behaviour neither further improved nor got worse following initial adjustments. This was consistent with how drivers described the changes they had made. Moving from awareness of the behaviours they needed to work on, making the necessary adjustments based on driving feedback, to sustaining such changes by being more mindful while driving. Moreover, motivation to do so was intimately tied to earning rewards for meeting the driving "standards" of the app.

Drivers also talked about the things that made it difficult to adjust or always maintain changes to their driving behaviour. These were related to the influence of aggressive drivers, friends, as well as established or accepted norms of driving. These influences were experienced in diverse ways for different participants, depending on their background and/or characteristics.

In as much as telematics use influenced driving behaviour, so did past driving experiences. Being involved in a crash (e.g., hit by a distracted driver), observing a crash unfold, or other driving mishaps (e.g., hitting an animal) were important lessons. Drivers shared how such experiences had shaped their driving

behaviour and/or habits – by being more aware of their surroundings and others on the road, abiding by the rules of the road, and driving in a safe manner. Drivers were also influenced to drive safely to protect themselves or others on the road and to avoid traffic fines and/or penalties.

Impact on Crash Rate

Despite improvements observed in driving behaviour, crash rates were comparable across all measures with only slight differences observed between the treatment and control group. As such, there were no significant differences. Telematics use then, while improving most driving behaviours had no direct impact on crashes. Considering this finding, several factors are considered, including,

- the limitations imposed by the data (insufficient exposure base),
- the small effect size (difference between the treatment and control) observed across targeted behaviours, and
- assumptions made about telematics use and crash reduction.

Because crashes are rare events a sufficient or large enough exposure base is often required to detect a difference or change. This was a limiting factor in the current pilot and as such, the crash data was sparse and under dispersed. With relatively few crashes observed, any differences between the treatment and control group would not have been easily detected.

Assuming that there is a causal relationship between the targeted behaviours and crash occurrence, larger behaviour effect sizes are likely needed to observe significant improvements in crash rates. While participants using telematics, showed improvements in the targeted driving behaviours, the effect size was relatively small. Differences ranged between 9 percent (speeding) and 14 percent (harsh braking). As such these changes likely had little direct influence on crash occurrence in a material and/or measurable way – changes were either too little to have an affect (as in speeding) or if there was an affect, it was too small to be detected or measured. Larger effect sizes, particularly among speeding behaviour may be more favorable to crash reduction.

Similarly, consideration is given to the severity of the behaviour events. Most events, regardless of the event type were low severity with very few high severity events observed. Improvements in driving behaviour then were associated with changes in these events only. Moreover, if crash risk is associated with and increases according to event severity, the likelihood of a crash event would have lessened in this case. Significant changes would not be expected or observed in crash reduction.

Further consideration is also given to the assumptions or expectations around telematics use. Various driving behaviours (rapid acceleration, harsh deceleration, hard cornering, speeding, and distracted driving) that are easy to measure are often targeted for improvement, as part of a telematics application. It is assumed that improvements in all or some of these driving behaviours leads to overall crash reductions.

It is important to bear in mind, that each of these targeted behaviours or combination thereof likely has a different crash risk and/or association with crash occurrence. Behaviours like speeding and distracted driving, for example, have long been associated with having a crash and are known to increase risk, relative to all other driving behaviours targeted by telematics. Less is made known about the relationship of these other behaviours with crash occurrence and the purported level of risk in having a crash. As such, these behaviours may only have an indirect affect on crash occurrence and/or minimal risk involvement. Therefore, despite observing improvements in rapid acceleration (11% difference) and harsh braking (14%

difference) this did not necessarily translate to a reduced risk or occurrence of crashes among treatment group participants.

Change in Engagement

In part, gamification successfully stimulated interest and engaged participants to adjust or change their driving behaviour. Achieving challenges and earning rewards for driving well, was a key to this success. Participants often, mentioned earning rewards as part of their motivation to not only adjust their driving but also sustain the improvements they had made. For some, it was the main reason they took part and continued to participate over the pilot term.

Monthly driving challenges, while engaging initially became less so as time went on. Initial engagement was replaced by complacency wherein participants showed more interest in collecting the rewards than taking notice of the challenges they had achieved. This was partly due to how the challenges were structured and used to engage and reward driving behaviour.

Monthly challenge themes were repeated (four to five times) over the term of the pilot, as were the individual challenges. No added content was available to promote further interest or engagement. Moreover, the passive achievement of challenges provided less opportunity and incentive to complete different challenges and earn even more rewards. Blissfully unaware of the variety of challenges available to them participants for the most part, grew accustomed to achieving the same challenges repeatedly with nothing new and exciting for them to accomplish.

It begs the question, as to whether the use of driving challenges had the desired influence. Engaging yes, but only initially and in as far as, rewards were collected. As discussed earlier, the monthly challenge themes tended to have little to no direct influence on individual driving behaviours. Driving feedback in the form of driving scores, trip details, rankings, and the like, seemed to be more important in this regard. This is supported by how participants discussed improving their driving behaviour, from adjusting their driving to sustainment efforts thereafter. Both were intimately tied to earning rewards more so than achieving a particular challenge.

Notably, as driving behaviour improved, participants found less need to engage with and refer to their driving feedback. Driving feedback provided no added information that could be used to tweak or further improve their driving behaviour. As aforementioned, engagement, both initially, and as time went on followed the steps drivers took to adjust and then sustain changes to their driving behaviour. Engaging more often, at the star as driving behaviour was adjusted, and less so or periodically with sustainment. Reduced levels of engagement, from this perspective, perhaps are not a bad thing, but rather an indication that the rewards were having the desired influence. As might be suggested, a meaningful reward system may be far more attractive and engaging to participants than the use of other gamification features, such as challenges.

Use of in App Resources

In app educational resources in form of driving tips and videos are less important to most drivers. As documented in the earlier reporting period, and again here, driving videos were rarely accessed and viewed by participants despite attempts to improve engagement. These improvements included a monthly email about the upcoming challenge theme, as well as enhancements to several of the driving videos. Most felt they did not need added help with their driving because they already knew how to improve. Thus, the

videos were felt to be uninteresting or irrelevant to their needs. They were however, more receptive of the monthly email notification. See Appendix D for findings.

Acceptance of Telematics

Based on their experience in Techpilot, participants were accepting of telematics technology and would be open to using it in the future. Its capability not only to improve driving behaviour, but its potential use as part of a usage based insurance (UBI) program was recognised. Improving road safety in British Columbia and promoting fairer insurance rates, respectively, were the main reasons given.

Concerns with telematics use were also raised. These were related to the technology itself and the issues that tended to arise during the pilot. Poor connectivity along with inaccurate and inconsistent capture of some behaviour events was often cited. Of top priority and highly recommended is selecting a telematics solution that is both stable and accurately and reliably detects and monitors driving behaviour. This has to do with both the type of telematics solution selected, as well as the ability to appropriately manage or make adjustments based on the quality of the telematics detection. Failure to address such concerns would not help the customer experience, especially if tied to a reward system (e.g., reduced insurance premiums) for driving well.

Concerns were also raised around the potential use or misuse of telematics data by ICBC and other third parties including law enforcement and the courts. As suggested, drivers were uncertain as to whether telematics data could be used against or in a way that compromised its original use. Consensus among drivers seemed to indicate a possible sticking point if not addressed at the forefront of a telematics program. It is understood that any terms around data collection and use need to be clearly defined, especially in circumstances where there is the potential for third party use. Moreover, potential users need to be made fully aware of such terms in a way that is easily digestible and understood.

Conclusion

The overall findings gathered from Techpilot suggest, that telematics use had a positive influence on the driving behaviour of new drivers. Improvements in driving behaviour were observed across all behaviour event types (rapid acceleration, harsh deceleration, hard cornering and speeding) and for the most part sustained over the pilot term. Except for hard cornering, these changes were statistically significant, $p < 0.05$. Such improvements however, were not shown to reduce crash frequency or rates among those using telematics. The behaviour effect size along with limitations imposed by the data are considered factors.

Gamification was important to engagement and behaviour change, particularly the use of rewards and to a lesser extent the driving challenges. Over time, engagement levels did wane and were reflected in both the frequency in which participants engaged with the app, and the reasons they had for doing so. Participants lost interest because there was nothing new – challenges were repeated, rewards did not change, and it had become relatively easy to meet the expected driving standards while still earning rewards.

Engagement with the app was also tied to the steps taken to adjust or change driving behaviour – both early on and in the latter stages of the pilot. Change in driving behaviour followed periods of self awareness, reflection and adjustment and mindfulness and sustainment. Engaging more often at the start and as driving behaviour was adjusted, and less so or periodically with sustainment. Over time, it wasn't as necessary to refer to the driving feedback as it provided no new information that could be used to further tweak or improve driving behaviour.

Based on the overall participant experience telematics use with a wider driving audience shows promise both from a road safety and insurance perspective. Its utility both in improving driving behaviour and offering usage based insurance programs were recognised but with caveats. Use of in vehicle telematics is dependent on the quality of the telematics solution, and clearly worded policies on the protection of user data, and the limitations placed on its use.

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Appendices

Appendix A - Survey Report 1 (Onboarding and Set up of the Technology)

Survey report 1 describes the participant experience in setting up and using telematics technology to monitor and inform their driving behaviour.

Method

The survey consisted of 18 questions, of which 10 were close ended and 8 were open ended questions.

A link to the survey was emailed to participants in the treatment group on June 8, 2020. The survey remained open for 10 days. Two email reminders were sent to participants; the first was sent 1 week following deployment of the survey, and the second and final reminder two days prior to the close date.

Altogether 998 participants received an email link to the survey. In total, 348 participants completed the survey with a response rate of 35%. The response rate climbs to roughly 45% when including active drivers (paired tag) only.

Of those taking the survey, 321 completed all survey items. The remaining 27 gave partial responses only, either because they had yet to download the app, install the smart tag, pair the smart tag, and/or take a trip using the technology.

Reasons for not completing the various set up activities ranged from giving-up because they had difficulty setting up the technology or couldn't get it to work, had no time to do so, no longer had access to a vehicle or were not comfortable sharing their personal information (invasion of privacy).

Participants responding to the survey had an average age of 25 years old with 2.3 years of driving experience. The youngest respondent was 17 years of age and the oldest was 63 years old. More females (57%) than males (43%) responded to the survey and most were from the Lower Mainland, Vancouver Island and the Interior of British Columbia.

Descriptive analyses were used to summarise all closed ended questions. Open-ended questions were analysed using content analysis; often-mentioned categories/themes were derived from participant comments. Illustrative quotes are used throughout to support these themes.

Limitations

Findings from survey may not represent the views of all participants taking part in the Techpilot. Participants choosing not to partake in the survey may have had a different experience when it came to setting up and using the technology.

Key Findings

Set up of Technology

Most participants (75%) found the set up of the technology from downloading the app to calibrating the tag, straightforward and easy to do.

A smaller proportion (25%) of participants however, experienced some difficulty when it came to pairing and/or calibrating the smart tag with their phone. Participants reported having to try multiple times, and/or having to wait a long time for the tag to pair and/or calibrate.

Techpilot Support

A little over 25% of participants contacted tech support for technical assistance, to report a problem with the technology and to make changes to their contact information. Notably, 11% of participants were unaware that support was available to them.

Participants reported an overall good tech support experience. The agent they dealt was both courteous and polite, and understood their issue. The majority (68-70%) agreed that they received a timely response and that their issue had been resolved.

Around 30% of participants said they did not receive a timely response and in most cases, their issue hadn't been resolved. Review of the ticket list provides added insight. Of the 369 tickets generated 22% tickets remained open with an average age of 100 days.

App Interface

Participants found the app easy to navigate, reported learning to use it quickly and for the most part, were able to find the information they needed. Though easy to use, participants said the app often crashed and/or was buggy, and that it lagged when loading or uploading information.

Some participants did not like the auto log feature related to driver/trip assignment and/or having to assign trips after each drive.

Several features were identified as either missing from the app or in need of enhancements. These were related to the driving feedback, availability of driving resources and other app enhancements.

Technology Issues

Almost all participants (87%) experienced an issue with the technology while driving. The most common of these included the incorrect capture of driving events and unlogged trips. Of the events incorrectly captured, phone use/distracted driving and to a lesser extent speeding were commonly identified.

Failure to automatically connect to, along with poor or lost connections between the smart tag and participant's phone were problematic

Participants expressed frustration with the technology and in some instances were demotivated to use it.

Use and Helpfulness of Driving Feedback

Participants referred to most, if not all, of the driving feedback that was available to them but were more apt to refer to the driving and distracted driving score and trip details.

How helpful participants found the driving feedback, also varied by feedback type and among participants. About half of participants found the driving score, the score details and the trip details to be helpful while the remaining 50% did not.

Of all the feedback available to them, many participants said the distracted score and the leaderboard were the least helpful.

Driving feedback was considered helpful when it provided specific details about their driving and the events that took place allowed them to gauge their performance and identified areas where they could improve.

Driving feedback was unhelpful when events were incorrectly or inconsistently captured (speed and distracted events), and when it was difficult or unrealistic to control their score based on time of day, road type and smoothness.

Participants suggested several ways driving feedback could be improved. These included having a more detailed description of driving events, the ability to compare feedback between trips and through time, a

driving summary with areas for improvement, and additional information and/or resources about how to improve their driving and their driving score(s).

Fairness of Driving and Distracted Scores

Most participants (70%) said that their driving score was fair. However, 60% did not feel the say way about their distracted score, and said it was unfair.

Issues with how the technology captures distracted events (too sensitive) along with participant perceptions of distracted driving were cited as possible reasons why.

Remarkably, issues with the distraction score/capture of distracted events were the most heavily commented on aspect in the survey. Issues with the distracted score are likely contributing to a negative participant experience.

Overall Experience

Participants mostly felt that the technology had helped them with their driving in some way. They reported being more self-aware and having a better understanding of where they needed to improve.

Some participants also said they had changed their driving behaviour to improve their score while others said they now took fewer risks while driving.

Participant experience, overall, was mixed. A little over half of participants reported having a positive experience but also recognised that the technology was in need of improvement.

For others, a culmination of issues with the technology resulted in a mostly negative experience. Participants reported not trusting the technology, feeling frustrated by it, and were discouraged from using it and/or participating in the pilot.

Appendix B - Survey Report 2 (Engagement & Use of the App Features)

This report describes the participant experience when it came to engaging with and using the app improve their driving. It touches upon the driving resources that were available to support them, the challenges and reward system, and engagement with app features.

Method

The survey consisted of 15 close ended and 15 open ended survey items.

A link to the survey was emailed to participants in treatment group on September 8, 2020 and the survey remained open for 10 days. Two email reminders were sent to participants; the first was sent 1 week following deployment of the survey, and the second and final reminder two days prior to the close date.

Altogether 739 participants in the treatment group received an email link to the survey. In total, 98 participants completed the survey with a response rate of 13%. Those taking the survey, completed all survey items.

Participants responding to the survey had an average age of 24 years old with 2.2 years of driving experience. The youngest respondent was 17 years of age and the oldest was 73 years old. Slightly more males (50.3%) than females (49.7%) responded to the survey. Most participants were from the Lower Mainland, Vancouver Island and the Interior of British Columbia.

Descriptive analyses were used to summarise all close ended questions. Open end questions were analysed using content analysis; often mentioned categories/themes were derived from participant comments. Illustrative quotes are used throughout to support these themes.

Limitation

Given the low response rate, findings from survey may not represent the views of all participants taking part in the Techpilot. Participants choosing not to partake in the survey may have had a different experience when it came to engaging with the app, completing challenges and earning rewards , and accessing driver resources.

Key Findings

Driving Resources (Videos)

Overall, 40% of participants said they had referred to the driving videos while 60% had not. Most said they did not refer to the videos because they were uninteresting, unrelated to the help they needed or unnecessary because they already knew how to improve their driving. Others simply didn't know the videos existed.

For those who referred to the videos, 80% agreed that the content of the videos was straight forward and informative, practical and easy to apply and for the most part, had helped them better understand the things they could do to improve their driving.

Some participants expressed wanting more frequent videos and videos that had interactive content or content that was more specific to the driving events. Participants also suggested several other video topics they felt would be helpful.

Driving Resources (Driving Tips)

Survey participants are less certain about the driving tips and tend to have differing views about them. Some participants reported rarely receiving driving tips, if at all, while others said the tips left them feeling judged.

A little over half of participants said, the tips had provided helpful advice. And while, the tips were easy to apply and targeted specific driving behaviours, only 44% of participants said the tips had helped them improve their driving score. A number of additional support and/or driving resources were suggested and include more detailed and 'just in time" feedback, and better and more information about how to improve driving.

Driving Challenges

Survey participants were mostly satisfied with the driving challenges and the ease with which they could progress to the next or higher level challenges. Challenges, however, were not always considered fair, especially among participants who didn't drive everyday, or who took longer versus more short trips. Notably, COVID 19 restrictions presented less opportunity for some drivers to complete challenges because of reduced driving.

Fairness was also tied to the telematics device itself. Failure of the device to pair and/or inconsistent recording of trips, as well as the inaccurate capture of distracted driving events, prevented some participants from successfully completing challenges and earning rewards.

Overall, most participants found completing the challenges and earning rewards to be engaging and helpful when it came to improving their driving behaviour.

Rewards

Participants were satisfied with the reward structure. Almost all participants said the reward system was easy to understand and that the rewards (XP) were fair. They reported that it was both easy to access the reward store (Augeo) and redeem diamonds once they had selected their reward.

Participants, however, were less satisfied with the selection of rewards that were available from the online store. They wanted a greater variety or selection of gift cards, as well as a selection of gift cards that could be redeemed at local businesses or online. If the opportunity was to arise, survey participants also said they would prefer a mix of E-gift cards and a discount on their insurance premium.

Engagement with the App

Though engagement with the app had shifted since the start of the pilot, the majority of survey participants reported moderate to high engagement with the app.

Several reasons for the shift, included the following:

- The novelty of the app wore off and/or app was no longer interesting.
- They were driving less or not at all because of COVID-19 restrictions or other (vehicle sharing, cost of insurance, vehicle no longer working).
- They got used to driving with the app and tended to forget about it.
- They became frustrated with app because it didn't track properly, and/or gave inaccurate scores.

Other app features, including more gamification and ways to connect with other users or friends through social media were suggested as ways to keep them engaged.

Motivation to Continue Participating

A little over 80% of survey participants said they are motivated to continue participating in the tech pilot. For these participants, continued participation in the pilot is important to:

- Further improving their driving habits and/or behaviours through feedback and earning rewards
- Reinforce newly acquired driving habits/behaviours to keep themselves and other road users safe.

For those who are not motivated to continue, several issues were cited:

- Flaws with the technology – disconnections and unrecorded trips
- Inaccurate capture and scoring of distraction and speed events
- COVID-19 and resulting restrictions (less opportunity to drive)
- Driving culture in BC (accepted speeding behaviour and/or fear of retaliation from other drivers)

Appendix C

Table 40. Participation by Pilot Month (Jan 2020 to October 2021)

	Tx	Control	Total
Jan-20	578	566	1144
Feb	586	595	1181
Mar	474	489	963
Apr	429	425	854
May	418	416	834
Jun	378	397	775
Jul	357	383	740
Aug	343	359	702
Sep	352	364	716
Oct	338	351	689
Nov	325	331	656
Dec	306	311	617
Jan-21	265	268	533
Feb	248	243	491
Mar	234	233	467
Apr	225	227	452
May	230	219	449
Jun	218	205	423
Jul	208	179	387
Aug	185	170	355
Sep	169	156	325

Appendix D - Use of Educational Resources

Table 41. Receipt of monthly notification emails about upcoming challenges (n=85)

	f	%
Yes	66	77.6
No	13	15.2
Don't Recall	6	7.1

Table 42. Extent to which the monthly emails were viewed/read (n=65)

	f	%
Viewed or read all of the notification emails received	31	47.7
Viewed or read some, but not all notification emails received	27	41.5
Ignored all notification emails	7	10.8

Reasons for not reading/viewing the emails included a preference for text messages over emails, uninteresting content and/or relevance of the information to their needs.

Figure 22. Level of Agreement with Statements about the Notification Email (n=58)

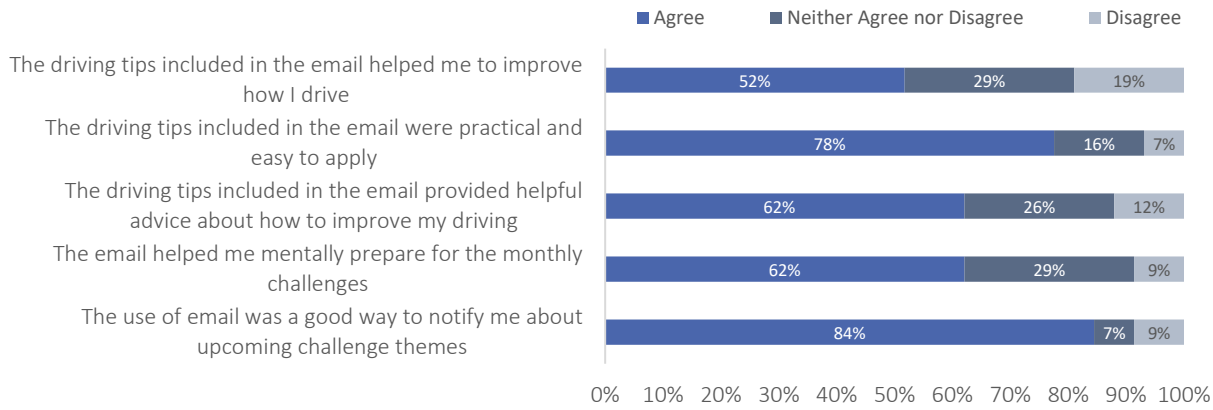
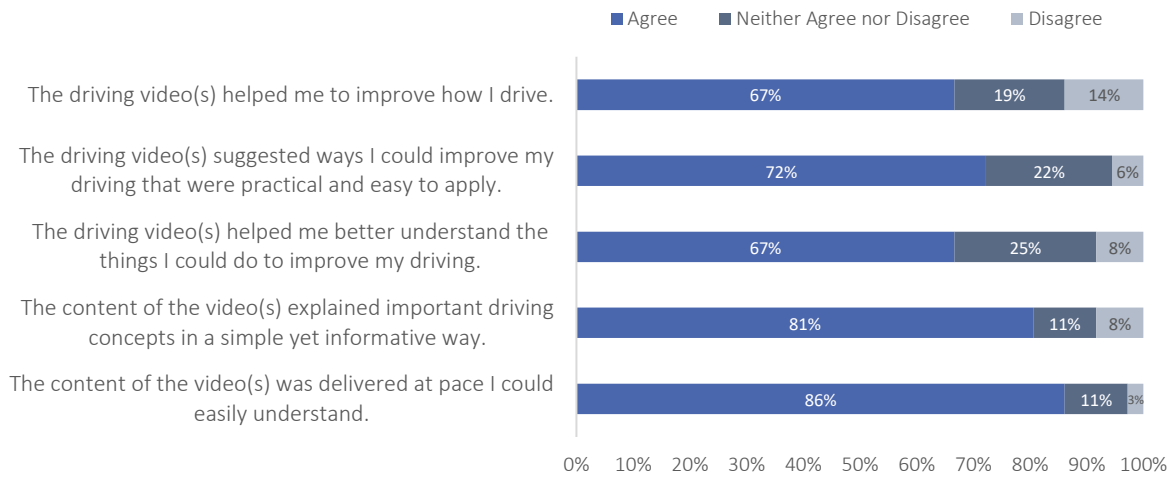


Table 43. Extent to Which Participants Referred to the Driving Videos

	f	%
Referred to each driving video as it became available	9	10.7
Referred to the driving videos only as needed	28	33.3
Didn't refer to the driving videos at all	47	56.0

Knowing what they needed to improve was the main reason mentioned for not accessing or referring to the driving videos, followed by the relevance and interest in the content relative to their needs. Despite receiving the notification email, few participants said they were not aware of the new driving videos.

Figure 23. Level of Agreement with Statements about the Driving Videos (n=38)



Appendix E

Table 44. Features that Most Represent Participant Driving Habits

	f
How far you drive	9
Where you drive	10
When you drive	6
How you drive	20
All of the above	42