UBC-DIBS Working Paper 2021-CBI-04

See the Sign, Avoid the Fine: TSZ Parking Signs in Vancouver

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Knowledge Summary: This project aimed to improve compliance with temporary parking restrictions in the City of Vancouver. New "Behavioural Insights informed" parking signs incorporated salience and loss aversion. Control and BI-informed signs were compared in a randomized controlled trial. The BI-informed signs reduced parking violations by 57%. Although this difference was not statistically significant, it may be managerially significant. The project team recommends extending the trial to collect more data, trialing BI-informed signs for other types of parking zones, and conducting a cost-benefit analysis to inform scaling decisions.

Keywords: *behavioural insights, nudge, salience, loss aversion, compliance, signage, parking*

Suggested citation: Chagani, P., Lai, E., Jensen, C., & Hardisty, D. J. (2022). *See the sign, avoid the fine: TSZ parking signs in Vancouver.* (UBC-DIBS Working Paper 2021-CBI-04).

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Acknowledgements

The project team would like to thank and acknowledge the following for their assistance with the completion of this project:

Project Sponsor: Chris Darwent, City of Vancouver

City of Vancouver Staff: Zoe Athans, Billy Dong, Taryn Fanzenga, Johnny Lai, Augusto Ng, Hon Ng

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Executive Summary

The City of Vancouver (City) frequently establishes Temporary Special Zones (TSZs), where parking is restricted, to make this space available for temporary initiatives (e.g., construction). Some drivers do not comply with the restrictions and park their vehicles in the TSZ, which creates an obstruction in the TSZ and results in complaint calls to the City. The City has to investigate the complaints, and potentially have the vehicles ticketed and towed. The situation results in frustration for all parties involved.

The target behaviour is for drivers to comply with the TSZ parking restrictions and avoid parking there. This may be measured by the number of non-compliant vehicles parked in a TSZ. The population is drivers looking for parking in the vicinity of the TSZ; the touchpoint with this population is the TSZ sign.

There are several cognitive, social, and situational barriers to the target behaviour. These include confusion caused by multiple/unclear signage, signage that is not readily visible, drivers being unaware of the potential consequences of non-compliance or of alternative parking facilities in the vicinity, and so on.

An academic and cross jurisdictional scan showed that parking signage that uses visuals and clear and easy-to-read messaging is more effective. We conducted an online qualitative survey with drivers in Vancouver to better understand the barriers to TSZ compliance. Over 50% of the respondents stated that it is moderately or highly likely that TSZ signage is conflicting, confusing or not noticeable. 81% of the respondents said they did not know the current penalties for parking in a TSZ, and 22% said they were unsure.

Informed by the above research and guided by the ethics of using Behavioural Insights (BI) principles for good, we used the principles of *Salience* and *Loss Aversion* from the EAST framework to develop a clear, eye-catching TSZ sign that would draw the driver's attention, and 'nudge' the driver to comply. Our BI sign followed the standards in the Manual for Uniform Traffic Control Devices (MUTCD), was longer than the City's regular TSZ sign and had reflective sheeting to make it more visible in the dark. It had the image of a tow truck on an orange background (standard color for construction) to convey the penalty for non-compliance.

We conducted a Randomized Control Trial (RCT) from March 7, 2021 to April 4, 2021, to evaluate the effectiveness of the BI solution. Our sample size of 117 TSZs had 68 TSZs in the control group (regular sign) and 49 TSZs in the treatment group (BI sign). The dependent variable was the number of violations per TSZ as reported to the 311 Contact Centre. On average, violations in TSZs with the BI sign dropped by 57% compared to the TSZs with the regular sign. Thus, the BI sign resulted in greater compliance. However, the difference is not statistically significant ($p = .33$), therefore these results may or may not replicate.

Based on the results of our trial we recommend:

1. Conduct additional testing in TSZs, using the same signs, a larger sample size and extending the scope to include types of TSZs excluded in this study. If statistically significant results are achieved, these can inform the decision to scale (to TSZs or to other categories of parking signage).
2. Develop BI signs for a different category of parking signage (e.g., rush hour, loading zones), which has a greater degree of non-compliance, and conduct a study to evaluate the effectiveness of the new signs.
3. The BI sign resulted in a 57% reduction in violations. However, it is more costly than the regular TSZ signs. Therefore, the City may wish to conduct a cost-benefit analysis for the BI sign. A favorable cost benefit analysis may justify replacing older signs (as they come due for replacement) with BI signs incorporating the principles of *Salience* and *Loss Aversion*. Such a needs-based, phased-in approach would help defray the costs of the new signs over a longer period.

Part A. Problem Background

The City of Vancouver (City) frequently establishes Temporary Special Zones (TSZ) in various parts of the city in order to make this space temporarily available to construction projects, filming, repair works, special events and other similar initiatives[1]. Temporary parking restrictions are generally posted in the area about 3-4 days ahead of the restriction period to give the public advance notice of the upcoming temporary parking restrictions (although some can be shortened to a day for rush TSZ permit). The TSZ signage states the period for which the temporary restrictions are in effect. However, drivers often do not comply with the parking restrictions and park their vehicles in the restricted area. When drafting new TSZ signage, we took into consideration the ethics of 'Benefit vs. Harm'.

When a vehicle is illegally parked in a TSZ, it creates an obstruction in the TSZ and may lead to a complaint call to the City. The City sends a Parking Enforcement Officer (PEO) to issue a parking ticket and call the tow company to tow the vehicle. This results in frustration for all parties involved - the organization for whom the space was reserved, the offending drivers, as well as the City who receives complaints from both the organizations and the offending drivers.

The target behaviour is for drivers to comply with the parking restrictions posted by the City and not park their vehicles in the TSZ during the dates of the temporary closure. Potential reasons for non-compliance include:

- Confusing, conflicting or unclear signage.
- Not knowing of other parking options in the vicinity.
- Drivers who accept the risk of making a quick stop if they do not see a PEO nearby.
- Drivers who do not realize the consequences of non-compliance.
- Time pressure for the driver.
- Short notice period of the TSZ and therefore insufficient time to make alternative travel arrangements rather than driving their vehicle.
- Limited public transit options resulting in more vehicle drivers in the TSZ area.

BI is the right approach for this problem as it seeks to address the problem of non-compliance at the source, through a shift in behaviour, i.e., by 'nudging' the driver to comply with the parking restriction. The approach seeks to support the desired behaviour through attractive and timely messaging at the time that the driver needs to park their vehicle. For that reason, our signage meets the 'Nudge for Good' ethical consideration, as it can influence the drivers' parking decision by providing restriction information (date and time period) and the consequences of non-compliance (tow to City impound) so that they do not park in the TSZ without a permit. In addition, we sought to maintain or minimize the workload of busy City workers. Our trial procedures were very similar to their current procedures, the only difference being that the regular TSZ sign was posted on odd dates and the new BI sign was posted on even dates.

Part B. Chosen Behaviour & Context

The target behaviour is for drivers to not park in a TSZ. This behaviour is important so that:

- The space is available for the activities that it is reserved for.
- The City does not have to take citation action.

[1] For more information about TSZ, please visit https://vancouver.ca/streets-transportation/reserve-metered-spaces.aspx

- There is less frustration for all parties involved.

The target behaviour is measured by the number of TSZ violations reported to the City's 311 Contact Centre. Other measurements are the number of parking tickets issued, and/or vehicles towed from the TSZ. The population for this project is drivers looking for parking in TSZ areas. The project has strong touchpoints with the population through the signage that is posted in the TSZ. The large number of TSZs at all times ensured that we could create sufficient sized TSZ sample groups.

We identified the following key barriers to the target behaviour and validated these in our online survey of Vancouver drivers. Signage-related problems were rated as key factors in respondents' parking behaviour. Please see 'Exploratory Research' for additional details of our survey results.

Cognitive

- Drivers do not see/notice the signs because they are in a hurry, or due to poor lighting (e.g., at night, or due to the orientation of the sign relative to where the driver is).
- Drivers are unclear which sign applies as there can be multiple signs stating different regulations for different time periods, some of which may appear to be conflicting (e.g., TSZ signs are posted in advance of the TSZ period, and therefore there are two signs, one allowing parking, the other restricting parking).
- Drivers misread the signs because they are difficult to read and/or understand (small letters, too much information on a small sign, poor lighting, etc.).
- Drivers may not be clear about the consequences of non-compliance.

Social

- Drivers may have also seen vehicles legally parked in those parking spots on the dates prior to the closure and not realize that there is now a restriction in effect.

Situational

- Drivers who only need to park for a quick 'in and out'.
- Drivers who are in a rush and cannot take the time to find a legitimate parking spot or are unaware of other parking options in the vicinity.
- Drivers may park there because they believe that the chances of the vehicle being towed are slim.

Behavioural insights such as *Salience* and *Loss Aversion* can be effective in altering drivers' behaviour of parking in a TSZ. These insights aim to 'nudge' by:

- Making the signage easy to spot (e.g., making a larger than usual sign) which helps to draw the driver's attention to the signage.
- Clearly conveying the penalties associated with non-compliance (e.g., graphic of a tow truck).
- Using a visual or eye-catching way of drawing attention to the TSZ sign (e.g., through colour).

Part C. Exploratory Research

Academic Literature Review

Sujanani (2017) conducted an experimental research study that aimed to compare the user experience for parking signs that were comprised of only text with signs that contained both text and visual messaging. The hypothesis was that the signs with both text and visual information would increase the driver's comprehension of the information. The research was conducted via a survey and the participants were randomly assigned to either the control or treatment groups. The results demonstrated several positive outcomes demonstrating the potential for parking signs incorporating visuals along with text.

Sattayhatewa and Smith Jr. (2003) looked at parking related to special events. Their research identified three factors that contribute to the 'utility' of parking: driving time, parking cost and walking time. This conclusion is relevant to our study of drivers in Vancouver and their responses to stimulus such as TSZ signs because this might lead us to think that some drivers will park in TSZs regardless of the signage. Their behaviours may be driven by the 'utility' as commercial drivers might not have the luxury of time to seek alternative parking if making a delivery or pick-up.

Rakoczi et al. (2013) studied visual perception in relation to traffic signs. Visual perception can be described as the brain's responses to visual stimuli. Their research looked at eye movement metrics and how they were impacted by international travel signs. The results demonstrated higher regression rates on foreign traffic signs. Their thesis to explain this was that "out-of-context or unexpected visual elements attract visual attention faster"(p.14). These results are relevant to the TSZ signs in Vancouver and the project team's intention to develop a salient sign that would attract driver's attention.

Cross-Jurisdictional Scan

Glasnapp and Isaacs (2010) discuss how parking signage can be challenging to drivers in terms of it providing multiple messages within a single parking zone, which may potentially include multiple conflicting signs mounted at the same location. The signs are typically designed from a "restriction-centered" design in terms of informing drivers what they cannot do (such as "No Parking") and when (the day/hours parking is not permitted). These types of signs require the driver to infer when they are allowed to park which can cause confusion for the drivers. Alternatively, they suggest, "that parking signs could be redesigned to be *use-centered* rather than *restriction-centered*" (p. 19) as this would be clear for the driver not requiring any inferences.

There may also be issues in terms of how effectively the information is presented on the signs. Signs with a great deal of information result in smaller fonts that might be challenging for drivers to see when they are selecting parking. There have also been issues identified with the placement of salient information and how this might hinder the driver from being able to discern when they might or might not be able to park in a zone. Glasnapp and Isaacs note, "The convention with parking signs is to state what is restricted when, but drivers looking for a spot want to know what they can do now" (p. 19).

It can be challenging for drivers who travel between local governments to see a variety of different styles of parking signs with a diverse range of instructions based on the unique requirements of each parking zone. However, in many cases, drivers do not have to leave their own local government to potentially see conflicting messaging on different sign layouts. The Town of Sidney, on Vancouver Island, commissioned a Downtown Parking Study with the Watt Consulting Group. Acknowledging there is a stark contrast between downtown Sidney and downtown Vancouver, there are, however, a few best practices that are applicable regardless of the size of a local government. Watt Consulting Group (2016) suggests that parking signage should be a single

design for all parking for consistency, and that the design should be aligned with the Parking and Stopping Signs as described within the Manual for Uniform Traffic Control Devices (MUTCD) for Canada by the Transportation Association of Canada.

The issues with confusion caused by multiple signs for a single zone are not unique to local government in Canada. Dixon Resources Unlimited (2014) in their study for the City of Hendersonville, NC, discuss complaints from residents in the neighbouring community, Waynesville, NC. They cite examples of posts within their downtown core that may have two different signs, one that states 'No Parking' in red, while the other states 'Three Hour Parking' in green. Both signs have the applicable hours, however, neither sign provides the days of the week that the signs are active. The recommendation of the report was that parking signs need to be clear, consistent and they should be aligned with the State Traffic Code requirements.

The City of Toronto, in a recent report, also spoke of the need to ensure improved legibility of their signage. The General Manager of Transportation Services (2017) acknowledged a desire to implement more graphics in their signs. The report speaks of the need to identify best practices from local governments that are leading the way in terms of curbside management signage.

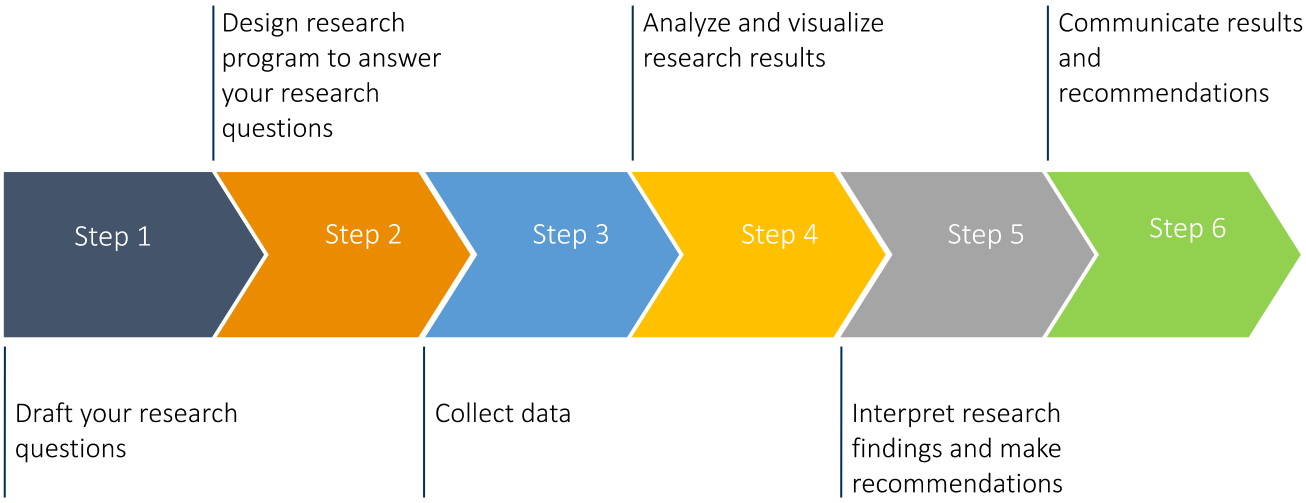
BI has a long history of helping to shape public policy in all levels of government. The first BI unit, the Behavioural Insights Team was formed within the UK government. Today, BI's influence on public policy can be seen around the world. Winter (2008) references how the United States Forest Service incorporated the teachings of Robert Cialdini in their signage to keep park users on paths. They trialed messaging for their signage using the message types: injunctive-prescriptive (i.e., desired behaviour, positive), injunctive-proscriptive (i.e., desired behaviour, negative), descriptive-prescriptive (i.e., others' behaviour, positive) and descriptive-proscriptive (i.e., others' behaviour, negative) to determine which had the greatest effect on their park guests. They found that injunctive-proscriptive messaging is the most effective when relaying information about desired park user behaviour. An example of an injunctive-proscriptive message related to parking could be, "Please do not park in the TSZ to allow TSZ holders to utilize the parking."

Qualitative Research

We used a qualitative survey as a way to gather in-depth information about how people feel about TSZ signage, how they respond to it, the barriers to complying with the TSZ signage, as well as potential touchpoints with the population. The survey method allowed us to obtain input from a large sample of people, thereby making the information that we collect more representative of the wider community. The survey allowed us to better understand the barriers to complying with the TSZ signage, and thereby positioned us to design an effective solution.

The survey method relied on self-reporting, which carried the risk of the data not being accurate, as respondents may have given the 'right' answer, intentionally or unintentionally. As this was an anonymous survey, there was no opportunity to go back and do an observation with the same group if the data showed a self-reporting bias. Nor would there be an opportunity to ask for clarification or probe about the intention-action gap and what happens, for example, when there are no alternative parking options close by. Figure 1 outlines the steps of our qualitative research.

Figure 1. The steps the team used for planning, conducting and analyzing the qualitative survey:



Our Qualtrics survey had 76 responses. Please see Appendix I for the Qualitative Survey we designed and implemented. Our key takeaways focused on observations about TSZ signage and the consequences of parking in TSZs:

- 56% of participants stated that it was moderately or extremely likely that TSZ signs were not noticeable.
- 51% responded that it was moderately or extremely likely that TSZ signs were conflicting between each other.
- 50% answered that it was moderately or extremely likely that TSZ signs were confusing.
- 58% stated they were not aware of the penalties for parking in a TSZ.
- 91% believed they could receive a ticket for parking in a TSZ.
- 80% thought they could be towed for parking in a TSZ.

In addition to our survey, the project team met with a number of City staff throughout the project to discuss TSZ parking in Vancouver and the specifics of how complaints, ticketing and towing is being managed. The team met with staff from Traffic Operations, Enforcement, Transportation Branch Heads, 311 Contact Centre, and Temporary Permits and Decals. These meetings helped to inform the project team on the development of its BI solution.

Summary

The findings from the academic literature review, the cross jurisdictional scan, and the qualitative research provided a number of insights for our project:

- Parking signage can be challenging to drivers in terms of how it can provide multiple messages within a single parking zone, which may potentially include multiple conflicting signs mounted at the same location.
- Positive results demonstrate the potential for parking signs incorporating visuals along with the text messaging.
- Parking choice models are often based on the belief that drivers make parking choices based on the highest possible utility.

- Parking signage should be a single design for all parking for consistency and that the design should be aligned with the Parking and Stopping Signs as described within the MUTCD for Canada by Transportation Association of Canada.
- Parking signs need to be clear, consistent, and aligned with traffic code requirements.
- Using more graphics in signs has a potential for impact.
- The use of injunctive-prescriptive, injunctive-proscriptive, descriptive-prescriptive or descriptive-proscriptive language in messaging results in different degrees of effect on behaviour.

Several themes emerged for the project team from the highlights above: confusion due to multiple conflicting signs, lack of visuals on the signs, and the utility of parking to the driver. The first theme illustrates the challenge of multiple or inconsistent signage that can be confusing for the driver. We have discussed several barriers that can affect the target behaviour, but when a driver is also faced with multiple or different messaging, it can be challenging to make the correct decision. The need to provide advance notice of an upcoming TSZ means that there will be situations where two conflicting parking signs are posted and visible at the same time. This also has the potential to affect the parking behaviour of drivers. There were three questions in the survey related to TSZ signs and, in each, 50% or more of respondents noted the signs were confusing, in conflict with each other, or not noticeable.

The second theme, incorporating visuals, is relevant to this project as it speaks to the salience of the signage. Does the sign incorporate sufficient details and does the sign attract the attention of drivers? Being a temporary measure, the TSZ signage must be obvious in order that drivers realize that there has been a temporary change to the parking rules for those spaces. Since the survey results demonstrated some confusion around the penalties for parking in a TSZ, the addition of visuals would help to confirm the potential penalties for drivers choosing to park in a TSZ.

The final theme of utility can describe some of the rationale underlying drivers' decision to park in a TSZ as they will usually have a purpose for parking, whether it is to drop something off at an address or visit a location. Regardless, the driver is attempting to get 'somewhere' and for the most part will try to park as close to that location as possible. The survey results highlighted the importance of a 'lack of time to find alternate parking' as over 50% of respondents answered that might be a reason driver might park in a TSZ.

Part D. BI Solution

We have chosen the 'Attractive' principle from the EAST framework to be our focus in our BI solution. We believe that new signage can be an effective way of addressing some of the barriers to the target behaviour. Within the 'Attractive' category, we selected *Salience* and *Loss Aversion* to shape our new TSZ sign. *Salience* is based on the behavioural principle that people's attention is drawn to something that is new or that is relevant to them. When applying *Salience* to the TSZ signage, the *Salience* effect needs to stand out so that the sign is completely distinct from the other signage. We want something unexpected for the driver, which will force them to use the System 2 level of cognition when they see the sign. There are many ways of making a message salient – for example, by using color or by making the messaging clear so that people know what you would like them to do. We also want to make the TSZ signage eye-catching and easy to spot. *Loss Aversion* is focused on people who dislike losses more than they like gains of an equivalent amount. In the *Loss Aversion* effect, delivering the message on the sign needs to be clear to the driver about the consequences of not following the message on the sign.

In our original sign design, we suggested that flashing lights around the signage would draw the driver's attention to the TSZ restrictions and this would 'nudge' the driver to avoid parking there. However, when we met with the Traffic and Data Management and Electrical teams to discuss implementation of the solution, we learned the MUTCD does not permit LED lights on parking signs. Therefore, we re-designed our proposed solution. We went through several solution designs before the final proposed solution was approved by the City; to see the full evolution of the TSZ sign design, refer to Appendix II. The final design includes an enlargement of the sign's size, a reflective coating for night vision, an orange background, a tow truck image and the contact information to the City Impound.

TSZ signage is generally installed a few days in advance of the effective period of the parking restrictions in order to give drivers advance notice of the upcoming restrictions. However, until the TSZ period begins, the regular parking signs are still in effect. This can cause confusion as the TSZ signage restricts parking, whereas the regular signage permits parking in that area. Therefore, it is important to clearly convey to the public that during the effective period of the TSZ restriction, the TSZ signage overrides all other signage placed in the TSZ. The eye-catching orange color that is a new addition to the TSZ sign would draw the driver's attention to the sign and the dates noted on it for the restrictions, thereby helping to convey when the sign is in effect. This should reduce the incidence of drivers parking in the TSZ. This will also address the situation where drivers simply miss the TSZ sign (because they are distracted, or the sign is far from a vacant parking spot where they are planning to park, etc.).

Figure 2. Regular TSZ sign is on the left, and on the right is our new BI sign.

As shown in Figure 2, our newly designed BI signage contains 5 differences from the City's regular TSZ sign:

1. The size of the BI sign is substantially larger than the regular signs.
2. A reflective coating helps drivers at night see the sign.
3. Filled part of the sign with an eye-catching orange colour.
4. Added an image of a tow truck.

5. Included City Impound information.

Through these changes, we hope to address the confusion that arises when the TSZ signage is posted on the same sign pole as other parking signs. Sometimes drivers may not have the time or patience to read each individual sign, and process the messages conveyed by each sign to determine which message applies to them. It is therefore important to ensure that the new TSZ signage is clear and obvious, thereby increasing the chances of compliance with the restrictions. Drawing the drivers' attention and 'nudging' the driver to park elsewhere is the aim of our BI solution.

Part E. Research Design

Our hypothesis is that TSZ signage that incorporates *Salience* and *Loss Aversion* will decrease parking violations. We hoped that the larger BI sign would catch the driver's eye and the graphic of the tow truck would clearly convey the repercussions of not complying with the restrictions. This would 'nudge' the driver to avoid parking there. We expected this to result in reducing the number of TSZ infractions, thereby also reducing the volume of complaint calls to the City, the volume of parking tickets issued, and the number of vehicles towed.

To test the effectiveness of the BI solution we conducted a randomized controlled trial (RCT) with one control group and one treatment group. The intervention was the parking signage that the City posts in TSZs, stating the parking restrictions. The control group received the regular signs, while the treatment condition received the BI sign.

The study was conducted between March 7 – April 4, 2021. Our sample size was 117, with 68 TSZs in the control condition and 49 TSZs in the treatment condition. To avoid experimenter/observer bias we used a randomized method to assign TSZs to trial groups. The randomization unit was the TSZ, and the randomization method was the TSZ start date, with odd start dates being assigned to the control condition and even start dates being assigned to the treatment condition. We randomized by TSZ start date in order to equalize background differences between the TSZ in the two groups as in the long run both conditions would be equivalent in terms of other background variables. The research design is illustrated in Figure 3 below.

Figure 3. Research design.

		Test Period
Randomize TSZ by Start Date	Control Group	Regular Signs used by the City
	Treatment Group	BI Signs

The dependent variable was the number of vehicles parked in TSZs. This was measured by the number of violations reported to the City's 311 Contact Centre. The independent variable was the TSZ signage.

The following factors were also taken into consideration in the design of the study:

1. The number of vehicles that violated the parking restrictions was chosen as the unit of analysis in preference to the volume of complaint calls, parking tickets, or tows for the following reasons:

- A single complaint call to the 311 Contact Centre could report multiple vehicles that had violated the TSZ restrictions.
- A complaint call to report a TSZ infraction does not necessarily result in a parking ticket being issued (e.g., the vehicle may have left before the Parking Enforcement Officer (PEO) arrived to validate the infraction).
- A complaint call may not result in a tow, even if a parking ticket is issued (e.g., the vehicle may have left by the time the tow truck arrives, or the TSZ restriction time period may be over).

2. TSZs vary in size. A large TSZ may potentially have more tickets issued simply because it can accommodate more vehicles. We adjusted for TSZ size by classifying TSZs into three categories - small, medium and large. TSZ sizes varied from 18 meters to about 100 meters, with a small number that ran for one to two blocks. We categorized TSZs as follows:
    - Small TSZs – less than 30 meters; Medium TSZs – 30-60 meters; Large TSZs – 60+ meters.
3. TSZs are in effect for varying lengths of time, as some run for many days/months; others for one or a few days. Additionally, when a TSZ is in effect for many days, we expected that as people who regularly parked there became familiar with the temporary restrictions, the number of illegally parked vehicles in the TSZ would drop. To adjust for the varying duration of the TSZ as well as the effect of 'learning' we only analyzed violations reported on the first day of the TSZ.
4. The risk of experimenter effects being introduced into the study was mitigated by the fact that the process of a complaint call intake at the 311 Contact Centre, the process of issuing a parking ticket, and the process of having a vehicle towed were all managed by City staff and not by the project team.
5. In addition to the number of violations per TSZ we also captured daily complaint call, ticket, and tow data for each TSZ for additional analysis purposes.
6. TSZs that spanned multiple streets or large areas were excluded from the study as since we had a fixed number of BI signs (150). Metered zones were excluded due to different signage regulations for meters.

Study Implementation

Prior to beginning the RCT:

- We worked with City staff to understand Traffic Signage guidelines and standards, and to redesign our preliminary design accordingly.
- Once the BI sign was approved, we coordinated with City staff to order the new BI signs.
- We briefed City staff on the randomization method so that they could assign TSZs appropriately.
- We confirmed that City work crew would post and remove TSZ signage.
- We reviewed the 311 Contact Centre, parking ticket, and tow data that was available to us. Parking ticket and tow data did not identify the TSZ with which it was associated. Therefore, we were unable to develop a baseline of violations using historical data.
- We highlighted the need to identify TSZ violations in the ticket/tow data to the City. A new code was established for PEOs to enter on the ticket for a TSZ violation so that we would be able to measure the dependent variables in our study.

During the study we conducted ‘spot checks’ on random TSZs to identify any potential issues.[2]

Data Collection

During the RCT, the City provided us two daily reports:

[2] In our spot checks, one TSZ was found to have the wrong sign—it had the Regular sign posted instead of the BI Sign.

- 311 Calls Report
- Parking Tickets Report showing all parking tickets/tows for the day

We also developed a 'master list' of TSZs in the trial, based on the lists of upcoming TSZs, the assignment to trial group for each TSZ, and the signage installation dates we received during the trial period from the City.

Our method of gathering the data from these reports was as follows:

- The 311 Call Report was our starting point as it lists all violations reported to the City on a daily basis. Each call to the 311 Contact Centre is assigned a Request Number. For a TSZ violation, the TSZ number was noted in a free form comment column. The report also showed the address of the TSZ. From the 'master' list, we determined the trial group to which the TSZ belonged.
- We cross checked the 311 Call Report and the Parking Tickets Report using the Request Number to determine the action taken for that request. For the most part, the 311 Request Number was noted in the Parking Tickets report. Where this was missing, we were able to use the TSZ number, or the address to identify the ticket/tow associated with the Request Number.
- We also searched the Parking Ticket Report (especially the free-form comments) to catch any other tickets/tows that were noted as TSZ violations and cross-verified with the 311 Call Report to determine whether this was a valid reported violation or whether the PEO may have forgotten to re-set their hand-held device from a previous ticket. We were able to reconcile discrepancies.

As some data on the reports was in free-form comments, there is potential for human error in recording the data at source, as compared to a system which validates input at data entry time. Please see Appendix III for a list of data elements collected and analyzed during the study.

Part F. Research Results

We analyzed our research data to test our hypothesis that TSZ signage that incorporates *Salience* and *Loss Aversion* will decrease parking violations. We analyzed the number of reported violations per TSZ in the regular sign and BI sign groups.

High Level Summary of Data Analyzed

We analyzed City data for total calls received by the 311 Contact Centre, parking tickets issued, and vehicles towed during the study period to determine how many of these were related to TSZs.

- Of the total 1,731 calls received by the 311 Contact Centre, 3.7% of related to TSZs during the RCT period.
- Of the total 19,763 parking tickets issued during the study period, 0.4% of tickets were related to TSZs.

Based on this data, it would appear that TSZ parking violations are not a major contributor to parking issues in Vancouver. Please see Appendix IV for further details.

Study Results

The RCT results show that there is a difference, on average, in drivers electing to park in TSZs when they see the regular sign versus the BI sign. A total of 13 violations were reported in 6 out of the 68 TSZs with the regular sign compared to a total of 4 violations occurring in 4 of the 49 TSZs that had the BI sign. The average number of reported violations per TSZ dropped by 57% in TSZs with the BI sign compared to those in TSZs with

the regular sign. Interestingly, although few violations were reported overall, there were a small number of TSZs that actually had more than one violation reported per TSZ. It should be noted that our metric for measuring the trial results was the number of reported violations. In a future study there may be value in gathering some data on violations that are not reported to the City. This could be done via qualitative research with TSZ permit holders, or by observation methods.

Key Descriptive Statistics

The mean of the number of violations per TSZ for the control group (regular TSZ sign) is 0.19 and the mean for the treatment group (BI sign) is 0.08. Therefore, on average there were 57% fewer violations in TSZs with the BI sign. Figure 4 shows the frequencies for the number of violations for TSZs in both groups. 91% of TSZs with the regular sign did not have a violation reported compared to 96% of TSZs with the BI sign. This bears out the picture conveyed by the analysis of overall statistics noted above that the number of TSZ parking violations is not high. Please see Appendix IV for detailed statistics.

Figure 4. Analysis of Number of Violations per TSZ

	Regular Sign (68 TSZs)	BI Sign (49 TSZs)
# of Violations	13	4
Mean	0.19	0.08
Standard Error of Mean	0.08	0.06
Standard Deviation	0.68	0.45

Key Inferential Statistical Test Results

We used the Independent Samples T-test to determine whether compliance to parking restrictions in TSZs (as measured by the number of parking violations in the TSZs) was statistically different in TSZs where the regular sign was posted compared to TSZs where the modified BI sign was posted.

TSZs with the BI sign had fewer violations on average (mean=.08, SD=.45) than TSZs with the regular sign (mean=.19, SD=.68), $t(117) = .99$, $p = .33$. The results of the study are not statistically significant. Therefore, we are unsure whether the results of the study are reflective of the general population.

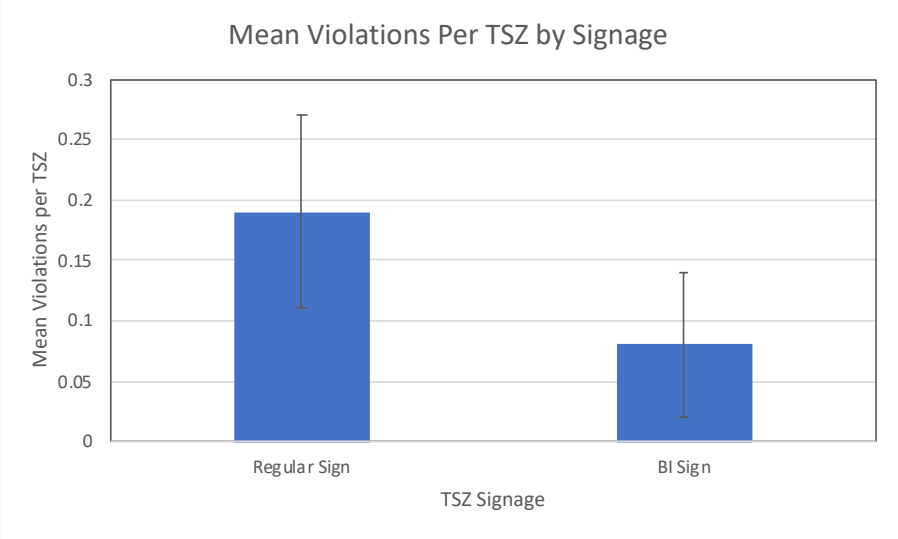
Note: We had hoped to measure the number of violations by TSZ size to 'normalize' for different size TSZs. However, all violations occurred in small TSZs. We then re-categorized the TSZs into two groups – larger than 30 meters, and smaller than 30 meters. We had 88 TSZs in <30 m and 29 TSZs in the > 30 m categories. We analyzed the proportion of violations in each group using a Z-score test, which retuned significant results with $p < .001$.

Therefore, there is a statistically significant difference in the number of violations in TSZs < 30 meters compared to TSZs > 30 meters. Smaller TSZs had more violations than larger TSZs. This is interesting as intuitively one may have expected that larger TSZs would have more violations simply because there is sufficient space for multiple vehicles to park there. The following factors may help explain the reason that smaller TSZs had more violations than larger TSZs:

- Our TSZ sample was heavily in favour of small TSZs due to the fact that we had a limited number of BI signs available for the study, and therefore large TSZs that would require many signs were excluded from the trial.

- Smaller TSZs can accommodate fewer vehicles. Even one non-compliant vehicle parked in a TSZ would potentially significantly reduce the space available to the TSZ permit holder, who may then decide to call the 311 Contact Centre and report the violation (e.g., when space is reserved in front of a single dwelling for moving purposes). In comparison, in a larger TSZ, one non-compliant vehicle may still leave sufficient room for the permit holder to successfully use the remaining space for their activities, potentially discouraging the permit holder to take the trouble to report the violation to the 311 Contact Centre.
- Smaller TSZs are also less noticeable. A large space without parked cars is unusual and drivers may automatically assume there is a reason people aren't parking in the area. A smaller space may be more often assumed to be a free space.

Figure 5. Mean number of TSZ violations in the control and BI-sign groups. Error bars indicate +/- one standard error.



Additional Analysis

We analyzed the number of calls to the 311 Contact Centre, the number of parking tickets and the number of vehicles towed during the trial by condition. Our analysis did not return statistically significant results. The results are shown in Appendix IV.

We also analyzed the volume of calls received by the 311 Contact Centre that were subsequently cancelled. Of the total of 12 calls received by the 311 Contact Centre reporting violations in TSZs in the study, 75% were processed through to completion, and 25% were cancelled.

Every parking enforcement call received at the 311 Contact Centre results in further processing by the City and may be seen as having up to 3 touchpoints by City staff.

- The 311 call is received and recorded.
- A PEO is dispatched to investigate the complaint and issue a ticket for the violation.
- A tow order is created and sent to the tow company; the PEO stays until the tow truck arrives.

The touchpoints may be seen as a measure of City resources expended to process a reported violation. During the RCT, 21 violations were reported to the 311 Contact Center. These resulted in 37 touchpoints by City Staff,

with 13 parking tickets being issued. The average number of touchpoints per reported violation is 1.76, and the average number of parking tickets per violation is 0.62.

We also analyzed the data to assess the impact of the following on violations in the regular and BI sign TSZ groups.

- TSZs in the Downtown vs Non-downtown areas (18 Downtown, 99 Non-downtown)
- TSZs on Weekday vs Weekend start dates (93 Weekday start dates, 24 Weekend start dates)
- Time of day that the violation was reported. All 311 calls except for two calls (one at 12:36pm and the other at 16:04 pm) were received before noon.
- Our results did not show any significant differences using the above criteria.

Our data showed that the majority of violations were made by drivers of vehicle with private license plates (88%), as opposed to commercial license plates (12%). One violation was by an out-of-Province vehicle (6%) compared to in-Province vehicles (94%).

We noted that there was no particular pattern or trend in terms of the violations and the time of the month that the violations occurred. Our trial ran for 29 days, spanning the mid-month and month-end time periods, and we saw that violations happened throughout this period with no discernible pattern.

Part G. Recommendations

Despite the relatively low number of total parking violations in both the Regular and BI sign groups, there was a noticeable difference in the results between the groups, as the BI sign group had, on average 57% less violations.

The project team has recognized through their analysis of the parking violations in the city of Vancouver that TSZs are one of the least frequent types of parking violations. The TSZ project was an opportunity to test out the impact of BI-informed signage on parking behaviour, since each TSZ sign needs to be customized to the parameters defining the specific restriction (dates, time, etc.). Therefore, the cost and effort associated with changing the signage to include BI principles could 'piggy-back' onto the existing process of customizing the sign for the TSZ.

When analyzing the results and comparing the different TSZs, it was recognized that there were not many downtown TSZs in the trial. This was due to the metered parking spaces being excluded from the study due to the project team not being aware that those spots would have required a small version of the BI signs that could have been added to the meter hoods in addition to the standard signage on the poles.

At the same time, the project team gained an understanding of the magnitude of the parking enforcement issue in Vancouver that results in hundreds of tickets being written every day, which can be generating literally thousands of touchpoints with the City as these parking violations can result in contact with 311 Contact Centre staff, PEOs, and tow truck drivers. This fact may inform City strategy to achieve greater compliance to parking signage.

Although the results do not have statistical significance, the project team acknowledges that the results may have managerial significance, as they confirm that with BI, changes can be made to signage which can modify driver behaviour. Managerial significance has often been compared to more of a 'cost/benefit' perspective in

business, that might often be associated with results in the 'real world'. We have three recommendations based on the results of this project:

Additional Testing

Conduct additional testing of the TSZs, using the same signs, an increased sample size, and extending the scope to include types of TSZs excluded in this study. If statistically significant results are achieved, these can inform the decision to scale (to TSZs or to other categories of parking signage). This recommendation is supported by both the secondary and qualitative research. There was a theme that discussed the challenges for drivers when they have more than one parking sign at one location with multiple messages based on the date or time of the day. With more data and an increased sample size, it may be possible to achieve statistical significance. This may then provide the justification for scaling the results to wider implementation. The project team ran a power analysis to determine how much more data would be required to achieve statistical significance. The analysis as 80% 'Power' determined that approximately 454 units would be required from each condition (908 total) to achieve statistical significance with the current trial conditions. Additionally, the City might consider redesigning the BI sign for future trials by separating the *Salience* and *Loss Aversion* features to help determine which might be the cause for the increased driver compliance. The project team did provide some analysis of TSZs by location in the Results section, but the results were not conclusive. This is an area the City might investigate further in future trials.

Additional Signs

Develop BI signs for a different category of parking signage (e.g., rush hour, loading zones, bus stops, commercial zones, etc.), which has a greater degree of non-compliance, and conduct a study to evaluate the effectiveness of the new sign. The team monitored the parking ticket report daily during the trial and determined that TSZs represented a very small percentage of the hundreds of other types of parking tickets being given out each day. This may have been partly responsible for the low number of parking violations that we saw in our results and may be a factor in not achieving statistical significance in the TSZ study. However, there are other categories of parking violations that have a much larger incidence. Conducting a study to trial BI signs in such a category has the potential to more thoroughly test the impact of BI-informed parking signage in reducing non-compliance. If statistically significant results are achieved that would be good justification to implement BI signs on a broader basis. At the end of the project team's presentation to the City of Vancouver Joint Transportation Branch Heads meeting, we were informed by one of the City staff that the signs were already being used in Yaletown for another type of parking enforcement.

Cost-Benefit Analysis

As the BI sign did result in a 57% reduction in violations, the City may consider conducting a cost-benefit analysis to inform the decision to develop and implement BI signs based on the principles of *Salience* and *Loss Aversion*. The BI signs are more costly to make than the traditional TSZ signs: Regular Signs cost $7.10 each, while the BI signs cost $18.00 each to produce. The higher cost is the reason the project team recommends a cost benefit analysis. A cost-benefit analysis would help the City with the decision of whether to proceed with the BI signs at the costs above. The replacement could be done over time, as older parking signs come due for replacement. Such a needs-based, phased-in approach will help defray the higher cost of the BI signs over a longer period. In terms of the cost-benefit analysis, the City might also consider a survey of the TSZ permit holders to ascertain their overall satisfaction with the TSZs they had leased.

Part H. Discussion of BI & Research Ethics

The project team felt that our qualitative research was within the boundaries of BI and research ethics. In terms of our qualitative research, we held several meetings with City staff to discuss the operations related to the TSZ process. We also conducted a qualitative survey of Vancouver drivers to learn about their experiences with TSZ signage in relation to parking. Several ethics considerations such as 'Transparency', 'Data privacy and Security', 'Nudge for Good', 'Benefit vs. Harm' were relevant for this portion of the project.

The project team was aware of 'Transparency' in all aspects of the work related to the qualitative research. There was not an issue raising the question of parking in Vancouver, as most drivers from that city have had some experiences with parking either downtown or in the suburbs outside of downtown. The team maintained 'Data Privacy and Security' by ensuring the data collected was secure and password protected. Our survey was anonymous, and we did not collect participants' names, addresses, or Internet Protocol addresses, and we made it clear that we do not ask for or keep any personal information and/or financial information in the survey. We felt that the philosophy of 'Nudge for Good' was promoted through this portion of the project as we are gathering information to develop a solution that would benefit Vancouver drivers by potentially reducing the issuance of parking tickets and vehicles being towed. The consideration of 'Benefit vs. Harm' was not considered during the qualitative research portion of the project.

In terms of the quantitative research, the project team conducted a RCT which was deployed in the field from March 7, 2021 – April 4, 2021. TSZs across Vancouver were randomly assigned to a control or treatment group based on their start dates. For this aspect of the project, the team considered the following ethics considerations: 'Data Privacy and Security', 'Nudge for Good', 'Publicity Principle' and 'Benefit vs. Harm'.

The data collected during the trial was securely stored and password protected in accordance with the 'Data Privacy and Security' guidelines. The purpose of this trial is to reduce the frequency of violations in TSZs which fits within the 'Nudge for Good' principle as this reduction could lead to less complaint calls from TSZ license holders, tickets, and tows, which benefits the driver while potentially reducing workload for City staff. This project would pass the 'Publicity Principle' as the City is hoping to reduce the frequency or TSZ violations, which could help to increase the satisfaction of drivers who may receive fewer tickets and the TSZ holders who should see a reduction in cars parked in the TSZs. The most important ethical consideration for the quantitative research would be 'Benefit vs. Harm'. When looking at trialing solutions that might affect drivers, it would be critical to ensure that the interventions being used would not impact the road safety of drivers and vulnerable road users (cyclists and pedestrians). In working with City staff, the project team were able to ensure that our solution would not contravene any road safety guidelines and that our signs would meet the national engineering standards for traffic signs.

In terms of ethical considerations for our BI solution we focused on 'Benefit vs. Harm'. This consideration is important especially looking at a solution that may influence drivers on the road which runs the risk of putting other vehicles and vulnerable road users potentially in harm's way. As stated earlier, we used *Salience* to draw attention to the TSZ signage, but we do not see our BI sign being so much of a distraction that it might impact road safety negatively during our trial.

There are no concerns that arise out of the 'Publicity Principle' as parking signs are widely used to inform the public of where and when they can park their vehicle. Therefore, there are no concerns arising from this project. We are simply making the signs more salient and are not imposing any new consequences or taking away any existing freedoms from the driver.

We felt that our use of *Loss Aversion* in our BI sign by adding the image of a tow truck and providing details to help the driver track down their vehicle would provide a better experience for the driver. At the same time, it could potentially reduce calls to the 311 Contact Centre by a driver who returns to their vehicle to find that it is no longer there, leaving them to call the City to ask for the towing company details. Ethical considerations were considered by the project team for each phase of this research project. We should note that the image of the tow truck does carry the potential of being interpreted or received by the driver as a 'negative' communication. One potential ethical consideration of the BI sign is that it may actually deter drivers from parking in the TSZ even outside of the restriction period simply because the sign is posted there, and drivers may not look closely enough to determine that the sign is in effect only for a specific time period. However, we believe that most people would benefit from being given accurate information that allows them the choice of making an informed decision.

Part I. Project Reflections

Our project has a few limitations which impact our results. The COVID-19 pandemic has brought significant changes to the driving behaviours in Vancouver. Our survey results showed that the number of people who used on-street parking prior to the pandemic dropped from 22% to 13% during the pandemic. During the pandemic many people worked from home, leading to fewer commutes. The pandemic also created a higher demand for food delivery services. All of this has resulted in changed traffic patterns and impacted the demand for parking. It is unclear to what extent the current demand for parking will change once the pandemic is over. Therefore, there is potential that our results, which were derived during the pandemic, may not accurately reflect the parking realities post-pandemic.

Observation was not feasible due to the pandemic and the restrictions on movement. Had it been feasible, it might have confirmed frequency of violations that occurred in TSZs but were not reported to the 311 Contact Centre.

The study did not include large TSZs, such as construction TSZs, filming TSZs, metered areas, and some areas where TSZ signage is not generally posted. It is possible that there are different rates of violations in these categories of TSZs than the ones we had in our study. Since these TSZs were excluded from the study, our results may not necessarily be representative of the frequency and number of violations in such TSZs.

TSZs are not a representative sample of all other types of parking violations, and this must be taken into consideration if/when generalizing the results to other types of parking signage.

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Appendices

Appendix I. Qualitative Survey

Welcome! This is a survey about vehicle parking in Vancouver. We are conducting this survey as part of a Behavioural Insights class project at UBC Sauder.

The City of Vancouver (City) is interested in learning more about the parking habits of individuals in Vancouver. The City often receives requests from businesses and residents looking to temporarily reserve all or parts of a street(s) for special projects such as construction, repair work, street cleaning, filming, or special events such as the Vancouver Sun Run, Fireworks, etc. The City therefore establishes "Temporary Special Zones" (TSZ) to temporarily restrict parking in these areas.

The information you provide us will assist the City in better serving the residents, businesses, and visitors to the City. Data will be stored on the advising professor's encrypted, password-protected computer for a period of at least six months.

The survey will take less than 5 minutes to complete. Your participation is voluntary, and the information you provide is anonymous. You may withdraw from the survey at any time by closing your browser window.

If you have any questions about this survey, you may contact the Project Team at tempstopbi@gmail.com or the Advising Professor: [David J. Hardisty], [david.hardisty@sauder.ubc.ca]

If you have any concerns or complaints about your rights as a research participant and/or your experiences while participating in this study, contact the Research Participant Complaint Line in the UBC Office of Research Ethics at 604-822-8598 or if long distance e-mail RSIL@ors.ubc.ca or call toll free 1-877-822-8598.

Clicking the button below indicates that you consent to participate in this study.

Q1. How frequently do you drive your vehicle in Vancouver, on average?

- Multiple times per day
- About once per day
- About once per week
- About once per month
- Once or twice per year
- Never

(Condition: Never is selected. Skip to: End of Survey)

Q2. **Prior to the pandemic**, how frequently did you use on-street parking in Vancouver (as opposed to private parking lots)?

- Multiple times per day
- About once per day
- About once per week
- About once per month
- Once or twice per year
- Never

Q3. During the pandemic, how frequently do you use on-street parking in Vancouver (as opposed to private parking lots)?

- Multiple times per day
- About once per day
- About once per week
- About once per month
- Once or twice per year
- Never

Q4. Please check the answer that best represents your parking habits most of the time

- I review parking restrictions and signage before parking my car
- I review parking restriction and signage after parking my car
- I review parking restriction and signage both before and after parking my car
- I am already aware of parking regulations for the parking spots I use

Q5. Examples of Temporary Parking Restrictions Signs

Sometimes people park in spaces that are temporarily restricted for parking (for construction work, repair work, street cleaning, filming, or special events such as the Vancouver Sun Run, Fireworks, etc.). See examples of temporary parking restrictions signs above.

Please rate the following for how likely these factors might be to lead a driver to park in a temporarily restricted parking spot.

	Extremely Likely	Moderately Likely	Slightly Likely	Not at all Likely
Signs and/or regulations are not easily noticeable				
Parking signs are conflicting (two or more signs in one place with different messages)				
Parking signs appear confusing (dates or times are unclear)				
Only need to park for a 'quick in and out'				
No visible Parking Enforcement Officers				
Consequences are not clear				
Lack of alternate parking options nearby				
In a rush and have no time to find alternative parking				

Willing to take a chance				
Don't care about parking regulations				

Q6. Are you aware of the current penalties for parking in a spot that is temporarily restricted for parking?

- Yes
- No

Q7. True or False: “If I park in a temporarily restricted parking spot, I will get a parking ticket.”

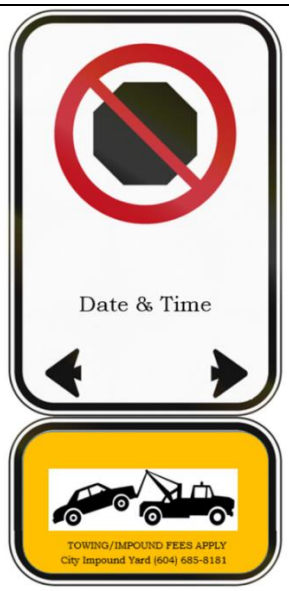
- Yes
- No

Q8. True or False: “If I park in a temporarily restricted parking spot, my vehicle will get towed.”

- Yes
- No

Q9. How many parking tickets (for parking in temporarily restricted parking spots) have you received in the last two years?

Appendix II. Evolution of the TSZ Sign Design

			
Proposed Solution. LED Lights no-go	Revised proposed solution options. First choice was the sign with the blue border chosen since the City used a blue border for signage during the Olympics. Blue border was a no-go.	Revised proposed solution with tow truck image and Impound contact information.	Addition to the tow truck image and Impound contact, showing fine amount and paid by *vehicle owner.*
			
Revised proposed that elongated sign with 'tab' showing tow warning for *vehicle owner.* Bright yellow background chosen to make the sign 'salient'.	Revised proposed that elongated sign with 'tab' showing *re-worded tow warning*. Yellow background changed to orange color with diamond grade reflectivity to make it 'pop'.	Final version of BI-informed TSZ Sign. Sign developed with mid-grade (instead of diamond grade) reflectivity due to cost considerations. Border changed to remove double lines and 'tab' feature removed.	

Appendix III. Data Collection

Data Element	Data Element Description	Source
TSZ_Id	Unique Identifier assigned to a TSZ	TSZ list from City
TSZ_Start_Date	The date when the TSZ restriction come into effect dd-mm-yyyy	TSZ list from City
TSZ_BI_Sign	Indicates whether the TSZ received the BI sign or the regular sign	TSZ list from City
TSZ_Address	Address of the TSZ	TSZ list from City
TSZ_Size	Identifies whether the TSZ was classified as 'Small' or 'Large'. This was based on the size of the TSZ (in meters) shown on the TSZ list provided by the City. 1 – Under 30 meters 2 – Over 30 meters	TSZ list from City
311_Call_Recd	Indicates whether a complaint call was received by the 311 Call Centre reporting a violation. 0 – No complaint call received 1 - Complaint call received	311 Call Report
CC_Req_#	Unique identifier assigned to the complaint call received at the 311 Call Centre	311 Call Report
Num_Viols	Number of violations reported in the complaint call to the 311 Call Centre	311 Call Report
Tkt_Ind	Indicator of whether or not a parking ticket was issued. 0 – No ticket issued 1 – Parking ticket issued	Project team based on Ticket Report from City
Num_Tkts	Number of tickets issued in the TSZ	Ticket Report
Tow_Ind	Indicator of whether or not the vehicle was towed. 0 – Vehicle not towed 1 – Vehicle towed	Project team based on Ticket Report from City
Num_Tows	Number of vehicles towed from the TSZ	Ticket Report

Data Element	Data Element Description	Source
Num_Touch_pts	Number of touchpoints by City staff to process the 311 call from start to end	Project team based on reports provided
311_Call_Status	Status of the complaint call received at the 311 Call Centre 0 – no call received 1 – call received and processed through to completion 2 – call received and subsequently cancelled	Ticket Report 311 Call Report
TSZ_Day_Type	Indicates whether the TSZ started on a weekday or weekend 0 – Weekday 1 - Weekend	Project team based on reports provided
TSZ_DT_Ind	Indicates whether or not the TSZ is located in downtown Vancouver 0 – Not downtown 1 - Downtown	Project team based on TSZ address and Downtown boundary provided by the City

Appendix IV. Detailed Results

High-level Summary of Data Analyzed

	#	%
Number of Calls to the 311 Contact Centre related to Parking Enforcement	1,731	100
TSZ related Calls to the 311 Contact Centre	64	3.7
Number of Calls to the 311 Contact Centre related to TSZs in the Study	12	-
Number of Parking Tickets Issued	19,763	100
Parking Tickets for TSZs	84	0.4
Parking Tickets for TSZs in the Study	13	-

Descriptive Statistics for Different Dependent Variables for the Regular and BI Sign Groups

	# of Violations		# of Calls		# of Tickets		% of Tows		# of Touchpoints	
	Regular	BI	Regular	BI	Regular	BI	Regular	BI	Regular	BI
Number of TSZs	68	49	68	49	68	49	68	49	68	49
Number of Occurences	13	4	9	3	9	4	7	4	26	11
Mean	0.19	0.08	0.13	0.06	0.13	0.08	0.10	0.08	0.38	0.22
Std. Error of Mean	0.08	0.06	0.4	0.4	0.06	0.06	0.06	0.06	0.15	0.16
Std. Deviation	0.68	0.45	0.3	0.2	0.49	0.45	0.46	0.45	1.20	1.09

TSZs with the BI sign had fewer tickets on average (mean=.08, SD=.45) than TSZs with the regular sign (mean=.13, SD=.49), $t(117) = .58$, $p = .57$

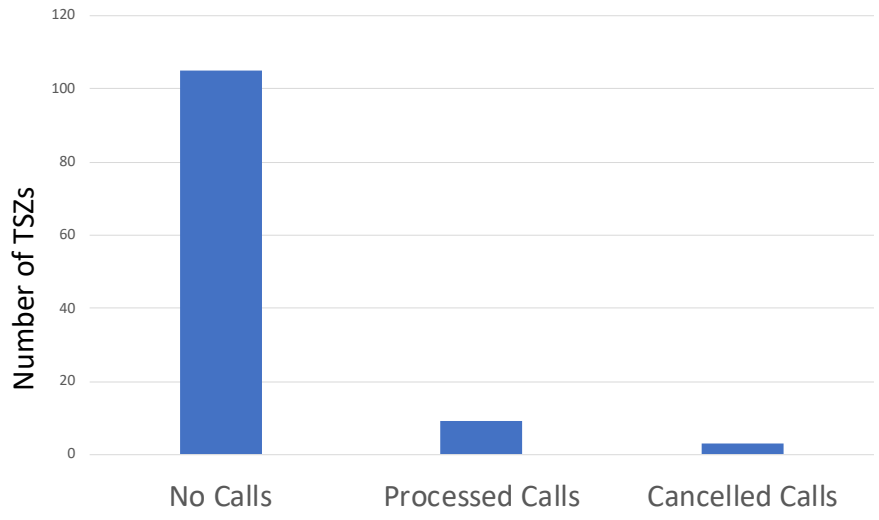
TSZs with the BI sign had fewer vehicles towed on average (mean=.08, SD=.45) than TSZs with the regular sign (mean=.10, SD=.46), $t(117) = .25$, $p = .80$

TSZs with the BI sign had fewer touchpoints on average (mean=.22, SD=1.1) than TSZs with the regular sign (mean=.38, SD=1.2), $t(117) = .73$, $p = .47$

Summary of Calls to the 311 Contact Centre, by Status

311 Call Status	# of TSZs	%
Calls Received	105	89.74
Calls Processed	9	7.70
Calls Cancelled	3	2.56
TOTAL	117	100.00

Bar Chart Showing Calls to the 311 Contact Centre, by Status



Appendix V. Glossary of Terms

City	City of Vancouver
Drivers	Commercial and recreational vehicle operators
Violation	A vehicle that is parked in contravention of the restrictions displayed on the TSZ signage
Parking ticket	A citation ticket issued to drivers who have contravened the City of Vancouver's Parking Bylaws
Parking Enforcement Officer (PEO)	City staff responsible for issuing parking tickets and for issuing tow orders to the towing company (when required)
Stakeholders	All individuals, groups or organizations who are impacted by the TSZ project
Temporary Special Zones	Areas of the City where public parking of vehicles is temporarily disallowed during the specified time period in order to make the space available for City-permitted initiatives such as Construction, Filming, Utilities works, Special events, etc.