Improving the Straeto Bus System

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Abstract

This project, completed at WPI in collaboration with the Straeto bus company in Iceland, identified methods to improve Straeto's bus system to better serve university students during the COVID-19 pandemic and beyond. Based on interviews with Straeto employees, a focus group of international students, and a survey of Reykjavik area university students, we provided recommendations to guide Straeto towards more efficient and customer friendly services.

Acknowledgements

Authorship

Sean Barry was the primary author for the abstract, sections 2.2, 2.4, 2.5, 5.4, appendix F, and much of the background. He was also the secondary author / researcher for sections 2.1, 2.3, 3.2, 3.3, 4.2, 4.3, as well as general editing and proofreading of the introduction, chapter 4 and chapter 5.

Sam Bello was the primary author of the final Executive summary, primary author and researcher for sections 2.3.1 and 2.3.2, secondary author for section 3.3, and primary author of section 4.3, 5.2, and Appendices A and E. He also contributed to the general editing and proofreading of every section and managing and compiling the survey results.

Matt Plympton was the primary author for much of the introduction, sections 2.1.2, 3.1, 4.1, and 5.1. He was also the secondary author/editor for sections 2.2, 2.4.1, 2.5, 4.2, and Appendix F. He did much of the proofreading for chapter 4 and some for chapter 5.

Chris Vieira was the primary or secondary author on sections 2.1, 2.1.2, 2.4, 2.4.1, 3.3, 4.3, and 5.3. He also contributed to general editing of every section/appendix along with helping transitions between chapters, such as those at the end of chapters 4 and 5.

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Executive Summary

Understanding exactly what the customer demographic is and what those customers need has been a recurring problem for companies around the world. As the primary public transportation company in Reykjavik, Iceland, Straeto managers have wanted to improve communications with one of their sizeable customer bases, university students. Straeto has a sincere desire to make their service more appealing and useful for these students.

The goal of our project was to provide Straeto recommendations on how to tailor services to the needs of university students during COVID-19 and beyond. Straeto wanted to get feedback on its current student customers' wants and needs so that these students will be more incentivized to ride Straeto buses more frequently. By having customers use the bus more often, they hope to reduce carbon emissions by helping to cut down on the large number of cars being used in Iceland, including by university students. This is important to Straeto because preserving the environment is a priority for both Straeto and Iceland as a whole.

We established three objectives to help Straeto achieve their goal. The first was determining where university students from Reykjavik University and the University of Iceland want to go in and around the Reykjavik region. The second objective was finding how people plan to get these locations (whether it be by buses or alternative forms of transportation). Lastly, the third customer satisfaction with the current service, including COVID-19 preparedness.

These objectives were completed by means of interviews, a focus group, and a survey. One of the main methods we used to achieve these objectives was by interviewing Straeto employees who used the Straeto system themselves. We inquired about the COVID-19 response and other factors surrounding riding the bus. Additionally, we surveyed student bus riders about the general cleanliness, safety, reliability, ease of use, and many other factors that characterize

Straeto buses and the service they provide. We also conducted a focus group with American students who had traveled to Iceland to gather insight into why they chose to use various forms of transportation and what improvements could be made to the Straeto system.

Holding a focus group with the American students who had lived in Iceland provided a unique perspective because as international students, they had some translation problems and language barriers to overcome while using the Straeto system. These problems the international students faced are presumed to be nearly identical to those of tourists, so talking with the international students provided information to us that will also help Straeto improve their service for tourists as well.

The results of our research with university students offers clarity regarding their travel patterns, needs and desires. For example, one interesting result was that 52 out of the 94 students who completed the survey did not ride the bus. Among those students who do not use Straeto, the most common form of transportation was a private vehicle. Aside from that, responses also indicated that e-scooters, biking, and walking were commonly used. This brings into focus the problem of the "last mile". The "last mile" refers to the short trip from the bus stop to one's desired destination. As a result of this, we recommend that Straeto partner with the e-scooter or bike rental companies to help address this problem of the "last mile".

Another finding from our research was that the Straeto mobile phone application needs improvement. There are some cosmetic changes, such as icons, which we recommend be updated as well as some content and features, such as a bus stop annunciator for non-native speakers, improved service update translations, and reference points within the app for bus stops. Many of these recommendations will benefit not only international students, but also tourists.

After analyzing our results and conducting supplemental research, we identified several recommendations involving the bus stops. The bus drivers feel riders do not make their intentions to get on the bus known, while riders feel bus drivers do not see them. To resolve this, we recommend a signal light system on each bus shelter that will light up to make it easy for the bus driver to spot riders at stops. We also recommend that the stops be renamed using a simple letter and number sequence as a longer-term effort to make it easier to navigate without knowing Icelandic and to understand the route better in general.

We also recommend that Straeto review its bus servicing schedules and protocols based on our findings. We found that some buses repeatedly break down or malfunction and may no longer have comfortable seats due to being worn out. This was said to be especially prevalent in some of Straeto's original buses, which are still in use and now 20 years old. We recommend that at minimum the seats and foam be redone in these older buses to increase driver and rider comfort. Moving forward, we recommend that during Straeto's continued purchase of new electric buses, those buses include wheelchair accessibility and electrical outlets because our survey found those to be desired by riders. We believe that after instituting these recommendations, Straeto will be able to much better serve their student customer base, as well as their general customer base.

1 - Introduction

Public transportation is one of the key elements of a city's infrastructure, and it takes research, troubleshooting, and experience to be able to operate and maintain a well-running system (Angel Grajeda, personal communication, 4/20/2020). The days of bus tokens and exchanging cash with bus drivers are likely over. Recent developments and updates to almost all successful systems include reusable fare cards, electronic ticket machines (ETMs), and even phone apps that allow users to utilize their phones to pay for fares without ever touching a physical ticket (Saha, 2016). Given the ability for COVID-19 to spread over objects, having less exchanges of cash or tokens is that much more important. Public transportation is a less wasteful way to get around that can save one money, yet its popularity still remains low (Shapiro, 2016). The city of Reykjavik, Iceland, has only one bus company, Straeto, that provides service to the city and the capital region surrounding Reykjavik (Haraldsdóttir, n.d.).

The system is well-used by residents. Strætó's service has had an important impact on the areas in which it operates and has served most people living in this urban region (Sigriður Harðardóttir, personal communication, 4/14/2020). Despite this, many residents opt to use their private cars instead. With fewer people using public transportation, more air pollution is being created by the many vehicles being used (Shapiro, 2016). Since Iceland cares about its environment, it makes sense to have more people use public transportation. COVID-19 has led to changes in the way many live their lives, including needing to often wear masks or stay 2 meters apart from other people. Due to these precautions just recently being put in place, Straeto was not clear how well their COVID-19 precautions and other aspects of their service were being received by their university student customer base.

Urban growth has forced most cities to provide better transportation systems for people to move around, and as a result there are many stellar examples of successful public transportation systems. For example, the CTA, or Chicago Transit Authority, transports around one and a half million people per day around a city with a population of less than three million (Angel Grajeda, personal communication, 4/20/2020). Another exemplary system is the Zürcher Verkehrsverbund (ZVV) (2018) in Zurich, Switzerland, where it was found that about 32% of all travel in the city was by public transportation. Both of these systems use well maintained and organized buses, trams and trains, along with careful planning to efficiently and swiftly transport great numbers of people every day, in a comfortable fashion. They are excellent examples that other cities could follow and learn from.

Since Reykjavik and the capital region is the most populated area in Iceland, the city offers a number of transportation methods to help visitors, residents, and students get around. In addition to the buses, other options include bikes, e-scooters, taxis, and personal vehicles. The most comprehensive public option in the city, though, is the Straeto bus company (Sigriður Harðardóttir, personal communication, 4/14/2020). What Straeto has not yet done is discover exactly how satisfied university students are with Straeto's bus service and its COVID-19 regulations, which could help Straeto to improve its service and increase ridership. Straeto is looking to build knowledge of its student customer base. This can help with this effort and cut down on the number of university students using private vehicles, which currently is the primary source of transportation for the majority of students (Sigriður Harðardóttir, personal communication, 4/14/2020; Iceland Monitor, 2018).

In this project, we identified ways to improve Straeto's public transportation service, specifically looking at ways to serve university students better. We did this through a survey of

Iceland university students, a focus group of WPI students who went to Iceland, and interviews with Straeto employees to gather information on how satisfied customers are with each step of using the bus system. We found that Straeto had overall handled the pandemic and day-to-day operations very well, though some improvements could be implemented. We found that some customers were not satisfied with the clarity of the Straeto app, the naming scheme of bus stops, the condition of some buses, and several other key areas. We have provided several recommendations such as a collaboration between E-Scooter companies and Straeto, improvements to the Straeto app, changes to the bus shelters, and improvements to the buses themselves. Through these recommendations, we believe that university students will not only be more satisfied with Straeto's buses, but also be more likely to take the bus when given the choice.

2 - Background

Overpopulation and all the consequences that arise from it are causing unprecedented global problems on a massive scale (Gibbs, 2020). Among these are the problems of traffic congestion and increased pollution. The ways some cities are mitigating these problems are through maximizing the use of public transportation and encouraging more frequent use of it (Angel Grajeda, personal communication, 4/20/2020). A related concern is how to reduce carbon emissions as much as possible in order to limit climate change. These two factors lead to the need for an efficient and environmentally friendly public transit system, especially in areas that are more densely populated. COVID-19, however, is making it much more difficult for public transportation companies to increase ridership. Private vehicles are generally safer for the user, reducing their chance of catching COVID. This means that public transit companies need to make sure they alter their services to better follow COVID-19 mitigation guidelines. In this chapter, we will discuss the importance of public transportation, the alternatives to public transportation that exist, public transportation case studies from Chicago, Illinois, and Zurich, Switzerland, COVID-19's impact on public transportation, and the current transportation situation in Reykjavik, Iceland.

2.1 - Importance of Public Transportation

In this section, we discuss the benefits associated with several forms of public transportation based on several studies, reports, and news articles. One study conducted by the Division of Waste and Hazardous Services (n.d.) in the United States found that a single bus with only seven passengers is more fuel-efficient than the typical single-occupant automobile used for commuting. They found that buses emit only 20% as much carbon monoxide per passenger mile as a single occupant auto. Carbon monoxide, though lesser known compared to carbon dioxide, contributes to the number of greenhouse gases (GHG) that are linked to climate change

(Department of the Environment, Water, Heritage and the Arts, 2009). Similar low GHG emission trends are seen with different forms of public transportation, such as the use of trains. For example, the fuel efficiency of a fully occupied train car is 15 times greater than that of the average commuter's single occupant auto. This highlights how much better public transportation is in terms of fuel-efficiency and negative environmental impacts compared to the use of cars.

An important feature of public transportation is its ability to reduce environmental impacts over time through the introduction of new, cleaner technology. One recent development is the introduction of hydrogen-fueled buses (Hydrogen Europe, 2017). The European Union has distributed funding to support this project, some of which is going to countries such as Iceland (Dalrymple, 2018). These buses are much more efficient in terms of fuel usage. Hydrogen Europe reports that while some older municipal buses still consume well over 20 kg of hydrogen (instead of 40 liters of diesel) per 100 km, newer fuel cell buses now use only eight to nine kg per 100 km. This gives these new buses an energy efficiency advantage of around 40% as compared with diesel buses. What makes the use of the Hydrogen fuel cells that are used in these buses beneficial environmentally is that it is possible to produce the fuel in an eco-friendly manner (Alternative Fuels Data Center, 2017). One such method is Electrolysis, which is able to produce hydrogen from water and only requires electricity to complete the process. Currently, the more popular method of gathering this fuel is gasification. This process relies on using natural gas and high-temperature steam. Iceland, however, generates a large portion of its power using renewable energy sources, reporting 85% of its yearly energy as being renewable in 2011 (ASKJA Energy, 2011). This power mainly comes from geothermal and hydropower sources. This would allow Iceland the potential to produce hydrogen, using electricity gained through

their renewable sources of energy, in a sustainable way. Adopting this technology would reduce carbon emissions in Iceland.

Another positive outcome of public transportation is reduced traffic congestion. Traffic is always an important factor to consider when discussing transportation. One study in the U.S. found that a lack of public transportation would have severe detrimental effects (Anderson, 2013). Using a regression discontinuity design, researchers found that the average highway delay increases 47% when public transit services stopped operating. This shows a significant increase in delays without public transportation, especially considering that public transportation only accounted for 1% of United States passenger miles.

Public transportation can have many benefits when implemented correctly from an economic perspective. A study was conducted in Nigeria in which the environmental and economic impacts of the passenger transport sector were analyzed (Gujba, 2013). The author used the findings to make predictions for the next 17 years based on several different scenarios. First, if there were an increase in the use of buses, there would be a reduction in the environmental impacts by an average of 15–20% compared to BAU [Business As Usual]. Not only would an increase in bus use reduce environmental impacts, but at the same time, the total fuel costs would be 25–30% lower. Granted, an argument could be made that if cars were used instead of buses and simply became more fuel-efficient over time, then similar results could be achieved. However, this study also found that if business continued as usual, the environmental impacts would be doubled over the same time frame. This is despite the assumption of fuel and vehicles being as much as 35% more efficient as time progresses. In addition, the total fuel costs at the sectoral level would increase three times from 2003 to 2030, starting at US $3.4

billion/year in 2003 and rising to US $9.7 billion in 2030. This would result in savings in fuel costs across an entire population in the range of billions of US dollars.

In sum, there are many benefits to using public transportation, including environmental, economic, and traffic benefits. There is general agreement that the use of public transportation is beneficial.

2.1.1 - Factors Affecting the Use of Public Transportation

Worldwide, there are several differences among factors that generally affect people's rating of a bus system. Some of the most important things people value if they have already ridden buses are the cleanliness and comfort of a bus, while the least important are the kindness of the bus driver and the time spent on the journey (dell'Olio, 2011). For new riders, they are most often concerned about waiting time, journey time, and how crowded the bus is. These factors are further magnified by the drastic impact COVID-19 has had on the world, and the guidelines put in place to help prevent its spread (Sigríður Harðardóttir, personal communication, 4/14/2020).

2.1.2 - Student Use of Public Transportation

Students of are one of the unique groups to use public transit. Two universities that highlight this are the University of Iceland and Reykjavik University. The University of Iceland is the largest university in Iceland, having 13,333 students registered for the 2020-2021 school year (Guðmundsson, 2020). Given the large number of students, the university does not provide or guarantee housing for all registered students (University of Iceland, 2020). The Reykjavik University (RU) is a smaller school with only 3,500 students but has a similar housing situation (Top Universities, 2015). The university recently finished its first on-campus housing building in August 2020, and it has 122 rooms (Reykjavik University, 2020). There are 3,500 in a typical

student population at RU, and a rough estimate of those who can live on campus would be 500 students. This means that most of the students, at around 3000, need to live off campus.

Students in these areas all have a very similar need, which is to be able to transport themselves to campus for classes. Whether this be walking, driving a car, or taking some form of public transit, they must use some method to move themselves from their current residence to the campus. This group is important to consider because of how necessary transportation is for them. What sets aside students compared to another group, say the common 9-5 worker, is they have a variety of busing schedule needs. Some students may have classes in the mornings they need to get to and would head home in the afternoons. Alternatively, other groups of students may have their classes primarily in the afternoons or evenings. This is important as it makes every student's transportation schedule needs potentially different from those of the rest of the population. This diversity in transportation times requires having constant busing service throughout the day instead of just having more service during workday rush hours.

2.2 - Tourist Use of Public Transportation

One reason some tourists prefer to use public transportation while others do not is because of the type of culture a tourist comes from. Certain countries, like Korea and Japan, have more collectivist cultures, meaning "each person is encouraged to be an active player in society, to do what is best for society as a whole rather than themselves" (Psychology Wiki, 2020, para #5). People from this kind of culture are more likely to use public transportation due to it being better for the community, as can be demonstrated in Japan and Korea. These two countries have the largest number of annual journeys via public transportation per capita in the entire world, as shown in *Figure 2.1.*
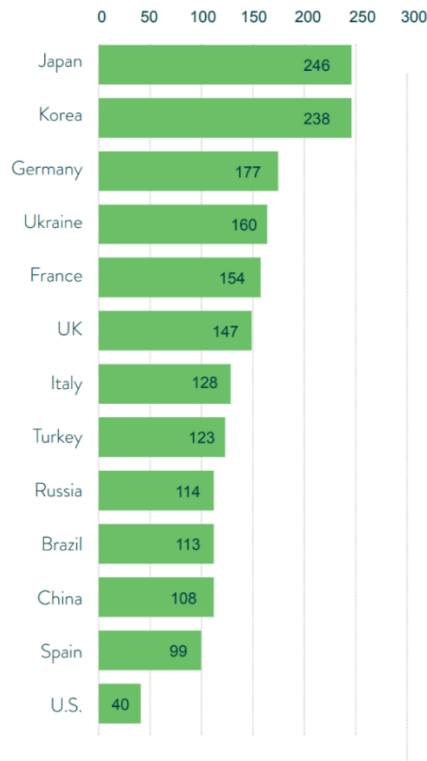
Annual journeys per capita in large countries (2015)

Figure 2.1: Annual Journeys Via Public Transit Per Capita in the World (Saeidizand, 2017)

Societies with more individualist cultures, such as in the United States, have a more self-centered point of view, where one's personal rights and well-being are more important than that of the community (Psychology Wiki, 2020). People from countries with this type of cultural norm are less likely to ride public transportation, and more likely to use personal vehicles because that gives them a sense of self-sufficiency. This can also be inferred from *Figure 2.1* as the U.S. has the lowest ranking of the countries being compared.

2.3 - Public Transportation in Selected Locations

There are numerous examples of successful public transportation systems both in the United States and Switzerland. The Cities of Chicago, Illinois, and Zurich, Switzerland, have

made their systems both accessible and appealing to tourists and citizens alike and are possible models for what Straeto may want to achieve in Reykjavik.

2.3.1 - Chicago, Illinois

One example of a stellar public transportation system is in the city of Chicago, Illinois. The Chicago Transit Authority (CTA) runs the buses and trains throughout the city, and the system is quite successful with over 468 million boardings in 2018 alone (Rackl, 2019). In fact, between the buses and trains, the CTA handles almost 1.5 million riders per day (Angel Grajeda, personal communication, 4/20/2020). This is quite impressive considering the population of Chicago is just 2.7 million.

In general, subway and bus use in Chicago is high when compared to public transportation use throughout the U.S. as a whole (Schutz, 2016). Eight percent of all travel within the city was found to be via public transportation, while the average for the U.S. was just one percent. The CTA system is so good that it is easier to get around by public transportation than a car within the city limits, and it has even become a tourist attraction itself (Angel Grajeda, personal communication, 4/20/2020). Tourism in Chicago reached an all-time high of 58 million visitors in 2018, and the CTA is taking measures to be tourists' preferred mode of transportation (Hunt, 2011). Shortly after travelers arrive at Chicago's airport, they will find CTA information booths with foreign language speaking personnel and signs advertising the languages each employee speaks (Angel Grajeda, personal communication, 4/20/2020). Additionally, the CTA has developed a 24-hour fare card and print and virtual materials to make getting around easier for visitors (Chicago Transit Authority, 2013). These include a brochure specifically for tourists providing directions to common attractions and a night bus map. The brochure provides tourists with information about what line, stops, and transfers they need to use to reach attractions as well

as a map specifically showing attractions and their relation to the CTA lines. The CTA website also lists numerous popular destinations in a user-friendly database, which provides the walking directions and routes to get there via any applicable transit lines. The CTA has a dedicated "Night Owl Map" for any visitors (or residents) who are unfamiliar with what transit lines run through the night, which makes it extremely easy to see how to get around if one is not familiar and out at night, as is typically the case with many tourists. Lastly, the CTA makes an effort to coordinate with the planners of large events happening within the city to increase the service of buses and trains in order to accommodate increased usage related to these events (Angel Grajeda, personal communication, 4/20/2020).

According to the monthly ridership reports, these methods to attract tourists are working as the CTA system, in 2019, had a total of 38.6, 39.0 and 39.3 million riders in June, July, and August, respectively (Chicago Data Portal, 2019). These numbers compared to 34.6, 33.5, and 34.6 million boardings in December, January, and February, respectively. This shows an increase in the number of people using the system during the summer (tourist months). These differences range from three to six million and are quite significant. These differences are likely the result of tourism (Angel Grajeda, personal communication, 4/20/2020).

The CTA's Marketing Manager Angel Grajeda (personal communication, 4/20/2020) believes the small details are what make the difference. Looking forward, the CTA is continuing to modernize in many areas. Introducing free Wi-Fi in stations and buses is among these improvements. Additionally, their fleet of electric buses is also growing dramatically, and bus-only lanes are being built to increase timeliness and reduce traffic, as well as the purchase of many new trains to be put into use in just a couple of years. Throughout the COVID-19 pandemic, the CTA has made changes to ensure regular disinfecting of all high–touch surfaces in

buses, but also in stations. Cleaning occurs before every service and during the service run as well. The CTA is also strictly following all federal and state regulations regarding COVID-19 safety including social distancing and face mask requirements.

2.3.2 - Zurich, Switzerland

Another city that has public transportation down to a science is the city of Zurich, Switzerland. The Zürcher Verkehrsverbund (ZVV), which runs throughout Zurich, is a comprehensive and dense network of buses, trolleys, trams, and trains (My Swiss Alps, 2020). In fact, the system is so comprehensive that the travel website cited above states "A car is absolutely not necessary to get around; it's more a burden than a benefit" (para 1). Research has shown that Zurich residents travel an average of 36 kilometers every day, and 32% of this travel is via public transportation. Additionally, it was found that one out of every two people prefers to use the public transportation system for transportation to school or work (ZVV, 2019a). Furthermore, ZVV currently offers 70% handicapped accessibility at train and trolley stations, with plans to be 100% accessible with all trains, trolleys, and buses by 2024 (ZVV, 2019b).

In addition to having an extensive and accessible transportation network for tourists and residents alike, the ZVV (2019b) also offers a unique option for tourists. The company offers the Zurich Card. This card can be purchased for a flat fee at the beginning of one's trip, and it entitles the cardholder to unlimited travel on the public transportation system for anywhere from one to three consecutive days, depending on one's trip length. In addition to unlimited transportation, ZVV has partnered with many local shops and restaurants offering cardholders a discount. Furthermore, the card provides either free or reduced admission into 40 museums around Zurich and 50% off city tours as well as cable cars and cogwheel train experiences (Get Your Guide, 2020). These perks are intended to persuade visitors to both use public

transportation and also to visit local shops, attractions, and stores. So, this card not only encourages tourists to use public transit, but it also encourages them to support the local economy. It accomplishes this by offering discounted activities and services. Additionally, the card itself brings in additional revenue on its own as the card costs $29 per person per 24 hours. It is essentially a win-win scenario for both Zurich and the tourists alike as it offers great deals on many activities and places that tourists are likely going to visit anyway.

Reports have shown that this card has been a success. In 2018, 67,641 cards were sold (ZVV, 2018). This was a 4.1% increase over the previous year. Contributing to evidence that Zurich is a seasonal destination is the fact that the months of June and July made up 29.1% of sales. The 24-hour ticket and 72-hour ticket sold approximately 37,500 and 30,000 units, respectively. Notably, the most Zurich Card sales occurred at the airport counter (21.5% of sales), and the main train station and the service center both sold ~15%. This is notable as it shows where tourists are most likely to be exposed to these transportation-related offerings. All of these are reasons why the ZVV system in Zurich is excelling at providing transportation for residents and tourists alike.

2.3.3 - Los Angeles, California

Some urban locations also introduced other methods of transportation that are less traditional than trains and buses. One area that has had an extremely effective implementation of dockless scooters is in California. Companies such as Lime, Bird, Spin, and Metro have all gotten in on the implementation of e-scooters in Los Angeles. The daily rentals are cheap and have been an extremely popular way of traveling while still taking in the city. One company, Metro, which also provides a bus and train service around the city, has added the ability to use

one app to pay for buses, trains, and e-scooters and has reduced the cost of the e-scooter rentals to be the same as a bus or train ride (Walker, 2018).

To speak to the naming scheme of one part of the metro, the subway system displayed a system that has a letter and color associated with each route (Wanek-Libman, 2018). The same letter is always paired with the same letter, not relying on the customer to be able to distinguish colors to determine a line. This prevents their colorblind customer base from being excluded. The color is used more as a way to help passengers that can distinguish colors with a certain line in particular. For example, this could be the red line A or the blue line B.

2.4 -Transportation Alternatives

While public transportation is a main form of transportation in urban areas, it is important to compare it with all the other possible forms of transportation that are used throughout the world. Alternatives to public transportation consist mainly of privately-owned vehicles or walking (Division of Waste and Hazardous Services, n.d.). The vehicles include but are not limited to cars, motorcycles, bikes, taxi services, and ridesharing services.

Cars are one of the most popular types of vehicles worldwide, being the primary form of transportation in some countries. In 2010, 95% of American households owned cars, while 85% used them to go to and from their place of employment each day (Robin, 2010). In Iceland, in 2016 there was a ratio of 711:1000 for the number of passenger cars to the number of people in Iceland (Iceland Monitor, 2018). In countries such as these, cars dominate the transportation sector, especially in more rural areas. A car gives the owners more flexibility and control over their own schedules compared with other forms of transportation, though they do have plenty of negative consequences when used in cities, such as those mentioned in section 2.1.

Motorcycles fall under a similar category of personal private vehicles. The popularity of motorcycles is much different than that of cars as it depends much more on the region. In Iceland, for example, they are not very popular. They are more commonly used as vehicles that can be rented for tours or for recreation, not necessarily a frequent form of transportation (Book Motor Cycle Tours, 2020).

Other forms of transportation that exist in cities are bicycles, walking, and ride-sharing services. In the past decade, bicycles have increased in popularity in cities due to the introduction of bike-share systems (Bureau of Transportation Statistics, 2018). The United States highlights this form of transportation as being incredibly popular. As of July 2018, there were 85 cities with bike-share systems. In the most recent decade, bike-share systems have also seen a massive increase in users. Bikeshare ridership increased from only 320,000 in 2010 to over 35 million in 2017. This form of transportation has emerged recently due to its low cost and ease of use, and the fact that bikes take up much less parking space in a crowded city. There are also many health benefits from biking to work, with one study finding that those who were more active and biked to work had a decreased risk of mortality by about 40% (Andersen, 2000). One disadvantage of bikes is they are inefficient for traveling longer distances (Angel Grajeda, personal communication, 4/20/2020). Bikes serve as more of a complement to buses and trains than a direct replacement. Walking provides the opportunity to get more exercise while traveling as well. A similar study also concluded a lower mortality rate in test subjects who averaged higher step counts per day (Saint-Maurice, 2020). Walking is popular in US cities as a means of getting to work (Florida, 2019). In New York, for example, roughly 6% of people walked to work.

Though people using their privately owned cars make up a major portion of the transportation sector, the use of cars as taxis and ride-sharing services is also important. Taxi

services worldwide generated revenue totaling over 302 billion USD in 2019 alone (Statista, 2020). Uber has grown immensely since its founding in 2009, affecting numerous people's daily lives (Mansoor, 2020). One report stated that as many as 14 million Uber trips were completed each day as of March 2020, with 3.9 million drivers and 75 million passengers currently registered in their service. These services give users the comfort of a passenger vehicle without the need for a parking space. It is something that may be ideal for users where public transportation is not available. In sum, of the many forms of transportation that exist in urban areas, personal cars, bicycles, taxi services, and ride-sharing services are responsible for a significant percentage of the total number of person-trips taken.

2.4.1 - Other Forms of Public Transit

There are many types of public transportation systems that exist worldwide in addition to buses. These range from trams, trolleys, trains, subways, ferries, and other options. We will focus on three of these options: trams, subways, and trains.

Trams can serve as an important form of transportation that can be introduced to a population already focused on using cars, buses, and other standard vehicles. As previously touched upon, the transportation system within the city of Zurich, Switzerland, consists largely of trams. The tram system is so comprehensive that there is essentially a tram stop every 1,000 feet along with a map and ticket machine at each stop (Bangoura, n.d.). The tram system is the backbone of public transportation and is supplemented by buses and trolleys. Within the city, there are over 100 miles of routes and the system services over 200 million people per year (Spring, 2011). As another example, we can look at the Yarra Trams (2020) network that exists in Melbourne, Australia. This system is quite large, having over 250 km of track and serving over 200 million annual trips. Just as important is that 75% of their network is shared with other

vehicles. This mainly consists of their network existing along with road systems that are already used by other forms of transit. This can allow an area to more easily introduce this system due to the road network that already exists since it allows other forms of transport to still move around as they did before the tram system.

Subways can also move many people from location to location very quickly in more densely populated areas. This system is usually seen in large cities such as New York City, where in 2018 there were roughly 1.7 billion riders (Metropolitan Transportation Authority, 2019). New York City has the largest subway system in the world, having larger ridership numbers than the bus systems run by the Metropolitan Transportation Authority. During this same year, there were a reported 690 million riders on their two bus systems. The sheer number of riders that the subway system can accommodate shows its success in being able to move massive numbers of people around satisfactorily.

Trains can allow users to travel long distances. As an example, we will look at the train system in Switzerland. Swiss citizens are reported to have traveled more by train than citizens of any other country in the world, averaging roughly 2400 km per person every year (Discover Switzerland, 2020). Transport systems often are based around cities or smaller areas, such as the subway system previously mentioned in New York City. Switzerland's train system, however, highlights how it can successfully enable people to travel long distances. It is also able to do this at speeds that make traveling these distances manageable, with trains traveling up to 250 km per hour. This allows large distances to be covered throughout the country in a reasonable amount of time.

Public transit exists in many forms in cities throughout the world. We have found that each type of transport has unique benefits and unique shortcomings

2.5 - Current Transportation Situation in Reykjavik, Iceland

Straeto is the main bus company in the city and has no direct rivals to compete with (Haraldsdóttir, n.d.). On top of that, Reykjavik also is missing rideshare platforms such as Lyft and Uber, as well as trains, trams and ferries. However, there are some other alternative methods of transportation that help get people around the city (Mansoor, 2020).

There are two main taxi companies in Reykjavik, both of which provide helpful services (Visit Reykjavik, n.d.). Taxis in Iceland provide private guided tours, transfers, and even a hotel shuttle service to get you, your bags, and fellow travelers to your hotel with ease. If need be, these companies also offer more niche services like limousines. The taxis tend to be expensive, however, charging around US $85 per hour for four people, so they are mainly used by tourists who have limited access to other forms of transportation.

While there may not be other widely available public buses to take a visitor around the city besides Straeto, there are numerous bus tours in Reykjavik (Extreme Iceland, 2020). All offer similar trips to popular Iceland destinations, such as the golden circle, Game of Thrones filming locations, coastlines, lagoons, and even trips to see the northern lights. These trips run throughout the year, and some include accommodations at hotels. All the information you need to go on one of these tours is provided to you online, including the itinerary, clothes you should bring, where you will be dining, etc. The tours are a great way to experience Iceland, so it is mainly tourists who use these services.

Like other cities, Reykjavik offers several rental services for people to get around. One of these is bicycle rentals (Reykjavik Bike Tours, 2019). Available all year round, you can rent a bike for any amount of time that you want and use it to get around the city. Like buses, there is one main company that offers bikes to people in the city. The company provides many types of

bikes to suit your needs; you can tour the city, go mountain biking, or just get a workout. The limitation is that the bikes are only available at limited locations, and they are rather expensive to use at $25 per hour USD.

Recently, electric scooters have exploded in popularity (Zolo, 2019). They are a good way to get around, inexpensive, and are environmentally friendly, and Reykjavik is well suited for them. In Reykjavik, there are only two companies that rent these e-scooters. These scooters have many benefits over previously mentioned public transportation methods. They are widely available around the city with multiple locations to pick up or return your scooter to, and they are quite inexpensive compared to more widely used methods of transportation, being US 69¢ to unlock and US 22¢ per minute until returned which translates to around $14 for an hour in USD. The company, Zolo, offers a free companion app to make using the scooters as easy as possible. The scooters have lights, brakes, and can reach speeds of 15 miles per hour. Since they are easy to use, convenient, and inexpensive, electric scooters have become a very popular method of transportation in the city.

By far the most popular method of transportation in Iceland is cars, with 711 registered cars per 1000 people, the second-highest number in Europe (Iceland Monitor, 2018). In fact, this number is still on the rise in 2020. Cars are popular in Iceland because they are faster than public transportation, and they provide more security and individuality. Although cars are very popular, the large increase in their number is causing some problems. While it can make sense to own a car in Reykjavik, as explained above, cars produce more emissions, take up more space, and cost more than public transportation (Shapiro, 2016). In fact, Iceland has the third-highest gas prices in the world, at around US $6.51 for a gallon (Campervan Iceland, 2020). On top of this, the challenging environment of Iceland makes car maintenance more expensive and more frequent.

In Iceland, companies offer extra insurance to cover damage done by sand and ash (Moon Travel Guides, 2016). Also, tourists present a special challenge for Iceland drivers, with their accident numbers doubling between 2010 and 2015 (Gunnarsson, 2015). This is due to an unfamiliarity with the weather and types of roads present in Iceland. Lastly, the large increase in the number of cars is greatly contributing to pollution, which goes against what Icelanders want for their country.

2.5.1 - Cleanliness & Comfort

Straeto buses are, for the most part, clean and comfortable, both in the buses and at the waiting areas (HuskerAV8R, 2018). The stops are bright red with a Straeto logo, so they are easy to find, and the buses themselves have comfortable seating. The buses generally run three to four minutes behind schedule, and for some riders who are concerned about waiting time, this short delay may be an issue.

Straeto has implemented several measures to help customers stay safe during this pandemic. To ensure customer satisfaction and safety, when riding the bus for longer than 30 minutes, a mask is required. Regular cleaning and disinfecting have also been adopted. Social distancing is also always enforced, and they also have restricted the times that the buses are out, limiting customers' and employees' potential exposure to COVID-19 (Sigriður Harðardóttir, personal communication, 8/31/2020).

2.5.2 - Ease of Use

Most people visiting the city of Reykjavik should be aware of the bus as an option, as there are many bus stops and stations around the city, each with bus maps displayed for people to see (Haraldsdóttir, n.d.). Buses can generally take riders to within about 100 meters from where they wish to go in the city, so there is no worrying about whether a bus can reach one's desired

location, assuming the rider takes the correct bus. For people living in Iceland, Straeto buses are extremely accessible, but for international students (and tourists), there are several reasons why it might be daunting to ride the bus. The first reason is a language barrier that may be present due to the fact that the bus drivers speak Icelandic and sometimes English, but for students from other countries where people don't speak those languages, this is a difficult barrier to overcome. The callouts and electronic screens displaying the name for each stop are also only in Icelandic and English, which could cause passengers to be afraid that they would miss their desired stop. Another factor, as previously discussed, that could affect an international university student's or tourist's willingness to take a bus would be whether they are from a collectivist or individualist culture (Psychology Wiki, 2020).

Although it has close to a monopoly on public transportation in the city, Straeto still has many innovative and modern features to offer its riders (Haraldsdóttir, n.d). The system consists of 27 routes inside of the city and 21 routes outside of Reykjavik to maximize efficiency and convenience for riders. Additionally, Straeto has frequent user bus fare cards and even a new phone app for both Android and Apple users, which locals and tourists alike can use to pay their fares. Some other convenience features Straeto offers are: free WiFi on buses, late-night bus service on Friday and Saturday Nights, and permission for a rider to bring a bike on board, if space permits. Below, Figure 2.2 shows a map of the bus routes throughout Reykjavik, with the locations of Reykjavik University and University of Iceland represented by a red and black X, respectively.

Figure 2.2: Map of Bus Routes Throughout Reykjavik (Parker, 2020).

People with mobility disabilities generally have the same access to the bus system as other users, but there are some cases in which they are unable to get on buses (Straeto, 2019). For example, buses that operate outside of the capital area of Reykjavik do not have access for wheelchairs, and even buses inside the city only have room for one wheelchair each. They do, however, have several accommodations and safety regulations in place to ensure people with disabilities can access the buses just like any other person. Bus drivers will assist with opening the ramp for wheelchairs, and they have straps in place to ensure the wheelchair is held in place.

2.5.3 - Climate & Weather

Iceland's climate sits on the cold side of mild, with temperatures ranging from -10°C (14°F) to +10°C (50°F) in the winter, and 7°C (44°C) to 25°C (77°F) in the summer. Despite the temperature being fairly mild, the weather is almost completely unpredictable. As far as weather goes, any day can go from gorgeous and sunny to a raging blizzard in a matter of hours. Daylight during the summer lasts up to a full 24 hours, while daylight in the winter can last as few as four to five hours.

2.6 - Summary

We have discussed the value of public transportation, from its positive economic factors to its reduced effect on the environment. We have also discussed the COVID-19 pandemic's effect on these systems and how public transit is handling the ever-changing situation. For example, there is the new importance of sanitizing public spaces and maintaining adequate social distances from others. This could change the way students use and interact with public transportation, so it is important to understand the effects COVID-19 is having on them. In the following chapter, we will explain how we carried out research to provide solutions to Straeto's unanswered questions regarding students' satisfaction with the Straeto system.

3 - Methodology

In order to provide Straeto recommendations on how to tailor services to the needs of university students during Covid-19 and beyond, there were several objectives we had to reach along the way. These included identifying alternatives to taking buses and why university students wanted to use these alternatives, determining where they wanted to go in and around the Reykjavik area, and determining the existing satisfaction level of riders, including Straeto's response to the Covid-19 pandemic. This chapter will discuss those objectives in detail, as well as the methods we used to achieve them.

3.1 - Alternatives to Buses

Our first objective was to identify alternatives to taking buses and why people wanted to use these alternatives. This was important because we needed to figure out why people chose alternatives and how that could be applied to improving bus service. In order to find this out, we conducted a survey using an online surveying tool called Qualtrics; the survey questionnaire is shown in Appendix B. This aided us in understanding why students used these alternatives, as well as the reasons the buses weren't their preferred form of transportation. The survey questions featured an easy-to-use Likert scale, which yielded easily quantifiable data.

This survey worked well for achieving this objective as we were able to collect data from students at both universities. We distributed the survey through Facebook groups, email communications with university faculty, and student union contacts. Although our survey did not differentiate between Reykjavik University and University of Iceland, the universities are close enough geographically to each other that the responses from students at each school would not be a big factor in achieving this objective. The main topics that were covered asked about the ease of use, handling of COVID-19, features, comfort, feelings of safety, and the students'

frequency of use of buses and other transportation methods. It was designed to be completed in under five minutes, so it was a fairly quick way to collect our data.

We were not able to use any sampling strategy for getting a diverse range of respondents because we had to carry out the survey remotely from the United States. Among other strategies, we had a link to the survey posted on Straeto's social media platforms and posted on two Icelandic student Facebook groups. We were able to have this survey posted and collecting data for roughly 1.5 weeks.

3.2 - Destinations and Routes

The second objective was to determine where university students wish to travel around the Reykjavik area. It was important to understand this so Straeto had the ability to alter the routes they offer to better suit the needs of university students if deemed necessary. Determining when a location needs to be visited by a bus more or less frequently also helped with the time in between stops, making rides shorter for passengers and increasing fuel efficiency for Straeto. The way we obtained this information was by using the same survey of university students mentioned in section 3.1, and by interviewing bus drivers and Straeto staff.

An online survey was useful in identifying the students' most popular destinations and was the best way to find out where such customers would want to go. In our customer survey, there were specific questions to gather data on this topic. The survey was distributed as discussed in section 3.1.

Along with the survey, we were able to interview a bus driver to have an improved understanding of the routes and destinations. The questions and protocol for this interview can be found in Appendix D. Bus drivers should have a better understanding than anyone when it comes to what routes are busiest or rushed. Interviewing this bus driver allowed us to get accurate first-

hand opinions on how the company is run, and how the customers act while on the buses, which

is critical information for us to be able to arrive at insightful recommendations.

3.3 - Satisfaction Level

Our third objective was to determine the current satisfaction level of riders. Since the

goal of our project was to identify strategies that Straeto can use to improve the customer

experience for students and ensure safety during COVID-19 and beyond, this was the most

important objective. We achieved this objective through the same survey of Straeto's university

student customer base mentioned in previous sections, by carrying out a focus group with WPI

students who had gone to Iceland for their research projects in 2019, and by conducting

interviews with Straeto employees.

To complement the above-mentioned survey in 3.1, we conducted interviews with several

Straeto employees. The protocol and questions asked in these interviews can be found in

Appendix D. During these interviews, our questions primarily focused on how their experience

has been as a passenger of a Straeto bus along with Straeto's handling of COVID-19. Not only

were the interviews we conducted very helpful for understanding some of the problems that exist

in Straeto's public transit system, but it provided a point of view that was much different than

that of the university student passenger.

Focus groups were also a great opportunity for us to collect results from multiple sources

while having their responses build on one and other. We conducted this focus group with WPI

students who had gone to Iceland during the previous year for their research project (IQP). The

questions asked during this focus group can be found in Appendix C. Due to the fact that they

lived in Reykjavik for a 7-week period in 2019, they had become fairly familiar with the public

transit system. They were extremely valuable to talk to, especially due to some of the difficulty

we had with gathering feedback from university students located in Iceland. Though they had not traveled to Iceland in a year, we were able to cover a range of topics with them that supplemented our data from people in Iceland.

3.4 - Summary

After completing the above tasks, we had several deliverables and other valuable information which we used to make recommendations to Straeto about how they can improve the service they provide to all university students. We also identified how well Straeto's current bus routes accommodated these users' needs. Lastly, we found out how satisfied a typical student rider of Straeto's buses is, including, but not limited to, factors such as comfort, handling of COVID 19, and cleanliness. This information will allow Straeto to better serve their customers in order to reduce private vehicle usership and ideally lead to the benefits of public transit, as discussed in chapter two.

4 - Results and Analysis

The purpose of our project was to provide recommendations to Straeto on how to improve service to their existing university student customer base. In this chapter, we present the results of our research and the analysis of the information we gathered in achieving each of our objectives. As detailed in Chapter 3, this data is compiled from our online survey which received 94 total responses, numerous Straeto employee interviews, and a focus group with WPI students.

4.1 - Alternatives to Buses

Based on interviews with the Straeto bus driver, interviews with other Straeto employees, our survey, and a focus group with WPI students we discovered that the three main alternatives to buses students use (not including cars) are e-scooters, bicycles, and walking. This information can be found in Appendix F. People use these methods for a variety of reasons, and one bus driver mentioned that sometimes people can even be seen using e-scooters in the snow. These three methods of transportation fit a niche of being able to be outside while also getting where one wants to go quickly without worrying about finding a place to park, which is likely one reason why they are popular. Bicycles and walking also have the added value of allowing the rider to get exercise and stay healthy, but they are not suitable for very long-range trips in the way Straeto buses or personal cars are. Since bicycles, e-scooters, and walking serve similar purposes, making one more viable than the other two could attract users of the other two methods.

We also found that most students use private cars, and almost everyone who claimed not to ride the bus reported using a personal car instead. These cars are generally preferred due to the reasons outlined in section 2.4, but even those who said they prefer cars reported using other methods as well. This trend can be seen in Figure 4.1, which was gathered through our survey.
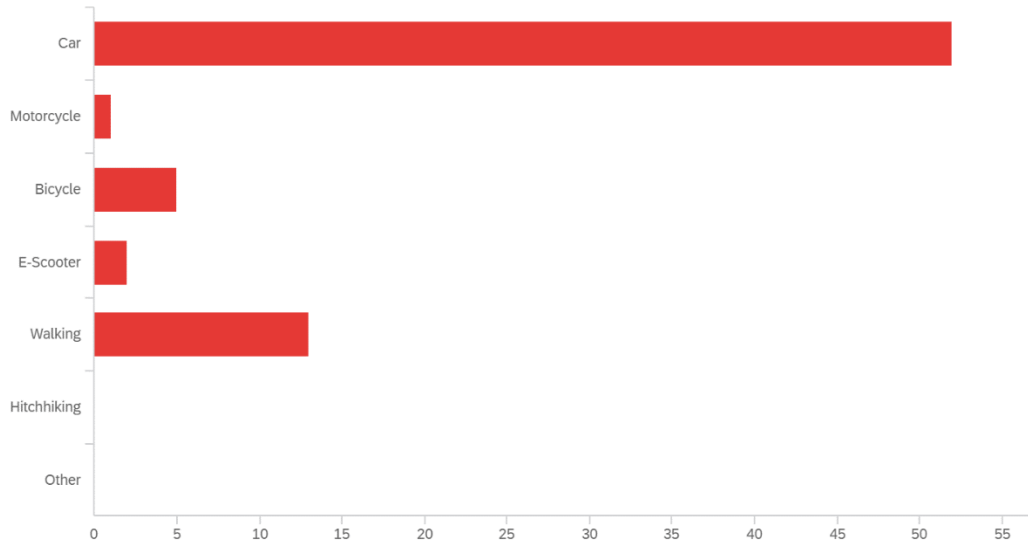
Figure 4.1: Survey Question - Select what forms of transportation you do use (check all that

apply). (n=73)

When it came to those who took the bus, we found that nearly every person is aware that Straeto buses are much more environmentally friendly than other forms of transportation. This environmental impact is discussed in our background chapter in section 2.1, and Figure 4.2 indicates that the respondents to our survey are aware of this fact.
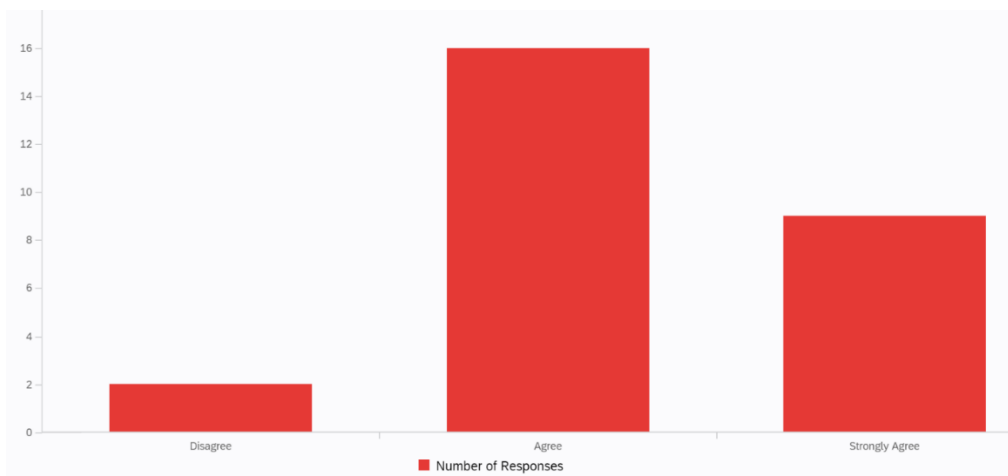

Figure 4.2: Survey Question - The bus is more environmentally friendly than other forms of transit. (n=27)

4.2 - Destinations and Routes

Based on our focus groups with students who went to Iceland and with others who have used Straeto we discovered some notable things regarding destinations and routes. It was a common complaint among international students that routes and bus stops were labeled with difficult to pronounce names. Bus stops have Icelandic names that are not well known to foreign riders, making it hard to determine what buses go where and when, along with where the bus stops are located. In addition, bus stop names do not serve as an easy way to remember where the stops are, further adding to a rider's confusion. We found that these issues did not exist with the bus routes themselves as each bus route is given a number for identification.

Based on what our focus group students reported regarding the current state of the bus system through the eyes of first-time users, we were informed that the bus system was very convenient for going anywhere in the city while anything located outside of the city was considerably more difficult for them to reach by bus. The students stated that when they made trips out of the city to scenic parks and locations, the buses were often quite packed during the return trip at the end of the day. Another interesting thing the students brought up was the fact that the bus drivers had to drive aggressively to ensure they would stay on schedule. This was confirmed in our interview with a bus driver, saying it is often hard to keep up with the schedule, especially for new and inexperienced bus drivers. Due to the pressure for bus drivers to stay on schedule, it was not uncommon for the drivers to drive at faster speeds than customers were comfortable with.

The Straeto bus driver also provided firsthand information about how the streets are in Reykjavik and spoke to the concerns of aggressive driving. He noted that traffic congestion caused slowdowns in the system, often making it unavoidable for some bus drivers to be late to

their destinations. Along with this, he described driving the buses as being in a very fast paced environment. Due to the small amount of time they stop at each bus stop, they need to be very familiar with the controls of the bus for tasks such as closing the door after people get on. The bus driver we interviewed mentioned that newer drivers have difficulty with this fast pace due to there being 7 different types of buses they need to learn the controls for.

4.3 - Satisfaction Level

Arguably the most important objective we sought to achieve was to determine how to improve the customer satisfaction level for the existing university student customers. The survey was able to give us insight into the perspective of university students in Iceland. One such area was their opinion on taking the bus during the pandemic. Based on our survey's responses, we found that on average, students were, in fact, discouraged from taking the bus as a result of the COVID-19 pandemic. This conclusion can be seen below in Figure 4.3, and furthermore, this fact is also demonstrated in Straeto's usership data, in which Gummi communicated to us that Straeto has seen a 70% drop in ridership as a result of the pandemic.
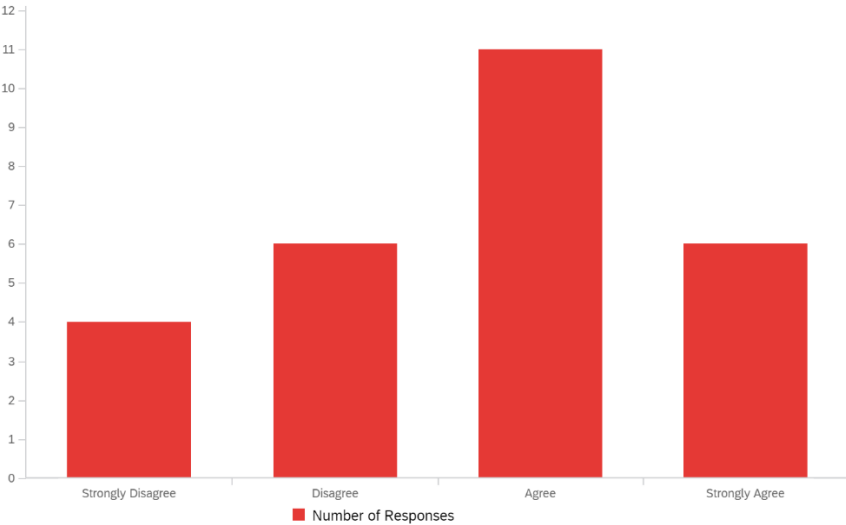
Figure 4.3: Survey Question - COVID-19 discouraged me from taking the bus. (n=27)

Interestingly, we found that overall (72%) of the survey respondents disagreed with the statement that other passengers on the bus follow COVID-19 regulations, meanwhile when asked about whether they themselves follow COVID-19 policies, 86% of the 25 responses either agreed or strongly agreed. Graphs comparing these responses can be found in Appendix F along with the rest of our survey responses.

When asked if Straeto was able to accurately and clearly relay information to their customers, we found that survey respondents overall disagreed with this statement. This proportion is shown in Figure 4.4 below. Similar concerns were echoed in our interviews with Straeto employees.
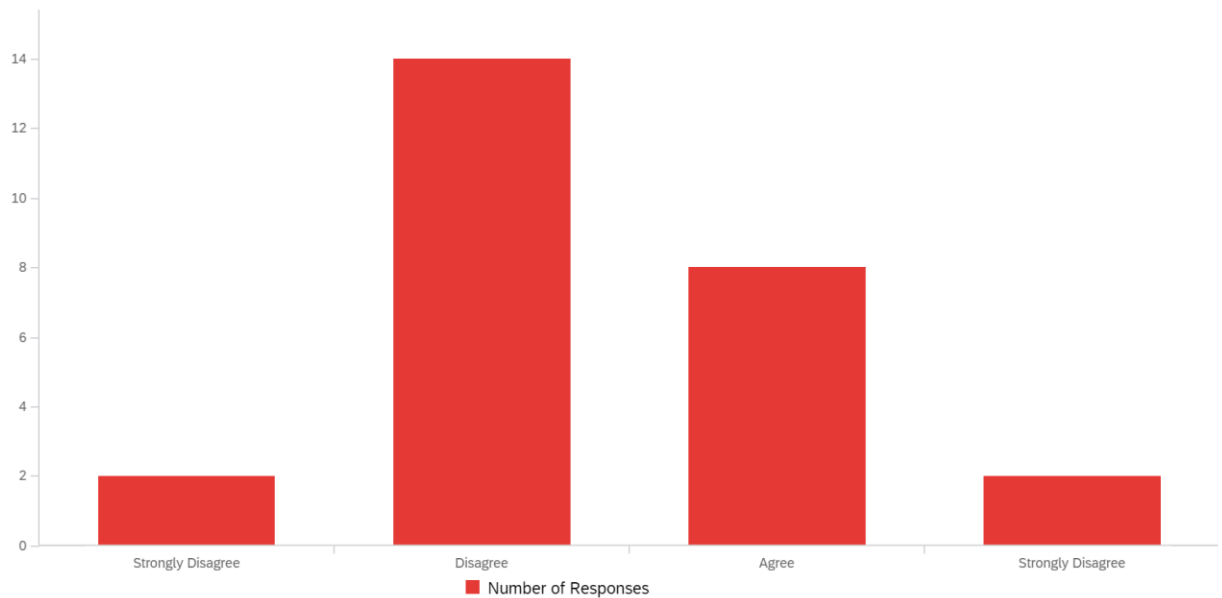
Figure 4.4: Straeto clearly and effectively relays information to customers. (n=26)

Our survey also asked the respondents to agree or disagree with the statement the bus fares are affordable. This question had the highest proportion of strongly disagree responses compared to other responses, having more than 2/3 of the respondents disagree or strongly disagree. This is shown below in Figure 4.5.
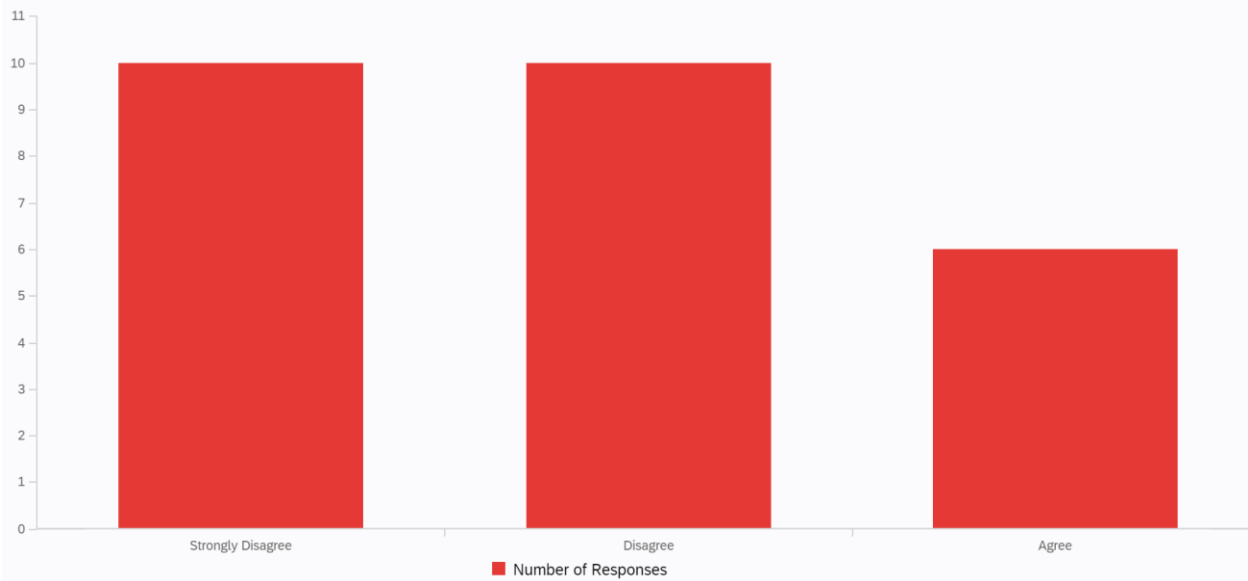
Figure 4.5: Survey Question - Bus fares are affordable. (n=26)

The survey was also able to give valuable feedback on the bus shelters themselves. Overall, survey respondents found that the shelters were clean and safe, though they did not feel that the bus shelters provided enough space and protection from the elements, as shown in Figure 4.6 below. The question's responses show that no one strongly agrees that the shelters provide enough protection and that the majority of the respondents disagree with this statement.
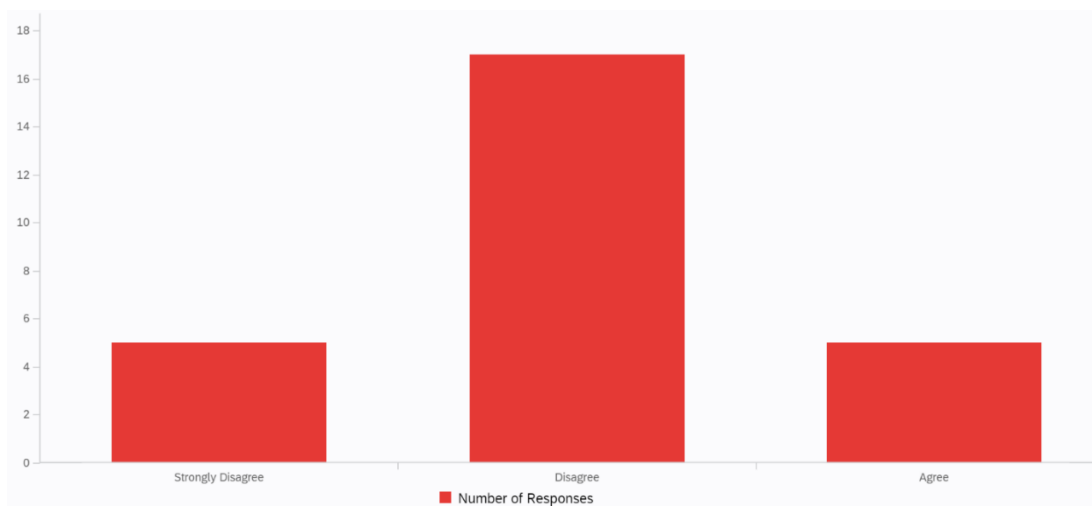

Figure 4.6: Survey Question - The bus stop shelters provide adequate protection from weather conditions. (n=27)

Another survey question which yielded quite clear results was the question regarding riding the bus with a mobility disability. It was evident that the majority of the Straeto system as a whole is not handicap friendly. Nobody strongly agreed that the buses were mobility friendly, and the vast majority disagreed. The results from this question are displayed below in Figure 4.7.
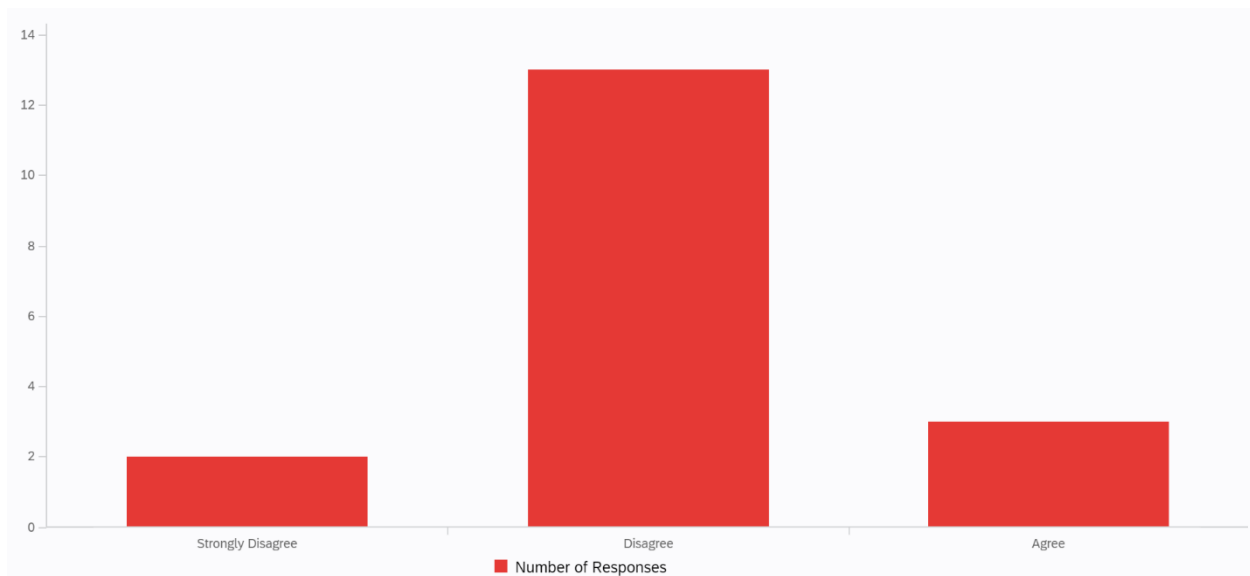

Figure 4.7: Survey Question – Riding the bus with a mobility disability is easy (n=18)

As was mentioned in section 3.3, we conducted a focus group with six WPI students who completed their IQP in Iceland during the previous year in the A19 term. Their residence in Iceland for the period of seven weeks led them to have extensive knowledge of what it was like to ride Straeto's buses. Our discussion led us to several areas involving their satisfaction level of Straeto from the perspective of a university-age customer. The first of these involved the ticket system currently in use. This system required the students to present their tickets, cards, or phones to the bus driver to confirm they were allowed on the bus. Every student displayed a negative opinion of this system, saying they would like a more electronic system. Straeto has

conveyed to us that they are implementing an electronic ticketing system in the very near future (within one year). Another talking point involved the Straeto app itself. Some elements of the app were found to be confusing, such as what side of the street a bus stop is located on along with the names of certain bus stops. That being said, they also saw many positive aspects of Straeto they wanted to highlight. They found the buses to be comfortable and clean, being a much better quality overall than the public buses they were used to riding in the United States.

The focus group with WPI students, who were essentially forced to use the Straeto system due to lack of permission to drive, stated that a common occurrence would be to miss the bus. They blamed this largely on the app because the icons were not clear to them on the map. Currently, all the pin icons for the map are the same rounded shape, only differing in color. This means that if one happens to be color blind, has a vision impairment, or simply looks too quickly, one could mistake an open bus stop for a detour, breakdown, or something similar. See screenshots of the app below in Figure 4.8 demonstrating this problem.
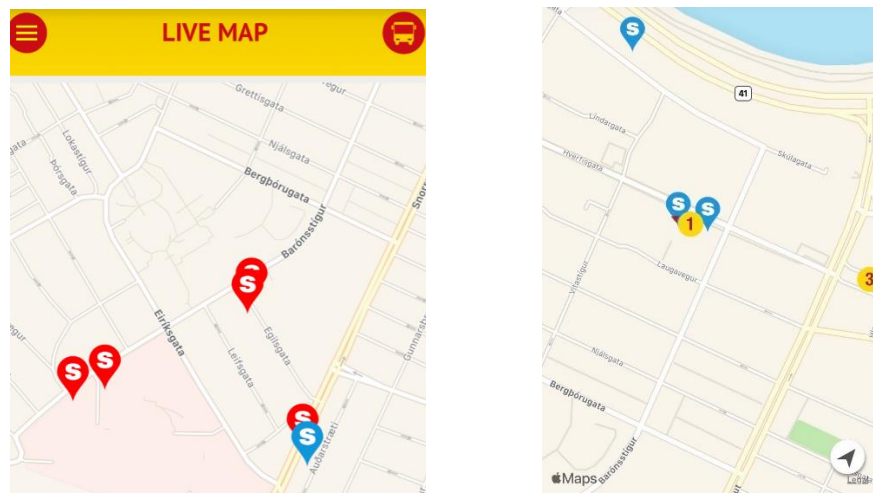

Figure 4.8: App Screenshots exhibiting similar location balloons

Additionally, the students stated that the app was sometimes confusing because some of the words did not translate from Icelandic. One specific example of this was on the "service

update" page. While a native English speaker may be able to make sense of what the notices are saying, the text in the service updates themselves are a combination of broken English and Icelandic. Refer to the screenshot below in Figure 4.9 for an example of this.
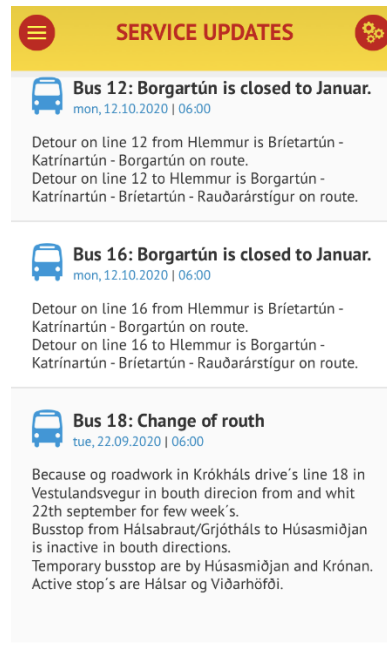

Figure 4.9: App Screenshot exhibiting poor translations

Our research had found that there were some issues involving the bus stops themselves that affected the customer experience. The WPI students who attended our focus group had a large amount of experience with using Straeto's buses, allowing them to give us valuable insight on existing issues. They stated that a common occurrence would be to miss the bus due to the bus leaving shortly after arriving. They hoped that the bus drivers would spend more time at each bus stop to correct for this problem. Our interview with a Straeto bus driver yielded the opposite sentiment, stating that passengers need to pay more attention at stops and make it clear they want to get on the bus.

We conducted one interview with a Straeto bus driver to gain insight on the environment in buses from someone other than the passengers. Something that was heavily stressed is the condition of some buses. It was mentioned that 6-7 buses are quite old compared to some of the newer electric buses in operation. These buses had been in service for over 20 years and had traveled over 1.5 million kilometers. This affected customers' satisfaction due to the frequency that these buses broke down and needed to be repaired. We were told that at least one bus breaks down a day out of the entire fleet, typically with each old bus breaking down once a week.

The bus driver reported to us that in the past two weeks alone, the bus he was driving (which changes multiple times per day) had the following problems:

- Steering alignment problems when braking

- The bus needing coolant

- Problems with the doors, such as not closing properly

- Soft brakes and poor braking performance

- Side mirror defrosters malfunctioning

- The heat/temperature inside the bus being too cold

This, along with the buses being older and less comfortable, most certainly could directly affect student customer satisfaction as well as any customer's satisfaction. One interesting item to note is that our survey did ask about the temperature of the interior of the bus and on average, the opinion was neutral about the bus being a comfortable temperature. In fact, there were slightly more people who agreed than disagreed that the temperature of the bus was comfortable. This graph and all other survey results can be seen in Appendix E. This does slightly contradict the bus driver's opinion, but it must be taken into account that a bus driver is stuck with the bus

for an extended period of time, whereas riders are not in the bus for as long and may be

comfortable for shorter rides. We also do need to take into account that our samples size may

prevent us from having an understanding of these conditions on every bus in the Straeto fleet.

4.4 - Summary

Through our methods we were able to gain valuable insights on university students' and

Straeto employees' thoughts on the Straeto bus system. Using the data we collected through the

methods outlined in chapter 3, in the next chapter we will present some recommendations that

can help Straeto improve their service for their university student customer base.

5 - Conclusion and Recommendations

By collecting data through interviews with Straeto employees, a survey of Reykjavik area university students, and a focus group with US students who had traveled to Reykjavik previously, we were able to come up with a set of conclusions, which include:

- o People who reported preferring cars also use methods such as walking, renting e-scooters, and biking.

- o The bus usually brings riders close to their final destination.

- o The Straeto app could use some small user interface improvements.

- o Straeto could improve how they relay information to customers.

- o Bus stop naming scheme was confusing and hard to pronounce for some users, specifically international students.

- o Bus drivers believe passengers should make it clearer they are waiting for the buses, while passengers believe bus drivers should be more attentive at every bus stop.

- o Some older buses have frequent breakdowns and malfunctions.

- o Electrical outlets would be an appreciated addition to all buses.

- o All new buses purchased should be equipped with features in place for people with mobility disabilities.

- o Most users find the bus fares to be too high

Based on these conclusions, we have come up with several recommendations. Each is backed up by data collected from one or more methods, and many are also supported by other case studies in which these ideas (or something similar) have worked well in other parts of the world.

5.1 - E-Scooter Implementation

One recommendation that could aid in increasing bus usage and attracting new customers is the integration of some type of e-scooter or bike rental system with the buses routes. This could be achieved by working with an existing rental company to set up scooters or bikes to be rented at bus stops, as this can help people get from the nearest bus stop to their final destination quickly. To support this idea, a Straeto employee even reported there are some distant plans to expand toward some inclusion of Straeto e-scooters. Our survey data further supports this recommendation, as several people who preferred cars over buses also chose to either ride bicycles, rent e-scooters, or walk. As was mentioned in section 4.1, these three methods have similar user bases. Allowing these scooters or bikes to be rented individually but also incentivizing usage of both buses and this "final mile" mode of transportation together (possibly through a decrease in price if bus passes and scooter/bike rentals are purchased together) could be a step toward increasing bus usage and overall revenue. This recommendation overall is medium-to-low priority, and could be estimated to take about 3-4 months to implement in one location as a test. It would, however, take much longer to implement at all Straeto bus stops if the initial test location is deemed a success.

As was mentioned in Chapter 2, e-scooters were implemented very effectively in California, and there was even an example where one company used the same app for scooter rentals, bike rentals, bus passes, and train tickets. This could be an inspiration for what Straeto could do, including the ability to pay for both methods in one easy-to-access spot.

5.2 - App User Interface

It was repeatedly conveyed to our team that the Straeto app needed improvement. Straeto has already stated that an app redesign is in the works, so we are providing the following recommendations to ensure that during the redesign, the problems which we uncovered are made

known to Straeto. These are higher priority and shorter-term recommendations because the new application is already in the development stage, so they could be implemented within one year.

In lieu of using one pin shape to mark the map, we recommend that the icon correspond with the type of pin. The buses, which are now simply a yellow circle with directional heading, should be changed to a rectangular shape, so it more closely resembles a bus. Additionally, the red icons should be changed to explain the type of warning. If there is a road closure or road work, a construction cone could be used. If there is a bus broken down, a wrench icon could be used. These changes would help to make the map within the application much clearer, especially for those with colorblindness, as mentioned in section 4.2.

We recommend including reference points for each shelter/station to solve the problem of clarifying sides of the road. When one clicks on the pin to look at a station, reference points could be added to places in the vicinity to help new students and tourists alike to find stations. For new students and tourists alike, this change would be of great assistance.

Additionally, we recommend increasing the clarity of the translations for service updates, which would make a big difference for students who do not speak Icelandic (and tourists alike).

To help remedy this, we recommend an annunciator that tourists and international students could use in order to learn how to pronounce stop names. This is a high priority and short-term item, which would help solve the station pronunciation problem at least until the stops might be renamed (see 5.3 below). This would be beneficial to help people with finding the bus stops and could even be marketed as a small learning opportunity for newcomers to learn some Icelandic! We have found a perfect place for this feature to be added. On the screen pictured below in Figure 5.1 a speaker icon could be placed next to the station name.
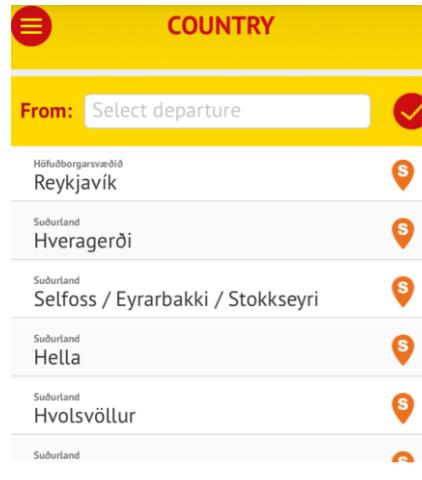
Figure 5.1: Potential screen that the annunciator could be added to.

Lastly, we recommend placing QR codes in buses to give passengers direct access to the Straeto app download link through which one can find useful information. This would make it easy for people without the app to stay informed about current status updates, bus stop information, policies, and more.

5.3 - Bus Stop Improvements

We recommend a very simple light system, whether it be on the bus shelter or on top of the light post. One such example is Urban Solar's PV-Stop light system (Urban Solar, 2020). This would greatly increase passenger noticeability at night and during the day. It could be a simple solar powered light with a small battery which would be activated by the user pressing a button on the post at the shelter to very clearly signal to the driver that someone is waiting. It could then automatically turn off after a short period of inactivity. This would be able to help people signal their intent to ride the bus while allowing them to focus on other tasks while at the bus stop. We believe this is a high priority recommendation that could be implemented over six to eight months. This an issue that directly affects university student customer satisfaction and as a result might be important to solve in the very near future.

To remedy the issue of bus stop name pronunciation, we recommend naming the bus in a simpler way in addition to their current names. One possible system to use is a combination of letters and numbers. The region of Reykjavik could be divided into equal sized sections, with each region being assigned a letter. A number along with the region's letter could be assigned to a bus stop. Some potential names could be A1, A3, B10, or Z21. Additionally, due to the Straeto bus routes already being associated with numbers, a similar naming convention for bus stops would make sense. A similar method was mentioned in section 2.3.3 for the LA metro system. This would ideally lessen confusion when trying to communicate what bus stop one is trying to reach, along with making that interaction much quicker. To further prevent confusion, a section in the app would ideally be dedicated to explaining this naming scheme. This is a medium priority recommendation that could be implemented over six to eight months. This directly affects university student customer satisfaction, though it is surely more important to any international students, who are the minority of students.

5.4 - Bus Improvements

We strongly recommend Straeto reviews the maintenance and checks they do on buses. Based on our data these checks are not preventing mechanical problems, which cause Straeto buses lost time and money. Another remedy we recommend, which we will go into detail with further, is to replace the older buses with electric buses. By doing this, the buses will break down less often, reducing the costs of fixing them, and increasing the satisfaction of customers. It would also help reach Straeto's goal of helping to preserve the environment. Since some of the buses are older, the seats are in worse shape than they initially were, and it is a cause for discomfort for students and bus drivers alike. For buses not being replaced soon, it would be worth it to reupholster the seats so customers would have a more comfortable ride. A great example of good bus maintenance would be school districts. With lots of people on their buses

every day, with constant use and abuse, keeping the school buses in good shape is essential. American Bus Sales (2020) has lots of documentation on how to maintain buses with heavy use, in winter months, or even the proper steps to take when replacing them. They recommend daily checks, frequent repairs, and replacement when needed, as stated above.

To help move Straeto towards the future, as mentioned previously, we recommend a move to electric buses. Due to the lack of infrastructure that would be necessary for Hydrogen fuel buses, it would be preferable to continue to move to electric. Straeto is doing a good job with this now, but it may want to be expanded to its whole fleet. As was discussed in section 2.1, electric buses will have a lower environmental impact, which goes along with Iceland's wish to combat climate change. During this move to electric, there are some specific features students and passengers would like to make riding the buses better. Bus accessibility for people with disabilities scored very low on the interview, so new buses should be wheelchair accessible, with sufficient seats/spaces reserved for them as well. Another customer desired change would be to have more electrical outlets near seats to charge smartphones and laptops. General conveniences like these would make the buses better for everyone and would increase satisfaction among customers. Though these buses will have the added challenge of needing to be charged for a period of time longer than filling the gas tank of a bus, we believe the benefits will outweigh these detriments.

5.5 - Summary

Through the recommendations we have listed here, we believe the customer experience for university students who use Straeto's buses would be improved. Along with the benefits for the university students, many of these recommendations would also improve the experience of

Straeto's entire customer base, which would, in turn, lead to a more efficient and more successful

Straeto bus company.

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Appendices:

Straeto is the primary bus company located in the city of Reykjavik. The system is run by a collective of the City of Reykjavik and neighboring municipalities (Sigriður Harðardóttir, personal communication, 4/14/2020). Straeto serves as essentially the sole provider of public transportation throughout the city of Reykjavik and the surrounding areas and is so ingrained in people's minds that Icelandic people typically refer to all public buses around the world as "Straeto" (Haraldsdóttir, n.d.). As the sole provider of public transportation in and around the city, their mission is: "a service oriented company in the field of public transport in the Reykjavik Capital area. Straeto's vision is to be the most important link in the chain of transportation in the area." (Sigriður Harðardóttir, personal communication, 9/20/2020). While there are a few privately owned bus companies, not many of them overlap with Straeto's bus routes in and around the city (Sigriður Harðardóttir, personal communication, 4/14/2020). The main competition for Straeto is private vehicles such as cars, motorcycles and bicycles, rather than the public transportation system. Additionally, Reykjavik lacks metros/subways, trains, ferries, and even ride sharing services (Sunderland, 2017). So, as far as public transportation in the city is concerned, Straeto has a monopoly, although there are two taxi companies that operate in the area. However, taxis do not serve as direct competitors due to much higher costs charged for their services.

Given that Straeto is overseen by the government, Straeto is a public organization, and they receive their funding from the local government along with the revenue generated through passengers' fares on their buses (Sigriður Harðardóttir, personal communication, 4/14/2020). In 2019, Straeto brought in 8.747 mil. ISK in revenue and had 8.738 mil. ISK in expenditures. The

organization is run by a "Bus Board," which in addition to four company executives, is

composed of one representative and one deputy from each of the 6 municipalities that utilizes

Straeto's system (Straeto, 2019). See Figure A-1 below for the organizational chart.
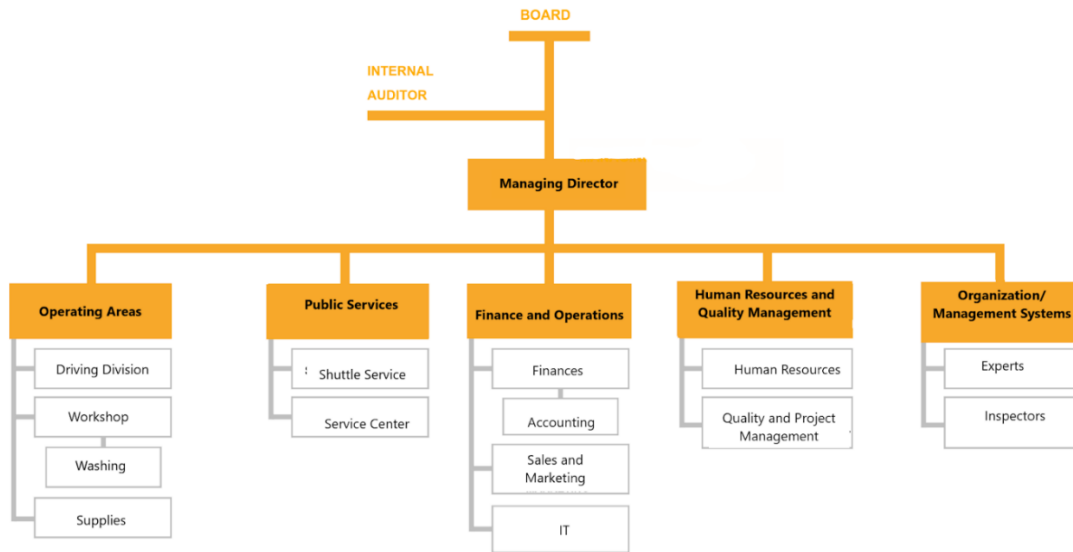
*Figure A.1: Business Organizational Chart for Straeto Bus (*Straeto bs, 2019b)

Straeto employs a total of 277 people, 182 of which are bus drivers (Harðardóttir, 2020).

Straeto operates 85 buses independently and also works in conjunction with two external

contractors that Straeto has hired under a special contract where they can run their own buses,

but for public transport. These contractors operate a total of 77 buses.

Combined with the contractors' buses, Straeto's bus system comprises a fleet of 162

single-level buses of varying fuel types, consisting of hydrogen, diesel, and electric-powered

buses (Rúnarsson, 2018). The majority of the fleet was still powered by diesel as of 2019,

however, they have begun to move more towards hydrogen-fueled and electric buses, with 15

electric buses and 2 hydrogen buses in the fleet (Sigriður Harðardóttir, personal communication,

4/14/2020). Despite having varying types of fuels that power the buses, they are fairly uniform in

their design and appearance with their distinctive and cheerful, bright yellow color

(Haraldsdóttir, n.d.). In the coming years, Straeto hopes to both increase customer satisfaction by developing new features while also becoming more eco-friendly and expanding service (Sigriður Harðardóttir, personal communication, 4/14/2020).

Hello, we are a team of university students from Worcester Polytechnic Institute (WPI) from the United States gathering information about Straeto to help them better understand and improve service for their student customers during this time of COVID-19 and beyond. We encourage you to take the survey to provide some useful feedback. Your responses will be kept completely anonymous and only used for statistical purposes. If you would like to reach us to ask any further questions, please feel free to email us at gr-icelanda20-straeto@wpi.edu.

I use Straeto as a way of transportation in Reykjavik – Yes/No

      If no – Select what forms of transportation you do use (check all that apply) and the survey is finished. If yes—please continue to complete the questionnaire.

- ❑ Car
- ❑ Motorcycle
- ❑ Bicycle
- ❑ E-Scooter
- ❑ Walking
- ❑ Hitchhiking
- ❑ Other

      If yes – How often do you use Straeto buses? (number of round trip(s) per week)?

- ❑ 1 or fewer
- ❑ 2-3
- ❑ 4-5
- ❑ 6-7
- ❑ More than 7

      I use the bus for transport to: (check all that apply)

- ❑ School
- ❑ Work
- ❑ Organized activities
- ❑ Recreational Activities
- ❑ Other

Please indicate whether you strongly disagree (1), disagree (2), agree (3), or strongly agree (4) for each statement below.

1. Straeto has adhered to COVID-19 safety measures effectively. _____
2. COVID-19 discouraged me from using the bus. _____
3. I follow COVID-19 regulations on the bus (Eg: wearing a mask during the ride if its duration is more than 30 minutes, or in the event I am not able to stay one meter from other riders). _____
4. Others follow COVID-19 regulations on the bus (Eg: wearing a mask during the ride if its duration is more than 30 minutes, or in the event they are not able to stay one meter from other riders) _____
5. The buses are clean. _____
6. The buses are always timely. _____
7. There is ample space in the buses for seating. _____
8. There is space on the buses for luggage (bikes, baby-trolleys, etc.) _____
9. The bus drivers are polite. _____
10. Bus fares are affordable. _____
11. The bus brings me close to my destination. _____
12. It is easy to move around on the bus. _____
13. Riding the bus with a mobility disability is easy. _____
14. Riding the bus is more environmentally friendly than other forms of transit. _____
15. The temperature on the bus is comfortably regulated to suit the season. _____
16. Seat belts on the bus would be an appreciated safety addition. _____
17. I would prefer if the bus had electrical outlets to charge my devices. _____
18. The bus stop shelters are clean. _____
19. The bus stop shelters are safe. _____
20. There is ample space at the bus stop shelters. _____
21. The bus stop shelters provide adequate protection from weather conditions. _____
22. The bus stop auditory announcements are clear. _____
23. Straeto clearly and effectively relays information to customers. _____
24. Are there any other recommendations you have for Straeto to improve their buses?

_____
_____
_____
_____

Hello, we are a team of university students from Worcester Polytechnic Institute (WPI) from the United States gathering information about Straeto to help them better understand and improve service for their student customers during this time of COVID-19 and beyond. We appreciate you participating in this focus group in order to provide some insight about this topic. Records of your participation in this study will be held confidential so far as permitted by law. However, the study investigators, the sponsor or its designee and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of the data will not identify you. If you would like to reach us to ask any further questions, please feel free to email us at gr-icelanda20-straeto@wpi.edu.

1. What are some common locations that you visit regularly via public/private transit?
2. What form of transportation do you use to get around Reykjavik City and the surrounding region?
3. Why do you use these methods of transit over others?
    o   What do you like, specifically, about that/those method/s of transit?
4. What specific reasons do you have for not using a Straeto bus?
    o   what are some ways that Straeto could remedy this?
5. Are there important locations that the bus does not go to? Please list them and explain why you want to go to these locations and when.
6. What are some things that you like about taking the bus? Things you dislike?
7. What else would make you use the Straeto buses more?
8. How do you think Straeto handled everything involving COVID 19?
9. What did Straeto do or didn't do in response to COVID 19 that makes you less likely to use the buses?
10. What recommendations do you have for improving Straeto's bus system or public transportation in general?

With today's increasing population, public transportation is increasingly becoming a necessary mode of transportation, in urban areas especially. The costly environmental impacts of private vehicles such as cars highlight the need for the increased use of public transportation. Despite the small population of Iceland, the city of Reykjavik is similar to other cities in the sense that there is traffic due to many personal vehicles on the roads. Being the sole provider of public transportation in Reykjavik, Straeto is looking to ensure their riders are happy with the services they provide, and our research is aimed at gathering this information for Straeto.

For Bus Drivers
1. How well have bus riders followed COVID 19 regulations? Please explain ways in which they have not followed regulations.
2. Do you feel Straeto reacted appropriately to COVID 19? In what ways were they appropriate and not appropriate? Please provide specific examples, if possible.
3. How safe do you feel while driving the bus? Why?
4. What other safety features/measures would you like to see on Straeto's buses, if any?
5. What would you like to see Straeto focus on or do better in the future? Please be as specific as possible.

For Other Straeto Employees
1. Do you ride the bus? If so, how well do you feel bus riders have followed COVID 19 regulations? Please explain ways in which they have not followed regulations.
2. In what ways do you feel Straeto reacted appropriately and/or not appropriately to COVID-19? Please provide specific examples, if possible.
3. What safety features/measures would you like to see on Straeto's buses, if any?
4. What would you like to see Straeto focus on or do better in the future? Please be as specific as possible.

Protocol:
1. Greet and thank those being interviewed for their time and ask how they would like to be addressed.
2. Introduce the team by first name.
3. Explain and then receive verbal confirmation <u>if it is acceptable to publish</u> their responses, names, titles, and any affiliations that they may have with groups that we may discuss during this interview. If applicable, explain that their information will appear on a web site or published paper. OR would they prefer to remain anonymous?
4. Explain, "Your answers will be kept confidential unless you permit otherwise. If agreed, your name will appear in our published IQP that will be stored in the WPI library."
5. "Your participation in this interview is completely voluntary and you may end the interview at any time or skip any questions you wish not to answer.'
6. Ask for permission to use their picture, when applicable.
7. Ask for the permission to record.
   a. "It would be very helpful to us if we could record this session. Do we have your verbal permission, consent, to record and use your quotes in our project?"

       b.   "Your information, this tape, will be retained by us and destroyed upon completion of the IQP."

8.   Introduce the project and explain how the interview will help the project.

9.   Explain your objectives, or the key topics for this interview.

10.   Explain that a member of your team is taking brief notes.

11.   Start the interview.

12.   Ask if you can follow-up for more questions later.

13.   Thank the interviewee for their participation in our study.

Appendix E - Graphs from All Survey Questions

I use Straeto as a means of transportation in Reykjavik. (n=94)
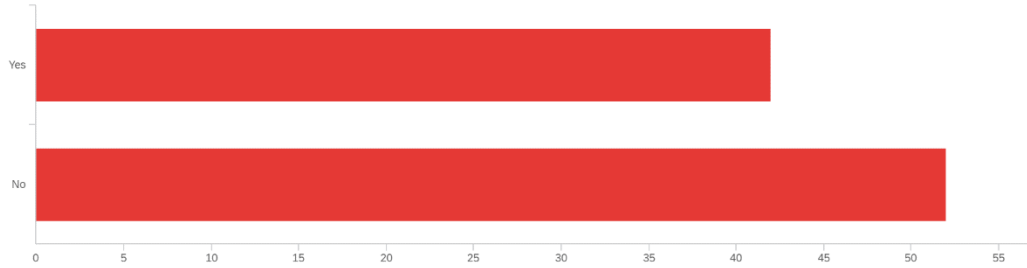
How often do you use Straeto buses? (number of round trip(s) per week). (n=40)
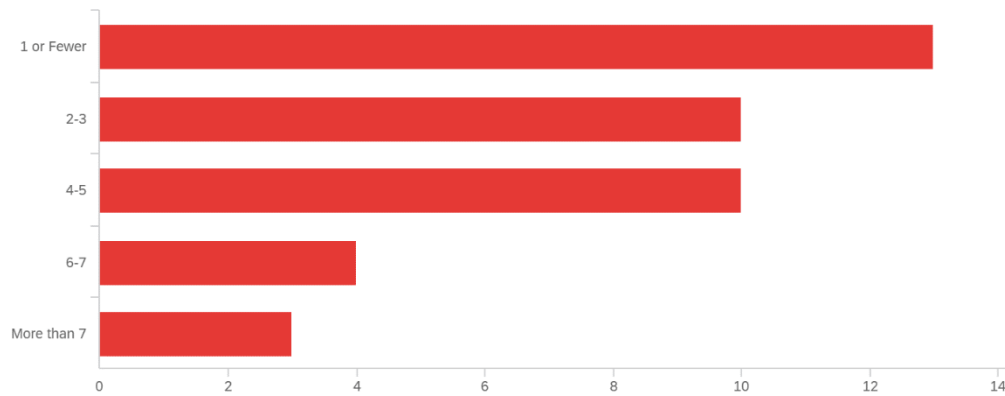
Select what forms of transportation you do use (check all that apply). (n=73)
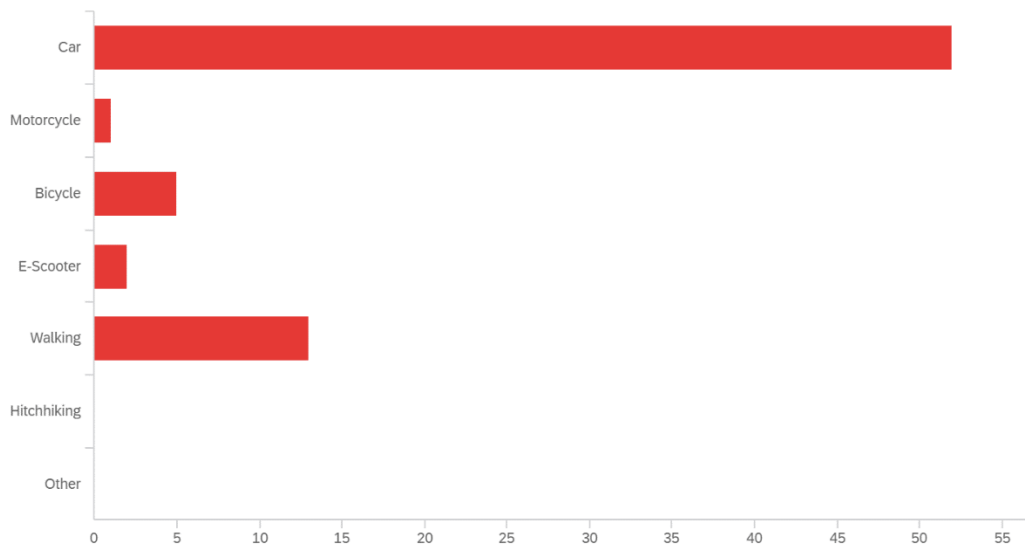
I use the bus for transport to: (check all that apply). (n=98)
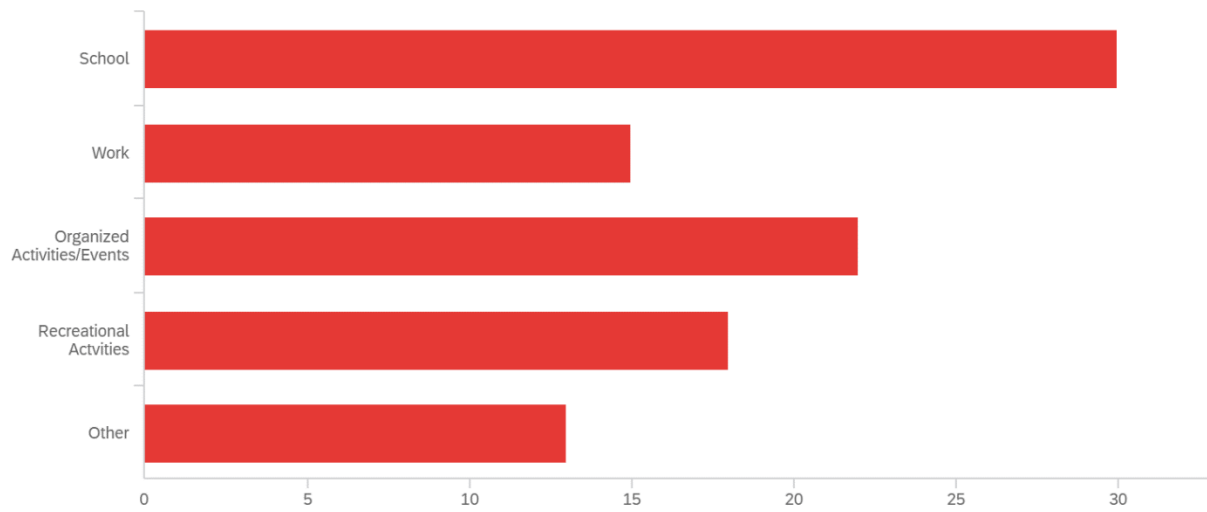
Straeto has adhered to COVID-19 safety measures effectively. (n=26)
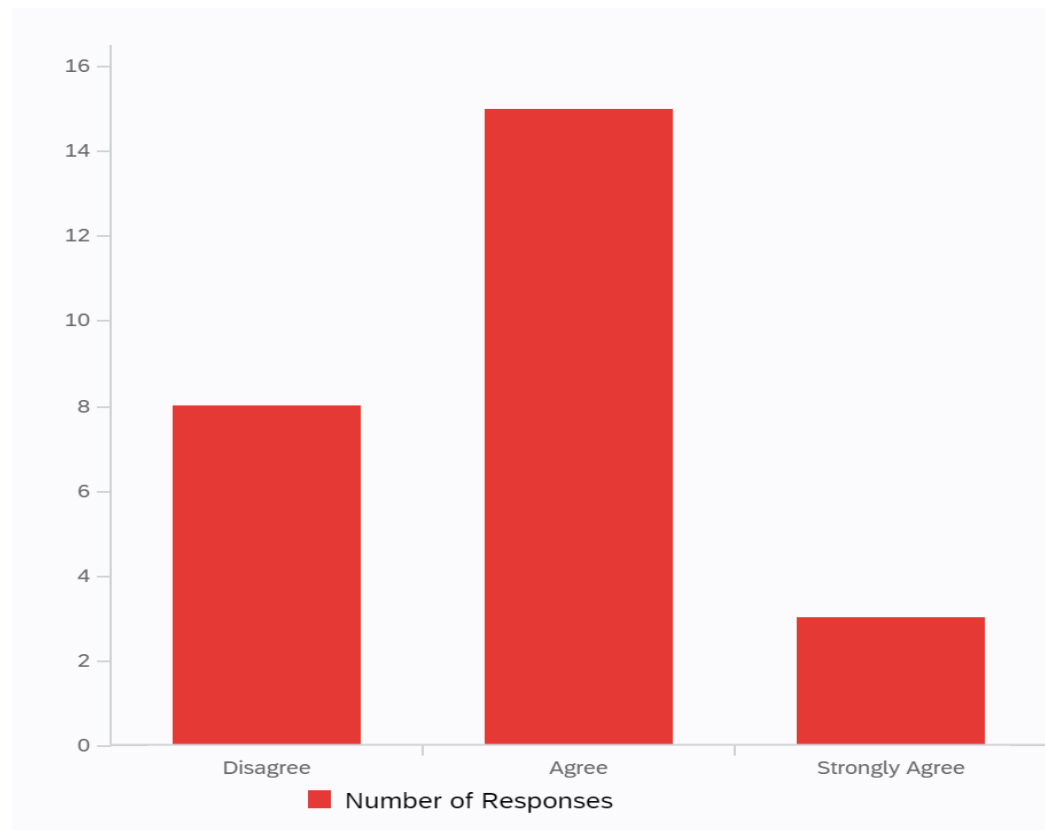
COVID-19 discouraged me from using the bus. (n=27)
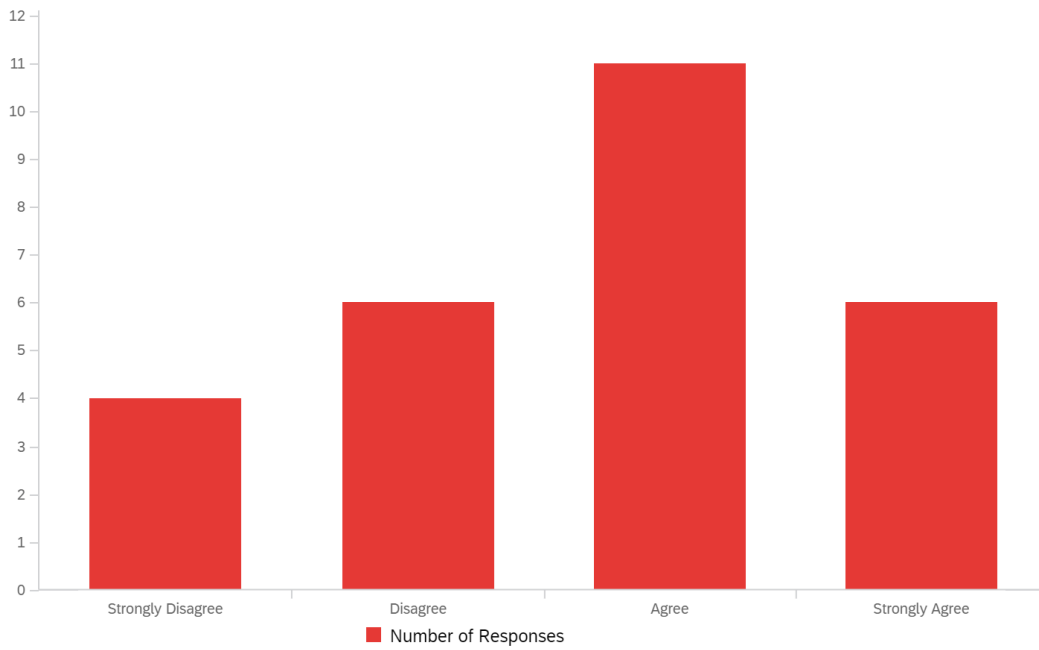
I follow COVID-19 regulations on the bus (Eg: wearing a mask during the ride if its duration is more than 30 minutes, or in the event I am not able to stay one meter from other riders). (n=25)
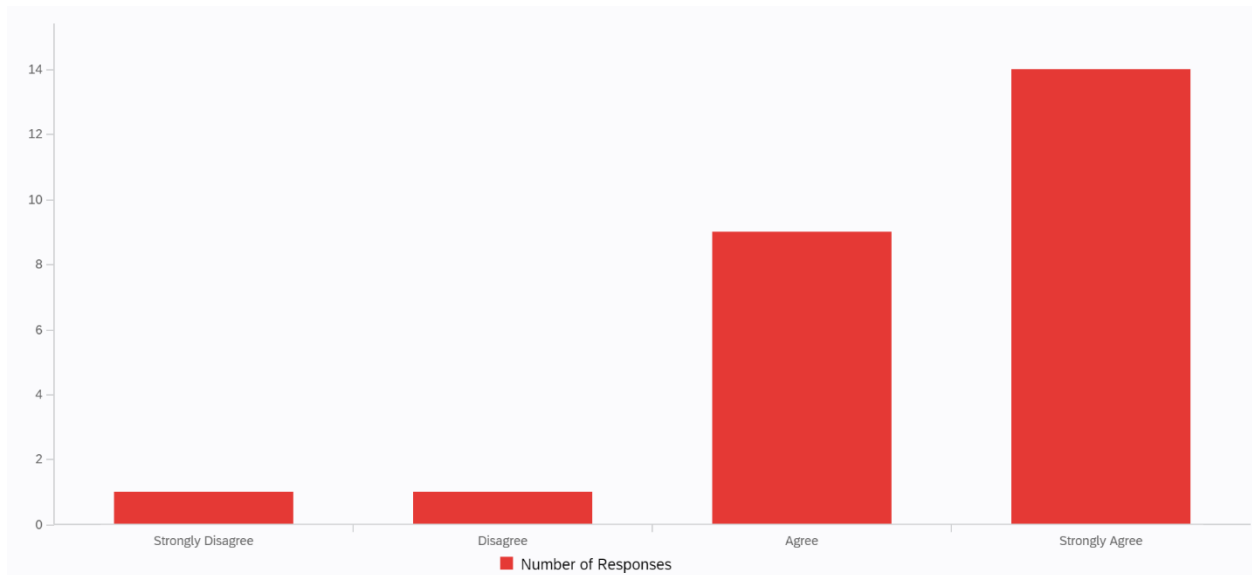
Others follow COVID-19 regulations on the bus (Eg: wearing a mask during the ride if its duration is more than 30 minutes, or in the event they are not able to stay one meter from other riders). (n=25)
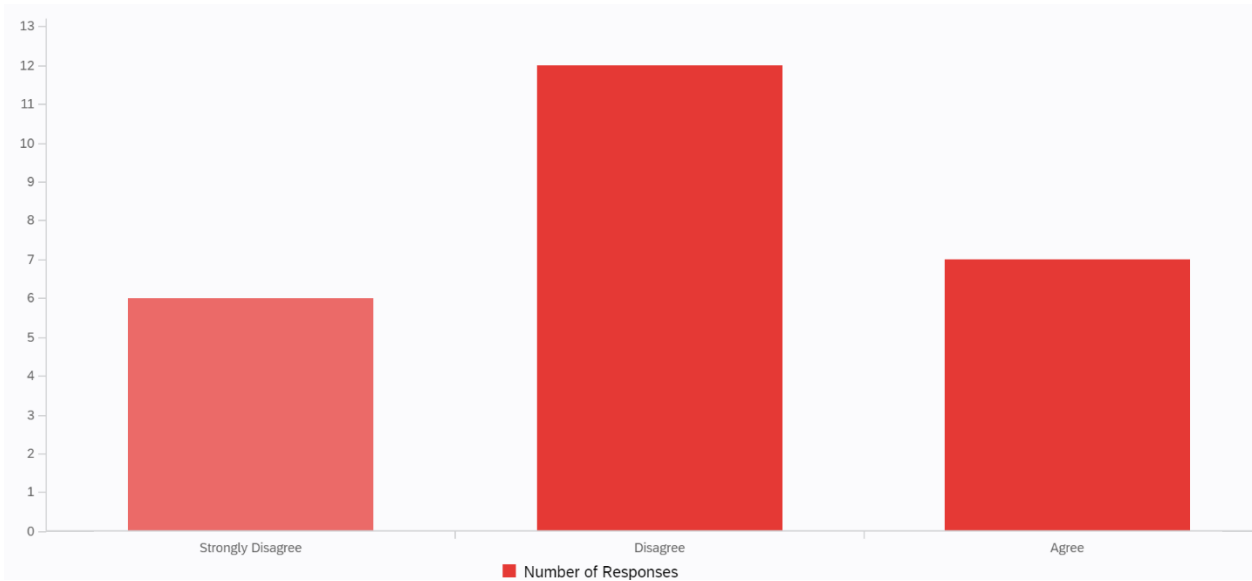
The buses are clean. (n=26)
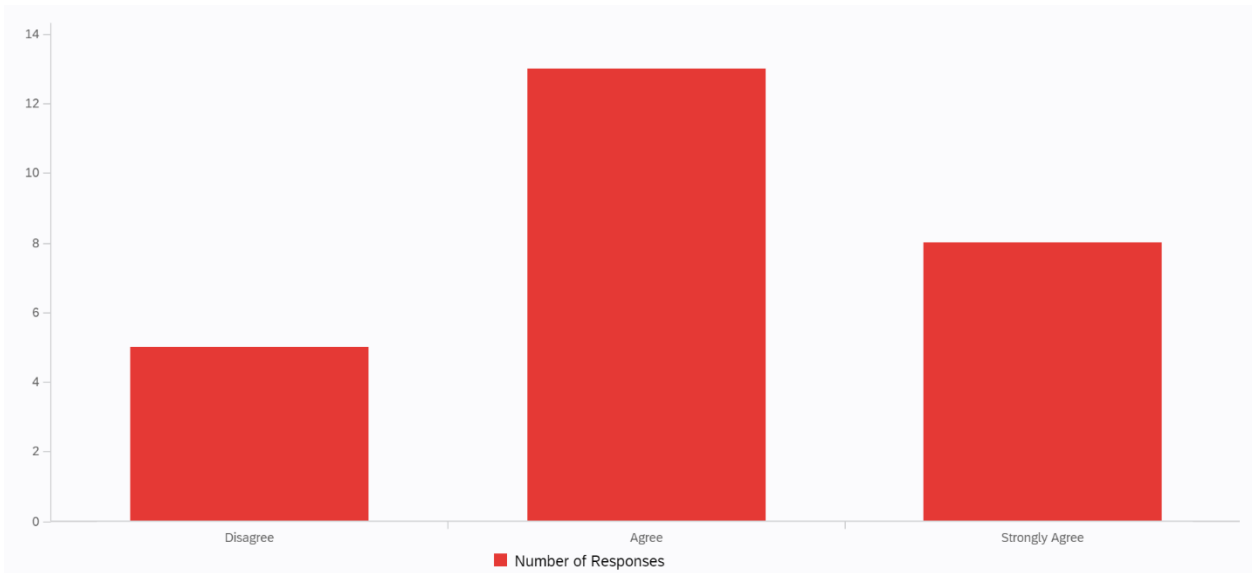
The buses are timely. (n=27)
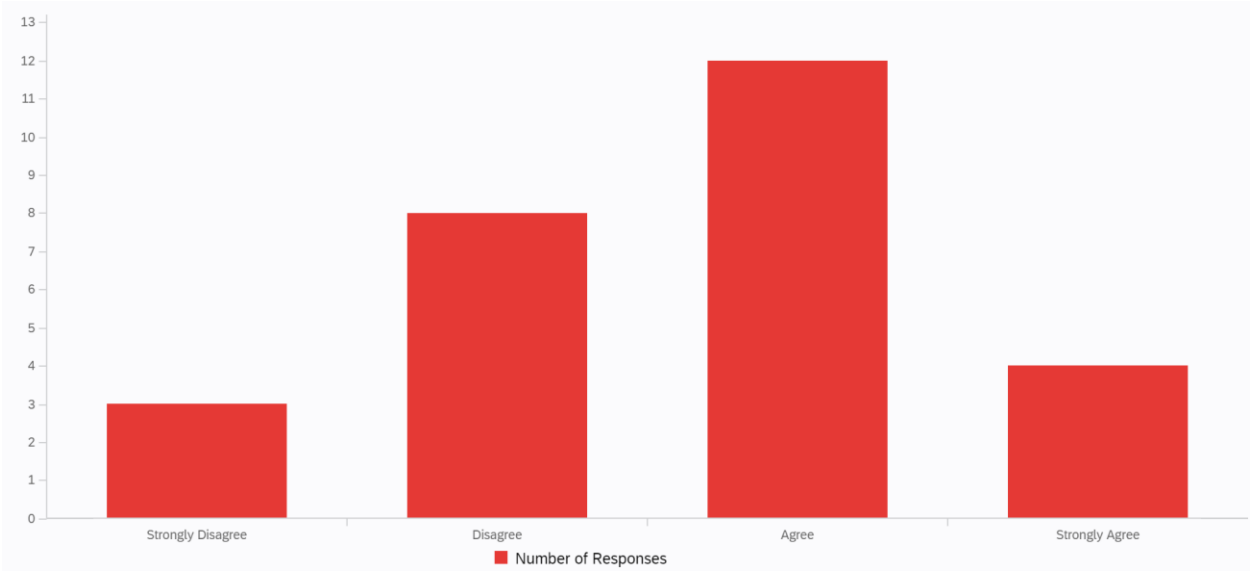
There is ample space in the buses for seating. (n=27)
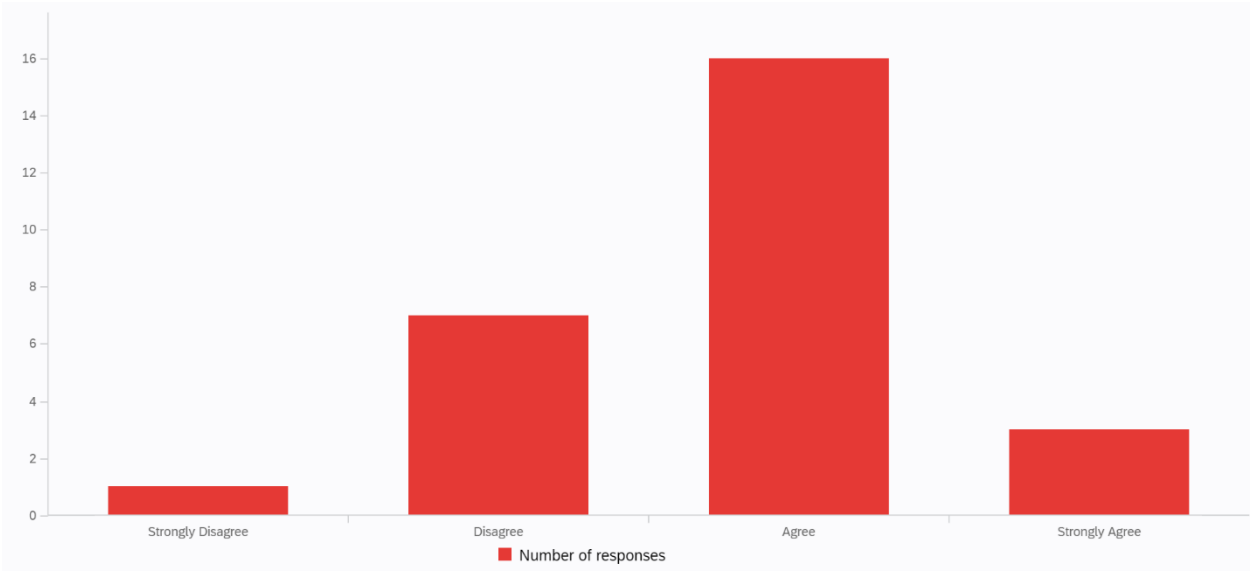
There is ample space in the buses for luggage (bikes, baby-trolleys, etc.) (n=26)
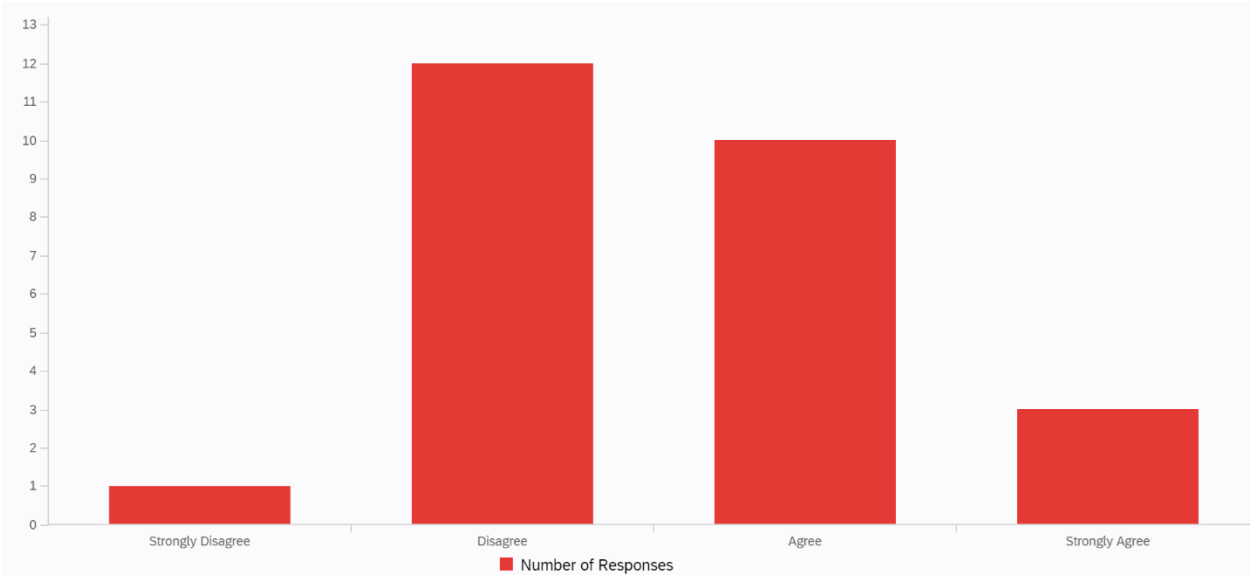
The bus drivers are polite. (n=27)
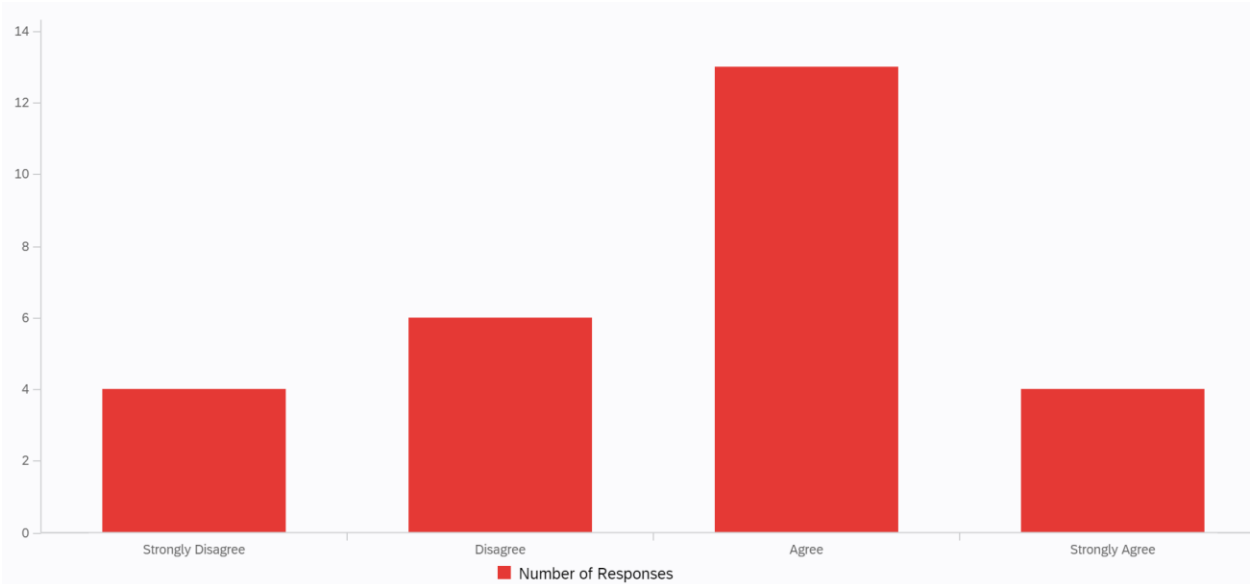
Bus fares are affordable. (n=26)
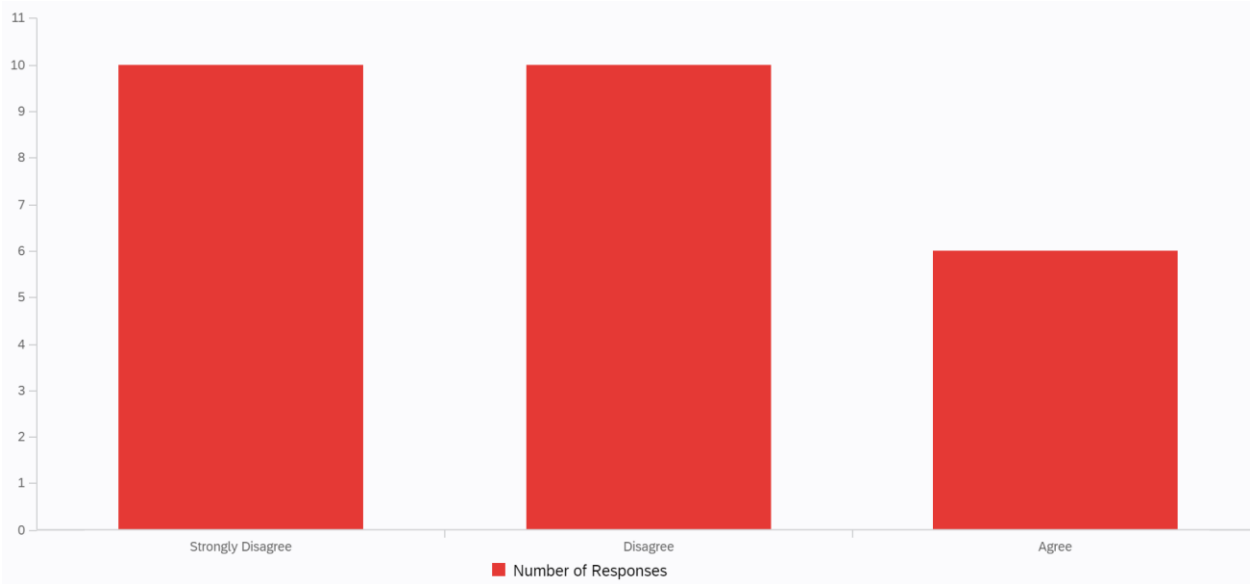
The bus brings me close to my destination. (n=27)
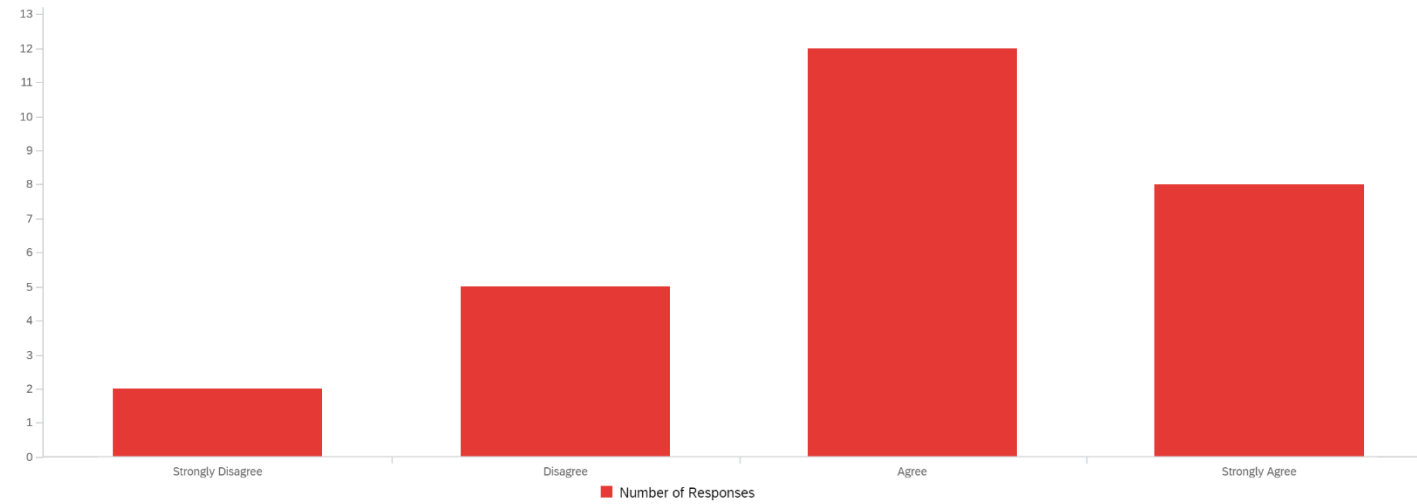
It is easy to move around while on the bus. (n=25)
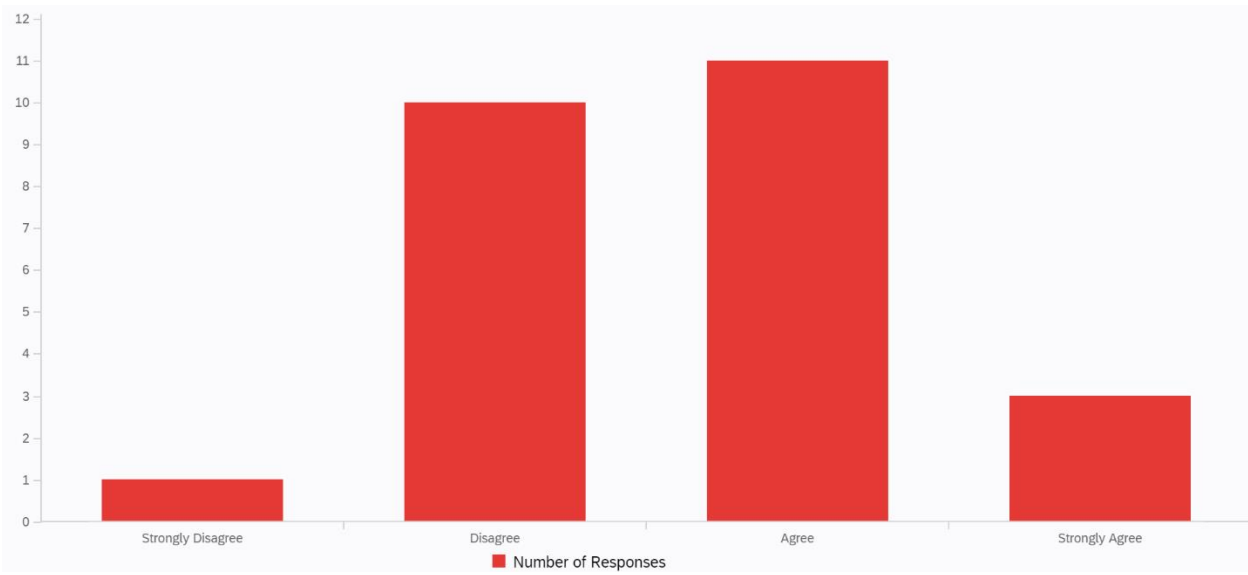
Riding the bus with a mobility disability is easy. (n=18)
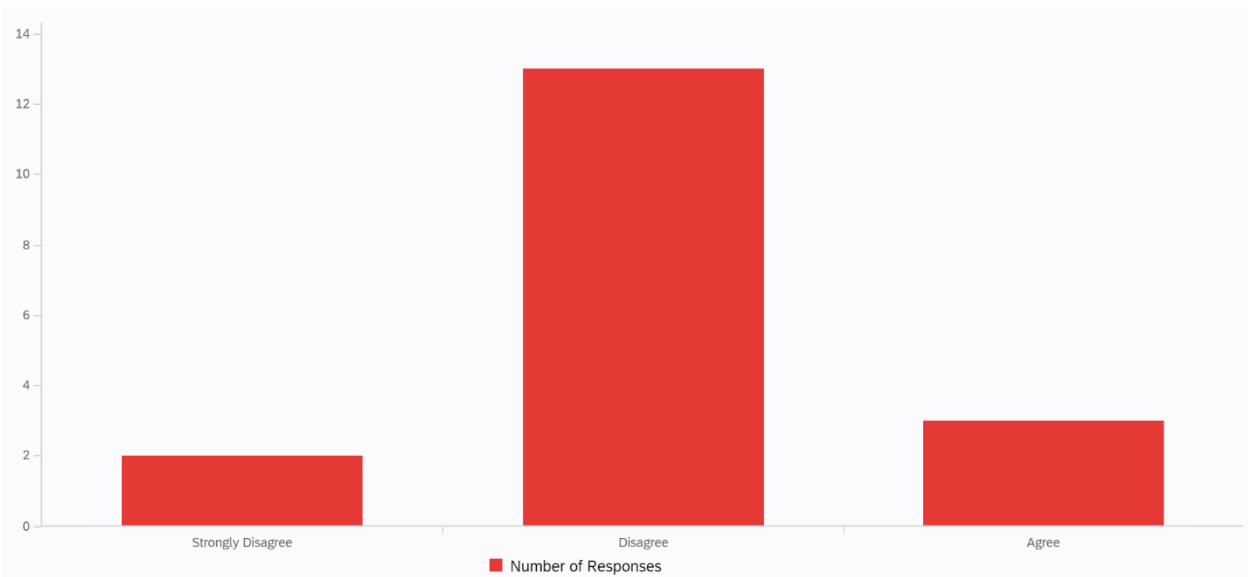
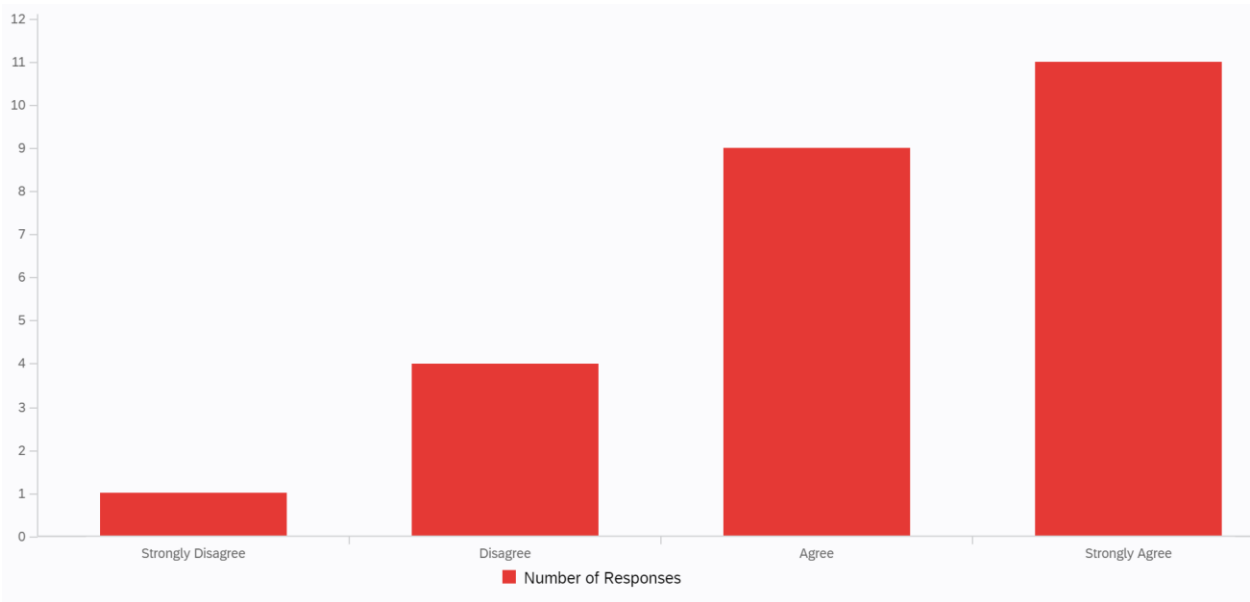The bus is more environmentally friendly than other forms of transit. (n=27)
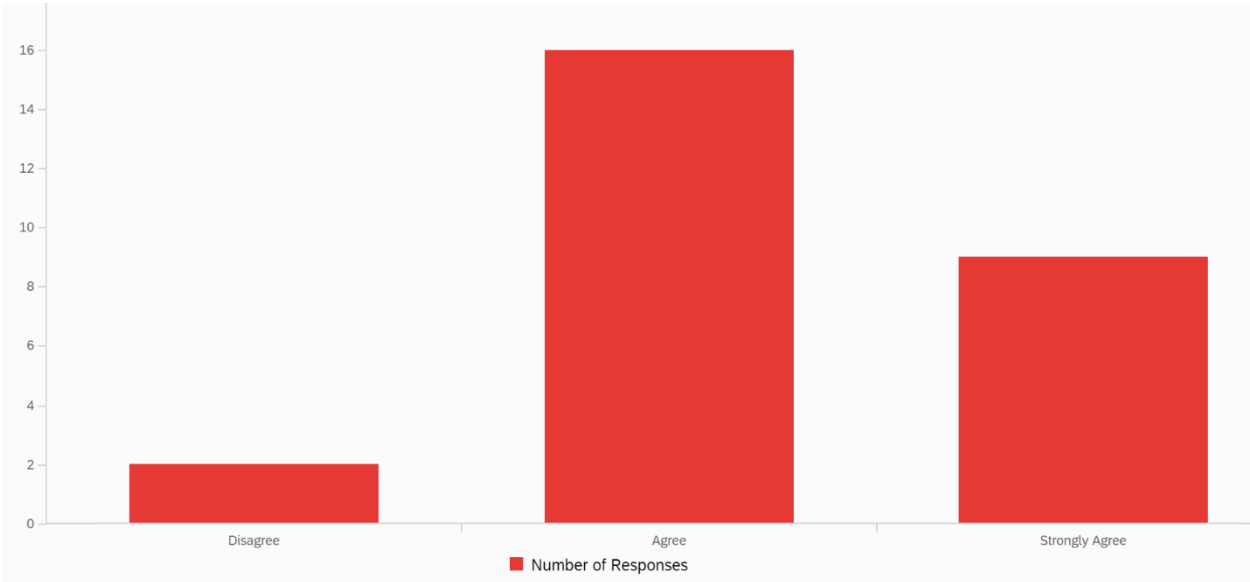
The temperature on the bus is comfortably regulated to suit the season. (n=27)
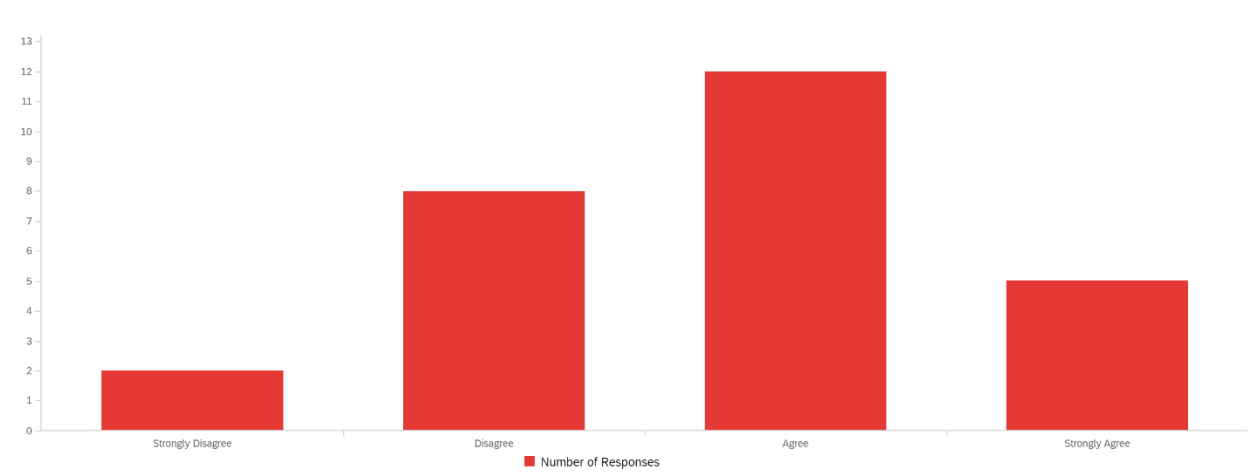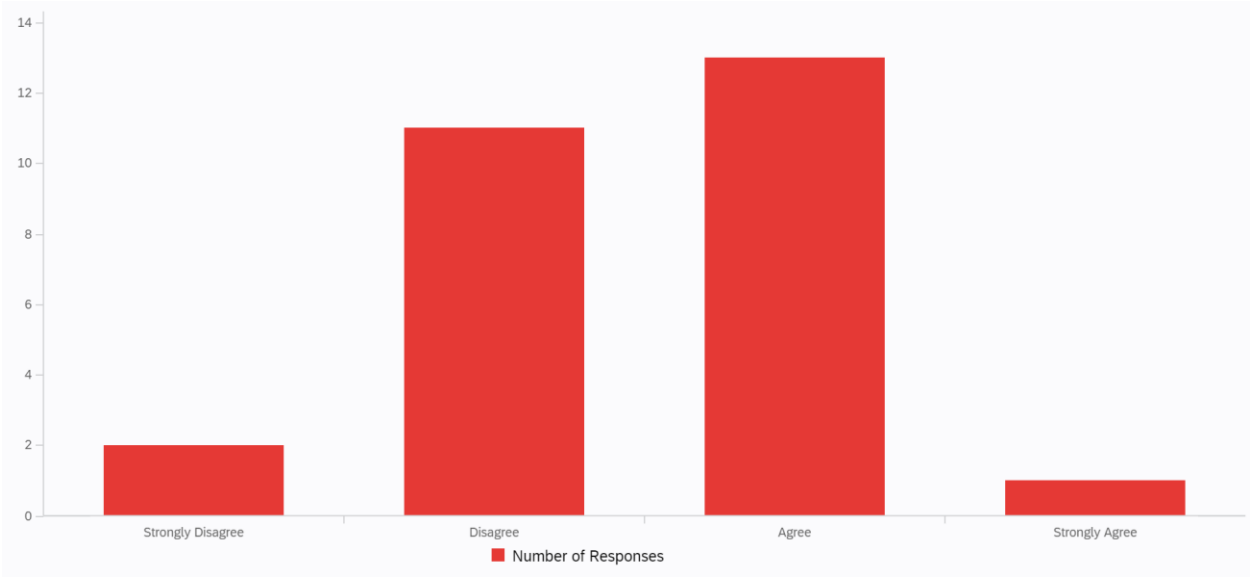
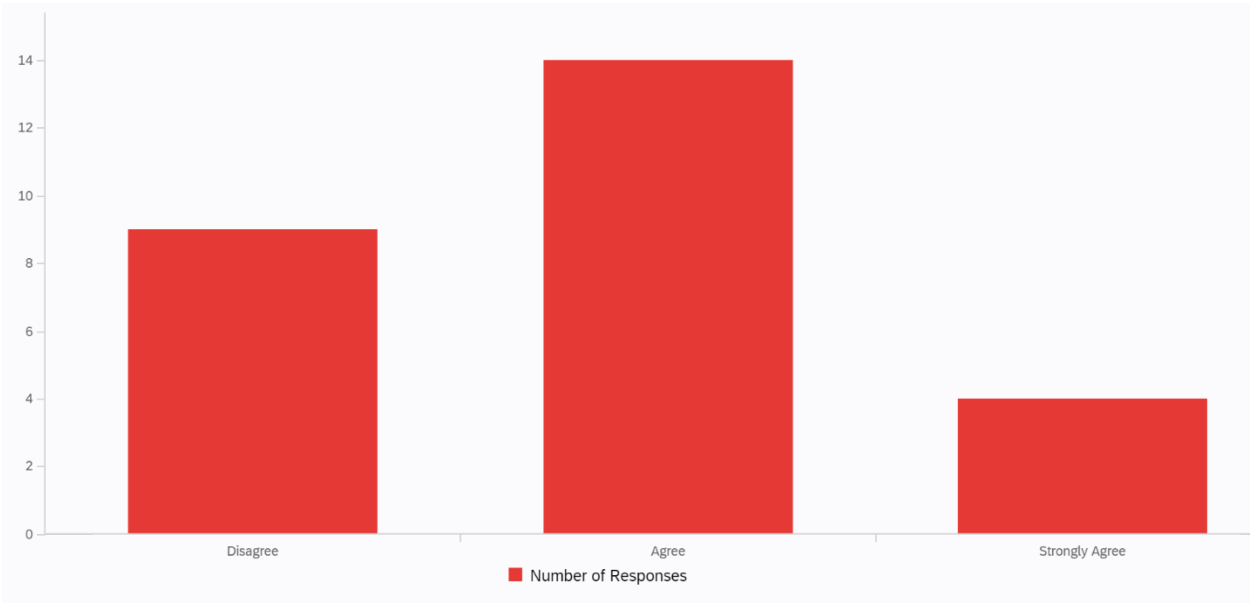Seat belts on the bus would be an appreciated safety addition. (n=27)
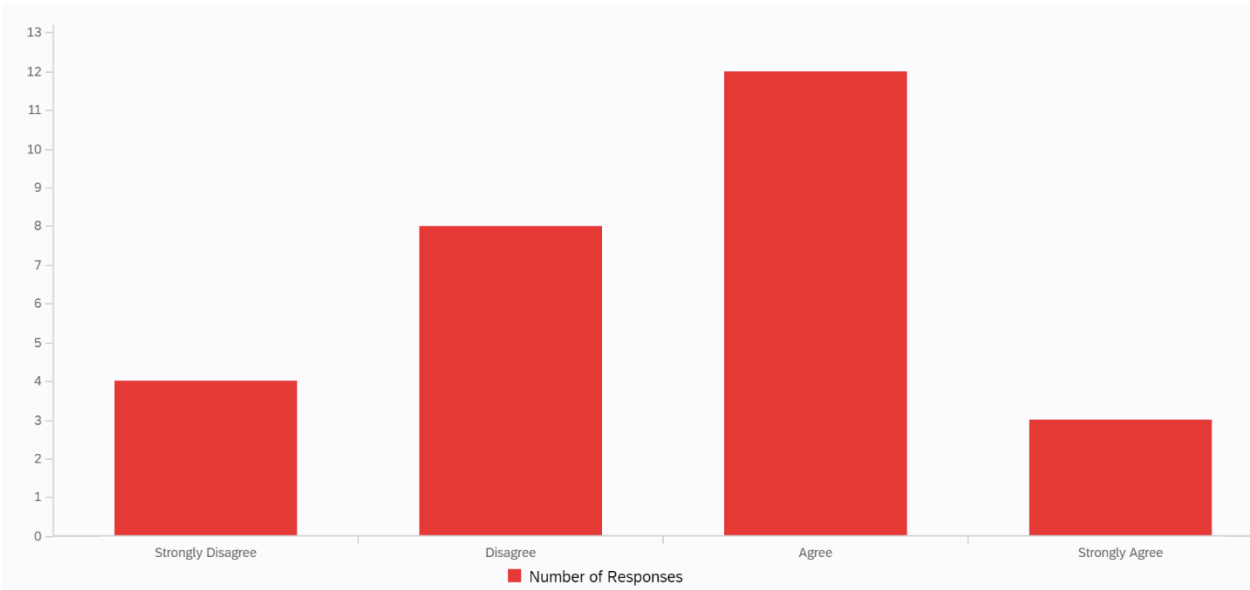
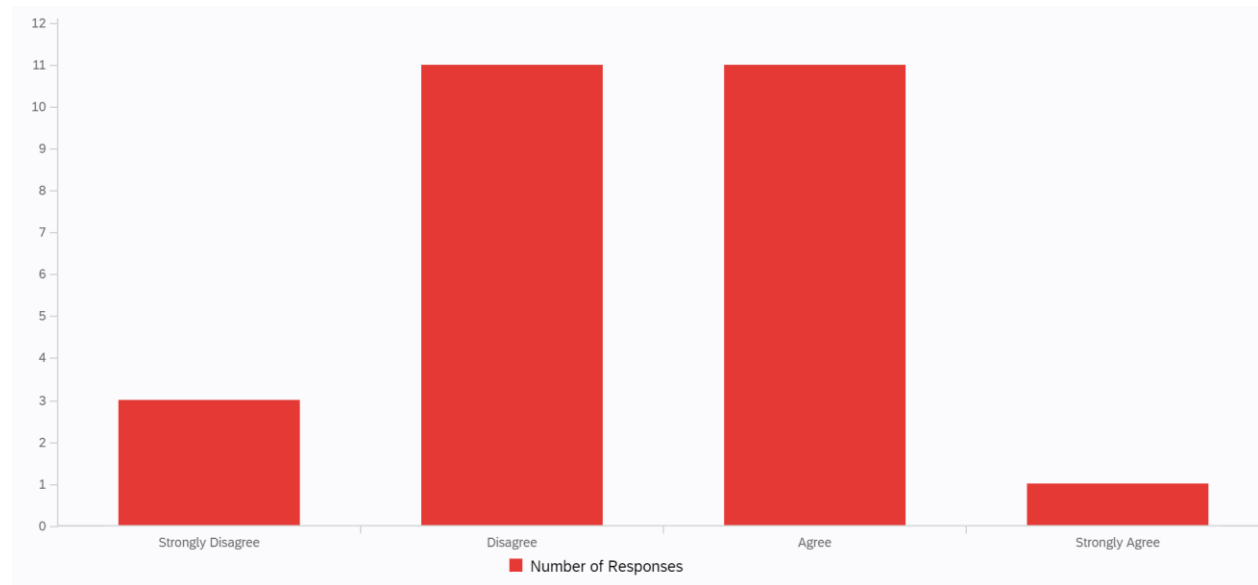I would prefer if the bus had electrical outlets to charge my devices. (n=25)
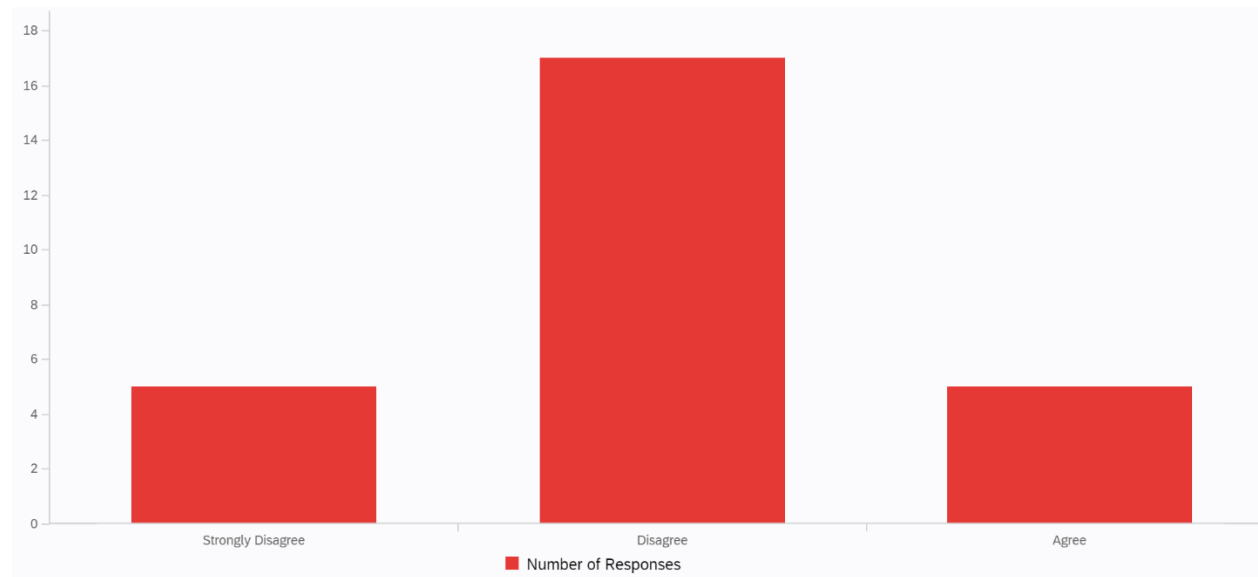
The bus stop shelters are clean. (n=27)
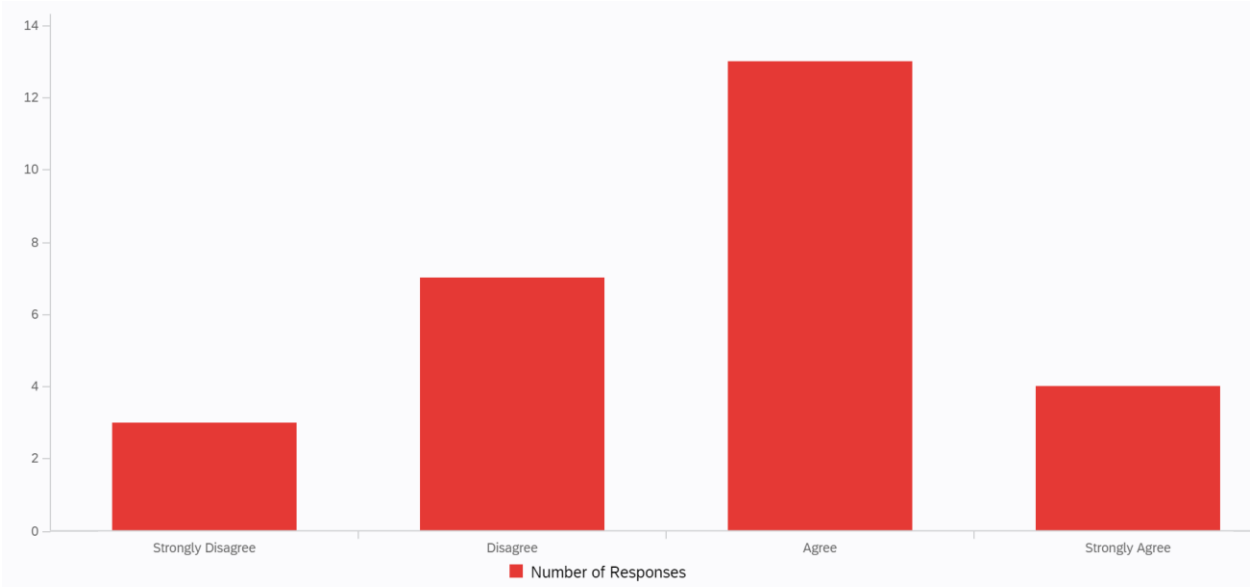

The bus stop shelters are safe. (n=27)

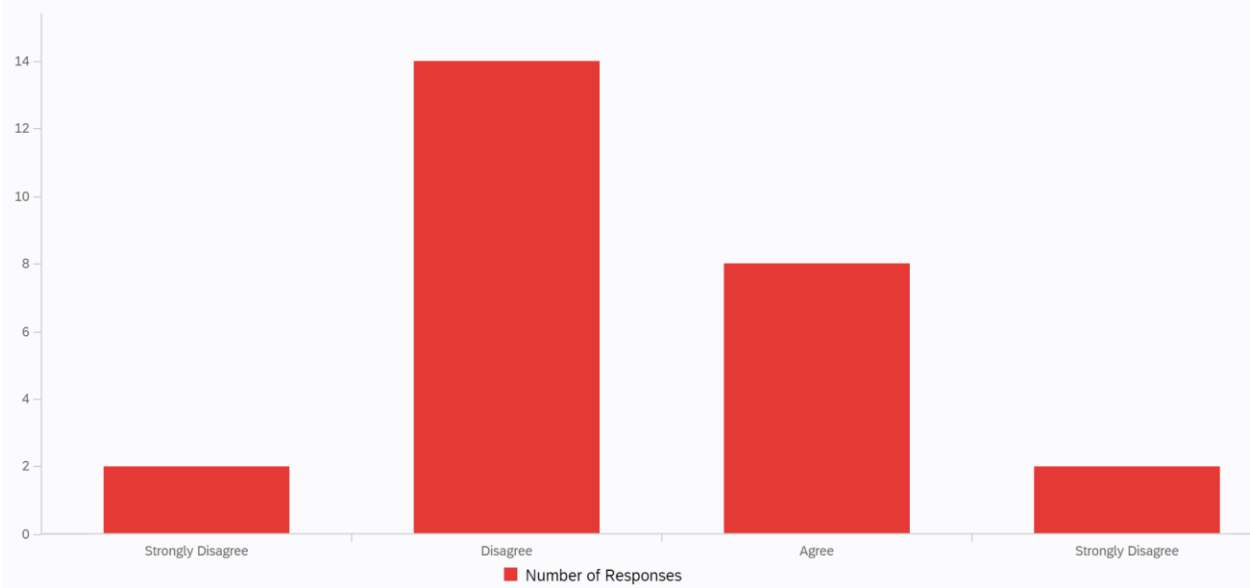There is ample space at the bus stop shelters. (n=26)

The bus stop shelters provide adequate protection from weather conditions. (n=27)

The auditory announcements are clear. (n=27)

Straeto clearly and effectively relays information to customers. (n=26)

Appendix F - Summary of Interviews and Focus Groups

During our interview with Guðmundur Heiðar Helgason (Gummi), the head of PR, we talked about Straeto's inability to enforce mask mandates, information not getting to customers efficiently, their loss of income due to the pandemic, and the importance of real time data in the app to help customers.

- Within the city, there is not a mask mandate so really people do not need to wear them.
    - Some riders choose to wear one.
    - Gummi does wear one when on the bus.
- Overall, Straeto was praised for acting quickly.
- About 70% of passengers were lost during the peak of COVID.
    - Typically, in Autumn the student population is thriving.
    - Straeto is looking at severe cuts as a result of the pandemic and students not being at school/on campus.
- There are 12,000 daily users for the app, but he is unsure of exactly how many total users.
- Gummi believes masks would be beneficial to wear on all Straeto buses.
- He wants to see more information and real time data being provided to customers.
    - He believes the key to public transport is real time data (minutes late, minutes to arrival, bus breakdowns, weather delays)

During our interview with Tonny Espersen, a Straeto bus driver, we talked about how bus drivers deal with the rules regarding COVID-19, bus reliability and maintenance, the difficult learning curve for new employees, and Straeto's fast paced schedule.

- There are really no enforced regulations for the bus driver themselves.
    - They have put up plastic blinds between the passenger and driver.
    - They also have hand sanitizer, gloves, and a mask if needed, but they are not mandatory.
- Straeto reacted extremely fast and he likes that they were so proactive. As a result, he doesn't feel very worried.
- Straeto needs newer buses.
    - They are not comfortable, and at the end of the week it is very apparent that you've been on the bus so long.
    - The seats themselves are very worn out.
- The older buses frequently break down when full of passengers.
- 6-7 of the buses are from 2000 and have over 1 million kilometers on them.
- The people always have their head in their phone. People need to show interest in getting on the bus.

- Some Icelandic people generally feel that buses are "not cool" and prefer not to use them.

During our interview with Markús Vilhjálmsson, Straeto's marketing manager, we talked about the impact that COVID-19 had on customers and income, Straeto's proactive and preventative measures taken during the pandemic, and the best ways to distribute our survey to students.

- Markus asked the developers about adding the survey into the app.
    - Decided adding the survey into the app would be costly and require some time development wise.
    - Markus will share it on the Facebook, Twitter, Instagram: we must provide the flyer and a blurb.
- 5 to 7% of passengers usually pay with cash, which went down during COVID-19.
- Cash sales went down from 1.5 mil krona to 60,000 krona during COVID-19.
- Authorities did not agree to put mask mandate in place for Straeto buses.

During our interview with Sigurður Grétar Ólafsson (Siggi), Straeto's project manager, we talked about how Straeto and its customers reacted to the pandemic, the communication between the customers and Straeto, and Straeto's future regarding public transportation that are not buses.

- During the peak, passengers let themselves in through middle doors, and the bus driver didn't count passengers so sometimes the buses were too crowded.
- Straeto also cut down number of buses and moved them to a Saturday schedule to deal with having less income.
- It was mentioned there were some beginnings of an idea to partner with e-scooter companies.

During our focus group with former WPI IQP students who traveled to Iceland, we discussed why people would or would not use buses to get around, experiences regarding the buses and public transportation, and thoughts on how to improve Straeto's buses.

- Some drivers were reported to be aggressive.
- It was difficult figuring out which stop to be at and when.
- Bus rides were uncomfortable.
    - Some seats were backwards.
    - People got car sick easily.
- If customers didn't make it clear they wanted to get on the bus, sometimes the drivers would leave the stop.

- The buses were on a very tight schedule.
- Location names were a problem due to the language barrier.
- Ticket sales were not electronic.
  - It was easy to reuse old tickets by rewriting the date, passengers could get out of paying.
  - Nothing confirming a person was who they claimed to be.