ENV332
PROJECT MANAGEMENT

2020

UTM SHUTTLE BUS COMFORT SURVEY: Findings Report

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Executive Summary

This project focuses on increasing the comfort of shuttle bus riders at the University of Toronto Mississauga campus. The UTM shuttle buses were initially introduced amid increasing demand for a cost-effective way to travel to and from the UTM campus. Amid complaints, the Sustainability Office within the Facilities, Management and Planning department has contracted this team to gauge whether improvements to bus comfort (such as comfortable seats, more spacious seating and better air conditioning) will translate into increased ridership. This was evaluated through the issuing of a comfort survey, to both riders and non-riders of the shuttle bus. The survey was administered in-person via paper, as well as online through the Parking & Transportation services website. Through primary data collection and analysis, a broader perspective of the changes needing to be made were achieved and is documented in this summary of findings report. Some of the highlights from the finding are that implementing comfort related changes can have a positive influence on ridership.. Specifically, about 74% of riders said that changes to comfort would encourage them to take the shuttle bus more often. Given the split results, it cannot be concluded that changes to these service areas would increase ridership among non-riders, despite their interest in timeliness and safety.

Overall, the service is well received with 54% of riders being somewhat satisfied with the UTM shuttle bus services that are already in place. However, there were clear areas of dissatisfaction found from the survey. These include uncomfortable seats, wifi connectivity, not enough buses with the presence of wifi. We recommend that the immediate improvement efforts be made in the above areas, by installing more comfortable seats or adding seat cushions, as well as ensuring high-connectivity wifi on all buses. Other secondary recommendations include increasing bus frequency, the development of a smartphone application that depicts the bus timings in real-time, and potentially examining the future possibility of creating a shuttle bus shelter. Implementing these changes, however, will not guarantee an increase in ridership due to the limitations of the study. Still, this study can provide a foundation for future projects and inform decision makers on how to improve the UTM shuttle bus.

Introduction

The University of Toronto Mississauga's (UTM) shuttle bus service is designed to provide a safe, cost-effective, and customer-oriented transportation for UTM students and faculty to the U of T St. George campus. The shuttle bus is not just restricted to UTM students, but is also open to UTM faculty and the non-UTM public for fixed bus fare of $7.00 each way (Fares and Boarding, n.d.). These fares are required to be paid in advance in exchange for a bus pass or ticket that is collected by conductors upon boarding of the bus (Fares and Boarding, n.d.). While there is a fixed fee to ride the shuttle bus, the service is available for free for all registered UTM students, as its fee is already incorporated into their tuition (refer to C2 in Appendix C). All they need to do is swipe their valid TCard for verification at each time of boarding (Fares and Boarding, n.d).. The main purpose of the UTM shuttle bus is to allow travelling between the St. George and Mississauga campus quick and cost-effective for its faculty and students.

Throughout the project, many limitations provided barriers to obtaining a conclusive result. In total, we were only able to receive a total of 279 responses out of the entire campus' population. In terms of demographics, while there were a few older adults and staff members using the shuttle bus, the majority of the demographic of the survey was focused on the student range of ages between 18 and 24 that did or did not use the service. For feedback from the current riders of the bus, we decided to focus on their feedback regarding the comfort of their ride rather than the number of times the respondent the bus. Moreover, due to the time the survey was administered, a great proportion of the feedback we received focused on the current experiences of the riders during the cold season. Perceptions regarding comfort levels during the warmer season may have yielded different conclusions. Therefore in this report, very limited feedback can be concluded about the comfort levels during the warm season. Lastly, due to the limited availability of potential

funds and lack of information availability, we were unable to conduct a proper cost-benefit analysis to provide an overall budget for the improvements. While these are just a few listed, there are many other specific limitations that are discussed throughout the report.

Based on our findings of the survey, our project aims to act upon the goals and objectives outlined as follows:

Goal & Objective

The goal of our project is to determine the aspects of the service requiring improvement in order to increase the overall ridership of the UTM shuttle bus. In this report, we are primarily focusing on a broad definition of comfort to suggest a large proportion of recommendations for improvement.

Recommendation

Currently, there has been a significant level of dissatisfaction with the overall service of the shuttle bus (Khan & Saqqa, 2020) . Our recommendations are not directly designed to increase the overall ridership. Instead, the recommendations outlined in this report are aimed to provide the UTM Shuttle Bus service with suggestions of improvement in the key areas of comfort that are greatly affecting ridership levels. By doing so, the UTM shuttle bus ridership may improve.

Background Information

Transportation at the University of Toronto Mississauga Campus

The University of Toronto Mississauga (UTM) campus is the second largest of the three campuses (St. George and Scarborough). Many students that attend UTM are fairly close to the campus. UTM's central location offers students with a shorter commute that travel from the South-end of the Greater Toronto Area (GTA). Most students either directly commute from the immediate region of Peel or surrounding regions such as Halton and York. Attending students that stay in the immediate city (Mississauga) are provided with free transportation via the MiWay Bus (U-Pass, n.d.). Furthermore, students that commute from the St. George Campus or the Sheridan College Trafalgar Campus are provided with a complimentary passage via the UTM Shuttle Service (UTM/Sheridan College Service, n.d.; UTM/St. George Service, n.d.)).

The University of Toronto Mississauga Shuttle Service

The UTM Parking & Transportation Office has provided significant information for the following (Refer to C2 in Appendix C):

UTM's shuttle bus services budget is based upon operating requirements obligated to administer the service. The budget is solely determined by the various ranks of UofT's governance. "First Student", a third-party that is contracted by the shuttle service, works with the Parking & Transportation Office for maintenance and daily shuttle bus operations (see C1 in Appendix C). There are a total of eight regulatory buses that provide students with complimentary transportation to the St. George (Downtown) Campus. Non-regulatory buses provide free transportation to the Sheridan College (Oakville) Trafalgar Campus (see C1 in Appendix C). Students that do not attend the UTM campus may use shuttle services after purchasing a ticket or bus pass. Shuttle services run frequently throughout the day with buses departing from five minutes before the hour and fifteen minutes after the hour. Each bus is equipped with thermal

heating and air conditioning for the comfortability of students and all other users. Each regulatory bus is also equipped with a wireless internet signal that can be used with school credential details (see C1 in Appendix C). Non-regulatory buses do not have wireless internet capabilities due to the short travel-time interval (see C1 in Appendix C). In addition, regulatory buses are equipped to accommodate accessibility needs, with the exception of double buses and buses to accommodate for maintenance, on both routes to and from the St. George campus (see C1 in Appendix C).

The Shuttle Bus Budget

UTM's shuttle bus revenue comes from two primary sources. For 2019 -2020, 80% of the total forecasted revenue is generated by Student Service Fees. Full-time UTM students are charged $54.08 per semester on tuition invoices (see C2 in Appendix C). Part-time students are charged 20% of this rate at $10.82 per semester (see C2 in Appendix C). The remaining 20% is generated from non-UTM students, faculty, staff, and other users from bus ticket sales and shuttle bus passes (see C2 in Appendix C).

Problem Statement

The UTM Shuttle Bus Service has received a great deal criticism from students and faculty throughout the years (Khan & Saqqa, 2020). Most of these criticisms revolve around the comfort and timeliness of the shuttle buses (Khan & Saqqa, 2020). This may prevent students from using the shuttle service. The coordinators at the UTM Sustainability Office are interested in studying various issues regarding comfort of the shuttle bus. Chelsea Dalton has assigned our group the task to determine the variables that will increase ridership. The Shuttle Bus Service was created to ease transportation for students that commute between the UTM and St. George campuses. By analyzing respondent feedback obtained from the comfort surveys, we hope to determine the main issues regarding comfort. We'd like to suggest improvements in these comfort factors to increase ridership of the shuttle bus.

Methods

To determine whether increasing the comfort of the UTM - St. George Shuttle Bus would translate into increased ridership, two types of comfort surveys were administered; (1) targeting riders and (2) targeting non-riders.

In an attempt to define comfort, we consulted various sources to inform our understanding. Following our literature review, factors such as timeliness, safety, availability of wifi, frequency, accessibility, seat comfort and availability, and bus temperature were prevalent aspects in defining comfort (Customer Satisfaction Survey, 2017; Fasa et al., 2017; Shen et al., 2016; EPTA, n.d.). Overall, it can be said that we adopted a broad and multi-faceted definition of shuttle bus comfort, which went beyond merely assessing the bus' internal conditions.

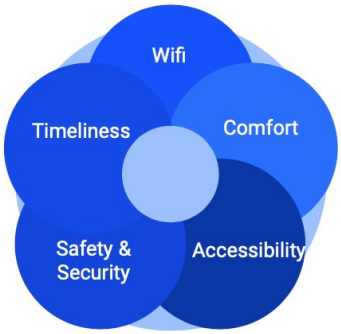


Figure 1: Diagram showing the aspects that informed our definition of comfort.

Besides the questions generated by this project's team, both surveys included questions provided by the Shuttle Bus Electrification Group. These gauged respondents' perceptions of lowering campus GHG emissions and willingness to pay for an electrified UTM Shuttle Bus. Both teams administered the same survey across the UTM campus, from March 2nd, 2020 to March 12th, 2020. Either individually or in pairs, administrators were stationed in high-traffic areas including the Shuttle Bus Stop (Instructional Building), Davis Building, Kaneff Centre, Communication, Culture and Technology Building (CCT) and other areas on campus. Additionally, the rider survey was loaded to the UTM Parking and Transportation website to collect responses online. Both surveys primarily consisted of close-ended questions, with open-ended comments sections provided at the end of the surveys. Given the UTM student population of 15,448 (U of T Mississauga, n.d.), we determined that a response rate of 266 was necessary given a confidence interval of 90% and a margin of error of 5% (refer to A7 in Appendix A). .

In conducting these surveys, we wished to understand;

1. The satisfaction of riders with certain aspects of the service and desire to improve them.
2. The factors influencing the prefered commuting mode of non-riders.
3. Whether any modifications would encourage both riders and non-riders to use the service more frequently.
4. How much riders and non-riders would be willing to pay for improvements in overall comfort.

For a more detailed description of the contents within each survey please navigate below.

Riders

The rider survey was geared towards those who do take the UTM shuttle bus. Respondents were asked to rate their satisfaction with the shuttle bus service using a four-point Likert scale across five focus areas; timeliness, safety and security, comfort, wifi and accessibility (if applicable). As well, respondents were asked to provide a rating of their overall satisfaction with the service. To gauge whether increased comfort would potentially translate into increased ridership, respondents were asked to answer yes or no to “Would improvements to any of these aspects increase your desire to take the UTM shuttle bus”? If yes was selected, those who identified as UTM students were asked how much they would be willing to contribute for a more comfortable bus. As for respondents that did not identify UTM students, they were asked whether they would be willing to pay a $1-2 price increase for shuttle tickets. These responses would later inform our costing analysis. For the full rider survey please see B1 in Appendix B.

Very unsatisfied	Somewhat unsatisfied	Somewhat Satisfied	Very satisfied
1	2	3	4

Figure 2. Likert scale used in rider survey to assess satisfaction with aspects of comfort

Non-riders Survey

The non-rider survey was geared towards respondents who do not take the UTM shuttle bus. We decided to survey this group to determine whether changes to the five-issue areas of timeliness, safety and security, comfort, wifi and accessibility would translate into increased ridership. First, respondents were asked their primary transportation method. Next, they were asked how often they travelled to the St. George campus and whether they knew of the UTM shuttle bus. Following this, respondents were asked to rank the importance of factors impacting their choice of transportation using a 4-point Likert scale. After this, non-riders were asked if implementing changes in any of these comfort areas would encourage them to take the UTM shuttle bus. Finally, respondents were asked about their willingness to pay for a $1-2 price increase in tickets and to provide comments if desired. For the full non-rider survey please see B2 in Appendix B.

Not Important	Somewhat unimportant	Somewhat Important	Very Important
1	2	3	4

Figure 3. Likert scale used to assess the importance of certain factors in determining the preferred commuting method for non-riders

Demographic Questions

For the purposes of understanding the respondent pool, both surveys asked demographic questions relating to age, student status (ie. full-time/part-time, international/domestic, year of study), employment status, car ownership, gender and region of residence. These specific variables were selected because we believed they would have the most influence on shuttle bus ridership. For the full demographic questions, please refer to B3 in Appendix B.

Limitations

Despite the extensiveness of our process, limitations in both the design and administration of the surveys may have contributed to biased or incomplete results. For one, the rider survey did not ask respondents how often they rode the shuttle bus. Those that do not take the shuttle as often may have a less nuanced opinion of its comfort, as compared to frequent riders. Consequently, our results may not be truly reflective of the comfort perceptions of riders. Furthermore, perceptions of comfort may be skewed due to the time of year the survey was administered in. If this survey was administered in the summer, one may expect to see varying results for thermal comfort, as opposed to in late winter to early spring, when this survey was administered. Provided this, a similar survey may need to be conducted in the summer to adequately assess certain factors such as cooling on the bus. Despite exceeding our response rate of 266 given a confidence interval of 90% and a margin of error of 5% (see B7 in Appendix B), a higher confidence interval and lower margin of error would have yielded results that were more reflective of the total UTM population. Given a longer time frame and greater capacity, another survey may be able to reach more conclusive results. Finally, some respondents did not complete certain portions of the survey and/or may have provided false respondes. This may have resulted in false or incomplete data, which may have impacted our analysis. However, our survey does provide a foundational understanding of how improvements in shuttle bus comfort can potentially increase ridership.

Findings

The data obtained from the administration of the rider and non-rider surveys was entered into Excel and coded using the same program. The survey was re-written into columns and the number of results for each answer were counted. As aforementioned, both surveys included questions generated by the electrification group. While responses were counted, we did not include these results in our summary of findings. In assessing the significance of certain responses, we established that total satisfaction scores (combining “somewhat satisfied” and “very satisfied”) of over 50% indicated that an aspect of the service was well received. Overall dissatisfaction was measured in the same way. Responses that were left blank were not counted in the total counts, due to missing data. As aforementioned, we are 90% sure that our results encompass the true mean of the population, with an identified 5% margin of error.

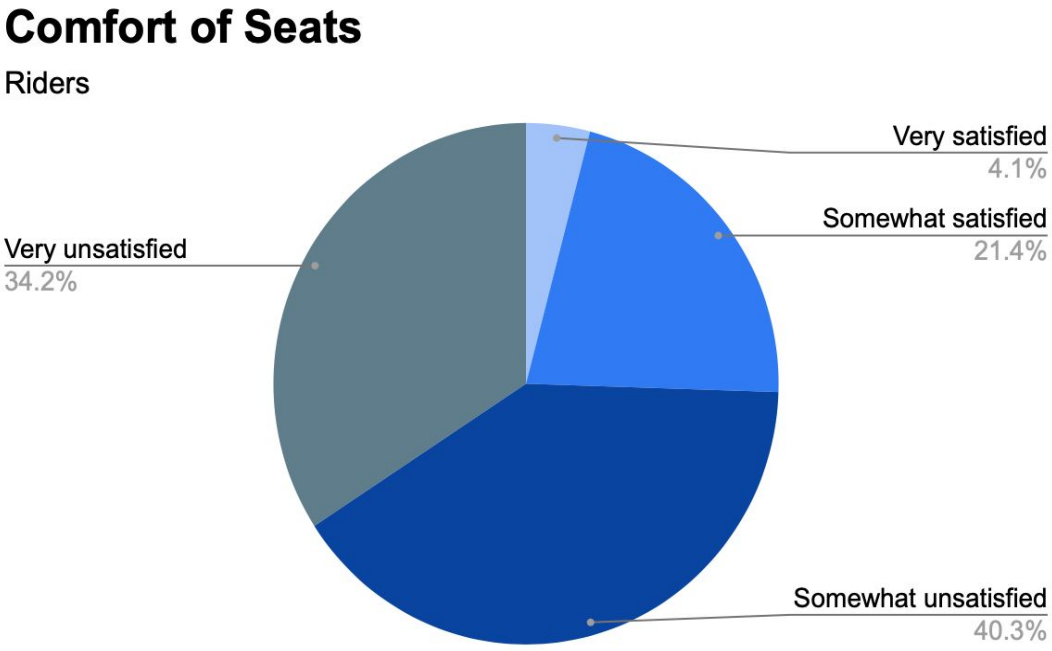
Riders

Of the 279 respondents, 197 identified as riders of the UTM shuttle bus, accounting for 70% of the total surveyed population. Among the riders, 91% were UTM students and 9% were non-students. Seeing that this group was provided with a particular set of questions, the respondent’s answers were influenced by their perception and identification as a “rider”.

Through the use of a Likert scale, respondents were first asked to assess their satisfaction with various aspects of the shuttle bus service. The results of these findings are represented in the satisfaction chart (See A2 in Appendix A).

On the whole, it can be said that riders are most unsatisfied with both the seat comfort, smoothness of the ride, availability and connectivity of the wifi.

Upon closer examination, riders expressed the most dissatisfaction with the comfort of the seats. Specifically, 34.2% of respondents were “very unsatisfied” and 40.3% expressed being “somewhat unsatisfied” with seat comfort, making for a total of 74.5% of respondents being in some way unsatisfied with this aspect of the service. Within the “Comments” section, eight respondents mentioned that the seats were uncomfortable and that “comfortable seating” is needed. Moreover, 2 respondents asked for “bigger seats.”



“Seats are very uncomfortable”

“The seats are tiny and suck”

Figure 4. Pie chart of rider’s satisfaction with comfort of seats

Following seat comfort, wifi connectivity elicited the second highest satisfaction scores with 34.2% of riders stating they were “very unsatisfied” and 33.7% stating that they were “somewhat satisfied”, with a total of 67.9% of riders expressing some degree of dissatisfaction with wifi connectivity. Similarly, 62% of riders were to some degree dissatisfied with the presence of the wifi, with 31.8% of riders being “very unsatisfied” and 30.2% being “somewhat dissatisfied”. Comments provided reiterated some of these frustrations with one rider stating “Wifi on all buses would be nice” and another expressing that “all busses should have wifi”, while another comment said to make “wifi more accessible” (see Table A14 in Appendix A).

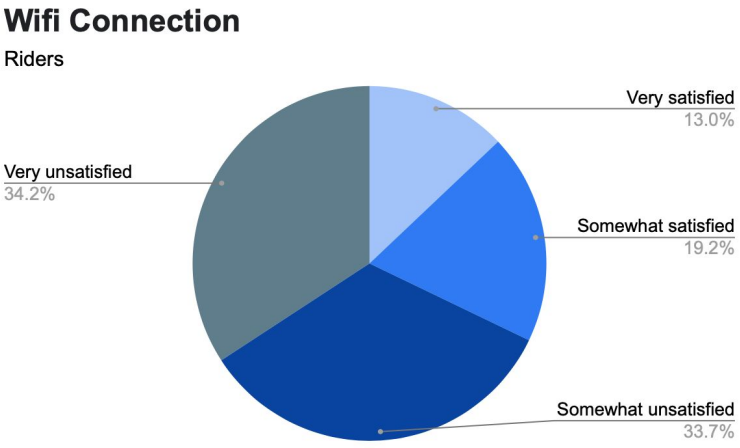


Figure 5. Pie chart of rider’s satisfaction with wifi connection

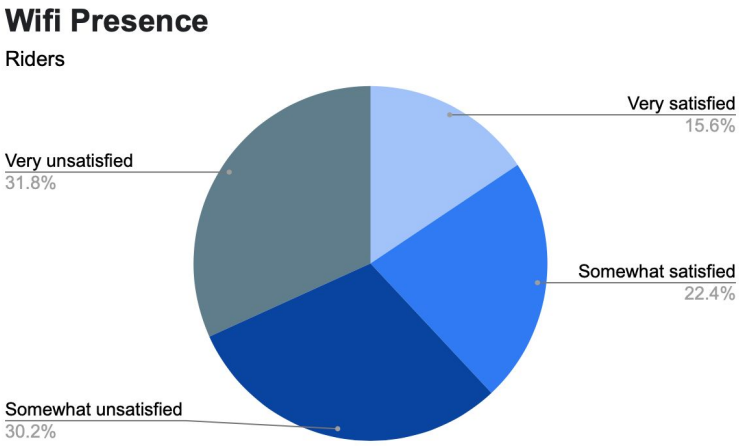
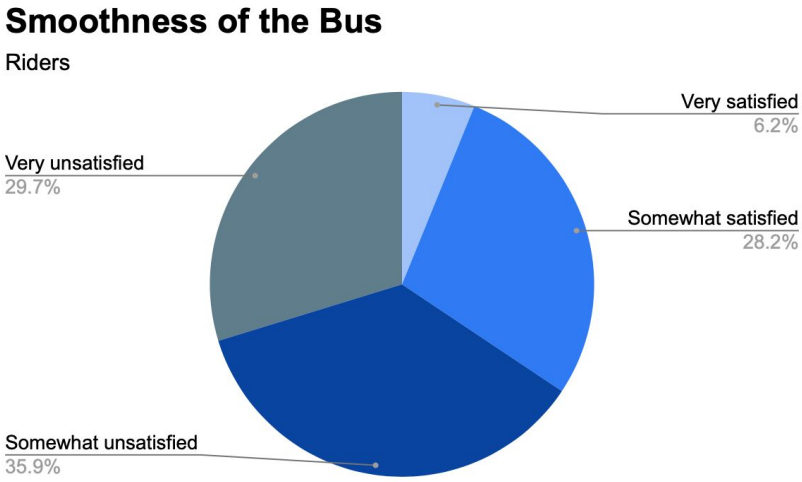


Figure 6. Pie chart of rider’s satisfaction with the presence of wifi.

Besides wifi and seat comfort, the smoothness of the bus ride was another area of low satisfaction. Of all riders, 29.7% reported being “very unsatisfied” with the smoothness of the ride and 35.9% were “somewhat unsatisfied” with this aspect. In total, 65.6% of riders were to some degree dissatisfied with the smoothness of the bus.



“Smoother Rides.”

“Steady Drivers (some people can easily get motion sickness).”

Figure 7. Pie chart of rider’s satisfaction with the smoothness of the shuttle bus.

While some aspects garnered strong dissatisfaction ratings, other aspects of the service were overall well received. On the whole, 53.6% of riders reported being “somewhat satisfied” with the service as a whole and 11.2% were “very satisfied”, resulting in a total satisfaction rating of 54.8%. Only 30.6% of rirders reported being “somewhat unsatisfied”, and 4.6% were “very unsatisfied”. However, improvement remains as only 11.2% or riders are “very satisfied” with the service.

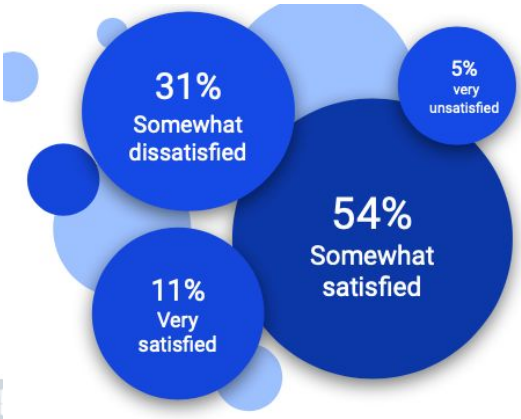


Figure 8. Bubble diagram of rider’s overall satisfaction with the UTM shuttle bus service.

Looking at individual components, riders feel safe while waiting and riding the UTM shuttle bus, with 87.7% of riders feeling either completely or somewhat satisfied with the former and 79.5% with the latter. Furthermore, respondents were satisfied with the timeliness of the bus, with 31.3% of riders being “very satisfied” and 48.2% being “somewhat satisfied”, yielding an overall satisfaction rating of 79.5%.

Similarly, 42.8% of riders reported being “somewhat satisfied” and 24.1% with the frequency of the shuttle bus, with an overall satisfaction score of 66.9%. As well, the availability of seats garnered slightly more satisfaction than dissatisfaction, with an overall satisfaction score of 60.6% and an overall dissatisfaction score of 39.8%.

Regarding accessibility, 9 of the 199 rides surveyed (4%) identified as having specific accessibility needs. Of those who stated the above, ⅔ were either “very satisfied” or “somewhat satisfied” with accessibility servicing on the shuttle. On the whole, riders reported an overall satisfaction score of 64.8%, suggesting that more than half of respondents were satisfied with the service.

Interestingly, rider’s satisfaction while waiting for the shuttle bus was less conclusive. Indeed, 32.7% of respondents reported being “somewhat satisfied” with their experience and 18.4% stated being “very satisfied”. Results expressing dissatisfaction were similar, with 33.7% of riders reporting being “somewhat unsatisfied” and 15.3% of riders being “very unsatisfied”. In looking at the overall satisfaction and dissatisfaction, 51.1% expressed the former, while 49% expressed the latter, an evident split. Likewise, opinions on heating and cooling were split, with an overall satisfaction score of 53.4% and an overall dissatisfaction score of 46.6%.

When asked to rate their overall satisfaction with the service, 53.6% of riders responded being “somewhat satisfied,” suggesting that numerous aspects of the service are well received. Only 30.6% of rirders reported being “somewhat unsatisfied”, and 4.6% were “very unsatisfied”. However, improvement remains as only 11.2% or riders are “very satisfied” with the service.

In seeing whether changes to any of these areas of comfort would translate into increased ridership, 74% of riders stated that they would take the shuttle bus more frequently if modifications were made to the factors above. To account for the expenses associated with enhanced bus comfort, 61.6% of riders who identified as UTM full-time or part-time students, expressed that they would be willing to pay more on the already existing fees of $54.08/semester for full-time students and $10.82/semester for part-time students. When asked how much of an increase, 40% of respondents expressed that a $5 rise in fees was. Of the non-student riders, 50% stated that they would be willing to pay a $1-2 increase in ticket fares (which costs $7.00 one way) to improve comfort.

All in all, while many aspects of the shuttle bus service were well received by riders, seat comfort, wifi presence, wifi connectivity and smoothness of the ride were poorly received. Despite this, riders are willing to pay to improve these areas of the service. As well, we found that changes in shuttle bus comfort would likely translate into an increase in ridership among riders.

Non-riders

Of the 279 responses, 80 identified as non-riders (about 29% of the sample size as seen in Table A1 in Appendix A). 88.8% of the respondents were UTM students and 11.3% were non-students (Refer to Table A3 in Appendix A). Respondents were also asked to identify their transportation method and region of residence. In addition, respondents also indicated the rank of importance of five different factors (Timeliness, Safety, Wifi Access, Comfort, Accessibility) to increase shuttle bus ridership. Among the non-riders, Timeliness and Safety were the greatest factors in increasing shuttle bus ridership, while Wifi Access was the least important. No additional comments were received non-riders.

Figure 9 depicts the transportation method non-riders use to commute to the UTM campus. A large proportion of students commuted via public transportation' (44%). The respondents also indicated driving as a significant transportation method at 36.0%. As seen in Table A4 in Appendix A, 76.9% of the respondents indicated access to a personal vehicle whereas 23.1% did not have access to a personal vehicle. 12% of the respondents identified they were dropped off on campus and 6% of the commuters indicated walking as their immediate form of transport. Non-riders indicated "Taxi/Uber/Lyft" significantly lower as a transport method at 2% as well as no respondents identified an "Other" form of transport.

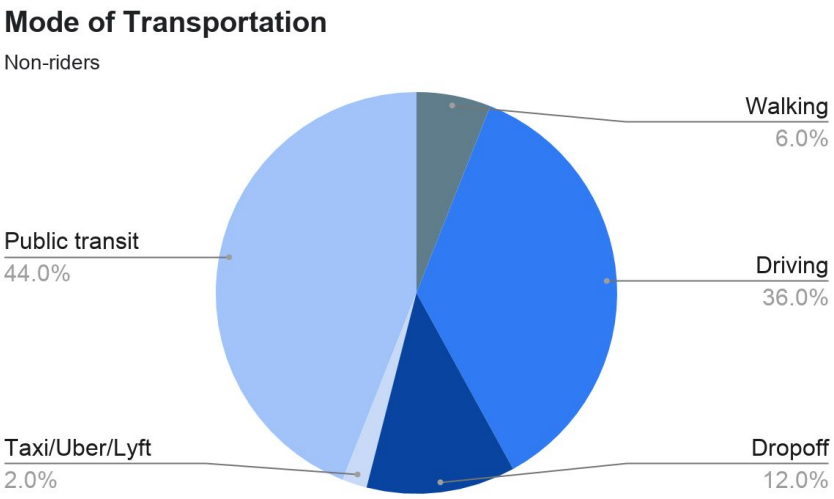


Figure 9. The mode of transport indicated by non-riders at the University of Toronto Mississauga campus.

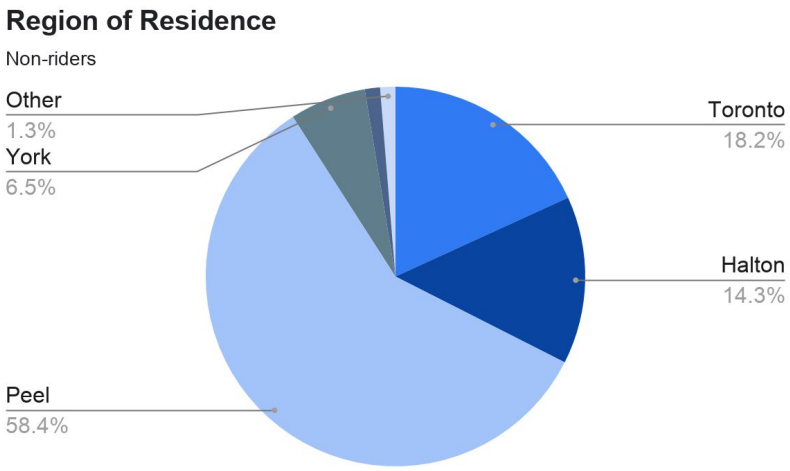


Figure 10. The region of residence indicated by non-riders at the University of Toronto Mississauga campus.

Figure 10 represents the regions non-riders reside in. A significant fraction of the respondents reside in the immediate region the UTM campus is located in (58.4% reside in the Peel Region). As discussed previously, 44% of non-riders commute via public transport. UTM provides students with free public transport via the MiWay Bus Service in the Peel Region. Because of this, a correlation may be present between these variables. A smaller proportion resides in the Toronto and Halton Regions (18.2% and 14.3% respectively). York, Durham, and "Other" had significantly lower residents compared to the other locations (6.5% in York and 1.3% in both Durham and "Other" Region) most likely due to the distance from the UTM campus.

Figure 11 illustrates the importance of various factors ranked by non-riders that is essential for Shuttle Bus ridership. The results were further segmented into percentages for each variable depicted in A10 in Appendix A. Timeliness and Safety were among the most important factors when increasing shuttle bus ridership. 81.3% and 77.5% of the

respondents identified Timeliness and Safety as “Very Important”, respectively. The respondents also indicated Comfort and Accessibility as an important variable in increasing shuttle bus ridership. Both these variables displayed similar results with over half of the respondents indicating Comfort and Accessibility as a significant factor for shuttle bus ridership (52.5% for Comfort and 51.4% for Accessibility). Wifi Access was the least important variable among the respondents. The results indicate a variability with 25.3% indicating Wifi Access as a significant factor and 38.0% of the respondents indicating it as least significant. This category, however, was ranked the least important compared to Timeliness, Safety, Comfort, and Accessibility.

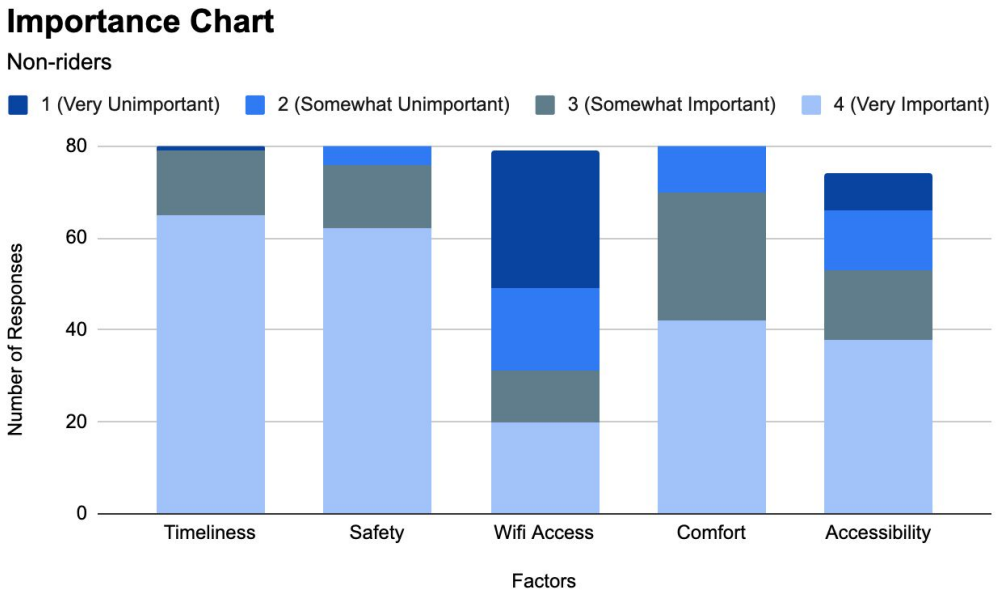


Figure 11. The rank of importance of five different variables indicated by non-riders to increase Shuttle Bus Ridership at the University of Toronto Mississauga Campus.

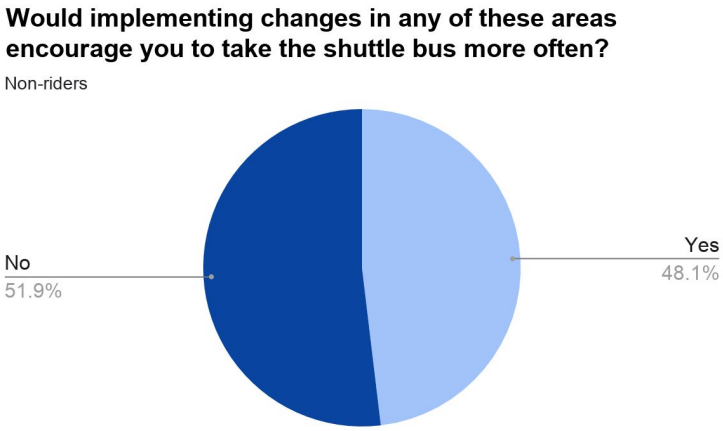


Figure 12. Response to "Would implementing changes in any of these areas encourage you to take the shuttle bus more often?" indicated by Non-riders at the University of Toronto Mississauga campus.

When assessing whether these factors would contribute to an increase in shuttle bus ridership for non-riders, 51.9% of the respondents indicated "No" and 48.1% of the respondents indicated "Yes" (see Figure 12). These results only varied by 3.8% indicating the proportions as insignificantly different. Non-students were also not willing to pay a $1-2 increase (68.1%) in shuttle tickets to accomodate for shuttle bus comfort (refer to A11 in Appendix A).

Cost

Communication with the Parking and Transportation office provided significant information regarding budgets and funding for shuttle bus services at UTM. With a total of eight shuttle busses running along the UTM and St. George route, revenues come from two primary sources. For 2019-2020, Student Services Fees account for 80% of total forecasted revenues providing unlimited access to the shuttle bus services. As a full-time UTM student, $54.08 is charged per semester on students' invoices and part-time students pay 20% of the rate, which is approximately $10.82 per semester (see C2 in Appendix C). The remaining 20% of revenue is determined from shuttle bus ticket sales and passes to non-UTM students, faculty, staff and other users (see C1 in Appendix C). According to recent study, UTM has a total of 15448 undergraduate and graduate students currently enrolled (Fact Sheet, n.d.). Based on data collected from the survey and the total number of full time and part time students at UTM, it was determined

that full time students contribute to approximately $742,680 (refer to A12 in Appendix A). Part time students currently contribute to around $11,361 (refer to A12 in Appendix A). Based on Figure 13, the majority of respondents are willing to pay an extra $5 to improve shuttle bus comfort. Therefore, parking and transportation services will have a pool of approximately $811,345 (refer to A12 in Appendix A). From full time students and approximately $16,611 (refer to A12 in Appendix A).from part time students to improve overall comfort.

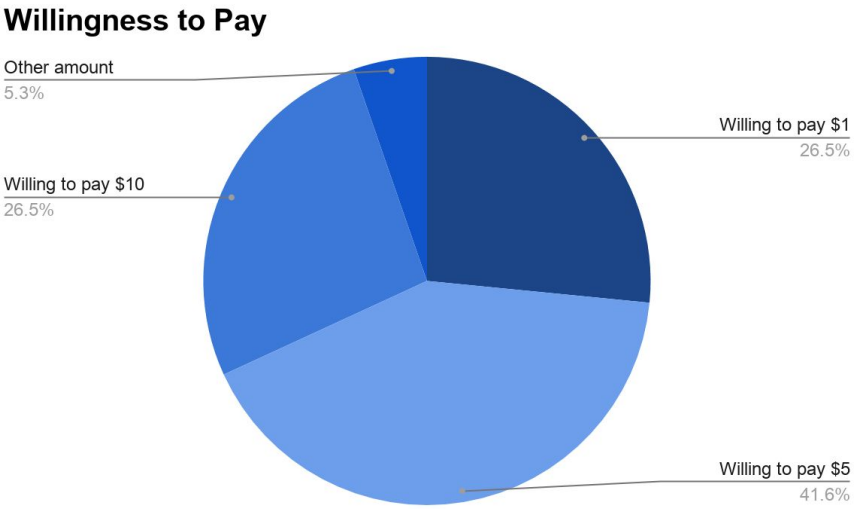


Figure 13. Response to "how much would you be willing to contribute for a more comfortable bus?"

As far as budgeting goes for shuttle bus services, it is determined based on operating requirements required to provide the service. Approval of the budget is confirmed and approved by multiple levels of UofT governance (see C1 in Appendix C). The shuttle service is contracted by a third party company known as, "First Student" (see C1 in Appendix C). The Parking and Transportation office closely monitors and works along with First Student to run daily operations. Due to unexpected measures (COVID-19), while communicating with stakeholders, the team was not able to get into contact with First Student to receive operational costs and other expenses associated with running the service.

Recommendations

According to the response we received in the non-riders and riders survey, most of them would travel on the bus more frequently if there were more comfortable seats and the space between seats. 64.9% of respondents who have access to the car take the UTM shuttle bus. 74.1% of riders responded that they would take the UTM shuttle bus more frequently if such changes were implemented.

Moreover, 50% of our non-riders would be more encouraged if the above changes were made. We suggest that initiating the installation of new seats completely or at least adding seat cushions would bring out the best results in terms of future increases in ridership. Second, most riders seem to be dissatisfied with the presence and connectivity of wifi, with “very unsatisfied” or “somewhat unsatisfied” with this aspect.

Provided this, we recommend the installation of wifi with a stronger network connection on all buses. The third area that garnered the most dissatisfaction was the smoothness of the bus operation. However, there is a limitation in solving this problem, as it can be caused by multiple variables such as road condition, tire, seat material, old vehicle etc. Also, there is a lack of information that was obtained from the third party (First Student) that provides the bus service to UTM.

While opinions on the quality of heating and cooling on the bus was polarizing, we still recommend that assessing the type of system used on the bus and ensuring that the temperature is appropriate for the season. However, maintaining the ideal temperature for everyone can be difficult as individuals may feel differently based on other factors such as clothing.

While seat availability was generally well received, there were a couple of comments regarding the shuttle bus needing more seats during busy hours (see A13 in Appendix A). About 39.8% of the shuttle bus rider found this factor unsatisfying. According to Shen et al. (2016), passenger load affects the comfort level over time while the vehicle is in operation, even when the passenger is seated. It shows that passengers' comfort level decreases during the ride and the point where it starts to decrease can be higher or lower depends on the passenger load (Shen et al., 2016). Also, the study suggests that the crowding effect plays an important role in choosing transportation methods as it impacts comfort that is not necessarily limited to physical, but also psychological comfort (Shen et al., 2016). Hence, increasing seat availability, such as running more buses at busy hours, can positively affect the rider's overall satisfaction and translate into increased ridership.

Table 14. Summary of recommendation that can increase comfort significantly

Seat Comfort	Wifi Availability	Smoothness	Standard Temperature
Install new seat	Install Wifi on all or most of bus	Limitation on identification	Maintain temperature
Add seat cushion	Provide strong network connection	-	Limitation on identification

In addition to the factors that contributed to the dissatisfaction level, it is also important to consider those aspects of the service with a higher satisfaction rating. Most of the shuttle bus riders feel safe waiting for the bus and when the bus is being driven, which is a positive testament to the quality of the service.

In the rider survey, 66.2% of respondents are satisfied with the frequency of the shuttle bus. However, 9/48 comments that riders made related to this aspect. Four respondents said that the bus needs to be more frequent and another 4 respondents for more frequent buses available at night or on the weekend (see A14 in Appendix A). As well, we received a comment alluding to issues with the bus' timeliness, specifically that the bus' arrival and departure does not align with their schedule. Although this factor has a considerably high satisfaction rate, it is important to consider increasing the shuttle bus frequency by having more buses running at the peak hour and on the weekends, as well as hire more drivers to operate these additional buses.

Table 15. Summary of recommendation that would increase comfort

Seat Availability	Bus Frequency	Timeliness & Waiting	Safety
Running more bus at busy hours	Additional bus schedule	Live bus time application	Most satisfied area
-	More bus at night & on weekends	-	-

We also recommend informing students about the UTM shuttle bus system through an application that could be built specifically for live bus timings and by doing so it would add to the comfort and convenience of riders and encourage the non-riders.

Finally, 2/30 comments expressed interest in the installation of a shelter. Seeing that only a pair of respondents voiced this desire, a definitive recommendation cannot be made. However, the UTM Sustainability Office or Parking and Transportation services may want to conduct a feasibility and interest study to examine whether this would be something that would increase shuttle bus ridership.

All of these suggestions are subject to the cost of adding these services to the UTM shuttle bus. The only cost analysis we could acquire was that 40.2% of our respondents were willing to pay $5 to the current transportation fee of $54.08 per semester for full-time students and $10.82 for part-time students (see C2 in Appendix C). Assuming that there are 15,448 students at UTM, a $5 increase in each fee would provide a total of $827,956 to Parking and Transportation Services to upgrade the UTM-St. George shuttle bus fleet. Since there are 8 shuttle buses, there would be $103,494.05 funds available for each bus. This can be used to implement any necessary changes in the future.

In order to increase the comfort level of the UTM shuttle bus efficiently, we suggest to concentrate on improving seat comfort and wifi on the bus.

Conclusion

This project provides insight on the various factors influencing the comfort of UTM's shuttle buses. The aim of this project was to determine these factors and provide recommendations to increase ridership. Online and in-person surveys were administered to both UTM shuttle bus riders and non-riders, and asked various questions on shuttle bus comfort. Results indicate seat comfort and wifi connection have a significant impact on the ridership of current UTM shuttle bus riders. In addition, through our survey we came to the conclusion that adding an additional $5 to student services fees would provide the Parking & Transport Office a total of $827,956 to implement changes to the shuttle bus. Since there are 8 regulatory shuttle buses, each bus would be provided $103,494.05 additional funds. We recommend immediate improvement in seat comfort and wifi access as these are the areas riders are most dissatisfied with. Despite dissatisfaction with smoothness of the shuttle bus, we could not obtain thorough information regarding bus mechanics, therefore, we cannot provide an accurate recommendation to improve this area. It is not guaranteed these recommendations would translate to increased ridership due to study limitations, however, this study will provide a foundation for future projects, as well as keep decision makers informed in priority areas for shuttle bus improvement.

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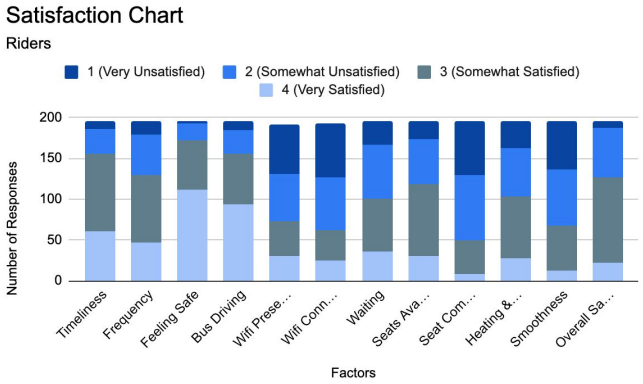
Appendix A

Table A1. The proportion of Shuttle Bus Riders (Yes) and Non-riders (No) at the University of Toronto Mississauga campus.

Do you take the UTM shuttle bus?		
	Frequency	**Percent**
Yes	197	70.6
No	80	28.6



A2. The level of satisfaction of twelve different variables indicated by Riders at the University of Toronto Campus.

Table A3. The proportion of students (Yes) and non-students (No) indicated by a. Riders and b. Non-riders at the University of Toronto Mississauga campus.

a.

Riders: Are you currently a UTM student?		
	Frequency	**Percent**
Yes	182	91.5
No	17	8.54

b.

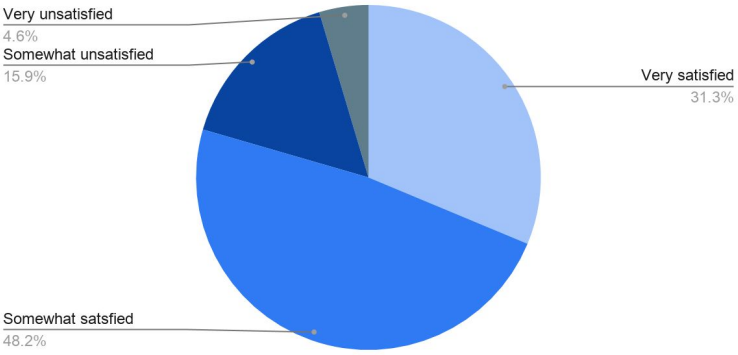
Non-Riders: Are you currently a UTM student?		
	Frequency	**Percent**
Yes	71	88.8
No	9	11.3

Table A4. The frequency and proportion of Non-riders that have access to a private vehicle at the University of Toronto Mississauga campus.

Non-Riders: Do you have access to a car?		
	Frequency	**Percent**
Yes	60	76.9
No	18	23.1

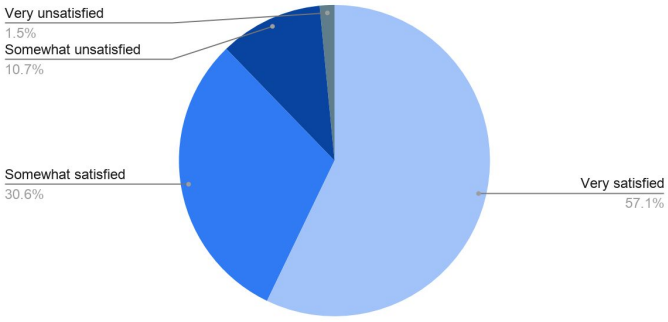
Timeliness

Riders



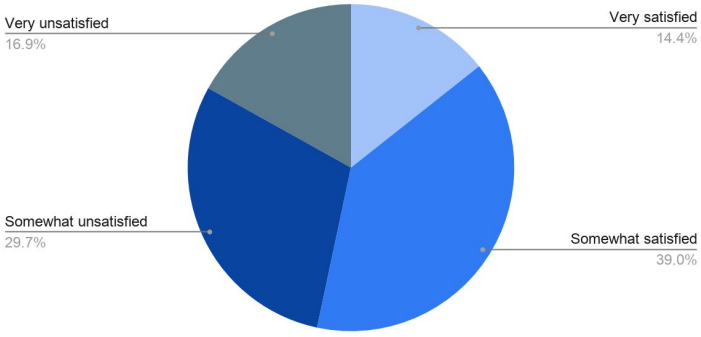
Feeling safe while waiting for the Shuttle Bus

Riders



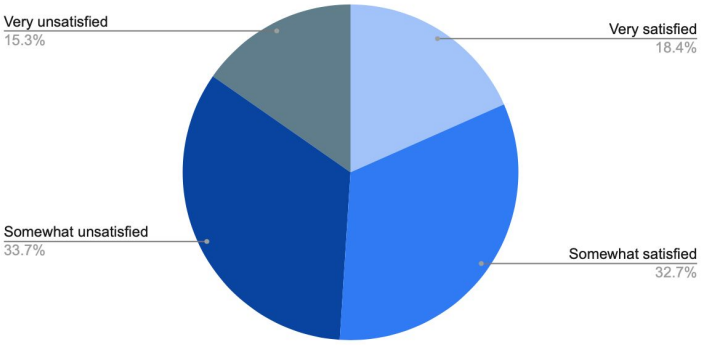
Heating and Cooling

Riders



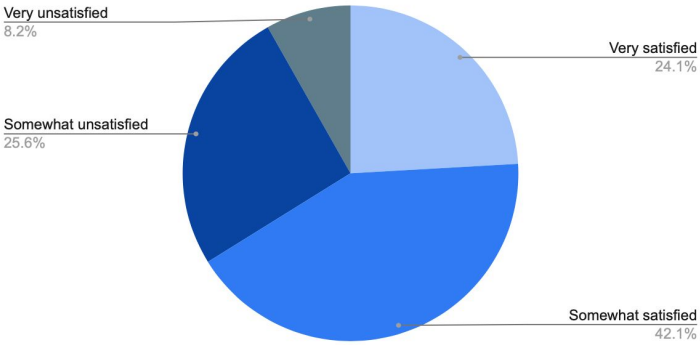
Waiting

Riders



Frequency

Riders



Availability of Seats

Riders

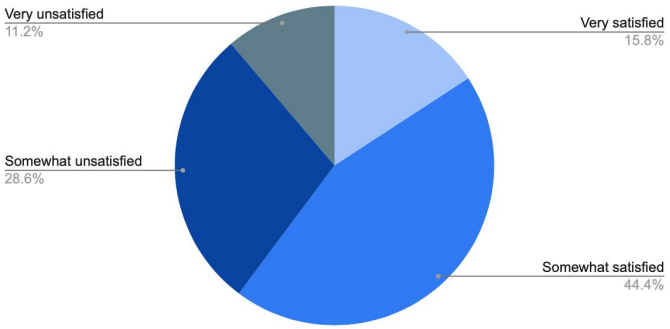
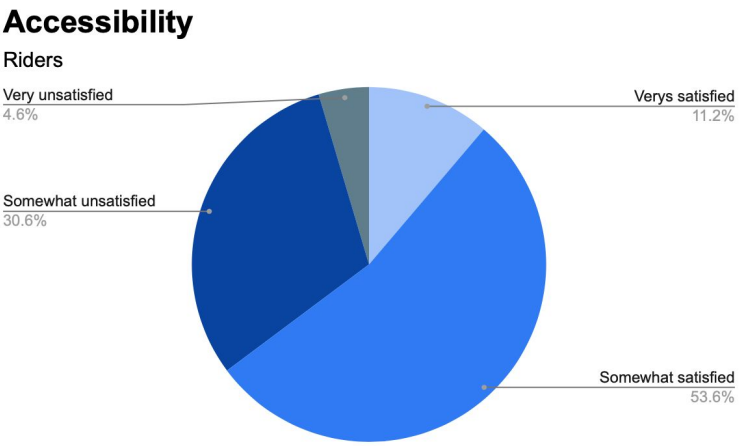
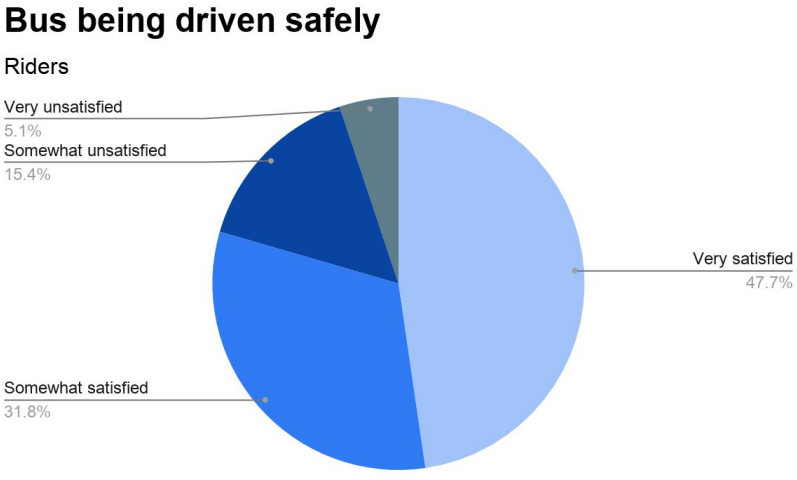
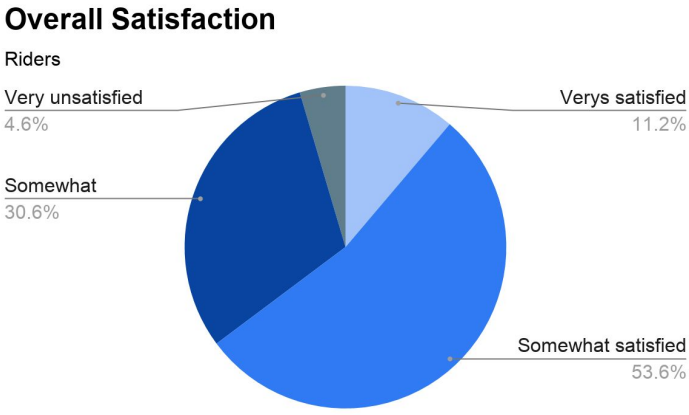


Table A5. Riders' response to satisfaction of accessibility needs at the University of Toronto Mississauga Campus

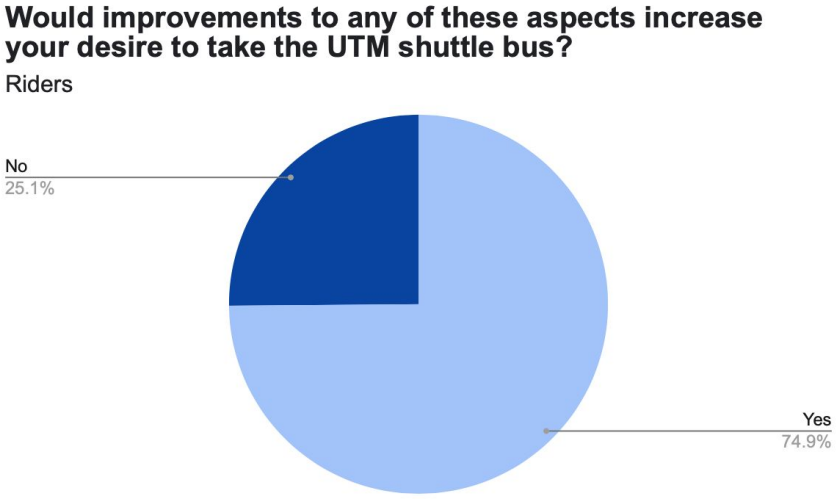
Satisfaction of riders who have specific accessibility needs	
	Frequency
Very satisfied	3
Somewhat satisfied	3
Somewhat unsatisfied	3
Very unsatisfied	0
Total	9



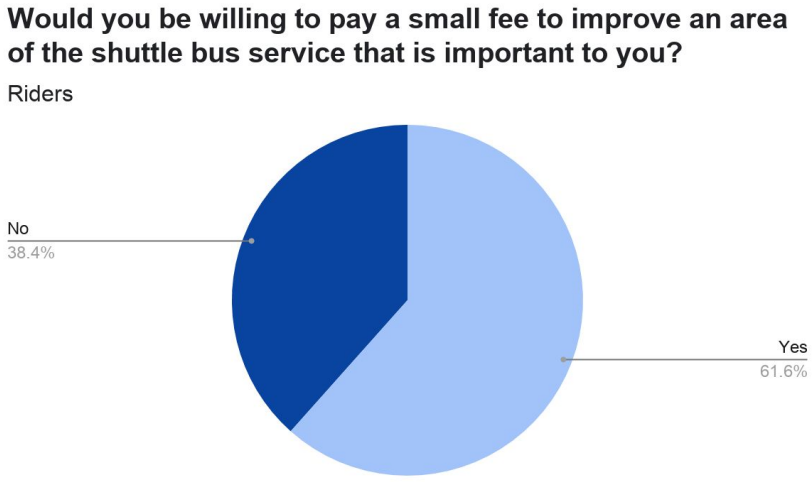




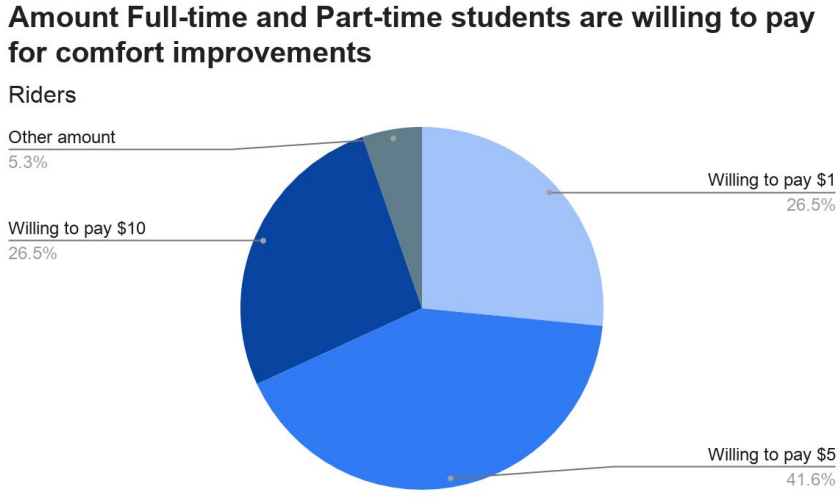
A6. Pie charts depicting the level of satisfaction of twelve different variables indicated by Riders at the University of Toronto Campus (pg. 30-31),



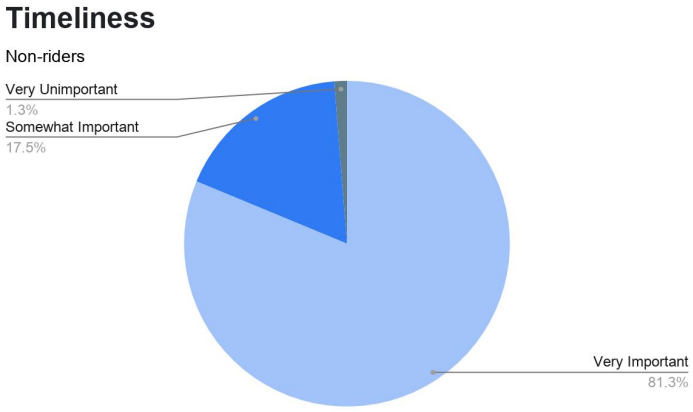
A7. Response to "Would improvements to any of these aspects increase your desire to take the UTM shuttle bus?".

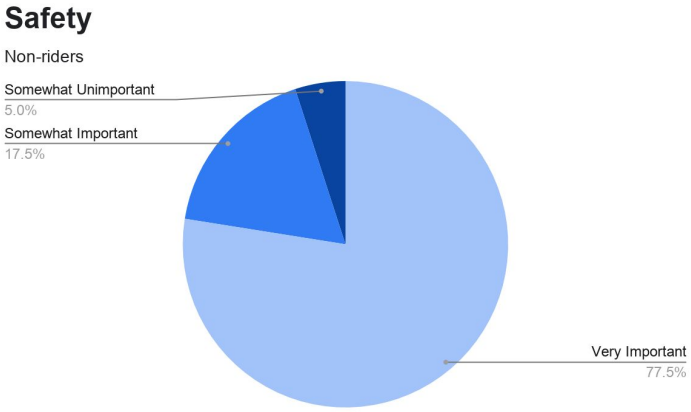


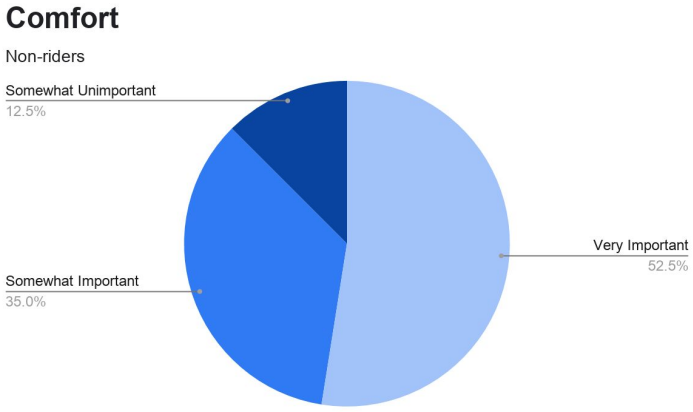
A8. Response to "Would you be willing to pay a small fee to improve an area of the shuttle bus service that is important to you?"" at UTM.

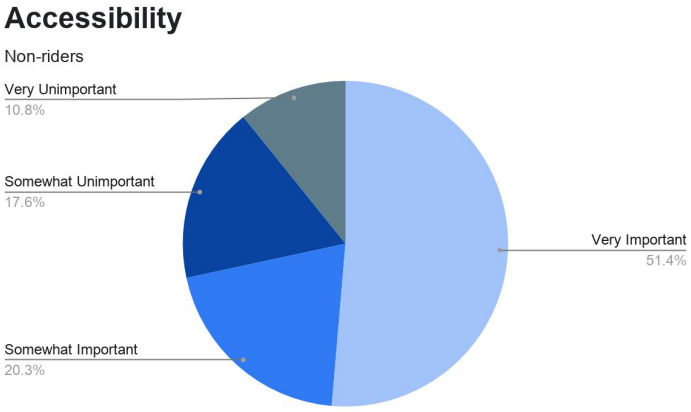


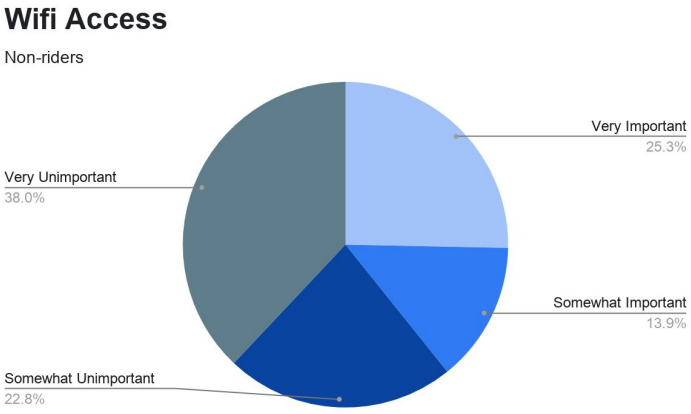
A9. Response to "Amount of full time and part time students that are willing to pay for comfort improvements" at UTM.



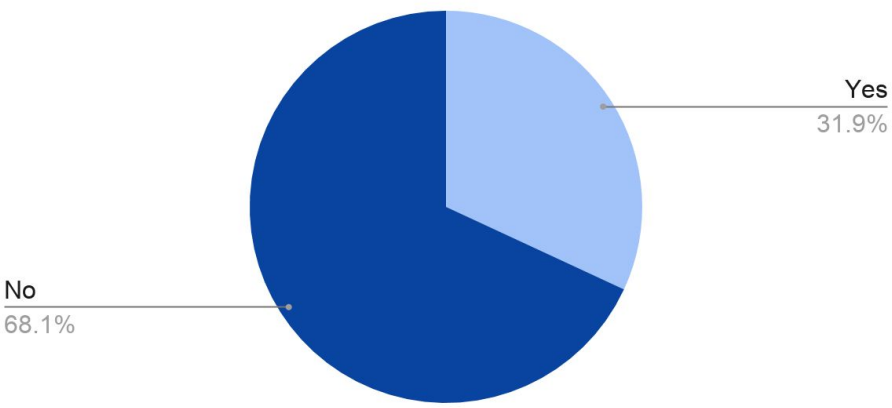








A10. The level of importance of five different factors indicated by Non-riders in increasing Shuttle Bus Ridership at the University of Toronto Mississauga campus.



A11. Response to "If you are not a UTM student, would you be willing to pay a $1-2 price increase for shuttle tickets?" indicated by Non-riders at the University of Toronto Mississauga campus.

A12. <u>Cost Calculation:</u>

279 respondents

Full time students: 248 (248/279*100 = 88.9%)

Part time students: 19 (19/279*100 = 6.8%)

Non- Students: 12 (12/279*100 = 4.3%)

Approximate Current Budget for Shuttle Bus:

88.9% x 15448 (Total undergraduate and graduate students) = 13733 Full time students

6.8% x 15448 (Total undergraduate and graduate students) = 1050 Part time students

$54.08 x 13733 = $742,680.64 (Full-time)
$10.82 x 1050 = $11,361 (Part-time)

Approximate Budget for Shuttle Bus with extra $5 contribution:

($54.08 + 5) x 13733 =811,345.64 (Full-time)
($10.82 + 5) x 1050 = $16,611(Part-time)

A13. Sample size calculation

$$\text{Sample size} = \frac{\frac{z^2 \times p\,(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p\,(1-p)}{e^2 N}\right)}$$

z= z score

N=population

e=margin of error (percentage in decimal form)

p= sample proportion

Sample size= [1.65^2* 0.5(1-0.5)/0.05]/1+ [1.65^2*0.5(1-0.5)/0.05^2*15448]

Sample size= 266 (with a 90% confidence interval and 5% margin of error)

Table A14. Additional comments provided by riders at the University of Toronto Mississauga.

Riders: Additional Comments	
Wifi on all buses would be nice	comfortable seats
Better wifi	SHELTER
Bigger seats	Better more regular service times
Seats are uncomfortable	Add a stop station at UTSC
The seats are tiny and suck	More frequent, more comfortable seats and removal of that loud metal thing in the back
More leg room	A way to know what route the shuttle bus is about to take
Comfortable Seating	Ask drivers to hang up lights
Shelter	Should have shelter for St George
wifi more accessible	More seats or buses in very busy hours
Better heat,A/C, wifi, windows, neck braces, more leg spaces	Seats are very uncomfortable
More buses!!!	Wifi advertise electrification
Shelter	Smoother Rides
Seats	More times to take the shuttle bus on weekdays and weekends especially weekends.
Nights and weekends run the shuttle more. Temp is too high	Steady Drivers (some people can easily get motion sickness)
More weekend shuttles, switch to electric, more friendly people?	Improving the space
More even heating	Safer and less reckless driving
Just more frequency on weekends	More comfortable seats
All buses should have wifi	The shuttle bus comes at weird times. If the bus comes at the hour or 10 minutes after the hour it would allow students to reach their destination at an earlier time. Additionally, the bus' heating and cooling system is not effective and I wish the seats were more comfortable.

Appendix B

Rider Survey

UTM ENV332H5 UTM Shuttle Bus Comfort and Electrification Survey

We are students from ENV332: Practicum in Environmental Management and we want to hear your feedback regarding the UTM shuttle bus, which might help our campus to make decisions in the future for its improvement. We appreciate your time and your participation.

Respondent #_____

1. Are you currently a UTM student?
   - ❑ Yes
   - ❑ No
2. Do you take the UTM shuttle bus?
   - ❑ Yes
   - ❑ No

Yes (Riders)

How satisfied are you with the following aspects of the shuttle bus service? (interviewer can circle each response)

1. Timeliness and frequency of the shuttle bus?

	Very unsatisfied	Somewhat unsatisfied	Somewhat Satisfied	Very satisfied
Timeliness				
Timeliness	1	2	3	4
Frequency	1	2	3	4

2. Safety & Security of the shuttle bus?

Safety & Security				
Feeling safe while waiting for the bus.	1	2	3	4
Bus being driven safely.	1	2	3	4

3. Wifi

Wifi				
Presence of wifi on shuttle bus	1	2	3	4
Ease of connecting to wifi on shuttle bus	1	2	3	4

4. Comfort

Comfort				
Waiting for the shuttle bus (ie. standing outside in line, inside IB etc.)	1	2	3	4
Availability of seats on bus.	1	2	3	4
Comfort of seats.	1	2	3	4
Heating & cooling on the bus	1	2	3	4
Smoothness of bus ride (ie. bounciness)	1	2	3	4

5. Are you someone with specific accessibility needs (i.e. use a mobility device, visually impaired, etc.)?

❑ Yes ❑ No

If YES, how satisfied are you with the accessibility of the UTM shuttle bus?

Very unsatisfied	Somewhat unsatisfied	Somewhat Satisfied	Very satisfied
1	2	3	4

6. Overall, how satisfied are you with the current comfort and overall service delivery of the UTM shuttle bus?

Very unsatisfied	Somewhat unsatisfied	Somewhat Satisfied	Very satisfied
1	2	3	4

7. Would improvements to any of these aspects increase your desire to take the UTM shuttle bus?

❑ Yes ❑ No

8. As a full time UTM student, you currently pay $54.08/semester for the shuttle bus service. As a part-time student you pay 20% of the rate which is approximately $10.82/semester. Would you be willing to pay a small fee to improve an area of the **shuttle bus service** that is important to you?

❑ Yes ❑ No

If yes, how much would you be willing to contribute for a more comfortable bus.

❑ None ❑ $5 ❑ Other
❑ $1 ❑ $10 _____

9. How important to you is lowering campus greenhouse gases related to the shuttle buses?

Not important	Somewhat unimportant	Somewhat important	Very important
1	2	3	4

10. How much would you be willing to contribute if UTM switched to an **electric bus**?

❑ None ❑ $5 ❑ Other
❑ $1 ❑ $10 _____

11. If you are not a UTM student, would you be willing to pay a $1-2 price increase for shuttle tickets?

❑ Yes ❑ No

6. Overall, how satisfied are you with the current comfort and overall service delivery of the UTM shuttle bus?

Very unsatisfied	Somewhat unsatisfied	Somewhat Satisfied	Very satisfied
1	2	3	4

7. Would improvements to any of these aspects increase your desire to take the UTM shuttle bus?

❑ Yes ❑ No

8. As a full time UTM student, you currently pay $54.08/semester for the shuttle bus service. As a part-time student you pay 20% of the rate which is approximately $10.82/semester. Would you be willing to pay a small fee to improve an area of the **shuttle bus service** that is important to you?

❑ Yes ❑ No

If yes, how much would you be willing to contribute for a more comfortable bus.

❑ None ❑ $5 ❑ Other
❑ $1 ❑ $10 _____

9. How important to you is lowering campus greenhouse gases related to the shuttle buses?

Not important	Somewhat unimportant	Somewhat important	Very important
1	2	3	4

10. How much would you be willing to contribute if UTM switched to an **electric bus**?

❑ None ❑ $5 ❑ Other
❑ $1 ❑ $10 _____

11. If you are not a UTM student, would you be willing to pay a $1-2 price increase for shuttle tickets?

❑ Yes ❑ No

12. Do you have any additional comments on how to improve shuttle bus comfort and the service as a whole?

_____

B1. Survey administered to Shuttle Bus Riders at the University of Toronto Mississauga campus. (pg 38-41)

Non-rider Survey

UTM ENV332H5 UTM Shuttle Bus Comfort and Electrification Survey
We are students from ENV332: Practicum in Environmental Management and we want to hear your feedback regarding the UTM shuttle bus, which might help our campus to make decisions in the future for its improvement. We appreciate your time and your participation.

Respondent #_____

1. Are you currently a UTM student?
   - ❑ Yes
   - ❑ No
2. Do you take the UTM shuttle bus?
   - ❑ Yes
   - ❑ No

No (Non-riders)

1. What is your main method of transportation to campus?
   - ❑ Walking
   - ❑ Cycling
   - ❑ Carpooling
   - ❑ Driving
   - ❑ Dropoff
   - ❑ Taxi/Uber/Lyft
   - ❑ Public Transit
   - ❑ Other _____
2. How often do you commute between UTM and St. George campus?
   - ❑ Everyday
   - ❑ A few times per week
   - ❑ A few times per month
   - ❑ Never
3. Do you know of the UTM shuttle?
   - ❑ Yes
   - ❑ No
4. Please rank the importance of these factors in determining which form of transportation you decide to take?

	Not Important	Somewhat unimportant	Somewhat Important	Very Important	Not applicable
Timeliness ie) frequency, schedule	1	2	3	4	
Safety & Security	1	2	3	4	
Wifi Access	1	2	3	4	
Comfort ie) uncomfortable seating, thermal	1	2	3	4	

comfort					
Accessibility	1	2	3	4	

5. Would implementing changes in any of these areas encourage you to take the shuttle bus more often?
   - ❑ Yes
   - ❑ No

6. How important to you is lowering campus greenhouse gases related to the shuttle buses?

Not important	Somewhat unimportant	Somewhat important	Very important
1	2	3	4

7. How much would you be willing to contribute if UTM switched to an electric bus?
   - ❑ None
   - ❑ $1
   - ❑ $5
   - ❑ $10
   - ❑ Other _____

8. If you are not a UTM student, would you be willing to pay a $1-2 price increase for shuttle tickets?
   - ❑ Yes
   - ❑ No

9. Do you have any other comments?

_____

B2. Survey administered to Shuttle Bus Non-riders at the University of Toronto Mississauga campus. (pg 42-43)

Demographics Survey

Demographic questions

Age
- ❑ Under 18
- ❑ 18 - 24
- ❑ 25 - 34
- ❑ 35 - 49
- ❑ 50 - 64
- ❑ 65+

Employment status
- ❑ Full-time employment
- ❑ Part-time employment
- ❑ Unemployed
- ❑ Retired

Student Status
- ❑ Full time
- ❑ Part-time

International/Domestic
- ❑ International
- ❑ Domestic

Where do you live?*
- ❑ City of Toronto
- ❑ Peel Region
- ❑ Halton Region
- ❑ York Region
- ❑ Durham Region
- ❑ Other _____

Do you have any access to a vehicle (ie. own, lease or parent's car)?
- ❑ Yes
- ❑ No

Please indicate your gender
- ❑ Male
- ❑ Female
- ❑ Non-binary
- ❑ Prefer not to answer
- ❑ Other _____

Year of Study
- ❑ 1
- ❑ 2
- ❑ 3
- ❑ 4
- ❑ 4+

*

Halton: Halton Hills, Milton, Burlington, Oakville
Peel: Caledon, Brampton, Mississauga
York: King, Vaughan, Newmarket, Aurora, Richmond Hill, Georgina, East Gwillimbury, Whitchurch Stouffville, Markham
Durham: Brock, Uxbridge, Scugog, Clarington, Oshawa, Whitby, Pickering, Ajax

B3. Survey demographics administered to Shuttle Bus Riders & Non-riders at the University of Toronto Mississauga campus.

Appendix C

1. Is there any way that we could get access to complaints pertaining to the shuttle bus (anonymously of course)? We wanted to understand the nature of the issues faced by riders to inform the types of questions we will be asking in our comfort survey.

   Unfortunately, we are not able to provide access due to privacy.

   In general, complaints may be about late or absent buses, trip frequency, length of trip or general conditions (i.e. noise levels, odours, cleanliness, seating, interior temperature, etc).

2. Could you please provide us with some history/background about the UTM shuttle bus?

   Who manages it? Parking and Transportation Services department manages the shuttle service.

   How has the service changed or been improved over the years? Service levels have increased including number of trips, departure frequency, newer buses, accessibility, wifi capabilities, air conditioning, access for non-utm students (i.e. tickets/bus pass).

   Have any of the complaints you receive been used to improve the bus? Yes. The majority of new service planning stems from the feedback of our users and the discussions of our Advisory Groups at QSS. Best efforts are made to accommodate service adjustments based on the varying needs of our users.

3. Why are not all of the buses equipped with wifi?

   All regularly scheduled buses (eight buses) on the UTM/St. George route are equipped with wifi capabilities. UTM/Sheridan service does not have wifi based on the short travel time.

4. Additionally how many of the buses can accommodate someone with accessibility needs?

   All regularly scheduled buses are equipped to accommodate accessibility needs (on both routes). With the exception of double buses or alternative buses used to accommodate maintenance.

5. Are there any plans to expand or make modifications to the service in the near future?

   The ability to have a real-time mobile application is desirable and options to deliver this service are being investigated, however the implementation for this technology is complex, challenging and time intensive. Improvements to shuttle stop signage such as trip updates/schedules are also being explored for user information.

6. What is the cost of maintenance associated with running the service?

   All operating costs related to the buses, including maintenance, are included in the bus lease agreement with the service provider.

7. Where does the budget for the bus come from? How does budgeting work for this service?

   The budget is determined by the operating requirements to deliver the service.

   Approval of the budget must pass multiple levels of UofT Governance.

   Revenues come from two primary sources. For 2019-2020, Student Services Fees account for 80% of total forecasted revenues. This fee allows for unlimited access to the shuttle bus service. The remaining 20% of revenues is generated from the sale of shuttle bus tickets and passes to non-UTM students, faculty, staff and other users.

8. Is the shuttle bus service contracted? If so, by which company? How much involvement in providing the service does UTM have?

   Yes, we contract a 3rd party (First Student) to provide the service. Parking and Transportation Services works closely with First Student to provide the daily operations of the Shuttle Service.

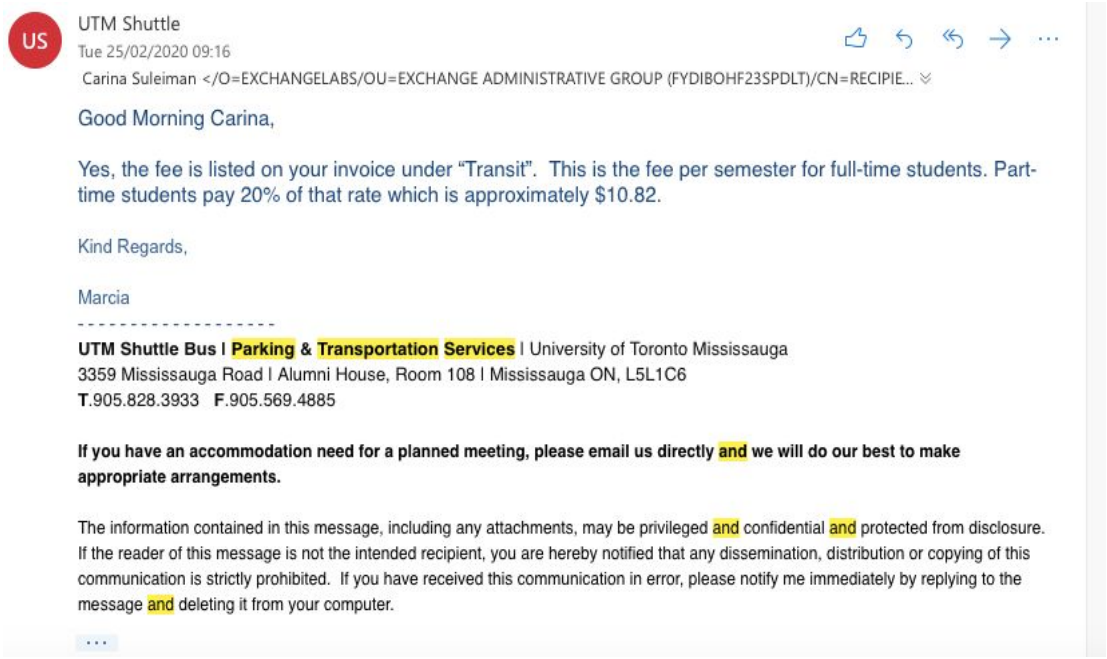
9. Are shuttle drivers given a specific route to take? Is there a difference in route during rush hour and non-rush hour times?

   The UTM Shuttle Bus routes are authorized by a Provincial Operating License to perform the service. The route taken may vary at times but for the most part, drivers take the most direct route.

10. As mentioned, part of our project involves the administration of a survey. Could we advertise the link to our online survey on the shuttle bus website, once it is completed? Additionally, is there a way to have the survey advertised on the shuttle? Could we have the drivers give students the survey or maybe have them physically there/link to online version?

    We would be happy to investigate what feasible options are available to assist with distribution; if you can provide us with a copy of the survey once completed, that would be appreciated.

C1. Responses provided by the UTM Transportation & Parking Office regarding operational details of the shuttle service (pg. 45-46).



C2. Responses provided by the UTM Transportation & Parking Office regarding the budgeting of the shuttle service.

UTM SHUTTLE BUS COMFORT SURVEY

Report 2020

ENV 332 April 6th, 2020

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