

Safety Perceptions of Transportation Network Companies (TNCs) by the Blind and Visually Impaired

October 2018

Final Report



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Abstract

For individuals that are visually impaired, access to safe and reliable transportation can be a significant challenge. The limited menu of mobility options can culminate in a reduced quality of life and more difficulty accessing housing and employment, relative to sighted individuals. Transportation network companies (TNCs, or ridesharing companies) have emerged as a new mode of travel that has the potential to increase access to transportation for the visually impaired. The opportunities and challenges for TNC use by individuals with blindness or visual impairment has not been widely studied. The goal of this research is to use both qualitative and quantitative methods to identify how this community perceives the safety of TNCs relative to other travel modes, and how they utilize TNCs for safe travel. The findings suggest that TNCs are used by a significant proportion of this population. The findings also suggest that one's experience (or lack thereof) with TNC use has a strong influence on the safety perceptions of this new mode of travel. Finally, while TNCs present an opportunity for riders that are visually impaired to become more engaged in myriad activities, there are still areas in which ridesharing companies can make improvements.

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Introduction

Estimates by the American Foundation for the Blind (AFB) suggest that there are 10 million individuals who are visually impaired in the United States. Of these, 1.3 million are considered legally blind (1). Many of these individuals cannot drive and face significant challenges trying to access safe and reliable transportation. These challenges can lead to additional consequences for mobility, quality of life, and access to housing and employment.

Transportation network companies (TNCs) have emerged as a new mode of travel that has the potential to increase access to transportation for the blind and visually impaired (BVI). In 2014, the American Council of the Blind (ACB) produced a white paper on TNCs to investigate “how the new products work and the extent to which they meet the needs of ACB’s members” (2). Additionally, bloggers who focus on the mobility challenges of BVI individuals have lauded the services offered by TNCs, referring to them as “an excellent alternative to public transportation, cabs, hiring personal drivers, and asking for rides from friends” (2). However, the opportunities and challenges of TNC use by the BVI community have not been widely studied.

This research uses qualitative and quantitative methods to identify how persons who are visually impaired perceive the safety of TNCs relative to other travel modes and how they utilize TNCs for safe travel. In this report, *visual impairment* is defined as “a term that encompasses both those who are blind and those with low vision” (3). Furthermore, the term *visually impaired* is used to describe the group of individuals that have some form of visual impairment.

Background

Individuals with visual impairment experience numerous barriers to moving safely, independently, and efficiently (4). Historically, this community has largely used public transportation, paratransit, riding in a personal vehicle as a passenger, and walking as their primary means of transportation.

Public Transit and Paratransit

One positive aspect of public transportation identified in the literature is the ability of users to develop a trusting relationship with a driver. French researchers found that some respondents with visual impairment preferred using the bus over the train, mostly because they could interact with the bus driver (5). Crudden et al. found that 85% of their survey population with visual impairment had high confidence interacting with a driver to get to their destination and/or obtain directions to their final destination upon arrival at the last transit stop. Riders with visual impairment also rely on fellow passengers for assistance (6). Researchers from India found that bus riders with visual impairment have a heavy reliance on sighted riders (7).

Due to this dependence on others and limited access to trip information, public transportation is challenging for the visually impaired. Drivers failing to audibly announce transit stops is a significant barrier to public transportation use, as BVI riders may lack the ability to visually

confirm their location (6). Researchers in India found that interactions between sighted and unsighted patrons often resulted in abuse and misguidance of visually impaired individuals (7). The findings of Marin-Lamellet et al. suggest that two-thirds of surveyed public transportation riders with visual impairment were not able to easily access trip information, because it was presented in a visual way (transit network maps, trip tables, etc.) (5).

Another significant barrier for the visually impaired is the lack of adequate transit services. Ademokoya posits that a lack of public transport greatly discourages persons with disabilities from travelling (8). Dr. Anne Corn theorizes that shrinking operational budgets prevent mobility services from meeting the needs of the visually impaired (9).

Paratransit services—a federally mandated service that must operate in conventional public transit service areas—offer the visually impaired another mobility option. In many areas the paratransit system may be the only accessible transit system for the visually impaired. These services can be unreliable or place undue burden on users, such as having pick-up windows that range up to three hours. They may also require that cancellations be made 24 hours in advance (11). However, some see intelligent transportation systems and the development of mobile apps as a means to potentially increase the quality of paratransit services and decrease the burden associated with scheduling (10) through technology (12).

Personal Vehicle

Some low-vision individuals may be able to drive in a limited capacity with the assistance of bioptic lenses (lenses that magnify between two and six times). However, many individuals who are visually impaired cannot drive. The inability to drive, despite a strong desire to do so, can be devastating to individuals with visual impairment (13). Dr. Robert Wall Emerson suggests that “many people who are blind do not want to drive so much as want to be able to be involved in the driver culture. They want to know about cars... and be knowledgeable about this important aspect of life” (11). This results in reliance on social networks to facilitate personal travel, which may lead to feelings of guilt and/or being a burden. Some individuals may be able to hire personal drivers, but this option requires a high level of personal involvement and significant costs (e.g., car insurance, gas, and maintenance). These costs may be prohibitive, especially for those that are unemployed and/or on a fixed or limited income (14).

Walking

Respondents interviewed by Pavey et al. mentioned low levels of confidence with pedestrian travel due to obstacles in their path (cars parked on sidewalks, trash bins misplaced on sidewalks), the urban environment (uneven or broken sidewalks), and traffic (13).

Transportation Network Companies

TNCs have introduced a new mobility option. Aspects of TNC services that may benefit the visually impaired include low cost of service relative to taxis (2), driver arrival notifications (17), driver attention focused on a single passenger (9), door-to-door service (9), cashless payment

transactions (2, 18), app compatibility with VoiceOver (17), driver rating system (2), and the ability to share trip details with family and friends (18). However, some improvements are needed for the visually impaired as well. The quality of VoiceOver (software that provides speech, output, and screen magnification for users of Apple products who are blind or low vision), and other speech products' compatibility with the TNC apps may vary from company to company. In some instances the text-based elements in the app, such as estimated time of arrival, work well, while map functionality may not (2). Similarly, TNCs update their app software frequently, which can sometimes lead to difficulties with certain smartphone operating systems (17). The ACB also cites the lack of TNC vehicles meeting Americans with Disabilities Act (ADA) accessibility criteria and surge pricing as significant barriers to the visually impaired (2).

An important issue is the accommodation of service animals in TNC vehicles. In April 2016, a two-year court case between Uber and multiple plaintiffs was settled. Uber agreed to take steps to prevent discrimination against riders using service dogs through driver education efforts about legal obligations and stricter enforcement of policies for noncompliant drivers (19). In April 2017, Lyft adopted similar policies (20).

Research Questions

Few researchers have yet focused on how TNCs may address transportation challenges for the visually impaired. Furthermore, no research has been conducted to assess the BVI population's safety perceptions of TNCs relative to other modes of travel. This research attempts fill this gap by addressing the following questions:

- What factors are used to assess the safety of transportation options by individuals with visual impairment?
- Relative to other modes of transportation available to individuals with visual impairment, how safe or unsafe are TNCs perceived to be?
- What characteristics of TNCs contribute to the perception of safety as compared to more traditional transit and paratransit services?
- What technologies mitigate the perceived safety risks for individuals with visual impairment?
- Do TNCs offer a service that can address the identified transportation challenges?

Methods

This section of the report presents a brief overview of the methodology used for this project. Additional details are included in the appendices.

Establish Strategic Partnerships

To ensure this research would best serve the visually impaired, the team established strategic partnerships with organizations that advocate on behalf of the BVI community. These partnerships served three main purposes: (1) to establish a knowledge base that would help inform panel

participant selection; (2) to provide access to a pool of eligible survey respondents; and (3) to legitimize the project among the target population.

Partnerships were established with the Texas School for the Blind and Visually Impaired (<http://www.tsbvi.edu/>) and the National Federation of the Blind (<https://nfb.org/>). Dr. Anne Corn, a founding member of the International Society for Low Vision Research and Rehabilitation, and a member and past division chair of the Association for Education and Rehabilitation of the Blind and Visually Impaired, served as a project consultant.

Establish Project Panel

A project panel provided a mechanism to ensure that the project team was conducting the research in a manner that is consistent with and respectful of the needs of BVI populations. Each panel member received a small stipend for their contribution. The following individuals served on the project panel: Dr. Robert Wall Emerson, a professor in the Department of Blindness and Low Vision Studies at Western Michigan University, Aaron Fox, General Manager of the Central Texas Region for Lyft, and Donna Dean, a Clinical Instructor at Stephen F. Austin State University's Visual Impairment/Orientation and Mobility Program.

Literature Review

A literature review addressed four core areas of concern to the BVI community: current challenges to safe mobility, technologies developed specifically for the visually impaired, use and accessibility of TNCs, and regulations and policy regarding the accessibility of TNC services. In addition, the literature review covered best practices for conducting quantitative and qualitative research with visually impaired individuals.

Survey Development and Testing

A survey instrument was created to answer the research questions using direct input from the target population. The project panel reviewed the survey and provided comments, which were incorporated into the final instrument. The survey was administered using the Qualtrics software platform, which has features to test accessibility for respondents who utilize screen readers. Using this feature, the project team was able to diagnose the survey and edit questions identified as potentially burdensome. The survey program was tested internally on several Web browsers and devices to ensure that it was usable across various platforms.

Finally, a focus group of participants with visual impairment reviewed and tested the survey program. Findings from the focus group informed a final round of edits. The final survey contained approximately 80 questions and is included in Appendix A – Survey Instrument. The focus group summary is presented in Appendix B – Focus Group Summary.

Data Collection and Processing

Respondents were recruited through advocacy organizations and direct outreach to support groups. More than 350 organizations received the recruitment email (Appendix D – Recruitment Email). Information about the survey was posted to seven Facebook groups for the blind and visually

impaired. Data collection occurred over an 8-week period from January 18, 2018, to March 12, 2018. The final dataset includes 283 total surveys, including 192 completed surveys and 91 partially completed surveys. The median length of time spent completing the survey was 25 minutes.

The survey data were extracted and processed. Data processing primarily involved subjecting the data to a series of logic checks to confirm that the program was working as planned and ensure consistency across variables. Researchers also post-coded open-ended variables and created new variables from existing variables for analytical purposes. The final processing step was to run univariate and bivariate frequencies to identify anomalies. Researchers did not weight the dataset to more closely match known sociodemographic characteristics of the study population because sociodemographic data were not readily available. The survey did not collect geographic identifiers; thus, geographic weighting was impossible. For these reasons, and because the survey employed a non-probability “opt-in” sampling approach, the survey results cannot be generalized to the population of all visually impaired individuals. Rather, the estimates presented in this report are only reflective of the opinions and behaviors of the survey participants.

Data Analysis, TNC Interviews, and Reporting

The analysis presented in this report uses descriptive statistics to address the primary research questions. This approach ensures that all audiences interested in these findings will be able to easily understand the results. The survey results also informed the development of a structured interview guide used to interview TNC representatives. The purpose of the interviews was to gain the perspective of TNC providers on the safe use of TNCs by the visually impaired. Where appropriate, the insights gained in the interviews are incorporated into the results and discussion to provide deeper understanding of the results from the perspectives of both the service users and service providers. A summary of the structured interviews is included in Appendix C – Structured Interview Summary.

Results

The survey results for respondents that completed the survey (N=192) are presented in this section. The results are presented in the same order that the questions were asked in the survey, with the exception of the demographics section, which is presented first here but was last in the actual survey instrument.

Demographics

This section briefly summarizes the demographics reported by survey respondents. Appendix E – Respondent Demographics presents a more detailed summary of the demographic results. The data suggest that a diverse sample of visually impaired individuals participated in the survey. When compared to estimates derived from 2015 American Community Survey Data by Cornell University’s Employment and Disability Institute, the sample appears to be under-representative

of males, non-white minorities, and individuals with less than a bachelor’s degree¹ (21). Interestingly, these groups are also commonly under-represented in general population surveys. The sample is over-representative of individuals that are totally blind and individuals that are employed.

Forty percent of the survey respondents were less than 45 years old. The average household size was 2.07. More than two-thirds (68%) were employed either full time (47%) or part time (21%). A slight majority were totally blind (52%), with a slightly higher proportion (59%) reporting no other disability. Nearly 9 of 10 (89%) have received orientation and mobility training. A majority of respondents (54%) live in a zero-vehicle household, and 16% have a child living within a 30-minute drive of home.

Travel Modes Used Recently

The survey began by asking respondents what modes of transportation they had used in the last 60 days. In the event they reported using multiple modes, respondents were asked to identify which mode was used most often. Table 1 suggests that a majority of respondents reported using a personal vehicle as a passenger (82%), walking (76%), a TNC (72%), and public transit (66%) to make trips in the last 60 days. Forty-six percent of respondents reported using paratransit in the last 60 days. Table 1 also suggests that the four modes most often used by respondents are public transit (26%), personal vehicle as a passenger (25%), TNCs (21%), and paratransit (17%).

Table 1. Mode Used in Last 60-Days and Most Often

Mode	Used Mode in Last 60 Days	Mode Used Most Often
Personal vehicle as the passenger	82%	25%
Walk	76%	7%
TNC	72%	21%
Public transit	66%	26%
Paratransit	46%	17%
Taxi, limo, or other for-hire driver service	29%	2%
Personal vehicle as the driver	8%	0%
Bike	4%	1%
Boat or ferry	4%	1%
Other	3%	0%
I have not made any trips in the last 60 days	1%	N/A

An exploratory statistical analysis was performed to better understand the influence of sociodemographic factors on the likelihood that a respondent would have used a TNC. A chi-

¹ These comparisons are not exact and should be interpreted with caution. For example, the Employment and Disability Institute estimates for gender are based on a sample of individuals age 16+ that reported a visual impairment in the 2015 American Community Survey. The age range for this survey was 18+. Similar differences exist with the comparisons of ethnicity, race, and education.

square (χ^2) test of independence was calculated comparing use of TNCs by respondents in the 60-day period prior to survey participation among two groups: (1) respondents living in a zero-vehicle household and (2) respondents living in a household with at least one vehicle. A statistically significant interaction was found ($\chi^2 (1, N=176) = 7.213, p = .007$). Respondents from zero-vehicle households were more likely to have used TNCs (81%) than those from households with vehicles available (63%). A statistically significant interaction was also found ($\chi^2 (1, N=142) = 11.890, p = .001$) between TNC use and full-time employment. Respondents employed full time were more likely to have used TNCs (86%) than respondents not employed full time (60%). Interestingly, both chi-square and correlation analysis suggest the lack of a statistically significant relationship between TNC use and annual household income. Given respondent comments regarding the importance of cost in the mode selection process, this was somewhat surprising.

Approximately one-fifth of respondents (21%) reported using TNCs more often than any other mode in the 60-day period prior to survey participation. None of the sociodemographic variables tested demonstrated a statistically significant influence on respondent propensity to use TNCs more than other modes. Among the variables tested, age showed the strongest (non-significant) influence. A chi-square test of independence was calculated to compare respondents that used TNCs more frequently than any other mode with other respondents across two age groups: (1) respondents younger than 45 years old and (2) respondents 45 years and older. A near statistically significant interaction was found ($\chi^2 (1, N=191) = 3.715, p = .054$). Respondents younger than 45 were likely to report using TNCs more frequently than any other mode (28%) than those that were 45 or older (16%). This is in line with some recent findings that younger (18–34) individuals are currently downloading the Uber and Lyft apps at higher rates than older age cohorts (22).

Reasons Modes Not Used

Respondents were asked to identify the reason they did not use a specific mode to make a trip in the last 60 days. Table 2 suggest that lack of access or lack of easy access was the most significant reason respondents did not make trips via personal vehicle as a passenger (35%). Cost was the most significant reason respondents did not make trips via for-hire services such as a TNC (41%) or taxi/limo (83%). Not feeling safe was the most significant reason respondents did not make walking trips (41%) or travel by bike (55%). Excessive travel time was the most significant reason respondents did not make trips via public transit (46%) or paratransit (53%). The percentages provided in Table 2 are based on the number of respondents that reported not using each mode in the last 60 days. As such, the sample size changes across columns.

Table 2. Reason Mode Not Used

Reason Mode Not Used	Driver	Passenger	Walk	Bike	Public transit	TNC	Para-transit	Taxi	Boat
I am not familiar with that mode	7%	6%	9%	11%	14%	24%	10%	2%	8%
That mode is not (easily) available to me	5%	35%	17%	9%	35%	13%	17%	13%	86%
That mode is too expensive	6%	27%	7%	1%	2%	41%	7%	83%	2%
I don't feel safe using that mode	7%	6%	41%	55%	23%	24%	3%	14%	3%
The travel time using that mode is too great	2%	9%	37%	14%	46%	2%	53%	11%	1%
It is too burdensome to use this mode	1%	18%	33%	4%	39%	4%	42%	18%	3%
The time of day or day of week I usually travel makes that mode impractical	1%	21%	11%	6%	15%	4%	8%	3%	3%
I had a bad experience or heard about a bad experience with that mode	2%	15%	11%	5%	9%	13%	14%	13%	0%
That mode is not reliable	1%	21%	17%	8%	17%	6%	35%	18%	2%
I am not a licensed driver	84%	NA	NA	NA	NA	NA	NA	NA	NA
I am not eligible for that mode	0%	0%	0%	0%	0%	0%	14%	0%	0%
Other	14%	24%	17%	43%	25%	15%	9%	10%	11%

Factors that Influence Travel

The next section of the survey focused specifically on factors respondents may or may not consider when making decisions to use various modes of transportation. Using a scale of 1 to 5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, respondents were asked to indicate the importance of each factor in their decision-making process. Table 3 presents the percentage of respondents that evaluated each factor as unimportant (extremely or somewhat), neither unimportant nor important (neutral), or important (extremely or somewhat). Table 3 also provides the mean score for each factor. The data suggest that a majority of respondents felt that 12 of the 14 factors were important considerations in their decision to use a specific mode. The only two factors that were not deemed as important by a majority were party composition (whom you were traveling with) (46%) and day of the week (42%). The two factors evaluated as important by the largest proportion of respondents were reliability (98%) and availability (97%). Cost (91%), ease of use (90%), and safety (89%) round out the top-five important factors. These top-five factors are also characterized by the highest mean scores.

Table 3. Importance of Factors that Influence Mode Use

Factor Influencing Mode Use	Unimportant	Neutral	Important	Mean
Availability	1%	2%	97%	4.83
Reliability	<1%	2%	98%	4.77
Safety	3%	7%	89%	4.44
Cost	2%	7%	91%	4.39
Ease of Use	2%	8%	90%	4.31
Travel Time	3%	7%	89%	4.29
Personal Constraints	3%	15%	82%	4.18
Level of Effort Required	9%	13%	78%	4.09
Trip Purpose	8%	18%	74%	4.05
Familiarity with Trip Route	14%	18%	68%	3.75
Familiarity with Mode	17%	19%	64%	3.73
Time of Day	19%	20%	61%	3.60
Party Composition	26%	28%	46%	3.24
Day of Week	28%	30%	42%	3.19

Realized or Perceived Safety

The next section of the survey focused on the safety of various modes. Using a scale of 1 to 5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, respondents were asked to evaluate each mode they had used in the last 60 days with regard to personal safety. These evaluations were based on the personal experience gained from using these modes, what they had heard about these modes, or what they had read about these modes.

Although it is assumed that respondents who used a particular mode within the last 60 days use were more frequent users of that mode and more familiar and/or comfortable with it, comments revealed that some respondents who had not used a specific mode in the last 60 days also had some level of personal experience with it. As such, respondents who did not use a mode in the last 60 days cannot be viewed strictly as non-users.

Table 4 and Table 5 suggest that a majority of respondents who had used the mode in the last 60 days evaluated eight out of nine modes as safe. The only mode not evaluated as safe by a majority of respondents was driver of a personal vehicle. The highest safety evaluations were attributed to personal vehicle as the passenger (mean score of 4.69) and paratransit (mean score of 4.56). The lowest safety evaluations were attributed to personal vehicle as the driver (mean score of 2.92) and boat or ferry (mean score of 3.33).

For respondents that had not used the mode in the last 60 days, a majority evaluated four of the nine modes (44%) as safe. The highest safety evaluations from this group were attributed to a personal vehicle as the passenger (mean score of 4.15) and paratransit (mean score of 3.85). The lowest safety evaluations were attributed to personal vehicle as the driver (mean score of 2.11) and

boat or ferry (mean score of 1.70). These were similar to the findings from the respondents who had used the mode in the last 60 days.

The overall safety mean score estimated for each mode is higher among respondents that used a mode than those that did not. Furthermore, the overall mean safety score (estimated by taking the average of the mean safety scores for each mode) is a full point higher for the users that used each mode in the last 60 days than for those that did not (4.1 vs. 3.1).

Table 4. Safety Evaluation of Various Modes – Used Mode in Last 60 Days

Mode	Unsafe	Neutral	Safe	Mean
Driver	38%	31%	31%	2.92
Passenger	1%	3%	96%	4.69
Walk	9%	8%	93%	4.15
Bike	33%	0%	67%	3.33
Public Transit	6%	9%	86%	4.34
TNC	1%	7%	91%	4.47
Paratransit	2%	5%	93%	4.56
Taxi	4%	11%	86%	4.36
Boat	0%	33%	67%	4.33

Table 5. Opinion of Safety – Not Used Mode in Last 60 Days

Mode	Unsafe	Neutral	Safe	Mean
Driver	63%	11%	26%	2.11
Passenger	6%	21%	73%	4.15
Walk	55%	20%	25%	2.45
Bike	81%	13%	7%	1.70
Public Transit	32%	32%	37%	3.08
TNC	23%	31%	46%	3.35
Paratransit	12%	25%	63%	3.85
Taxi	17%	25%	59%	3.59
Boat	3%	41%	56%	3.82

Reasons for Feeling Unsafe

A central focus of the study was to identify what makes respondents feel safe or unsafe across modes, and if there were differences based on whether a respondent had used a mode in the last 60 days or not.

Respondents that evaluated public transit, TNCs, or paratransit as being unsafe were asked to explain what made them feel this way. Respondents were allowed to provide any level of detail, as these answers were collected via open text entry boxes. These open text responses were coded by the project team into logical categories.

Table 6 and Table 7 present the most-often-mentioned responses for each mode regarding what made respondents feel unsafe about public transit, TNCs, or paratransit. These responses are grouped by those that had used a specific mode in the last 60 days and those that had not.

Public Transit

Feeling uneasy around other passengers was the most-often-mentioned reason that respondents considered public transit as unsafe. This was true regardless of how recently the mode was used. A lack of safety at transit stops was another most-often-mentioned reason. Respondents that had used public transit in the last 60 days also mentioned that the trip to or from the transit stop made them feel unsafe. Respondents that had not used public transit in the last 60 days felt that their disability (or disabilities) made them feel as if they were more vulnerable on public transit.

TNC

Among respondents that had used TNCs in the last 60 days, the most-often-mentioned reason for TNCs being unsafe was the difficulty experienced by the driver and passenger recognizing one another. Among respondents that had not used TNCs in the last 60 days, reasons for feeling unsafe included a lack of familiarity with the drivers, a feeling of vulnerability due to their disability (or disabilities), and their perception that TNCs are not sufficiently regulated.

Paratransit

Among respondents who had used paratransit in the last 60 days and those who had not, the most-often-mentioned reason for considering it unsafe regarded the drivers. Respondents that had used paratransit in the last 60 days felt that the drivers were not well-trained, whereas respondents that had not used paratransit in the last 60-days lacked trust in the driver’s ability to operate the vehicle in a safe manner, or be respectful of passengers with disabilities. Respondents that had not used paratransit in the last 60 days also felt that the service was not reliable or were concerned about the well-being of their service animal.

Table 6. Most-often-mentioned Reasons Modes Are Deemed Unsafe – Used in Last 60 Days

Public Transit	TNC	Paratransit
Felt uneasy around other passengers.	Difficulty recognizing driver/passenger.	Driver was not well-trained.
The trip to or from the transit stop made me feel unsafe.	N/A	N/A
Felt unsafe at the transit stop.	N/A	N/A

Table 7. Most-often-mentioned Reasons Modes Are Deemed Unsafe – Not Used in Last 60 Days

Public Transit	TNC	Paratransit
Feeling of uneasiness/lack of trust around other passengers.	Lack of familiarity with the drivers.	Lack of trust in driver’s ability to operate safely and respectfully.
Transit stops are unsafe.	My disability makes me vulnerable.	The service is untimely.
My disability makes me vulnerable.	TNCs are not sufficiently regulated.	Concerned about my service animal.

Public Transit

Among respondents that had used public transit in the last 60 days, well-trained drivers was the most-often-mentioned reason they felt safe. This was followed by being familiar with the system and the presence of other passengers leading to an overall feeling of safety. Conversely, respondents that had not used public transit in the last 60 days reported that the larger size of the public transit vehicle compared to passenger cars led to an overall feeling of safety.

TNC

For TNCs, well-trained drivers was the most often-mentioned reason for feeling safe for both those who had used a TNC in the last 60 days and those who did not. Among respondents that had used a TNC in the last 60 days, significant reasons for feeling safe also included the rider’s familiarity with TNC services and the ability to monitor the trip via their smartphone. Among respondents that had not used a TNC in the last 60 days, significant reasons for feeling safe included their perception that TNCs did their due diligence in screening drivers, as well as their perception that TNCs have a good reputation in their city.

Paratransit

Finally, among both categories of respondents, the most-often-mentioned reason for feeling safe using paratransit was the belief that the drivers were well-trained. Respondents that had used paratransit in the last 60 days also felt safe because of their familiarity with specific drivers and their previous positive experiences with the service. Respondents that had not used paratransit in the last 60 days reported they would feel safe because they felt that paratransit organizations did their due diligence in screening drivers, as well as their perception that paratransit organizations have a good reputation in their city. Table 8 and Table 9 present the most-often-mentioned reasons why respondents feel or believe they would feel safe when using public transit, TNCs, or paratransit.

Table 8. Most-often-mentioned Reasons Modes Are Deemed Safe – Used Mode in Last 60 Days

Public Transit	TNC	Paratransit
Drivers are well-trained.	Drivers are well-trained.	Drivers are well-trained.
Familiarity with system.	Familiar with service/Never had a bad experience/Nothing to worry about.	Familiarity with specific driver.
Other passengers led to feeling of safety.	Ability to monitor trip with TNC app.	No major issues on trip/No reason not to feel safe.

Table 9. Most-often-mentioned Reasons Modes Are Deemed Safe – Not Used Mode in Last 60 Days

Public Transit	TNC	Paratransit
Vehicle size leads to feeling of safety.	Drivers are well-trained.	Drivers are well-trained.
N/A	TNCs perform due diligence on drivers.	Paratransit has a good reputation in my city.
N/A	TNCs have a good reputation in my city.	Public transit agencies perform due diligence on drivers.

Experience with TNCs

The final section of the survey queried respondents that had used a TNC in the last 60 days about their TNC experience. Unless otherwise noted, this section of the report focuses solely on this respondent group. Respondents were asked to identify the types of activities in which they were more likely to be engaged since their use of TNCs began. Table 10 suggests that a majority of respondents reported increased engagement with six of the twelve activity types. Health care and going out for dinner or drinks were the most-often-mentioned activity types (each mentioned by 78% of respondents), followed closely by visiting friends or relatives (73% of respondents) and shopping (72% of respondents).

Table 10. Activities in which Respondents Are More Likely to be Engaged In since TNC Use Began

Activity Type	Percent
Health care	78%
Going out for dinner or drinks	78%
Visit friends or relatives	73%
Shopping	72%
Recreational activities	69%
Run errands	62%
Volunteer outside my home	48%
Work for pay outside the home	44%
Religious	41%
Exercise	30%
School or school-related activities	15%
Other	17%

Twenty-nine percent of respondents reported that they currently have a service animal. Of these individuals, approximately three-quarters (74%) had a negative experience related to their service animal while using a TNC. Table 11 suggests that 93% of respondents who had a negative experience described a situation where the driver refused service because of the service animal. Refusal of service was by far the most common issue, but respondents also reported a reduced quality of service (22%) and that a driver mistreated their service animal (4%).

Table 11. Type of Service-animal-related TNC Experience

Description of Issue	Percent
The driver refused service because of my service animal.	93%
I received a reduced quality of service because of my service animal.	22%
The driver mistreated my service animal.	4%

When asked to identify what TNC technologies made them feel safer (Table 12), the notification of a driver approaching or arriving was the most-often-mentioned technology (85%). Avoiding a manual payment of the driver was a close second (81%). Nearly three-quarters of respondents (73%) mentioned either the ability to rate the driver or the app's compatibility with Voiceover and other speech products.

Table 12. TNC Technology that Makes TNC Users Feel Safer

TNC Technology	Percent
Driver approaching/arriving notification	85%
Avoiding a manual payment of my driver	81%
Rating the driver	73%
App's compatibility with Voiceover and other speech products	73%
Sharing trip details (location/arrival time) with others	61%
None of these make me feel safer	1%

The final survey question asked respondents that had used both TNCs and public transit in the last 60 days to evaluate their sense of safety of one mode relative to the other. Respondents were asked to identify the extent to which they agreed or disagreed with the following statement: I feel safer making trips with a TNC than I do making trips using public transportation. Table 13 suggests that 48% of these respondents agreed (either strongly or somewhat), whereas one-fifth disagreed (either strongly or somewhat). Almost one-third (32%) were neutral.

Table 13. Respondent Feels Safer in TNC than Public Transit

Level of Disagreement or Agreement	Percent
Strongly disagree	7%
Somewhat disagree	13%
Neither agree or disagree	32%
Somewhat agree	31%
Strongly agree	17%

Discussion

The survey findings show that nearly three-fourths of respondents had utilized ridesharing in the 60 days prior to survey participation. Twenty-one percent reported using TNCs more than any other mode during this time period. The lack of research on this topic makes it difficult to validate these proportions. Moreover, the survey recruitment message explained that the purpose of the study as “identify[ing] how this community utilizes TNCs for safe mobility.” This framing may have led some individuals with no previous TNC experience to believe that they were not qualified to participate, which may have resulted in a proportion of TNC utilization higher than the true proportion. A probability-based sample design may improve the accuracy of future survey estimates. This sample design is more rigorous and generally results in a sample size that is more reflective of the survey universe, but it is more resource intensive.

Considering the wide array of socioeconomic variables collected in the survey and evaluated, employment and vehicle availability appear to be the best predictors of recent TNC use. Fully employed respondents are more likely to have used TNCs in the last 60 days prior to survey administration, relative to other respondents. While some might theorize that being employed

requires an employee to be more mobile and perhaps reliant on multiple modes, it is plausible that employed respondents can more easily afford to pay for TNC services. Similarly, respondents living in a zero-vehicle household were more likely to have used TNCs in the last 60 days than respondents living in a vehicle-available household. In this situation, the lack of a vehicle to address personal mobility increases the likelihood of depending on other modes, including TNCs.

Respondents identified mode availability, mode reliability, and mode safety as the three most influential factors when selecting a mode of travel. These findings are generally in line with similar research focused on identifying factors affecting mode choice within the elderly population and the general population (23–25). Post-survey structured interviews revealed that both Uber and Lyft were aware of the importance of these factors. A recurring theme in the structured interviews was that pooled services (Lyft Line and uberPOOL) were available to users that are visually impaired. The hope is that the reduced cost will encourage hesitant riders to use ridesharing and gain familiarity with the service. Furthermore, the multiple users required by pooled services may facilitate an increased feeling of safety relative to riding alone with an unfamiliar driver. Strategies like this that focus on recruiting users that are visually impaired could prove beneficial for ridesharing companies. This is brought to light by the research findings, which suggest that more than 90% of recent TNC users believe ridesharing to be safe; that proportion shrinks to less than half among those that have not recently used these services.

A majority of recent TNC users confirmed that ridesharing has increased their engagement in myriad activities, ranging from health care to running errands. This is a clear example of how ridesharing helps visually impaired individuals live more independently. Furthermore, features like cashless payment and real-time driver notifications are ways in which ridesharing companies are using technology to increase perceptions of safety. Because of these and other similar technologies, 48% of recent TNC users reported feeling safer using TNCs than public transit.

Despite high praise of TNCs from visually impaired riders, issues surrounding service animals persist. Nearly three out of every four recent TNC users with a service animal reported a service-animal-related issue. While some respondents experienced lower levels of service, most had experienced complete denial of service, seemingly as a result of being accompanied by a service animal. This contradicts the case made by ridesharing companies that TNC transportation is for everyone. During follow-up structured interviews, both Uber and Lyft elaborated on recent policy and technology changes to reduce the frequency of these events and address this shortcoming.

Conclusions and Recommendations

The sections below present a brief summary of the conclusions that were drawn from the data collected in this study.

Factors Used to Assess Safety

A qualitative evaluation of the open text comments identified 10 factors that are important safety considerations for BVI individuals using TNCs, public transit, or paratransit.

- 1. Passengers.** Respondents that evaluated a mode as unsafe often mentioned a feeling of uneasiness around other passengers. Conversely, respondents that evaluated a mode as safe mentioned that the presence of other passengers made them feel safer.
- 2. Drivers.** Drivers that are poorly trained or were not good at recognizing riders who are visually impaired were mentioned as leading causes of feeling unsafe. Respondents that evaluated a mode as safe reported that well-trained drivers put them at ease. Furthermore, this group felt safe because transportation service providers, TNCs, or public transit agencies conduct driver background checks.
- 3. Familiarity.** Familiarity with services, familiarity with the system, and/or familiarity with the driver were identified as significant factors that affect feelings of safety and security. A lack of familiarity can lead to an unsafe feeling.
- 4. Technology.** Among TNC users, the ability to use the TNC app to monitor a trip was seen as a safety promoter.
- 5. Pre- or post-trip activities.** The trip to or from a transit station was mentioned by respondents as a factor that impacts their perception of safety. Additionally, waiting at a transit station was also reported to make many people feel unsafe.
- 6. Regulation.** Particularly among respondents that had not used TNCs in the last 60 days, lax TNC regulations led to a feeling of concern regarding safety.
- 7. Service Animals.** For respondents with service animals, a cause for concern was how well their animal is accommodated. Many respondents with service animals reported lower quality of service or no service at all as a result of the service animal.
- 8. Vehicle.** Several respondents, particularly those that had not used a TNC in the last 60 days, stated that larger vehicles make them feel safer than smaller passenger vehicles.
- 9. Reputation.** Particularly among respondents that characterized TNCs and paratransit as being safe (despite not actually using these modes in the last 60 days), the reputation of a transportation service provider is a factor that can help establish a perception of safety.
- 10. Vulnerability.** Many people reported that being disabled in and of itself was cause for a sense of feeling vulnerable and unsafe. The extent to which a modal option either mitigates or exacerbates this feeling of vulnerability can be linked to perception of safety, or a lack thereof.

Perceived Safety of TNCs and Other Modes of Transportation

Seventy-two percent of respondents reported using TNCs in the 60-day period prior to the survey, and 21% indicated TNCs as the mode they use most often. Among recent TNC users, TNCs were rated as the third-safest mode out of nine modes. The only modes deemed safer than TNCs among this user group were riding in a personal vehicle as the passenger and paratransit, with the difference in safety scores being quite small. Among respondents that had not used TNCs in the

last 60 days, TNCs were rated as the fourth-safest mode, behind riding in a personal vehicle as the passenger, paratransit, and boat or ferry.

Across all modes, individuals that had recently used a mode assigned a higher mean safety score than those that had not recently used a mode. This suggests that one of the biggest opportunities for TNCs as they market their services to BVI users is to encourage them to try the service in the hope that a safe and positive experience leads to long-term use. Post-survey structured interviews with both Uber and Lyft confirmed this as an opportunity.

TNC Characteristics that Convey Safety, or Lack Thereof

The most significant characteristic associated with a respondent feeling safe in a TNC vehicle was a well-trained driver. This held true for both recent users and those that had not recently used a TNC. Among recent TNC users, an increased perception of safety was associated with familiarity with the service from having used a TNC previously and the ability to monitor the trip with the TNC app. Among respondents that had not used a TNC in the last 60 days, perceptions of safety were also driven by their belief that TNCs performed due diligence on drivers and the good reputation of TNCs in the respondents' home region. A plurality of recent TNC users with experience riding public transit agreed that they feel safer using TNCs than public transit.

Just as some respondents feel that TNC drivers help to establish a feeling of safety, respondents that perceive TNCs as unsafe commented that drivers are a key factor in their sentiment. More specifically, recent TNC users reported difficulty with the driver recognizing the passenger and vice versa. Similarly, respondents that had not used a TNC in the last 60 days reported their lack of familiarity with the TNC driver as a reason that they would feel unsafe. Respondents that had not used a TNC in the last 60 days also mentioned feeling vulnerable using TNCs, simply because they were disabled. This sentiment was not unique to TNCs, as it was also mentioned as a reason for feeling unsafe on public transit. This sense of vulnerability was not mentioned with paratransit, which may be because paratransit specifically focuses on serving the mobility needs of individuals with disabilities. This sentiment may offer an example of a context in which TNCs' business model of providing mobility to all may prove more detrimental than positive, at least where the population of BVI users is concerned. Lastly, some respondents that had not used a TNC in the last 60 days perceived TNCs as unsafe due to insufficient regulation. This opinion is certainly not unique to visually impaired riders and remains a highly debated topic.

TNC Technologies that Mitigate Safety Risks

When asked to identify what TNC technologies made them feel safer, a majority of TNC users said many TNC technologies accomplished this goal. The notification of an approaching driver is one example. This may be particularly important given the difficulty with drivers recognizing passengers, and vice versa. Avoiding manual payment was also a favored use since it may be useful in helping visually impaired TNC riders avoid being taken advantage of financially. At a minimum, it lessens the chance of something like this occurring, which may reduce feelings of vulnerability. The ability to rate the driver and the app's compatibility with VoiceOver and other

speech products were also integral in mitigating risk. Finally, the ability to share trip location details with others was identified as a positive use of technology to increase safety.

TNC Services that Can Address Transportation Challenges of BVI Individuals

In some ways, the service model offered by TNCs provides users with visual impairment solutions to some of the challenges they may face when seeking safe transportation options. TNCs provide a service that is akin to a taxi or other private ride, and thus offer transportation that inherently eliminates some of the perceived risk factors of alternatives like public transit. Other aspects of TNC services that were developed to produce a convenient service for the wider consumer market can have additional benefits for BVI users. For example, TNCs place a fundamental emphasis on technological features, such as real-time location tracking and a cashless payment system, that help overcome issues like identifying and locating the correct vehicle or having to rely on others to find out the bus or taxi fare. In addition, smartphone-based TNC services ensure integration with text-to-voice services that are a well-established tool for self-sufficiency among the visually impaired. The survey findings suggest that increased familiarity with TNCs leads to better perceptions of their safety as well.

However, TNC services do not resolve all challenges for BVI users. They have real and perceived limitations that affect the perception of their safety. BVI users may still face challenges related to their vulnerability to drivers and other passengers. As with public transit and paratransit, it is important to respondents to feel familiar and comfortable with the service. The survey demonstrates that users who are unfamiliar with TNCs have lower perceptions of their safety. Finally, the cost of TNCs may be more acute for visually impaired individuals, who may have fewer options than sighted individuals. In interviews, TNC companies pointed to lower-cost shared rides as a tool to decrease the expense of TNC use. Future studies could look into the viability of shared TNC rides for BVI users. The survey results and interview findings suggest that users have different concerns and interpret their level of safety in different terms. While this makes it challenging to identify specific cross-cutting solutions, it reinforces the need to inform potential users about how the services operate, how they regulate or enforce safety, and how to use their services.

Additional Products

The Education and Workforce Development (EWD) and Technology Transfer (T2) products created as part of this project can be downloaded from the Safe-D website [here](#). The final project dataset is located [on the Safe-D Dataverse](#).

Education and Workforce Development Products

The Education and Workforce Development Plan established for this project includes four components, each of which is described below. At the time this report was submitted, components all items had been completed.

1. A graduate student from the University of Texas at Austin LBJ School of Public Affairs was hired as a member of the research team. This student was a Texas A&M Transportation Institute (TTI) employee during the 2018 Spring semester. She was engaged in multiple aspects of the research and gained an understanding of quantitative and qualitative research tasks with at-risk populations that have special needs. She was able to leverage her research experience to help her gain full-time employment in Austin, where she will be working with public policy in the tech industry.
2. The research team worked with the National Federation of the Blind – Austin, Texas Chapter to identify two local chapter members to assist with the recruitment of focus group members.
3. A research packet was developed that includes all project materials such as the report, survey instrument, and dataset. It will also include a slide deck that can be used by lecturers that guide the “teacher” through the material without having to review the complete report. The deck will highlight “nuggets” of information that are particularly novel and/or useful. The slide deck will contain links to other Web-enabled resources, such as a research reference list to highlight similar work, and research lessons learned throughout this project that might be useful to researchers looking to get more involved with this community.
4. The research team will develop a project summary presentation that can be delivered in a “Brown Bag” presentation format. The presentation will be tested by the research team and refined based on the comments received from the audience.

Technology Transfer Products

The Technology Transfer Plan established for this project includes four components, each of which is described below. At the time this report was submitted, the first component has been completed.

1. On April 10, 2018, members of the research team participated in a podcast called “Eyes on Success.” This half-hour weekly podcast discusses products, services, and daily living tips for people with vision loss. “Eyes on Success” reaches a wide audience and has been downloaded in all 50 states in the U.S. and over 100 other countries on all the inhabited continents. The episode featuring TTI researchers focused on preliminary findings and conclusions. Further details about the program can be found by visiting <https://www.eyesonsuccess.net/>. The podcast will be shared broadly through TTI and partners’ websites and social networking channels, including Facebook, LinkedIn, Google+, and YouTube. It will also be publicly accessible online and via other outlets through TTI, Safe-D partners, and BVI community partners.
2. A research article was generated from this research for submission to the *Journal of Blindness Innovation and Research*. At the time this report was submitted, the journal article submission website was down for maintenance. As soon as it is back up, the article will be submitted.

3. The research team will leverage available support from the Safe-D consortium's existing technology transfer programs, including the Virginia Tech Intellectual Properties (VTIP) Corporation, Texas A&M University's Technology Commercialization Agency, and San Diego State University's Technology Transfer Office to share and market the findings and materials developed during this research.
4. As part of the project, the research team planned to host a research summit with participants from the research panel, TNC representatives, BVI experts, technology experts, and BVI rehabilitators. The summit was planned to be a one-day event held in Austin, Texas, with two components: a forum to share research findings and a small group discussion session to elicit feedback from the various stakeholder groups and facilitate communication among those groups. Because our audience was visually impaired, the decision was made to transition from a research summit to a webinar. The webinar was held on August 29, 2018 at 11 a.m. CST. The webinar was attended by approximately 50-individuals.

Data Products

The final data product for this project consists of a WinZip file that contains two individual files.

1. Final Survey Instrument – This Microsoft Word file is an export of the Qualtrics program that was used to collect the survey data. It contains the questions, question numbers, responses, response codes, and survey logic.
2. Final Survey Data – This Microsoft Excel file contains several tabs:
 - Questions – This tab contains the survey questions and QIDs. The QID corresponds to the survey question number identified in the Final Survey Instrument. Bolded questions (Q37–Q42, Q52–Q57, Q61) are questions where respondents were asked to provide an open text response. These responses have been post-coded. The post-coded categories are summarized on the Postcodes tab, and the actual post-coded responses are summarized on the Coded Responses tab.
 - Data Dictionary – This tab contains the data dictionary for the survey data file.
 - Complete_Partial_Ineligible – The data file contains completed surveys (192), partial surveys (79), and ineligible (12). This tab identifies each survey as being complete, partially complete, or ineligible.
 - Partial – This tab contains the percentage complete for each of the 79 partial surveys.
 - Survey Data – This tab contains the actual survey data. It should be noted that this survey file does not contain the open text data referenced above (Q37–Q42, Q52–Q57, Q61). These questions must be merged into the data file using ResponseId as the key field.
 - Coded Responses – This tab contains the open responses to the open text questions (Q37–Q42, Q52–Q57, Q61) and the post-codes.
 - Postcodes – This tab contains the response value and response description for each of the post-coded questions. The same list was used for all open text questions.

References

1. American Foundation for the Blind. <https://www.afb.org/default.aspx>.
2. Brooks, R. Do Transportation Networking Companies Like Uber and Lyft Offer a Viable Alternative to Taxicabs for People who are Blind or Visually Impaired? <http://acb.org/transportation?network?companies>. Accessed Jun. 30, 2017.
3. Erin, J. and A. C. *Foundations of Low Vision: Clinical and Functional Perspectives*. AFB Press, New York, NY, 2010.
4. Zimmerman-Janschitz, S., B. Mandl, and A. D. Clustering of Mobility Needs of Persons with Visual Impairments or Legal Blindness. 2017.
5. Marin-Lamellet, C., and G. Pachiaudi. Information and Orientation Needs of Blind and Partially Sighted People in BIOVAM Project. *Transportation Research Record*, Vol. 1779, No. 01, 2003, pp. 203–208.
6. Crudden, A., K. Antonelli, and J. O’Mally. Transportation Self-Efficacy and Social Problem-Solving of Persons Who Are Blind or Visually Impaired. *Journal of Social Work in Disability & Rehabilitation*, Vol. 15, No. 1, 2016, pp. 52–61.
7. Taneja, Yogesh, A. Gupta, P. Chanana, S. Sanyal, S. Das, M. Paldhe, S. Eswaran, S. Ranjan, S. Maji, D. Mehra, S. Dhakar, V. Singh, V. Sharma, D. Manocha, P.V.M. Rao, R. Paul, M. B. *A Study of Challenges Faced By Visually Impaired Persons in*. New Delhi, India.
8. Ademokoya, J. A. Cultural Barriers to Inclusive Transport for Persons with Disabilities in Southwest Nigeria. 2006.
9. Personal Conversation with Dr. Anne Corn.
10. Van, S. S. Are There Alternative Transportation Options for Blind or Visually Impaired People? <https://sandysview1.wordpress.com/2015/08/27/are-there-alternative-transportation-options-for-blind-or-visually-impaired-people/>. Accessed Aug. 4, 2017.
11. Personal Conversation with Dr. Robert Wall Emerson.
12. Dacuan, L. The Potential for Smart Paratransit Services: On-Demand Service is Driving Technology Integration. <https://www.onvia.com/company/blog/potential-for-smart-paratransit-services-technology-and-training>. Accessed Jun. 13, 2018.
13. Pavey, Sue, A. Dodgson, D. G. and B. C. *Travel, Transport, and Mobility of People who are Blind and Partially Sighted in the UK: Final Report to the RNIB*. Birmingham, 2009.
14. Demmitt, A. The Transportation Problem : Finding Rides When You Can't Drive. <http://www.visionaware.org/blog/visually-impaired-now-what/the-transportation-problem-finding-rides-when-you-can't-drive/12>. Accessed Aug. 4, 2017.
15. Marston, J. R., and R. G. Golledge. The Hidden Demand for Participation in Activities and Travel by Persons Who Are Visually Impaired. *Journal of Visual Impairment & Blindness*, Vol. 97, No. 8, 2003, p. 475.

16. Corn, A. L., and L. P. Rosenblum. Experiences of older adults who stopped driving because of their visual impairments: Part 2. *Journal of Visual Impairment & Blindness*, Vol. 96, No. 7, 2002, pp. 485–500.
17. Kendrick, D. Access to Transportation. *AccessWorld Magazine*, November 2016, , 2014, pp. 1–6.
18. Accessibility at Uber. <https://accessibility.uber.com/>. Accessed Jun. 30, 2017.
19. Danielson, C. Groundbreaking Settlement to End Discrimination Against Blind Uber Riders Who Use Guide Dogs. <https://nfb.org/groundbreaking-settlement-end-discrimination-against-blind-uber-riders-who-use-guide-dogs>. Accessed Jun. 30, 2017.
20. Lyft. [Updated w / FAQ] Our New Service Animal Policy : What You Need to Know FAQ for Drivers. <https://thehub.lyft.com/blog/new-service-animal-policy>. Accessed Jun. 28, 2018.
21. Cornell University. Disability Statistics. <http://www.disabilitystatistics.org/>. Accessed Aug. 20, 2005.
22. Molla, R. Lyft’s new users skew younger than Uber’s. <https://www.recode.net/2018/5/17/17360564/lyft-uber-younger-users>. Accessed May 25, 2018.
23. Olsson, A.-L. L. *Factors That Influence Choice of Travel Mode in Major Urban Areas. The Attractiveness of Park & Ride*. KTH Royal Institute of Technology, 2003.
24. Sitlington, J. *Moving to Healthier People and Healthier Places*. 1999.
25. Wong, R. C. P., W. Y. Szeto, L. Yang, Y. C. Li, and S. C. Wong. Public transport policy measures for improving elderly mobility. *Transport Policy*, Vol. 63, No. October 2016, 2018, pp. 73–79.
26. Newcomer, E. Lyft Gains on Uber in U . S . Business Travel , Doubling Share. <https://www.bloomberg.com/news/articles/2018-04-30/lyft-gains-on-uber-in-u-s-business-travel-doubling-share>. Accessed Jun. 1, 2018.

Appendix A – Survey Instrument

NOTE: For the sake of readability, the skip logic has been removed from the survey instrument.

Q1 Welcome to the Texas A&M Transportation Institute **Mobility Needs Survey**. The goals of this research are to 1) identify how individuals who are blind or have visual impairments use various modes of transportation and, 2) determine how these individuals perceive the safety of transportation modes they do and do not use. Your participation in this survey is greatly appreciated. Your answers on the survey will be confidential to the extent permitted or required by law. This survey has skip logic, and the amount of time to complete the survey will vary based on your responses. The average interview length is estimated to be approximately 15 minutes. Answering these questions presents no risk greater than that which you would come across in everyday life. This research study has been reviewed by the Human Subjects' Protection Program and/or the Institutional Review Board at Texas A&M University. For questions about your rights as a research participant, to provide input regarding research, or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office by phone at 979-458-4067, toll free at 855-795-8636, or by email at irb@tamu.edu. If you have questions, concerns or complaints regarding this study, you may contact the principal investigator, Chris Simek at 512-407-1153, c-simek@tti.tamu.edu. To learn more you may also review the Survey Information Sheet. If you are using a screen reader, the survey may be easier to navigate if you use the keyboard, instead of the mouse. You may navigate forward and backward in the survey by clicking on the navigation buttons at the bottom of each page. Do you agree to participate in this survey?

Yes (1)

No (2)

Q2 Are you at least 18 years old?

Yes (1)

No (2)

Q3 The first part of the survey will collect some information about how you travel. The term transportation network company, referred to as a TNC, is used to describe companies such as

Uber and Lyft. TNC's provide for-hire transportation services. In the past 60-days, which of the following modes of transportation have you used to make a trip? A trip is defined as one-way travel from an origin to a destination. If you are a public transit user, please consider your mode of travel to and from the transit stop as a separate mode. Select all that apply.

- I have not made any trips in the last 60-days (11)
- Personal vehicle as the driver (1)
- Personal vehicle as the passenger (including carpool, vanpool and receiving rides from friends and relatives) (2)
- Walk (3)
- Bike (4)
- Public transit (includes bus, subway, train, etc.) (5)
- Transportation Network Company or TNC (Uber, Lyft, etc.) (6)
- Paratransit (defined as as special transportation services for people with disabilities, often provided as a supplement to fixed-route bus and rail systems by public transit agencies) (7)
- Taxi, limo or other for-hire driver service (excluding Transportation Network Companies like Uber, Lyft, etc.) (8)
- Boat or ferry (9)
- Other (10)

Q4 Which of the following modes do you use to make most of your trips? Select only one.

- Personal vehicle as the driver (1)
- Personal vehicle as the passenger (including carpool, vanpool and receiving rides from friends and relatives) (2)
- Walk (3)
- Bike (4)
- Public transit (includes bus, subway, train, etc.) (5)
- Transportation Network Company or TNC (Uber, Lyft, etc.) (6)
- Paratransit (defined as special transportation services for people with disabilities, often provided as a supplement to fixed-route bus and rail systems by public transit agencies) (7)
- Taxi, limo or other for-hire driver service (excluding Transportation Network Companies like Uber, Lyft, etc.) (8)
- Boat or ferry (9)
- Other (10)

Q5 The next part of the survey will collect some information about why you may or may not choose to use various modes of transportation. Earlier in the survey you indicated that you have not used a personal vehicle as the driver to make a trip in the last 60 days. From the list below, please select the reasons why you have not used this mode. Select all that apply.

- I am not familiar with that mode, or I have not learned to use that mode (1)
- That mode is not available or not easily available where I live/travel (2)
- That mode is too expensive (3)
- I don't feel safe using that mode (4)
- The travel time using that mode is too great (5)
- It is too burdensome to use this mode (i.e., I have to wait a long time. I have to walk to far to access this mode.) (6)
- The time of day or day of week I usually travel makes that mode impractical (7)
- I had a bad experience or heard about a bad experience with that mode (8)
- That mode is not reliable (9)
- I am not a licensed driver (10)
- Other (11)

Q6 Earlier in the survey you indicated that you have not used a personal vehicle as the passenger to make a trip in the last 60 days. From the list below, please select the reasons why you have not used this mode. Select all that apply.

- I am not familiar with that mode, or I have not learned to use that mode (1)
- That mode is not available or not easily available where I live/travel (2)
- That mode is too expensive (3)
- I don't feel safe using that mode (4)
- The travel time using that mode is too great (5)
- It is too burdensome to use this mode (i.e., I have to wait a long time. I have to walk to far to access this mode.) (6)
- The time of day or day of week I usually travel makes that mode impractical (7)
- I had a bad experience or heard about a bad experience with that mode (8)
- That mode is not reliable (9)
- Other (10)

Q7 Earlier in the survey you indicated that you have not walked to make a trip in the last 60 days. From the list below, please select the reasons why you have not used this mode. Select all that apply.

- I am not familiar with that mode, or I have not learned to use that mode (1)
- That mode is not available or not easily available where I live/travel (2)
- That mode is too expensive (3)
- I don't feel safe using that mode (4)
- The travel time using that mode is too great (5)
- It is too burdensome to use this mode (i.e., I have to wait a long time. I have to walk to far too access this mode.) (6)
- The time of day or day of week I usually travel makes that mode impractical (7)
- I had a bad experience or heard about a bad experience with that mode (8)
- That mode is not reliable (9)
- Other (10)

Q8 Earlier in the survey you indicated that you have not used a bike to make a trip in the last 60 days. From the list below, please select the reasons why you have not used this mode. Select all that apply.

- I am not familiar with that mode, or I have not learned to use that mode (1)
- That mode is not available or not easily available where I live/travel (2)
- That mode is too expensive (3)
- I don't feel safe using that mode (4)
- The travel time using that mode is too great (5)
- It is too burdensome to use this mode (i.e., I have to wait a long time. I have to walk to far to access this mode.) (6)
- The time of day or day of week I usually travel makes that mode impractical (7)
- I had a bad experience or heard about a bad experience with that mode (8)
- That mode is not reliable (9)
- Other (10)

Q9 Earlier in the survey you indicated that you have not used public transit to make a trip in the last 60 days. From the list below, please select the reasons why you have not used this mode. Select all that apply.

- I am not familiar with that mode, or I have not learned to use that mode (1)
- That mode is not available or not easily available where I live/travel (2)
- That mode is too expensive (3)
- I don't feel safe using that mode (4)
- The travel time using that mode is too great (5)
- It is too burdensome to use this mode (i.e., I have to wait a long time. I have to walk to far to access this mode.) (6)
- The time of day or day of week I usually travel makes that mode impractical (7)
- I had a bad experience or heard about a bad experience with that mode (8)
- That mode is not reliable (9)
- Other (10)

Q10 Earlier in the survey you indicated that you have not used a TNC to make a trip in the last 60 days. From the list below, please select the reasons why you have not used this mode. Select all that apply.

- I am not familiar with that mode, or I have not learned to use that mode (1)
- That mode is not available or not easily available where I live/travel (2)
- That mode is too expensive (3)
- I don't feel safe using that mode (4)
- The travel time using that mode is too great (5)
- It is too burdensome to use this mode (i.e., I have to wait a long time. I have to walk to far to access this mode.) (6)
- The time of day or day of week I usually travel makes that mode impractical (7)
- I had a bad experience or heard about a bad experience with that mode (8)
- That mode is not reliable (9)
- Other (10)

Q11 Earlier in the survey you indicated that you have not used paratransit to make a trip in the last 60 days. From the list below, please select the reasons why you have not used this mode. Select all that apply.

- I am not familiar with that mode, or I have not learned to use that mode (1)
- That mode is not available or not easily available where I live/travel (2)
- That mode is too expensive (3)
- I don't feel safe using that mode (4)
- The travel time using that mode is too great (5)
- It is too burdensome to use this mode (i.e., I have to wait a long time. I have to walk to far to access this mode.) (6)
- The time of day or day of week I usually travel makes that mode impractical (7)
- I had a bad experience or heard about a bad experience with that mode (8)
- That mode is not reliable (9)
- I am not eligible for this mode (10)
- Other (11)

Q12 Earlier in the survey you indicated that you have not used a taxi, limo or other for-hire service to make a trip in the last 60 days. From the list below, please select the reasons why you have not used this mode. Select all that apply.

- I am not familiar with that mode, or I have not learned to use that mode (1)
- That mode is not available or not easily available where I live/travel (2)
- That mode is too expensive (3)
- I don't feel safe using that mode (4)
- The travel time using that mode is too great (5)
- It is too burdensome to use this mode (i.e., I have to wait a long time. I have to walk to far to access this mode.) (6)
- The time of day or day of week I usually travel makes that mode impractical (7)
- I had a bad experience or heard about a bad experience with that mode (8)
- That mode is not reliable (9)
- Other (10)

Q13 Earlier in the survey you indicated that you have not used a boat or ferry to make a trip in the last 60 days. From the list below, please select the reasons why you have never used this mode. Select all that apply.

- I am not familiar with that mode, or I have not learned to use that mode (1)
- That mode is not available or not easily available where I live/travel (2)
- That mode is too expensive (3)
- I don't feel safe using that mode (4)
- The travel time using that mode is too great (5)
- It is too burdensome to use this mode (i.e., I have to wait a long time. I have to walk to far to access this mode.) (6)
- The time of day or day of week I usually travel makes that mode impractical (7)
- I had a bad experience or heard about a bad experience with that mode (8)
- That mode is not reliable (9)
- Other (10)

Q14 The next section of the survey will focus specifically on factors you may or may not consider when you make decisions to use various modes of transportation. Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, please indicate how important each factor is in your decision making process. Each question presents only one factor. The first factor is **your level of familiarity with the mode of transportation. (Do you have prior experience with the mode?)**

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q15 Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, how important is **your familiarity with the trip route?**

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q16 Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, how important is **how available the mode of transportation is to you for your trip?**

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q17 Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, how important is **the total cost of the mode of transportation for your trip?**

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q18 Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, how important is **how safe you feel when taking a mode for your trip?**

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q19 Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, how important is **the total travel time it will take to make your trip using that mode of transportation?**

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q20 Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, how important is **the personal constraints you are faced with at the time of your trip?**

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q21 Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, how important is **the level of effort required for navigating from your origin to your destination?**

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q22 Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, how important is **the purpose of the trip**?

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q23 Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, how important is **who else you will be traveling with on the trip**?

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q24 Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, how important is **the time of day the trip is made?**

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q25 Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, how important is **the day of week the trip is made?**

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q26 Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, how important is **the expected reliability of that mode?**

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q27 Using a scale of 1-5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, how important is **how easy it will be to use that mode?**

- 1 - Extremely unimportant (1)
- 2 - Somewhat unimportant (2)
- 3 - Neither unimportant or important (3)
- 4 - Somewhat important (4)
- 5 - Extremely important (5)

Q28 The next section of the survey will focus specifically on the safety of various modes of transportation you may or may not have used in the past. Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on your personal experience** please rate how safe or unsafe you felt while making your last trip as the driver of a personal vehicle.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q29 Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on your personal experience** please rate how safe or unsafe you felt while making your last trip as a passenger in a personal vehicle.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q30 Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on your personal experience** please rate how safe or unsafe you felt while making your last walk trip.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q31 Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on your personal experience** please rate how safe or unsafe you felt while making your last bike trip.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q32 Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on your personal experience** please rate how safe or unsafe you felt while making your last public transit trip.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q33 Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on your personal experience** please rate how safe or unsafe you felt while making your last TNC trip.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q34 Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on your personal experience** please rate how safe or unsafe you felt while making your last paratransit trip.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q35 Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on your personal experience** please rate how safe or unsafe you felt while making your last trip with a taxi, limo or other for-hire driver service.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q36 Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on your personal experience** please rate how safe or unsafe you felt while making your last boat or ferry trip.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q37 In your own words, what was it about your last public transit trip that made you feel unsafe?

Q38 In your own words, what was it about your last TNC trip that made you feel unsafe?

Q39 In your own words, what was it about your last paratransit trip that made you feel unsafe?

Q40 In your own words, what was it about your last public transit trip that made you feel safe?

Q41 In your own words, what was it about your last TNC trip that made you feel safe?

Q42 In your own words, what was it about your last paratransit trip that made you feel safe?

Q43 You indicated you have not used a personal vehicle as the driver to make a trip in the last 60 days. Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on what you have experienced, heard or read,** please rate how safe or unsafe you think you would feel while making a trip as the driver of a personal vehicle.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q44 You indicated you have not used a personal vehicle as a passenger to make a trip in the last 60 days. Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on what you have experienced, heard or read,** please rate how safe or unsafe you think you would feel while making a trip as a passenger in a personal vehicle.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q45 You indicated you have not walked to make a trip in the last 60 days. Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on what you have experienced, heard or read,** please rate how safe or unsafe you think you would feel while making a walk trip.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q46 You indicated you have not biked to make a trip in the last 60 days. Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on what you have experienced, heard or read,** please rate how safe or unsafe you think you would feel while making a bike trip.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q47 You indicated you have not used public transit to make a trip in the last 60 days. Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on what you have experienced, heard or read** please rate how safe or unsafe you think you would feel while making a public transit trip.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q48 You indicated you have not used a TNC to make a trip in the last 60 days. Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on what you have experienced, heard or read,** please rate how safe or unsafe you think you would feel while making a TNC trip.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q49 You indicated you have not used paratransit to make a trip in the last 60 days. Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on what you have experienced, heard or read**, please rate how safe or unsafe you think you would feel while making a paratransit trip.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q50 You indicated you have not used a taxi, limo or other for-hire driver service to make a trip in the last 60 days. Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on what you have experienced, heard or read**, please rate how safe or unsafe you think you would feel while making a trip with a taxi, limo or other for-hire driver service.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q51 You indicated you have not used a boat or ferry to make a trip in the last 60 days. Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, **based on what you have experienced, heard or read,** please rate how safe or unsafe you think you would feel while making a boat or ferry trip.

- 1 - Extremely unsafe (1)
- 2 - Somewhat unsafe (2)
- 3 - Neither unsafe or safe (3)
- 4 - Somewhat safe (4)
- 5 - Extremely safe (5)

Q52 In your own words, what makes you believe that making a public transit trip would make you feel unsafe?

Q53 In your own words, what makes you believe that making a TNC trip would you feel unsafe?

Q54 In your own words, what makes you believe that making a paratransit trip would make you feel unsafe?

Q55 In your own words, what makes you believe that making a public transit trip would make you feel safe?

Q56 In your own words, what makes you believe that making a TNC trip would make you feel safe?

Q57 In your own words, what makes you believe that making a paratransit trip would make you feel safe?

Q58 The next section of the survey will focus specifically on your use of TNCs in the past. In which, if any, of the following activities are you more likely to engage, since you started using TNCs? Select all that apply.

- Work for pay outside of home (1)
- Volunteer outside my home (2)
- School or school related activities (3)
- Shopping (4)
- Run errands (dry cleaning, banking, etc.) (5)
- Recreational activities (visit parks, museums, etc.) (6)
- Exercise (7)
- Visit friends or relatives (8)
- Health care (medical, dental, therapy, etc.) (9)
- Religious (10)
- Going out for dinner or drinks (11)
- Other (12)

Q59 Do you have a dog guide or other service animal?

Yes (1)

No (2)

Q60 Have you ever had negative experiences while using a TNC (related to your service animal)?

Yes (1)

No (2)

Q61 Can you explain that issue?

Q62 Which, if any, of the following uses of technology by TNCs make you feel safer when you have used their services? Select all that apply.

The notification you receive when the driver is on their way and/or arrives (1)

The ability for you to share your location and/or estimated arrival time with others (2)

The ability to avoid a manual payment of my driver at the end of the trip (3)

The ability to rate the driver at the end of the trip (4)

The app's compatibility with Voiceover and other speech products (5)

None of these make me feel safer (6)

Q63 To what extent do you agree or disagree with the following statement: I feel safer making trips with a TNC than I do making trips using public transportation?

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree or disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q64 The final section of the survey will collect some basic information about you. What is your gender?

- Male (1)
- Female (2)
- Transgender male (3)
- Transgender female (4)
- Gender variant/non-conforming (5)
- I do not know (7)
- I prefer not to answer (8)

Q65 Which of the following categories best describes your age?

- 18 - 24 (1)
- 25 - 34 (2)
- 35 - 44 (3)
- 45 - 54 (4)
- 55 - 64 (5)
- 65 and older (6)
- I do not know (7)
- I prefer not to answer (8)

Q66 Are you of Hispanic, Latino or Spanish origin?

- Yes (1)
- No (2)
- I do not know (3)
- I prefer not to answer (4)

Q67 What is your race? Select all that apply

- White or Caucasian (1)
- Black or African American (2)
- American Indian or Alaskan Native (3)
- Asian alone (4)
- Native Hawaiian and other Pacific Islander alone (5)
- Some other race alone (6)
- Two or more races (7)
- Other (8)
- I do not know (9)
- I prefer not to answer (10)

Q68 Which best describes your level of visual impairment or blindness.

- Low vision, not legally blind (1)
- Legally blind (2)
- Totally blind (3)
- I do not know (4)
- I prefer not to answer (5)

Q69 Do you have any of the following additional disabilities or health problems? Select all that apply.

- I do not have additional disabilities (1)
- Health problems that limit my travel (2)
- Hearing impairment or deafness (3)
- Physical disability (4)
- Social/emotional disability (5)
- Cognitive disability (6)
- Other (7)
- I do not know (8)
- I prefer not to answer (9)

Q70 Including yourself, how many people live in your household?

Q71 Do you have any children living at home?

- Yes (1)
- No (2)
- I do not know (3)
- I prefer not to answer (4)

Q72 Do you have any adult children (who drive) living within 30 minutes of your home?

- Yes (1)
- No (2)
- I do not know (3)
- I prefer not to answer (4)

Q73 How many vehicles does your household own or lease?

Q74 Do you have a driver living in your home?

- Yes (1)
- No (2)
- I do not know (3)
- I prefer not to answer (4)

Q75 Are you a student at a high school, vocational school, college, technical school, or university?

- Yes (1)
- No (2)
- I do not know (3)
- I prefer not to answer (4)

Q76 What is the highest level of education you have completed?

- Less than high school diploma/ GED (1)
- High school diploma/ GED (2)
- Some college, no degree (3)
- Associate degree or technical degree (4)
- Bachelor's degree (5)
- A graduate or professional degree (6)
- I do not know (7)
- I prefer not to answer (8)

Q77 Please select which of the following that describe your current work status.

- I am unemployed (5)
- I am employed full time (at least 40 hours per week) (1)
- I am employed part time (less than 40 hours per week) (2)
- I do not know (3)
- I prefer not to answer (4)

Q78 Are you a licensed driver in the state in which you live?

Yes (1)

No (2)

I do not know (3)

I prefer not to answer (4)

Q79 Have you received orientation and mobility training?

- Yes (1)
- No (2)
- I am currently receiving orientation and mobility training. (3)
- I do not know (4)
- I prefer not to answer (5)

Q80 What category best describes your yearly household income? By yearly household income we mean pre-tax earnings from jobs that you or other household members have had during the past 12 months.

- Less than \$25,000 (1)
- \$25,000 to \$49,999 (2)
- \$50,000 to \$74,999 (3)
- \$75,000 to \$99,999 (4)
- \$100,000 or more (5)
- I do not know (7)
- I prefer not to answer (6)

Q81 The survey is over. Thank you very much for participating in this important project. If you are interested in obtaining a copy of the final report, or learning more about the project, please contact the principal investigator, Chris Simek, at c-simek@ti.tamu.edu. By selecting the Move Forward button, you will complete the survey.

Appendix B – Focus Group Summary

Overview

This report provides an overview of the focus group that the Texas A&M Transportation Institute (TTI) conducted to better understand the perspectives of survey participants that are visually impaired.

Methodology

Focus groups center on understanding the why behind various research questions. Focus groups provide the opportunity to allow researchers to delve into the thought processes and rationale behind specific attitudes and opinions and understand what may motivate a specific decision. Most focus groups follow a semi-structured interview format, allowing follow-up questions that can help cross-validate responses between participants and gauge their reactions to proposals that may not be completely developed. Research to understand a user's unique perspective can inform strategies for message development, delivery, and timing. Although not representing a statistically significant portion of the general population, focus groups do provide a qualitative sample of public opinion that is particularly useful to guide follow-up education and outreach activities. Focus groups can complement quantitative research to address research topics where human perceptions and experiences are important.

The goals of the focus group conducted during this research were to (1) validate survey content as appropriate for capturing the mobility safety preferences of individuals that are visually impaired, (2) ensure that the method of survey administration is appropriate for this specific community, and (3) identify aspects of the survey that are particularly burdensome or difficult to understand. The input provided by participants would be directly incorporated into revisions made to the survey instrument, with the overall goal of the focus group being to ensure that the instrument would work seamlessly for members of this community.

The focus group was held at the Texas School for the Blind and Visually Impaired located at 1100 West 45th Street, Austin, Texas, on October 30 from 6:00 p.m. to 7:30 p.m. Seven participants took part in the focus group, all of whom were blind.

Focus Group Recruitment

Focus group participants were recruited using a multi-stage process. Initially, the research team identified two individuals affiliated with the Austin Chapter of the National Federation of the Blind who were willing to help with identifying focus group participants. These two individuals were tasked with providing the contact information of visually impaired individuals who might be willing to participate in the focus group. Upon securing this list, members of the research team recruited these individuals for focus group participation. A total of 10 individuals were recruited to attend.

Discussion Guide Development

TTI used Qualtrics to develop a Web survey to understand the mobility safety preferences of individuals that are visually impaired. Qualtrics has a built-in survey diagnostic that reviews surveys for 508 compliance (<https://www.qualtrics.com/support/survey-platform/survey-module/survey-tools/general-tools/check-survey-accessibility/>). This diagnostic was useful in helping prepare the survey for focus group administration.

The survey was the basis of a discussion guide developed for the focus groups. The discussion guide navigated participants through each section of the survey and provided opportunities for participants to discuss areas where questions were easy to navigate and understand, identify questions that should be reworded for better comprehension, and identify areas of the survey where the screen reader (JAWS) was not working properly.

Conducting the Focus Group

An experienced moderator led each group and two note-takers were also present. The focus group began with introductions where the moderator, note-takers, and participants introduced themselves. The focus group lasted approximately 1½ hours. Throughout the focus group, participants were actively engaged in the discussion.

Focus Group Findings

The moderator navigated participants through each section of the survey and prompted them to provide input on areas where wording was confusing or inappropriate. They were also asked to identify areas where the screen reader did not work correctly with the survey. The following results of the focus group are organized into two sections:

- Comments provided by participants about specific questions, and
- Comments provided by participants that refer to the survey in general.

Comments on Specific Questions

Each of the following comments is associated with specific questions in the survey.

Welcome screen. Where the survey reads, “2) determine how these individuals perceive the safety of transportation modes they do and do not use,” Jaws is pronouncing transportation in what appears to be Spanish (transportacion) for some participants. Other participants indicated that this could be JAWS attempting to be “intuitive” as it can detect foreign languages. There was also discussion that this could be an issue with the coding.

Question 7: “The next part of the survey will collect some information about why you may or may not choose to use various modes of transportation.” Participants indicated that the question was confusing and thought it should be removed.

Question 9: “Earlier in the survey you indicated that you have not used a personal vehicle as the passenger to make a trip in the last 60 days. From the list below, please select the reasons why you have not used this mode. Select all that apply.” The last sentence (“Select all that apply”) was in the instructions twice.

Question 16: “Earlier in the survey you indicated that you have not used a boat or ferry to make a trip in the last 60 days. From the list below, please select the reasons why you have never used this mode. Select all that apply.” Participants indicated that after the check box was checked, JAWS reread the question.

Question 17: “Presented below are several factors you may or may not consider when making a decision about modes of transportation. Using a scale from 1 to 5, where 1 is extremely unimportant, 3 is neither unimportant or important, and 5 is extremely important, please assign a score to each.” Some participants indicated that they like edit boxes and some people indicated that they like drop-down boxes. One participant requested that it would be helpful to include some examples of personal constraints in the responses to provide context for respondents. Finally, one person said that the second-to-last option, “the expected reliability of that mode,” repeats, and the last option, “how easy it will be to use that mode,” is not read.

Question 19: “Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, based on your personal experience please rate how safe or unsafe you felt while making your last trip as the driver of a personal vehicle.” Some participants indicated that they like the way the scale is set up and would like the scale on previous scale questions (Questions 16, 17, and 18) to be like this question.

Question 23: “Using a scale of 1-5, where 1 is extremely unsafe, 3 is neither unsafe or safe, and 5 is extremely safe, based on your personal experience please rate how safe or unsafe you felt while making your last public transit last.” A participant indicated that the question has a typo as the last sentence should end with “trip” not “last.”

Question 61: “Which best describes your level of visual impairment or blindness.” Participants indicated that the options should read as follows:

- Option 1: “Low vision, not legally blind” (do not change).
- Option 2: Change to “Legally blind.”
- Option 3: Change to “Blind/totally blind.”

Question 64: “Do you have any children living at home?” Participants indicated that this question should not be asked if the respondent lives in a one-person household.

Question 67: “Do you have a driver living in your home?” Participants indicated that if they answered “not a licensed driver” to Question 8, this question should be skipped,

Question 68: “Please select which of the following that describe your current work status.”
Participants explained that there should be a student option added to this question.

Comments on the Survey in General

The following comments refer to either numerous questions on the survey or the general survey-taking experience.

- Participants indicated that there should be page breaks between each question.
- Participants indicated that removing the numbers before the questions in the body will help the survey flow better. Participants also indicated that the numbers were “confusing” the reader.
- Participants indicated that when they were answering questions in the second section of the survey, where respondents are asked to select reasons why they have or have not used a mode, the JAWS rereads the opening question before each reason. Participants indicated that this was extremely frustrating and made this section of the survey progress extremely slowly. Participants provided the following suggestions and comments about this issue:
 - One participant suggested changing this to a radio button.
 - Another participant indicated that if you navigate through each of the “reasons” with the arrows while holding the Control key that JAWS does not repeat the question before each “reason.” The participant did indicate that she had to go through all of the options before she could choose any. In addition, she explained that holding Control while using the Up arrow did not work. Finally, this participant indicated that holding the Shift key while navigating is not intuitive and the BVI community would not instinctively know to do this.
 - One participant indicated that if the survey is to be ADA compliant, this issue has to be addressed.
- Participants explained that there is an error in the coding of the HTML at the end of the responses where “other” is an option (the issue is with the coding of “other”).
- Participants also explained that all “other” responses need to be non-randomized or deleted.
- One participant explained that if there is a Captcha (a mechanism to distinguish between a real person and an Internet bot) to make sure there is an audio version.
- Participants explained that questions asking people what they think about modes they have never taken should be prefaced with the phrase “earlier you told us you have not taken...”

- Finally, participants indicated that on the questions asking respondents to rate items on a scale (starting with Question 19) the cursor has to be in the box for the reader to work. If the respondent hits “e,” the cursor will enter the box.

Conclusions and Recommendations

The focus group offered researchers the opportunity to identify issues with the survey that were addressed in order to ensure that the survey was more effective. Participants indicated that beyond the issues identified in the above sections, the survey was well designed, made sense, and was easy to complete. The majority of the comments were focused on areas where the screen reader (JAWS) was not working properly and coding needed to be addressed. This is an area where the participation of members of this community in a focus group setting was invaluable. Additionally, participants identified some issues with wording and typos that provided the opportunity to improve the overall fluidity of the survey.

While the vast majority of the input was focused on how the screen reader was working, and to a lesser extent on typos and general wording of questions, there was one example of input that was provided that identified an issue with a question that was confusing and could have been perceived as insensitive. The question asked was, “Which best describes your level of visual impairment or blindness,” and it offered the following options:

- Low vision, not legally blind
- Low vision and legally blind
- Functionally or totally blind

Participants indicated that these options were not clear as the term “functionally” has a range of meaning in the BVI community. The input provided three separate and distinct categories of the level of blindness and the term “functionally” was removed. This input was extremely helpful as the term may have been perceived as insensitive and researchers would not have been aware of this otherwise.

Limitations

While the research team has extensive experience with conducting focus groups, this was the first experience with conducting a focus group with a community of users that are visually impaired. This section identifies areas where the research team learned how to better work with this community in the future.

The research team did not bring headphones, and some of the participants did not have headphones that would work with the computers provided. This led to some participants having a hard time hearing their screen readers as there were numerous screen readers active at once. Participants did their best to focus on their own screen readers, but this environment led to some

distraction and an inability to hear all questions the first time they were read. In the future, the research team will bring headphones for each participant in case they do not have their own.

The computers provided had just been set up with the JAWS screen reader software, and there were some issues getting the program set up in the way that each participant was accustomed to. It would have been more effective to have each participant use their own computer with their screen reader, so that they could speak to the effectiveness of the survey, as opposed to having to navigate a new computer environment and decide whether anomalies were based on the survey instrument or the unfamiliar computer.

The research team realized shortly after the focus group began that it was challenging to have all participants review the survey at the same speed. Some participants were far faster in moving through the survey than others, and this led to the research team having to ask some participants to slow down while others caught up. This led to some frustration on the behalf of participants. It also led to the group being less focused on the moderator.

Overall the participants were extremely helpful and provided invaluable input. However, the distractions did lead to the moderator not having as much of an opportunity to ask the group more general, qualitative questions about the overall experience of taking the survey. Details regarding how the survey worked, how the screen reader worked, and what changes needed to be made were provided, so the overall experience was worthwhile. However, researchers would have liked to capture more general feedback from the group.

Appendix C – Structured Interview Summary

Following a preliminary descriptive data analysis, the research team held structured interviews with representatives of two TNCs, Uber and Lyft. These two companies account for more than 70 percent of the U.S. ride-hailing industry (26). The purpose of the interviews was to gain the perspective of TNC providers on the safe use of TNCs by the community of users that are visually impaired. This section summarizes those discussions but does not attribute comments to a particular company or individual.

TNCs Emphasize Service for All Users

An overarching theme that emerged from the interviews is that both TNCs view their primary objective as providing safe and accessible transportation to all individuals. Rather than focusing on efforts to specifically recruit or serve specific subgroups, the TNCs focus primarily on ensuring that their services are equally available to anyone and everyone. One TNC representative felt that a misperception among some visually impaired individuals is that only a subset of their services are available to them. They stated that this is not the case.

To address visually impaired users' desire for availability and reliability, the TNCs note that it is their vision to fill mobility gaps and increase access to transportation services for all users. One aspect of this is increasing driver supply. Another aspect is expanding from urban markets to less-dense geographies that are traditionally underserved by transportation options. One TNC noted that their biggest opportunity to serve visually impaired users is to increase the number of potential users who have access to the TNC technology, and one way they are doing that is through partnerships with transit agencies and advocacy organizations.

From the TNC perspective, the challenge is to balance their core mission of ensuring accessibility to everyone while maintaining high standards for non-discrimination. This challenge is demonstrated by two competing perspectives held by visually impaired users. One TNC reported that some users would prefer to have a driver informed of their visual impairment, so that a driver is aware of it and can provide assistance. On the other hand, others have concerns that sharing this information could expose them to potential discrimination (e.g., such as a driver cancelling their pick up). One TNC representative noted that they do not collect any sociodemographic data about their users in an effort to avoid the potential for discrimination. The TNCs also noted that the primary concerns for visually impaired users (e.g., safety, cost) identified in this project's survey are similar to the concerns among most users. The survey suggests that safety is a primary concern for visually impaired users. The TNCs emphasized that safety is a top priority. One TNC noted that they have made recent changes to reaffirm their commitment to safety with improvements such as 911 integration and annual background checks.

Similarly, when asked about cost concerns among visually impaired riders, the TNC representatives noted that this is a major factor for them, but reiterated that the strategies they

implement to serve their patrons do not differentiate between sighted and non-sighted riders. One noted that pooled-ride service is an opportunity to lower trip cost and is available to everyone in communities where these services are offered. One TNC mentioned a pilot project to offer transit riders discounted TNC rates and that the TNC sees partnerships with paratransit service providers as an opportunity to help improve mobility for disabled riders.

Other Hurdles to Safe TNC Use for the BVI Community

Other hurdles for visually impaired riders discussed in the interviews included familiarity with ridesharing, including digital ridesharing technologies. However, both TNCs noted that these issues are not specific to the visually impaired population. In fact, one TNC representative suggested that these are common issues and potentially less significant for this group of users than among other groups, such as older adults. Once again, the TNC representatives did not emphasize strategies specific to the visually impaired community. From a business perspective, one TNC noted that marketing to new customers is a large part of their business model, but, to date, it has not been focused specifically on the visually impaired community.

The TNCs mentioned being aware of the importance of accommodating users with service animals. One TNC noted that their company policy is a mandatory requirement for drivers to be willing to accept service dogs.

Role of Technology

Technological solutions were noted as key features that make TNC services accessible and appealing to visually impaired users. One TNC representative reported hearing from visually impaired users that the core TNC technology is “revolutionary” for them. The primary technology that improves access to TNC services for this community is the integration of TNC apps with voice-to-text tools. Both companies offer this service compatibility on Android and iOS devices. The TNCs noted that the service is updated regularly through app updates to ensure compliance and compatibility.

Both TNCs reported that several core features of the TNC app or service are attractive to visually impaired users. These functions include:

- Ability to get a ride “on-demand”
- Real-time tracking and route monitoring
- Ability to share their estimated time of arrival
- Cashless payment
- Driver rating system

On the benefits of driver ratings, one TNC also noted that this function also allows the TNC to address issues with drivers who provide poor service to disabled users expeditiously.

In contrast, some features that assist sighted TNC users do not help visually impaired users. One example is providing vehicle color and license plate numbers to identify the arriving vehicle.

One TNC representative noted that the TNC is aware of this shortcoming and they regularly make updates to the smartphone applications as part of their ongoing efforts to improve service.

Appendix D – Recruitment Email

Good afternoon,

The Texas A&M Transportation Institute (TTI) was recently awarded a project that will investigate how individuals that are visually impaired perceive the safety of transportation network companies or TNCs (companies like Uber or Lyft, sometimes referred to as ride sharing companies) relative to other travel modes. The research will also seek to identify how this community utilizes TNCs for safe mobility. Our project team has designed a web survey, which will capture data from this community. To make this project a success, we need your help.

At this time, TTI is reaching out to organizations that work with and/or advocate on behalf of individuals that are blind and visually impaired requesting their assistance as a research partner. All we are asking is that you distribute a web survey URL to members of your organization. Distribution might involve any or all of the following:

Sending an email to your membership.

Including the survey link on your website.

Advertising the project in organizational newsletters or other communications.

Encouraging your membership to participate.

The web survey will take approximately 15 minutes to complete, and may be accessed with the following URL: <https://goo.gl/JSBbtE>. We would like to begin data collection immediately. The survey will remain open until the middle of March 2018. For your convenience, a short blurb about the survey that can be used to help spread the word is at the end of this email.

Can we count on you as a research partner? Please contact me at your earliest convenience and let me know if you agree to partner with us, or if you have further questions.

Survey Blurb

The Texas A&M Transportation Institute (TTI) is conducting a web survey investigating how individuals that are visually impaired perceive the safety of transportation network companies or TNCs (companies like Uber or Lyft, sometimes referred to as ride sharing companies) relative to other travel modes. The research will also seek to identify how this community utilizes TNCs for safe mobility. You may participate by clicking here, or by copying the following URL and pasting into your web browser: <https://goo.gl/JSBbtE>.

Appendix E – Respondent Demographics

Table 14. Gender

Gender	Percent
Male	40%
Female	59%
Refuse	1%
Total	100%

Table 15. Age

Age	Percent
18-24	4%
25-34	17%
35-44	19%
45-54	22%
55-64	23%
65+	15%
Total	100%

Table 16. Ethnicity and Race

Ethnicity and Race	Percent
Hispanic	5%
Non-Hispanic White	78%
Non-Hispanic African American	6%
Non-Hispanic Some Other Race Alone	<1%
Non-Hispanic Asian Alone	<1%
Non-Hispanic Two or More Races	4%
Non-Hispanic Other	<1%
Don't Know / Refuse	7%
Total	100%

Table 17. Type of Visual Impairment (N=200)

Type of Visual Impairment	Percent
Low vision, not legally blind	6%
Legally blind	41%
Totally blind	52%
Don't Know / Refuse	1%
Total	100%

Table 18. Presence and/or Type of Non-Visual Disability (N=230)

Impairment	Percent
I do not have additional disabilities	59%
Physical disability	16%
Hearing impairment or deafness	13%
Health problems that limit my travel	12%
Other	6%
Social/emotional disability	4%
Cognitive disability	2%
Don't Know / Refuse	1%
Total	100%

Table 19. Household Size (N=195)

Household Size	Percent
1	30%
2	49%
3	10%
4+	11%
Total	100%

Table 20. Presence of Child in Home (N=134)

Child in Home	Percent
Yes	17%
No	81%
Don't Know / Refuse	2%
Total	100%

Table 21. Presence of Child within 30-minute Drive of Home (N=200)

Child within 30-minute Drive of Home	Percent
Yes	16%
No	82%
Don't Know / Refuse	2%
Total	100%

Table 22. Household Vehicles (N=196)

Household Vehicles	Percent
0	54%
1	29%
2	12%
3+	5%
Total	100%

Table 23. Presence of Licensed Driver in Home (N=32)

Licensed Driver in Home	Percent
Yes	68%
No	29%
Don't Know / Refuse	3%
Total	100%

Table 24. Is Respondent Licensed Driver in Home State (N=46)

Is Respondent Licensed Driver	Percent
Yes	30%
No	71%
Total	100%

Table 25. Student Status (N=201)

Student Status	Percent
Student	9%
Not a Student	90%
Don't Know / Refuse	1%
Total	100%

Table 26. Educational Attainment (N=201)

Educational Attainment	Percent
High school diploma/ GED	5%
Some college, no degree	17%
Associate degree or technical degree	7%
Bachelor's degree	32%
A graduate or professional degree	38%
Don't Know / Refuse	1%
Total	100%

Table 27. Employment (N=187)

Employment Status	Percent
Full time	47%
Part time	21%
Don't Know / Refuse	32%
Total	100%

Table 28. Has Respondent Received Orientation and Mobility Training? (N=200)

Training Received	Percent
Yes	89%
No	10%
I am currently receiving orientation and mobility training	1%
Total	100%

Table 29. Annual Household Income (N=201)

Income Level	Percent
Less than \$25,000	23%
\$25,000 to \$49,999	18%
\$50,000 to \$74,999	17%
\$75,000 to \$99,999	13%
\$100,000 or more	13%
Don't Know / Refuse	16%
Total	100%