FIRST/LAST MILE CHALLENGE: PERSPECTIVES OF MILLENNIALS

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ABSTRACT

According to the American Public Transportation Association (APTA), public transportation use in the United States reduces the nation’s carbon emissions by 37 million metric tons. In addition, for every $1 invested in public transportation, approximately $4 in economic returns is generated (APTA, 2015). Although public transportation offers several benefits, one of the major drawbacks is connecting users from their place of origin to transit nodes, and then to desired destinations, also known as the ‘first and last mile’ (FLM) problem. Researchers have discovered the connecting ends of the FLM to be the weakest link of transit systems (Krygsman, Dijst, & Arentze, 2004). However, one of the best approaches to addressing FLM is developing a multimodal network. Studies highlight that the millennial generation, those born between 1982 and 2003, the largest generation in American history, is attracted to multimodal transportation options (APTA, 2013). This research explores the preferences of millennials on a college campus to connect to transit nodes. The goal is to identify millennials’ preferred methods to get to and from transit nodes in order to enhance the FLM. In order to examine millennials’ preference, students attending the University of Florida were selected as the study group and were surveyed. The findings suggest that priority should be given to maintaining and enhancing pedestrian facilities to improve the FLM experience.

Keywords:
First and Last Mile
Transit
Millennials
University of Florida
I. Public Transportation and the FLM Problem

1.1 Background

In the United States (U.S.), public transportation plays an essential role in reducing the country’s carbon footprint and congestion costs, and stirring significant economic growth. According to the American Public Transportation Association (APTA), public transportation use in the United States reduces the nation’s carbon emissions by 37 million metric tons. If public transportation was absent in 2011, congestion costs would have risen by nearly $21 billion in the U.S. (APTA, 2015). For instance, consider the person capacity per lane equivalent of a public bus and a single occupancy vehicle (SOV). In the bus, 9,000 individuals could be transported over a 3.5 meter wide space in an urban environment during a one-hour period, while only 2,000 individuals could be transported via SOVs (see figure 1). Moreover, public transportation enhances property values, provides critical support during emergencies and disasters, provides access to all ages, and delivers essential health and human services (Litman, 2015). Although public transportation offers several benefits, one of the major drawbacks is connecting users from their place of origin to transit nodes, and then to desired destinations, also known as the ‘first and last mile’ (FLM) problem (see figure 2). Researchers have discovered the connecting ends of the...
FLM to be the weakest link of transit systems. These connecting ends can significantly influence an individual’s choice to use transit given the lengthy travel time and travel discomfort often associated with FLM (Krygsman, et al., 2004) (Rietveld, 2000). In the U.S., this problem is amplified due to sprawling land-use patterns that move more jobs and people to lower-density suburbs that are often not within walking distance to existing public transportation (Lesh, 2013). Consequently, a reliance on cars is strengthened, which results in more traffic congestion, pollution, and urban sprawl.

![Diagram showing the first and last mile of transit](image)

*Figure 2. Graphic showing the first and last mile of transit*

However, research highlights that the millennial generation, those born between 1982 and 2003, the largest generation in American history, is attracted to multimodal transportation options (APTA, 2013). A Google Scholar search suggests that there are few studies overall, and even fewer peer reviewed studies concerning millennials’ preference in using FLM connectors. By enhancing not only the quality and attributes of the main mode of transit, but also the influence of connectors, the appeal of using public transportation will likely increase.

1.2 Scope of Study and Organization

Students attending the University of Florida (UF) rely heavily on the Regional Transit System (RTS) to travel to and from school. However, accessing the transit nodes can be quite challenging. This research will explore the preferences of millennials on a college campus to connect to transit nodes. UF is striving to reduce the need for
additional parking spaces and limit vehicular emissions on campus to promote a more sustainable campus (University of Florida, 2016). In fact, a recent survey of undergraduate students in the U.S. concerning the most prevalent issues on college campuses identified that the lack of adequate parking is the seventh major concern among students (Student Monitor, 2014). Transit represents a viable option for reducing reliance on private vehicles for college students. However, the effectiveness of public transport as a mode depends largely on the connecting ends. Researchers studying the multimodal public transportation chain have generally found the connecting ends to be influential enough to encourage or discourage a person to ride transit. (Krygsman, et al., 2004) (Rietveld, 2000).

This study will focus on trip making during the morning and evening peak hours on a weekday. Students will be targeted to participate in a survey throughout UF’s campus. The primary reason for choosing the morning and evening hours is because these hours are typically associated with the highest travel volumes. Below is an outline of the logic model summarizing the study:
In the subsequent chapter, a literature review on the following will be provided:

- the FLM of public transportation and its importance in the public transport trip chain;
- services used to connect to transit; solutions to the FLM challenge; and a review of FLM initiatives throughout the United States. Research data and methodology will be covered in Chapter 3 and Chapter 4 highlights the results from the survey. Following
chapter 4, chapter 5 will discuss the implications and limitations of the results for future planning initiatives. Lastly, Chapter 6 will conclude the research with a critique and provide suggestions for future directions in the area of FLM research.

1.3 Objective
This paper examines millennials’ preferred methods to get to and from transit stations and bus stops in order to enhance the FLM. To do so, the following questions are asked:

- What are the established solutions to address the FLM issue?
- Which mode do millennials prefer using to connect to transit?
- Which features of bicycle, pedestrian, and station facilities are most important to millennial riders?

II. Literature Review
2.1 FLM and Its Importance in Transit
FLM in public transportation revolves around two main phases: access mode and egress mode. The access mode refers to connectivity between the origin (home-end) of a user’s journey and the transit node. The egress mode refers to connectivity between the transit node and the destination (trip-end) of a user’s journey (Tay, 2012) (see figure 2).

Research continues to emphasize that the convenience of a FLM trip depends on three key factors:

- Distance- length of travel between transit services and the origin and/or destination
• Modal Integration - the ease of pairing a transit trip with bicycling, driving, or a ridesharing service

• Network Quality - the physical conditions of biking and pedestrian infrastructure between the origin/destination and the transit facility

The distance variable is often quite clear cut; a transit agency should strive to have transit nodes as close to desired destinations and starting points as much as possible. However, addressing the modal integration and network quality can be a bit more complicated since transit users express varying preferences on ways to enhance modal integration and network quality.

### 2.2 Types of FLM Connections

Public transit agencies continue to recognize the challenge of addressing the FLM problem in order to maintain and increase ridership. Historically, transit riders focused mainly on using walking, bicycling, public and private shuttles, or private vehicles as means to connect to transit. In recent years, publicly operated Flex Bus services — on demand door to door bus service —, private rideshare companies such as Uber and Lyft, and private car rental companies such as Zip Car and Car2Go have expanded the options to address the FLM problem.

In general, walking is the most popular way people access transit. According to APTA’s 2007 Profile of Public Transportation Passengers, nearly 60% of transit users walk to and from transit. Notably, several studies assert that most transit riders have little to no problem walking approximately 0.25 miles to access transit or to get home (Advocacy Advance, 2014). However, if the infrastructure such as sidewalks, traffic mediums, and refuge islands are absent, the desire to walk declines. For potential riders
who do not live or work within close walking distance to transit services, the prospect of a long walk before or after their transit ride may be enough to deter transit use entirely (Lesh, 2013).

Along with walking, biking is another form of active transportation commonly used to reach transit. Commuters using cycling as a feeder mode to transit can be classified in one of two categories: bike and ride (B&R); or bike, park, and ride (B, P&R). B&R involves bringing the bike on the main mode of transit while B, P, & R entails parking bikes at a transit stops. Similar to walking, cycling is often used to connect to transit nodes that are in close proximity, about 1.24 - 3.10 miles (see table 1) (Martens, 2004).

Apart from the above-mentioned active transportation forms, commuters use personal vehicles to connect to transit nodes. This connection is often associated with park and ride facilities or the commuter being dropped off at a transit node, also known as ‘kiss and ride.’ Markedly, the ‘kiss and ride’ method of station access requires no parking spaces and since this is a motorized mode, the catchment area is much larger than the catchment area for non-motorized modes. The catchment area for ‘kiss and ride’ services range between 0.62 - 4.35 miles (see table 1) (Gil and Read, 2012).

In addition to using personal vehicles, shuttles and feeder buses serve as options to address the first and last mile issue. A great example of the success of a shuttle service is present in Oakland, California. Oakland’s Broadway shuttle, owned by the City of Oakland’s Community and Economic Development Agency, connects the Bay Area Rapid Transit (BART) with the Jack London Square, a popular entertainment and business destination. After the Broadway shuttle was introduced, authorities noted that
ridership was higher than expected and requested that the program be expanded (Gomez, 2010).

Table 1. Catchment area for transit based on mode choice

<table>
<thead>
<tr>
<th>Mode</th>
<th>Range (miles)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk</td>
<td>0.01 - .5 mile</td>
<td>(Guerra, Cervero, &amp; Tischler, 2011)</td>
</tr>
<tr>
<td>Cycle</td>
<td>1.24 - 3.10 miles</td>
<td>(Martens, 2004)</td>
</tr>
<tr>
<td>Public Transport (Feeder Buses)</td>
<td>1.24 -3.73 miles</td>
<td>(Gil &amp; Read, 2012)</td>
</tr>
<tr>
<td>Car (kiss and ride)</td>
<td>0.62 - 4.35 miles</td>
<td>(Gil &amp; Read, 2012)</td>
</tr>
</tbody>
</table>

On the other hand, private ridesharing companies such as Uber and Lyft, represent a novel option to addressing FLM issues. For instance, in Dallas, riders on the Dallas Area Rapid Transit (DART) system can now access Uber via the agency’s mobile ticketing application (app), a program intended to simplify connections at transit stations (Dallas Area Rapid Transit, 2015). The main idea is that Uber will act as a feeder option to and from transit stops. Apart from the Uber app being integrated within a transit agency’s app, transit agencies in Minneapolis and Los Angeles have signed deals with Uber to cover trip costs on Uber as part of their respective guaranteed ride home programs (Simes, 2016).

2.3 FLM Strategy Toolbox

As aforementioned, several forms of connectors exist that commuters rely on to connect to transit nodes. Each connector relies on various elements that improve the travel experience of end users. Generally, the elements used to improve FLM fall under
one of the following categories: pedestrian tools; bicycle tools; transportation demand management tools; transit access information tools; and auto access tools (Utah Transit Authority, 2015). Given that such a wide variety of tools are available, the question arises, which ones should receive priority? Julian Lauzan, a transit planner at the RTS asserts that the funding and the bureaucratic process required for implementing the improvement generally dictates which enhancement will be made. In fact, in many instances, the grants transit agencies apply for usually outline the scope of improvements that can be made. Other than costs and the required bureaucratic process, the typology of the area can be used to guide the prioritization improvements for transit connections as well (Utah Transit Authority, 2015). For instance, some transit nodes may be concentrated in downtown areas characterized by high densities and more pedestrian traffic.

### 2.4 FLM Initiatives Throughout the United States

Throughout the U.S., transit agencies are expanding efforts to increase the convenience for individuals to use transit. In fact, considering the volatility of gasoline, combined with the millennials’ desire to use multi-modal travel options and the Baby Boomers’ return to urban areas, the environment is quite conducive for growth in transit (APTA, 2016). In order to increase the attractiveness of transit, localities are focusing significantly on enacting FLM initiatives. The table and graphic (see table 2 and figure 4) below outline the latest initiatives taken by transit agencies in the U.S. to address FLM issues.
Table 2. The latest trends for addressing FLM issues

<table>
<thead>
<tr>
<th>Latest Trends for Addressing First/Last Mile Issues</th>
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<tbody>
<tr>
<td><strong>Pinellas Suncoast Authority (PSA)</strong></td>
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<tr>
<td><strong>The Regional Transportation District (RTD) in Colorado</strong></td>
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<tr>
<td><strong>TriMet in Portland</strong></td>
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<tr>
<td><strong>Maryland Transit Administration (MTA)</strong></td>
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<tr>
<td><strong>MARTA in Atlanta, Georgia</strong></td>
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</table>
Los Angeles County Metropolitan Transportation Authority (LA Metro) recently conducted an in-depth FLM study to identify the best ways to improve connections to transit. As a result of the study, LA Metro is increasing its focus on improving the following: crossing and connections (enhance existing crosswalks, mid-block and additional intersection crossings, raised crossings, cut-throughs and shortcuts, curb extensions at intersections, and scramble crossings); signage and wayfinding (metro signage & maps, medallion signage, time-to-station signage, real-time signage adjacent to station, & smart technologies); safety and comfort (street furniture, landscaping & shade, lighting, enhanced bus waiting areas, freeway underpass & overpass enhancements, traffic calming, sidewalk paving & surface enhancements); allocation of street-space (reduced lane width, enhanced bike facilities, bus enhancements, the “Green Zone”, signal modifications, sidewalk widening, rolling lane); and plug-in components (car share, neighborhood electric vehicles (NEVs), bike share & bike station, van pool & feeder bus, high visibility bicycle parking, electronic bicycle & pedestrian counters, kiss & ride, micro park-and-ride) (Los Angeles County Metropolitan Transportation Authority, 2013).

**Figure 4. A comparison of FLM strategies with peer transit agencies**

*Source: Utah Transit Authority*
Based on both the table and the graphic above, transportation agencies are evidently committing significant effort to enhancing pedestrian and bicycle facilities to address FLM challenges. Some agencies are also exploring partnerships with ridesharing companies such as Uber and Lyft as a means of attracting more ridership on transit. As ridesharing companies continue to evolve, transit agencies should seek opportunities to further enhance transit use.

III. Methodology

3.1 Overview of Research Design
In this chapter, the methodology used to conduct this research is described. The study design is cross-sectional and focused on studying and drawing inferences from the existing differences among the student population at UF. Moreover, it should be noted that data was collected at and concerning one point in time. The main tool used to collect data was a brief survey (see appendix). Both the findings of the literature on FLM and conversations with transit officials at the RTS in Gainesville, Florida were used to refine the issues to be explored. The survey is made up of 10 questions with five implicit sections: the first section focuses on the respondents’ usage of transit; the second section collects demographic information; the third section collects information on the respondents’ preference to connect to transit; the fourth section investigates the students’ opinion concerning the importance of bicycle, pedestrian, and transit station facilities; and the final section asks participants to identify any additional barriers of connecting to transit that were not highlighted in the questionnaire.

3.2 Study Population and Sampling
The study population consisted of millennial students attending the University of Florida. In this study, the millennial generation is defined as persons born in 1982 –
2003. In order to determine if a participant was classified as a millennial, the participant was asked to select the range that included their respective birth year. If the participant was not born in 1982 – 2003, the survey was destroyed. Students waiting at bus stops, exiting classes, and throughout the UF campus were randomly selected to participate in the survey.

3.3 Data Collection
A ten question survey was the only tool used to collect data from participants. The variables being examined include: the frequency of using public transit; preferred method to get to and from bus stations/stops; and preference for bicycle, pedestrian, and station facilities at or near transit nodes. The researcher printed the survey and issued it to participants to answer. A paper survey was issued instead of an online survey mainly because the researcher had no access to an email listserv for students. In addition, the researcher realized that having a paper survey would allow more participants to be surveyed in one sitting, in comparison to asking students one-by-one to answer the survey on a smart device such as a tablet. In total, eighty-five individuals agreed to participate in the survey over a two week period. Out of the eight-five, ten respondents were outside of the established classification for millennials and as a result, those ten surveys were destroyed (see figure 5).
3.2 Data Analysis
Each answer to a question was given a numerical value which allowed descriptive statistics to be gathered. The responses to the survey were entered in Microsoft Excel, and several pivot tables and charts were created to visualize the descriptive statistics.

IV. Results
After entering the data in Microsoft Excel and generating a pivot table, the researcher was able to gather the desired descriptive statistics. The results show that 77% of millennials attending UF prefer walking as the mode to connect to transit, while 13% prefer bicycling and 8% prefer using a private automobile. No respondent chose the options: shuttles (both private and public); publicly operated Flex Bus services; or private rideshare companies such as Uber and Lyft (see figure 6). In addition, noticeable variation existed in the respondents’ preference for connecting to transit based on the respondents’ frequency of using transit (see figure 7). Finally, most
participants valued pedestrian and transit facilities near transit nodes as either very important or important, while a few expressed neutrality or aversion to pedestrian and transit facilities (see figure 8 and 9). On the other hand, a striking amount of respondents disregarded bike facilities (see figure 10).

Figure 7. Most preferred method to get to and from transit nodes by respondents

Figure 6. Most preferred method to connect to transit nodes based on respondent’s frequency of riding transit
Figure 8. Importance of pedestrian facilities based on students’ responses

Figure 9. Importance of transit stop facilities based on students’ responses
Figure 9. Importance of bike facilities based on students’ responses

V. Discussion

5.1 Interpretation of Results and Implications

The results indicate that the majority of students attending UF prefer walking as the main mode to access transit. Considering that the FLM trip is substantially impacted primarily by distance, modal integration, and network quality, the question arises, which categories are influencing the students’ preference the most? By analyzing the location of the majority of student housing developments in relation to bus stops, it is evident that a relatively short distance exists between a student’s origin and a transit node.

Lauzan, the transit planner at RTS explained that most routes offered by RTS are created to cater to students for increased convenience. Consequently, walking to transit is likely more attractive for potential transit users. In terms of modal integration, RTS has instituted park and ride facilities and most buses are able to carry at most, two bikes on bike racks attached to the front of the bus. The limited capacity to carry bikes onboard buses may discourage the use of bikes to connect to transit. Also, the network
quality may further deter using bikes to connect with transit due to the lack of bike facilities such as bike paths, lanes, lockers, and stations.

Notably, none of the respondents of the survey chose the following connector options: shuttles (both public and private); publicly operated flex-bus Services; and private rideshare companies (Uber & Lyft). Once again, the present modal network may have influenced the correspondents’ choice for not choosing shuttles (both public and private) and publicly operated flex-bus services as connectors to transit. The culture of using ridesharing along with the close distance between one’s origin and the transit node are likely factors that influenced the students’ disfavor for using Uber to connect to transit. According to a student attending UF who wanted to maintain anonymity, “Uber is for weekend fun; and whenever you are too drunk to drive home.”

Along with selecting a preference for a mode to connect to transit, respondents were asked to rate the importance of bike, pedestrian, and transit facilities. The participants’ appreciation for pedestrian facilities supports their preference to walking as the main mode to connect to public transportation. Street lighting for pedestrians and improved crosswalks garnered the larger support as most important, while respondents were notably neutral to pedestrian specific signage and landscape improvements. Markedly, the easy access to real time information via smart phones may be meeting the purpose of printed wayfinding and signage. For instance, by providing the schedules and bus stop coordinates to Google, RTS gives transit riders the option to use Google Maps for directions to nearby bus stops and to obtain the expected arrival and departure time. However, the high level of neutrality and the evident disregard towards
bike facilities raises several questions. Bike facilities received the highest percentage of ratings as less important or not important.

This data suggest that in order to enhance the FLM experience for millennials attending UF, priority should be directed to maintaining and enhancing pedestrian facilities. However, transit and bicycle facilities should not be overlooked. The data also indicate that 20% of respondents who never used transit would prefer biking to transit nodes and another 20% would prefer using a private vehicle to connect to transit; these respondents represent a segment of potential transit riders (see figure 7).

5.2 Limitations
One possible limitation may have been that respondents were not familiar with certain terms used on the survey sheet. For instance, students may not have known what are Flexbus services or bike lockers. In addition, the survey did not allow the strength of preference for each stated connector type to be measured. Also, three campus bus routes, route 46, 17, and 16 were not identified as routes taken by any of the respondents who completed the questionnaire. As a result, the overall perceptions of student transit riders may have been discounted. Finally, participants who answered the survey in a group setting may have been influenced by others in close proximity.

VI. Conclusion
This paper has analyzed millennials’ preferred means to connect to transit nodes by surveying students attending UF. Based on the results of the survey, priority should be given to maintaining and enhancing pedestrian facilities to improve the FLM experience. Further studies should be pursued to examine why millennials at UF consider biking facilities as unimportant; moreover, research should be conducted at the micro-level to examine the strategies best suited for each bus route. Finally, when
selecting strategies to improve the FLM, it is important to consider context and tailor the network to the preference of the users.

VII. Appendix

Questionnaire Used to Survey Students

Preferred Methods for Riders to Get to and from Transit Stations

This study focuses on the preferred methods for millennial riders to get to and from transit stations. The purpose of the study is to enhance the convenience of using transit specifically for college students. Participating in this survey is completely voluntary. At any time, you can opt to not answer a question. The questionnaire will take about 2 – 3 minutes. All of the responses will be confidential.

1) Select how frequently do you ride public transit?
   1. Daily
   2. A few times a week
   3. A few times a month
   4. A few times a year
   5. Never
   6. Other

2) Did you ride transit today?
   1. Yes
   2. No

3) If yes, what bus route(s) did you take to get to school?

4) Circle when were you born?
   1. Before 1982
   2. 1982 – 2003
   3. After 2003

5) Select your gender?
   1. Male
   2. Female
   3. Prefer not to specify

6) Circle your most preferred method to get to and from bus stations or bus stops (Choose one)?
   1. Walking
2. Bicycling
3. Private automobile
4. Shuttles, both public and private
5. Publicly operated Flex Bus services
6. Private rideshare companies, such as Uber and Lyft

7) Please tick how important these features of bicycle facilities at or near transit stops and onboard buses are to you.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Very Important</th>
<th>Important</th>
<th>Neutral</th>
<th>Less Important</th>
<th>Not Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bike paths (separated trail)</td>
<td></td>
<td></td>
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<tr>
<td>Bike sharing (the ability to pick up a bicycle at any self-service bike-station and return it to any other bike station located within the system’s service area)</td>
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<tr>
<td>Bike racks/lockers</td>
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<td></td>
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<td></td>
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<tr>
<td>Onboard Bike racks (on bus)</td>
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</table>

8) Please tick how important these features of pedestrian facilities at or near transit stops are to you.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Very Important</th>
<th>Important</th>
<th>Neutral</th>
<th>Less Important</th>
<th>Not Important</th>
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</thead>
<tbody>
<tr>
<td>Improved Crosswalks (i.e. raised crosswalks, marked crosswalks, etc.)</td>
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<tr>
<td>Pedestrian specific signage (i.e. fixed maps, schedules, and instructions or brochures)</td>
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<td>Street lighting for pedestrians</td>
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<tr>
<td>Landscape improvements along sidewalks (i.e. provide street trees, shrubs, etc.)</td>
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</tbody>
</table>
9) Please tick how important these features of station facilities at transit stops are to you.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Very Important</th>
<th>Important</th>
<th>Neutral</th>
<th>Less Important</th>
<th>Not Important</th>
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<tbody>
<tr>
<td>Lighting</td>
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<tr>
<td>Improved passenger waiting areas (i.e. covered shelters, real-time bus/train information, trash cans etc.)</td>
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<tr>
<td>Wayfinding and signage (i.e., information about transit routes, availability of services, etc.)</td>
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</table>

10) What other barriers (getting to and from bus stops and transfer stations) are not identified?
References


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