



Assessing Student Concern with Public Transportation at The International University of Rabat

Noah Cook, Grace Cummings, Travis McGregor, and Katherine Morissette

Assessing Student Concern with Public Transportation at the International University of Rabat

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Noah Cook
Grace Cummings
Travis McGregor
Katherine Morissette

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Report Submitted to:

Professor Mounia Malki
International University of Rabat

Professor Mustapha Oudani
International University of Rabat

Professors Karen Oates and Ken Stafford
Worcester Polytechnic Institute

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Abstract

The remote location of the International University of Rabat in Morocco creates unique transportation challenges for students commuting to and from campus. Our team utilized the student population at this university to collect data and document the leading difficulties students face with the current transportation options. We then explored potential solutions that precisely target each of these difficulties. Extensive analysis of interviews and school-wide surveys led to a series of recommendations that, while maintaining simplicity of implementation, will significantly increase the affordability, accessibility, efficiency, and safety aspects of a student's commute to and from this university.

Acknowledgements

Our team would like to start by thanking our sponsors Professor Mounia Malki and Professor Mustapha Oudani of The International University of Rabat. Professor Mouina Malki mentored us and provided us with the necessary resources to create a successful project. She also offered meaningful support and encouragement throughout the entirety of our project. Professor Mustapha Oudani provided us with valuable information and insight in crafting our survey.

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Next, we would like to thank our advisors Professor Karen Oates and Professor Ken Stafford from Worcester Polytechnic Institute. Their countless hours dedicated to editing our paper, giving feedback on our presentations, and their general guidance helped refine our project, bringing it to its greatest potential. We would also like to mention our ID2050 Professor John-Michael Davis. His class helped redefine our project and find a new understanding of social science. We are thankful for his compassion and irreplaceable support through our project proposal. Additionally, we appreciate all the help and support from Professor Mohammed El Hamzaoui and Professor Rebecca Moody.

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Executive Summary

In 1968, the population in Rabat, Morocco had nearly tripled in size since 1950. At a growth rate of 7.81%, the rapid urbanization affecting this city created a demand for improved systems amidst the growing population (Rabat Population, 2022). Although the current population growth isn't nearly as high as it was in the past, the region is still recovering from the effects of the 20th century. Urban sprawl has continued to present a challenge for public transportation to fulfill the needs of people residing at all locations throughout the city. Those who would benefit most from public transportation options often live in areas with low transportation coverage. Through in-depth research on the topic, the problems associated with the current transportation system in Rabat can be categorized into affordability, accessibility, efficiency, and safety concerns. Throughout Rabat, people are currently being affected by transport poverty which is essentially a lack of access to adequate transportation. Looking deeper into the demographics of public transportation use, we can also determine how different groups are being affected by this transport poverty framework. For example, the effects of public transportation issues on a student scale is going to vary among the general population. Since the available information on student transport use is a lot less documented, we thought this group would be an appropriate subject for our research. With the assistance of our sponsor Dr. Mounia Malki, a professor at the International University of Rabat (UIR), we were able to easily access the student population for our data collection.

Objectives and Development of Methodology

The goal of this project is to improve the accessibility of transit and the overall transportation experience for students at the International University of Rabat. This could only be achieved by first identifying areas of improvement among the transportation options for students at UIR. This ultimately led to recommendations that we offered to the university for future systemic improvements of the UIR provided bus system as well as additional suggestions based on other findings from our collected data. Our methodology was developed from the following objectives:

1. Obtain an understanding of the current transportation usage and the options that are available to students at the International University of Rabat
2. Analyze and classify the pressing issues with transportation experienced by UIR students

3. Determine solutions to address articulated challenges and present them to students for evaluation and feedback

With a six-week timeline for gathering data, a combination of interviews, surveys, and a focus group provided the evidence to support our final recommendations. The exploratory interviews were completed in two separate group settings with a total of five students. These interviews helped to familiarize us with the public transportation system and establish a framework for our future methods. To analyze the issues affecting students on a larger scale, we developed a survey that would reach a large sample size to better encompass the overall opinions on public transportation. The survey helped us determine trends in the responses based on gender, on or off-campus residency, and car ownership. Additional survey questions presented the user with statements that they were able to agree or disagree with based on their preferred mode of transportation. To complete our methodology, a focus group was conducted with seven students to present our findings and suggested recommendations for feedback. We prompted the group with general problem statements that we used in our survey to gather their opinions on public transportation in general and elicited what they thought would be the most effective improvements.

Findings

Through the evaluation of interviews, survey data, and focus group discussion, we developed the following findings regarding the public transportation options for students at UIR.

- 1. The quality of service provided by the UIR Bus system has significantly degraded since implementation.** The exploratory interviews raised awareness of the past operation of the UIR Bus and described the decrease in quality of service over the past years. Survey responses confirmed the notion that the UIR Bus is not providing the necessary services that the students require.
- 2. Taxis are an expensive transportation option for students, and rideshare services offer a cheaper alternative.** Grand taxis and rideshares services were the second and third most utilized modes of public transportation according to our survey results. Despite the high amount of taxi usage, additional survey data suggests that cost is a concern among students. Rideshare services

had many positive responses to questions about accessibility and efficiency, plus they tend to generally cost less than taxis.

3. The public bus is an inaccessible, inefficient, and unsafe mode of transportation.

According to our survey data, aside from affordability, public bus users found issues with every other aspect of this mode of transportation. During interviews, students expressed concern about the safety and comfortability of the public bus, especially for women. Survey data confirmed additional background research that the public bus is inefficient and inaccessible.

4. The UIR bus is overwhelmingly the safest form of public transportation. Participants of our survey who take the UIR Bus agree that it is generally a safe transportation option.

Compared to other modes of transportation, people who take the UIR Bus also experience fewer events that make them feel scared or uncomfortable.

5. The rate of private vehicle usage is high among the student population. According to survey data, a large percentage of students indicated private vehicles were their primary form of transportation. The data suggests that students would like to be able to utilize public transportation, like the UIR Bus, but avoid these systems due to the numerous challenges they present.

Final Recommendations

Based on our findings, we have developed a list of recommendations regarding the improvement of the UIR provided bus along with other suggestions that we believe will better the overall UIR student transportation experience.

1. Provide more information on the UIR Bus. According to our survey, the single biggest issue with the UIR Bus was the inaccessibility to the schedule. We recommend that UIR adopt a single method for providing this information on their website that is both easy to access and understand.

2. Increase UIR Bus frequency and run buses later. According to our interview, survey, and focus group findings, many students found an issue with the limited times that the UIR Bus ran throughout the day. Our recommendation is for UIR to increase the number of times the bus travels to and from the campus each day and to run the bus later into the night for additional use.

3. Increase the number of UIR Bus Stops. A majority of survey participants wanted to see an increase in the amount of UIR Bus stops. Our recommendation is that UIR conducts a poll to determine which regions are most populated with UIR students and create more bus stops or adjust the current stops.

4. Create a single-use ticket for the UIR Bus. Currently, the UIR Bus only offers a monthly and yearly bus pass for students. Introducing a single-use ticket would allow the convenience and safety of the UIR Bus to be available to all students living on or off-campus.

5. Promote the Current Carpool Application. We discovered that one of our initial recommendations to create a carpooling application had already been developed by students at the university. We suggest the school share this app with more students and make them aware that it is available.

6. Provide more information on the Public Bus. Many students indicated that the Public Bus was inaccessible, and it was hard to find information on the routes and schedules. Our recommendation is that UIR provides this information for its students and have it easily accessible online or at the university.

If successfully implemented, we feel that these recommendations will greatly improve the student transportation experience to and from UIR. With the rapidly evolving nature of the Rabat-Salé region's transportation ecosystem, it is imperative that these recommendations be implemented at the soonest opportunity. As Technopolis grows and develops its infrastructure, UIR has the ability to play a key role in improving student transportation in the region, and further integrate itself into the community.

Authorship Table

	Author(s)	Editor(s)
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Chapter 1: Introduction

Within the last century, Morocco has experienced a rapid increase in migration to its major cities which has put pressure on the public transport systems. At the height of urbanization in the mid-20th century, Morocco's capital had a population growth rate of 7.81% (Rabat Population, 2022). Considering that the average growth rate of cities globally was typically between 1 and 3% over that same time period, Morocco's rapid increase introduced problems for their growing population (Bettencourt, 2020). In a 2012 study on urbanization and its effects on national transport, Poumanyvong found that there is typically a positive relationship between a population's growth and its transportation system. However, this statement is only true for areas that have developed a sustainable growth plan. Due to the lack of government response in efficiently expanding public transportation, Morocco's major cities have been unable to meet the growing demand for transportation.

A poll from the Institute for Opinion Polls and Market Research Averty in 2013 revealed that 72% of the surveyed residents in the Rabat-Salé region view the current transportation system as unsatisfactory. However, this poll did not establish a metric for defining 'unsatisfactory' transportation. While there has been some research into operational inefficiency in Rabat's public transportation network (El Goumi et al., 2016), little work has been conducted investigating the human factors that create accessibility and mobility issues in greater Rabat. As our team analyzes the prevalent issues within the current public transportation system, we have focused our studies on the issues faced by students at the International University of Rabat (UIR). Students are the primary demographic for this study for several reasons. Transportation systems tend to be designed with the commuting worker in mind and students exhibit transit usage patterns that do not always overlap with workers, making them a particularly underserved demographic (Fitzpatrick et al., 1990). Additionally, students have lower car ownership rates and regularly rely on public transportation, so they tend to have a clear perception of what issues are most prominent and how a transportation system operates. Previous work has documented complaints from university students regarding bus networks in the Madinat al Irfane neighborhood of Rabat, located at the end of the L1 tram line south of the Agdal neighborhood (Dodani et al., 2018). This research, however, was not generalized to all colleges in the Rabat

region, which are located in varying urban environments. The purpose of this research is to investigate the issues UIR students face regarding affordability, accessibility, efficiency, and safety with their various forms of public transportation and propose potential solutions to these difficulties. These potential solutions could improve student access to UIR's campus, hopefully growing participation in on-campus events and improving student performance. As well, more efficient student transportation would reduce the environmental burden of UIR's transportation efforts, making the university even more sustainable.

Chapter 2: Background

A robust transportation system is closely tied to the socio-economic well-being of a society and the livability of a city (Lucas et al., 2016). Lower-income populations tend to live on the periphery of cities where transportation options require longer commutes (Titheridge et al., 2014). This is in line with how cities are often developed, with the transportation system coming as a reactionary measure to urban sprawl. Flawed systems force lower-income individuals to work further away from where they live and spend more time commuting than wealthier demographics.

This chapter first examines the general qualities of good transportation system design. Then we investigate how public transportation affects individual well-being, as well as provide an overview of metrics to evaluate these systems. Next, we explore and highlight some of the overarching problems of the Moroccan public transportation system. We review various types of Moroccan transportation and how they are used. Lastly, we review general university students' experiences with transportation and discuss how this relates to UIR students.

2.1 What Defines ‘Good’ Public Transportation?

Car ownership rates in urban areas are only around 40 percent, so most people living in cities rely on public transportation for access to employment, shops, and other essential services. Therefore, the quality of public transportation is closely tied to individual economic well-being, which is the ability of a person to successfully demand goods and services from an economy (White, 2016; additional citation). Residents' daily commutes and employment status often depend on transport being available close to them, having an appropriate frequency to accommodate them at busy rush hours, and consistently operating on time (Lucas et al., 2016). Because of this, social equity is a major concern in the design of transport systems. This section focuses on the analysis of bus systems, as they typically offer a wider, lower-density spatial coverage and have cheaper fares than urban rail systems making them a critical factor in ensuring equity and justice in the relationship between income level and accessibility of transit (Nazari Adli et al., 2019).

Initially, transportation design theory encouraged the development of systems that meet the needs of as many travelers as possible, but this ignores how reliance on public transport varies among different demographics (deGrassi, 2009; Abenoza et al., 2017). Lucas et al. (2016) identifies a shift in the transportation industry in the past three decades to a focus on transportation poverty and social justice. Social justice places a particular focus on the distribution of wealth and privilege within society. A conceptual framework was developed around the basis that the poorest people in a society tend to be the least mobile and most reliant on public transportation. Public transportation design, in practice, rarely focuses on meeting the needs of the most transport-disadvantaged people, creating a significant accessibility issue (Titheridge et al., 2014). According to Lucas et al. (2016), the goal of modern public transportation design is therefore to provide transportation options in a city that:

1. Are efficient, minimizing the effort of a public transport trip compared to the equivalent private vehicle trip.
2. Are accessible to as wide of a user base as possible, with a focus on improving accessibility to areas with low car ownership levels.
3. Provide necessary mobility to both daily and sporadic socio-economic activities (i.e. work, school, stores, medical services, etc.).
4. Provide all the above at a cost that is comparable to or lower than private transportation, so as to reduce car dependency.

This transport poverty framework considers the above factors and aims to design public transportation that suits the needs of people most affected by lack of efficiency, accessibility, and affordability.

2.1.1 Efficiency Analysis of Public Transportation

Efficiency design and analysis of a bus system from a transport poverty perspective is mostly unchanged from traditional approaches that, as mentioned earlier, do not consider the needs of as many demographics as more modern approaches do. The transport poverty framework considers how efficiently a network is designed as well as how functional systems operate under real-world conditions. These two concepts are referred to as structural efficiency

and operational efficiency, respectively. From a design perspective, there are a few key metrics to consider. These include providing travel routes that are comparable to private vehicle travel distance, providing service within adequate range of passenger origin and destination, and designing route frequency such that bus travel availability fits traveler’s schedules (White, 2016). To do this, bus route design combines temporal and spatial analysis techniques. Spatial factors differ depending on the density of the area and are summarized in Table 1.

Design Criteria	For High Density Urban Areas (>4000 people/mi²)	For Low Density Urban Areas (2000-4000 people/mi²)
Bus Stop Spacing	Less than 1/8 mile apart	Less than 1/4 mile apart
Ideal Service Coverage	90% of people within 1/4 mile of a bus stop	50-75% of people within 1/2 mile of a bus stop
Distance Between Bus Routes	Around 1/2 mile apart	Around 1 mile apart
Deviation from direct path	Less than 20%	Less than 20%

Table 1: Common Spatial Design Criteria for Urban Bus Transport (Fitzpatrick et al., 1990)

The parameters are shown in table 2.1.1 inform analysis of physical transportation design and describe how transportation systems should be laid out in a city. When bus routes are designed to these criteria, it ensures that all people living in the urban area can access the transportation system. This improved accessibility allows more people to ride public transportation and reduces car usage rates. The ultimate effects of this include reduced traffic congestion as well as decreased fuel emissions (Lucas et al., 2016).

For designing temporal parameters, urban planners anticipate the passenger demand for each bus route and how it varies over time. To account for this, the time between buses on a

given route is increased or decreased throughout the day. This time is commonly referred to as the route's 'headway' (Transportation Research Board, 2013). Consensus in the transportation field is that the ideal route headway should be variable dependent upon the number of people utilizing that route. For moderate volume routes, headway should be between 5-10 minutes at peak hours, and between 2-5 minutes for higher volume rates. No matter how low passenger volume is, headway should never exceed 30 minutes as longer wait times result in people tending to not use public transit (Transportation Research Board, 2013). Once bus headways decrease below 10 minutes, riders typically no longer need to schedule their travel based on the availability of transportation as the maximum possible wait time no longer impacts their travel time significantly (White, 2016).

Transport networks are inherently large, complicated systems, and a consistent system of measurement and analysis is necessary to manage their operation. One approach to this is the '6M method,' which divides complex systems into the following categories: Materials, Mother Nature, Machine, Manpower, Method, and Measurement (Kawtar & Fouad, 2018). Applying this to transportation systems, any bus network could be deconstructed, and its components classified into the 6M categories. Cause and effect analysis could then be conducted on each constituent group to better identify the source of any system-wide inefficiency. The use of this type of analysis allows transportation companies to ensure that their transport system operates as efficiently as they were designed to.

2.1.2 Accessibility and Social Equity in Transportation Design

Transport system efficiency is closely related to the concepts of accessibility and mobility, which will be examined as parallel issues connected under the common consideration of social equity. In this context, mobility refers to the availability of transportation options to people, and accessibility as an extension of mobility that also considers ease of access to the locations and services needed for an individual to participate in society (Preston & Raje, 2007). Rapid population growth and development of cities have seen poorer populations moving further from the city center to peripheral communities. Traditional urban planning connects these communities to the larger city via large highways and arterial roads. These infrastructure investments rarely benefit the poorer population who lack access to private vehicles to use the

road network (Starkey & Hine, 2014). With commercial activity focused on the city center, these city peripheries tend to be overwhelmingly residential and do not provide sufficient employment opportunities for their population. Lack of employment potential isolates poor individuals in these communities and severely limits their access to basic services and the goods necessary for survival (Harvey, 2003). Economic isolation then creates a destructive cycle where decreased transportation options cause lower household earnings and decreased mobility. The remaining transportation options are more expensive and less accessible, which decreases mobility and potential earnings further.

Accessibility design also considers that different demographics of people use transportation for different reasons. One of the most important factors to consider is the gender difference. On average, women are more likely to lack access to private vehicles or may not be the primary driver in their household. Because women have lower vehicle access rates but still need to travel to reach places of employment and services, they make more bus trips on average than men (White, 2016). This reflects common societal gender roles, and transport design must accommodate this. Age is another key factor: younger students tend to return home from school at an earlier time than working adults, while their morning commutes experience a larger overlap (White, 2016). Demographic differences in transit usage patterns create a significant impact on temporal design and route frequency, as bus routes should vary capacity over the day to meet this time-variant passenger demand.

Measuring transportation accessibility is a difficult task, as it involves many qualitative aspects that vary over the space of an entire city. Analysis methods have been proposed, but the individual metrics chosen depend heavily on local socio-economic and cultural context (Abley, 2010). These methodologies typically involve spatial analysis of an individual city using geographic information system software to evaluate metrics such as population density, land zoning, and land use patterns. Mobility is the more concrete and simpler concept to measure, and common metrics include the number, average distance, and duration of trips a person takes over a defined period (Lucas et al., 2016). The accessibility component of a transit system encompasses many aspects and dimensions, so to analyze accessibility it is necessary to use several different types of measurements. A way of quantifying travel difficulty is the most important metric and is typically covered by the mobility metrics outlined above. Recent

literature has discouraged metric-heavy analysis and encouraged local community discussion and holistic analysis. This fully captures the nuances associated with accessibility problems in unique locations (Booth et al., 2000; Freeman, 2009). In order to accurately capture the geographic, demographic, and cultural intricacies of accessibility, Booth et al. and Freeman both agree that discussion with community residents and officials is critical. Community discussion is an overlooked way to effectively gauge the level of accessibility provided by public transport. This approach highlights the complex human factors intertwined with transportation poverty, and the results it produces when used in conjunction with quantitative data can produce higher quality solutions that more precisely target accessibility concerns specific to each community.

2.1.3. Affordability Considerations for Public Transportation

Public transportation is typically subsidized with government funding, so the cost to use public transport is not always directly associated with the cost of operating the transport itself (Gwilliam, 2002). Because the primary policy tool available to lawmakers is subsidization, affordability has long been the classical measurement of choice in identifying transportation poverty (Lucas et al., 2016). Affordability simply concerns the portion of a person's budget devoted to transportation costs and is usually measured via the percentage of an individual's or household's budget spent on transportation costs. Transport poverty in the classical sense, as opposed to more modern approaches, occurs when greater than 10% of a monthly budget is spent on transportation costs. On average, commuting college students in the United States spend 18% of their monthly budget on transportation, making them a transport-poor group (Price & Curtis, 2018). Measuring monthly budget alone, however, does not consider the phenomenon of transport suppression, where individuals avoid travel due to high costs and instead spend their income on more essential services or goods (Lucas et al., 2016). Social factors such as these significantly reduce the importance of measuring transportation affordability in isolation. Although the metrics used in the affordability analysis of public transportation remain largely unchanged, they are now used as one pillar of the larger analysis of transport poverty as a whole. Current research is more focused on the interconnection of affordability and accessibility than affordability by itself (Booth et al., 2000).

2.2 Urbanization and Transportation in Morocco

As migration from rural to urban areas continues to rise, the success of Morocco's major cities depends on the growth of its public systems alongside the population increase.

Poumanyong (2012) studied the effects of urbanization on national transport based on incomes, population size, and GDP and demonstrated that there is a positive correlation between the growth of the population and the coverage of the public transportation system in well-planned communities. Rabat has not adapted its systems to adequately address the effects of previous rapid urbanization as Poumanyong describes. The area lacks a mode of transportation that is both accessible and efficient while maintaining affordability.

Rapid urbanization began in Morocco in the early 1920s, and the population continued to grow substantially after World War II. As Morocco's capital city, Rabat accepted a large portion of the migratory population that moved to major cities in the 20th century (Saadaoui, 2019). Rabat's population in the 1950s stood around 150,000 with a growth rate of 4.83% which continued to rise to about 7.81% in the 1960s (Rabat Population 2022, n.d.). This rapid urbanization from the previous century continues to affect Moroccan public transit systems and its people.

Within the Rabat-Salé region, there are numerous forms of transportation for people to utilize. One of the newer investments in public transport, being implemented in 2011, is the Rabat-Salé Tramway (Karim & Fouad, 2021). In addition to the tramway, there is a well-established taxi system operating within Rabat. Light blue vehicles are known as petit taxis, supplemented with the white grand taxi, their larger counterpart. While the petit taxi system is designed to take passengers short distances within city or town limits, the grand taxis work on a larger scale, moving people further distances or between those cities and towns. Larger buses also operate within Rabat, but the operational inefficiency causes them to be less consistent and reliable than the tram or taxis. The tram costs only about 6 MAD to ride from one end of a line to another and has wait times of under five minutes, making it both an affordable and efficient option (El Goumi et al., 2016). The flat rate for buses in Rabat is only 4 MAD (El Goumi et al., 2016), but as mentioned earlier, the buses operate on a sporadic and unreliable basis. This often makes them less convenient than the tramway unless one's destination is far from either of the

two tram lines. A map of the tram network is provided in Figure 2.2. The location of the International University of Rabat is represented in the image by a red star while the current tram lines are shown by the blue and green lines. The red lines represent future expansion to the tram network.

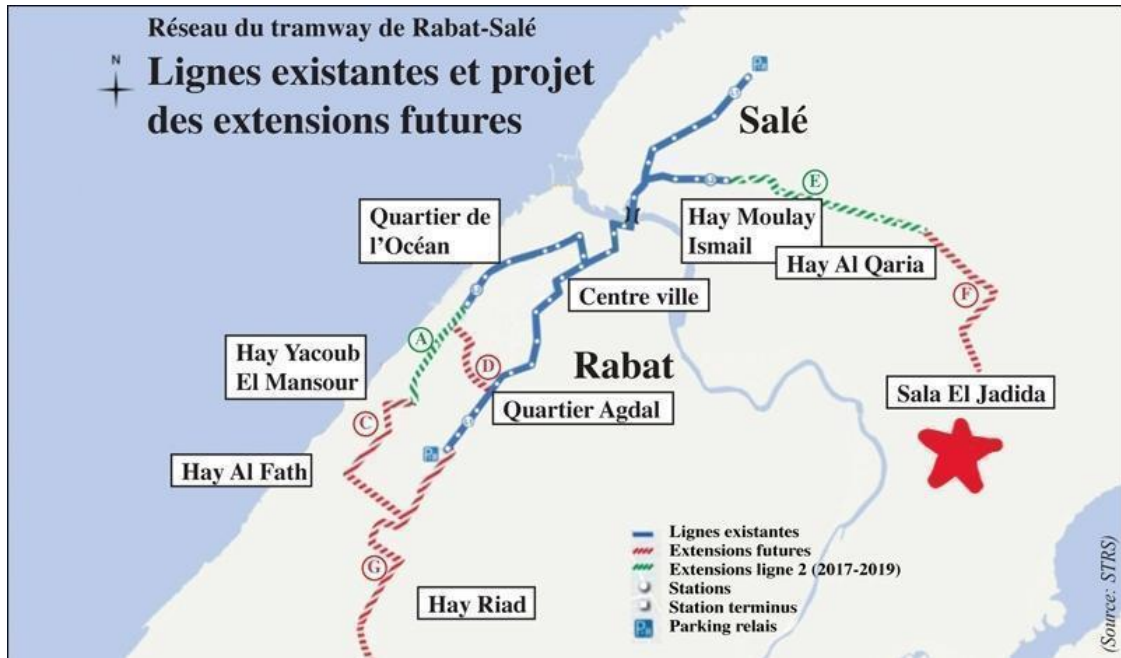


Figure 1: A Map of the Tram Lines in Relation to UIR (RABAT-SALÉ, 2019)

Most of the tram’s operation is far from the university, so it is understandable why students must rely on other forms of public transportation to travel to and from school. Extensions to the tram lines that would bring it closer to UIR have been proposed, but these extensions have been repeatedly delayed and construction has not begun at the time of writing. These additions would extend the tram line to Sala Al Jadida, which is located across the highway from Technopolis and the UIR campus.

Although the ability to hail a taxi from almost anywhere in the city and take it to almost anywhere else within the city certainly makes it one of the more convenient options, it is also significantly more expensive. Taking a petit taxi along the same route followed by the tram would cost upwards of 70 MAD while the tram itself would be only 6 MAD. Personal vehicles

also exist within Rabat, but according to a study done in 2013 by The Institute for Opinion Polls and Market Research Averty, only 31% of Moroccans commute using their own vehicles.

Additionally, two private rideshare services exist in Rabat, Careem, and Heetch, which function similarly to taxis and have similar costs (Hajar & Abdelghani, 2017). These rideshare services allow riders to be picked up and dropped off at pre-selected locations. Because these services function very similarly to taxis, we will hereafter refer to both systems as ‘taxis’ for simplicity.

2.3 Problems with the Public Transportation System in Morocco

Besides adjusting to urbanization, there are additional elements that go into the success of the transportation infrastructure. As mentioned above, the “6M” method can be utilized to distinguish different aspects of the transportation system based on six major categories. Classifying each component of public transportation allows for a visual representation of the major issues. Kawtar and Fouad (2018) used this approach to consider the large and small-scale problems that have impacted the public transportation network in Morocco. The collection of issues they discovered confirms the need for reform of this system.

In addition to the problems that affect the majority of the population, there are issues within the transport system that are specific to certain demographics. Cultural factors and societal norms influence the way women are treated in Morocco. The lack of an updated and organized transportation system contributes to the discrimination that women continue to experience in their communities (Saadaoui, 2019). Safety is a major concern among women in Morocco and the current public transportation does not provide a safe environment (Saadaoui, 2019). Women often choose to walk to avoid the cramped spaces and possible harassment they may face on public transportation. In 2020, the employment rate of women was 16.7% while the men were around 62.9% (Saleh, 2022). While the majority of men are using transportation to get to and from work each day, women who stay at home rely on the public transport system to run errands and make trips. Womens’ frequent stops make it difficult for them to take public transportation due to the unreliability of the bus schedules (Saadaoui, 2019).

In addition to the struggles faced by women, other minorities find that they have similar challenges with the public transportation system. Members of the community with a disability find that the transport system offers little accessibility for them. For people with physical disabilities, buses fail to provide a way to board the vehicle nor offer adequate space on the bus (Zahidi & Wardi, 2016). In the article by Zahidi and Wardi, an interview was conducted with a handicapped man who explained that it is difficult to catch a taxi because they are either not big enough to carry his wheelchair in the trunk or don't want to deal with the effort of his disability. The interviewee goes on to explain that although he prefers taking the bus, he must wait for one that has enough space. Even after a bus with sufficient space arrives, he still faces a lengthy process to get on, often making him late.

Although the Rabat-Salé region does provide other transportation options in addition to taxis and buses, systems like the tram do not reach more local areas and cannot be utilized as often. The next two sections describe specific issues within the bus and taxi systems in the Rabat-Salé area.

2.3.1 Concerns with the Bus System

Ideally, bus systems provide accessible and convenient travel for the public. When the population growth rate of Rabat hit a high of 7.81% in the late 1960s, the promises of this reliable and efficient transportation system were not met (Rabat Population 2022, 2022). A primary cause of these issues was and continues to be disorganization. Bus stations have timetables that aren't always updated or easy to find, and buses do not always follow the posted schedules. When the buses do arrive, a seat is not guaranteed, and passengers must choose between waiting for the next bus or forcing themselves onto an already cramped one (Karim & Fouad, 2019).

One reason the buses may be so inconsistent is due to the large spatial coverage of their network. As the number of passengers increases and they expand further outwards from the city center, the bus system fails to improve with it. A study analyzed the efficiency of six bus companies in 2013, one from each major city in Morocco; results found four of the six buses inefficient, and it was found that all the companies had significant areas for improvement (Karim & Fouad, 2019). Efficiency scores were calculated based on the Data Envelopment Analysis

(DEA) method using decision-making units (DMUs). The researchers considered inputs including capital, labor, and energy with respect to the size of the company and area of operation (Karim & Fouad, 2019). In Figure 2.3.1, the resulting efficiency scores of each major city’s bus company is given.

Cities	Score	Peers
Agadir	0.851	Casablanca; Marrakech
Casablanca	1	Casablanca
Fez	0.782	Marrakech; Casablanca
Marrakech	1	Marrakech
Rabat-Salé	0.877	Casablanca
Tangier	0.83	Marrakech; Casablanca
Mean	0.89	

Figure 2: Resulting Efficiency Scores of a 2013 Study on Moroccan Buses (Karim & Fouad, 2019)

Although they are not among the lowest-scoring companies, Rabat-Salé’s efficiency score is not high compared to cities of similar population count, like Casablanca and Marrakech.

In the Rabat-Salé region, the bus systems lack monitoring and resources to acknowledge their major issues. Moroccan transportation policy was reformed in 2006 when legislation passed that allowed for the privatization of bus companies. This created several disparate bus companies operating in each city, causing significant transportation difficulty in connecting between companies. More recent reform in 2019 has contracted all bus services in Rabat under one company, but little publicly available information about service offerings exists (Karim & Fouad, 2019). The ineffective pushes for reform over the past decades highlight the need for sustainable changes that can be well-maintained into the future.

2.3.2 Concerns with the Taxi System

Many Moroccans prefer taking the taxis to avoid the cramped and poorly scheduled buses. As taxis are the only other feasible transportation option for transportation through smaller local areas, it forces people to deal with the problems within this system. Similar to the bus systems, the taxis are organized in a way that lacks a straightforward method for someone who

doesn't regularly utilize them. Although timetables do not apply to taxis, grand taxis typically do not depart until they are filled, unless one wishes to pay extra, and petite taxis will stop during the ride to pick up new passengers. In both cases, extending the passenger's travel time (Benaicha, 2017).

Taxi drivers also contribute to some of the observed problems in the taxi system. Taxi drivers work long, unpredictable hours and struggle under a fragile management system. Drivers endure pressure to get people to their destination as quickly as possible in order to ensure customer satisfaction. In a 2018 study researching prevalent substance abuse among taxi drivers in Morocco, 49.7% of drivers were found to have at least one toxic habit regarding tobacco, marijuana, or alcohol (Laraqui et al., 2018). Though this may not be true for all taxi drivers, it does contribute to the lack of safety people experience when they take taxis.

2.4 Transportation Issues Relevant to University Campuses

Research pertaining to the overall issues with public transportation is extensive, but less is known about specific issues with university student-oriented public transportation. This section discusses the overarching concerns of various higher education students' experiences with their respective university-established public transportation. Adequate transportation is imperative to a university student's experience. In addition to traveling to and from school, students use public transportation to go to local shops, grocery stores, medical facilities, and other trips.

The effect of previously rapid urbanizing cities has caused inaccessible and ineffective transportation when these systems are not adequately planned. Inaccessibility of transportation due to lack of planning is part of the problem contributing to inadequate student transportation. Among American universities, 91% of schools have a campus master plan, but only 65% of them have updated their plans in the past 8 years (Dagget & Gutkowski, 2003). A master plan is a long-term planning document designed to guide a universities' future growth and development. It is a document that contains not only current but also future plans for the given infrastructure which is crucial for effective expansion. However, only 57% of American universities reported having future plans for transportation systems on their master plan. Factors that are addressed in

a campus master plan include traffic management, safety and security, accessibility, sustainability, roadways and routes, parking, mobility, transit, bikes, motor vehicles, and pedestrians.

Master plans should be well thought out to ensure that expanding and updating universities can be effective, accessible, and affordable (Aldrete-Sanchez et al., 2010). Although there are differences between American and Moroccan universities, student needs regarding transportation remain largely the same. Based on UIR's organizational similarities to typical American universities, the school lacks plans for future transportation needs. Research on underserved subgroups of the student population is more extensive. As previously mentioned, women regularly face difficulties with transportation. During interviews with African American women attending a Johannesburg-based university, it was found that all forms of harassment and general street crimes are shared experiences (Eagle & Kwele 2019). All of the interviewed students had experienced first or second-hand taxi-related incidents. The same group of students also felt anxiety due to the experienced aggression and/or sexualization from the taxi drivers. Sexual, verbal, or physical assault is also linked to a decrease in academic performance. Women who are either physically or sexually assaulted face an associated drop in GPA (Mengo & Black, 2015). Therefore, unsatisfactory transportation can also be defined by experiencing these types of traumatic interactions, not just the unreliability or lack of transportation.

Another underrepresented and negatively affected group is students with disabilities, who face inadequate transportation because systems are designed for the general public. This group's complaints about their schools' transportation can be categorized by unreliability, infrequency, and inefficiency. Overall, the complaints students with disabilities have about buses involve restricted hours of operation to and from their residence hall, traumatic navigation experiences, concerning attitudes from drivers, and difficulties maneuvering in small places. A major complaint from the visually impaired students is the lack of announcement systems for stops on buses (Soorenian, 2012). Students who need a wheelchair state that taxis can be wheelchair friendly, but a limited number may be available. In addition, the drivers may lack the willingness to assist people with disabilities. Visually impaired students have the most concerns with the accessibility of travel information, whereas students with physical impairments' biggest aggravation is the lack of space on transportation (Soorenian, 2012). Many people with

disabilities feel so anxious about planning to use public transit that they might delay or cancel their travel. Students with disabilities typically feel anger towards drivers and other passengers that do not show compassion or understanding for them (Mogaji & Nguyen 2021). Although these experiences were not direct accounts from UIR, these concerns are a good place to start when wanting to improve public transportation accessibility.

The transportation issues that affect Moroccan university students are scarcely researched. Outtaj (2014), while not focused on transportation, still found that transportation played a major part in student absences. 57% of Moroccan students use buses, so there are far more students than the number of buses can hold. The number of buses is unchanging as the student population only increases, causing an imbalance in the supply and demand of transportation, leading to even less reliable transportation to and from schools (Outtaj, 2014). Additionally, the buses lack accessibility in that they tend to arrive late to the stops or sometimes don't even arrive at all.

2.5 International University of Rabat Students and Their Transportation

Moroccan students' transportation habits could be applied to the UIR students, but careful consideration should be taken when specifying this scope. UIR is a smaller, more advanced private institution, giving benefits to their students that many other Moroccan students do not get. There is minimal documented research on UIR students and their specific transportation issues. The research and data on UIR students is more general, mostly concerning university demographics.

UIR is made up of approximately 6,000 undergraduate and graduate students, as of the academic year 2021-2022. The 11 different schools within UIR allow for students to research different fields of study and in turn attract a diverse student body (The Innovative University, 2019). Students with differing areas of studies yield unique perspectives on transportation. UIR's student body is made up of international students who primarily speak French and English (The Innovative University, 2019). Therefore, it is important to remember that the diverse cultural

backgrounds, areas of study, and motive of students attending higher education may affect their transportation decisions.

There is some available data about UIR's public transportation. The posted information about their student available transportation outlines the few services they offer: Shared Transportation and UIR Pass. Shared Transportation brings students to UIR and runs every day from morning until night and is priced around 500-800 MAD per month (53.12-85.00 USD) as of 2022. UIR also offers a service called UIR Pass as of 2022, which was established in 2017-2018 by the university and helps with intercity travel for students and employees. UIR Pass runs from Monday through Sunday linking UIR to the Rabat-Salé tramway as of 2022. Lastly, UIR also provides limited information about the public bus lines near the university city that allow for center city travel to Rabat and Salé which is about 4 MAD per trip (Transportation|UIR, n.d.) as of 2022.

2.6 Conclusion

Our background research underscores the need for a holistic, people-focused framework for the analysis of transportation systems that fully captures the location-specific difficulties associated with transportation. These difficulties largely fall under the categories of efficiency, accessibility, and affordability, and are best assessed through a combination of measurement of transportation systems and more open discussion with those who use or desire to use public transport. In the Moroccan context, the effects of rapid urbanization still present a distinct challenge. Those who would most benefit from transportation options often reside in sprawled areas with low transportation coverage. In understanding the unique situation of UIR (being an international university in an area of urban sprawl) we expect the holistic transport poverty framework will best capture their transportation problems. This defines a student-centric approach utilized in our research methodology. Our objectives, then, are to understand how UIR students use transportation and understand any difficulties they might face with the university's public transportation. The ultimate goal of these methods is to improve transit accessibility and the overall transport experience at UIR.

Chapter 3: Methods

Using various research methods, we obtained valuable, nuanced data on the primary transportation problems experienced by students at the International University of Rabat. Our background indicates that due to the campus location, the current public transportation system does not adequately support the needs of students commuting from the surrounding regions. The following are three objectives that determined the course of our data collection:

1. Obtain an understanding of the current transportation usage and the options that are available to students at the International University of Rabat
2. Analyze and classify the pressing issues with transportation experienced by UIR students
3. Determine solutions to address articulated challenges and present them to students for evaluation and feedback

The first objective was accomplished by conducting exploratory interviews. These structured interviews allowed us to understand transportation concerns from different demographics in a brief but effective way. To obtain large-scale quantitative data on prominent transportation issues that UIR students face, we distributed an online survey to students in our sponsor's classes in addition to groups of students found around campus. Lastly, we conducted focus groups to obtain ideas for transportation improvements from the students as well as collect feedback on previous solutions gathered from the first two methods.

3.1 Understanding Student Transportation Usage Options Available at UIR

To better understand the transportation options for students at the International University of Rabat, we chose to conduct exploratory interviews to determine usage and preferred modes of public transportation for this demographic. This research was conducted with exploratory interviews to obtain richer qualitative data and capture nuanced individual reactions to our questions.

Group exploratory interviews were conducted on two separate occasions with five total interviewees. The scribe notes from these two interviews can be found in Appendix A1 and A2.

The first set of interviews was done with three undergraduate students from UIR. The second group interview was conducted with two doctorate students from UIR. All of the students interviewed spoke English and both interviews took place on the university campus, each lasting approximately 20 minutes. The interviews were completed in a group setting and questions were directed to the entire group, then each interviewee was given the opportunity to answer individually. Although the participants responded to questions with opinions from their own experiences, they also attempted to generalize their opinions on public transportation for the student population as a whole.

Transcripts from these interviews, found in Appendix A1 and A2, were analyzed using deductive content analysis, which allows for the connection of interview data into predefined categories (White, 2013). Interview transcripts were reviewed and used to identify particularly notable quotes or phrases that highlight transportation concerns. Our team then analyzed these concerns under our predefined categories of affordability, accessibility, efficiency, and safety. The same procedure was then followed for the potential solutions the interviewees proposed. The information from our exploratory interviews about how and why students use different transportation methods helped refine survey questions which can be found in Appendix B. The survey was guided by our exploratory interview findings to more efficiently gather the intended data as well as more accurately portray the leading problems. The initial survey template was then edited to reflect the new information obtained from these interviews.

3.2 Analyzing the Issues Experienced by UIR Students with Public Transportation

To accomplish this objective, online surveys were conducted to understand and quantify public transportation challenges faced by the students at UIR. Surveying consisted of gathering data from a large sample of the student body to help generalize our findings. The survey questions given through this method can be found in Appendix B.

Beginning with the preamble, survey participants were immediately presented with the purpose of this research, and it was made clear that they can stop at any time if they do not wish to continue. It was also indicated that their responses will remain confidential. The survey

preamble can be found at the beginning of Appendix B. The questions following asked about identity and transportation usage, and then the survey directs the respondent to more participant-specific transportation questions. The students were asked to select the modes of public transportation they use most often. Then they were presented with statements about affordability, accessibility, efficiency, and safety for each public transportation mode they selected. For each statement, the students would rate on a Likert scale how much they agree or disagree. An example statement would be: "The UIR Bus operates when I want it to." The results helped to determine which problem seems to be the most relevant and pressing among the student population.

Members of our team walked around the UIR campus with QR codes and asked students to take the survey. With the help of our sponsors, Professors Mounia Malki and Mustapha Oudani, the survey was also distributed to UIR students in their classes and sent out through student email lists and social media groups. Greater data credibility was established by collecting a larger sample and biases were avoided by asking clear and concise questions (Ball, 2019). The survey was generated in English, and with the help of UIR students and Professor Malki, was translated into French. This translation presented an opportunity to obtain data from students who are not fluent in English.

By collecting age, gender, and additional background information, responses were able to be categorized by group and trends could be explored among each category of analysis. The use of a Likert scale for transportation questions also allowed for cross-tabulation analysis with demographic variables. A final question on the survey asked students if they would be willing to participate in an English-language focus group focused on solutions to their transportation challenges.

3.3 Propose Solutions to Address Student Articulated Challenges

After understanding the problems students face with public transportation, we examined how students want these problems to be addressed. A focus group was conducted to brainstorm potential solutions and obtain student feedback on the improvements our team had developed

using the previous methodology. Developing solutions to a multifaceted issue like transportation is not straightforward, so the goal of this focus group was to create an open conversation within a group that perceives similar issues. The point of conducting a focus group is not to necessarily come to a conclusion, but to understand how the people who will be most affected feel about the potential solutions (Krueger & Casey, 2000).

The purpose of this focus group was to get information from a selection of students who have first-hand experience with public transportation, following the suggested methodology from Krueger & Casey. The focus group was administered with seven UIR students of various ages, sex, and majors. This focus group was conducted on the UIR campus in the sixth week of the data collection period. The focus group was prompted with initial questions that can be found in Appendix C. Participants were encouraged to talk freely about their experiences, however, the monitor was present to steer the conversation if it went off-topic. Multiple note-takers were designated to document the main points of the conversation. The focus group lasted approximately 15 minutes ending after a majority of the participants had spoken their opinions and did not have more to contribute. Before ending the session, the monitor summarized the main points of the conversation and recapped the primary solutions the students wanted to see with public transportation which can be found in Appendix C.

While analyzing transcripts, it was acknowledged that these participants have put a lot of emotions into their responses, so the project team did their best to convey their thoughts effectively. The analysis involved a post focus group discussion with the monitors and everyone else on the research team. Debriefing helped each member collectively understand and conceptualize the main themes of the conversation.

3.4 Methods Summary

Our research began by familiarizing ourselves with current transportation options available to students so that we can better understand their challenges. We accomplished this through research on transport modes that reach UIR as well as interviewing students about how these systems are commonly used. Our next steps more precisely identified and quantified what common problems students experience with public transportation by utilizing a university-wide

survey. The survey was used to analyze the root causes of transportation challenges and categorize them by type of challenge and mode of transportation. After these problems had been identified, we worked with students in a focus group to get feedback on potential student-oriented solutions.

Chapter 4: Findings and Analysis

Evaluating the data from our various methods provided valuable information on the opinions of students regarding transportation challenges. Findings from exploratory interviews were used to understand how students use transportation as well as to identify some of the large-scale student transportation problems. After a preliminary understanding and classification of the current problems, a survey was developed to collect large amounts of quantitative data that could be used for the analysis of the problems. This survey received 342 responses, which at a confidence level of 95% results in a 5.15% margin of error. The analysis process evaluates the severity of transportation problems in terms of affordability, accessibility, efficiency, and safety, as well as performs comparative analysis in various areas using relevant demographic information collected by the survey. Focus groups were evaluated for potential solutions, synthesizing scribe notes with important quotes from the transcribed audio recording to identify trends in the solutions proposed by students. Following the analysis of our three methods, we were able to synthesize data into five major findings that are outlined below.

Finding 1: The Quality of Service Provided by The UIR Bus System has Significantly Degraded Since Implementation

In the exploratory interviews, one point that consistently came up with the UIR Bus was that it used to function according to the students' needs, but over the past few years, it has significantly decreased in quality. Interviewees indicated several accessibility and efficiency concerns that limited their ability to use the UIR Bus to effectively commute to the university campus. One interviewee stated that they used to take the UIR Bus because it stopped near their residence hourly, but the frequency has reduced to the point that it is no longer a viable transportation option for them. The interviewee stated that the UIR bus now only stops near them once or twice a day in each direction. Another interviewee indicated they would like to use the UIR Bus as a primary form of transportation, but a lack of stops near their residence forces them to utilize supplementary transportation.

Forty-five respondents answered Likert scale questions about the UIR Bus in categories of affordability, accessibility, efficiency, and safety. The survey data largely support the

accessibility and efficiency concerns raised in the exploratory interviews. Accessibility appeared to be the larger problem among students surveyed, as the majority of respondents disagreed with every accessibility statement about the UIR Bus. Figure 3 displays their responses.

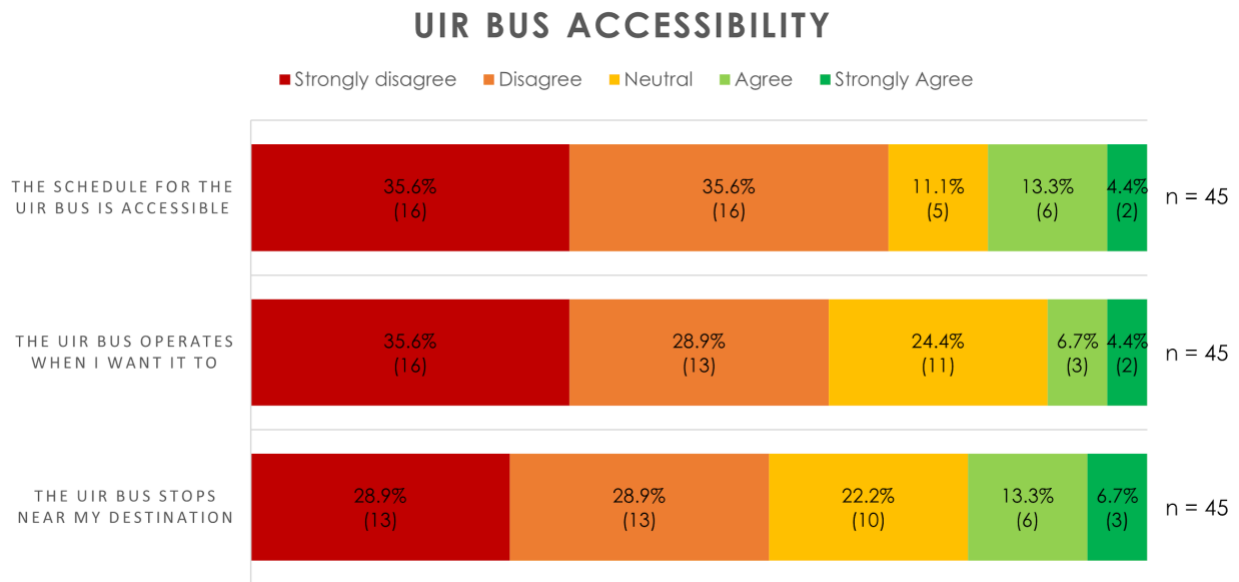


Figure 3: Survey Response to UIR Bus Accessibility Questions

This data illustrates the broad spectrum of accessibility challenges with the UIR Bus. Referring to the first bar in Figure 3, students indicated that the schedule for the UIR Bus is difficult for them to access. This data shows 71.2% of respondents disagreed with the statement “The schedule for the UIR Bus is accessible.” Our background research affirms this, as the university website appears to have multiple contradicting schedules posted. The lack of schedule accessibility is exacerbated by the larger inaccessibility of the bus service itself; 64.5% of respondents stated that the UIR Bus does not operate when they want it to, and 57.8% stated that the bus does not stop near their destination. This data collectively indicates that students have a high degree of difficulty in accessing the UIR Bus.

Likert data from efficiency questions about the UIR Bus also illustrates systemic problems with both structural and operational efficiency. The Likert scale survey data for these efficiency questions is given below in Figure 4.

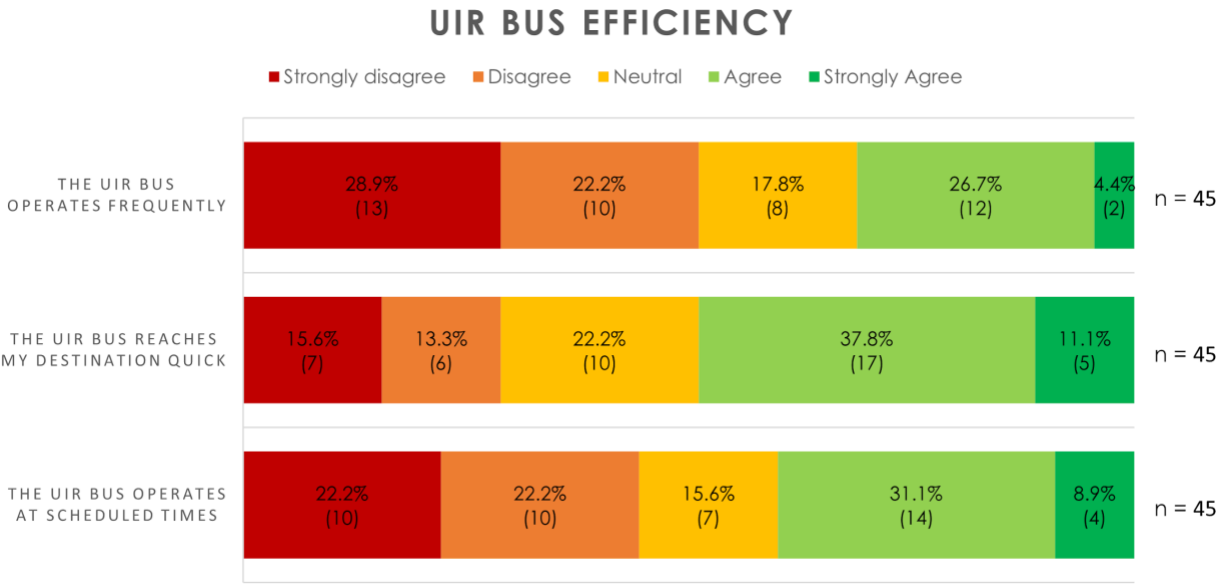


Figure 4: Survey Response to UIR Bus Efficiency Questions

Concerning structural efficiency, survey respondents seemed to agree that the UIR Bus’ designed frequency does not meet their commute needs. A total of 51.1% of respondents disagreed with the statement “The UIR Bus operates frequently enough for my schedule.” This indicates that the frequency with which the UIR Bus runs, which is typically only a few times per day in each direction, is insufficient. Additionally, 44.4% of students disagreed that the UIR Bus operates at scheduled times. Altogether, this data suggests that the structural and operational efficiency of the UIR Bus, while overall rated highly in comparison to other forms of public transportation, still faces systemic timing issues.

Another question on the survey polled students about their biggest problems with the UIR Bus. This largely affirms the above data, highlighting serious student concerns with the accessibility and efficiency of the UIR Bus.

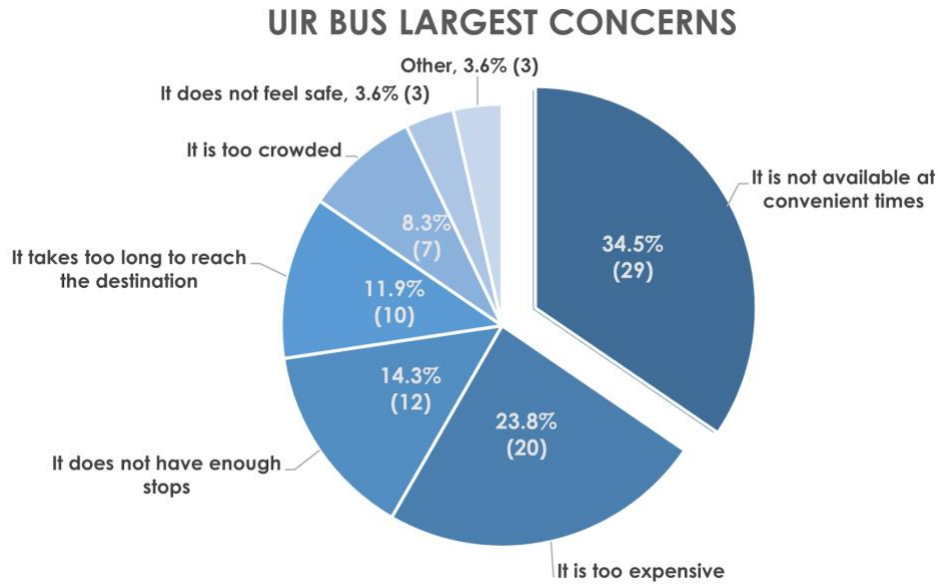


Figure 5: The Biggest Problem with UIR Bus

When asked about their single biggest issue with the UIR Bus, 34.5% of total students responded that ‘It is not available at convenient times and 14.3% that ‘It does not have enough stops.’ Affordability was also a large concern, with 23.8% of students responding that their single biggest issue was ‘It is too expensive.’ Survey data also suggests that students who use the UIR Bus may be likely to rely on this as their sole form of transportation to campus. When asked how frequently students use the UIR Bus, 82.2% of respondents who used the bus system stated that they use it every day. This is abnormally high compared to other forms of transportation. For example, only 14.6% of public bus users in our survey use the bus daily, and only 13.7% of grand taxi users utilize taxis daily. This illustrates the unique nature of UIR Bus riders as a particularly vulnerable transportation user group, as they may not have other modes of transportation upon which they can regularly rely.

Finding 2: Taxis are an Expensive Transportation Option for Students, and Rideshare Services Offer a Cheaper Alternative

After private vehicles, taxis are the most common mode of transportation respondents use to commute to UIR. Rideshare services, which function similarly to taxis, were the third most common. Of 342 respondents, 72 indicated that they use grand taxis and 69 use rideshare

services. Although taxis are utilized frequently, data from our survey suggests that there is a significant cost barrier to using them for regular travel to and from UIR, which is expanded upon below. This analysis concerns grand taxis rather than petite taxis, as the latter does not reach from surrounding cities to the UIR campus.

Although grand taxis were the most utilized form of public transportation, seven out of 51 students indicated that they use them for daily commute, only 13.7%. Twenty-six students, 51.0%, use grand taxis a few times a week and 35.3% use them only a few times a month. According to our survey data, students regarded grand taxis as highly accessible and efficient. Survey responses regarding grand taxi efficiency and accessibility are shown in Figure 6.

GRAND TAXI ACCESSIBILITY AND EFFICIENCY

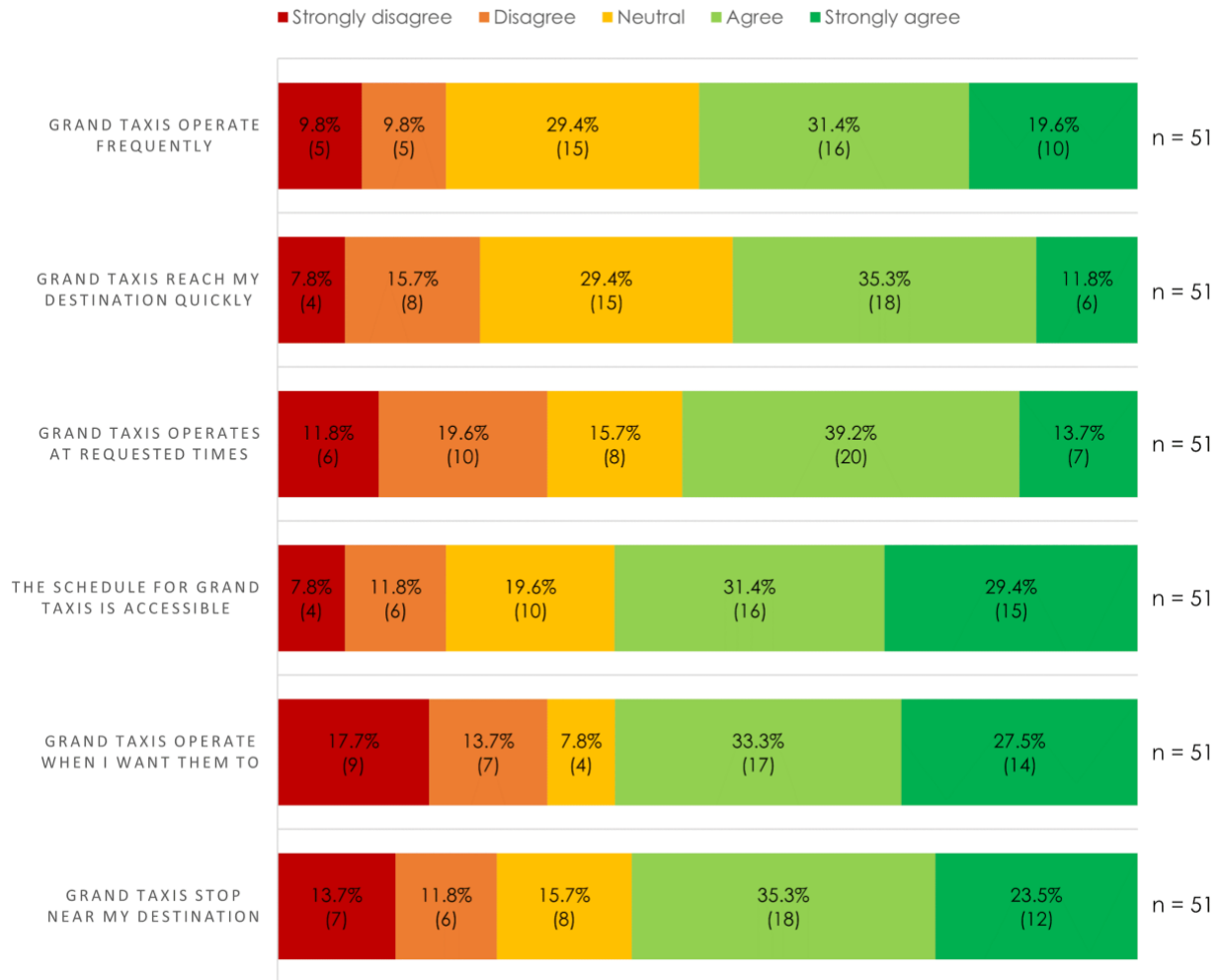


Figure 6: Grand Taxi Likert Scale Responses Efficiency (Top 3) and Accessibility (Bottom 3)

A majority of the efficiency and accessibility statements for Grand Taxis had the highest rate of agreement for most modes of transportation surveyed. Every statement in Figure 6 except “grand taxis reach my destination quickly” had a higher rate of agreement than the UIR Bus, public bus, or tram. As well, most of the statements in Figure 6 had over 50% of students in agreement, which indicates high rates of efficiency and accessibility.

Rideshare services present a very similar alternative to taxis and typically operate at a lower cost. Comparing the Likert scale results for affordability between grand taxis and rideshare services, the survey data supports this assertion. Figure 7 shows the affordability Likert scale

results for grand taxis and rideshare services. Respondents were asked to rate how much they agree with the statement “Grand taxis/Rideshare services are affordable for me.”

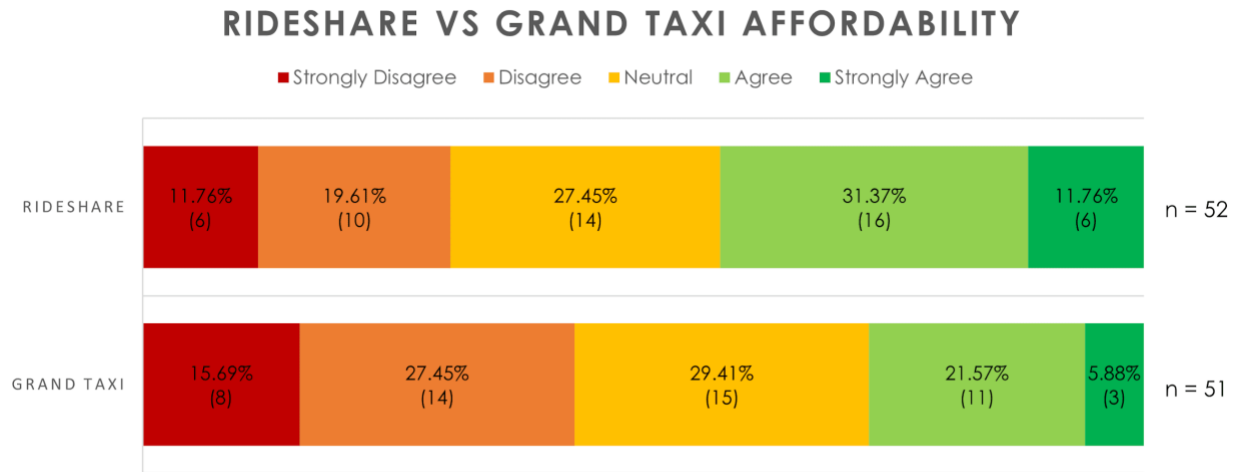


Figure 7: Affordability Likert Scale Comparison Between Rideshare and Grand Taxi

This data suggests that students are more likely to find rideshare services affordable in comparison to grand taxis. In combination with highly positive efficiency and accessibility data given in Figure 7, this indicates that cost is the limiting factor in how often students choose to use grand taxis to commute. Anecdotally, our team paid 150 MAD to commute from our hotel residence to the UIR campus via grand taxi, whereas the same trip via a rideshare service cost 67 MAD. Rideshare services, therefore, present a similar alternative to grand taxis at a more affordable cost. Given that students identified cost as their most significant concern, rideshare services are an excellent opportunity for students to improve their transportation experience.

Finding 3: The Public Bus is an Inaccessible, Inefficient, and Unsafe Mode of Transportation

While the public bus is an affordable option at a price of only 2 MAD per ticket, students have expressed serious concern about the accessibility, efficiency, and safety of the bus system. A student in our interview reported avoiding the public bus because it took over two hours to reach UIR from Rabat, which is more than four times longer than the UIR Bus. This points to

systemic operational efficiency problems in the public bus system, which is supported by data in Figure 8.

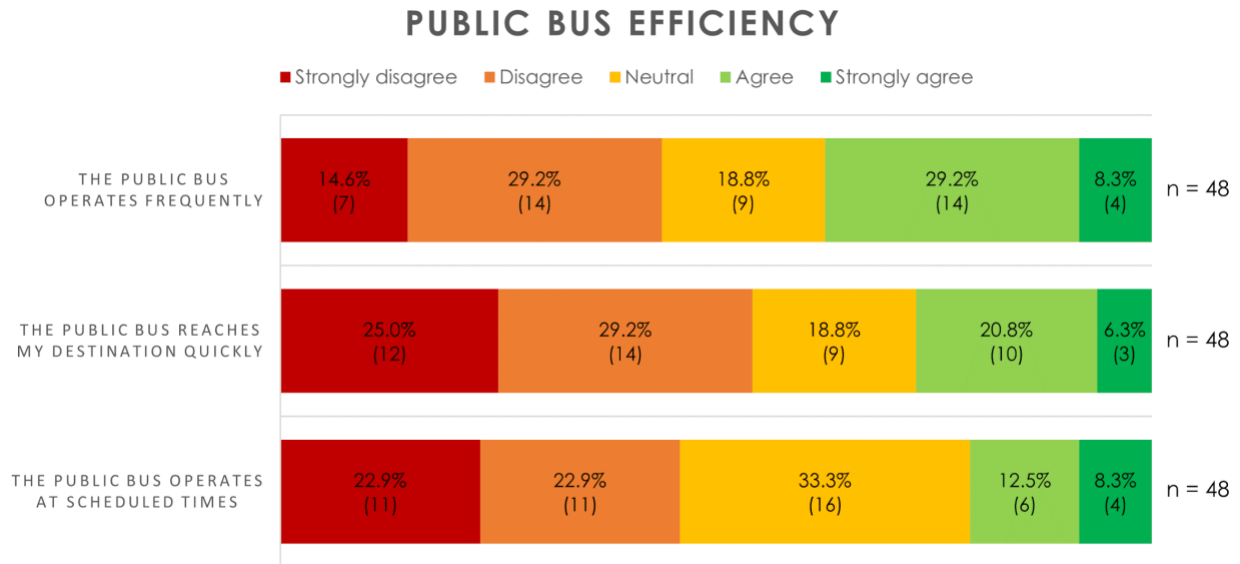


Figure 8: Survey Response to Public Bus Efficiency Questions

The data displayed in Figure 8 shows that 54.2% of students who take the bus indicate that it does not reach their destination quickly. Another major operational efficiency concern was that the bus’s published schedule is vastly different from the actual arrival and departure of the bus. Only 20.8% of students agreed that the public bus follows its intended schedule. The bus system was also reported to not run frequently enough for many students, with 43.8% indicating that current trip frequencies are insufficient for their needs.

Background research indicated that public bus timetables and route maps were difficult to access and often confusing if available at all. Accessibility data from the survey tends to confirm this claim as well as raise additional accessibility concerns. This public bus Likert accessibility data is presented in Figure 9 below.

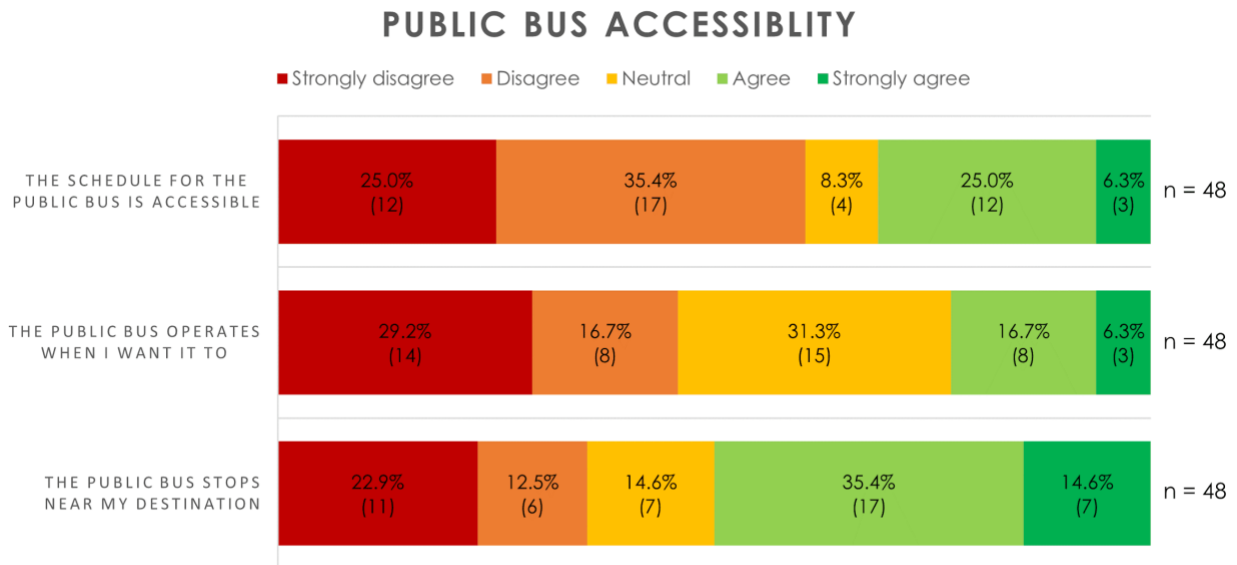


Figure 9: Likert Agreement/Disagreement with Public Bus Accessibility Statements

The first bar in Figure 9 shows that 60.4% of UIR students feel that the public bus schedule is not easily accessible. Schedule accessibility continues to be a major concern with many forms of public transportation in the Rabat-Salé region. The public bus in particular has the second-highest inaccessibility rate in our survey after only the UIR Bus. In addition to the availability and accessibility of the schedule and route maps, survey data indicates a concern with the timing and availability of the bus itself. Only 23% of students agreed that the public bus operates when they want it to. This indicates that the hours of operation and frequency of public buses are inconvenient for students who need to commute to campus. A student in our exploratory interviews affirmed this claim, stating that if they missed the public bus, they would have to wait anywhere from 30 minutes to upwards of an hour to catch the next bus on that route. Ideal headway should never exceed 30 minutes, making this wait time between buses excessive.

While there were significant efficiency and accessibility concerns about the public bus, the data overwhelmingly shows that safety is the largest concern for UIR students. Interviewees indicated that many students take alternate forms of transportation like rideshare services or grand taxis because the public bus tends to feel unsafe or uncomfortable. In the survey, students were asked what form of transportation they would most like to see improved and then asked to select their biggest problem with that mode of transportation.

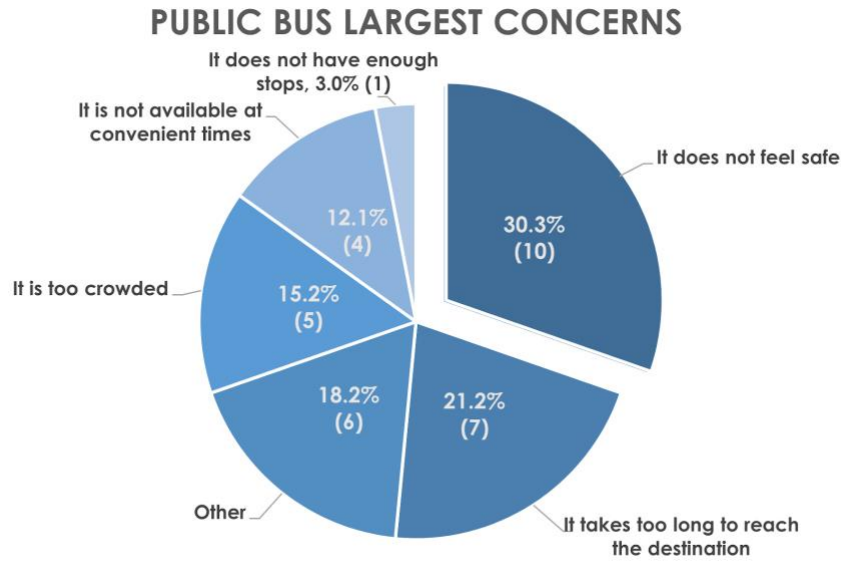


Figure 10: Pie Chart of Biggest Concerns with the Public Bus

Almost one-third of students indicated that their biggest concern with the public bus was safety, a clear majority when compared to the other concerns. Additionally, many of the ‘other’ comments included feeling unsafe. Additional Likert scale data is supporting this claim. This is presented in Figure 11 below.

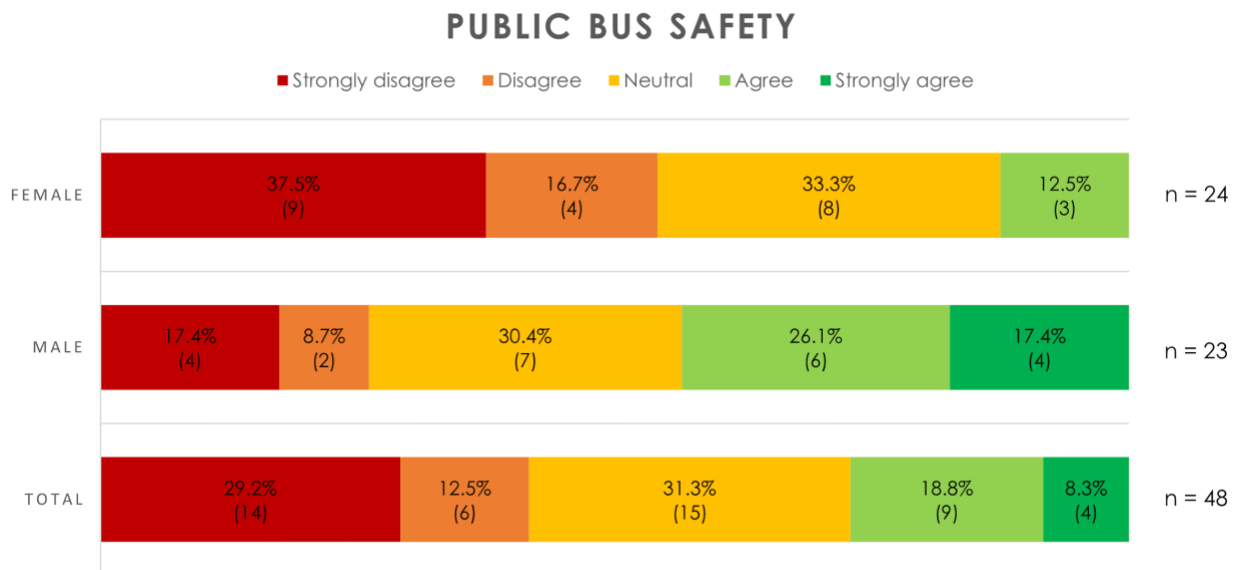


Figure 11: Safety Statement About the Public Bus Likert Data

Data in Figure 11 shows that safety is a major concern on public buses with a strong gender difference present. An overwhelming 54.2% of people who identified as women reported feeling generally unsafe on the bus, with 37.5% strongly agreeing that they regularly feel unsafe. Amongst people who identified as men, 21% reported feeling generally unsafe on the public bus. This is understandably less than among those who identify as women, however, the polarization of the overall data indicates that this is an extremely serious issue that students feel strongly about.

A large portion of students also expressed frequently experiencing events on public buses that make them feel scared or uncomfortable. This data is presented in Figure 12 below.

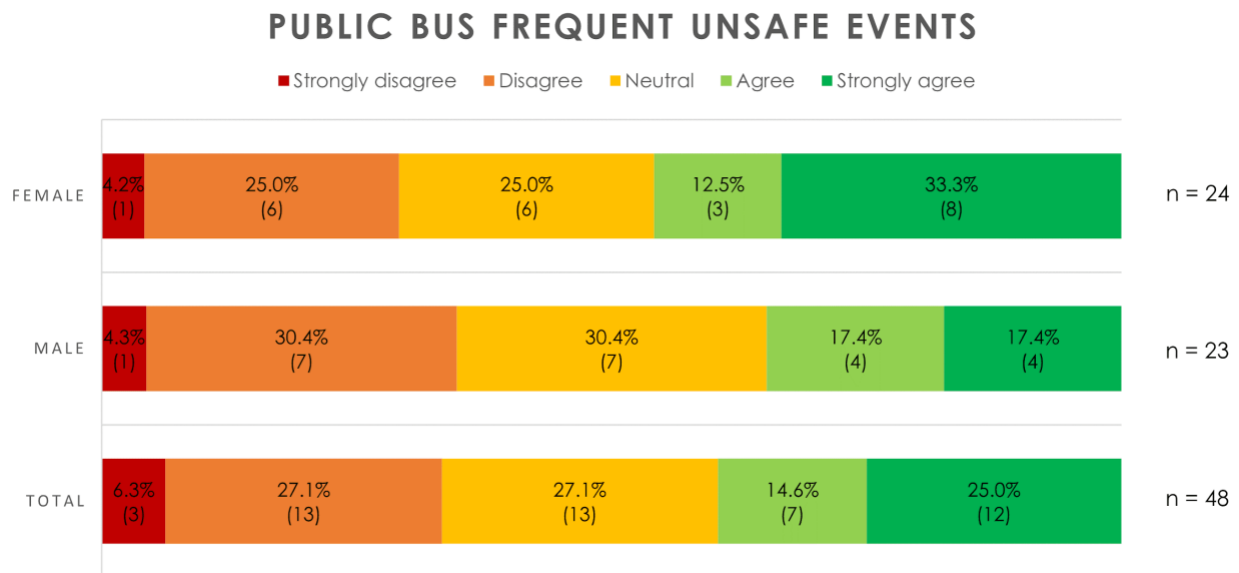


Figure 12: Student Agreement with Frequently Experiencing Uncomfortable or Scary Events on the Public Bus

Once again a gender divide was present in this safety data, with more respondents who identified as women reporting unsafe events than men; 45.8% of women surveyed reported frequently experiencing events on the public bus that make them feel scared or uncomfortable. At an understandably smaller but still significant percentage, 34.8% of men reported frequently experiencing unsafe events on the public bus. These percentages were by far the highest of any mode of transportation respondents were asked about and demonstrate consistent safety problems with the public bus.

Finding 4: The UIR Bus is Overwhelmingly the Safest Form of Public Transportation

The data regarding student experiences on the UIR Bus suggests that it provides the safest commuting option for UIR students. Whereas no strong opinions were raised about the UIR Bus' safety in our exploratory interviews, the survey data displayed in Figure 13 shows strong agreement toward the safety of the UIR bus. The data shows 73.3% of students either agreeing or strongly agreeing with the prompt "I feel safe on the UIR Bus." This was the highest rate of students feeling safe of any of the forms of transportation mentioned in the survey. Conversely, only two of the 45 students disagreed with the statement that the UIR bus is safe.

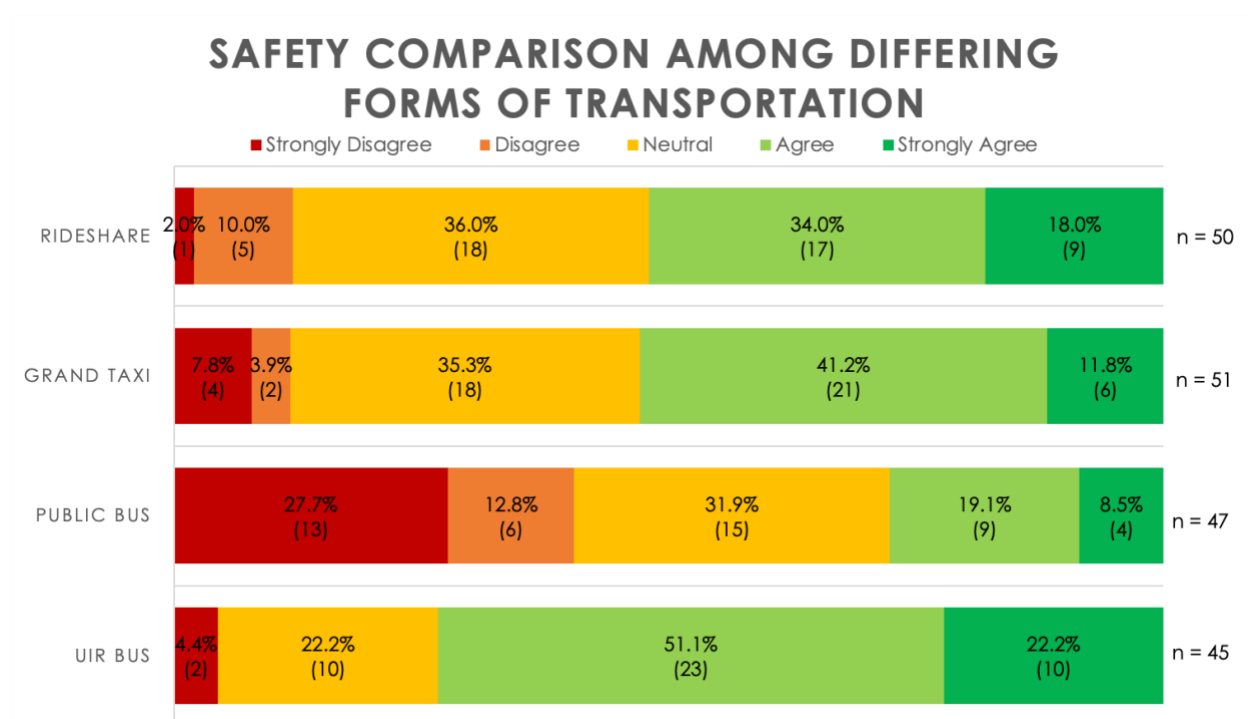


Figure 13: "I feel safe" Likert Data Across Various Forms of Transit

Additional Likert scale data further support that the UIR Bus is the safest transportation option available to students. As shown in Figure 14, 55.6% of students disagree that they frequently experience events on the UIR Bus that make them feel unsafe.

SAFETY EVENT COMPARISON AMONG DIFFERING FORMS OF TRANSPORTATION

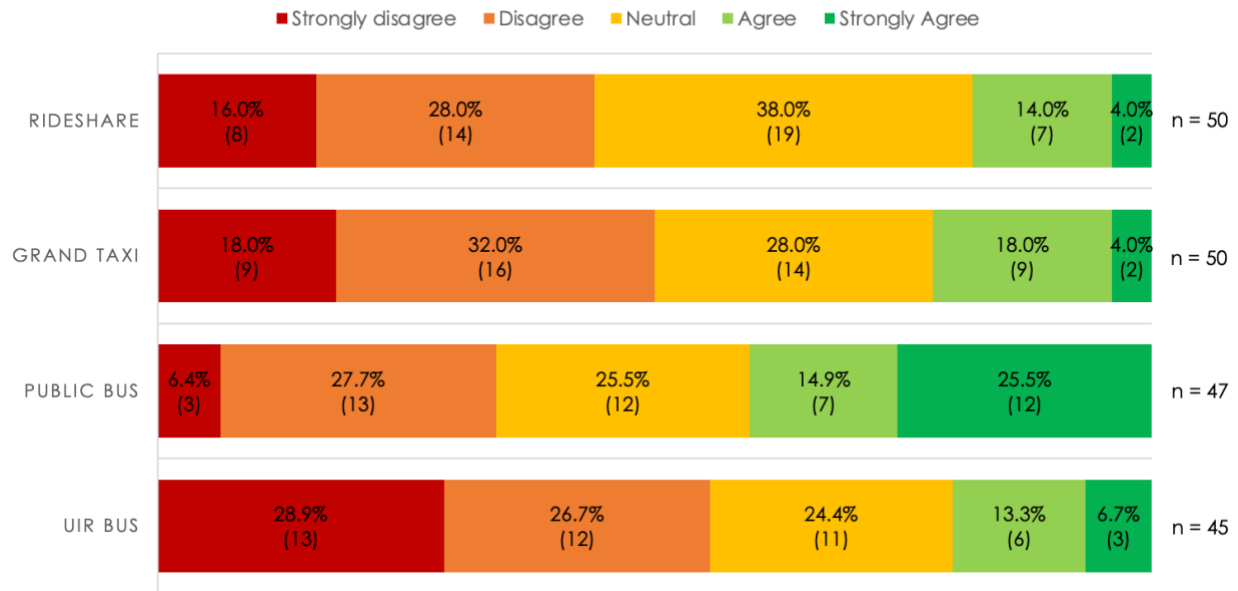


Figure 14: How Students Feel About Unsafe Events on Public Transportation

This is the highest percentage of disagreement for this statement across all forms of transportation indicating that unsafe events do not occur often on the UIR Bus.

While rideshare services and the tram rank only slightly lower than the UIR Bus in safety concerns, the public bus ranks far lower. This indicates that safety is one of the major characteristics the UIR Bus does not need to improve on.

Finding 5: The Rate of Private Vehicle Usage is High Among the Student Population

The dissatisfaction with public transportation options to and from UIR is highlighted by the fact that 45.7% of the students that participated in the survey indicated that they had access to and used private vehicles. As the most selected form of transportation, this percentage was high considering the concern for gas prices that was brought up during one of the exploratory interviews. The same interviewee suggested that improving the accessibility of the UIR Bus would be an adequate solution to provide an affordable option to encourage students to use their personal vehicles less. Survey data shows that car-owning students still care about the UIR Bus'

quality; 39 of 125 or 31.2% of students who own private vehicles indicated that they wanted the UIR Bus to be improved over any other mode of transit.

CAR OWNERS: WHAT MODE OF TRANSPORTATION IS MOST IN NEED OF IMPROVEMENT?

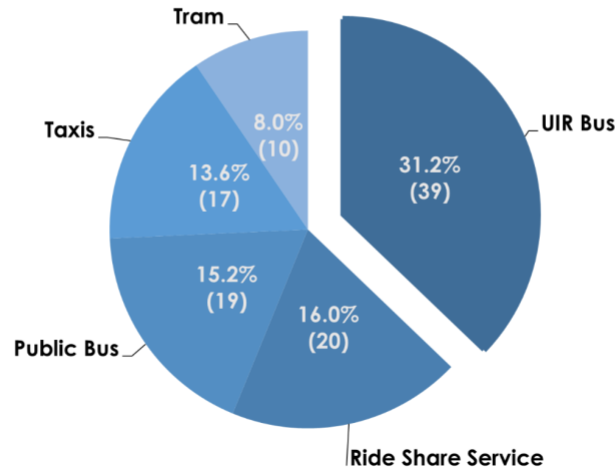


Figure 15: Desired Mode of Transit to Improve Among Personal Vehicle Owners

Additionally, one interviewee who utilizes their personal vehicle to get to and from UIR mentioned not being able to use the UIR Bus because of a lack of stops near their home. The above data suggests that a large percentage of students would like to use the UIR Bus over their personal vehicles but avoid it because of the inefficiencies and lack of accessibility.

Chapter 5: Discussion, Recommendations, and Conclusion

The following chapter will discuss additional information that was found during the collection of our data and consider the potential drawbacks of the way our methods were designed. The final recommendations we are proposing to UIR for improvement to the transportation system are also outlined below.

5.1 Discussion

This discussion mainly outlines decisions made on our research methodology and limitations we came across due to complications or drawbacks in our chosen research methods. We discuss how each of our methods changed with unforeseen conditions, and how any potential flaws or shortcomings were alleviated. We also briefly discuss how future research might expand on areas not sufficiently covered by our student-focused approach, such as the details of implementation for many of our recommendations.

5.1.1 Exploratory Interviews Discussion

The exploratory interviews gave opportunities for clarification questions which was an aspect that would have been completely missed if this method had been skipped. For example, our group was unaware that rideshare apps such as Careem and InDriver are commonly used until the exploratory interviewees brought them to our attention. The answers given described less of a personal experience regarding transportation usage and more of a general perception of how friends and peers were witnessed using it. This gave diverse information despite a relatively small number of participants.

Many claims or remarks made during the exploratory interviews supported the findings made from the survey. However, interview and survey data occasionally produced conflicting information. These instances were not mentioned in the corresponding findings section. One student's lack of awareness of a specific transportation issue does not mean that this issue does not exist. For example, interviewees mentioned that cost was not a major concern for them, but a majority of survey participants selected 'It's too expensive' as the primary concern of their preferred mode of transportation.

5.1.2 Survey Discussion

As our second method, the survey was to obtain more data on student opinion of public transportation from a school-wide perspective. There was a total of 342 participants in the survey. Although this was an appropriate sample size to make claims based on, the way the survey was designed resulted in insufficient data for some individual modes of transportation. Students were able to choose which forms of transportation they use on a daily basis, and in turn, were asked specific questions based on their choices. For this reason, we received more data on certain modes of transportation and less on others. For example, the tram and petite taxi each had fewer than 20 responses while private vehicles had over 100 responses. Based on background research, the tram and petit taxis do not reach UIR directly, so it was expected that students would not rely on these two modes of transportation as often as others. However, because of the low response rate on these transportation options, there are no confident claims that can be made about the tram or petit taxis. Similarly, some survey respondents indicated that they identified as non-binary, but due to this group only being a few people analysis was not performed on that data subset.

We are aware of the population size of UIR to a reasonable degree of certainty which gave higher levels of confidence for survey data cross-tabulations. This mainly applies to comparisons of survey questions with demographic questions, such as comparing safety and gender. It is difficult to obtain an exact confidence level for individual modes of transportation because we are unaware of the total population of users for each transportation type. The trends in the data are still clear enough to draw significant conclusions and make recommendations by triangulating data from all three methods.

Although there were issues that resulted from the survey design, some factors were out of our control. Due to the nature of our canvassing process, many students indicated that they had already taken the survey when asked. It is therefore possible that some students filled out multiple responses, but we believe the probability and number of potential incidents to be low enough to not have a significant impact on data integrity. We also had students who started our survey but did not finish it, resulting in a completion rate of 63.4%. Some students also could have interpreted questions differently than others. For example, the question asking about

students' experience with unsafe events was not defined by quantity, so students could have conflicting ideas about what amount is considered to be frequent.

5.1.3 Focus Group Discussion

The focus group was conducted with a total of seven UIR students. We were able to discuss the issues experienced by each individual with transportation, ask for their personal recommendations, and obtain feedback on the improvements that had already been proposed. We had approximately 70 students who responded to our survey that they wanted to participate in a focus group. However, after reaching out to these students' multiple times, we received a poor number of responses. Our survey group members were ultimately selected by our sponsor.

The students were briefed on our project before beginning the focus group. However, because they did not take our survey, they had limited time to collect their thoughts about public transportation. The lack of clarity about the purpose of the focus group caused confusion and little discussion between participants. In addition to the fact that four of the seven students were truly engaged in the conversation, they also had less than a half-hour to participate, creating a lack of depth in our conversation.

Although we had several limitations when conducting our focus group, the qualitative responses added dimension to our quantitative survey data. This method was conducted primarily to hear ideas from the students and use them to validate or invalidate the improvements that were formed during survey collection, as well as obtain new issues and solutions.

5.1.4 Additional Discussion

The majority of the following recommendations are centered around the UIR Bus system. During our initial exploratory interviews, our team identified that improvement of this mode of transportation would be the most feasible for the UIR administration to accomplish. Improving the UIR Bus would provide a system of transportation tailored to fit student needs specifically while being well within the control of UIR to modify.

The purpose of this research was broadly to investigate solutions to transportation challenges from a student perspective, focusing on forming solutions that would have a

meaningful impact on student quality of life. Our research was less focused on determining the financial and practical feasibility of implementing our recommendations. Many of these potential recommendations are focused on the UIR Bus and will likely place an increased financial burden on UIR. We have considered this and included some aspects in our recommendations that should offset this increased cost, however, we cannot be sure of this with the data available to us. Our recommendations will require running more UIR Buses at extended hours, which will increase the cost. We anticipate that increased ridership levels from a more affordable, accessible, and efficient bus service should offset a portion of this cost. UIR administration might also consider further subsidizing this service to continue to provide a valuable transportation option to the student body.

5.2 Recommendations

This section contains the recommendations our team created based on our background information, exploratory interviews, survey data, and focus group. These recommendations represent the changes that UIR can feasibly make to its bus transportation system and other information services that will have the largest tangible impact on student quality of life.

5.2.1 Provide More Information on The UIR Bus

UIR advertises two bus services on their website, “UIR Pass” and “Shared Transport.” The format of the brochures for these services are inconsistent and do not sufficiently convey how these bus systems operate. The French version of the UIR website also presents a different brochure on the UIR Bus that contains contradictory information compared to the English version. This makes it difficult for students to determine which information is most accurate. To rectify these issues, we recommend that UIR adopt a single, consistent method of presenting timetables and route maps for UIR-provided transport options. To do this, the following actions should be taken:

- Adopt a consistent method of presenting information for all UIR-provided transport options, in both French and English.
- Provide a map with a visual indication of where bus stops are located and an illustration of each bus route.

- Post the timetable with the visual map for each route so that information can be easily compared between the timetable and the route map.
- Introduce a strategic plan for raising awareness of the UIR Bus and the locations it serves.

5.2.2 Increase UIR Bus Frequency and Run Buses Later

The few trips offered into and out of UIR from the provided bus service rarely align with students' class schedules, forcing them to alter their day around the availability of the UIR Bus' Even on-campus students are affected by the schedule as UIR Bus times do not run frequently or late enough to offer them a quality form of transportation. Improving the availability of the UIR Bus will not only increase the ridership but benefit the well-being of the students. quality form of transportation. To alleviate these student's concerns, we recommend that UIR:

- Increase the UIR Bus frequency to allow for access to campus at times that are more convenient for students.
- Expand the UIR Bus operating hours to allow for later evening and nighttime travel.
- Work with students to determine the optimal hours and frequencies to operate the UIR Bus.

5.2.3 Increase the Number of UIR Bus Stops

Based on survey data analysis, we have determined that there are accessibility issues with the UIR Bus. An increase in bus stops for the UIR Bus was the most desired solution out of the improvement options presented in the survey. Most students indicated they commute from the Rabat area and need to take other forms of transportation to reach the closest UIR Bus stop. To address the inaccessibility of the UIR Bus, we recommend that UIR:

- Poll students to determine the most populous regions they are commuting from and create additional bus stops based on that data.
- Analyze the current bus route and modify or completely redesign it to more efficiently serve the areas where a majority of students live.

5.2.4 Create a Single-Use Ticket for The UIR Bus

The only current ticket option available to students taking the UIR bus is to purchase a monthly or yearly pass. A majority of commuting students do not find it too costly to purchase the 700 MAD monthly pass. Students who live on-campus do not benefit as much from the convenience of this bus pass as they do not have a daily need for transportation. The purchase of the pass seems unnecessary to these students, so most take other less-efficient forms of transportation. We recommend that UIR implements a single-use ticket, so that the convenience and safety of the UIR Bus can be an option for all students, on and off-campus.

5.2.5 Promote the Current Carpool Application

Students had an overwhelming concern with the cost of grand taxis and rideshare services. Dividing the total cost among multiple passengers decreases the amount paid individually and increases the desire to take that form of transportation. Our sponsor and focus group participants informed us that UIR students have already created an application that allows people to set up carpool groups based on their class schedule. There is little information about this app, and many students are unaware that it even exists. Carpooling apps such as this one operate more effectively if they have a large user base. Our recommendation is that UIR promotes this app on their website or around campus so that more students can utilize it.

5.2.6 Provide More Information on the Public Bus

UIR currently provides a limited amount of information on the public bus. The French and English university websites provide different bus line numbers that reach Technopolis from the Rabat-Salé region. There is no additional information on either providing times that the line operates, the frequency of buses on this route, or a map of where the bus travels. The majority of students commute from Rabat, while other students commute from Salé, Temara, and Kenitra. Most students commuting using the public bus will have to take another bus line before they can transfer onto the line that goes closest to UIR. Based on these considerations, we recommend that UIR take the following steps to improve student awareness about the public bus schedules:

- Provide information about bus lines throughout the Rabat-Salé region that connect to lines that reach Technopolis.

- Publish corresponding public bus route maps on the UIR transportation webpage, ensuring consistency between the French and English versions.
- If possible, provide the frequency at which buses operate on these lines and any available timetables.
- Produce a pamphlet or brochure with the above information similar to existing brochures for the UIR Bus.

5.3 Conclusion

If successfully implemented, we feel that these recommendations will greatly improve the student transportation experience to and from UIR. With the rapidly evolving nature of the Rabat-Salé region's transportation ecosystem, it is imperative that these recommendations be implemented at the soonest opportunity. As Technopolis grows and develops its infrastructure, UIR has the ability to play a key role in improving student transportation in the region, and further integrate itself into the community.

Because of the limited scope of our research, future work will likely be necessary to determine how to best implement the specifics of our proposed recommendations. Many of our recommendations are centered around changing timing, hours, and stop locations of the UIR Bus. We have significant data to support that these changes would have an immensely positive impact on students' ability to commute to campus, but insufficient data to suggest how these changes should be implemented on a micro-level. Therefore, we suggest that future research on UIR's transportation ecosystem be focused on identifying the specifics of the network design.

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Appendix A: Exploratory Interview Scribe Notes

A.1 First Exploratory Interview Session

Date: 28 March 2022, 1:00pm

Location: Classroom at the International University of Rabat

Interviewer(s): Noah Cook, Katherine Morissette

Notes: This interview was conducted as a group interview with three undergraduate students that all currently attend the International University of Rabat.

Q: Are you a student at the International University of Rabat?

Yes (all)

Q: What is your age and what year are you in school?

Third year (all)

Q: Do you live on or off-campus?

1. Off campus in Rabat
2. Off campus (no specific area given)
3. On campus

Q: How often do you use public transportation?

1. Not every day, he has a car but doesn't like to drive it too early in the morning.
Tends to use public transportation about half of the time.
2. Takes his car every day.
3. Spends most of her time on campus. Only uses public transportation when necessary.

Q: What forms of public transportation do you use regularly?

1. He takes the early tram and then the UIR provided bus.
2. Takes his own car on the highway to get to UIR.
3. *Doesn't use public transportation regularly*

Q: On average, how much do you spend on public transportation each week?

1. Not too expensive for the bus (about \$100/month for combined tram, taxi, bus).
He explained that it is 400USD for the whole year UIR bus pass. Tram

subscription is around 200USD. To have those subscriptions in addition to taking another bus or taxi is about 800USD per month. Cost wasn't a huge issue for him, the bigger issue is availability with class times.

2. He said gas is expensive, therefore he would take public transportation if it was an option in his area (he thinks the bus is convenient for the people who can take it).
3. *Doesn't use public transportation regularly*

Q: Do you avoid any transportation options due to cost?

1. He says taxis and Ubers (Careem, Indriver) tend to be more expensive.
2. *Didn't answer*
3. The public bus doesn't offer a one-time fee so she avoids it because she doesn't want to buy the monthly pass.

Q: Are there any forms of transportation that you would like to utilize but can't because of accessibility?

1. He would take the UIR provided bus more because there used to be a bus coming every hour but it no longer does that. The public bus can't drop you off anywhere besides the designated spots (not enough of those places, capital only has two places).
2. He would take white taxis, but the problem is that if you don't know the driver it can be hard to find one to take you to UIR. Also, if you don't have other people to ride with, it can be really expensive to take by yourself.
3. The public bus takes a really long time to get you to your destination.

Q: What form of transportation would take the longest amount of time to catch?

1. UIR public bus (wait hours), need multiple transfers to get anywhere
2. *Didn't answer*
3. Careem is too much time, need to find driver and make sure they're nearby, calculate time to get here and bring you

Q: For what form of transportation is overcrowding the biggest issue?

1. Tram at 8am (you don't have a choice so you have to take it anyway).
2. *Didn't answer*
3. Public buses aren't too crowded but the ride is too long and will get crowded along the way and is bumpy.

Q: For what form of transportation is safety the biggest issue?

1. *Didn't answer*
2. Said that women tend to feel less safe than men.
3. She says the taxi does feel a little unsafe, and people talk to you a lot. The bus is not that unsafe if you just ignore people. It is not safe to take an uber with a driver you don't know and she said she would only try it if she was with another passenger that she knew.

Q: Suggestions for improvement?

1. Make an option for people who use UIR provided buses to get a special schedule, your classes don't line up with bus schedules, more lenient for people and available.
2. If the white taxis were more organized, with a big group of people it wouldn't be expensive at all. App to organize people's schedules to find someone who has a similar schedule and take the taxi with them.
3. Make a one-time ticket for the UIR provided bus and make the bus late enough (9:30pm is not late enough for it to stop running). You could have people who drive cars offer rides to other people, but asking for gas money can seem conceited.

A.2 Second Exploratory Interview Session

Date: 31 March 2022, 10:00am

Location: Classroom at the International University of Rabat

Interviewer(s): Grace Cummings, Travis McGregor

Notes: This interview was conducted as a group interview with two graduate students that both currently attend the International University of Rabat.

Q: How often do you use public transportation to get to UIR?

1. She doesn't use it, but she used to a long time ago. She uses trains when traveling further distances. She mostly uses Careem when she has a problem with her car.

2. She doesn't like public transportation. The only public transportation she uses is trains to go city to city. She takes Uber / Careem / rideshare everywhere, including work.

Q: How does price affect your public transportation decisions?

1. Careem is comparatively more expensive to the bus. The problem with the normal cab is they don't get to the UIR. If the cab could go to UIR, then she would take the cab over Careem.
2. Careem is much more expensive than a cab and the public bus. She wouldn't take the cab even if it got to UIR because it is more comfortable to take Careem. Careem is also more direct and doesn't want to wait for others.

Q: Have you used the UIR provided bus?

1. Yes. She used it when her car was broken and needed to walk 20 minutes to get to the UIR Bus stop.
2. Used to use it to get from Rabat to UIR. It has specific times so she has stopped using it. She needs a more flexible schedule.

Q: Is there any improvement with the taxis or UIR provided bus?

1. She acknowledges it won't cut down the price, but it will be helpful to have more stops and times for the UIR Bus.
2. She'd prefer if taxis could be more private with less seats. For example, 2 seats in the cab instead of 6 seats. She doesn't like sharing taxis with other customers. She also suggested that taxis join Careem or Uber. This would allow the cab to have a precise GPS location instead of a general verbally described area.

Appendix B: Sample School-Wide Survey Questions



WPI

English ▾

Select language above / Sélectionnez la langue ci-dessus

We are a group of students from Worcester Polytechnic Institute in Worcester, Massachusetts in the United States of America and we are working with Professor Mounia Malki at the International University of Rabat to investigate student concerns with the current public transportation system. Currently, we are conducting surveys to gain a better understanding of the preferred types of transportation within the student demographic of the Rabat-Salé region. This will also help us to determine which problems seem most relevant to the current student population. This will be done specifically with the students that attend the International University of Rabat. Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain anonymous. No names or other identifying information will appear on the questionnaires or in any of the project reports or publications.

Are you a student at the International University of Rabat?

- Yes
- No

What year are you in University?

- First year
 - Second year
 - Third year
 - Fourth year
 - Graduate student
-

With which gender do you most identify?

- Male
 - Female
 - Non-binary / third gender
 - Prefer not to say
-

Do you live on-campus or off-campus?

- On-Campus
- Off-campus

What types of transportation do you use? (You can select more than one)

- UIR provided bus
 - Public bus
 - Grand taxi
 - Petite taxi
 - Tram
 - Ride Share Service (Careem, Indriver, etc.)
 - Personal Vehicle
 - Other (Please elaborate)
-

Do you have access to a personal vehicle?

- Yes
- No

How frequently do you use the **UIR Bus**?

- Everyday
- A few days a week
- A few days a month

Please rate how much you agree with the following affordability statement about the **UIR Bus**

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
The UIR Bus is affordable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please rate how much you agree with the following accessibility statements about the **UIR Bus**

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
The UIR Bus stops near my destination	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The UIR Bus operates when I want it to	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The schedule for the UIR Bus is easy to access	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please rate how much you agree with the efficiency statements about the **UIR Bus**

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
The UIR Bus arrives and departs at scheduled times	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The UIR Bus reaches my destination quickly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The UIR Bus operates frequently enough for my schedule	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please rate how much you agree with the safety statements about the **UIR Bus**

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
I feel safe on the UIR Bus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I frequently experience events on the UIR Bus that make me scared or uncomfortable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What mode of public transportation would you most like to see improve?

- UIR Bus
- Taxis
- Ride Share Service
- Tram
- Public Bus

What do you think the biggest issue is regarding that mode of public transportation?

- It is too expensive
- It is too crowded
- It does not have enough stops
- It does not feel safe
- It is not available at convenient times
- It takes too long to reach the destination
- Other (please specify)

What suggestions do you have for improving transportation to and from UIR?

- A single use ticket for the UIR Bus
- More stops on the UIR Bus
- Run the UIR Bus more frequently and at later times
- An app to organize groups for grand taxis
- Other (please specify)

Would you be interested in participating in an English-language focus group with other students to discuss your experience with public transportation?

- Yes
- No

Please provide your email address so our team can contact you about the focus group.

Appendix C: Focus Group Notes

Date: 21 April 2022, 12:00pm

Location: Room 401 Classroom at the International University of Rabat

Focus Group Leader: Noah Cook

Focus Group Scribes: Grace Cummings, Travis McGregor, Katherine Morissette

Notes: This focus group was conducted with seven undergraduate students that all currently attend the International University of Rabat.

Q: What are the current problems with transportation/hardest things to deal with when getting to and from campus?

- Students agree that it can be expensive when you are commuting from a further region and try to use public transportation to get to UIR
 - Example: One student commutes from Kenitra and tried to use a bus system called Firstway, but it cost between 500 and 1200 MAD
- When you try to commute with other people and carpool, it can be hard to coordinate when everyone has different schedules

Q: Do you utilize the UIR Bus as transportation?

- A majority of the students don't tend to use the UIR Bus for travel
- Some participants used the bus in the past, but no longer do because of time (waiting hours for the bus), money (too expensive), and overcrowding

Q: What problems would you like to see changed? What solution do you have to these problems?

- UIR bus is overcrowded, so you need to get on early to get a spot
 - Solution: Increase the number of buses and the frequency that they come to UIR
- Buses don't come often enough and don't typically align with your school schedule
 - Solution: Increase the number of buses and the frequency that they come to UIR
- Students want to go straight to campus on the UIR Bus, but sometimes there are employees on the bus that need to get dropped off, causing there to be extra stops on the way to school
 - Solution: Have the UIR Bus be strictly for students and go directly to UIR
- There are not enough bus stops in each commuting region (Only two stops in Rabat, one in Temara, and none in Salé)

- Solution: Create additional stops in each region, especially the areas where most students commute from
- Students have a hard time coordinating carpools due to schedule differences
 - There is an app that was created by two students that helps coordinate carpooling
 - Solution: Promote this app so that more students are aware of it

Appendix D: IRB Approval

WORCESTER POLYTECHNIC INSTITUTE

100 INSTITUTE ROAD, WORCESTER MA 01609 USA

Institutional Review Board

FWA #00030698 - HHS #00007374

Notification of IRB Approval

Date: 06-Mar-2022

PI: Karen Oates K
Protocol Number: IRB-22-0480
Protocol Title: UIR Morocco Public Transportation IQP

Approved Study Personnel: Cook, Noah~Davis, John-Michael~McGregor, Travis
B~Cummings, Grace~Morissette, Katherine~Oates, Karen
K~Stafford, Kenneth A~

Effective Date: 06-Mar-2022

Exemption Category: 2

Sponsor*:

The WPI Institutional Review Board (IRB) has reviewed the materials submitted with regard to the above-mentioned protocol. We have determined that this research is exempt from further IRB review under 45 CFR § 46.104 (d). For a detailed description of the categories of exempt research, please refer to the [IRB website](#).

The study is approved indefinitely unless terminated sooner (in writing) by yourself or the WPI IRB. Amendments or changes to the research that might alter this specific approval must be submitted to the WPI IRB for review and may require a full IRB application in order for the research to continue. You are also required to report any adverse events with regard to your study subjects or their data.

Changes to the research which might affect its exempt status must be submitted to the WPI IRB for review and approval before such changes are put into practice. A full IRB application may be required in order for the research to continue.