

Challenges In Multimodal Mobility: A Study Of University Students In Algiers, Algeria

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Abstract:

In contemporary urban environments, over half of the population relies on walking as a primary mode of transportation, with the majority engaging in multimodal walking—combining walking with other transportation modes. Despite its growing significance, there is a notable lack of research on multimodal walking. This paper addresses this gap by examining the challenges of multimodal walking within a unique cultural context: Algeria, specifically Algiers. A 2008 study revealed that more than 50% of Algiers residents use walking daily, a substantial portion being students. To enhance their daily commute satisfaction, this paper identifies barriers to multimodal walking among this essential demographic.

Focusing on the Department of Architecture in Algiers as a case study, the researchers conduct a physical analysis of pedestrian routes connecting universities and public transport stations. They observe and record the behavior of students, both pedestrians and multimodal pedestrians. The study identifies four main categories of barriers: Physical Condition, Hygiene, Width, and Safety—covering path conditions, cleanliness, space availability, and safety hazards. The findings underscore the importance of addressing these barriers, particularly for university students, providing valuable insights to enhance the overall satisfaction of multimodal pedestrians in urban landscapes..

Keywords: *Walkability; multimodal walking; modal choice; student; Algiers.*

1. Introduction

In the literature, "multimodality" and "intermodality" are used to describe the use of more than one mode of transportation for a trip. In practice, authors use multimodality more often in the context of passenger transport. However, they often use intermodality in the context of freight transportation (Corinne Mulley, Claudine J. Moutou, 2015, P118).

Additionally, multimodality, which refers to the use of multiple modes of transportation during a specific time frame (Joachim Scheiner, Kiron Chatterjee, Eva Heinen. 2016, P 148) has emerged as an important trend in transportation. It offers a range of benefits, including increased flexibility, accessibility, and reduced environmental impact. However, the interrelation between different modes of transportation is often neglected, and there is a need to address this gap.

Furthermore, transportation has the potential to contribute significantly to socio-economic development by improving access to job opportunities, education, healthcare services, and the delivery of goods and services (Asmaa ATTARCA, 2020, p29). Moreover, multimodal transportation involves the use of two or more modes of transportation to transport passengers or containers from the starting point to the final destination. The mode of transport may be altered at a designated location known as the transfer node. (MNIF Mouna , BOUAMAMA Sadok 2017, P144).

Aside from the clear environmental advantages over driving, walking also offers health benefits. Studies have shown that this mode of transportation is associated with increased longevity in older adults. (Arlie Adkins , Jennifer Dill , Gretchen Luhr, Margaret Neal, 2012, P499).

Despite its growing importance, there is a lack of research on multimodal walking, a recent concept that involves walking in combination with another mode of transportation (Mokhtarian, P. L., & Handy, S. L. , 2002, P567). This gap in research is particularly important in the Algerian context, where multimodal transportation is increasingly becoming a popular mode of transportation among university students.

This paper aims to address this gap by providing insights into the barriers faced by multimodal pedestrians and promoting the development of solutions to overcome these challenges. Through this research, we hope to emphasize the importance of multimodal transportation and the need for further research on multimodal walking to improve the experience of university students and increase their satisfaction.

In this study, the researchers analyze the pedestrian routes between universities and public transport stations, and observe how students behave while using different modes of transportation. Through their research, they aim to identify the challenges faced by students who use multimodal walking and suggest ways to overcome these challenges. Their study highlights the importance of understanding these challenges and finding solutions to improve the experience of multimodal walking for university students in Algeria. Ultimately, their goal is to raise awareness about the barriers to multimodal walking and encourage the development of effective solutions.

2. Factors that impact walking behavior

The literature highlights that various broad factors affect walking behavior, including the quality of the walking environment, demographic characteristics, attitudes, and the existence of desirable destinations. To enhance the user experience and encourage walking, it is crucial to comprehend how micro-scale built environment characteristics impact user perceptions of quality (Arlie Adkins, Jennifer Dill , Gretchen Luhr, Margaret Neal, 2012, P 499).

These factors can interact and have a cumulative impact on walking behavior, with the influence of each factor varying based on the individual and context. To promote walking and improve walkability, it is important to consider all of these factors in the design and development of pedestrian paths and the built-environment.

Many authors spoke about this subject before but the most known authors are Alan Jacobs, Jane Jacobs, William Whyte, Mariela A. Alfonzo, M Southworth and Jan Gehl.

William H. Whyte conducted extensive research on the use of public spaces and found that people are more likely to walk in areas that offer comfortable seating, a balance between sun and shade, and attractive destinations. He also identified the importance of active edges and the presence of trees and plants in creating an engaging walking environment (William H. Whyte, 1980)

According to William H. Whyte 1980, these are the factors that affect walking behaviour:

- Seating: People are more likely to walk in areas where there are opportunities to sit and rest.
- Sun and shade: People tend to walk in areas where there is a balance between sun and shade.
- Trees and plants: Vegetation can make the environment more pleasant and attractive for walking.
- Active edges: Buildings with active edges, such as shops and cafes, can create an engaging and lively walking environment.
- Clear and compelling destinations: Places that are interesting and appealing, such as public art or historic landmarks, can encourage walking.

Moreover, Mariela A. Alfonzo (2005) has created the Hierarchy of Walking Needs Model. This model fits in a social-ecological program to offer a conceptual context for the purpose of understanding how several aspects may affect walking behavior, This model organizes five levels of need hierarchically. According to Mariela A. Alfonzo (2005), these levels are: (Alfonzo, 2005,P 817,818)

- Pleasurability: Architectural scale and coherence, Aesthetic appeal, Diversity, Complexity, Liveliness, Interesting/attractive architecture, Unique/historic buildings, Public spaces, Mixed uses, Street trees, People
- Comfort: Features of urban form, State of pedestrian pathway system, Elements of urban design, Protection from weather conditions, Facilities (drinking fountains, street furniture)
- Safety: Urban form, Building types, Individuals/groups, Fear of crime, Environmental qualities, Physical incivilities (graffiti, unwell-preserved buildings)
- Accessibility: Trails, sidewalks, paths, Physical obstacles, Psychological obstacles, Reasonable walking distance, Distance perception, Neighborhood proximity to commercial areas, Residential/commercial area relations.
- Feasibility: Physical factors affecting mobility, Time constraints, Other responsibilities (children, commitments)

Likewise, Southworth (2005) suggests six criteria for designing a walkable environment: connectivity; linkage with other modes; fine-grained land use patterns; safety; quality of path and path context. (Southworth M, 2005, P 249, 250, 251):

- **Connectivity:** The connectivity of the pedestrian path network depends on the availability of sidewalks and other walkways, and the smoothness of the paths and lack of major obstacles.
- **Linkage with Other Modes:** The pedestrian network must be linked to the broader city and surrounding area through accessible and convenient connections to other modes of transportation such as buses, streetcars, subways, or trains that are within reasonable walking distance.
- **Fine Grained and Varied Land Use Patterns:** A neighborhood or city that's conducive to walking has a readily available layout of services for everyday needs, accessible within a 10-20 minute walk or up to 1-2 miles.
- **Safety:** The aspect of walkability that is probably best comprehended and most thoroughly developed is pedestrian safety.
- **Path Quality:** The condition of the path is crucial to walkability. A commercially-oriented street designed for automobiles, characterized by multiple lanes of noisy

Additionally, Alan Jacobs argues that a holistic approach to urban design is necessary to promote walking behavior, which includes creating safe and accessible environments, providing comfortable and enjoyable walking experiences, and prioritizing pedestrian convenience (Alan Jacobs, 2013). According to this author, factors that affect walking behavior are:

- **Safety:** People are more likely to walk in areas that are perceived as safe from crime and traffic accidents.
- **Accessibility:** Walking is more likely to occur in areas where destinations are easily reachable by foot.
- **Comfort:** The physical environment should be comfortable and conducive to walking, including factors such as shade, seating, and good pedestrian infrastructure.
- **Enjoyment:** Walking should be enjoyable and provide a positive experience, which can be influenced by factors such as aesthetics, social interaction, and sense of place.
- **Convenience:** Walking should be a convenient mode of transportation, with efficient and reliable pedestrian infrastructure, good wayfinding, and appropriate zoning policies.

Finally, according to Jan Gehl, factors that affect walking behavior are:

- **Quality of urban design:** Prioritizes the needs of pedestrians by providing safe and comfortable sidewalks, well-designed street crossings, and pedestrian-friendly spaces such as plazas and parks (Jan Gehl, 2010).
- **Mix of uses in a neighborhood:** A mix of residential, commercial, and cultural activities can create vibrant and diverse places that encourage people to walk (Jan Gehl, 2013).

- Presence of street-level activity and social interaction: Sidewalk cafes and community events can contribute to a lively and inviting pedestrian environment (Jan Gehl, 2013).
- Human comfort: Factors such as shade, shelter, and seating can help create a pleasant walking experience and encourage people to walk (Jan Gehl, 2011).

After this literature review, the researchers formulated the following hypothesis: the use of multimodal walking as a mode of transportation is discouraged by the physical condition of pedestrian routes, their safety, cleanliness, and dimensions.

3. Methods and case study:

The authors chose to focus on the Algerian public transport system and the challenges faced by multimodal pedestrians in this context for several reasons. Firstly, they noted that walking is a popular mode of transportation in Algeria, with more than 50% of the inhabitants of Algiers using it as a daily mode of transport (BAOUNI Tahar, 2008, P04). Secondly, they observed that many of the people who travel regularly in this city are students, making them an important population to study. Thirdly, they recognized that there is a lack of research on the concept of multimodal walking despite its recent importance, and they wanted to provide insights into the challenges faced by pedestrians in different cultural contexts.

Algerian public transport

Algeria is located in the northwestern part of Africa, on the southern shores of the Mediterranean Sea. Algeria is bordered by Morocco to the west, Tunisia and Libya to the east, Niger and Mali to the south, and Mauritania and Western Sahara to the southwest. (ABBAS Mohamed , MERZOUK Nachida Kasbadji, 2012, P179). Algeria is the gate of Africa, it is the largest country in this content and it has a strategic location in the north facing Europe (BOURAIYOU, Ahmed et al, 2020, P04). With a total area of 2,381,741 km², where the Sahara occupies 86% of the total area (BOURAIYOU, Ahmed and al, 2020, P04). It is divided administratively into 58 provinces in 2020.

Furthermore, in January 2019, Algeria's population is estimated at 43 million according to the National Office of Statistics (ONS), (National Office of Statistics (ONS), n.d.; BOURAIYOU, Ahmed and al, 2020, P04).

To add to that, according to Boubakour and Bencherif (2013), the development of urban transport in Algeria after the liberalization of the transport sector has had two phases. The first phase is the disappearance of the local historical operators: During the 1970s and 1980s, and long before in the large Algerian agglomerations, all medium-sized cities created their public transport operator. For the most part, these operators were in a quasi-monopoly situation in the urban transport market. This period was characterized by a severe shortage of transportation. These public companies, financially supported by the state through the municipalities, provided the public service as best they could. From the 90's and for lack of support, these public urban transport companies experienced serious financial problems. That is why they eventually disappeared in most of the country's cities, with the exception of the main public operator, ETUSA, in Algiers (BOUBAKOUR Farès , BENCHERIF Houria , 2013, P 92).

The second phase is the explosion of supply and the rise of operators. This phase comes after the liberalization of the public transport market. During this period, many private transport operators emerged in the form of very small companies, often with only one vehicle. The increase in supply is the most visible result. Between 1988, the year of liberalization, and 2002, the transport system grew by 266%, from 12,600 vehicles to 46,136 vehicles of all types for passenger transport alone (not including taxis). In 2008, there were more than 4,000 operators in the city of

Algiers alone. Compared to the 1980s, public transport has been able to respond much better to the needs of the population in terms of means of transport (BOUBAKOUR Farès , BENCHERIF Houria ,2013, P 93).

We will mention that this development focused only on the numbers, it did not guarantee a quality transport that could meet all the needs of the users, while taking into account the challenges in terms of sustainable development (BOUBAKOUR Farès , BENCHERIF Houria ,2013, P 95).

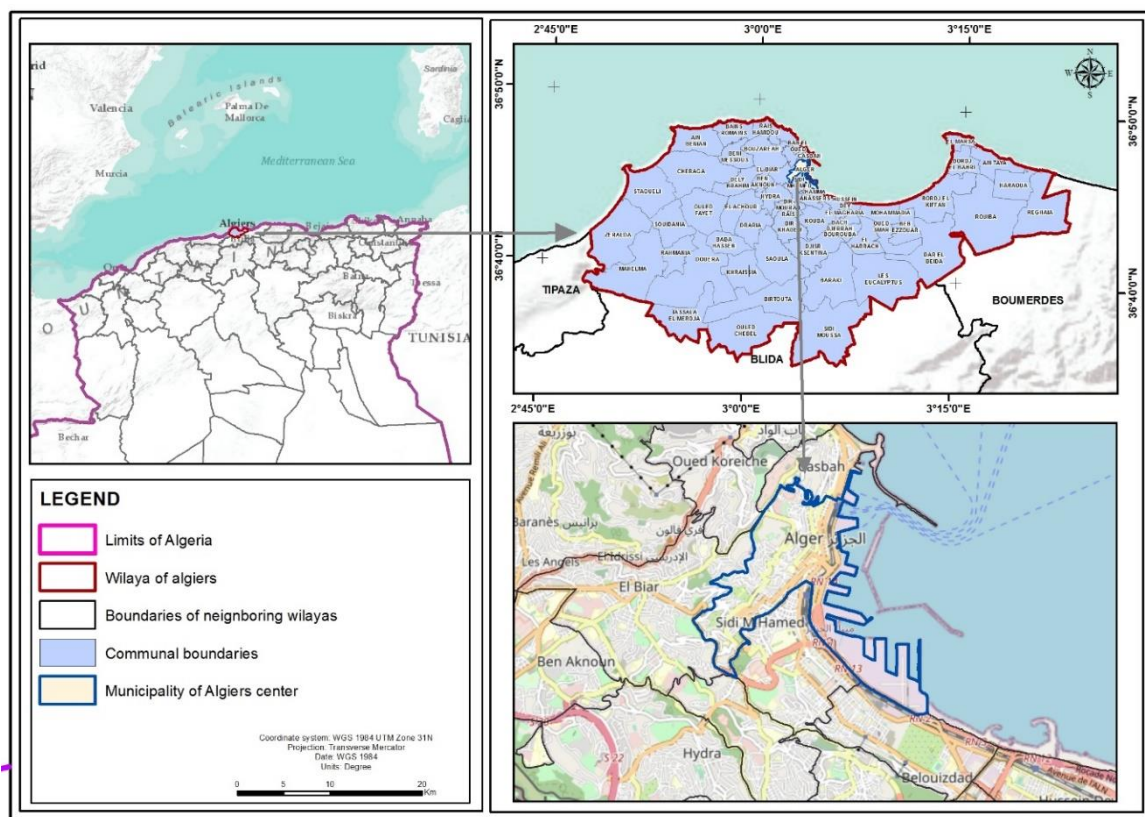
In Algeria, a rapid urban extension has been led by the demographic increase in the last decades. This expansion increased the need for mobility. This situation also increased the demand for transportation. Meanwhile, the improvement of urban transport is still an important issue for public authorities as well as the quality of service. (Houria BENCHERIF, Farès BOUBAKOUR, 2019, P560)

In Algeria, for the last decades, the issue of customer satisfaction has been a concern with the appearance of the law n° 01-13 of August 07, 2001 on land transport. The liberalization of the transport sector achieved its main objectives in increasing the supply of public transport, but it destroyed the circumstances of travel due to the inadequacy of public regulation (Boubakour, 2010; Houria BENCHERIF, Farès BOUBAKOUR, 2019, P562)

The Algerian state, since 2001, in order to correct the transport's failures, has become a central actor in projects that were incorporated in the structure of the national transport policy. Its main objective has always been to improve the transport sector and the quality of services, especially in urban areas. (Houria BENCHERIF, Farès BOUBAKOUR, 2019, P564).

The case study

map 1 The situation of Algiers



Source: S.ACHOURA, I. HARAUBIA, I. MOHINO, T. BAOUNI, 2023

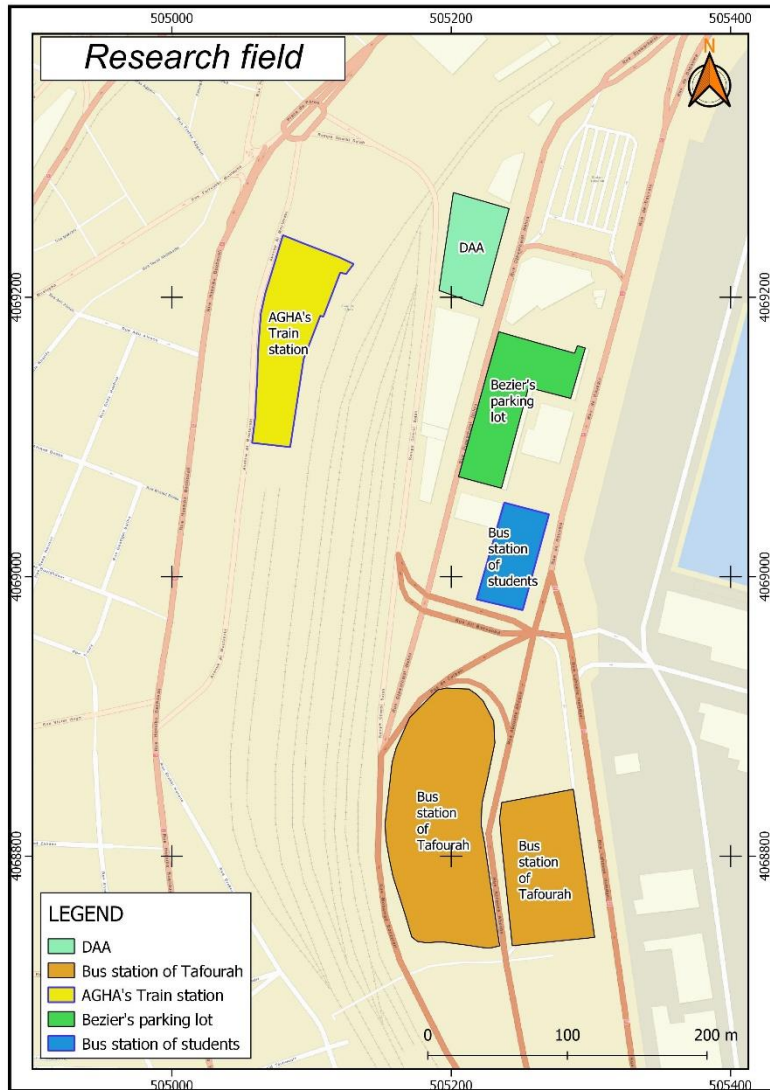
Algiers is the capital city of Algeria, located in the northwestern part of the country along the Mediterranean coast. It has a population estimated at 2.4 million inhabitants in 2008, or 6.9% of

the national population, making it one of the largest cities in Africa. (Tarek Medjad, M'hammed Setti and Guy Baudelle, 2015).

Our field of study includes AGHA train station, Tafourah bus station, student bus station, Bezier parking lot and the department of architecture of Algiers 01. We chose this neighborhood as a case study because it is one of the most visited neighborhoods in Algiers. Since it is one of the gates to the center of Algiers and contains the majority of the public transportation in Algiers. (look at map2)

The University of Benyoucef Benkhadda is one of the biggest universities of Algiers. It has five departments and contains 6352 students. In this study, the researchers focused on the department of architecture, which has 1400 students, due to location issues. The Department of Architecture is surrounded by many public transportation stations and a large parking lot. We also worked specifically with them because we conducted qualitative interviews with 300 students from many majors. The students who better understood our objective were the architecture students. These students also described their daily itineraries without any difficulty.

The Department of Architecture is located on the first floor under the Faculty of Commerce. It has two entrances, one of which is on the second floor of Bouzerari Mouhamed Street. This entrance is located in front of a large pedestrian crossing. It has a very good security because the policemen stay there all day. The second door is located at the back of the department on the first floor. This door faces the "Beauvais" street. It is under the gate to protect the students from the highway. However, the majority of students who come out of this door do not use this pedestrian gate.



Source: S.ACHOURA, I. HARAUBIA, I. MOHINO, T. BAOUNI, 2023

Methods:

To verify the hypothesis, the researchers used a practical inductive approach. Furthermore, the researchers made qualitative analysis based on documentary research, interviews with 82 students of the department of Architecture, and an in situ observation for pedestrians and pedestrian routes connected to the department of Architecture.

To clarify, the interviews with the 82 students of the department of Architecture were conducted face-to-face. The researchers have used an open-ended interview format to gather data. The interview questions focused on the barriers to multimodal walking experienced by the students and their opinions on the physical condition, safety, cleanliness, and dimensions of pedestrian routes. The data collected from the interviews provided qualitative insights into the reasons for the modal choice of university students in Algiers.

Furthermore, following other similar works (Jan GEHL, 2013) the researchers selected 120 randomly chosen university students and recorded their itineraries for physical analysis. Moreover, the researchers examined the pedestrian routes that connect the department of Architecture and the public transport stations, as well as the behavior of the students, to achieve their objective.

Additionally, the physical analysis of the pedestrian routes in the study involves observing and evaluating the condition of the sidewalks, paths, and crosswalks that connect the public

transportation stations and the department of architecture. These indicators play a crucial role in determining the barriers to multimodal walking among university students.

In addition, the condition of the sidewalks will be evaluated in terms of their width, surface quality, and obstacles such as obstructions or unevenness. If the sidewalks are in poor condition or not wide enough, they may make walking difficult or uncomfortable for students, which could deter them from using this mode of transportation.

Also, the condition of the paths and crosswalks are evaluated. Researchers examined the presence and condition of pedestrian signals, signs, and markings, which play an important role in ensuring the safety and comfort of pedestrians. If the paths and crosswalks are poorly marked or lacking proper signals, students may feel unsafe or uncomfortable when walking, which could discourage them from choosing this mode of transportation.

Likewise, the researchers also consider the presence of amenities along the pedestrian routes, such as benches, shelters, or lighting. These amenities can contribute to the overall comfort and safety of the walking experience for students, and their absence could serve as a barrier to choosing walking as a mode of transportation.

Additionally, the researchers divided their terrain of research into two parts, focusing on the pedestrian routes connecting the department of architecture to the train station and the two bus stations. Moreover, they observed the behavior of pedestrians on these routes to identify the problems that exist in these facilities.

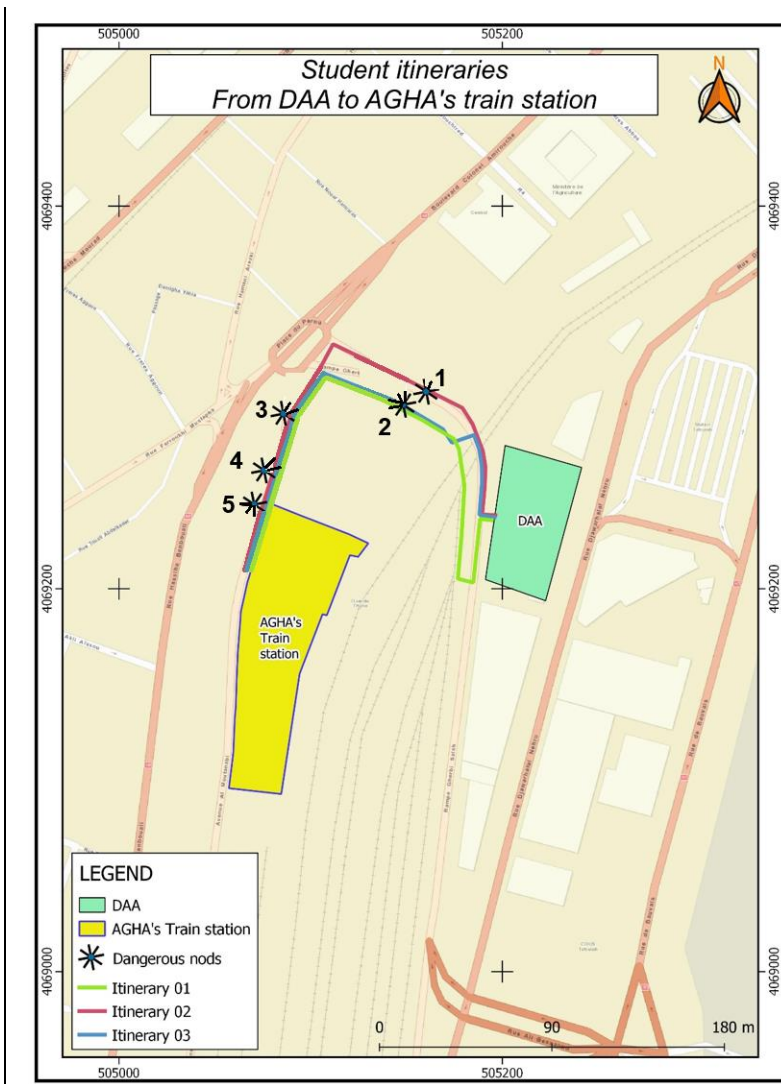
To clarify, the researchers divided the research terrain into two parts to make it easier for the reader to observe the different routes taken by the students. The first part is the pedestrian routes that connect the department of architecture and the AGHA train station. The second part is the pedestrian routes that connect the department of architecture and the two bus stations.

table 1 Physical analysis of the pedestrian paths

Term	Area 1	Area 2	...etc.
Clear width			
Clear height			
State of paving	Breaks		
	Protrusions		
	Slips		
	Different types		
Covers / fences manholes	Flush		
	Joints		
Level changes	Steps		
	Slope L		
	Slope T		
	Continuity guide line		
Grids	Direction of travel		
	Flush		
	Separation		

For the first part

map 3Students's itinerary from DAA to the train station of AGHA



Source: S.ACHOURA, I. HARAUBIA, I. MOHINO, T. BAOUNI, 2023

In this part there are three routes. In addition, these students came out of the department from the first door in the street "Bouzerari Mouhamed". By analyzing the pedestrian routes taken by the students, the researchers provide these photographs:
table 3 Pedestrian routes near AGHA's train station

photo 1 Dangerous nodes of the terrain of research in the part 01



Source: S.ACHOURA, I. HARAUBIA, I. MOHINO, T. BAOUNI, 2023

Nod	Issue	Explanation
1	Construction site	Makes walking difficult, causing pedestrians to walk on the highway
2	Dangerous crosswalk	Pedestrians cross the street at a dangerous crosswalk
3	Narrow sidewalks	Narrow sidewalks near the station cause some pedestrians to walk on the highway
4	Parked cars	Many parked cars along the route disturb pedestrians and cause them to walk on the highway
5	Lack of cleanliness	Unclean route and poorly placed garbage cans disturb pedestrians

photo 2 Dangerous nodes of the terrain of research in the part 01 from the map 03

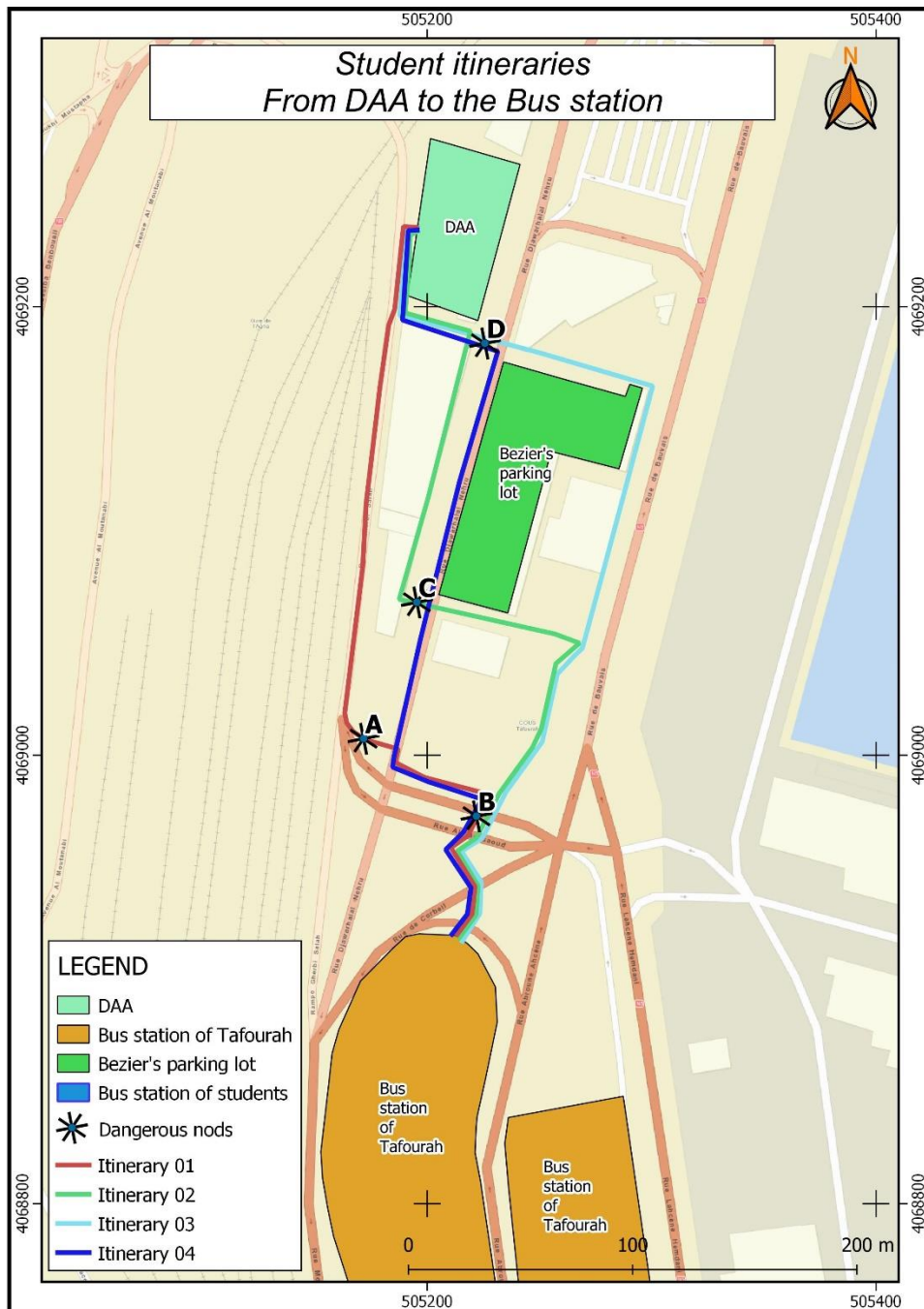


Source: S.ACHOURA, I. HARAUBIA, I. MOHINO, T. BAOUNI, 2023

Source: S.ACHOURA, I. HARAUBIA, I. MOHINO, T. BAOUNI, 2023

For the second part:

map 4 Students's itinerary from DAA to the bus stations



Source: S.ACHOURA, I. HARAUBIA, I. MOHINO, T. BAOUNI, 2023

table 4 Dangerous nods of the terrain of research

photo 3 Dangerous nods of the terrain of research in the part 02



Source: S.ACHOURA, I. HARAUBIA, I. MOHINO, T. BAOUNI, 2023

Nod	Description	Risk
A	Near the traffic lights, poor physical condition of sidewalk, high and dangerous sidewalk, old railroad nearby	High
B	Between two bus stations, no crosswalk, pedestrians walk on the highway	High
C	Isolated pedestrian route near parking lot entrance, used as a shortcut by students, dangerous crossing of highway	High
D	Only pedestrian route directly connected to gate, narrow and dangerous, potential for crime, blocks by cement bags, feared by female students, long detour to avoid	High
End of D	In front of second door of department, students cross highway without using gate, cars go fast, high and uncomfortable sidewalk	High

photo 4 Dangerous nodes of the terrain of research in the part 02 in the map 04



Source: S.ACHOURA, I. HARAUBIA, I. MOHINO, T. BAOUNI, 2023

Source: S.ACHOURA, I. HARAUBIA, I. MOHINO, T. BAOUNI, 20235.

5. Discussion

Part 01

The results of this analysis indicate that there are several barriers to safe and comfortable multimodal walking for university students in Algiers. The presence of a construction site along one of the pedestrian routes makes it difficult for pedestrians to navigate and increases the risk of walking on the highway.

In addition, the lack of safe pedestrian crossings and narrow sidewalks near the train station cause some pedestrians to walk on the highway, which is dangerous. The problem is compounded by cars parked along the route, which disrupt pedestrian flow and increase the probability of walking on the highway.

Finally, the lack of cleanliness of the routes and the improper placement of trash cans further hinder the comfort and safety of pedestrian travel. These findings highlight the importance of improving the physical conditions of pedestrian routes in Algiers to encourage multimodal walking and increase the safety and comfort of university students.

Part 02

The results of the analysis of the pedestrian routes in the four routes reveal several problems that threaten the safety and comfort of pedestrians, especially students. One of the main problems is the lack of pedestrian crossings in certain areas, which forces pedestrians to cross the highway, exposing them to dangerous conditions. In addition, the majority of sidewalks are in poor physical condition, making the walking experience unpleasant and dangerous. The narrow sidewalks also contribute to the safety hazards.

There are also several dangerous intersections in the area, including areas with high sidewalks, old railroad tracks, and isolated pedestrian routes. Some of these areas are of particular concern to female students who express fear of walking through them. The lack of security in these isolated pedestrian areas increases the potential for criminal activity.

In addition, some students coming from the Tafourah bus station are forced to cross the bus station, and most of them don't use the sidewalks, which are crowded during rush hours. This results in increased traffic on the sidewalks, making them even more difficult and dangerous to navigate.

Overall, the analysis highlights the need for immediate intervention to improve the safety and comfort of pedestrian routes in the area.

6. Barriers to multimodal walking

After analyzing pedestrian routes that surround the department of architecture, observing the behavior of 120 students and saving their itinerary, interviewing 82 students from the department of architecture we defined multimodal walking's obstacles among the department of architecture's students in Algiers.

The physical condition of pedestrian routes:

The predominant state of pedestrian walkways is in a state of degradation. This is largely attributed to their advanced age and the presence of significant elevations and potholes, which pose a hazard to pedestrians and disrupt their mobility. Conversely, the infrastructure of vehicular roadways is maintained in satisfactory condition. This discrepancy highlights the vulnerability of pedestrians in these areas, a result of long-standing prioritization of motorized transportation by governing bodies.

Hygiene:

A portion of pedestrian walkways is marred by substandard cleanliness conditions. The presence of waste containers within limited sidewalk space impedes pedestrian movement and comfort. In certain areas, ongoing construction projects necessitate that pedestrians divert to vehicular roadways, increasing their potential exposure to danger. Furthermore, the presence of unclean water originating from nearby buildings on sidewalks can negatively impact the sensory experience of pedestrians, compromising both their olfactory and visual comfort.

The route's width:

Many pedestrian walkways are characterized by insufficient width, requiring pedestrians to divert onto vehicular roadways when encountering other pedestrians in close proximity. This situation is exacerbated by the presence of parked vehicles along the sides of these walkways, further diminishing available space and heightening the potential for criminal activity. On the other hand, some streets are designed with excessive width. This disparity in design and planning quality can be attributed to inadequate policy and poor urban planning decisions.

Security:

A number of pedestrian walkways are located in isolated areas and lack adequate security personnel, creating an environment that is conducive to criminal activity. This has led to a reluctance among many students, particularly females, to utilize these paths, often opting to alter their route in order to avoid them. Additionally, these walkways frequently present physical hazards, such as potholes and aging metal fixtures, which pose a risk of injury to pedestrians. In fact, there have been instances of individuals falling on these sidewalks, particularly among the student population. These safety and security concerns are a result of a lack of proper infrastructure and maintenance.

7. Conclusion:

In conclusion, this study aimed to identify the barriers to multimodal walking among university students using Algiers as a case study. A qualitative analysis was conducted based on documentary research, personal interviews with 82 students of the department of architecture, and in situ observation of pedestrian routes. The results showed that the physical condition, safety, cleanliness, and dimensions of pedestrian routes were significant barriers for students to use multimodal walking.

Furthermore, the study also revealed that the majority of students preferred to travel in groups, which further highlights the importance of ensuring safety and hygiene of pedestrian routes. Based on the findings, it is recommended that local authorities in Algiers improve pedestrian routes that surround the department of architecture, to enhance the satisfaction of pedestrians and encourage students to use multimodal walking as a mode of transportation.

To fully understand the barriers to safe and comfortable pedestrian travel in the area, further research that includes a wider range of participants and perspectives is necessary. The current study provides important insights into the experiences of university students in Algiers, but it is limited in scope and does not take into consideration the perspectives of other groups of pedestrians or relevant stakeholders. By expanding the sample size and incorporating a wider range of perspectives, future research can provide a more comprehensive understanding of the challenges faced by pedestrians in the area and inform the development of effective interventions to improve pedestrian safety and comfort.

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