

**Sustainable urban mobility in a medium-sized mountain town:
Case of the town of Tizi-Ouzou****AKKACHE-MAACHA Dehbia¹, BELGAID-BATACHE Lynda^{2*}**¹ Mouloud Mammeri -Tizi-Ouzou University, (Algeria), maachadehbia@gmail.com² Mouloud Mammeri -Tizi-Ouzou University, (Algeria), lynda.belgaid@ummto.dz**Received:** 13/03/2025**Accepted:** 29/04/2025**Published:** 25/05/2025**Abstract:**

Faced with rapid urbanization, mobility in Tizi-Ouzou has become a major challenge. The increase in the vehicle fleet and the intensification of travel exacerbate the imbalance between transport supply and demand, mainly due to the lack of public transportation. Despite the implementation of ETUSTO, a multimodal station, intermediate stations, and a cable car, traffic congestion persists. This study questions the existence of a genuine transport policy by relying on surveys, field visits, and documents from the DTWTO. For sustainable development, reducing car use in favor of public transport and soft mobility is essential to improving the quality of life in the city center.

Keywords: Tizi-Ouzou, Urban mobility, congestion, external effects, traffic plan.**JEL Classification :** R41, R42

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1. Introduction

Mobility is often associated with travel demand, commonly defined as the number of trips an individual makes from one location to another. This concept has evolved as modern individuals frequently change their residence, region, or even country, and travel regularly or occasionally for professional or personal purposes over varying distances. In addition, people seek access to goods and services within a radius that often extends well beyond walking distance, and they dedicate their free time to diverse activities. However, mobility is not without constraints—it is influenced by factors such as travel costs, time consumption, and physical fatigue.

The agglomeration of Tizi-Ouzou has undergone a remarkable urban transformation. After a prolonged period of stagnation, the so-called "Genêts" town began to grow significantly following several development plans implemented between 1970 and 1977. These initiatives elevated the city to the status of a "regional capital." This transformation is evidenced by substantial demographic growth and spatial expansion. Tizi-Ouzou's administrative, political, and academic roles—along with its integration into the national and regional urban network—have reinforced its economic, cultural, and social development.

Transport has played a central role in this evolution, making Tizi-Ouzou increasingly attractive. The city now concentrates a wide range of urban functions, including economic, administrative, and educational activities. As a medium-sized urban center, its sphere of influence reflects a considerable demographic and functional weight.

Despite these developments, the rapid urbanization and growing mobility needs have generated complex challenges related to transport demand and supply, traffic congestion, negative externalities, and social costs. This raises a central research question: How effectively does the urban transport system in Tizi-Ouzou respond to the mobility needs of its population, and what public policy measures can improve its performance and sustainability?

To address the complex transport and mobility issues observed in the city of Tizi-Ouzou—ranging from infrastructure saturation to inadequate public transport coverage—this article seeks to analyze the current urban transport system in terms of both supply and demand. It also examines the structural and operational challenges that hinder its performance. In order to provide a comprehensive understanding of these dynamics and propose viable public policy interventions, a specific research methodology was adopted.

Research Methodology

The methodology employed in this study is based on a qualitative and descriptive approach, supported by the use of secondary data obtained from internal documents of the Transport Department of the Wilaya of Tizi-Ouzou. The analysis focused on assessing the supply and demand of urban transport, identifying dysfunctions in the road network, and evaluating the negative externalities generated by increasing urban mobility. Statistical data related to transport lines, operators, vehicle fleet size, and vehicle age were analyzed to provide an accurate overview of the current transport system. Additionally, field observations were conducted to identify specific problem areas and traffic congestion points. This

methodological approach aims to highlight the limitations of the current transport offer and to inform public policy toward more efficient and sustainable solutions.

2. Transport and Traffic Situation in the City of Tizi-Ouzou

Urban transport, commonly confused with “public transport”, is a service production activity which brings human and material resources together such as infrastructure, vehicles, operating techniques and regulations. Urban space is, in fact, a place of communication, meeting of supply and demand which requires permeability to be open to exchanges. However, it must not be overwhelmed by flows and “the transport problem is directly linked to those of the location of residences and that of activities”¹

As passengers were not supported by public transport, the State called for private transport companies to enter in the market. Indeed, the government decrees law 88-17 of May 10, 1988 relating to the orientation and organization of land transport.² This law represents a legal instrument linked to the process of privatization of passenger transport in Algeria.

Several factors have militated in favor of increasing the car fleet in Algeria, more particularly in the wilaya of Tizi-Ouzou. We mention:

- Granting credit to individuals to purchase foreign cars;
- Presentation of all car brands by dealers in Tizi-Ouzou, Ouaguenoun, Azazga...
- Availability of spare parts sales stores;
- Opening of vehicle maintenance and repair workshops;
- Opening of a car “scrapyard” in Draâ-Ben-Khedda which is supplied by this car park.
- Based on this observation, the transport department of Tizi-Ouzou notes a significant improvement in transport thanks to buses, urban collective and interurban collective taxis which serve all peripheral directions of the city. Despite increased means of transport, they still remain insufficient, particularly towards the Upper Town (Haute-Ville) and M'DOUHA, given the flows of people converging towards the regional capital. The displacement of the population represents a serious problem for both residents and municipal officials. The daily reality of Tizi-Ouzou reflects a confusing situation due to the importance of migratory flows (around 500,000 inhabitants during the day and more than 140,000 in the evening³) which have caused a saturation of the city's space and infrastructure. The city of Tizi-Ouzou is facing major traffic problems. Some singular points prevent the good functioning of the road network. This is the following subject.

2.1 Identification of Traffic Problems in the City of Tizi-Ouzou

Traffic problems identified by the study of the traffic plan of the city of Tizi Ouzou⁴:

- Congestion generating vehicle/vehicle conflicts, but also vehicle/pedestrian conflicts;
- Absence of adequate horizontal and vertical signage;
- Centralization of public buildings and social infrastructure in the city center generates conflicts between cars and pedestrians in terms of traffic and occupation of parking areas;
- Degradation of the roads of the main and secondary networks;
- Absence of direction and user orientation signs on almost the entire urban perimeter;

- Insufficiency of the upper town road network in terms of capacity due to parking on the left and right of the roadway;
- Several possibilities of access to the city center via different entrances and congestion points make traffic very difficult;
- Inefficiency of the traffic pattern in some places;
- Existence of a single bypass (southern ring road) forcing all flows from the Upper Town to the city center to access the southern neighborhood of the New Town (Nouvelle-Ville);
- Lack of comfort and safety for pedestrians at intersections;
- Parking saturation throughout the city and lack of compliance with parking regulations;
- Parking on the left and right of the road, at crossroads, near bus stops, in double lines on certain streets and on sidewalks;
- Lack of parking lots.

2.2 Identification of Singular Points

Several singular points were also noted in addition to the traffic problems identified previously. These are [Idem]:

- The layout of certain intersections: the absence of adequate layout of certain intersections leads to vehicle/vehicle conflicts and very pronounced vehicles/pedestrians;
- The presence of bus stops and vans on the very branches of certain intersections generates vehicle/vehicle and vehicle/pedestrian conflicts;
- The reduced operation of certain intersections which, nevertheless, have adequate layout.

3. Supply and Demand for Urban Transport

3.1 The Urban Transport Offer

“The urban transport offer refers to all the infrastructure and equipment (lanes, stations, stops and rolling stock) which are made available to users for their travel needs within the city”⁵. Since the implementation of a micro-enterprise system for young people, there is a significant number of operational companies in the transport sector. Vans and minibuses are the most notable means in the different stations of the city. In what follows, we will deal with public passenger transport, taxi transport, management of passenger flows in Tizi-Ouzou, passenger rail transport and cable transport.

3.1.1 Public Passenger Transport

According to the internal DTWTO document, “passenger transport is almost 100% ensured by private operators. The only public operator is ETUSTO which operates lines at the urban level”⁶. The following table provides us with information on this category of transport.

Table 1. Situation of Road Passenger Transport as of 08/31/2022

Type of lines operated	Number of lines	Number of operators	Park operated	Places offered
Intermunicipal	234	2 301	2 560	48 749
Inter wilaya	105	174	298	13 691
Urban-private-suburban	<u>15</u>	<u>346</u>	<u>451</u>	<u>17 804</u>
Urban - ETUSTO	<u>7</u>	<u>1</u>	<u>40</u>	<u>4 000</u>
Rural	375	2 656	2 807	39 631
Total	736	5 478	6 156	123 875

Source: Internal document at the transport department of the wilaya of Tizi-Ouzou, p. 9, September 2022.

The public passenger transport network consists of 736 lines, 5,478 operators, 6,156 vehicles, and offers a total capacity of 123,875 places per rotation. The table below gives the distribution of the public passenger transport fleet by vehicle type.

Table 2. Public Passenger Transport Fleet by Vehicle Category as of 08/31/2022

Lines	Autocar	autobus	Minibus /MC	vans	Total
Intermunicipal	114	00	703	1 743	2 560
Private urban/suburban	11	118	97	225	451
Public urban	0	40	0	0	40
Inter wilaya	126	00	172	00	298
Rural	11	00	193	2 603	2 807
Total	262	158	1 165	4 571	6 156
In %	4%	3%	19%	74%	100 %

Source: Internal document at the transport department of the wilaya of TO, p. 9, September 2022.

Broken down by vehicle type, 74% are vans and 19% are minibuses. Concerning the distribution of the POS fleet according to the age of the vehicles operated, the following table will give us the following statistics:

Table 3. Distribution of the Passenger Transport Vehicle Fleet (buses) by Age Group

Age operators	Less than 5 years	From 5 to 9 years	From 10 to 14 years	From 15 to 19 years	20 years and more	Total
Private operators	199	298	472	1838	3309	6116
Public operators (ETUSTO)	10	0	14	16	0	40

Source: Internal document at the transport department of the wilaya of Tizi-Ouzou, p.10, September 2022.

According to the table above, 3309 vehicles (54%) are 20 years old and over while 5163 vehicles (84%) are 15 years old and over. Therefore, we note the dilapidation of the vehicle fleet since only 209 vehicles are classified in the age group of less than 5 years. This may

endanger the safety of passengers. The renewal of equipment is more than necessary in order to protect the lives of travelers.

It is important to note that the average age of vehicles is 18.3 years for private operator vehicles, while the average age of ETUSTO vehicles is 11.63. The cost of maintaining the rolling stock is very expensive because of the purchase price of spare parts and the salaries of the maintenance and repair workforce.

3.1.1.1 Urban Public Transport Network

The urban collective transport network is made up of six lines articulated around five stations located on the outskirts of the city of Tizi-Ouzou, a multimodal station and seven taxi transport lines. They cover the following axes⁷:

- The Bouhinoun multimodal station;
- The inter Daira station of Boukhalfa;
- The inter Daira station of Oued-Aissi;
- The inter Daira station of Timizart Loghbar;
- The inter Daira station of Beni-Douala.

According to the new traffic plan, the urban public transport network is based on⁸:

- Distinction between urban collective transport and interurban transport;
- Creation of parking areas at the entrance to the city;
- Creation of scheduled parking areas within the framework of the PDAU;
- Creation of own site transport in the medium term;
- Development of new modes of transport, particularly the cable car.
- Generally speaking, urban transport is made up of urban and suburban transport lines.

3.1.1.2 Urban Transport Lines

The following table presents the summary of urban public transport lines, the number of stops created and the routes followed.

Table 4. Summary of Transport lines, number of Stops per line and Routes Followed

Line Name	Number of Stops	Routes Followed
Boukhalfa Station-Timizart-Loghbar Station	07	RN 12, Larbi Ben M'Hidi avenue, Abane Ramdane avenue, Tarbouche Mourad avenue
Timizart-Loghbar Station-Boukhalfa Station	08	RN 12, Tarbouche Mourad avenue, Abane Ramdane avenue, Larbi Ben M'Hidi avenue
Boukhalfa Station - Oued-Aissi Station	13	RN 12, Larbi Ben M'Hidi avenue, Abane Ramdane avenue, Tarbouche Mourad avenue
Station Oued- Aissi- Station Boukhalfa	11	RN 12, Tarbouche Mourad avenue, Abane Ramdane avenue, Larbi Ben M'Hidi avenue
Boukhalfa station - Bouhinoun station	08	RN 12, Boulevard Stiti, road of Maâtkas, CW 147, Rocade Sud
Bouhinoun Station - Boukhalfa Station	10	Rocade Sud road, Ihasnawen road, Beggaz Brothers street, 20 Avril crossroads, Ouamrane brothers street, Lamali Ahmed street, Abane Ramdane avenue, Larbi Ben M'Hidi avenue, RN

		12
Boukhalfa Station – Beni-Douala Station	11 11	RN 12, Larbi Ben M’Hidi avenue, Abane Ramdane avenue, Lamali Ahmed street, Ouamrane Brothers street, crossroads of 20 Avril, Boulevard Krim Belkacem, Beni-Douala road

Source: CNTC -Spa Boumerdes, Traffic plan study for T-O city, phase V, our groups, August 2019, p.79-100

The number of stops depends on the number of passengers that are taken on the routes and the number of residents in the different sectors of the city.

3.1.1.3 Urban University Transport Lines

Urban university transport is provided on 24 lines, 34 routes followed, used by 132 buses and 5 minibuses making 204 rotations per day. They are presented in the following table:

Table 5. Urban University Transport Lines

N° of the Line	Routes	Bus Number	Number of Rotations
1	Hasnaoua 1 Rehahlia 1+2	03 bus	09
2	Hasnaoua 1 Ex Campus (Oued-Aissi)	04 bus	09
3	Hasnaoua 1 M’Douha	05 bus	08
4	Hasnaoua 1 Didouche Mourad	04 bus	06
5	Hasnaoua 1 Draâ-Ben -Khedda	08 bus	05
6	Hasnaoua 1 Boukhalfa garçons	15 bus	06
7	Hasnaoua 2 Rehahlia 1+2	08 bus	09
8	Hasnaoua 2 Ex Campus (Oued-Aissi)	04 bus	09
9	Tamda Boukhalfa	01 bus	05
10	Hasnaoua 2 M’Douha	06 bus	08
11	Hasnaoua 1 Ex Habitat	02 bus	10
12	Hasnaoua 2 Draâ-Ben -Khedda	02 bus	05
13	Hasnaoua 2 Ex Habitat	02 bus	10
14	Hasnaoua 2 Didouche Mourad	01 bus	06
15	Hasnaoua 2 Boukhalfa garçons	05 bus	06
16	Tamda Rehahlia 1+2	02 bus	05
17	Tamda Ex Campus (Oued-Aissi)	04 bus	05
18	Tamda Didouche Mourad	01 bus	05
19	Tamda M’Douha	02 bus	05
20	Tamda Draâ-Ben -Khedda	02 bus	04
21	Boukhalfa/Hôpital Hasnaoua 2	04 bus	05
22	Boukhalfa M’Douha	05 bus	06
23	Tamda Hasnaoua 1	10 bus	05
24	Boukhalfa Hamlat	02 bus	08

25	Tamda	Ex Habitat	01 bus	05
26	Boukhalfa	Draâ-Ben -Khedda	05 bus	05
27	Boukhalfa/Autoroute	Hasnaoua 2	04 bus	05
28	Hamlat	Hasnaoua 2	01 bus	06
29	Hamlat	Draâ-Ben -Khedda	02 bus	05
30	Tamda	Hasnaoua 2	12 bus	05
31	Sanatorium	Hasnaoua 1	01 minibus	05
32	Sanatorium	Hasnaoua 2	02 minibus	05
33	Sanatorium	Ex Habitat	01 minibus	05
34	Sanatorium	M'Douha	01 minibus	05

Source: CNTC-SPA Boumerdes, Traffic plan study for the city of Tizi-Ouzou, report V: presentation and consultation, edition of final reports, August 2019, p.105.

Lines 6, 7, 13, 23, 30 mobilize a total of 47 buses and 35 rotations following the flow of students converging to these locations. Concerning the other 29 lines, sometimes carried out over short distances, the number of buses is smaller, but the number of rotations has increased.

3.1.1.4 Suburban University Transit Lines

Suburban university transportation is spread over 16 lines and 35 routes. The number of buses is 97. The table below presents the different localities served there:

Table 6. Suburban University Transportation Lines

N° of the line	Routes	Number of buses
01	Tadmait – Hasnaoua 1 Tadmait- Tamda	03
02	Beni-Zmenzer- Hasnaoua 1 Beni-Zmenzer- Tamda	06
03	Boudjima- Hasnaoua 1 Boudjima- Tamda	06
04	Ouaguenoun- Hasnaoua 1 Ouaguenoun -Tamda	05
05	Souk-El-Thenine-Maatkas-Hasnaoua 1 Souk-El-Thenine-Maâtkas-Tamda Maâtkas-Betrouna—Hasnaoua 1 Maatkas-Betrouna—Tamda	14
06	Makouda-Crête-Hasnaoua 1 Makouda-Tamda Thala Bouzrou-Makouda- Hasnaoua 1 Istithen-Makouda-Hasnaoua 1	08
07	Sidi Naamane-Hasnaoua 1-Tamda Zeboudj Kara- Sidi Naamane-Hasnaoua 1	02
08	Tirmitine-Hasnaoua 1 Tirmitine- Tamda	06
09	Beni-Douala-Hasnaoua 1 Beni-Douala-Tamda	08

10	Azazga-Hasnaoua 1 Azazga-Tamda	09
11	Freha-Hasnaoua 1 Freha-Tamda	05
12	Larbaa-Nath-Irathen-Hasnaoua 1 Larbaa-Nath-Irathen-Tamda	10
13	Tizi-Rached-Hasnaoua 1	02
14	Mekla-Hasnaoua 1 Mekla-Tamda	06
15	Sid Ali Bounab-Hasnaoua 1	02
16	Ait-Aissa-Mimoun- Hasnaoua 1 Ait-Aissa-Mimoun- Tamda Ikhalouiene-Ait-Aissa-Mimoun-Hasnaoua 1	05

Source: CNTC -Spa Boumerdes, Study of the traffic plan for the city of Tizi-Ouzou, report V: presentation and consultation, edition of final reports, August 2019, p. 106.

Lines 05, 06, 09, 10, 12 correspond, respectively, to the Dairas of: Maatkas (14 buses), Makouda (08 buses), Beni-Douala (08 buses), Azazga (09 buses), Larbaa Nath Irathen (10 buses). Bus allocation is based on the number of students transported to these different locations. The multiplication of university transport lines (urban and suburban), i.e. 50 lines in total, has contributed to the congestion of certain routes in the regional capital. To deal with this traffic congestion, the study of the traffic plan for the city of Tizi-Ouzou “calls upon the authorities on the need to launch a study for the development of a transport plan for the benefit of university transport”.

3.1.2 Transport by Taxi

The number of taxi service operating licenses, allocated in the wilaya of Tizi-Ouzou, amounts to 14,090. Only 3,841 are operated; i.e. a rate of 27.265%. There are seven taxi transport lines. The following table shows the distribution of the taxi fleet by category.

Table 7. Distribution of the Taxi Fleet by Category as of 08/31/2022

Type of taxi	Individual Taxis	Collective Taxis	Interurban collective taxis	Total
Number	1129	60	2106	3841
In %	29 %	16 %	55 %	100 %
Places offered	4 516	4 242	16 848	25 606

Source: Internal document at the Transport Department of the wilaya of Tizi-Ouzou, p.10, 2022.

Interurban collective taxis are ranked first since they represent 55% of the taxi fleet in the wilaya. The number of individual taxis is significant, i.e. 1,129 taxis. Shared taxis represent 16% of the taxi fleet because vans (74%) and minibuses (19%) have taken their places. The urban transport offer is marred by inadequacies in the quality of service: lack of training for transporters (only 177 drivers trained in 2021, 75 in 2022), lack of hygiene, non-compliance with timetables and stops, etc.

3.1.2.1 Management of passenger flows in the city of Tizi-Ouzou

The flow of urban and non-urban travelers is managed at the bus stations operated by the ATLAS SOGRAT SPA. The ‘SOCIÉTÉ GARE ROUTIÈRE ATLAS EPE/SOGRAT/SPA’ operates and manages the stations of Bouhinoun and Boukhalfa. According to the director of DTWTO, the two other inter-daira stations, Beni-Douala and Timizart Loghbar stations, do not have managers. Since September 2023, major redevelopment work at Timizart-Loghbar station has been underway with a view to offering better services to travelers.

3.1.2.2 Activities of the Bouhinoun Multimodal Station

Bouhinoun station includes 25 boarding platforms serving local and inter-wilaya lines. The table below presents the number of operators and departures per day for each line.

Table 8. Number of operators and departures per day, by line category as of 08/31/2022

Line Category	Number of operators/line	Number of departure/day
Big lines	10	17
Average lines	143	407
Local lines	208	793

Source: Information taken from the DTWTO internal document, p. 11.

The Bouhinoun multimodal station houses a platform accommodating 63 buses/day, several taxi ranks where 296 taxi drivers operate, 2 van stations with a total of 188 vans heading to 2 destinations which are Larbaa Nath Irathen and Ain-El-Hammam. The number of people passing through the Bouhinoun multimodal station is around 60,000 travelers per day.

3.1.2.3 The Activities of the Boukhalfa inter Daira Station

The Boukhalfa inter daira station covers an area of 03.38 ha and was assigned on 02/10/2014 to SOGRAT by the Tizi-Ouzou land agency. It is equipped with:

- 01 platform which serves the Dellys line, with 17 operators;
- 22 vehicles making 71 departures per day;
- 01 urban platform for 130 buses per day, 01 taxi station where 06 individual taxis operate and 12 platforms serving local lines with 338 vans to the destinations of Draâ-Ben-Khedda, Tigzirt, Boghni, Makouda, Boudjima, Tirmitine...⁹

NB: The Beni-Douala and Timizart-Loghbar stations do not currently have managers.

3.1.3 Passenger Rail Transport

According to the DTWTO, in the wilaya of Tizi-Ouzou, “rail passenger transport is carried out by the SNTF on the Oued-Aissi - Thenia - Algiers line by train shuttles. The number of services that are carried out is 12 departures per day from Oued-Aissi; the maximum train capacity is 586 passengers per train, including 144 seated places and 442 standing places”¹⁰ the following table gives us the statistics concerning passenger traffic of 2021 and 2022.

Table 9. Situation of passenger traffic for the year 2021 until 08/31/2022

Railway Stations	2021	2022 (08/31/2022)
Oued-Aissi Université	25 082	19 048
Kaf Naâdja	168 156	144 236
Tizi-Ouzou	108 289	96 529
Boukhalfa	25 515	22 484
Draâ-Ben-Khedda	20 397	16 875
Tadmaït	51 653	44 856
Total	399 092	344 028

Source: Internal document at the Transport Department of the wilaya of Tizi-Ouzou, p.11, September 2022.

The Kef Naadja and Tizi-Ouzou railway stations contain more travelers than the other stations since 70% of passengers frequent them. This can be explained by their location near the most inhabited sectors of the city and the importance of flows entering it from the East (Azazga, Bouzguene, Azeffoun, Mekla, LNI, AEH, Tizi-Rached, Iferrhounene) and the South-East (Beni-Yenni, Ouacifs, Ouadhias).

3.1.4 Cable Transport

The city of Tizi-Ouzou has a new means of transportation. This is transport by cable car. The Tizi-Ouzou cable transport line, between Bouhinoun and the wilaya station (section 4), is operated by ETAC, a subsidiary of the Algiers metro company.

This line is an asset for the modernization and development of urban transport in the town of « Genêts ». This line connects the Kef Naadja multimodal station to Redjaouna over a distance of 6 km by air. For this purpose, six stations have been programmed, including four intermediate ones: Kef Naadja multimodal station (departure station), station N° 1 (New Town), station N° 2 (November 1 stadium), station N° 3 (Saïd Babouche Middle School), station N° 4 (Sanatorium Hospital), arrival station (Redjaouna station). Since January 2020, section 1 is operational. Cable transport is carried by 65 10-seater cabins out. In the first half of 2022, the Tizi-Ouzou cable car transported 1,622,032 passengers.

3.2 The Demand for Urban Transport

Several factors determine this demand, the main ones being the length of the journey, the reasons for travel, the availability of means of transport and the prices charged.

3.2.1 The length of the Journey

The lack of development of a real transport and travel policy in the city has weighed heavily on the demand for urban transport. The public authorities were content to meet the demand for housing without worrying about the economic challenges of the city. The anarchic urbanization of the city has generated a plethora of supply on certain lines and an almost total absence of means of transport on others; which prevents rapid access of individuals residing on the outskirts to the goods and services available in the city center.

3.2.2 Reasons for Travel

Urban functioning is at the origin of diversified flows: population migrations, flow of goods and transport are essential to human activities. Tizi-Ouzou city is characterized by intense daily mobility. The following table presents the importance of flows entering the town.

Table 10. Origin of Flows Entering the Town of Tizi-Ouzou

Origin	Dairas	Number of Municipalities
East	Azazga Bouzeguene Azeffoun Mekla LNI AEH Tizi-Rached Iferhounene	28
South East	Ouacif Beni-Yenni Ouadhias	10
East Center	Beni-Douala	04
North	Tigzirt Makouda Ouaguenoun	08
West	DBK	04
South	Draa-El-Mizan Tizi-Ghennif Boghni	13
Total		67

Source: Internal document at the transport department of the wilaya of Tizi-Ouzou, September 2022.

The reasons for travel may be work, studies, the market, shopping, administrative matters, leisure and family visits. Travel for work is the most dominant. Their scale is linked to urban sprawl. At peak times, these trips create congestion; all entrances and exits to the town of Tizi-Ouzou are paralysed¹¹.

3.2.3 Availability of Means of Transport

Urban travel requires the use of different means of transport, tools of mobility and exchange. “The conditions of circulation, that is to say accessibility to the city, intra-urban relations and connection with the outside world are based on individual and/or collective, private and public means of transport and routes in quality, depending on their position of natural elements in all cities¹².”

3.2.4 Transport Costs

Transport costs are the responsibility of customers or users. Walking does not incur any expense, but the costs become significant with the automobile. The user prefers individual transport because of its flexibility of use and the costs that seem bearable (fuel, maintenance and repair costs). So-called “social” costs are added to expenses linked to urban transport. They consist of road and infrastructure costs, the extension of distances to be covered which limits the effectiveness of coverage in low-density neighborhoods to travel during peak hours, the operation of services (maintenance, repair, depreciation, etc.) and security costs.

3.2.5 The Modes of Transport Used

Since the transfer of ECOTRAP assets to the private sector, private public transport, which is carried out by bus, has entered into competition with minibuses, collective taxis, individual taxis and vans. Transport by taxi “is taken care of by the private sector by granting specific regulations regarding the allocation of operating licenses (decree 86-287 of 9/12/1986), general operation (decree of 8/8/1993) and pricing (decree of 4/7/1994)”¹³. Private transport designates “vehicle operators with atomized ownership and management methods decentralized to the crews (drivers, conductors) and not subject to official accounting”¹⁴. Alongside collective means of transport, there are two other individual means of transport: the automobile and walking. Bicycles, motorbikes, mopeds...do not exist in Tizi-Ouzou. Its relief does not lend itself to this; the habit does not exist either.

4. Negative externalities and social costs induced by urban transport in Tizi-Ouzou

Urban sprawl, the development of activities in the city, the use of the automobile are the essential causes which increased the density of travel in the capital of the “Genêts”.

Urban transportation is responsible for urban congestion; air pollution; degradation of land or water due to carbon emissions from vehicles...; noise; accidents that happen in the city. Therefore, urban transport generates negative externalities and represents a social cost for the municipality. Urban transport carries internal and external costs which are called social costs of transport¹⁵:

* **Internal costs** are made up of public costs (subsidies for public transport, road creation) and private costs (vehicle depreciation, fuel, insurance, taxes, maintenance, ticket price);

* **External costs** are made up of congestion costs (loss of time, delays), human costs (accidents, deaths, injuries), environmental costs (air pollution, noise), and other local costs (wear and tear of roads, landscape degradation, cutting effects).

4.1 Congestion Costs

Congestion reduces the speed of automobile traffic. Road congestion costs are difficult to measure since they incorporate the costs of delays and loss of time imposed on third parties.

4.2 Human Costs

Accidents generate market costs (medical costs, private material costs such as vehicles and public material costs such as damaged infrastructure) and non-market costs. Other market costs, such as the loss of production due to the number of killed, wounded or prisoners, are not compensated. Finally, non-market costs represent moral damage that is difficult to measure. They are most often assessed based on court cases and sums awarded to take into account the pretium doloris (damage linked to the physical and moral suffering of an individual) of relatives of road accidents' victims.

4.3 Environmental Costs

Tizi-Ouzou city provides transport which generates pollution and nuisances that are only elements of the process of degradation of the environment and the living environment.

4.3.1 Air pollution

Toxic gases and carbon monoxide from exhaust pipes are the cause of air pollution. Industrial air pollution is almost non-existent in the city of Tizi-Ouzou. The automobile would be the main cause of air pollution. Using a vehicle in a congested city like Tizi-Ouzou would be a real problem in terms of pollution in a few years.

The greatest damage affects health: cardiovascular deaths and deaths from lung cancer. The consequences in terms of air pollution are very worrying because heavy road traffic produces the formation of ozone. The congestion in which private transporters operate and to which they contribute increases the degree of pollutant emissions.

The main pollutants produced by automobiles: nitrogen oxides (NO₂); carbon monoxide (CO); Particulate Matter (PM); sulfur dioxide (SO₂); ozone (O₃); carbon dioxide¹⁶. Pollutants from automobiles induce various impacts; they destroy the atmosphere

and the ozone layer. They act on human health, buildings, urban infrastructure, fauna and flora.

4.3.2 Noise (or Noise Pollution)

Noise is an integral part of urban pathologies; the acceptable sound level is generally set at 69 decibels. Noise pollution mainly comes from car traffic and urban activity in general. Despite the opening of the southern ring road (Rocade), the volume of traffic has not reduced the growth in traffic noise. Measures to reduce it are far from being implemented; reducing nuisance is not a top priority. This is one of the many shortcomings of municipal officials, and even of the new traffic plan. Due to traffic saturation, noise intensity is even greater on the main arteries of the city of Tizi-Ouzou.

Noise is a nuisance that can have physiological, psychological, economic and social aftermath. Stress, loss of concentration, nocturnal weddings, the leisure center of New Town, the calls of the Muezzins for morning prayers, particularly for the neighborhood (more than 140 decibels) are the specific expressions of this nuisance. Noise pollution, air pollution, alteration of the aesthetic quality of landscapes, pollution by public trash cans, garbage, rubble, incivility, etc., reinforce the main causes of environmental inconvenience.

All these nuisances contribute to the decline of cities and urban areas. These are all negative external economies for the social and cultural progress of populations. Shouldn't the search for a transport policy for a "sustainable city" focus on traffic management, the replacement of the most polluting vehicles, the technical inspection of vehicles and the elimination/replacement of vehicles that are too dilapidated? Financing the development of public transport? The bus seems more efficient in the use of traffic space which is a rare resource. Shouldn't public transport be given priority in the busiest areas?

4.3.3 Public Policies for Urban Transport in the City of Tizi-Ouzou

In the city of Tizi-Ouzou, urban transport is experiencing real dysfunctions. Indeed, the question of their development is at the heart of local political news. The new form of offer is that of public transport by bus, train, cable, soft or active modes (walking, cycling) which have an insignificant presence. In fact, there are no cycle paths or parking lots for bicycles. Nevertheless, the gradual withdrawal of cars from the city center seems to be a necessary step to ensure sustainable urban mobility.

Development of pedestrian spaces, installation of parking lots on the outskirts of the city, use of soft modes of transport, development of intermodal transport, etc, are the essential points of the public policies chosen by local officials. However, the supply policy, initiated by the city of Tizi-Ouzou, did not result in traffic fluidity. The drop in travel costs, which were to result from the development of road networks, did not occur. Traffic congestion remained intense in the city. The social costs linked to the increased use of automobiles have led to a whole change in urban transport planning and organization policies. Under these conditions, local officials are called upon to reflect on the definition of a real transport policy by entrusting the development of the study of the traffic plan for the city of Tizi-Ouzou to the National Center for Technologies and Consulting (CNTC –SPA Bumerdes). Among the objectives to be achieved¹⁷:

- **Short Term:** Hierarchy of the city's road network; reorganization of parking and traffic directions in the city center; improving the operation of major intersections; organization of the public transport network;
- **Medium and Long Term:** Carrying out workarounds; redevelopment of intersections; reorganization of downtown traffic; reorganization of downtown parking; reorganization of urban public transport; prioritization of the city's road network for new achievements.

The main objective of this plan is to propose a set of technical and regulatory actions and recommendations, intended to improve travel conditions by maximizing the operation of the existing road network. Besides, proposing, if necessary, the arrangements which are essential for its proper functioning. The traffic plan recommends, in the short term, the management and development of intersections, the ban on parking on roads especially along the central axis, the restructuring of public transport and the modification of some traffic directions.

The new traffic plan proposes sites that can accommodate multi-storey car parks near 'Frères Beggaz' street. Moreover, interchange to the southern Rocade area, next to the local market at the eastern entrance to the city, near the new Daira inter station in Boukhalfa, on the side of 'Frères Ouamrane' street and the old wholesale market (Stiti Boulevard).

Signaling, speed bumps, regulation of the movement of delivery vehicles, regulation of commercial activities, safety and comfort of pedestrians are the main appropriate solutions to improve road traffic. As for the medium term, the traffic plan recommends:

- Public transport (TCSP), street name plates throughout the city;
 - Bus shelters intended for public transport passengers at all stops, adorning them with city maps indicating the location of the bus shelter and urban transport lines;
 - Public lighting equipment (street lights): rest furniture on major arteries and within neighborhoods;
 - Information and communication equipment (newsstands, clocks, display panels).
- These various operations are being implemented in order to remedy the ever-increasing road traffic accompanied by the limited capacity of the road infrastructure.

5. Conclusion

At the end of this research, we can conclude that the growing mobility needs of the population have led public authorities to open the transport sector to private operators. The recent spatial expansion of the town of Genêts has made daily travel increasingly difficult. As a result, the imbalance between transport supply and demand is largely attributed to the inadequacy of public transport, itself a consequence of uncoordinated urban development.

To address mobility issues in Tizi-Ouzou, the DTWTO (Direction of Transport of the Wilaya of Tizi-Ouzou) proposed a traffic management plan in August 2019, prioritizing public transport in the "capital" of Djurdjura. While this initiative sought to improve transport conditions and traffic flow, it has yet to resolve major challenges, such as congestion at key intersections and the lack of efficient mass transit. Public transport services continue to fall short in terms of comfort, frequency, regularity, speed, and

affordability. Moreover, intermodality has not delivered the expected improvements in travel organization or congestion reduction.

Urban congestion is not a viable long-term scenario from economic, social, political, or environmental standpoints. Beyond environmental degradation, stakeholders broadly agree on the urgent need to develop sustainable mobility solutions such as soft modes and public transport to reduce congestion, pollution, stress, noise, and overall decline in quality of life. The 2019 traffic plan emphasized low-cost public bus transport with minimal infrastructure, vehicle fleet, personnel, and energy usage. In this context, ETUSTO remains a central component of local transport policy, given its lower energy consumption, reduced environmental impact, and space-saving advantages.

Recommendations

In light of our findings, we propose the following recommendations:

- Ensure territorial continuity in citizen mobility to eliminate areas of spatial disadvantage;
- Promote sustainable urban mobility through mechanisms such as the “polluter pays” principle;
- Introduce taxation based on vehicle pollution levels or noise output (e.g., engine age, power) to improve the environmental quality of the city’s vehicle fleet;
- Construct underground parking facilities outside the city center to reduce congestion;
- Encourage the adoption of hybrid and electric vehicles in the medium to long term to mitigate greenhouse gas emissions;
- Promote soft modes of transport (cycling and walking) in selected urban areas;
- Improve ETUSTO services by ensuring accessibility, connectivity, speed, regularity, extended operating hours, and service frequency.

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Notes

¹ SÜNO, F. LAUMIERE, F. LERICHE, Metropolization and large structuring facilities, PUM, Toulouse, 2004, p. 101.

² Official Journal of the Algerian Republic No. 10, March 1990

³ Transport Directorate of the wilaya of Tizi-Ouzou, September 2023.

⁴ CNTC-SPA Boumerdès, Study of the traffic plan of the city of Tizi Ouzou, report 1, Reconnaissance of the site and our groupings, August 2019, p. 19-27.

⁵ CNTC Boumerdes, Study of the traffic plan of the city of Tizi-Ouzou, report 1, Reconnaissance of the site and our groupings, August 2019, pp. 27-30.

⁶ Transport Directorate of the wilaya of Tizi-Ouzou, p. 9. September 2022.

⁷ CNTC-SPA Boumerdes, Traffic plan for the city of TO, summary report, August 2019, p. 37.

⁸ CNTC-SPA Boumerdes, Op. Cit, p. 38

⁹ Internal document at the Transport Directorate of the wilaya of Tizi-Ouzou, p.11.

¹⁰ Same

¹¹ Dehbia Akkache-Maacha, Tizi-Ouzou, Travel generator hub, Insaniyat magazine n°54, 2011, p.p.63-84.

¹² F. BENNOUI, "Rural transporters, factors of development in the daïra of Blida", in E. DORIER-APPRILL, "Cities and environment", ed. SEDES, Paris, 2006, p. 145

¹³ Ch. CHANSON-JABEUR, S. MUSETTE, Urban and interurban transport in Algeria, CREAD, Algiers, p. 22.

¹⁴ Ch. CHANSON-JABEUR, S. MUSETTE, op. , quoted, p. 180.

¹⁵ Emile Quinet, Principles of Transport Economics, Economica editions, Paris, 1998, pp.63-69.

¹⁶ Emile Quinet, op. Quote, p. pp. 70-71

¹⁷ CNTC-SPA Boumerdes, traffic plan for the city of Tizi-Ouzou, summary report, August 2019, p.3.