

Population Vulnerability to the State of Public Transport in Bamenda city, Cameroon

Lesley Ntumngia Nchang^{1*}, Lawrence Fon Fombe¹ and Clarkson Mvo Wanie¹

Department of Geography and Planning, Faculty of Arts, The University of Bamenda, P.O Box 39, Bambili, North West Region of Cameroon.

***Corresponding Author**
Lesley Ntumngia Nchang

Department of
Geography and
Planning, Faculty of
Arts, The University
of Bamenda, P.O Box
39, Bambili, North
West Region of
Cameroon.

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Abstract: Cities all over the world and particularly in the developing countries are experiencing problems of increasing motorization, severe congestion, pollution, safety concerns, insufficient transport infrastructure and socio-economic exclusion. This study seeks to examine the vulnerability of different demographic groups to the state of public transport and develops a conceptual framework on how susceptible and exposed they are to the conditions of public transport (PT) in Bamenda. In order to achieve this objective, a cross-sectional research design was used in which quantitative and qualitative data was collected and analysed. Systematic field surveys via the administration of 400 questionnaires within different demographic groups, focused group discussions and structured interviews with household heads and urban transport agents were conducted. Collected data was analysed descriptively and quantitatively. Findings showed that the majority (52%) of the population make use of PT on a daily basis for work, school, business, employment, social and other purposes. The most preferred means include taxi (65.50), motor cycle (41.75%) and bus (20.50%). There is poor neighbourhood coverage (51%) of PT services and most of the residents considered PT as unaffordable because taxi is expensive especially over short distances of between 0-2km (61.76%, 29.41% and 8.82% for Bamenda I, II and III respectively). The majority of the population (38%) equally feel unsafe using PT especially within the context of the on-going socio-political crisis in the area, while the majority (51%) further rated the overall condition of PT vehicles to be poor. The most vulnerable demographic group to the currently poor conditions of PT include the individuals with disabilities (30%), the elderly/older persons (60+) (25%), women (2%), lowly paid workers and unemployed people (29%) and students/pupils (14%), who continue to experience key challenges including poor service quality, unaffordability, health/safety concerns, congestion and delays and the absence of zebra crossing. The identified indicators of the poor PT conditions include health and safety concerns (13%), inadequate access to PT facilities (7%), long waiting/movement time (14%), poverty/lack of finance (23%), inaccessibility by individuals with disabilities (6%) and inadequate of PT facilities (37%). All these have caused the vulnerable populations to be highly exposed to the current state of PT in the city. The study develops a conceptual framework on how susceptible and exposed specific demographic groups are to the poor conditions of PT in the area which equally suggest how PT could be improved upon in order to better serve these groups in the future.

Keywords: Public transportation, vulnerability, demographic groups, exposure, Bamenda, Cameroon.

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Introduction

Movements of people, goods and information have always been fundamental components of human societies. The specific purpose of transportation is to fulfill a demand for mobility, since transportation can only exist if it moves people, freight and information around. Otherwise, it has no purpose (Rodrigue, 2020). One form of transportation that makes this to happened is PT, which is a major means of transportation practiced in both the developed and developing world. PT is shared passenger transport services that are available to the general public and which are

provided for the public good, excluding taxis, car pools, and hired buses, which are not shared by strangers without prior arrangement (UN Habitat, 2018). It is indispensable to the lives of people in cities as it makes cities more inclusive, safe and sustainable (UN-Habitat, 2018). PT plays an essential role in enabling people from low income and other disadvantaged groups to access employment and services. A lack of access to PT services can influences population access to employment, education, leisure activities and health services. It also contributes to the development of social networks and social capital, by helping people to visit friends and relatives and take part in community and other social activities.

Public policy makers have begun to recognise that adequate PT provision can play an important role in reducing social exclusion (Lethbridge, 2008).

Given both the importance and the fragility of PT, vulnerability has become an important area of research for city planning as it can shed light on where new routes and stations can be added to an existing system to enhance its resilience in the face of disruptions such as failing infrastructure, severe weather, or targeted attacks (Aquino *et al.*, 2017). In the last few years, studies on the vulnerability of PT networks attract a growing attention because of the repercussions that incidents can have on the day-to-day functioning of a city (Rodríguez-Núñez *et al.*, 2014). Also, understanding transportation network vulnerability can enhance prevention and response capabilities during disaster events and emergency incidents (Chen *et al.*, 2015).

According to the UNISDR (2016), vulnerability is defined as “the conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards”. Vulnerability assessment of complex systems, such as transportation facilities requires the use of an integrated framework, which should include various analytical methods to investigate the problem from a range of perspectives (Papilloud and Keiler 2021).

In road infrastructure studies, vulnerability has taken on a different meaning. For instance, Jenelius *et al.*, (2006) argued that the concept of vulnerability with respect to road infrastructure should address two components: probability of hazard occurrence and consequences of the hazard event (impact of different demographic groups for this study). Jenelius and Mattsson (2015) and Taylor and Susiliwati (2012) while considering vulnerability in the context of road infrastructure stated that the impact for a single user under a certain disruption scenario is considered as a function of the exposure of a user to that scenario. However, Berdica (2002) defined vulnerability more specifically in transport facility to include “the susceptibility to incidents that can result in considerable reductions in road network serviceability”. Moreover, Taylor (2008) defined transport network vulnerability based on road accessibility to activities from different locations within a regional network. In this context, accessibility is defined as the ease with which services and facilities can be reached while using the road network (Litman, 2017). Therefore, while transportation system has a close bearing on the prosperity of society, transportation infrastructures are highly vulnerable to extreme events (Lin and Lin, 2022).

SGD 11 and Target 11.2 on PT system focuses on providing, by 2023, access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding PT, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons. Indicator 11.2.1 particularly seeks to increase the proportion of the population that has convenient access to PT by sex, age and persons with disabilities (UN-Habitat, 2018). By improving transportation infrastructure, SDG 11.2 seeks to make cities and human settlements more inclusive, safe and sustainable.

Africa is rapidly transforming into a predominantly urban continent. The African Development Bank Group (2012) projected that between 2010 and 2015, some African cities will account for up to 85% of the population. African cities are facing critical

challenges in supporting the rapid population increase, with limited and inadequate urban transport space. There is poor design of urban roads and non-motorized modes with lack of road safety. As urban populations in Africa increase, existing and emerging cities face the challenge of meeting rising demands for efficient mobility within limited physical infrastructure capacity. This growing demand of urban mobility converges with an inadequate supply of physical transport capacity in many cities which can result in crowding, congestion and an unpleasant experience of the city.

PT is on-going in Bamenda city of Cameroon. Various PT means include cars, buses and motor cycle (locally called *okada*). However, there is less accessibility for vulnerable groups such as the aged, physically challenged /handicapped, women and children due to lack of required infrastructure by these users, constituting one of the challenges of sustainable urbanization in Cameroon previously identified by Fombe and Balgah (2010). Vulnerable groups are important disadvantaged social groups with special mobility needs. In Bamenda city, the special needs of these persons are not anticipated in the planning and construction of new transport infrastructure and barrier free facilities are not provided to enhance the mobility of these social groups in Bamenda.

In the rapidly urbanizing Bamenda city, most of the roads seem to lack adequate construction and engineering norms such as the absence of zebra crossings, sidewalks and other pedestrian amenities like street lights, traffic signs and markings. The current state of roads is poor and maintenance activities are slow due to technical, operational and security reasons. Sidewalks are largely missing on majority of the roads making both pedestrians and motorized vehicles to share the same track. In the few areas where sidewalks exist, they are poorly maintained, containing open drains and have been usurped by vendors for trading activities. Zebra crossings for pedestrians have not been provided except at the Commercial Avenue which is the city center.

It also appears that the following categories of persons, including, women, children, individuals with disabilities, elderly persons, single parents, lowly paid workers and unemployed people have very limited access to convenient PT services in Bamenda city, which seems to further influence, in a cyclical pattern, their access to employment, education, leisure activities and health services. The present PT in Bamenda seems insufficient to meet the demands and requirements of the present and potential users. Currently, not all citizens seem to be using PT as specific demographic groups like the aged and disabled have been excluded from initial planning and use of PT services. Due to the absence of required vehicles for their movement such as paratransit complements bus services because most of them cannot use cars and motorcycles, it appears their mobility and accessibility are highly limited.

To further compound the mobility situation for these vulnerable groups, only one mode of transport (road) is obtainable in the city, with its attendant problems such as narrowness, traffic, rough surfaces for most parts, lack of adequate road signs and signaling, amongst others. No alternative routes such as urban train exist for the residents who are all obliged to use the currently available roads which remains inadequate for the ever-growing population and rapid rates of urban sprawl and urban growth. It is within the above problematic that the study seeks to examine the vulnerability of different demographic groups to the state of PT facilities in Bamenda city. It specifically answers the following research

questions; (1) What is the current condition of PT in Bamenda? (2) Which demographic groups are vulnerable to the poor PT conditions? (3) What are the specific vulnerability indicators of the poor PT conditions in Bamenda city?

Several research studies exist on PT and vulnerability around the world. In an attempt to develop a method for strategic assessment of vulnerability in road networks, Taylor *et al.*'s., (2006) vulnerability analysis of strategic road networks considered the socio-economic impacts of network degradation on the basis of changes in the levels of accessibility provided by the degraded network, to develop a method for strategic assessment of vulnerability in road networks. In their study aimed to present network-based accessibility measures for assessing vulnerability of degradable transportation networks, Chen *et al.*, (2007) indicated that the accessibility measures derived from a combined travel demand model are capable of measuring the consequences of both demand and supply changes in a road network and have the flexibility to reflect the effects of different travel choice dimensions on the network vulnerability. As far as they are concerned, a study by Taylor and Susilawati (2012) developed a method for road network vulnerability analysis which considered the socio-economic impacts of network degradation, determines the most critical locations in the network and compared the levels of remoteness (or its inverse, accessibility) of localities within the study region, on the basis of the impacts of degradation of the road network on a recognised accessibility/remoteness index that can be applied to each and every location within the region of south east Australia, thereby extending the earlier work on accessibility-based vulnerability analysis which was limited to assessment of impacts on selected nodes in a network.

Using the Madrid Metro system as a case study, Rodríguez-Núñez and García-Palomares (2014) developed a methodology for measuring PT network vulnerability as a result of the ever growing interest in studies on vulnerability of PT networks and the repercussions that incidents can have on the day-to-day functioning of a city. On their part, Cats and Jenelius (2014) in their study developed a dynamic and stochastic notion of PT network vulnerability and the measures of betweenness centrality (often used to identify potentially important links) and link importance are extended to a dynamic-stochastic setting from the perspectives of both operators and passengers in Stockholm, Sweden. Their study suggested that betweenness centrality (passenger/vehicle flows) may not be a good indicator of link importance. By help of a case study based on data from Hillsborough County, Florida, Chen *et al.*, (2015) conducted a study on 'Analysis of Transportation Network Vulnerability under Flooding Disasters' by help of ArcGIS to identify the inundated segments. Accessibility values were then calculated with the proposed accessibility-based method and the Hansen accessibility index method were compared and comparison of results shows that the results of the two methods are quite close, but the proposed method yields normalized values, which make the results clearer and provide more levels of accessibility loss. Aided by the recent proliferation of data and the wide adoption of Geography Information Systems (GIS), Kermanshah and Derrible (2016) used a data-driven approach via USGS ShakeMaps to determine vulnerable locations in road networks two US cities, Los Angeles and San Francisco, both of which are susceptible to severe seismic activities. They provided a geographical and multi-criteria vulnerability assessment method to quantify the impacts of extreme earthquakes on road networks for

these cities. From their perspective, Candeliera *et al.*, (2019) studied potential vulnerabilities of the urban transportation networks that must be considered to support the planning process into the creation of resilient structures and implements a topological approach, using a multi-graph to model PT networks and analyse vulnerabilities.

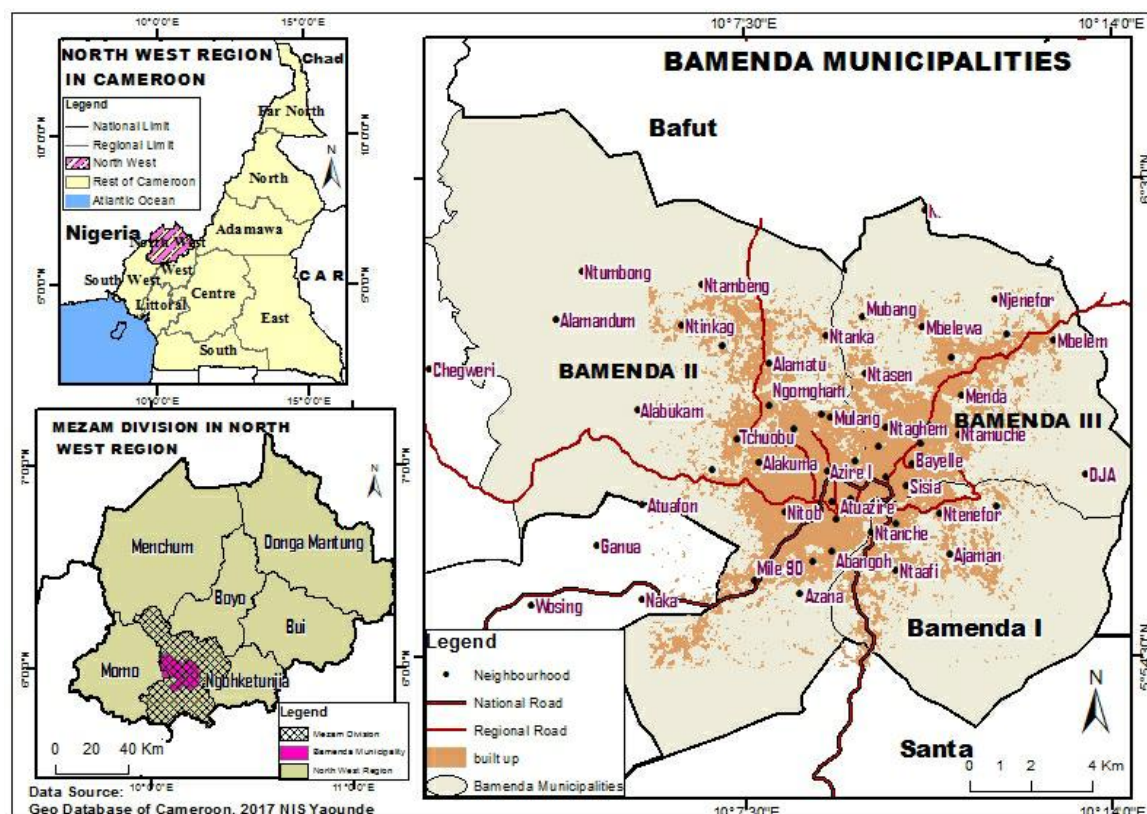
In their view, Kizhakkedath and Tai (2021) conducted a vulnerability analysis of critical transportation infrastructure network using two vulnerability indicators (network efficiency and accessibility) in order to understand how the failure of the components in such a network affects the performance and integrity of the whole network. Papilloud and Keiler (2021) on their part compared methods to assess vulnerability of road networks to extreme floods, highlighting those measures of overall vulnerability, with respect to inter-comparisons of flood scenarios alone, do not fully capture the local vulnerability of some traffic zones particularly evident with the flooding of highly connected roads that serve these zones. Regarding them, Malandri *et al.*, (2021) in studying PT network vulnerability and delay distribution among travelers proposed a novel methodology which combines the traditional approach, based on the quantitative evaluation of averaged disruption effects, with the analysis of the asymmetry of effects among users, by means of Lorenz curves and Gini index, to provide better knowledge about the effects of a disruption on a PT network. Testing the results of their study on 'Infrastructure-based transportation network vulnerability modeling and analysis' on the highway network of Florida, USA, Lu *et al.*, (2021) showed that various road alignment and types could have different impacts on the accessibility of road network and road network vulnerability is obviously affected by road alignment and types. When road sections are more curved, the network becomes more vulnerable under disruptions. More bridge and tunnel sections in transportation network would result in higher vulnerability of the highway network. Lin and Lin (2022) proposed a novel framework to identify the most vulnerable component for a road transportation system using travelers' response to the changes in the transportation network topology and capacity after an extreme event. Two types of vulnerability measures were developed by the authors to assess the vulnerability of road transportation system, namely, System Travel Time-Based Vulnerability (STTV) on the basis of short-term planning and System Emissions-Based Vulnerability (SEV), put forward on the basis of long-term planning.

Because road traffic is occasionally blocked by landslide geological disasters in remote mountainous areas causing obstruction to economic society and national defense construction, Yao *et al.*, (2023) carried out a study on 'Road Network Vulnerability Considering the Risk of Landslide Geological Disasters in China's Tibet' and proposed an effective, rational and understandable multicriteria heuristic analytical hierarchy process model, fuzzy comprehensive evaluation and frequency ratio-interactive fuzzy stack analysis for vulnerability assessment of road networks in large and complex networks. Based on the comprehensive use of geographic information technology, the road network vulnerability of Tibet in China was evaluated by introducing slope, topographic relief, normalized difference vegetation index (NDVI), annual mean precipitation, distance from river drainage, glaciers and snow, habitation, seismic center and geological fault zone, and soil erosion intensity. Wang *et al.*, (2023) conducted a vulnerability analysis of urban road networks

based on traffic situation by taking Shanghai road networks (SRNs) as an example and proposed a method for building a weighted road network by using the real-time traffic situation and the inherent characteristics of Urban Road Networks (URNs). Through the estimation of the accessibility and Link Importance Indicator (LII), Henke *et al.*, (2024) conducted and applied to a real case study, a vulnerability road transportation network analysis in response to external shocks using the 112 districts of the metropolitan area of the city of Naples, in the south of Italy. On their side, Wei *et al.*, (2024) filled the research gap that Intermodal Freight Transportation Networks (IFTNs) are exposed to due to integration of diverse transportation modes in global logistics by proposing a vulnerability assessment and reduction (VA&R) framework for IFTNs considering uncertain disruptions that impact IFTN nodes and links, along with cascading failures and influence spreading.

Study Area and Research Methods

An evaluation of the previous research highlight gaps in knowledge on the subject. It shows that this far, no study has concentrated on vulnerability of different demographic groups to the conditions of PT. By aiming at examining the vulnerability of different demographic groups to the conditions or state of PT in Bamenda city, this present study adds a novel aspect and case



Source: Adapted from Cameroon Atlas for Schools and Colleges (2017)

Bamenda is composed of three municipalities (Bamenda I, Bamenda II and Bamenda III), each with a different population composition. The total population of Bamenda city as of 2010 stood at some 519,000 inhabitants, given a population density of some 166p/km² (BCC, 2020). The population, constituting of different demographic characteristics is highly mobile (within and between the different municipalities) but facing vulnerability to the existing state of PT facilities.

was collected from different demographic groups including age, gender, ethnicity, income level, level of educational attainment, marital status and occupation. This was done through observation, the design and administration of semi-structured questionnaire and interviews on PT and vulnerability experiences in the city. As concerns the questionnaire, some 400 sampled copies were administered to participants through face-to-face method. Face-to-face interviews were also carried out with the resource persons such as the representatives of the Ministry of Transport for the Northwest, Bamenda I, II, and III councils and the Bamenda City Council (BCC). Direct field observations method was used to observe the state or conditions of PT facilities in the city. Data from secondary source was obtained from journal articles downloaded from online search, institutions such as the BCC and the Regional Delegation of Transport for the Northwest as well as the libraries of The Universities of Bamenda and the Department of Geography and Planning.

Data Analysis

Thematic analysis was used to quantitatively group the opinion of respondents with respect to population vulnerability to the state of PT in Bamenda. This was then presented using statistical tables, pie and bar charts. Furthermore, qualitative data obtained from interviews with resource persons and field observations were sorted out manually and equally summarized according to the various themes in order to avoid confusion and to make them more meaningful.

Findings

State of Public Transport in Bamenda city

The entire population of Bamenda city who do not use private means of transport acknowledged making use of PT in movement oftenly, with the majority (52%) being on a daily basis involving students, pupils, businessmen and other commuters (Table 1).

Table 1. Frequency of using of PT (Taxi) in Bamenda City

Frequency	Frequent		At times		Rarely	
	F	%	F	%	F	%
Daily						
Most preferred	224	61.88	15	100	23	100
More preferred	121	33.43	0	0	0	0
Less preferred	17	4.70	0	0	0	0
Total	362	100	15	100	23	100
Weekly						
Most preferred	137	59.05	36	55	89	87.25
More preferred	95	40.95	13	20	13	12.75
Less preferred	0	0	17	26	0	0
Total	232	100	66	100	102	100
Monthly						
Most preferred	168	63.88	31	65	63	70.79
More preferred	95	36.12	13	27	13	14.61
Less preferred	0	0	4	8	13	14.61
Total	263	100	48	100	89	100

Source: Fieldwork (October 2022)

It was equally observed during fieldwork that the most common reasons for using PT was socio-economic, including work, school,

business, employment, social, amongst others. These reasons for movement are as seen in Figure 2.

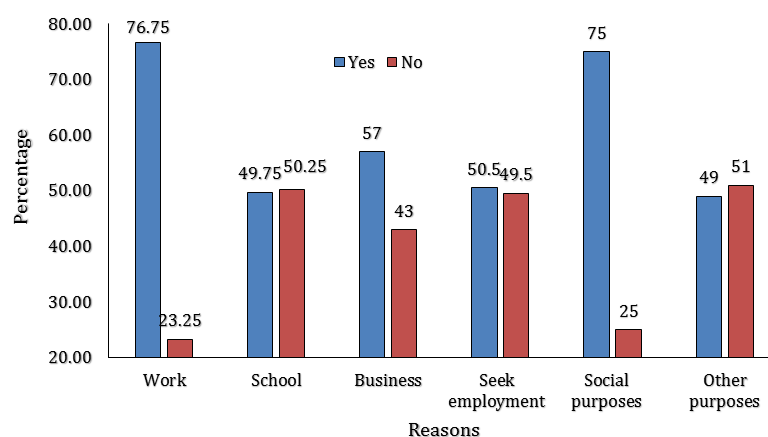


Fig. 2. Reasons for undertaking movements with PT in Bamenda city

Source: Fieldwork (October 2022)

From Figure 2, we observe that the most important reason of movement was work (76.75%) and other social purposes with 75% followed by business (57%), employment (50.5%), school (49.75%) and lastly by other purposes (49%).

The means of PT that Bamenda city offers to its residents include taxi, bus and motor cycle (locally called *okada*) (Figure 3). Access

to these means by the population vary in terms of cost and physical access (distance) within the city, further influencing the means to be selected. Generally speaking, buses are used by the population for long distances, taxis for intermittent or medium distances and motorcycles or bikes for short distances.

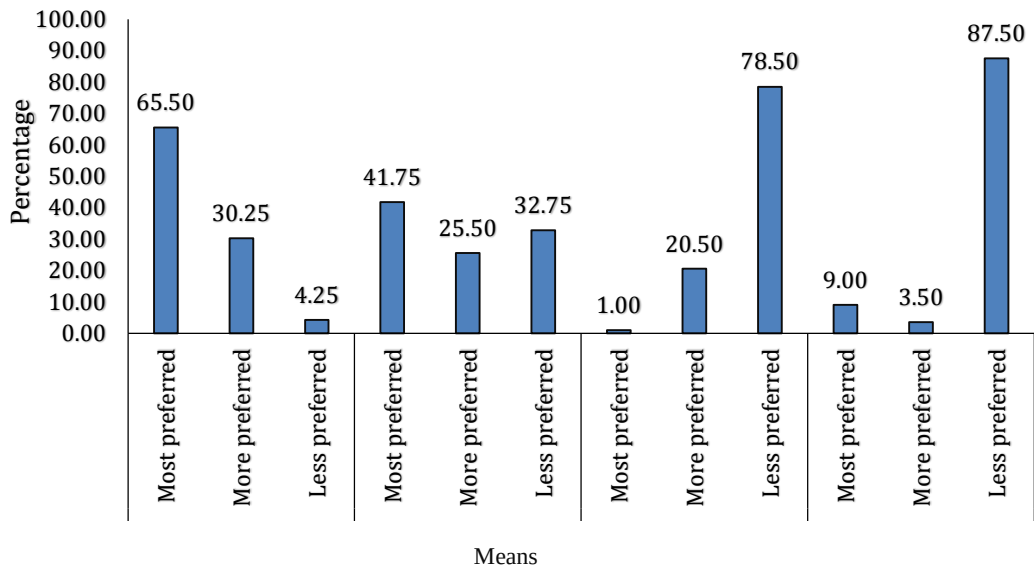


Fig. 3. Most preferred means of PT in Bamenda city

Source: Fieldwork (October 2023)

Field findings further observed that the most preferred means of transport in Bamenda was the taxi (65.50%), followed by the commercial bikes (41.75%), other means of transport (9%) and lastly by the bus (1%). Some 65.50% of the population use the taxi as the most preferred means of transportation, while 30.25 % believed it was more preferable and 4.25% believed it was less preferable. Some 41.75% believed the commercial bikes was the most preferable means of transportation while 25.50% believed it was more preferable and 32.75% believed it was less preferable.

Also, 1% of the population agreed that the bus was the most preferred means of transport, 20.50% said it was more preferable and 78.50% said it was less preferable. Furthermore, 9% of the population agreed that other means of transport was most preferable, 3.50% said it was more preferable and 87.50% said it was less preferable.

The population were asked to rate the coverage of PT in their neighbourhood. Findings showed that this was poor as most neighbourhoods were not covered as indicated in Figure 4.

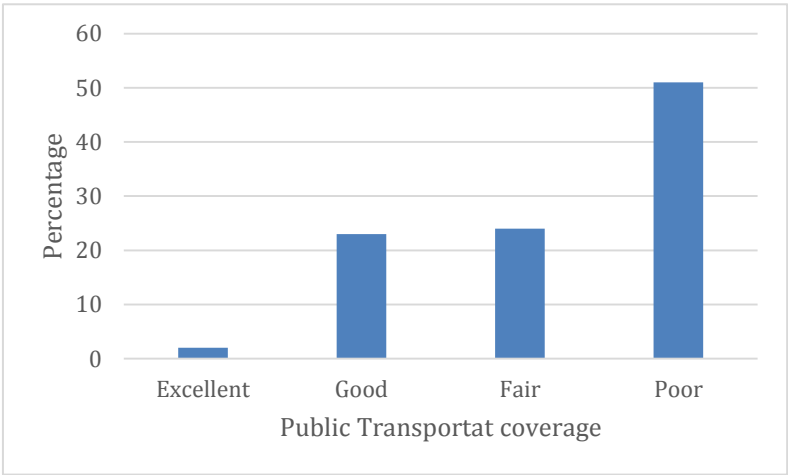


Fig. 4. Neighbourhood Public Transport Coverage in Bamenda city

Source: Fieldwork (January 2023)

Figure 4 suggest the non-coverage of PT in the entire city (poor). The non-coverage of PT in all neighbourhoods of the city imply that PT stops are not easily accessible from the majority of homes of the community members (78%). Another 12% of the population

responded that it was somewhat accessible, mostly those who live close to the road, motor parks, and other PT terminals.

Concerning affordability, the population perception of daily expenses on transport fare in Bamenda city is presented in Table 2.

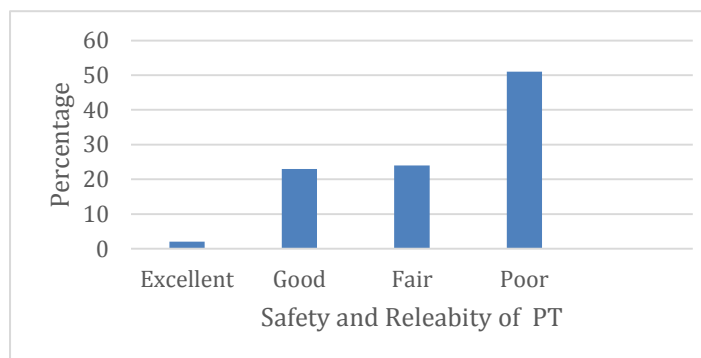
Table 2. Daily expenses on transport fare in Bamenda

Sub-Division	Daily transport fare					
	<500 FCFA		500-1000FCFA		>1000 FCFA	
	Distance(km)	0-2	2- 4		>4	
	F	%	F	%	F	%
Bamenda I	3	8.82	9	11.69	45	15.57
Bamenda II	21	61.76	42	54.55	120	41.52
Bamenda III	10	29.41	26	33.77	124	42.91
Total	34	100	77	100	289	100

Source: Fieldwork (October 2022)

In Bamenda II, 61.76% of the population spend less than 500FCFA daily on transport fare over a distance of 0-2km, 54.55% spend between 500 – 1000FCFA (2-4km) and 41.52% spend more than 1000 FCFA (>4km). In Bamenda III, 29.41% of the population spend less than 500FCFA on daily transport fare (0-2km), 33.77% spend between 500-1000FCFA (2-4km) and 42.91% spend more than 1000FCFA (>4km). On average therefore, between 500-1000FCFA is spent daily on transport fare by community members. As such, the population further rated PT in the city to be very expensive, compared to their annual incomes (for workers). This was also the case with students/pupils who commute to school on a daily basis.

The majority of the population (38%) equally feel unsafe using PT, especially within the context of the on-gong socio-political crisis in the area (Figure 5). They also see it as been unreliable due to sometimes long waiting time, poor state of the vehicles and the presence of potholes almost everywhere on road surfaces. They therefore consider it to be unreliable means currently. Most now prefer private transport.

**Fig 5. Safety and Reliability of PT in Bamenda city**

Source: Fieldwork (January 2023)

The population considered PT highly unsafe because moving of persons and goods throughout the major road axes and major lanes,

there is either a pothole or a completely degraded pavement which makes it quite difficult for residents to freely move about especially pregnant women on maternity visits, the aged who are exposed to lung infections coming from the dusty roads during the dry season and most importantly students who commute for knowledge acquisition.

The majority of the responded (51%) further rated the overall condition of PT vehicles to be poor (Table 3), with vehicles that are unclean and not well maintained (47%) and sometimes unfriendly drivers/staff (39%). The population therefore requested to see a lot of changes in the current PT vehicle conditions in the city.

Table 3. Overall condition of PT vehicles in Bamenda city

S/N	Condition of PT Vehicles	Percentage
1	Excellent	2
2	Good	23
3	Fair	24
4	Poor	51
Total		100

Source: Fieldwork (January 2023)

Demographic groups most affected by the state of PT in Bamenda

This refers to those with special needs who equally have rights to PT accessibility. Systematic monitoring through surveillance and observation identified vulnerable populations to PT in Bamenda to include the individuals with disabilities (wheelchair, visually and/or hearing-impaired as well as those with temporary disabilities), the elderly/older persons (60+), women and other people in vulnerable situations lowly paid workers and unemployed people (Figure 6).

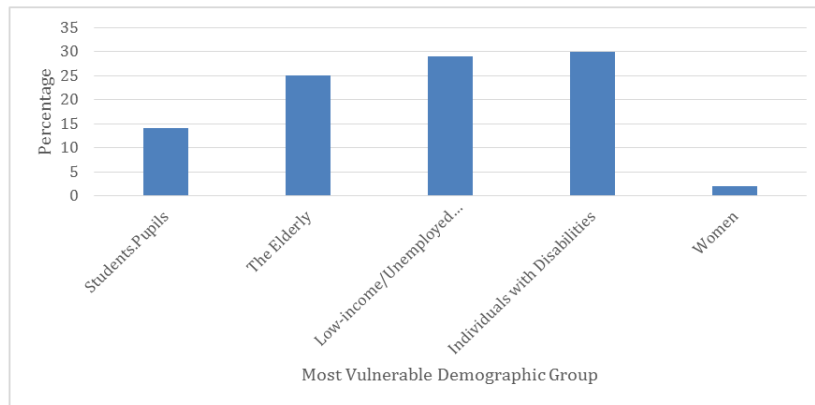


Fig. 6. Demographic Group most Vulnerable to the Conditions of PT in Bamenda

Source: Fieldwork (October 2023)

Students/pupils who commute to school due to lack of school buses are often trapped for long hours in traffic at various points in the city such as along the Finance Junction-Mile Four Nkwen corridor mostly during the morning hours. The other are the low-income/unemployed groups most of whom earn between 0-30,000FCFA monthly. Individuals with disabilities like blindness and hearing impairments and the aged (60+) are also highly vulnerable as they lack the required vehicle to for their transportation. Women are

equally vulnerable because they easily fall prey to theft/harassment.

These vulnerable population experience several key challenges accessing PT in Bamenda city. Amongst these challenges include congestion and delays, health and safety concerns, unaffordability, the lack of PT like sidewalks and zebra crossing, poor service quality, unevenly tarred road surfaces and poor physical state of the roads (Table 4).

Table 4. Key challenges faced by vulnerable persons in accessing PT in Bamenda

Sub-Division	SA		A		N		-		-	
	F	%	F	%	F	%	-	%	-	%
Quality of services										
Bamenda I	49	14.24	5	11.63	3	23.08	-	-	-	-
Bamenda II	138	45.93	22	51.16	3	23.08	-	-	-	-
Bamenda III	137	39.83	16	37.21	7	53.85	-	-	-	-
Total	344	100	43	100	13	100	-	-	-	-
Affordability										
Bamenda I	9	18.75	48	13.79	0	0	-	-	-	-
Bamenda II	18	37.50	162	46.55	3	75	-	-	-	-
Bamenda III	21	43.75	138	39.66	1	25	-	-	-	-
Total	48	100	348	100	4	100	-	-	-	-
Health challenges										
Bamenda I	6	23.08	3	17.65	6	6.90	25	16.78	17	14.05
Bamenda II	6	23.08	6	35.29	56	64.37	59	39.60	56	46.28
Bamenda III	14	53.85	8	47.06	25	28.74	65	43.62	48	39.67
Total	26	100	17	100	87	100	149	100	121	100
Absence of sidewalks										
Bamenda I	15	20	8	6.02	14	16	9	18.37	11	18.97
Bamenda II	24	32	88	66.17	34	40	18	36.73	19	32.76
Bamenda III	36	48	37	27.82	37	44	22	44.90	28	48.28
Total	75	100	133	100	85	100	49	100	58	100
Uneven surfaces/pavements										
Bamenda I	15	17.44	37	13.12	3	15	2	16.67	-	-
Bamenda II	33	38.37	137	48.58	9	45	4	33.33	-	-
Bamenda III	38	44.19	108	38.30	8	40	6	50.00	-	-
Total	86	100	282	100	20	100	12	100	-	-
Poorly regulated traffic for cyclists										
Bamenda I	26	15.95	18	11.18	13	17.11	-	-	-	-
Bamenda II	68	41.72	86	53.42	29	38.16	-	-	-	-
Bamenda III	69	42.33	57	35.40	34	44.74	-	-	-	-
Total	163	100	161	100	76	100	-	-	-	-
Absence of pedestrian/ zebra crossings										
Bamenda I	27	16.98	24	11.71	6	16.67	-	-	-	-
Bamenda II	62	38.99	106	51.71	15	41.67	-	-	-	-
Bamenda III	70	44.03	75	36.59	15	41.67	-	-	-	-
Total	159	100	205	100	36	100	-	-	-	-
Poor physical state of roads										
Bamenda I	22	16.06	29	12.24	6	23.08	-	-	-	-
Bamenda II	56	40.88	121	51.05	6	23.08	-	-	-	-
Bamenda III	59	43.07	87	36.71	14	53.85	-	-	-	-
Total	137	100	237	100	26	100	-	-	-	-

Source: Field work, 2022

Source: Fieldwork (October 2023)

In Bamenda I, the greatest challenge faced by vulnerable groups in accessing PT include safety/health challenges (23.08%), followed by absence of sidewalks (20%), affordability (18.75%), uneven surfaces/pavements (17.44%), absence of pedestrian/zebra crossings (16.95%), poor physical state of roads (16.06%), poorly regulated traffic for cyclists (15.95%) and lastly quality of service (14.24%). In Bamenda II, the greatest challenge faced was quality of service (45.93%), poorly regulated traffic for cyclists (41.72%), poor physical state of roads (40.88%), absence of pedestrian/zebra crossings (38.99%), uneven surfaces/pavements (38.37%), affordability (37.50%), absence of sidewalks (32%) and lastly safety/health challenges (23.08%). In Bamenda III, the greatest challenge faced was safety/health challenges (53.83%), followed by uneven surfaces/pavements (44.19%), absence of pedestrian/zebra crossings (44.03%), affordability (43.75%), poor physical state of roads (43.07%), poorly regulated traffic for cyclists (42.33%), quality of service (39.83%) and lastly absence of sidewalks (27.82%). These challenges negatively affect these vulnerable population through increase in transport fare (26%), block access to basic socio-economic services (24%), long waiting time (12%), missed work/business/school (4%) and stress and discomfort (34%).

Vulnerability indicators of the poor public transport conditions in Bamenda

Findings showed that the population of Bamenda city is highly vulnerable (Figure 7) to the conditions of PT by help of certain vulnerability indicators. These indicators include health and safety concerns (13%), inadequate access to PT (7%), long waiting/movement time (14%), poverty/lack of finance (23%), inaccessibility by individuals with disabilities (6%) and absence and/or inadequate PT facilities (37%), which all combine to cause the population to be exposed to the current state of PT in the city. The absence of PT facilities (37%) constitutes by far the highest vulnerability indicator. This is because the city currently lacks basic PT facilities like zebra-crossing especially for pupils and children's safety, sidewalks and other pedestrian amenities like street lights, traffic signs and signaling, vehicle flyovers, bridges, drainage channels, roundabouts, just to name these few. Existing ones are obsolete and fast degraded as noticed with most of the road surfaces. The long waiting/movement time to the nearest public PT facility is equally an indicator as up to some 14% of the population have to walk for more than 20 minutes before reaching the nearest one from their home. Some 43% walk for between 10-20 minutes, 32% between 5-10 minutes while only 11% do so in less than 5 minutes. The latter concerns those who either own private means of transport which they use to join the public ones or those residing close to such facilities. Concerning the lack of finance, some 23% of the population including the unemployed/low-income group and students/pupils were poor financially and do not have the means adequately pay for PT.

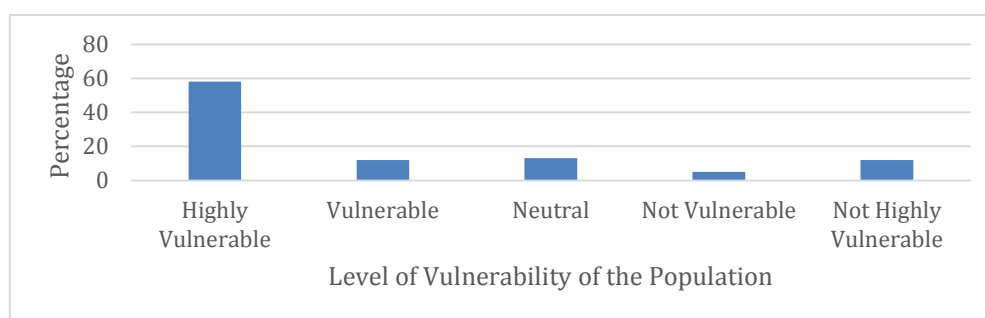


Fig. 7. Level of Vulnerability of the population to the conditions of PT

Source: Fieldwork (2023)

The indicators of vulnerability focusing on the 'bad' state of roads observed in Bamenda I, II and III included the presence of

potholes, poor drainage narrow roads, absence of or insufficient sidewalks and zebra crossings (Table 5).

Table 5. Indicators of 'bad' roads in Bamenda city

Indicators	Bamenda I	Bamenda II	Bamenda III
Potholes	Bad	Very bad	Very bad
Poor Drainage	Bad	Very bad	Very bad
Narrow roads	Very bad	Very bad	Very bad
Insufficient sidewalks	Bad	Very bad	Very bad
Absence of zebra crossings	Very bad	Very bad	Very bad

Source: Fieldwork (October 2024)

One of the indicators of the poor PT in Bamenda city is the absence of sidewalks on most streets. In the few lanes where they exist, they do not serve their rightful purpose as they have been unscrupulously invaded by businessmen to display their products or commodities as is the case in Commercial Avenue Street, Bamenda II Sub-division. This constitutes mobility challenge to

vulnerable groups such as the aged, pregnant women, children, individuals with disabilities, etc. In Bamenda I, 16.05% of population strongly agreed to the occupation of existing sidewalks for business purposes, 40.88% in Bamenda II and 43.07% in Bamenda III (Figure 8).

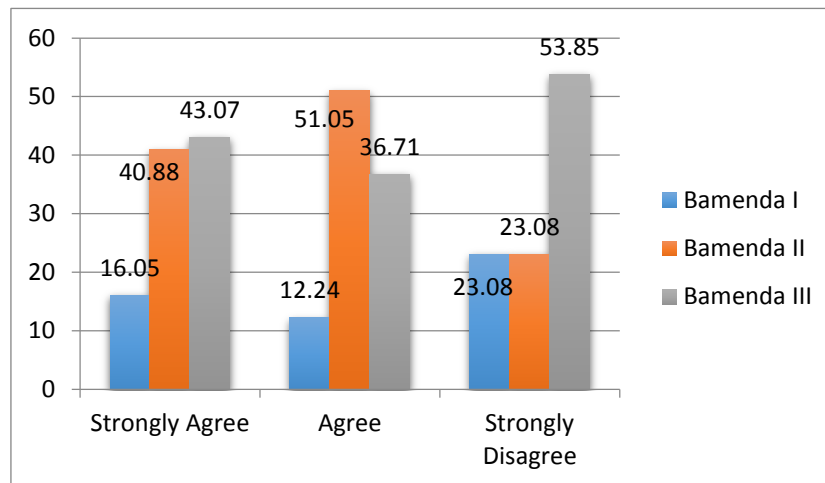


Fig. 8. Population perception of sidewalks occupation in Bamenda city

Source: Fieldwork (October, 2023)

As Figure 8 shows, sidewalks are pro-pedestrians and consequently favourable for disabled persons, 96% of whom cannot afford their required vehicles. The percentage of those who agreed to this in Bamenda I stood at 12.25%, 51.05% for Bamenda II while Bamenda III constituted 36.71%.

According to a road engineering who was interviewed and whose name we chose to keep anonymous on the state of roads in Bamenda “*the state of roads in Bamenda is bad and has been a nightmare since it has not been in conformity to construction norms. They also degrade fast, once rehabilitated*”. This further highlight the poor state of existing roads as an indicator of population vulnerability.

Another indicator is the marked presence of potholes on road surfaces all over the city. The pothole depths vary within in city and reaches 20cm in most places (Figure 9). Most of the street, especially for secondary roads still remains untarred, hence in a bad shape. Culverts are also conspicuously absent. These road stretches include Ngeng Junction-Sonac street-City Chemist, T-Junction, Lower Atu-azire (Metta Quarter) to Hospital Round About, Veterinary Junction to T-Junction and City Chemist and Food Market to Hospital Roundabout. Field work permitted us to count up to 1,123 potholes mostly around Metta quarters, Sonac Street, Mile 2 Junction and Ntarikon neighbourhoods only. Some potholes were 6m long while some were as small as 13.5cm. Figure 10 illustrates the dimension of potholes in some of the neighbourhoods in Bamenda city.



Fig. 9. State of streets characterized by potholes in Metta Quarters, Bamenda II Sub-division

Source: Fieldwork (October, 2022)

On a comparative basis to highlight their vulnerability, the perception of the population was sought on the state of urban roads in the three Sub-Divisions in Bamenda as seen in Table 6. Generally, it was observed that Bamenda II had “worse” or degraded roads, followed by Bamenda III and lastly by Bamenda I.

The indicators of bad roads observed were numerous potholes, little or no drainage systems, untarred road surfaces, muddy roads during the raining season and dusty roads during the dry season, insufficient pedestrian paths and absence of zebra crossings.

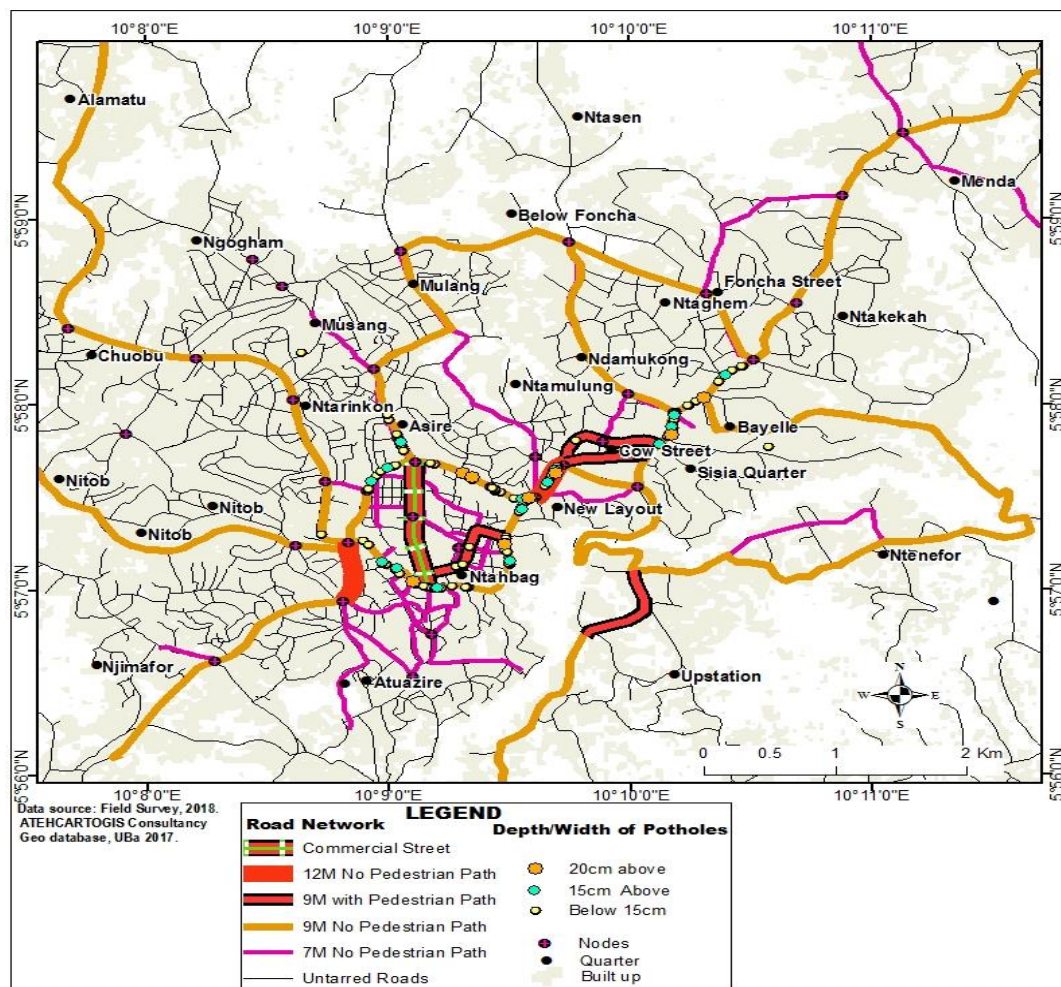


Fig. 10. Spatial distribution of potholes in in Metta Quarters, Bamenda II Sub-division

Source: Fieldwork (October, 2022)

We observe from Table 6 that in Bamenda I, 12.37% of the population agreed that the roads were tarred, 12.88% agreed that they were earth roads, 11.92% agreed that the roads were paved, 13.90% agreed that the roads were tarred but in bad shape and 12.80% agreed the roads were paved but in bad shape. In Bamenda II, 50.52% of the population agreed that the roads were tarred, 49.39% said they were earth roads, 51.66% agreed the roads were paved, 46.59% agreed the roads were tarred but in bad shape and 49.39% agreed the roads were paved but in bad shape. In Bamenda III, 37.11% of the population agreed that the roads were tarred, 37.73% agreed the roads were earth roads, 36.42% agreed the roads were paved, 39.51% agreed the roads were tarred but in bad shape and 37.80% agreed the roads were paved but in bad shape.

These above results highlight the high vulnerability of the population to existing conditions of PT in the city. To this effect, the study develops a conceptual framework on how susceptible and exposed specific demographic groups are to the conditions of PT in Bamenda city (Figure 11). It is hoped that this framework could suggest how PT could be improved upon in order to better serve these groups in the future.

Table 6. State of Urban Roads in Bamenda city

Sub-Division	Yes		No	
	F	%	F	%
	Tarred			
Bamenda I	36	12.37	21	19.27
Bamenda II	147	50.52	36	33.03
Bamenda III	108	37.11	52	47.71
Total	291	100	109	100
	Earth roads			
Bamenda I	42	12.88	15	23.08
Bamenda II	161	49.39	15	23.08
Bamenda III	123	37.73	35	53.85
Total	326	100	65	100

	Paved			
Bamenda I	36	11.92	21	21.43
Bamenda II	156	51.66	27	27.55
Bamenda III	110	36.42	50	51.02
Total	302	100	98	100
	Tarred but in bad shape			
Bamenda I	51	13.90	6	18.18
Bamenda II	171	46.59	12	36.36
Bamenda III	145	39.51	15	45.45
Total	367	100	33	100
	Paved, but in bad shape			
Bamenda I	42	12.80	15	20.83
Bamenda II	162	49.39	21	29.17
Bamenda III	124	37.80	36	50.00
Total	328	100	72	100

Source: Fieldwork (October, 2022)

Conclusion

The aim of this study was to examine the vulnerability of different demographic groups to the state of PT and develop a conceptual framework on how susceptible and exposed specific demographic groups are to the present conditions of PT in Bamenda city. To do this, the study specifically diagnosed the current condition of PT,

identified the demographic groups most vulnerable to the poor PT conditions, determined the specific vulnerability indicators of the poor PT conditions and developed a conceptual framework for Bamenda city which could have a wider application in other cities in SSA facing similar challenges. Findings showed that while PT is used oftently with the majority (52%) being on a daily basis for various reasons using different means such as taxis (the most preferred means), buses and motor cycle (*okada*), PT coverage is currently poor as most neighbourhoods are not covered, unaffordable due to high and ever increasing fare over the same distance, unsafe and unreliable and an overall poor condition of vehicles being used in the process. Also, most vulnerable populations to PT in Bamenda are individuals with disabilities (wheelchair, visually and/or hearing-impaired as well as those with temporary disabilities), the elderly/older persons (60+), women and other people in vulnerable situations such as lowly paid workers and unemployed people like students and pupils who do not have access to school bus. These vulnerable population experience several key challenges accessing PT on a daily basis. Findings further showed that the population of Bamenda city is highly vulnerable to the conditions of PT by help of certain vulnerability indicators. These indicators include health and safety concerns, inadequate access, long waiting/movement time to the nearest public PT facility, poverty/lack of finance, inaccessibility by individuals with disabilities and absence of PT amenities. All these causes the population to be highly exposed to the current state of PT in the city. Finally, the study develops a conceptual framework on how susceptible and exposed specific demographic groups are to the conditions of PT in Bamenda city which suggest how PT in the city could be improved upon in order to better serve these groups in the future.

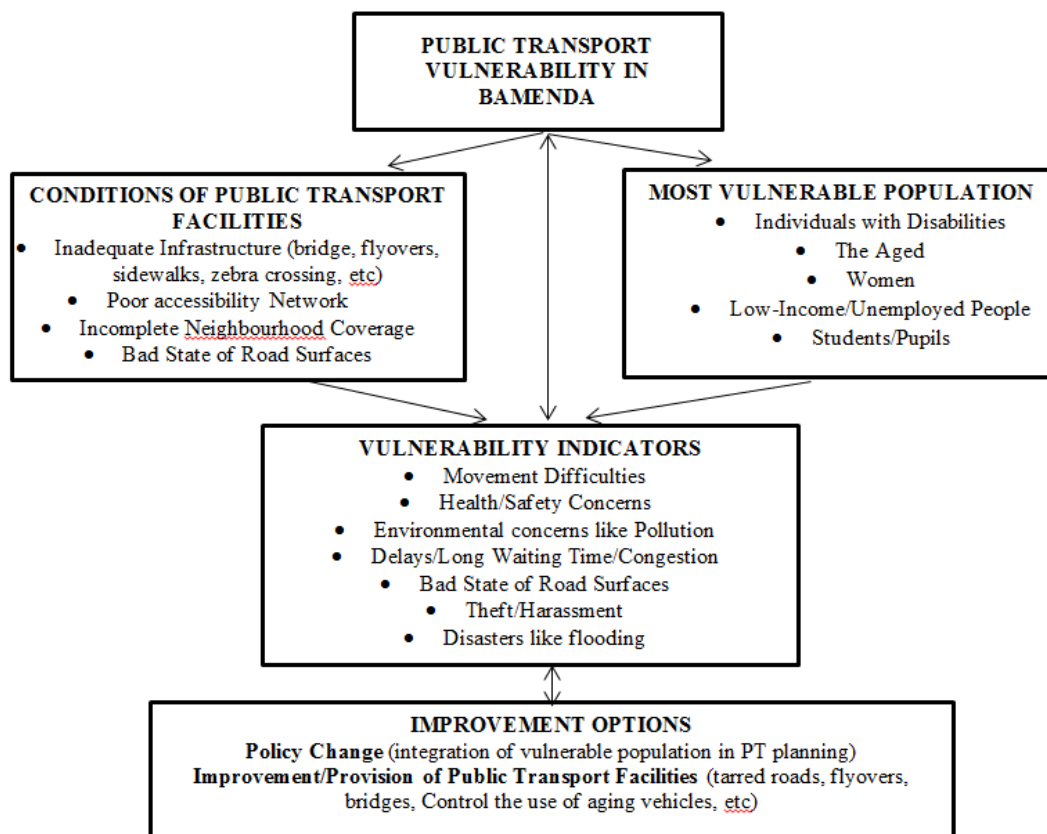


Fig 11. A Vulnerability Framework analysing how Susceptible and Exposed Specific Demographic Groups are to the State of PT in Bamenda city, Cameroon

Source: Conceived by Authors (2024)

By concentrating on vulnerability of different demographic groups to the conditions of PT in Bamenda city, this present study adds a novel aspect and case study to the subject of sustainable urban public mobility in SSA. It develops a conceptual framework on the susceptibility of specific demographic groups to the conditions of poor PT. By developing a novel conceptual framework on how susceptible and exposed specific demographic groups are to the conditions of PT in Bamenda, this study further makes a contribution to existing knowledge on sustainable urban public mobility and vulnerability which could positively influence policy changes on the part of the concerned stakeholders (Ministries of Transport, Public Works and Urban Development and Housing, Bamenda City Council, Bamenda I, II and III Sub-divisional Councils, Urban planners and developers, etc) towards improving the process of PT in Bamenda in particular and other SSA countries facing similar PT challenges in general. This study therefore makes a significant contribution to urban PT sustainability within the context of developing countries where there is still an acute shortage of PT facilities.

It is recommended that the concerned stakeholders should ensure to promote PT systems that secure the mobility of all citizens including the less poor and the poor and maintain the accessibility for all locations with improved road infrastructures. They should make a paradigm shift in their current policy endeavours by integrating individuals with disabilities in the PT planning process for best future outcomes, which is currently not the case. There is also a dire need to improve the current conditions of PT in the city by providing PT facilities such as bridges, flyovers, tarred roads, constantly maintain/renovate degraded road portions, amongst others. It is also recommended that they provide specifically-designed buses to cater for people with disabilities such as those to take on board travelers on wheelchairs to travel conveniently. While the study recommends a paradigm shift in current policy endeavours by integrating individuals with disabilities in the PT planning for best future outcomes, it recommends future studies on how to integrate individuals with disabilities in PT planning in Bamenda city.

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