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Active Mobility Assessment in the City of Bamenda

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Abstract:
Embarking on active mobility strategies, by promoting cycling and walking as transport modes in combination with public transport to facilitate longer distances can greatly influence cities' livability. Active mobility forms part of Sustainable Urban Mobility Planning. The inadequacy of sidewalks, which include narrow, uneven, obstructed, or even absent walkways, poses significant challenges and safety risks for pedestrians, who are among the most vulnerable road users. The study aimed at examining the active mobility infrastructure in the city of Bamenda and identifying the various barriers involved. Quantitative and qualitative data were collected through survey, inspection, interviews as well as secondary data sources. A sample size of 250 was used to represent the population of the focus area and considering the parameters on the checklist used, the average adequacy, which represents the qualitative score of the active mobility infrastructure for the six areas surveyed, was rated at 6.31 percent. Walking is the mode of travel predominantly used in the city of Bamenda as almost half of the total daily trips (48.8%) are made on foot in combination with taxi but unfortunately, initiatives have focused on roads and intersections meant for motorist travel and not on a systematic diagnosis of active mobility, especially sidewalk safety. The roads in the city are poorly designed with streetlights, pedestrian crossings and sidewalks visibly absent or partially obstructed by permanent obstacles and street vendors. Traffic safety is the leading factor, with a significant influence of 82.0% on active mobility. Good health is another important factor influencing the preference for walking or cycling, with a score of 70.40%. Thus, traffic safety and good health are interconnected factors that significantly influence the preference for walking or cycling in Bamenda. Consequently, pedestrian infrastructure need urgent improvement while cycling facilities are still to be conceived and implemented in the city by the policymakers. Thus, active mobility reduces reliance on private vehicles, alleviates traffic congestion, contributing to a more sustainable transportation system by lowering greenhouse gas emissions and reducing air pollution.

Keywords: Active Mobility, Road, Infrastructure, walking, Cycling.

1. Introduction

Transportation greatly influences the environment and cities' livability. To tackle the consequences, many cities have embarked on active mobility strategies, by promoting cycling and walking as transport modes and in combination with public transport to facilitate longer distances. Nonetheless, a wide adoption of active mobility has not been achieved yet, even in mature active mobility cultures. Transport planning should prioritize environmental friendly, efficient and accessible modes of travel, starting with walking, cycling, public transport, freight transport and finally passenger cars (Interreg Europe, 2019)**.** Active mobility forms part of Sustainable Urban Mobility Planning (SUMP) and can be assessed through a multi-faceted approach, considering its alignment with strategic policies, its impact on the social environment, its interaction with the physical environment and infrastructure, and its compliance with relevant regulations and legislation (PASTA Consortium, 2017). Active mobility measures, such as walking or cycling, can be effectively implemented in a city or region with strong and continuous political commitment, strategic planning and social advocacy. This commitment ensures that the necessary resources and infrastructure are provided to support and encourage active transportation. However, many cities adopt a piecemeal approach,

implementing a set of activities and actions unsystematically. A more systematic and comprehensive approach would lead to better outcomes, as it allows for a more integrated and coherent active transportation network**.** The Dutch Cycling Embassy (2019) and the European Cycling Federation (2016) suggest that active mobility such as cycling contributes to at least eleven of the seventeen Sustainable Development Goals.

For the case of exploring research and reviewing literature on active mobility in the city of Bamenda to develop a comparison study with previous findings and knowledge, there was only very little available online. As cited by Tatah et al. (2022) who worked on "Travel Behaviour and Barriers to Active Travel among Adults in Yaoundé, Cameroon", data on travel habits in Cameroon is scarce and limited to a single survey conducted in Douala in almost two decades. Active mobility plays a vital role in creating sustainable, healthy, and livable cities. This is further supported by the fact that road transport is the dominant mode of transportation in the city for both persons and goods (Tachi & Fombe, 2021). The favorable temperatures in Bamenda enable the utilization of active mobility as a beneficial and eco-friendly transportation option. However, the pedestrians and cyclists are forced to share public spaces with motorized transport meanwhile pedestrians are those who suffer more injuries in the event of a crash (Jia, Fantta, & Mercado, 2022). This requires a city like Bamenda to have the tools to design streets that can protect the integrity of pedestrians, cyclists and to prioritize sidewalks and cycle lanes.

The objective of this study was to examine the active mobility infrastructures in the city of Bamenda, identify the various barriers preventing active mobility and develop evidence-based recommendations and strategies for improving walking and cycling as a viable transportation options in Bamenda. Consequently, the study is based on the hypothesis that adequate sidewalks, better infrastructure standards and maintenance, proper lighting, and traffic enforcement are crucial to enhancing active mobility**,** particularly walking in urban areas. The research emphasizes the importance of incorporating active mobility improvement projects into the Master Plan and Urban Mobility Plan of the City Council. This approach is significant for effectively enhancing the conditions for safe walking and cycling throughout the city.

2. **Methodology**

2.1. Study area

Located approximately 366 kilometers northwest of Yaounde, Cameroon's political capital, Bamenda city is situated in the Mezam division of the North West Region. The city is the most populated within its region, boasting a population of approximately 393,835 out of 2,302,871 for the entire region. Its geographical coordinates are 5°56'34.9"N latitude and 10°10'45.5"E longitude, with an elevation of 1,614m above sea level. (Country Profile, 2019). The City Mayor is responsible for administering the city council, which is composed of three sub-divisions, namely Bamenda I, Bamenda II, and Bamenda III. The City Mayor's role is to oversee the operations and activities of these sub-divisions, ensuring that they function efficiently and effectively in providing services to the city's residents. The road network that links the city's business center is deplorable, be it from T-junction to Hospital roundabout, Ngeng Junction to City Chemist roundabout, Veterinary junction to T-junction amongst others, pot holes are very much present with very few or no traffic signs along these streets. It covers a total surface area of 3125 hectares, Neba (as cited in Nyambod Emmanuel Mba, 2010). These three sub-divisions are made up of seven villages: Mankon, Nkwen, Mendankwe, Nsongwa, Banza, Bantou and Chomba.

The study was delimited to Bamenda II to ensure effectiveness and efficiency. Bamenda II is made up of four villages; Mankon, Nsongwa, Bantou and Chomba. The study area included the Central Business District (CBD), City Chemist roundabout surrounded by travel agencies, Food Market and Hospital roundabout (**Figure 1**). These facilities form the most pedestrian attraction points in the city.

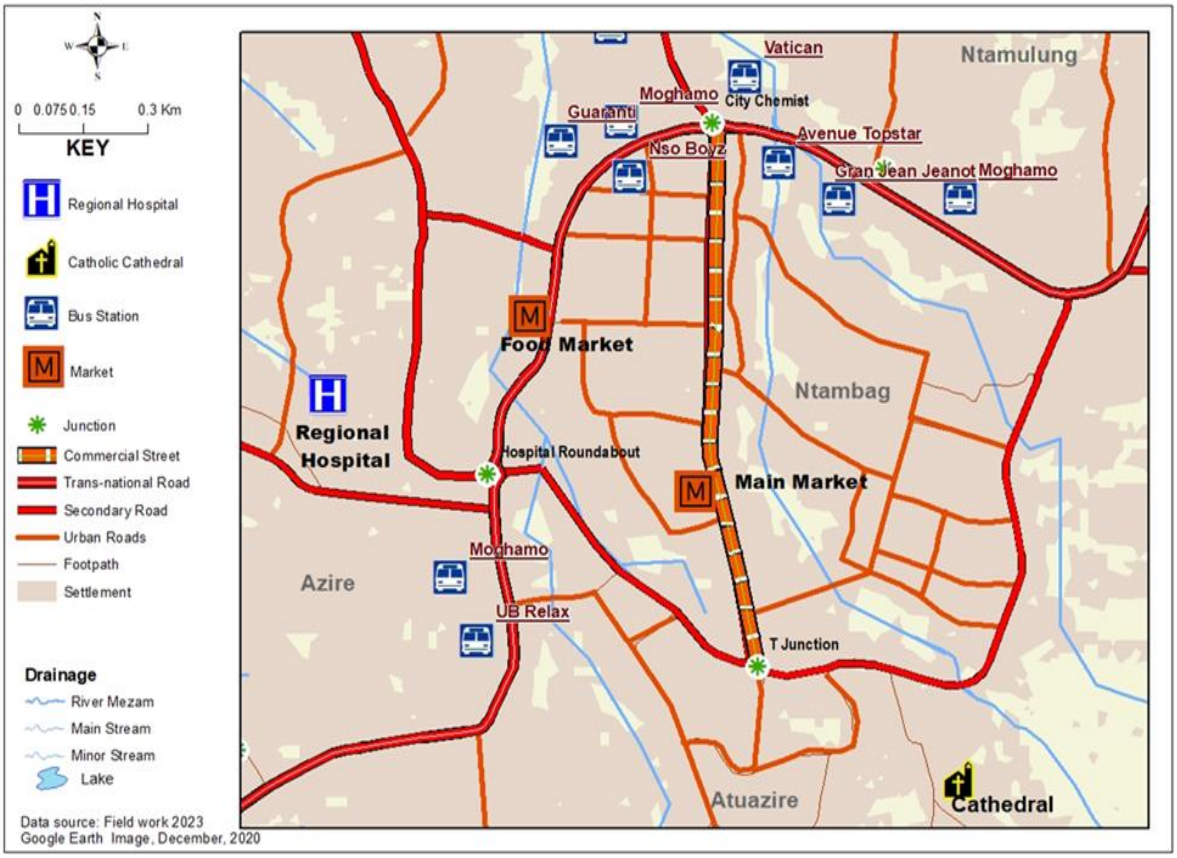

Figure 1: Delimitation of the study area

2.2 Data Collection Procedure

Quantitative and qualitative data were collected from primary sources since the study involved both numerical and non-numerical data. In an effort to meet the general objective of the study, three methods of assessment were used to collect the data, which include survey, field inspection and direct interviews. The data collection was carried out in the month of October 2023.

2.2.1 Population survey

The survey involved issuing structured questionnaire to the road users especially pedestrians within the focus area. The study population was made up of students, workers and other road users in the city of Bamenda who use the road almost on a daily basis. To ensure accurate and reliable results, a representative sample was estimated, as collecting data from the entire population was impractical. Therefore, Slovin's formula in Equation (1), a well-established method for calculating the necessary sample size to adequately represent the population was utilized. The error was set to 0.05, as it has been used several times by researchers (Meesit et al, 2023), for similar study and has been reported to provide reliable results.

$$n = \frac{N}{1 + Ne^2} \qquad (1)$$

Where N = total population size
n = required sample size
e = margin of error

The city's population is estimated to be approximately 393,835 (Country Profile, 2019). Hence, applying Slovin's formula we obtained the following results.

$$n = \frac{393835}{1 + 393835\,(0.05)^2}$$
$$= 399.59$$

Bamenda II Subdivision plays a significant role in the statistical analysis of the Bamenda municipality due to its composition of four out of the seven villages. Thus, the sample size for the focus area was calculated as 60% of 399.59 which gives about 240. Responses were received from 250 participants.

A structured Likert scale questionnaire with closed-ended questions was used to collect information from the participants who voluntarily gave their opinion concerning active mobility infrastructures and its barriers in the city of Bamenda. The questionnaire was divided into three sections with the first involving the demographic and socioeconomic characteristics, the second part consisted of questions related to active mobility infrastructure and the last part was intended to have the perceptions of the respondents with respect to the various barriers to active mobility in the city. The response scale ranges from 1 to 4, with 1 indicating "Strongly agree," 2 representing "Agree," 3 signifying "Disagree," and 4 denoting "Strongly Disagree". The anonymous, self-administered format of the questionnaire aimed to increase response rates and address issues related to supplemental data. The survey questions can be seen in **Appendix A**.

2.2.2 Field inspections

Field visits to the selected streets in the study area were carried out to assess the state of active mobility infrastructure as well as the day-to-day challenges faced by the road users due to these infrastructures. Camera was used to take photos of the infrastructure for further processing.

To effectively assess these infrastructures, a checklist was developed combining several parameters considered in previous assessment techniques in other city centers. Some of these techniques include; the use of Pedestrian Environment Assessment Tool (PEAT) in South Africa (Albers et al. 2010), the ELECTRE TRI method for sidewalk performance (Sousa et al. 2017), the Global Walkability Index (GWI) developed by taking research locations in Beijing and New Delhi (Krambeck & Shah, 2006) and the walking and cycling guidelines for streets published by UN HABITAT (2018). The parameters considered in the checklist covered both pedestrian and cyclist infrastructure in various dimensions including infrastructure convenience, its safety, its signalization, its accessibility, and its comfort. Some of these parameters were the width and height of the sidewalk, parking facilities, bus stops, pavement conditions, obstruction, crosswalk, lighting conditions, traffic calming measures etc.

In total, 37 parameters were considered over the five dimensions, and for each parameter, a description was specified with the criteria used to assess the parameters. This approach was to thoroughly observe each parameter, to assess it based on the criteria and to assign a qualitative score fixed to two possibilities: adequate or inadequate. This was to simplify the assessment process and to allow its replicability over locations. Finally, the ratio of the adequate parameters over the total number of parameters was computed to have a sense of the magnitude of the adequacy of the infrastructure. The adequacy rate of each street chosen in the study area was calculated by dividing the number of parameters with satisfactory features by the total number of parameters and the result multiplied by 100. That is, (N /37) x 100 gives the adequacy rate where N is the number of parameters with satisfactory features in a given area and 37 is the total number of parameters.

2.2.3 Interview

Direct interviews were conducted with some key practitioners in active mobility infrastructures in the city of Bamenda. These interviews were carried out with three primary employees of the City Council. The objective was to gather first-hand information and their insights on active mobility in the city. They were the Director of Urban Development, responsible for planning and implementing urban development projects, the Chief of Service for Transport and Traffic Circulation, overseeing the city's transportation system and traffic flow and the Bureau Head for Public Utility and Networks. In addition**,** Interviews were carried out during participatory field trips. The information gotten, provided unique insights and served as a method for fact-checking unverified data. Some of these questions can be seen in **Appendix B**.

2.3 Data analysis

In this analysis, descriptive statistics was employed to gain a fundamental understanding of the dataset's characteristics. This involved summarizing the key features of the sample data using measures of central tendency like mode and mean. Inferential statistics contributed in making inferences about the population by testing hypothesis based on the sample of data. In this case, a non-parametric test using Mann-Whitney U (2 samples) was carried out as an independent sample t-test as a test of hypothesis to indicate whether the perception of male and female respondents is significantly different or not. All the questions on active

mobility infrastructure and barriers on the questionnaire served as the null hypotheses for the t-test. Quantitative data were entered and analysed using the SPSS software. The specific version of the software used in this case was version 23, which offers a wide range of statistical tools and techniques for analysing quantitative data.

3. Results and Discussion

3.1 Results of the survey

3.1.1 Descriptive statistics of demographic information

Overall, 250 respondents took part in the study excluding those interviewed. Out of this number, 85 were males and 165 were females road users. Other demographic characteristics recorded were age, level of education and the economic status of the respondents. The relative frequency of various respondents is shown in **Table 1** below.

Table 1: Demographic information of the respondents

Demographic Information		Count	Column N %
Gender	male	85	34.0%
	female	165	66.0%
Age	5-25	167	66.8%
	26-35	58	23.2%
	36-45	25	10.0%
	46-55	0	0.0%
	>56	0	0.0%
Level of Education	Primary school	2	0.8%
	Secondary school diploma	79	31.6%
	High school diploma	104	41.6%
	Bachelor's degree	46	18.4%
	Master's degree	18	7.2%
	PhD	1	0.4%
Worker/Student	Worker	60	24.0%
	Student	190	76.0%

3.1.2 Active mobility infrastructure in the City of Bamenda

It is clear from the diagnosis that the city of Bamenda requires infrastructure design guidelines, effective implementation and monitoring. This research proposes design solutions for each category identified during the diagnosis, especially special designs at intersections and a sidewalk maintenance section. According to the study results, the mean scores of the active mobility infrastructures with their respective standard deviations are as seen on **Table 2** below.

Table 2: Mean score of active mobility infrastructures with their respective standard deviation

Active Mobility Infrastructure	N	Mean	Std. Deviation
1. There are dedicated cycling paths in the city.	250	3.17	.873
2. Sidewalk conditions and pavements in the city are good.	250	3.13	.765
3. There are street furniture (footrests, benches, trees) within the city.	250	2.94	1.036
4. There are intersections between public transit and pedestrian/bicycle infrastructure	250	2.81	.920

5. Like to cycle if safe bicycle lanes are available in the city.	250	2.23	1.049
6. The streets in the city have usable footpaths.	250	2.22	.941
7. Where sidewalk exist, it is often discontinuous, narrow, obstructed or poorly maintained	250	2.04	1.067
8. Like to walk if safe pedestrian paths are provided in the city.	250	1.74	.878
Valid N (listwise)	250		

The information on **Table 2** above can be elaborated as seen below:

- Dedicated cycling paths: This item received a mean score of 3.17, suggesting that majority of respondents disagreed or strongly disagreed that there are dedicated cycling paths in the city. Thus, including cycling tracks during road design and construction in the city would contribute to enhancing active mobility.
- Sidewalk conditions and pavements: The sidewalk conditions and pavements in the city were rated poorly by respondents, as evidenced by the score of 3.13.
- Street furniture: The assigned score of 2.94 for the city's street furniture suggests an inadequate provision, implying that there should be more street furniture to meet the desired standards.
- Connection points between public transport stations and pedestrian or cycling lanes: The respondents expressed their disagreement regarding the presence of adequate connection points between public transport systems and pedestrian or cycling lanes, as indicated by the score of 2.81.
- Like to cycle if safe bicycle lanes are available: This item earned a score of 2.23, denoting that majority of the respondents would like to cycle if safe bicycle lanes are available in the city.
- Streets in the city have usable footpaths: This item had a score of 2.22, suggesting that majority of the respondents agreed that streets in the city have usable footpaths.
- Where sidewalk exist, it is often discontinuous, narrow, obstructed or poorly maintained: The majority of respondents indicated that while sidewalks exist in the city, they are often fragmented, narrow, blocked, or poorly maintained, leading to a perception of unsafe conditions, as indicated by the score of 2.04
- Like to walk if Safe pedestrian paths are provided in the city: A significant majority of the respondents expressed a strong preference for walking if safe pedestrian paths were available in the city, as this received a score of 1.74

Table 3 below shows the hypothesis test summary on the perceptions across male and female respondents concerning active mobility infrastructures in the city. According to the Mann-Whitney U test, the null hypothesis assumes that the opinions of male and female respondents concerning active mobility infrastructure and barriers do not differ significantly while the alternative hypothesis states that their opinions do differ significantly.

From the table, the analysis of the data shows a statistically significant difference in opinions about footpath usability in the city between men and women. This conclusion is based on the p-value for the first hypothesis being 0.005, which is less than the significance level of 0.05. Thus, the data suggests that male and female respondents have significantly different opinions on footpath usability, leading to the rejection of the null hypothesis that there is no difference between their views

The second hypothesis, which likely examines the difference in opinions about sidewalk conditions and pavements between men and women, does not show a statistically significant difference. This is because the p-value of 0.276 is greater than the significance level of 0.05**.** That is their attitudes, feelings are the same towards sidewalk conditions and pavements in the city, and thus the null hypothesis is retained.

Comparing all the p-values on the table with 0.05, we would be able to determine the attitudes, feelings or behaviours of the male and female respondents with respect to the active mobility infrastructures in the city of Bamenda.

Table 3: Hypothesis Test Summary for the Perceptions of male and female respondents concerning active mobility infrastructure

S/N	Null Hypothesis	Test	Sig.	Decisions
1	Streets in the city have usable footpaths.	Independent-Sample Mann-Whitney U Test	0.005	**Reject the null hypothesis**
2	Sidewalk conditions and pavements in the city are good.	Independent-Sample Mann-Whitney U Test	0.276	Retain the null hypothesis
3	There are street furniture (footrests, benches, trees) within the city.	Independent-Sample Mann-Whitney U Test	0.202	Retain the null hypothesis
4	Where sidewalk exist, it is often discontinuous, narrow, obstructed or poorly maintained.	Independent-Sample Mann-Whitney U Test	0.301	Retain the null hypothesis
5	Like to walk if safe pedestrian paths are provided in the city.	Independent-Sample Mann-Whitney U Test	0.003	**Reject the null hypothesis**
6	There are dedicated cycling paths in the city.	Independent-Sample Mann-Whitney U Test	0.027	**Reject the null hypothesis**
7	Like to cycle if safe bicycle lanes are available in the city.	Independent-Sample Mann-Whitney U Test	0.006	**Reject the null hypothesis**
8	There are connection points between public transports and pedestrian or bicycle lanes.	Independent-Sample Mann-Whitney U Test	0.002	**Reject the null hypothesis**

Asymptotic significances are displayed. The significance level is 0.05

3.1.3 Barriers to Active Mobility

To effectively promote active mobility, such as walking and cycling, it's not enough to simply build the necessary infrastructure. We must also find effective ways to educate people about the benefits of active mobility and inspire them to actually change their transportation habits. Thus, in order to encourage people to commute by foot or bicycle, road safety and other infrastructural factors must be considered in advance.

Table 4 presents the respondents' ratings of various barriers to active mobility, based on the study results**.**

Table 4: Descriptive Statistics of the barriers to active mobility			
Barriers to active mobility	N	Mean	Std. Deviation
1. Adequate lighting of sidewalks and cycling paths during nighttime	250	3.24	.908
2. Feel safe crossing the streets in the city.	250	3.19	.802
3. Walking or cycling to school, market or work is for poor people.	250	3.19	1.010
4. Strategies to deter motorcycles from riding on sidewalks.	250	3.08	1.011
5. Safe walking and cycling paths in the city.	250	3.07	.967
6. Drivers respect pedestrian crossings in the city	250	2.84	1.031
7. Travel time and quality of service are some of the reasons I do not like walking or using a bicycle in the city.	250	2.29	.969
8. Taking advantage of pedestrian and bicycle lanes for purposes like setting up booths, showcasing products, and organizing various events.	250	2.27	1.021
9. Prefer walking and cycling because of the desire for better health.	250	2.00	1.037
Valid N (listwise)	250		

The information on **Table 4** above can be elaborated as seen below:

- Improving lighting during night-time: This assessment had an average score of 3.24 suggesting that the majority of the respondents disagreed or strongly disagreed that there is adequate lighting of sidewalks during night-time**.** By upgrading urban lighting, there is a potential to stimulate and boost active mobility**.**
- Safe crossing the streets and walking or cycling to school and other places is for poor people: These two actions received the same score of 3.19, indicating that the implementation of safer pedestrian crossing facilities would encourage more individuals to participate in active transportation methods, such as walking or cycling. In addition, they reaffirmed that engaging in active mobility is not because someone is poor.
- Measures to prevent motorcycle from using the sidewalks: The action of preventing motorcycles from using the sidewalks has a policy implementation score of 3.08, which suggests that respondents generally agreed or strongly agreed that the current measures in place are inadequate and weak.
- Safe walking and cycling paths: This item had a score of 3.07, signifying that the walking and cycling paths in the city are not safe.
- Respect of pedestrian crossings: The survey results revealed that only 39.6% of the respondents agreed or strongly agreed that drivers respect pedestrian crossings in the city, given that the action was rated 2.84. This observation was consistent with the findings from the field inspection.
- Travel time and quality of service: This item had a score of 2.29, suggesting that for majority of the respondents, travel time and quality of service hinder their willingness to engage in active mobility in the city.
- Utilising pedestrian paths for other activities: The action of roadside vendors occupying pedestrian paths with their product exhibitions was evaluated during field inspection. With an average score of 2.27, it is indicative of the majority of the respondents agreeing or strongly agreeing with the aforementioned statement.

- Active mobility and health: The action had an average score of 2.00, indicating that a vast majority of the respondents expressed strong agreement that promoting walking and cycling significantly enhances health benefits

The perceptions of the male and female respondents concerning the various barriers to active mobility in the city of Bamenda is summarized on **Table 5** below.

Table 5: Hypothesis Test Summary for the Perceptions of male and female respondents concerning barriers to active mobility.

S/N	Null Hypothesis	Test	Sig.	Decisions
1	There are safe walking and cycling paths in the city.	Independent-Sample Mann-Whitney U Test	0.060	Retain the null hypothesis
2	Feel safe crossing the streets in the city.	Independent-Sample Mann-Whitney U Test	0.594	Retain the null hypothesis
3	Adequate lighting of sidewalks and cycling paths during nighttime.	Independent-Sample Mann-Whitney U Test	0.022	**Reject the null hypothesis**
4	Strategies to deter motorcycles from riding on sidewalks	Independent-Sample Mann-Whitney U Test	0.100	Retain the null hypothesis
5	Sidewalks and bicycle paths are being used for other activities	Independent-Sample Mann-Whitney U Test	0.539	Retain the null hypothesis
6	Walking or cycling to school, market or work is for poor people.	Independent-Sample Mann-Whitney U Test	0.014	**Reject the null hypothesis**
7	Drivers respect pedestrian crossings in the city.	Independent-Sample Mann-Whitney U Test	0.217	Retain the null hypothesis
8	People prefer walking and cycling because of the desire for better health.	Independent-Sample Mann-Whitney U Test	0.272	Retain the null hypothesis

9	Travel time and quality of service hinder active mobility in the city.	Independent-Sample Mann-Whitney U Test	0.480	Retain the null hypothesis

Asymptotic significances are displayed. The significance level is 0.05

Comparing **Tables 4** and **5,** it can be concluded that the opinions of the respondents can be considered with certainty during policy implementations concerning active mobility infrastructure and barriers in the city of Bamenda. This applies everywhere with the exception of adequate lighting of sidewalks and cycling paths during nighttime and walking or cycling to school, market or work being for poor people. The Independent-Sample Mann-Whitney U test indicates that the opinions of male and female respondents are, in fact, not identical regarding these two cases mentioned. Consequently, their opinions cannot be considered with certainty.

3.2 Results of the field inspection

The six different sites inspected within the study area were City Chemist roundabout, Hospital roundabout, T-junction, Commercial Avenue, Food Market stretch and Meta Quarter stretch (linking T-junction and Hospital roundabout). From this field inspection and the parameters on the checklist, the active mobility infrastructures at these six sites are below standards and thus inadequate, with Food Market Stretch and Meta Quarter being the worst cases. Some of these situations can be seen on **Figure 2** below.

Poor sidewalk condition along the Food Market stretch

Vicious behaviour by road users along the CBD

Figure 2: Some barriers to active mobility in the City

Considering the parameters on the checklists, the adequacy rates for the active mobility infrastructures for the six different locations in the study area inspected are 16.22% for T-junction and Commercial Avenue, 2.70% for City Chemist and Hospital Roundabouts, and 0.00% for both Food Market stretch and Meta Quarter. This indicates that T-junction and Commercial Avenue are better in terms of active mobility infrastructures while Food Market stretch and Meta Quarter have the worst cases of active mobility infrastructures. Consequently, an average adequacy rate for the active mobility infrastructures in the study area is 6.31 percent. Thus, it can be concluded that pedestrian infrastructures need urgent improvement in the city. As for cycling, the infrastructures are still to be conceived and implemented in the city by the policymakers.

Pedestrian crossings especially at intersections are completely absent in the city. **Figure 3** shows an example of the actual situation in the study area when it comes to crossing at intersections. This explains one of the challenges faced by pedestrians in the city.

Figure 3: Lack of crosswalk at Savana Junction along the CBD

3.3 Results of interview

The interview revealed that an active mobility plan has been proposed for the city of Bamenda but waiting approval of the City Mayor. It was also learned that there is no separate budget for active mobility infrastructure and monitory in the city. This confirms the many lapses in the city when it comes to active mobility infrastructure. It was also discovered that the main black spot of pedestrian concern in the city identified during the study include Commercial Avenue, Food Market and Mobil to Amour Mezam stretch in Nkwen. Lack of political will, qualified personnel and non-respect of the council norms by some road users are some of the challenges faced by the City Council.

Thus, there is need for greater effort to raise awareness among various stakeholders for the successful implementation of pedestrian safety measures and promotion of walking benefits in Bamenda. This can be achieved through strategic planning, collaboration, and investment in infrastructure and safety measures.

4. Recommendations

Active mobility infrastructures are undeniably lacking in the city and legal mechanisms are needed to address the barriers that active travelers face so that city dwellers can arrive safe to their destinations. To address this issue, short-term, medium and long-term measures are proposed as seen on the table below depending on the number of stakeholders/institutions involved. It should be noted that to sustainably implement the following recommendations, there must be effective and efficient collaboration among the different stakeholders involved.

Table 6: Long-term, Medium-term and Short-term measures proposed for the city of Bamenda

Measures	Medium and long-term actions	Short- term actions in the study area	Institution responsible
Action 1: Land-use policies	Development strategies should promote the construction of residential, business, and leisure spaces within walking distance of public transport.		• Bamenda City Council • MINHDU
Action 2: Improving multimodal facilities	Enhance intermodal transport hubs to foster pedestrian-friendly environments	Improve connection between taxi stops and public transport stations	• Bamenda City Council • MINT
		Regulate parking for cars along Food Market and the CBD	• Bamenda City Council
		Designate bicycle parking areas at City	• Bamenda City

		Chemist, T-Junction & Hospital Roundabout	Council • MINT
Action 3: Complete street and parking policies	Implement comprehensive street policies, aimed at improving spatial distribution among various modes of transportation, including pedestrians, cyclists, and motorists	Improve sidewalk width, frequent crossings, dedicated bike lanes and effective parking regulation policies at Food Market, CBD, etc	• Bamenda City Council
Action 4: Reclaiming urban spaces	Transform some city areas primarily used by vehicles into spaces that prioritize pedestrians to encourage more people to walk, thereby fostering a sense of safety and ownership of the space.	Construct new pedestrian areas through pavement work along Food Market stretch, Meta-quarter, etc	• Bamenda City Council
Action 5: Guidelines for sidewalk design	Proper sidewalk geometry is crucial for ensuring the safety, accessibility, and usability of pedestrian facilities.	Sensitize designers, decision-makers, and local authorities on the importance of sidewalks that meet the needs of all users and contribute to healthier, more sustainable communities.	• Bamenda City Council • MINHDU
Action 6: Build adequate sidewalks	To ensure universal accessibility, it is essential to construct sidewalks with appropriate dimensions, correct slopes, adequate pavement, and necessary infrastructure.	Expand the size of the sidewalk along the CBD, etc	• Bamenda City Council
		Construct ramps and install tactile Pavement for accessibility in the study area	• Bamenda City Council
		Reconstruct the sidewalks along Food Market stretch and Meta-quarter.	• Bamenda City Council
Action 7: Increase urban furniture	Increase the urban furniture along pedestrian paths in the city.	Benches: To provide rest spots for pedestrians, especially for the elderly, disabled, or those with mobility issues.	• Bamenda City Council • MINHDU

		Trees: To contribute to a healthier environment, provide shade, and enhance the aesthetics of urban landscapes.	• Bamenda City Council • MINHDU
		Garbage bins: To maintain cleanliness, prevent littering, and promote responsible waste disposal habits.	• Bamenda City Council • MINHDU
Action 8: **Install street lighting**	Implement street lighting along sidewalks and pedestrian crossings.	Street lighting should be installed at regular intervals on both sides of the sidewalk and pedestrian crossings to ensure even distribution of light and adequate visibility for pedestrians.	• Bamenda City Council • MINHDU
Action 9: **Strict regulation on street vendors**	Effectively regulate street vendors by designating suitable areas in furniture strips for their operations.	Identify suitable locations like intersections and crosswalks for street vendors within furniture strips, accessible to both pedestrians and vendors, with adequate space for setting up stalls and displaying products. Local authorities should establish clear regulations regarding street vending in these areas.	• Bamenda City Council • MINHDU • MINT • Law Enforcement Officers
Action 10: **Increase the number of crossings**	Enhance pedestrian accessibility through strategic crossing placement.	Increase the number of pedestrian crossings, which reduces the distance pedestrians need to walk without a designated crossing point, decreasing the risk of accidents.	• Bamenda City Council
Action 11: **Reduce crossing distance**	Minimize interactions between vehicles and pedestrians through infrastructure and signaling adjustments	Decrease the distance pedestrians need to cover while crossing a road by adjusting the layout of intersections or incorporating pedestrian overpasses/underpasses .	• Bamenda City Council • Ministry of Public Works

		Enhance signal timings and patterns, which can further decrease the potential for vehicle-pedestrian interactions. For example, implementing leading pedestrian intervals (LPIs)	• Bamenda City Council
Action 12: Traffic calming measures	Implement traffic calming measures to enhance pedestrian safety and mitigate the severity of traffic accidents.	Increase sidewalk area within curves and reduce turning radius.	• Bamenda City Council • Ministry of Public Works
		Place speed cushions	• Bamenda City Council • Ministry of Public Works
Action 13: Road safety strategies for all	High-risk environments, such as schools, hospitals, and areas with high pedestrian presence, require special attention when developing road safety strategies and assessments.	Reduce the speed limit in these areas to provide additional reaction time for drivers and reduce the severity of accidents. Design roads with pedestrian-friendly features like wider sidewalks, dedicated pedestrian crossings, and traffic calming measures. Improve visibility through better lighting and reflective materials in these areas.	• Bamenda City Council • MINT • Law Enforcement Officers
Action 14: Awareness campaign	Inform the community on road safety risks and promote road safety measures.	Launch educational initiatives, public awareness campaigns, and collaborative partnerships with local organizations.	• Bamenda City Council • MINT • Law enforcement Officers

The above main strategies can be implemented in the following strategic positions in the study area as summarized in **Figure 4** below. It should be noted that zebra crossings and sustainable street light are not included in the figure below because they are highly needed in all the city at standard intervals. Thus, there is need for street lighting installation and zebra crossings at all intersections and at safe locations within the road sections.

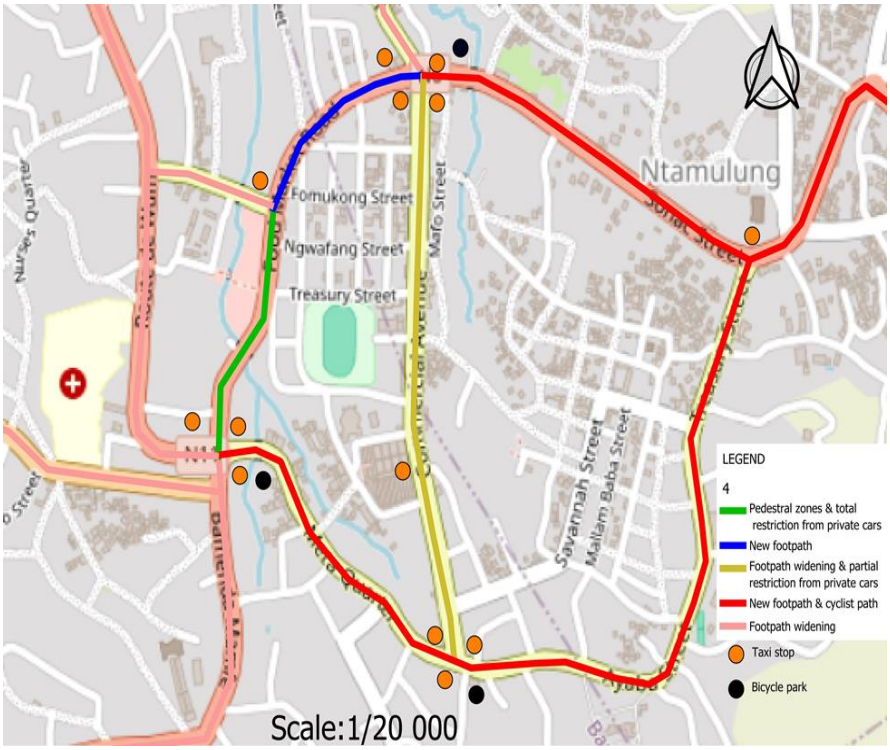

Figure 4: Priority possible interventions and where to be implemented

Conclusion

The primary issue underlying the problems related to Bamenda City sidewalks is the lack of adequate guidance on the conception, design, and execution of these structures. This ambiguity extends to the general population, designers, builders, and policymakers alike. To rectify this situation, it is essential to increase awareness among all stakeholders regarding the concepts and parameters that define high-quality sidewalks. This will facilitate the successful implementation of these elements in Bamenda over the coming years. Currently, there is a lack of clarity regarding who holds these responsibilities, which hampers efforts to prioritize active mobility in Bamenda. Another crucial factor in addressing Bamenda City's sidewalk issues is not allocating resources specifically earmarked for improving active mobility infrastructure and urban planning.

The study conducted in Bamenda aimed to examine the active mobility infrastructures and identify the barriers preventing walking and cycling. The data was collected through various sources, including surveys, inspections, interviews, and secondary data sources. It was found that traffic safety and good health were the most significant factors influencing the preference for walking or cycling in the city of Bamenda. Traffic safety emerged as a crucial factor influencing the preference for walking or cycling in Bamenda, with 82.0% of respondents indicating this as a significant concern. Good health was another essential factor influencing the preference for walking or cycling in Bamenda, with 70.40% of respondents indicating this as a significant concern. Consequently, it can be concluded that pedestrian infrastructures need urgent improvement in the city. As for cycling, the infrastructures are still to be conceived and implemented in the city by the policymakers. To effectively improve walking and cycling safety across the city, active mobility enhancements must be integrated into the City Council's Master Plan and Urban Mobility Plan.

Some limitations during this research was collecting insights and expertise on building active mobility routes and its barriers as Bamenda is filled with many roads and streets, which are typically built for cars as of the time of this data collection. Another challenge faced during survey was that the law enforcement officers had suspicious feelings especially when snapshots were being taken at some strategic positions due to the ongoing crisis in the region.

Further research is needed to explore how these contextual factors may affect the political and decision making processes across the city. In addition, future research should focus on evaluating and quantifying the beneficial effects of implementing active mobility regeneration strategies on a city's accessibility and competitiveness.

Appendix

Appendix A: Survey questions

- **Respondents' Demographic Information**
- Gender
- Age
- Level of education
- Employment status
- Do you have a bicycle in your household?
- Daily commuting distance (km)
- Daily commuting time (minutes)
- What is your preferred mode of transport within the city?
- Where do you start your trip?
- Where do you go most often?
- **Active Mobility Infrastructure (strongly agree to strongly disagree)**
- 1. The streets in the city have usable footpaths.
- 2. Sidewalk conditions and pavements in the city are good.
- 3. There are street furniture (footrests, benches, trees) within the city.
- 4. Where sidewalk exist, it is often discontinuous, narrow, obstructed or poorly maintained.
- 5. Like to walk if safe pedestrian paths are provided in the city.
- 6. There are dedicated cycling paths in the city.
- 7. Like to cycle if safe bicycle lanes are available in the city.
- 8. There are transit stations with pedestrian and bicycle infrastructure.
- **Barriers to Active Mobility (strongly agree to strongly disagree)**
- 9. There are safe walking and cycling paths in the city.
- 10. Feel safe crossing the streets in the city.
- 11. Adequate lighting of sidewalks and cycling paths during nighttime.
- 12. Strategies to deter motorcycles from riding on sidewalks.
- 13. Taking advantage of pedestrian and bicycle lanes for purposes like setting up booths, showcasing products, and organizing various events.
- 14. Walking or cycling to school, market or work is for poor people.
- 15. Drivers respect pedestrian crossings in the city.
- 16. I prefer walking and cycling because of the desire for better health.
- 17. Travel time and quality of service are some of the reasons I do not like walking or using a bicycle in the city.

Appendix B: Semi-structured interview questions for City Council employees

1) Are there any plans on improving active mobility (walking and Cycling) in the city?
2) Is there any budget for active mobility infrastructure during construction?
3) Is there any budget for maintenance and monitoring?
4) Is there any particular spot of pedestrian concern in the city identified by the council?
5) Is there any intention to create cyclist lane, shades like trees, sitting places (furniture zoon)?
6) What challenges are faced during the implementation of the respect of pedes-trian path, from vendors, vehicle owners?
7) Are there any transport planning document on active mobility for future road design in the city?
8) What is the most recent approximated population of the city (any document?)

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