

A Study on Service Quality of Footpath in Panthapath Signal to Kawran Bazar Signal

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A thesis submitted to the Department of Civil Engineering in partial
fulfillment for the degree of Bachelor of Science in Civil
Engineering



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BOARD OF EXAMINERS

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DECLARATION

It is hereby declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma.

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Dedicated
to
“Our Parents”

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ABSTRACT

Workers typically reside close to their workplaces in industrial zones of developing nations and prefer to walk there to get to work. Therefore, footpaths are essential in these locations, especially in developing nations like Bangladesh where people have a propensity to walk to their workplaces in order to save money on transportation costs for their living. To accommodate this large numbers of pedestrians, the level of service (LOS) of the walkway in these areas should be substantially higher. However, Bangladeshi authorities have not clearly defined the LOS evaluation criteria for off- street pedestrian facilities, and there have been very few research on the topic. This inspires the writers to evaluate the walkways' level of service using both qualitative and quantitative methods in areas like Panthapath.

In this study, 250 people participated in a survey to determine the critical elements that influence how satisfied pedestrians are, and it was discovered that the average rating of the footpath is 2.53 (out of 5), which is unfavorable and unwanted. Such findings provide guidance for future improvement and are useful for designing footpath design and maintenance policies.

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CHAPTER 1

INTRODUCTION

1.1 Background and Motivations

In the previous 200 years, the world's population has expanded six times, while the urban population has multiplied 100 times. By 2050, the world's largest urban centers will be home to 70% of the world's population, or roughly 6.3 billion people. This growth rate is more severe in developing nations like Bangladesh, especially in industrial zones where population density has beyond all acceptable levels and poor people from the bourgeoisie reside there more densely for survival. (Ortiz Ospina, 2020)

These people typically reside in unsanitary and unhealthy areas close to where they work and prefer to walk there from where they live. Thus, in these areas, where working-class people virtually invariably walk to their workplaces and use footpaths to return to their homes, footpaths play a very essential function. This study has a particular focus on Panthapath signal to Kawran Bazar Signal, a significant employment area in Dhaka city with a population of 12000 people (approximately) (Hanif, 2021).

It is the area in Dhaka, Dhaka being the fastest population growth, with a million residents, as of 2022, there were 22,478,116 people living in the metro region of Dhaka, which has a population of 23,234 per square kilometer. The population of the 300 square kilometer-large capital city has grown by 3.39% since 2021. A number of significant national infrastructures, together with significant industrial zones, educational institutions, and religious institutions, draw people from all over the nation, which serves as a stimulus for this expanding population.

The city authority is working extremely hard to meet these booming populations' basic needs, but doing so has unexpected and unintended consequences, such as chronic traffic jams, extreme water, air, and noise pollution, interruptions in other power supply systems, failure of inadequate drainage facilities, and so on. (Hanif, 2021)

The most frequent issues with transportation include traffic congestion, inadequate and damaged pathways, and a lack of appropriate public transportation. Particularly, despite the

fact that locals frequently use footpaths and that a large number of people are moving into this area, their service quality is lacking in the eyes of the general public. Footpaths should ideally be level and smooth, without any dangerously uneven surfaces that could lead to falls and injuries.

Unfortunately, this area dwellers' demand cannot be satisfied by the current pathway infrastructure. Numerous times, this topic was covered in the national print and electronic media, but little has been done to improve the state of these type of walkways Dhaka city. The authors' perceptive brains couldn't help but think of this situation while they were in this location.

1.2 Research Objectives

This study analyzed current state of the selected footpath in Dhaka and offers suggestions for potential improvements.

- i. To evaluate the service quality of footpaths in selected area.
- ii. To identify the contributing factors to the current level of service quality.

1.3 Organization of the Thesis

The report of the analysis is organized in this paper to represent and discuss the results and findings that come out from the studies.

Chapter 1 : Introduces the topic, in which overall idea is presented before entering into the main studies and discussion.

Chapter 2 : Is literature review, which represent the work performed so far in connection with it and is collected from various references. It also represents the strategy for moving forward with the success current issue.

Chapter 3 : Is all about the methodology.

Chapter 4 : Is concerned with the results and discussion.

Chapter 5 : Is about the findings of this parametric study are demonstrated and discussed in detail with a recommendation of further study scope and a conclusion.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

According to a review of the literature, research on pedestrian footpaths has received significant interest in developed nations from antiquity to the present. The elements affecting the structural design requirements for a permanent walkway were highlighted. By examining the area over the course of four weeks, (A. F. Gellatly, 1986) evaluated the effects of frequent footpath trampling and highlighted the significance of interactive forces like surface roughness, drainage, and natural obstacles with appropriate recommendations to prevent the phenomenon Commission for Western Australian Planning (Comission, 2000), It is advised that all community members be consulted prior to designing a pathway, and the requirements of the disabled, pedestrians, cyclists, and users of public transportation should take precedence over those of cars. Later research concentrated on the elements that essentially determine a footpath's service quality in a pedestrian's eyes and graded them using several accepted techniques. (Kelly, 2011) compared three methods for evaluating the walkability of the pedestrian environment and identified pedestrian attributes, such as clean pavement, safe crossing places, good connectivity, and a sense of security. They came to the conclusion that the walking experience is influenced by the cumulative impact of numerous interactions (both positive and negative) as people move about the pedestrian environment. Whereas, Holly Krambeck's rating scale was designed by (Abaya, 2011), who undertook a research to evaluate pedestrian amenities in significant Philippine cities.

By examining the implications for how connectedness might be measured, (G. Ellis, 2016) explored the elements of the walkability index utilizing a network of footpaths. Additionally, (M. Aghaabbasi, 2017) created a method for evaluating neighborhood sidewalks using micro scale factors, which is capable of identifying their shortcomings and also gives locals a way to communicate with city planners about their needs and request improvements to current sidewalks.

Later research developed a mechanism to evaluate the service quality in terms of level of service, securing some advanced level job (LOS). To simplify the LOS measurement, (B. D. Daniel, 2016) created the FOOT-LOS (pedestrian footpath level of service) model. The model offered a mechanism for calculating LOS and identified the variables that most significantly affect the LOS of pedestrian walkways. (N. Raad, 2017) reviewed the prior experience with PLOS measures and tools and provided an outline of a more robust approach and methods to develop an improved PLOS tool and measures using a Delphi process (online survey and walkshop) with a panel of experts with a focus on pedestrian issues, as well as intercept surveys with pedestrians.

Studies on the subcontinent have also been conducted, with similar results in Bangladesh and India. Using an ordered probit (OP) model, (B. R. Kadali, 2015) collected PLOS for various land-use types, including shopping, residential, and business areas, where factors like the number of vehicles encountered, the difficulty of a road crossing, and safety were prioritized over pedestrian individual factors like age and gender. In a similar vein, (R. Sahani, 2017) created a model for pedestrians to evaluate service measures at the roadside walking environment from qualitative and quantitative analysis in developing countries and discovered that the sidewalk's width, vehicle volume, pedestrian volume, etc. are all significantly influencing the pedestrian service measure.

Additionally, (S. Jena, 2018) created a model to 5 2020 MANTECH PUBLICATIONS. Otherwise Noted The LOS provided by urban street segments in developing nations is evaluated in Journal of Transportation Engineering and Its Applications Volume 5 Issue 1 to highlight the current status and what changes are needed to make it better. (Geetha Rajendran Bivina, 2019) looked at the built environment's most significant influences on perceived Structural Equation Modelling (SEM) technique was used to analyze pedestrian level of service (PLOS) of sidewalks and identify the contributing elements.

Petritsch, (2008) established models based on pedestrian density and other factors, respectively. The overall PLOS was the worse one of the 2 levels. This kind of model neglected the interacting effects among the influencing factors. The combined impact of traffic conditions, road facility conditions and environmental conditions could not be revealed. This comprehensively considered traffic conditions, road facility

conditions and environmental conditions and established a linear regression model for evaluating PLOS on Chinese sidewalks. However, linear regression model was only suitable for the regression analysis for continuous variables, while pedestrians' satisfaction ratings were ordinal variables.

Excessive trampling in sub-alpine environments results in footpath erosion. An experiment which describes the amount of trampling required to create a footpath is explained. Using a simple filtering mechanism, different trampling intensities can be determined simultaneously. Obvious damage to soil and plant cover occurred after 70 tramples. Sections trampled more than 80 times were still visibly affected one year later. A threshold for damage of less than 200 tramples is suggested, with implications for recreational management in similar areas. (Gellatly, A. F. 1991)

Urban footpath quality and pedestrian level of service is a popular subject for modelling and simulation in transport engineering. This paper reports an investigation into the capacity of footpaths alongside a city street in Sari, Iran to determine whether the current provision can meet the present and forecast pedestrian demand, or whether improvements are required. To assess the capacity of the footpaths, a database including the location and time, speed and number of pedestrians, as well as determining and identifying points of footpaths with relatively high crowding, was prepared. Finally, the level of service (LOS) was obtained using a US code and proprietary modelling tool. The results indicated that some sections of the route were currently below an acceptable LOS and needed improvement to provide an adequate provision for pedestrians. When factoring in forecast growth, the LOS in these substandard sections was predicted to reduce even further and, without improvement, could undermine future economic growth. (ICE Proceedings Municipal Engineer)

In recent years, the impact of the urban environment on residents' Physical Activity (PA) has received extensive attention, but whether this impact has differences in the jogging preferences of residents in different footpath environments and different genders requires further research. Therefore, based on jogging trajectory data, this paper uses the grouping multiple linear regression model to study the different influencing factors of different footpath environments on the jogging of residents of different genders. The results show that (1) jogging activities (JA) were mainly concentrated in the community footpath environment, and its peak was reached at night; (2) the rise and fall of elements in built environments, social environments, and natural environments significantly affected the relative jogging distance of

residents; (3) Residential land density (RLD) has a positive impact on the JA of community and green land footpaths and has a negative impact on the JA of urban footpaths. However, arterial road density (ARD) and bus distance density (BDD) have opposite significant effects on the JA of communities and green land footpaths; (4) ARD has the significant opposite effect on the JA for residents of different genders on urban footpaths and community footpaths. Facilities diversity (FD), population density (PD), and bus stop density (BSD) also had significant opposite effects on the JA of residents of different genders on green land footpaths. In general, we put forward a method theory to identify the footpath environment and provide references for improving the layout and construction of different gender residents for different footpath environment elements.

In industrial zones of developing countries, workers tend to live nearby places of their working zones and prefer to go to their working places by walking. Hence, footpath plays a crucial role in these areas, particularly in developing countries like Bangladesh, where garments worker have a penchant to save the transport cost for their livelihood by walking to their working places. Hence, level of service (LOS) of the footpath in these zones should be much higher to facilitate these heavy loads of pedestrians. However, LOS evaluation criteria for off-street pedestrian facilities are not well defined in the context of Bangladesh and a negligible number of studies have been performed on this subject of matter. This motivates the authors to assess the service quality of footpaths in a heavy industrial zone like Gazipur city using both qualitative and quantitative approaches. In this study, a survey of 450 people was conducted to identify the key factors that attribute to the pedestrian's satisfaction and it is found that the average rating of the footpath is 2.66 (out of 5) which is unsatisfactory and undesirable. Such findings are effective for developing footpath design and maintenance policies and provides guidelines for future improvement. (Service Quality Assessment).

The most basic demand, the desire for traffic, was all that pedestrians cared about when there was a high pedestrian volume or a narrow sidewalk. Because their basic needs had been addressed, pedestrians would pay more attention to the comfort of road facility conditions and environmental circumstances in the case of low pedestrian volume or large walkways (Kim S., 2014).

By observing how they typically walk, people' psychological states could be objectively determined. By using video observation and image tracking techniques, this paper was able

to capture the usual walking patterns of pedestrians under a variety of pedestrian traffic conditions. Additionally, the levels of pedestrian flow rate might be categorized in accordance with the correlation between pedestrians' traffic states, walking habits, and pedestrian flow rates.

Individual pedestrians often move normally, avoid confrontations at intersections, pass slower pedestrians, and follow other pedestrians. These usual behaviors may also manifest separately or in combination (Shan X., 2016). Through observation, it was found that the above-mentioned pedestrian walking behaviors under various pedestrian flow rates resulted in varying pedestrian speeds and relative lateral displacements. Therefore, this study chose pedestrian speed and cumulative relative lateral displacement as the classification criteria for pedestrian flow rates in order to establish the cutoff points for various degrees of pedestrian flow rate.

2.2 Studies Conducted in Bangladesh

However, a small number of studies have been conducted to evaluate the footpaths' level of service in underdeveloped nations like Bangladesh. For the Chittagong Metropolitan Area in Bangladesh, (K. E. Zannat, 2019) established a thorough framework to assess the impact of pedestrian facilities on perceived PLOS both qualitatively and statistically. To identify pedestrian amenities, relating to footpath, carriageway, and transit, influencing perceived PLOS, researchers modeled triangular interactions among pedestrian facilities, perceived roadway conditions (accessibility, safety, comfort, and attractiveness), and perceived PLOS. The availability, maintenance, and design of various pedestrian amenities are necessary to achieve a better perceived PLOS, they found, noting accessibility, beauty, and safety as essential variables. (T. Hasan, 2015) used the integration of objective measurement and subjective assessment to select the best pedestrian level of service technique among five PLOS methodologies for Dhaka city, Bangladesh.

2.3 Area Studies

We carefully examined the perception ratings to look for any potential gender or participant age-related differences. The Australian technique outperformed the other four methods in the ratings and recommended creating a new PLOS method that makes advantage of the criteria found in their study. Additionally, (M. S. A. Salan, 2018) evaluated the service quality and pedestrian behavior in the Rajshahi city, Bangladesh, residential, commercial, and mixed-use footpath areas. They discovered that the commercial area had the highest pedestrian flow and advised placing an emphasis on the rehabilitation of illegal businesses, building footpath infrastructure, and placing restrictions on footpath parking in the commercial and mixed-use areas.

Unfortunately, no study has yet been conducted to evaluate the footpath's level of service in this area, Dhaka's most significant area. This drives the authors to perform this study in order to ascertain the footpaths' true state, create a plan to improve their current state, and provide a framework that can be used in any busy area like Panthapath of a developing nation anywhere in the globe. During data collecting time, in first three weeks the weather was in favor. But on 4th weeks the weather was quite unfavorable because there was little rain in the study area.

CHAPTER 3

METHODOLOGY

3.1 Location and View

Dhaka North City Corporation (DNCC), the largest city corporation in Bangladesh, Our study area located in it. In our study area, 52.52% are men and 47.48% are women. (DNCC, 2023)

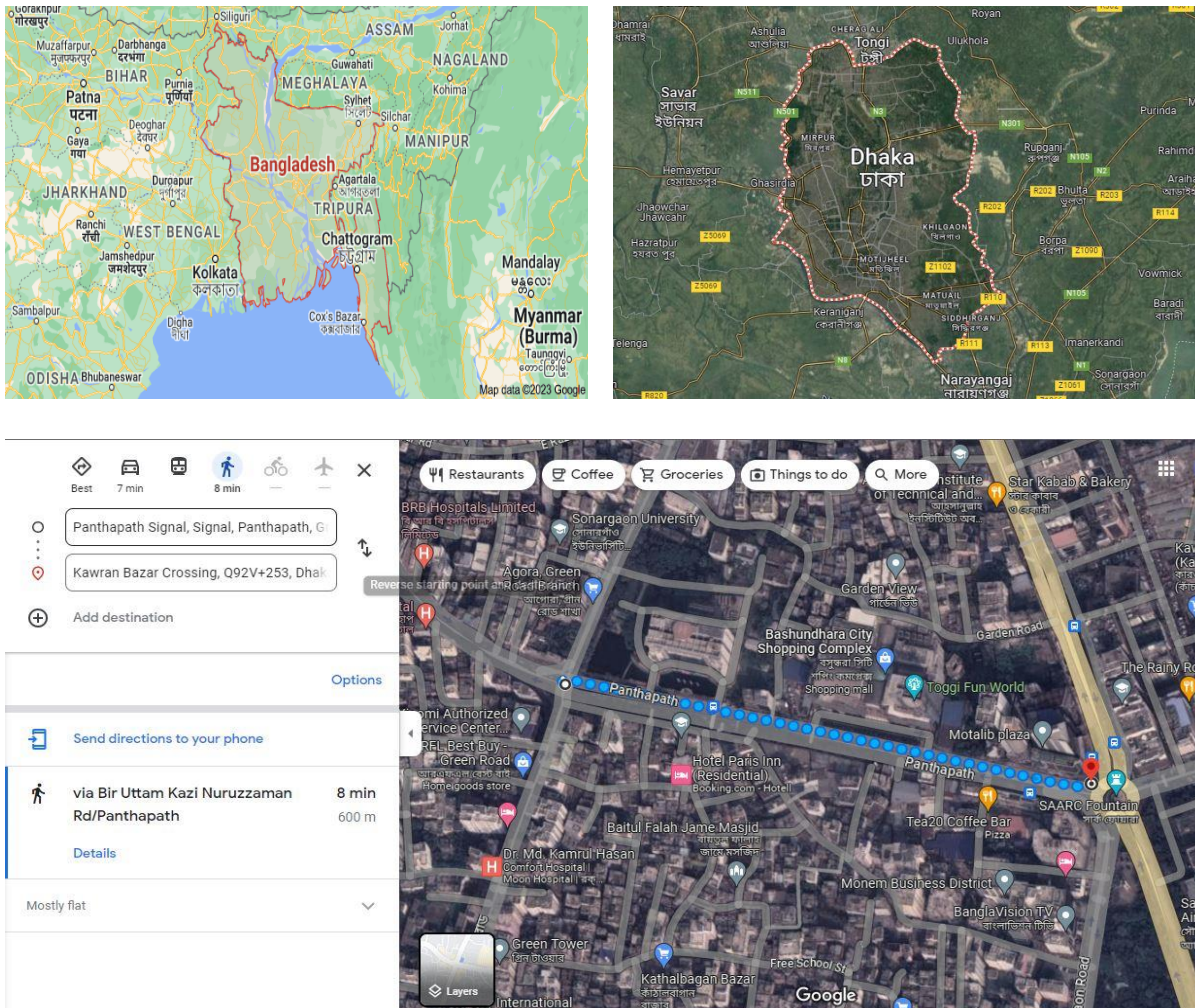


Figure 3-1 : Satellite View of the Study Area

3.2 Data Collection

Primary and secondary level data were gathered for the study from the area's permanent citizens as well as the visitors who are just here temporarily. A questionnaire survey that included not only specific questions for the pedestrians to respond to but also their own opinions on the current state of the footpaths and how these situations can be improved was conducted to assess the level of service (LOS) of the footpath in the selected area based on people's perceptions.

A field study was undertaken to assess the real field situation before the data collection questionnaire was finalized. A pilot survey of pedestrians was also carried out to capture their thoughts in the questionnaire. The 600m long road was in under study, and was divided into 2 sectors for improved efficiency in accordance with its geometric layout and social significance (as seen in Figure 1 and Table 1).

The partitioning of the route into sections provides a clear picture of the condition of the pathway; around 250 walkers were interviewed from 8 am to 5 pm with an hour break at 1 pm. The days for data collecting were chosen so that both working days and holidays would be experienced.

Table 3-1 : Footpath length in the study area

Sector	Location	Estimated Length of Footpath
01	Panthapath signal to Kawran bazar signal (Panthapath)	600 m
02	Panthapath signal to Kawran bazar signal (Panthapath) Opposite side of the same road	600 m

3.3 Existing Field Condition



(a) vehicle parked on footpath



(b) Footpath occupied by vendors



(c) Broken segment of footpath



(d) Footpath uses for commercial purpose



(e) Discontinuous footpath with zero slopes with road

Figure 3-2: Pictorial representation of existing footpath condition

Some physical deviations from the ideal were noticed throughout the field inquiry and data collection.

Figure 8 depicts the characteristics of a footpath. Unauthorized vehicles are frequently seen blocking footpaths across the examined area, as illustrated in Figure 8. This is a common occurrence (a). This severely discourages pedestrians from using sidewalks and leads them to mentally adapt to walking on the pavement of the road, which causes catastrophic traffic accidents. Additionally, a related observation is that vendors continue to sell their wares on the sidewalk while operating their businesses, obstructing pedestrians' access to the sidewalk [Figure 8(b)].

Locals also put their building supplies on the pathway in front of their homes, which reduces the effective road width by requiring pedestrians to cross the road segment [Figure 8(f)]. Uncomfortably, it was discovered that there are enormous broken holes in the middle of the walkway, dangerous building parts, such as reinforcement, are exposed, and this poses a serious safety risk to walkers, as illustrated in Figure 8. (c-d).

Field research found that 40% of the footpaths in the study region are made of soil, 10% of which are severely broken, and 50% are made of concrete, 50% of which are extremely narrow and out of date. The footpath may occasionally become uneven due to tree roots, or it may become slick from debris or fallen leaves. On sometimes, people walking on footpaths trip and fall. The fact that footpaths are substantially higher than the elevation of main roads and that there is either no slope or a very slight slope connecting them to the main road makes it difficult for pedestrians, especially the elderly, the disabled, and children [as illustrated in Figure 8(e)].

Apart from these, there was no other apparent footpath furniture, such as benches for pedestrians, pedestrian shelters during bad weather, or rubbish bins, in the research area. Additionally, footpaths are too narrow for wheelchair-using disabled and physically challenged people. In cases of heavy traffic on the road, motor vehicles like motorcycles, autos, and rickshaws would occasionally use the walkway. The footpath lacks guard rails for the safety of pedestrians.

The poor illumination on the walkway contributes to accidents at the intersections of the roads and encourages unlawful activity at night. Other than contemporary footpaths, the area

under study lacks amenities like public telephones, latrines, and water sources. There are no directional signs, such as distinct region indicators, speed meters, signals, etc. to direct walkers. There aren't enough trees or other objects providing enough shade on walkways from an aesthetic or environmental point of view to keep pedestrians comfortable on a hot day.

CHAPTER 4

DATA ANALYSES AND RESULTS

4.1 Demographic characteristics of the responded

According to the survey's statistics, 25% of women and 75% of men use footpaths daily for a variety of activities. This suggests that a higher proportion of males than women are using footpaths. Additional analyses will provide more details about its consequences.

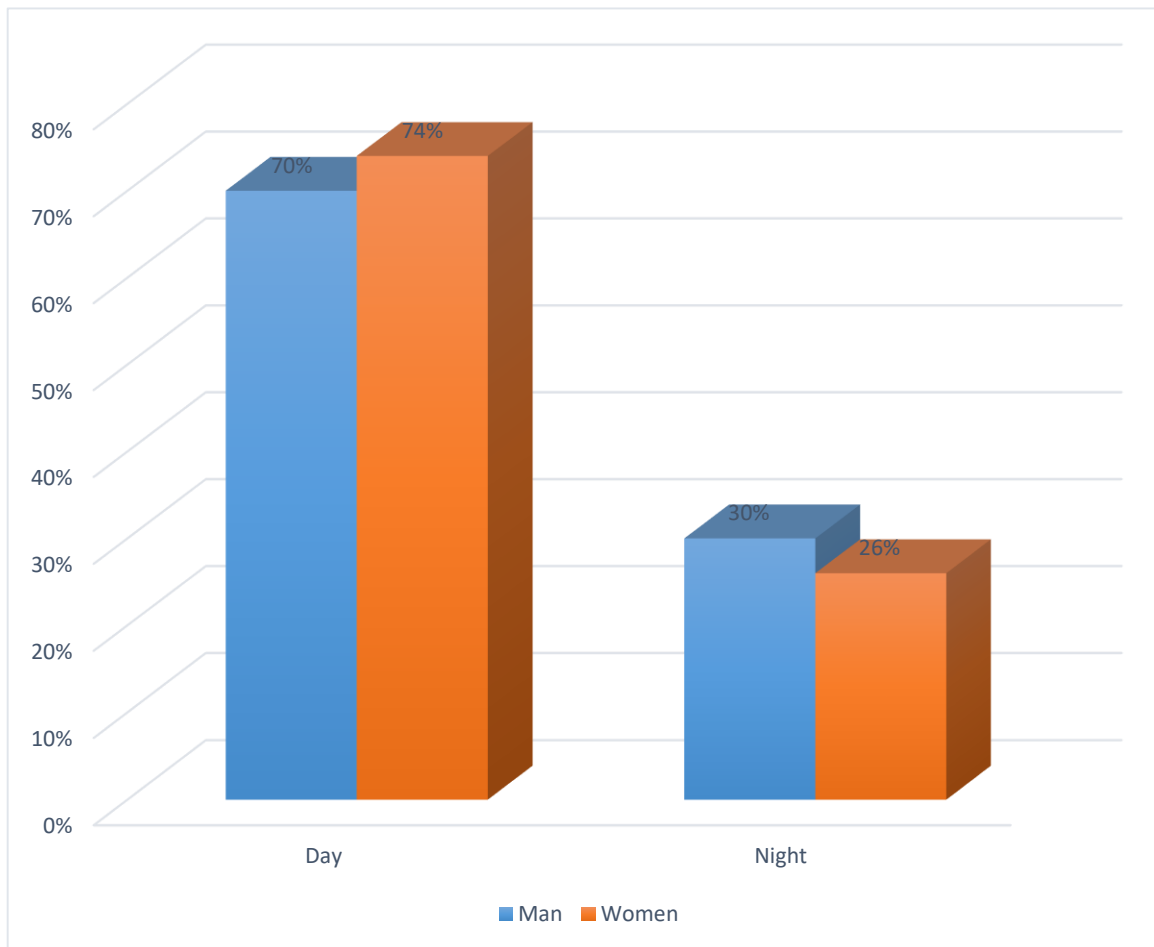


Figure 4-1 : Gender distribution during day and night.

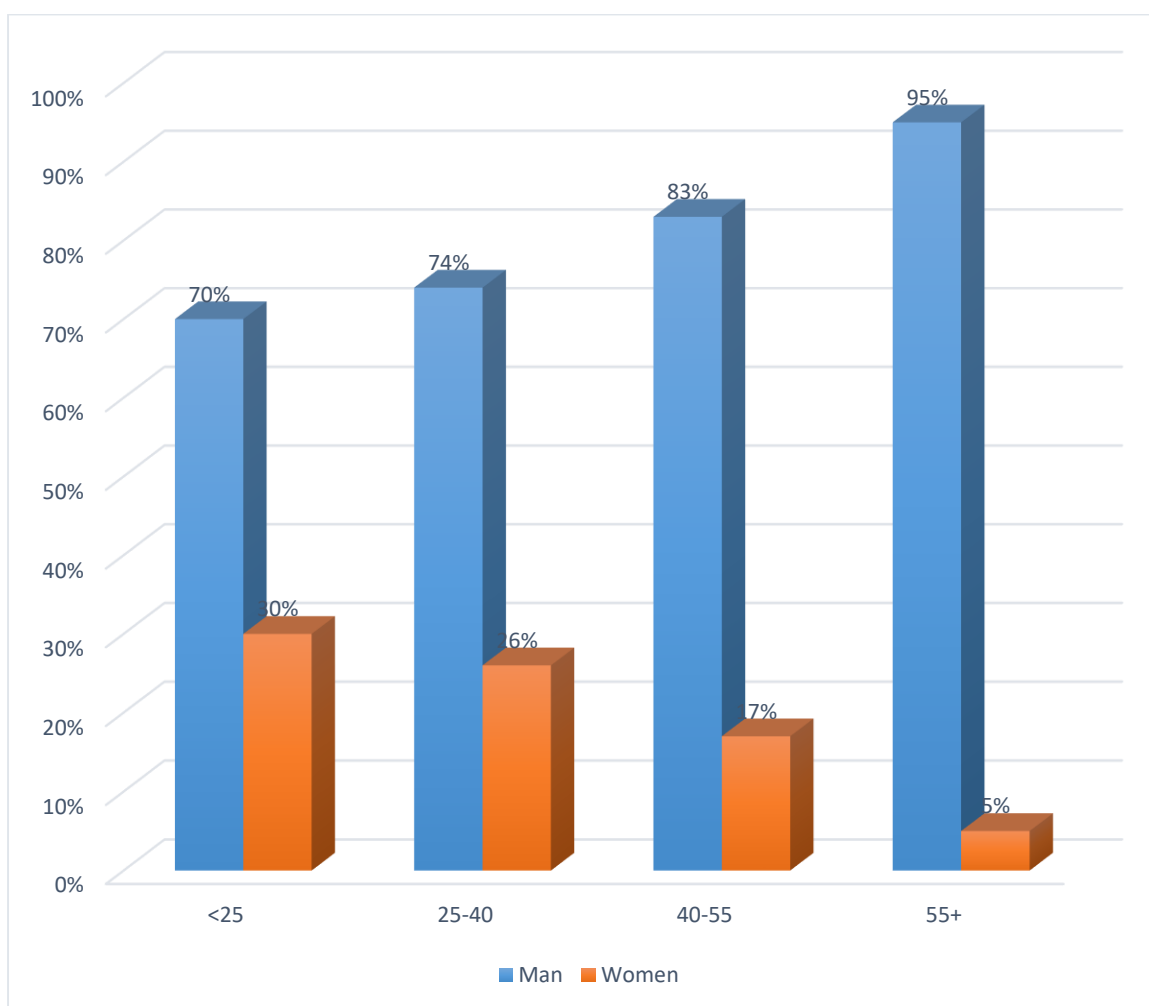


Figure 3-2 : Age distribution of Responded.

Figure 2 presents an intriguing finding about the proportion of male and female pedestrians. While the number of male pedestrians rose at night (from 70% during the day to 74% at night), the number of female pedestrians fell (from 30% during the day to 26% at night). This suggests that female pedestrian activity at night reduced because they frequent markets to purchase their essentials from sellers and prefer to browse shops before making a purchase. Another implication is that there are many manufacturers in the study area, which are dominated by female workers

The age distribution of those who replied is shown in Figure 3 along with the corresponding percentage. According to data analysis, 47% of pedestrians in the 25-55 age

group prefer to walk on footpaths. In essence, these are members of the working class. Additionally, a notable pedestrian percentage of 39% has been noted for those under the age of 25. This primarily reflects students who are enrolled in high school, community college, or a university, as well as the many female workers who are under the age of 25. They basically come here to survive their livelihood by escaping from extreme poverty. This survey also shows that only 5% of people above 55 years range use footpath where woman rate is almost little (Figure 3). This alludes that there is little provision for old people to use the footpath and hence, their negligible percentage resembles their levity to use the footpath.

4.2 Purpose of using footpath

Table 4-1: Gender wise purpose of using footpath

Purpose of using footpath	Percentage of pedestrians (%)	Purpose wise male percentage (%)	Purpose wise female percentage (%)
Work	44	74	26
Educational institute	31	55	45
Market	9	69	31
Others	16	89	11

Table 2 and Fig. 4 demonstrate that 44% of respondents prefer to utilize footpaths for work-related purposes. This shows that the area has many employment opportunities and that the majority of the residents are from the working class. 31% of the population attends educational institution, which shows that there are many schools, colleges, and universities in our study area and that the proportion of students to the overall population is high. The fact that 9% of people are going to the market shows that there are marketplaces and that they are close to residential areas, thus people prefer to walk there. People who use footpath for other purposes, to go to religious establishments, enjoy sports, morning walk are 16% this indicates that there lots of religious establishments, travel spots and open lands for excursion are present in this area. Though woman doesn't use footpath frequently for other purposes, their participation in working purpose is significant.

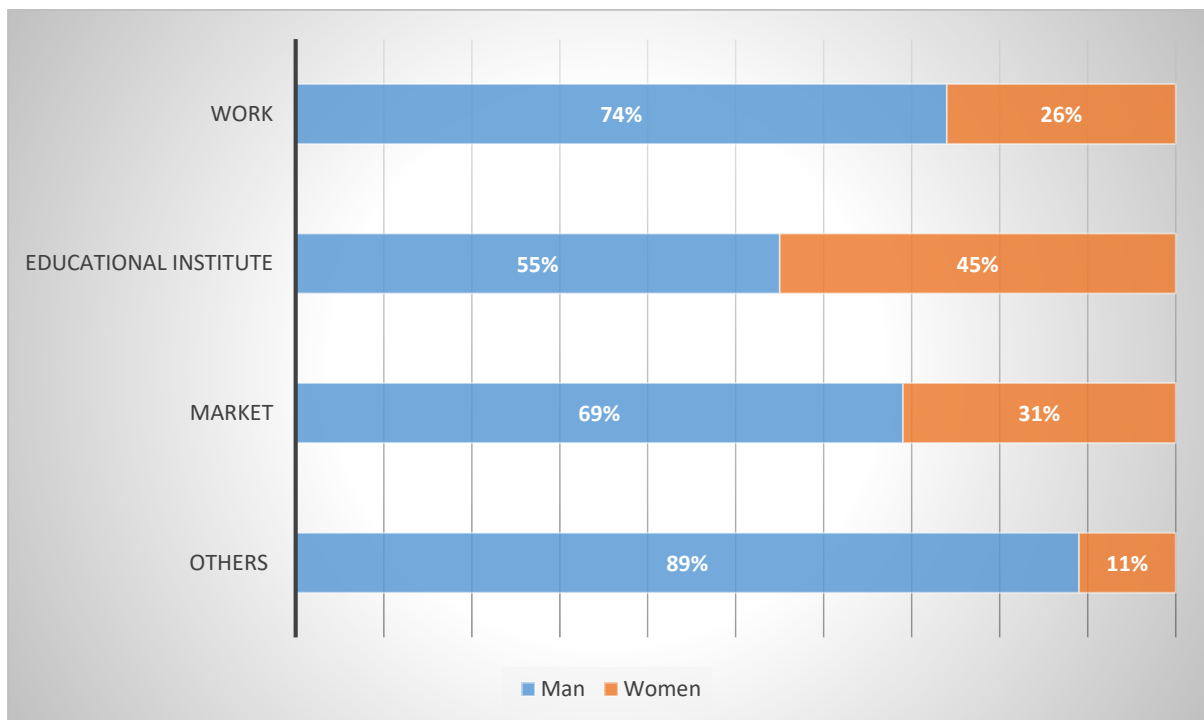


Figure 4-3 : Footpath use in terms of purpose

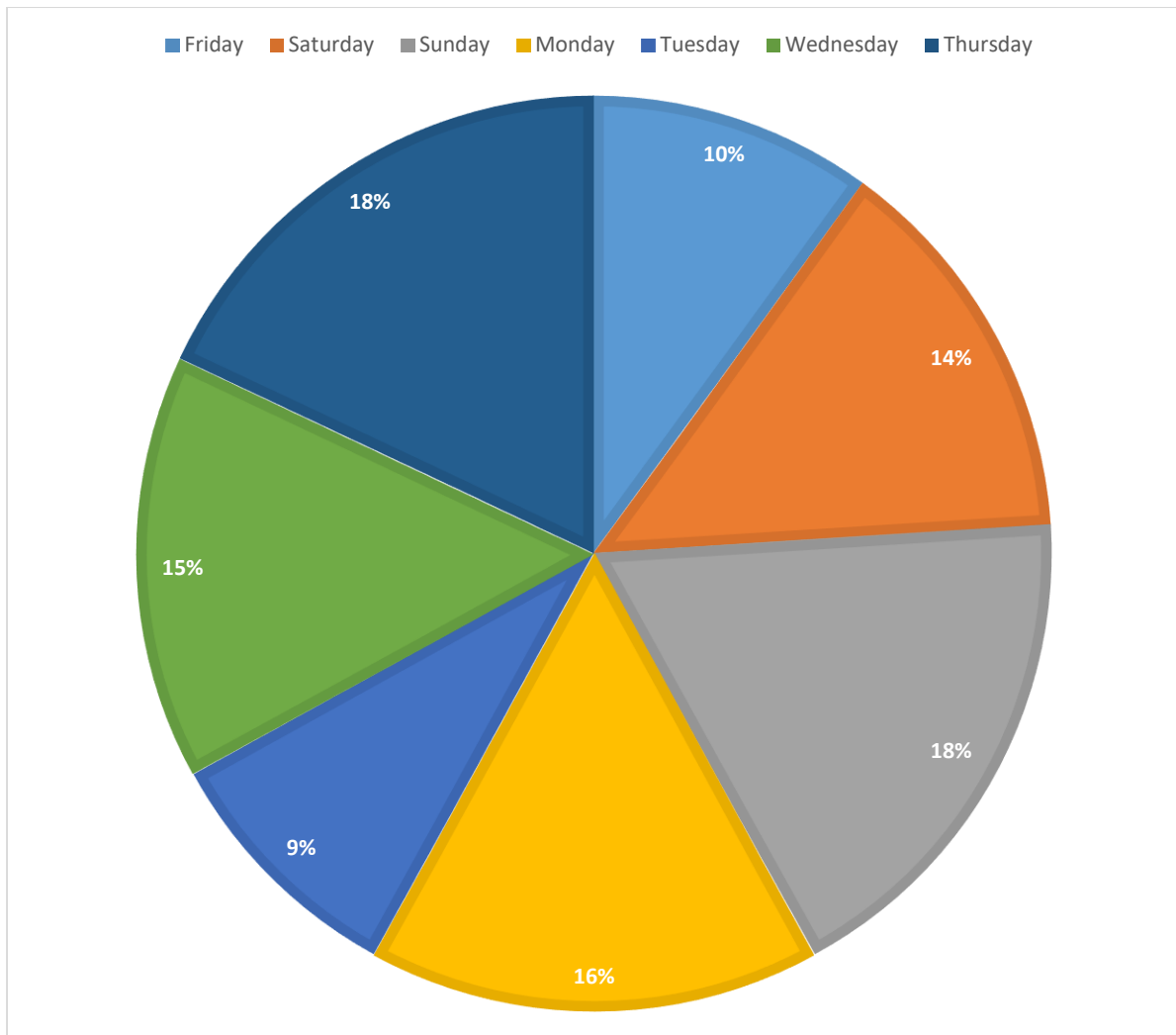


Figure 4-4 : Daily use of footpath responded

4.3 Temporal variation of usage

According to Fig. 5's daily use pattern, people use footpaths less frequently on Tuesday (9%) and Friday (10%) than on any other day of the week. According to a field survey, the height of footpath usage on wednesdays is 15% on Sunday and 18% on Monday. This suggests that people favor using footpaths more on weekdays than on weekends. According to a field interview, residents of this neighborhood love spending their vacations engaging in leisure activities including going to the movies,

shopping, parks, and markets. These activities may be the probable causes of the footpath's usage increasing on weekends compared to weekdays.

According to Figure 6, which depicts the hourly flow rate, foot traffic is significantly higher in the morning and evening than it is at noon. The justification for this is that most sectors operate from 8 am to 9 pm, with an hour-long break between shifts at roughly 2 pm. In general, they choose to have their lunch in work rather than traveling home during this little break.

Women prefer to explore marketplaces on their way home, but males tend to congregate in tea shops or other public spaces for purposes such as talking, playing cards, and other leisure activities.

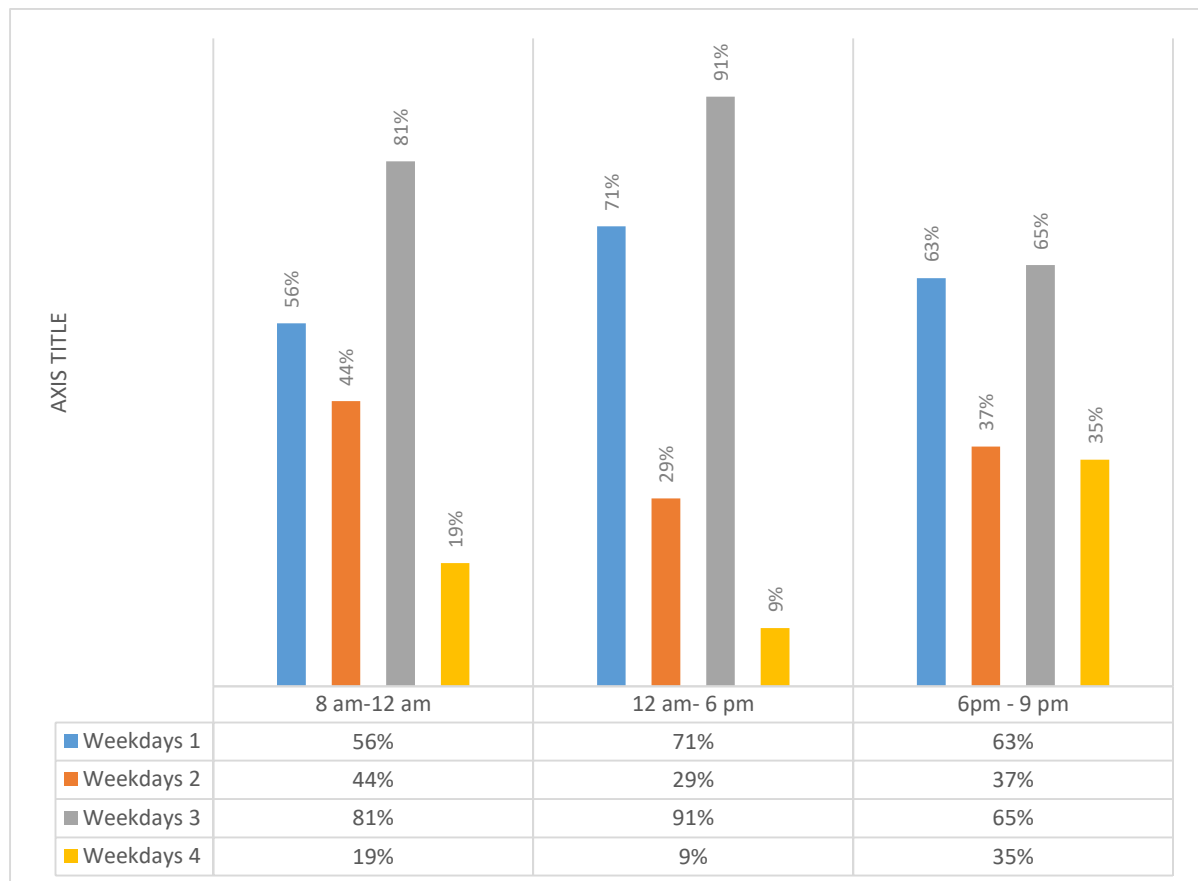


Figure 4-5 : Hourly flow of pedestrian

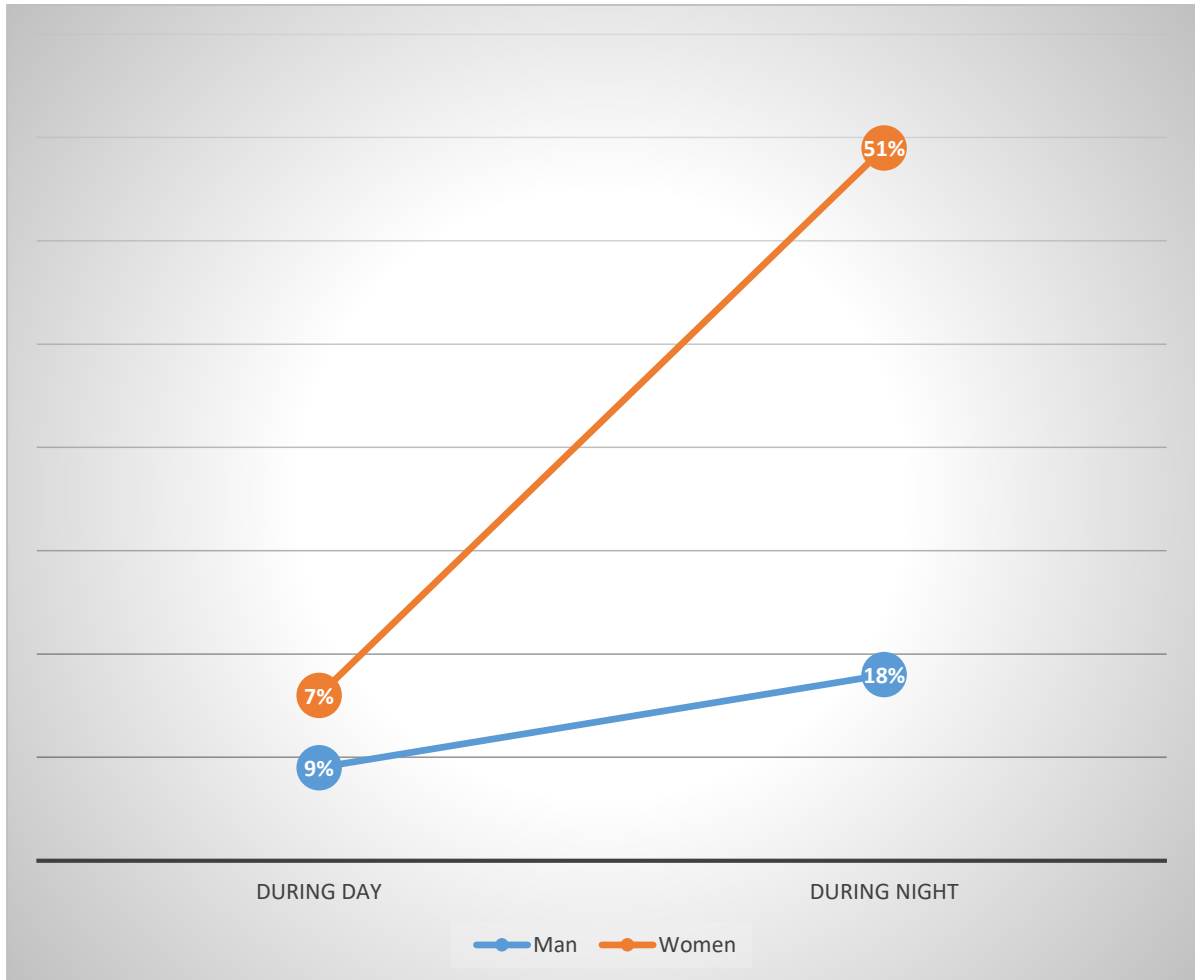


Figure 4-6 : Personal Insecurity level of using footpath

4.4 Safety and Security

In terms of safety, just 7% of women and 9% of male pedestrians evaluated the footpath as risky to use during the day (Figure 7). However, 51% of women report feeling insecure at night, which is a fairly high rate. Although this location is secure from late morning to early at night, there have been a few reports of theft and hijacking during the late night and early morning hours, especially close farmgate area.

4.5 Determination of level of service

The level of service (LOS) for the sidewalk in the study area was determined by study using both qualitative and quantitative methods. Different social classes use the selected area's walkway for a variety of purposes. Therefore, a questionnaire survey regarding the purpose of footpath use, age, gender, safety, and security was undertaken among 250 pedestrians from a typical Thursday to Saturday to carry out this study. A sample of the questions that were posed to the pedestrians in Table 3 to ascertain their opinions regarding the use of the footpath in the area under study.

Table 4-2 : Perceptions of pedestrians when using footpath

Question	Yes	No
Do you use footpath in unfavorable condition?	74%	26%
Do you like to use footpath during day ?	87%	13%
Do you like to use footpath during night?	70%	30%
Are you satisfy in current footpath condition?	24%	76%
Have you observed any illegal work on footpath?	9%	91%

Because the majority of people in this city work in the apparel sector and prefer to use footpaths in the morning, evening, and afternoon, Table 3 reveals that 87% of people prefer not to use the footpath at night. Instead, they prefer to use it during the day. Additionally, since they must travel to work in spite of the bad weather (heavy rain or cold), these people have little alternative but to utilize footpaths, which is why 74% of people choose to do so. Although residents of this area are dissatisfied with the quality of the footpaths currently, one of their complaints is that the footpaths are not up to par and occasionally at night,

pedestrians must deal with criminal activity, which is a very common occurrence in this area.

On a scale of 1 to 5, where 1 represents the worst condition, 2 represents poor, 3 represents fair, 4 represents good, and 5 represents exceptional condition, pedestrians were also asked to judge the service quality of the pathway. The results of the poll were then scored in order to determine how satisfied pedestrians were with the

walkway and to rate it. The matching rating value provided by the pedestrians is shown in Table 4.

Table 1-3 : Pedestrian rating on footpath

Categories	Worst	Poor	Fair	Good	Best
Respondent	55	82	63	38	17

The average pathway condition calculated using the score method is $(1*53 + 2*82 + 3*63 + 4*38 + 5*17)/255=2.53$

This is in a poor to good condition that is very near to being in a poor condition. It is evident that the footpath's LOS is in really poor shape, and that people are dissatisfied with the current state of the service's quality.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

The main considerations for designing and building facilities for pedestrians are convenience, continuity, and safety. Smooth walking space is provided by well-designed walkways. Additionally, they support various activities like bus stop waiting areas and street selling without impeding pedestrian circulation. The examined portions of the sidewalk, however, reveal observable deviations from this usual ideal state. Deep analysis of the perception data from pedestrians clearly showed that the walkways in this location offer less safety and comfort to pedestrians. Unauthorized parking, vendor appropriation of the footpath, broken potholes, construction materials left on the footpath by neighbor boring households, and a lack of accommodations for children, the elderly, and people with disabilities made using the footpath a nightmare for users. Resulting in a poor level of service rating of 2.53 out of 5, which provides quantitative evidence that amply demonstrates the footpath's poor condition.

5.2 Recommendations for future studies

To increase pedestrian satisfaction, the condition of the walkway must be improved from its current state. It is advised to do the following to accomplish this:

- i. How pedestrians perceive a walkway is determined by how different elements are combined into a coherent design.
- ii. To ensure smooth pedestrian flow, footpaths must continue even at property entrances.
- iii. A footpath should have a smooth surface without any damaged potholes or extraneous dangers. To provide pedestrians confidence in utilizing footpaths, this must be ensured.

iv. Since late at night and early in the morning, pedestrians feel unsafe, precautions should be implemented to ensure their safety so that they can use the footpath at any time of day or night.

v. Increase footpath furniture like lighting, seating, shelters, rubbish bins, etc.

vi. The distance between the road level and the footpath should stay constant. The use of a walkway that often changes levels is discouraged. Instead, pedestrians like using the carriageway to travel.

vii. Finally, since many pedestrians have already developed the habit of using the road instead of a footpath for walking, initiatives should be implemented to educate the public about the value of walking and encourage them to use footpaths rather than roadways.

viii. In order to make footpaths impassable to vehicles, they should be 0.15 m high (the top of the curb should be at 0.15 m).

ix. A designated area should be made available for trees and utilities that are not in the way of pedestrian traffic.

x. Due to space savings and increased safety when leaving the parking area, parallel parking is favored for cars over angle or perpendicular parking. For two-wheelers and bikes, parallel parking can also serve as perpendicular parking.

xi. The life span of the pavement surface should be more and the maintenance should be low.

xii. To stop water from seeping into the layers of the pavement, the pavement surface needs to be completely impermeable. Furthermore, the pavement surface's design and texture should facilitate quicker water drainage from the surface.

xiii. Pavement surface must also have the ability to reflect light. The road should not only be visible during the day but also at night.

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