Journal of Bangladesh Institute of Planners ISSN 2075-9363
Vol. 11, 2018 (Printed in June 2020), pp. 157-169, © Bangladesh Institute of Planners

Pedestrian Facilities at Khulna CBD

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Abstract

The detrimental impact of automobiles in today's contemporary world has revived the interest in pedestrian facilities to promote walking as a sustainable mode of transportation. There are no better alternatives than pedestrian facilities to ensure and promote sustainable urban transportation. Bangladesh, being a developing country, has an lack of proper policy guidelines regarding pedestrian facilities. Khulna being a major city of Bangladesh, due to lack of proper policy and legislation, is lacking pedestrian facilities even in the CBD area. This study aims to investigate the existing pedestrian facilities, evaluate their condition and fulfilment of pedestrian demand in Khulna CBD. The study is mainly explorative in nature and both quantitative and qualitative approach of research has been implied. The quality of the existing pedestrian facilities has been compared to the standards identified from the international policies. Based on the extensive policy review, this study considers footpath, crossings, kerb ramp, street furniture and street lights as the most indispensable for pedestrian facilities. The findings reflect on poor quality pedestrian facilities in Khulna CBD. Finally, some general guidelines are recommended to incorporate in the National Land Transport Policy to shift focus from wider road provision to pedestrian facility development in areas like Khulna CBD to promote walking and, therefore, to contribute towards transport sustainability and livability of the CBD area.

Introduction

Rapid urbanization has been initiating much automobile dependency since the 1940s (Kenworthy and Hu, 2002) which has led an urban society to withdraw from the habit of walking and investment in pedestrian ways. As a result of car dependency- carbon emission, noise pollution, and traffic congestion are affecting the built environment severely. Increased number of automobiles have led to a dramatic decrease in pedestrian facilities and force the pedestrians to walk in the middle of vehicular streets, causing traffic congestion and accident. As a way out of these problems, caused by automobiles and motorized vehicles, walking can be encouraged by providing proper pedestrian facilities as a mode of transportation.

Walking is the most sustainable and primitive transportation mode which is very much dependent on proper pedestrian facilities. Adequate pedestrian facilities including appropriate footpath, crossing, and pedestrian signage encourage people to withdraw their dependency from motorized vehicles and motivate them to walk, which in the long run contribute to sustainable city growth. Although walking is one of the most dominant transportation modes, pedestrian facilities have often been ignored by urban planners and policy-makers (Litman, 2018). In the contemporary era, the detrimental global impacts of motorized vehicles have revived the interest in pedestrian facilities to promote walking as a healthy mode of transportation and to reduce pollution and traffic

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congestion. It is gradually becoming an important issue in urban planning and design for influencing social life. To ensure sustainable growth of a city or to promote sustainable transportation, there are no better alternatives to pedestrian facilities to encourage walking of the people. For promoting walking, pedestrian facilities can efficiently be applied to the physical networks like "mix land-use and accessibility," "safety and streetscape," "contact and social encounter" (Rooij, 2012).

With rapid urbanization and enormous population growth, Bangladesh, as a developing country has led to unplanned and compact city development, where the major destinations are located within the walking distance and too close to use any vehicles. However, there are hardly any appropriate pedestrian facilities in major cities like Khulna. Studies in the context of Khulna city revealed that the growing massive population need adequate pedestrian facilities due to the deficiency of suitable road for the transportation and, also for the poor economic status of the mass (Rahman, 1997). In recent time, non-motorized vehicles like rickshaw and auto-rickshaw movement in the CBD area are more significant compared to any other parts of Khulna city, which causes traffic congestion and wastage of time. The absence of proper pedestrian facilities and informal business activities both in the footpath and on carriageway significantly affect the pedestrian activities of that area every day (Rahman and Hossain, 2009). Being a mixed-use area with different service activities along with narrow vehicular roads, in Khulna CBD, pedestrians have to meet their service demand without proper pedestrian facilities and this pedestrian demand in this area is ever increasing.

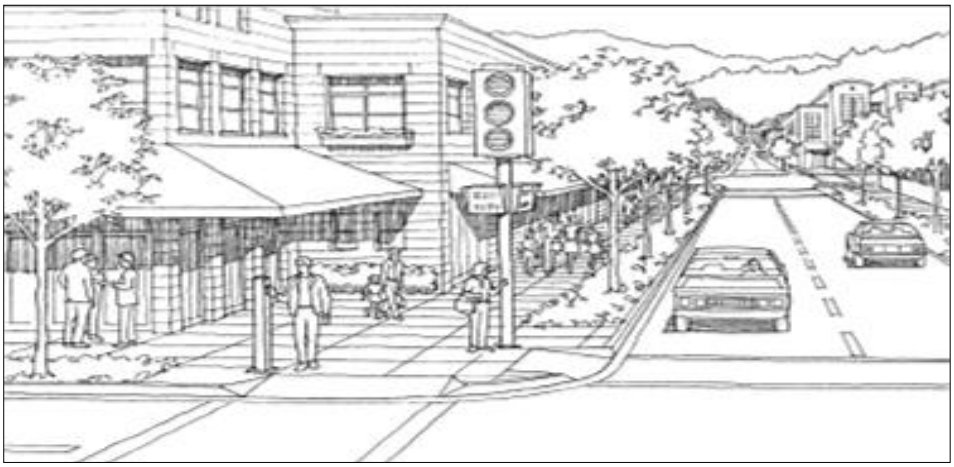
This study aims to identify the existing pedestrian facilities, evaluate their condition and explain to what extent they are serving the pedestrian demand. This study is not limited to only providing a glimpse of the current pedestrian infrastructure, but at the same time, it also comes up with the backlogs of the current facilities, so that if any necessary steps can be required that might be recommended for implementation to improve the existing pedestrian facilities of Khulna CBD. To achieve these goals, this study is conducted based on an inventory of pedestrian facilities that was prepared by reviewing different literature and policy guidelines. Furthermore, existing demand of the pedestrians and how the supply of pedestrian facilities are meeting that demand and to what extent, had been assessed right after. Therefore, to achieve this purposes, three objectives were set: to find out the existing pedestrian facilities at Khulna CBD, to explore the issues and opportunities regarding pedestrian facilities of the study area and to propose some measures to enhance pedestrian facilities at Khulna CBD.

Pedestrian Facilities

Pedestrian facilities are crucial to encourage walking to endorse responsive and sustainable built environment (Shelton, 2008). It serves the essential transportation purposes by promoting walking as an alternative means of vehicular travel and safeguards community livability and health by reducing traffic congestion and pollution. People can be encouraged to walk as a regular mode of travel through creating a pedestrian-friendly environment. However, the types and standards of pedestrian facilities vary among countries based on their transportation policy, strategy and, preferences. The following sections are intended to introduce the concepts, types, and standards of pedestrian facilities of different countries by analyzing the contemporary

and standards practices in designing and implementing pedestrian facilities in the broader literature and policy guidelines.

Transit Corporative Research Program (2006) identifies two main barriers of walking, which are the lack of contiguous pedestrian facilities and concern for personal safety (Fitzpatrick et al., 2006). Urban environment of the city centers should offer comfortable and barrier-free walkways to achieve sustainable pedestrian mobility. Pedestrians are defined as any person on foot (RCP, 1995). Design of sidewalks and crossings according to pedestrian's perception can ensure the development of a pleasant city center (Lee and Moudon, 2006). The design elements of pedestrian facilities refer to the design of walkways, sidewalks and, crosswalks that are to be exclusively used by pedestrians. Although pedestrian facilities often assume as segregated footpath for pedestrians, it further includes road crossings, walking signage, street lighting, proper accessibility and mobility throughout the pavement, street trees, reduced footpath parking and encroachment and proper maintenance which is depicted in Figure 1 (Department of Transport and Main Road, 2017).



Source: Guidebook, 1997

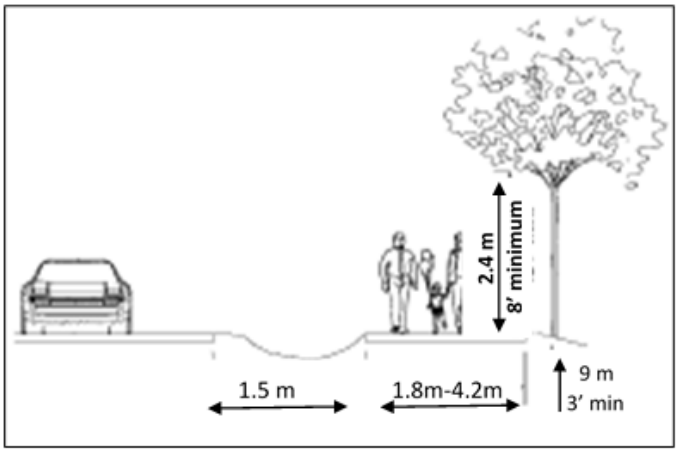
Figure 1: Pedestrian facilities showing side walk including curb, crossing, street lighting and street furniture.

Well-designed pedestrian facilities can encourage people to walk and contribute to improve pedestrian safety. Pedestrian facilities that are safe, attractive, convenient, and easy to use should be provided. According to Guidebook (1997) kerb ramps, sidewalks with on-street facilities, walkways and trails, traffic calming and control devices, crosswalks, grade separations for underpasses and overpasses, street furniture such as benches and landscaping and other technology, design features, and strategies intended to encourage pedestrian travel such as planting strips, shelters, public art and lighting altogether is defined as pedestrian facilities.

An integrated set of principles are required for designing of efficient pedestrian facilities. To achieve this, the pedestrian network should be safe, accessible, well-connected, easy to use, economical and usable for many activities. An outstanding side-walk should

consider accessibility, safety, adequate traffic width, continuity, landscaping, social space and, quality of places. Accessibility defines the condition of access to all people. Safety refers to the people's perception to feel safe and not threatened by adjacent traffic. Adequate traffic width indicates the state that may accommodate the higher volume of pedestrians, and different walking speeds. Continuity ensures that pedestrians should not require traveling out of their way unnecessarily. Landscaping is necessary to enhance psychological and visual comfort (Social Space is a place for people's interaction and recreational activities. Quality of place strengthens local identity and neighborhood character (Portland Office of Transportation, 1998).

Pedestrian facilities should design in a way that can accommodate the pedestrian's demand of any location. Pedestrian demand can be identified by monitoring the existing pedestrian activities and through pedestrian count. Footpath or sidewalk, crossings, pedestrians guiding measures, lighting and maintenance of pedestrian network are the most crucial consideration of pedestrian facilities. Different transport authorities designate different sets of standards to support their policy guidelines and transportation to maximize the effectiveness of pedestrian facilities. Designing of footpath as a separate route from the vehicular street (Figure 2) is the most vital element of pedestrian facilities. According to New Zealand(NZ) Transport Authority (2009), footpath width in CBD area should be at least 4.5 meters on both sides of vehicular roads with the maximum pedestrian flow of 80 people/min. The footpath surface should be designed with contrast materials to attract pedestrians, whereas Guidebook (1997) considers the least width of the sidewalk as 3.0-4.6 meter on both sides of the vehicular street with an additional 1.2 meter for planting buffer zone. According to the policy of Florida Department of Transportation (1999), the CBD area should consider the minimum 2.4-meter width of the sidewalk, which is the least width recommended sidewalk or footpath in the context of the guidelines of developed countries.

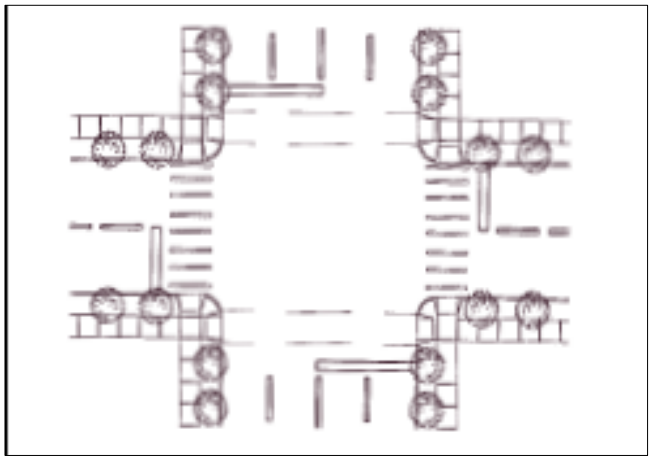


Source: Guidebook, 1997

Figure 2: Sidewalk separation from vehicular road

Crosswalk (Figure 3) and walking signage are considered as the other most important pedestrian facilities in different design policy guidelines to encourage walking as a

secure, comfortable and convenient travel mode. Zebra crossing to ensure safe crossings should be installed within 100 m of any other pedestrian crossing point on the same route and all major intersections, along with signalized pedestrian crossing can be provided to ensure safe crossings along with different pedestrian guiding measures including walking signage, road signage and direction signage with distance may attract people to walk (NZ Transport Authority, 2009). Even, different signage such as, pedestrian prohibited signs, pedestrian crossing signs, traffic signal sign, warrant signage including maximum vehicular speed, school crossings along with signalization such as pedestrian signal, intersection crossings with marked or unmarked crossings with minimum 1.8 m minimum width should be provided to encourage safe walking (Florida Department of Transportation, 1999).



Source: Guidebook, 1997

Figure 3: Marked and unmarked crosswalks at intersection.

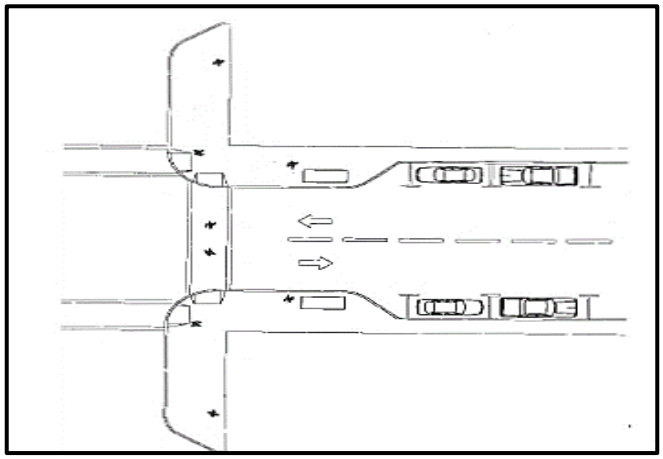
Kerb ramps are also considered as one of the most important elements of an accessible pedestrian environment along with designing vertical kerb adjacent to a planting strip between the sidewalk and vehicular street (Guidebook, 1997). With a longer distance, kerb extensions or designing pedestrian island (in between street divider) should be used to reduce the distance traveled in one crossing movement (Figure 4) and it should be at least 3.5 meters in width (NZ Transport Authority, 2009). Florida Department of Transportation (1999), emphasized kerb ramp as a mean for the efficient transition from and to the elevated sidewalk, especially in connection of crosswalk which slope should not exceed 1:12. Thus kerb ramps radically improve mobility and access of disable persons and can effectively reduce the rate of accidents.

Although different policy guidelines emphasized street lighting installment and describe it as another most essential pedestrian facility, however, they provide no fixed standards of this. Such as, NZ Transport Authority (2009) emphasizes lightings without any description of standard but recommends it to be installed on street level, crossings, and footpath at a consistent distance. However, according to Guidebook (1997), street lighting that is needed to ensure pedestrian safety and comfort should be installed between 0.5 and 2.0-foot laps throughout pedestrian travel ways. Furthermore,

signalization, midblock crossings, pedestrian guiding measures, on-street facilities, street furniture including resting space and street trees are also recommended to enrich the pedestrian facilities accompanied by maintenance of pedestrian network is endorsed for the upkeep of these pedestrian infrastructural facilities and promotion of one-way vehicular street provision is also being recommend in order to promote and ensure better use of the pedestrian facilities and to reduce accidents (Florida Department of Transportation, 1999 and Guidebook, 1997).

In the context of the Asian countries, pedestrian facilities are still not so prevalent in consideration of policymaking. Lack of dedicated institution for pedestrian improvements in addition to improper allocation and use of funds for pedestrian facilities are identified as a significant hindrance in these countries to promote walking as a sustainable mode of transportation, although in recent time different government policies emphasize pedestrian facilities development to ensure transport sustainability (Leather et al., 2011).

As an Asian country, Singapore's Land Transport Master Plan (2008), highlights the pedestrian-friendly development plan. According to the plan, minimum 1 to 1.5-meter-wide pedestrian walkways is considered as a significant pedestrian facility. India follows the policy provided by the India Roads Congress (IRC), which urges footpath development for a clear pedestrian zone with a width of 3.50 to 4.50 meter for shopping frontages and 2.5 meters for the commercial or mixed-use area. Along with zone wise footpath width, IRC (2012) also recommends footpath width based on the pedestrian flow per hour, which is given in Table 1.



Source: Guidebook, 1997

Figure 4: Kerb extension to facilitate crossing

Table 1: Footpath width based on flow in number of persons per hour in India

Footpath width (meter)	Flow in Number of Persons per hour	
	In Both Direction (minimum)	In One Direction (minimum)
1.8	1350	2025
2	1800	2700
2.5	2250	3375
3	2700	4050
3.5	3150	4725
4	3600	5400

Source: Adopted from: India Roads Congress, 2012

Pedestrian crossings are considered as another major pedestrian facilities in the context of Asian countries. Singapore's Land Transport Master Plan (2008) recommended, pedestrian crossing with slight drop of 25mm from footpath to road and grading with thicken visible road crossing line, whereas IRC (2012) considers, zebra crossing with the range of 2 to 4 meter in an uninterrupted way with signal provision along with kerb extension in the intersection and kerb ramp with connection of crossings as a measure of safe crossing.

Other pedestrian facilities are being less focused on the policies of Asian countries like Singapore and India. Although, according to Singapore's Land Transport Master Plan (2008) only higher reflective traffic signs and connected ramps with bus or train interchanges are considered as relatively effective measures of pedestrian facilities to promote walking as a sustainable mode of transportation. IRC (2012) considers some other pedestrian services including space allocation for street vendor, public toilet, street furniture such as street trees within less than 30 meter distance and uniform street lightings are considered as standard pedestrian facilities in context of developing countries.

Following the Asian countries, Bangladesh's National Land Transport Policy (2004) provides a small sub-section on development of pedestrian facilities through development crossing facilities with grade crossings and signal controlled traffic regulation to encourage road safety; but, footpath continuity, street furniture, kerb ramp and other various pedestrian facilities are not considered in this policy. Lack of standard policy provision in Bangladesh is very much responsible for creating hindrance towards improvements of pedestrian facilities to promote walking as a sustainable mode of transportation (Ministry of Communication, 2004).

From extensive literature and policy review, this study identifies footpath, crossings, kerb ramp, street furniture and street lighting as the primary criteria to analyze the quality of pedestrian facilities in the context of Khulna CBD, Bangladesh. As there is no fixed standard available in Bangladesh, in context of Khulna CBD, which is a part of developing Asian countries, the standard provided by IRC (2012) is the most conventional standard to measure the quality of pedestrian facilities, which is why it is adopted in this study to analyse and measure the quality of pedestrian facilities in Khulna CBD.

Methodology of the Study

To attain the objectives of this research, both quantitative and qualitative approach of research was implied. A qualitative approach was followed to explore the present quality and condition of available pedestrian facilities and to measure the extent in which these existing facilities serve the pedestrian demand quantitative approach was implied. Primary data sources were used to collect data for this study. Existing pedestrian facilities, their conditions observed and measured through field survey and their extent of services according to demand were measured through counting peak pedestrian volume from the study area. For this study, CBD zone was considered as the area of interest, which is a center of different business and service activities that attracts the highest flow of pedestrians in Khulna city.

Pedestrian Facilities at Khulna CBD

Khulna CBD being an organically developed place without any proper standard for the development of pedestrian facilities, there is an acute shortage of these facilities. In the study area, the available pedestrian facilities only include footpath, kerb and street light, although often these facilities failed to serve the pedestrian with proper services because of their inadequacy. Even though the area generates massive pedestrian movement, some of the dominant pedestrian facilities are absent throughout the study area. This absence of these facilities results in inconvenience in walking. For instance, road-crossing facilities, which is an obligatory requirement to ensure safe walking is absent. Along with this, street furniture such as a bench or street trees to make the walk comfortable and enjoyable and to attract more pedestrian activities is also absent throughout the CBD area.

Footpath, as is the major element of pedestrian facilities which should be at least 3.50 to 4.50 meter in width, is although available along with most of the vehicular roads but lacks proper width and management. In the study area, the highest width of the footpath is 1.8 meter, which is too poor to accommodate proper pedestrian facilities in areas like CBD. In the most situation, the insufficient footpath width fails to support the excessive pedestrian flow, while some footpath is only available on one side of the vehicular roads (Table 2). Therefore, to fulfil the pedestrian demand of the other side of the road, pedestrian have no other ways than to walk in the middle of the vehicular roads, which led to traffic congestion and inconvenience of walking. Due to the poor management and regulation, people often choose to walk in both directions of a single footpath (Figure 5), which creates pedestrain collisions.

Source: Author, 2018

Figure 5: People walking in both directions in a single footpath

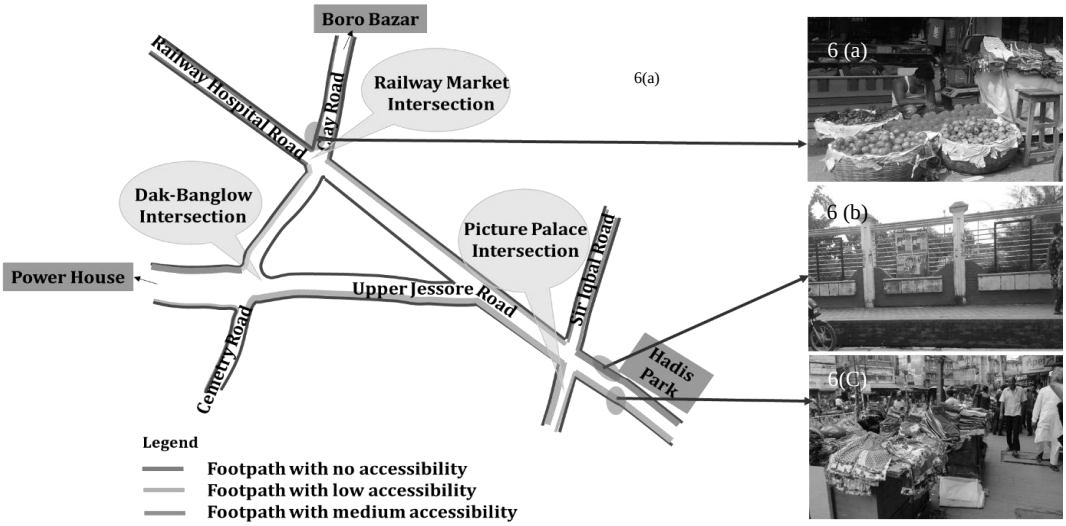
Table 2: Existing condition of the footpath and peak hour pedestrian flow

From	To	Availability of Footpath	Footpath Width (m)	Pedestrian Flow/ Hour	
				In Flow	Out Flow
Dak-Banglow Intersection	Railway Market Intersection	Only in one side of the road	1.2	1464	1560
	Power House		1.8	2073	1513
	Cemetry Road	In both side of the road	1.8 in east 1.2 in west	1176	1068
	Upper Jessore Road		1.4 in north 1.8 in south	1236	1116
Railway Market Intersection	Railway Hospital Road	Both side of the road	0.8 in east 0.5 in west	1680	1824
	Clay Road (Boro Bazar)		1.2 in both sides	1488	1716
	Picture Palace Intersection	Only in one side of the road	1.8	1728	1422
	Dak-Banglow Intersection		1.2	1572	1464
Picture Palace Intersection	Dak-Banglow Intersection	Only in one side of the road	1.8	987	868
	Railway-Market Intersection		1.8	1265	1032
	Hadis Park	In both sides of the road	1.8	1108	978
	Sir Iqbal Road		0.8 in both sides	678	972

Source: Field survey, 2018

Being the dominant intersection, Dak-banglow attracts the highest number of pedestrian flow (Table 2), whereas the supply of footpath as a necessary pedestrian facility with the surrounding roads are inferior. Dak-banglow to Railway Market Intersection or Cemetry Road footpath provides very few opportunity for pedestrian facilities. Similarly, other footpath circulations surrounding this intersection and others are also insufficient to supply as per pedestrian demand which discourages people from walking.

Moreover, some of these footpaths are highly occupied with informal business activities, which not only failed to adequately accommodate the pedestrian but in some ways, hardly offer any walking options through it (Figure 6). Such is the case of in Clay road or Railway Hospital Road, although these roads have footpath alongside, there is no access to walk there as these are fully occupied by different informal business and street shops (Figure 6a). Similarly, some footpath such as the footpath of Upper Jessore Road is partially occupied by different vending activities, which provide some access to walk through these but obstructed the continuity of the present footpath and created hurdles of walking (Figure 6c). However, these footpaths failed to attract people to walk because of safety issues as street vendors occupied the footpath with temporarily bamboo-made shade or hanger, which can break-down anytime upon the pedestrians and causes accident.



Source: Author, 2018

Figure 6: Footpath availability and accessibility at the study area.

Kerb being another indispensable pedestrian facility, should be available in connection of crossing, which is absent with the absence of footpath. However, in adjacent of some footpath regarding connection with the vehicular road, there is some kerb ramp present. Whether some of these kerb ramp facilitates walking of the aged people because of easy access from vehicular road to footpath, some other create hurdles because of it's inappropriate height (Figure 7). In most of the scenario, these kerb ramps are developed without any proper consideration, which is apparently indicated by the differences between various heightened kerb ramp along with their availability and absence with different footpaths (Table 3). For example, the lowest height of kerb ramp is 4 inch along with some footpath throughout Clay Road, whereas the highest elevation of the kerb ramp is 6.5 inch in Upper Jessore Road. Moreover, in the Railway Hospital Road and in a major portion of cemetery road kerb is absent along with footpath. However, neither of these kerb are continuous, nor are properly maintained. Because of improper management, these kerb are often used as the extended stair of the shop frontages, which instead of providing easy access to footpath, create difficulties as these shop frontages reduce access to the footpath.

Source: Author, 2018

Figure 7: Improper kerb alongside the footpath.

Table 3: Present condition of the kerb

Name of the Road	Availability of Footpath	Availability of Kerb	Height of the Kerb (inch)
Upper Jessore Road	In both sides	In both sides	6.5 inch on both sides
Clay Road	In both sides but not accessible	In one side	4 inch
Sir Iqbal Road	In both sides	In both sides	5.5 inch on both sides
Cemetery Road	In one side, but not continuous	In one side, but not continuous	-
Railway Hospital Road	In both sides but not accessible	Absent	-

Source: Filed survey, 2018

Although street light is available along most of the roads throughout the area, there are problems with the installment locations of the street lights, maintenance and the distance between the lights are not uniform. Moreover, due to the poor maintenance, some of these lights are out of order. The electric poles of these street lights are installed in a way that hinders pedestrian vision. Moreover, although there is street light pole available throughout the Upper Jessore Road, there is hardly any light with this pole which reflects the poor maintenance. Most of these lights are mounted facing the carriageway, that is why instead of supporting the pedestrian movement they are failing to provide a safe environment for the pedestrians. However, to meet the need, some people have to walk, who mainly walk through in the light of street shops (Figure 8), which reflects the improper distribution of street lighting.

Source: Author, 2018

Figure 8: People walking in the light of street shops.

Without proper crossing arrangement and zebra crossing the pedestrian facilities of the study area remains very poor. People have to cross road haphazardly in the middle of the vehicular street by compromising their safety issue (Figure 9), which further is responsible for traffic congestion, especially at the intersections.

Source: Author, 2018

Figure 9: People crossing the street haphazardly by risking their life.

Conclusion

Pedestrian facilities are very much crucial in order to encourage walking as a sustainable and inclusive mode of transportation. Khulna CBD being the heart of vibrant commercial and business center of Khulna city attracts the highest pedestrian flow than any other part of the city. However, the acute deficiency of pedestrian facilities not only creates hurdles for the pedestrians but also discourages people who prefer to walk in this area. In order to promote walking as a sustainable mode of transportation, new policy should be introduced regarding the proper provision of pedestrian facilities. Pedestrian facilities should be focused and integrated in National Land Transport Policy, where different standard of pedestrian facilities should be clearly defined. Most importantly connected, widened and barrier-free footpath should be introduced to accommodate the pedestrian flow. In the study area, crossing facilities is completely missing which forces people to walk through in the vehicular road by risking their life. The provision of proper crossing facilities is also vital in order to ensure safe crossing, especially at the intersection. Along with these facilities, proper provision of kerb ramp with proper height distribution and extended kerb ramp at the intersection should be considered in transportation policy to facilitate walking. At the last but not the least, street light and street furniture should be taken into consideration to encourage a safe and pleasant walking.

Maintenance of existing pedestrian facilities should be given due importance. Moreover, some street furniture such as street trees, proper space for street vendor allocation or sitting space should be considered to ensure aesthetic and responsive walking environment, which will attract more pedestrians to walk. With appropriate policy provision, proper implementation and maintenance should be in due order to achieve the maximum effectiveness of the pedestrian facilities.

This study highlights the existing conditions and deficiencies of pedestrian facilities at Khulna CBD in comparison to the policy review of different countries and also attempts to recommend some guidelines to incorporate in policy, following which standard

pedestrian facilities can be developed to facilitate walking in CBD area. However, this study is explanatory in nature, which provides further scope to quantitatively measure these pedestrian facilities.

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