Jordan Journal of Civil Engineering, Volume **18**, No. **3**, **2024**
DOI: https://doi.org/10.14525/JJCE.v18i3.02

Jordan Journal of Civil Engineering

Journal homepage: https://jjce.just.edu.jo

Assessing the Walkability and Pedestrian Facilities at Major Intersections in Rajshahi City, Bangladesh

Sabbir Ahmed Siddique [1)*], Md. Asaduzzaman [2)], Sheikh Hameem [3)]

[1)] *B. Arch., Department of Architecture, Faculty of Civil Engineering, Rajshahi University of Engineering & Technology, Rajshahi-6204, Bangladesh. * Corresponding Author. E-Mail: siddiquesabbirahmed@gmail.com*
[2)] *Assistant Professor, Department of Architecture, Faculty of Civil Engineering, Rajshahi University of Engineering & Technology, Rajshahi-6204, Bangladesh. E-Mail: asaduzzamansohag@gmail.com*
[3)] *B.Arch., Department of Architecture, Faculty of Civil Engineering, Rajshahi University of Engineering & Technology, Rajshahi-6204, Bangladesh. E-Mail: sheikh.hameem71@gmail.com*

ARTICLE INFO

Article History:
Received: 27/4/2023
Accepted: 24/4/2024

ABSTRACT

For more than a half of a century, vehicular-mobility rate is thriving so much that it already has taken all the attentions of sidewalk infrastructure facilities, commonly called "pedestrian". At present, pedestrian facilities represent one of the essential challenges in terms of traffic safety and sidewalk environment, mainly for the urban dwellers of the Asian cities like in Bangladesh, as the average median walkability rating for the Asian countries is only 58.43. Currently, Rajshahi city has been severely affected regarding the safety and mobility of pedestrians, as there is no maintenance of supporting infrastructures, amenities and services at all. The impetuous and excessive increase of urbanization and motorization combined with limited attention to sidewalk facilities and public-transport opportunities resulted in a decrease in the overall pedestrian mode share. Considering the facts and to maintain the comfortable moving of the citizens, identifying the existing conditions of the walkability and pedestrian facilities of Rajshahi city must be considered as the topmost priority. This study aims to apply the principles of Global Walkability Index (GWI), incorporating a "field walkability survey" together with an ADB study, in four major intersection points of Rajshahi city; namely, zero point (CBD), Uposhohor, Kazla and Railgate. Each area will be assessed based on nine parameters of equal weight, with the average of each parameter transformed into a rating system from 0 to 100. The resulting walkability index will classify the areas into red, yellow and green zones for walking and assess Rajshahi city's global standing based on safety, security and convenience.

Keywords: Walkability, Pedestrian facilities, Asian cities, Walking environment, Walkability indicators, ADB study, Public transport.

INTRODUCTION

The success of maintaining the recent unprecedented urban-population growth relies on infrastructure that supports mobility and walking is the cheapest and most appropriate commuting route, especially for the underprivileged. By 2030, the annual passenger traffic will exceed 80 trillion passenger- kilometres and

additional 1.2 billion cars will be on the road, where the major percentage will rule over in Asia (Sustainable Mobility for All, 2017). Many expect Asia's population to grow by 750 million people to reach 5.2 billion people by 2050, where more than a half of all people around the globe (3.97 billions) live in just seven countries of Asia (Mahajan, 2019). As Bangladesh has ranked fifth in Asia and eighth across the world for the category of "most populous nation", growing motorization has become a common phenomenon for maintaining the citizens' mobility in its big cities (Quader, 2021).

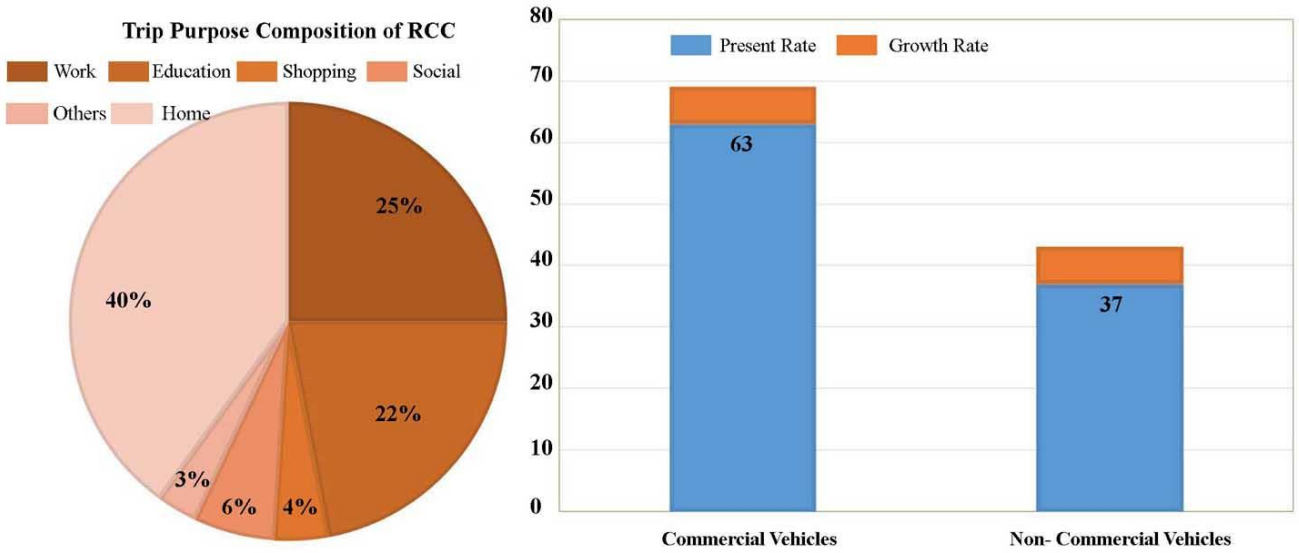

Figure (1): Trip purpose and statistics of commercial and non-commercial vehicles in Rajshahi city corporation
(Source: Rajshahi City Corporation, 2014)

In Rajshahi city, the current infrastructure facilities are not quite enough for providing a friendly and breathable environment where commercial vehicles and non-commercial vehicles cover respectively 63% and 37% of the total transport coverage on the roads with 6.1% growth rate (see Figure 1). Comfort of pedestrians on walkways has been seized due to street fatalities, narrow roads, unorganized on-street parking and lack of appropriate street infrastructure and road signalling. Thus, a concentrated shift is needed to let people, not cars, rule the city. The first step is to assess walkability and pedestrian facilities to help policymakers, development agencies and other stakeholders understand the need and establish priorities for increasing walkability.

The objective of this research is to provide information on the current walkability and pedestrian facilities in four major intersection points of Rajshahi city; namely, zero point (CBD), Uposhohor, Kazla and Railgate, to rank them across the world based on the safety, security and convenience of their pedestrian environments. In this regard, we are going to use the Global Walkability Index (GWI), developed by H. Krambeck for the World Bank together with an ADB Study on 'Walkability and Pedestrian Facilities in Asian Cities'. This study includes a "field walkability survey" to assess the walkability and pedestrian facilities against nine parameters in those four areas. The final walkability ratings in the different area types in Rajshahi city were derived by taking the average of the individual parameters' averages.

In summary, this paper will initially provide an overview of the theoretical framework and existing literature relevant to the study. Following this, it will provide some insights into the research areas in the "Survey Areas Profile section". The "Methodology" section will detail the research design, data-collection methods and analytical approach employed. The subsequent sections will present the findings of the study, followed by a discussion of the results in relation to the research questions and theoretical framework. Finally, the conclusion will summarize the key findings, implications and avenues for future research.

LITERATURE REVIEW

This study proposes the use of "walkability index" to capture pedestrians' attitudes to their walkability and pedestrian facilities in terms of their current pedestrian environment. For this, we review a few specific categories of "Walkability" literature which will lead us to the main objective of this paper and provide us with a survey procedure (criteria and indicators) to calculate the "walkability" rating of some major intersection points of Rajshahi city.

Walkability Survey in Asian Cities

In recent years, the impetuous and excessive increase of urbanization and motorization, combined with limited attention to walkability and pedestrian facilities, resulted in killing 1.2 million people each year by road accidents, with the majority of these accidents taking place in Asian cities (Al-Masaeid, 2009).

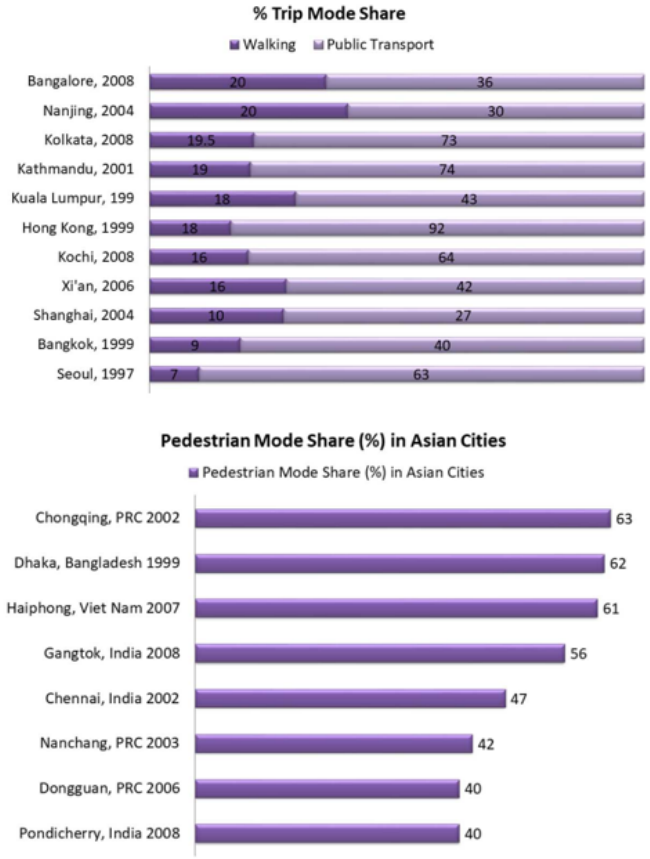

Figure (2): (a) Pedestrian mode share in Asian cities and (b) Trip modal share
(Source: Leather et al., 2011)

Figure 2(a) almost clears that the mode share of walking of Asian cities is almost in a vulnerable position, ranging from 40% in Pondicherry, India to as high as 63% in Chongqing, PRC. Figure 2 (b) shows that almost many cities with low pedestrian mode shares surprisingly have high public-transport shares, such as Seoul, Colombo and Bangkok, which proves that walking trips are not only replaced by private vehicles, but also by public transport. The Clean Air Initiative (2011) is an organization dedicated to assessing Walkability in Asian cities, particularly through pedestrian surveys. It recommends considering the following attributes for a comprehensive evaluation (Minhas and Poddar, 2017):

1. Cleaner and wider sidewalks.
2. Low traffic volume on roads.
3. Obstacle- free footpaths.
4. Increased crossing points.
5. Effective street lighting.
6. Easy access for disabled persons.

As part of its efforts, the organization calculated the walkability index for 30 major cities in India. The reported average walkability for India was 0.52. Chandigarh leads in walkability with a score of 0.92,

followed closely by Delhi at 0.87, while Shimla scores the lowest score of 0.22. Given the bad statistics, a concerted makeover is required to help people recover the urban environment rather than vehicles. So, in order to accomplish this aim, these communities may poll the population by conducting a walkability survey to gather input from the public.

Measuring and Evaluating Walkability Indices

Walkability surveys must assess a city's walkability and recommend ways to improve pedestrian amenities. Though there are several methodologies used worldwide to measure walkability and pedestrian facilities of a city, like Institute for Transportation and Development Policy Index, Sidewalk Condition Index (SCI), Pedestrian Environmental Quality Index (PEQI), Ministry of Urban Development Method (MOUD), the most comprehensive one is the Global Walkability Index (GWI), developed for the World Bank in 2006 by Holly Krambeck and Ralph Gakenheimer. Krambeck's global walkability index includes a survey of the service levels of many factors and the measurement is divided into three categories: 1. Safety; 2. Convenience and attraction and 3. Government policies (Krambeck and Shah, 2006).

Global Walkability Index (GWI) and ADB

Walking is highly valued throughout Asia, particularly by low-income individuals who have limited access to financial resources and public transit. However, with the discouraging statistics highlighted above, it is increasingly difficult for pedestrians to navigate the streets. A collective effort is necessary to revitalize the urban environment, prioritizing people over vehicles. In order to identify and assess the walkability index for the unprivileged cities of Asia, the ABD conducted the investigation of walkability index in many Asian cities in collaboration with Krambeck's Global Walkability Index (GWI) parameters (see Table 1). That walkability index comprises nine parameters as evaluation criteria, including:

Table 1. Field walkability survey parameters (Source: Leather et al., 2011)

Parameter	Description	Points
Walking-path modal conflict	Significant conflict that makes walking impossible	1
	Significant conflict that makes walking possible, but dangerous and inconvenient	2
	Some conflict-walking is possible, but not convenient	3
	Minimal conflict, mostly between pedestrians and non-motorized vehicles	4
	No conflict between pedestrians and other modes	5
Availability of walking paths	Pedestrian walkways required, but not available	1
	Pedestrian walkways available, but highly congested, badly maintained and not clean	2
	Pedestrian walkways available, but congested, needing better maintenance and cleanliness	3
	Pedestrian walkways available which are sometimes congested and are clean and well-maintained	4
	Pedestrian walkways not required, as people can safely walk on roads	5
Availability of crossings	Average distance of controlled crossings is greater than 500m and average speed is high	1
	Average distance of controlled crossings is between 300m-500m and average speed is 20-40 kmph	2
	Average distance of controlled crossings is between 200m-300m and average speed is 20-40 kmph	3
	Average distance of controlled crossings is between 100-200m and average speed is 20-40 Kmph	4
	There is no need of controlled crossings, as pedestrians are safe to cross wherever they like and vehicles and pedestrians co-exist	5
Grade of crossing safety	Very high probability of accidents with very high crossing time	1
	Dangerous; pedestrians face some risk of being hurt by other modes and crossing time is high	2
	Difficult to ascertain dangers posed to pedestrians, but the time available for crossing is less and people have to hurry	3

	Safe; pedestrians are mostly safe from accidents with other modes, exposure time is less and time available for crossing is more	4
	Very safe; other modes present no danger to pedestrians	5
Motorist behaviour	High traffic disrespect to pedestrians	1
	Traffic disrespect and rarely pedestrians get priority	2
	Motorists sometimes yield to pedestrians	3
	Motorists usually obey traffic laws and sometimes yield to pedestrians	4
	Motorists obey traffic laws and almost always yield to pedestrians	5
Amenities	No amenities	1
	Little amenities at some locations	2
	Limited number of provisions for pedestrians	3
	Pedestrians provided some good amenities for a major length	4
	Pedestrians have excellent amenities, such as lighting, cover from sun and rain, making walking a pleasant experience	5
Disability infrastructure	No infrastructure for disabled people is available	1
	Limited infrastructure for disabled persons is available, but it is not in usable conditions	2
	Infrastructure for disabled persons is present, but in poor conditions and not well-placed	3
	Infrastructure for disabled persons is present, in good conditions, but poorly placed	4
	Infrastructure for disabled persons is present, in good condition and well-placed	5
Obstructions	Pedestrian infrastructure is completely blocked by permanent obstructions	1
	Pedestrians are significantly inconvenienced, effective width <1m	2
	Pedestrian traffic is mildly inconvenienced; effective width is < or = 1m	3
	Obstacle presents minor inconvenience, effective width is > 1m	4
	There are no obstructions	5
Security from crime	Environment feels very dangerous – pedestrians are highly susceptible to crime	1
	Environment feels dangerous – pedestrians are at some risk of crime	2
	Difficult to ascertain perceived degree of security for pedestrians	3
	Environment feels secure – pedestrians at minimal crime risk	4
	Environment feels very secure – pedestrians at virtually no risk of crime	5

Results from the study encompass details regarding the state of pedestrian facilities based on different types of activity and respondents with varied travel destinations. This method can also detect possible difficulties in the region in question, on the basis of an analysis and recommendations for solutions for walkability improvement and development in terms of engineering, management and law enforcement (Baobeid, Koç and Al-Ghamdi, 2021).

SURVEY AREA PROFILE

This research took place in Rajshahi, which is a metropolitan city, mainly known as the major commercial, urban and educational centre of Bangladesh. We selected four highly economical areas from Rajshahi City Corporation (RCC) according to categories for the survey; namely, zero point (CBD-commercial zone), Uposhohor (residential zone), Kazla (educational zone) and Railgate (public-transportation terminal) (see Firgure 3).

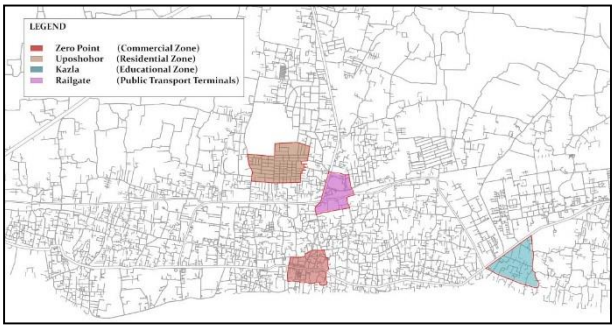

Figure (3): A schematic map of Rajshahi city corporation, locating the survey areas
(Source: by the authors)

Zero Point (Commercial Area)

Zero point is the centre of all the trade and commerce of Rajshahi city. Being the CBD, this area always stays vibrant for all night long. But, the walkway facilities are not very much satisfactory, being mostly consumed by various types of obstructions. The total area which is considered for the study is 0.214 km^2.

Nonetheless, studies show that only 12% of the

observed roads had footpaths on both sides of the street; 45% had footpaths on one side of the street, while almost a half (43%) had no footpaths at all and only 4% of the observed footpaths were given a "good rating". Most footpaths were given either a fair (35%) or a poor (61%) rating (see Figure 4).

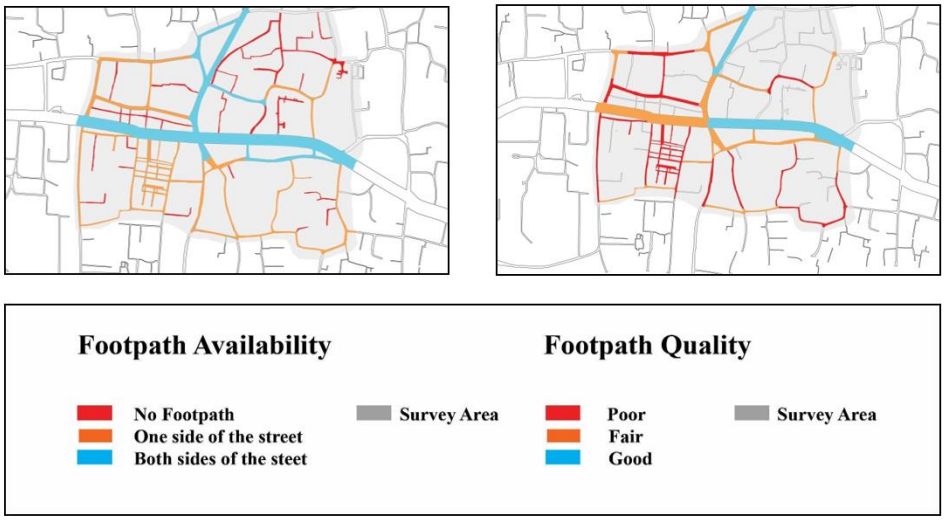

Figure (4): Current pedestrian availability and quality of zero point, Rajshahi city
(Source: by the authors)

Uposhohor (Residential Area)

It is mainly a residential area, but some commercial and educational activities are also held there. Only small vehicles run through the area only for residential and commercial purpose. The total area which is considered for the study is 0.3 km^2. Figure 5 shows that only 35% of the observed roads had footpaths on both sides of the street; 22% had footpaths on one side of the street, while almost a half (43%) had no footpaths at all and surprisingly no footpaths were given a "good rating", which refers to the evenness of the footpath. All footpaths were given either a fair (42%) or a poor (67%) rating.

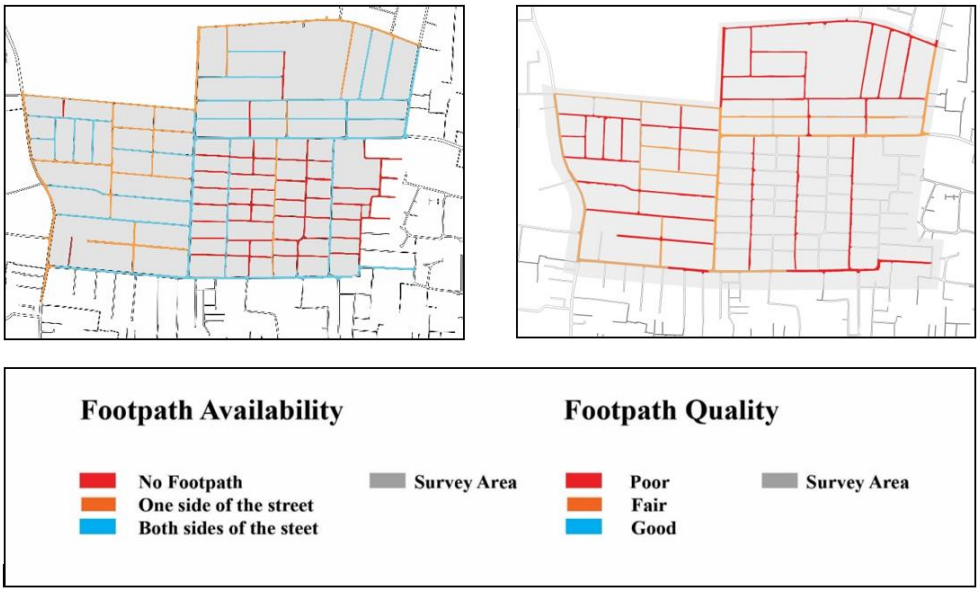

Figure (5): Current pedestrian availability and quality of Uposhohor, Rajshahi city
(Source: by the authors)

Kazla (Educational Area)

Kazla is the centre of the major educational facilities of Rajshahi city. Rajshahi University of Engineering & Technology and Rajshahi University are located in this area, along with few commercial or govt. primary and high schools covering 0.247 km^2. So, a large number of pedestrian trips are generated in this place, but the walkway facilities are not quite enough for the citizens here.

Additionally, studies show that only 2% of the observed roads had footpaths on both sides of the street; 24% had footpaths on one side of the street, surprisingly 74% had no footpaths at all and no observed footpaths were given a "good rating", which refers to the evenness of the footpath. All footpaths were given either a fair (20%) or a poor (80%) rating (see Figure 6).

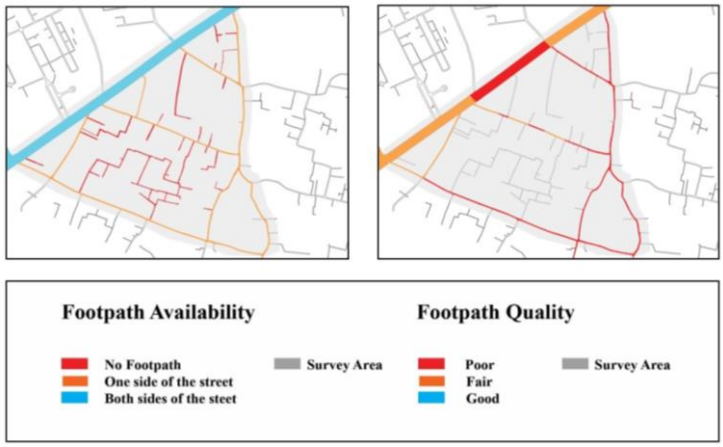

Figure (6): Current pedestrian availability and quality of Kazla, Rajshahi city
(Source: by the authors)

Railgate (Public-transport Terminal)

Railgate is called the gateway of Rajshahi city. This intersection is also known as the junction point of all the busiest areas of Rajshahi city, like zero point (CBD), new market, greater road, Aam chatter and Vodra. To maintain the daily movement of this huge population, all types of transport facilities always have to be present here. In the peak hours, this point becomes the most congested point among all the others of Rajshahi city. The total area which is considered for the study is 0.2 km^2.

Moreover, Figure 7 shows that only 17% of the observed roads had footpaths on both sides of the street; 29% had footpaths on one side of the street, while almost a half (54 %) had no footpaths at all and only 16% of the observed footpaths were given a "good rating". Most footpaths were given either a fair (10%) or a poor (74%) rating.

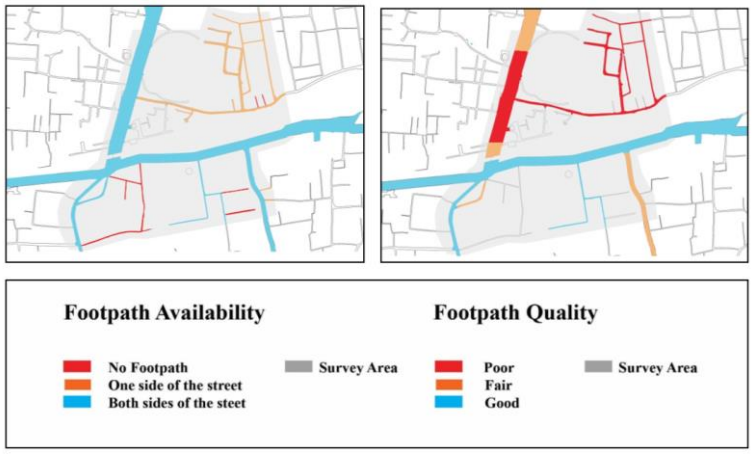

Figure (7): Current pedestrian availability and quality of railgate, Rajshahi city
(Source: by the authors)

RESEARCH METHODOLOGY

This research focuses on evaluating the existing conditions of the walkability and pedestrian facilities in Rajshahi city, Bangladesh through a "Field Walkability Survey" that includes nine parameters derived from the Global Walkability Index together with an ADB study, which will be our major criteria and indicators for this research paper (see Table 1). All factors are given equal weights when calculating the walkability grade. Different weights may be used to enhance the rating scale in order to reflect community preferences (Krambeck and Shah, 2006). The research-methodology flowchart represents the entire process of this research paper (see Figure 8).

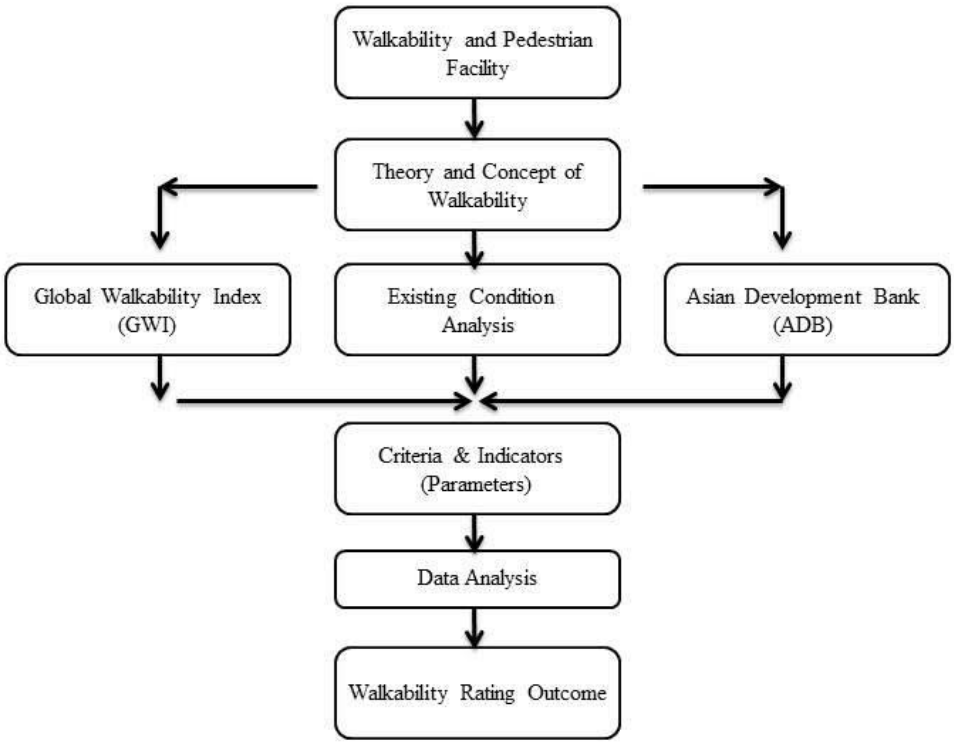

Figure (8): Flowchart of research methodology
(Source: by the authors)

In this research, each and every parameter is scored with a value from 1 to 5, where 1 is for being the lowest and 5 for being the highest (Leather et al., 2011). The average for each of these parameters will be transferred into a rating system ranging from 0 (lowest score) to 100 (highest Score). The final walkability ratings in the different area types in Rajshahi city were derived by taking the average of the individual parameters' averages.

The result of the walkability index is divided into three categories (Gota et al., 2010a), as follows:
Green category: Highly walkable, score more than 70.
Yellow category: Waiting to walk, score between 50-70.
Red category: Not walkable, score less than 50.

ANALYSIS OF THE WALKABILITY AND PEDESTRIAN FACILITIES IN RAJSHAHI CITY

These walkability surveys were carried out in four major intersection points of Rajshahi city; namely, zero point (CBD), Uposhohor, Kazla and Railgate (respectively known as commercial, residential, educational and public-transport terminal zones), to benchmark them against different walkability parameters and rank them across the world based on the safety, security and convenience of their pedestrian environments.

The findings of the walkability index are outlined, providing insights into various aspects related to walkability (see Figure 9).

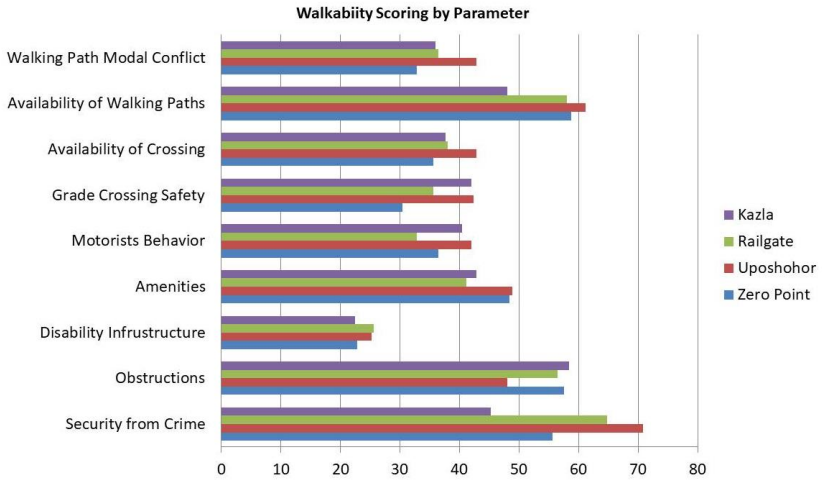

Figure (9): Walkability scoring by parameters in zero point, Uposhohor, Railgate and Kazla

Zero Point (Commercial-centre Surveys)

The average walkability rating in the commercial area is 42 out of 100. Almost all the parameters scored below 60, with "disability infrastructure" recording the lowest score at 22.8 out of 100 (see Figure 9), whereas the availability of walking paths achieved the highest score at 58.8. As the parameters have scored very poorly in this area, this might affect the economic condition of the city, which may result in decreasing the overall GDP of the city.

Uposhohor (Residential-zone Surveys)

The average walkability rating in the residential area is 47 out of 100, the highest among the four different area types. The availability of "disability infrastructure" got the lowest score once more, indicating that access to walking infrastructure is a big issue, while "security from crime" gets the highest score followed by "availability of walking paths". These two parameters got very low scores (see Figure 9).

Rail Gate (Public-transport Terminal Area Surveys)

The average walkability rating in this area is 43.20 out of 100. Similar to the residential area, "security from crime" is the highest rated parameter (64.80) followed by "availability of walking paths (58)". Again, as in the commercial and residential areas, the "disability infrastructure" parameter received the lowest rating (25.60) (see Figure 9).

Kazla (Educational-area Surveys)

The average walkability rating in the educational area is 41.4 out of 100. This suggests that schools and colleges may not provide quality sidewalks or convince city authorities to further improve the pedestrian environment in their vicinity (Leather et al., 2011). The parameter "obstruction-free sidewalk" is the highest rated parameter with 58.40. Similar to other areas, "disability infrastructure" received the lowest rating (22.40), which suggests that it is quite impossible for disabled students to cross the road or to participate in any other educational functions (see Figure 9).

RESULTS AND DISCUSSION

For assessing the walkability conditions of Rajshahi city, we surveyed four major intersection points of different land-uses, which will be representative of the overall rating of Rajshahi city. We assessed those areas and gave them individual ratings according to the selected parameters. But now, we are going to analyse and calculate all the ratings of those areas together to measure the overall walkability index rating of Rajshahi city and rank it across the world (see Table 2).

Table 2. Summary of computation of ratings of pedestrian facilities of Rajshahi city (zero point, railgate, Kazla and Uposhohor) (Source: by the Authors)

Parameters	Zero Point (Commercial Center)		Railgate (Public-transport Terminal)		Kazla (Educational Area)		Uposhohor (Residential Area)		Overall Rating	
	In 5-point Scale	In 100 Scale	In 5-point Scale	In 100 Scale	In 5-point Scale	In 100 Scale	In 5-point Scale	In 100 Scale	In 5-point Scale	In 100 Scale
Walking-path modal conflict	1.64	32.8	1.84	36.4	1.80	36	2.14	42.8	1.85	37
Availability of walking paths	2.94	58.8	2.90	58	2.40	48	3.06	61.2	2.82	56.4
Availability of crossings	1.78	35.6	1.90	38	1.88	37.6	2.14	42.8	1.92	38.4
Grade of crossing safety	1.52	30.4	1.78	35.6	2.10	42	2.12	42.4	1.88	37.6
Motorist behavior	1.82	36.4	1.64	32.8	2.02	40.4	2.10	42	1.89	37.8
Amenities	2.42	48.4	2.06	41.2	2.14	42.8	2.44	48.8	2.26	45.2
Disability infrastructure	1.14	22.8	1.28	25.6	1.12	22.4	1.26	25.2	1.2	24
Obstructions	2.88	57.6	2.82	56.4	2.92	58.4	2.40	48	2.75	55
Security from crime	2.78	55.6	3.24	64.8	2.26	45.2	3.54	70.8	2.95	59
Average	**2.10**	**42**	**2.16**	**43.2**	**2.07**	**41.4**	**2.35**	**47**	**2.16**	**43.4**

Table 3. Comparison of ratings of pedestrian facilities between Asian cities (Source: Tanan & Darmoyono, 2017)

Parameters	Metro Manila (Philippines)	Pangkalpinang (Indonesia)	Bogor (Indonesia)	Rajshahi (Bangladesh)
Walking-path modal conflict	92.6	33.75	85.14	37
Availability of walking paths	79.4	42.5	82	56.4
Availability of crossings	75	87.5	74.29	38.4
Grade of crossing safety	79.6	53.75	67.62	37.6
Motorist behavior	75.4	57.5	52.57	37.8
Amenities	60	30	44	45.2
Disability infrastructure	45	20	53.71	24
Obstructions	73	35	80.57	55
Security from crime	76	80	86.29	59
Average	**72.9**	**48.88**	**69.58**	**43.2**

In whatever way, the research findings show that right now, Rajshahi city is in a horrible condition for walking and at the same time not pedestrian-friendly. The walkability index of Rajshahi city is 43.20 out of 100 (see Table 2), which puts the city into the red category, as the score is below 50. The walkability rating for the individual areas is accordingly, zero point (commercial centre) 42, Railgate (public-transport terminal) 43.2, Kazla (educational hub) 41.4 and Uposhohor (residential area) got a score of 47, a little better than the others. In summary, this study reveals that pedestrian facilities in these areas, such as walking-path modal conflict, walking-path availability, motorist behaviour, amenities availability, obstructions and disability infrastructure need more increasing, where "disability infrastructure" scored the lowest with only 22.4 out of total 100 in Kazla, while "security from crime" scored the highest with the rating of 70.8 in Uposhohor. Due to high-speed vehicles and higher probability of street fatalities, zero point scored worse than Railgate and Kazla. Uposhohor scored better than the other areas because of being a residential zone, where speedy vehicles are not permitted to enter. All of the stretches had inadequate widths of footpaths, poor footpath surfaces and a lot of obstructions, requiring to be improved. Further, barricading must be done and encroachment should be cleared. These stretches have acute shortage of footpath widths and more than 50% of the pedestrians were found walking on the roadway. There we found no crossing facilities at regular intervals and pedestrians were found crossing the road haphazardly risking their lives.

To elaborate the results for better understanding and to present their significance, a comparison of ratings of pedestrian facilities between few more Asian cities along with Rajshahi is given in Table 3; namely, Metro Manila from Philippines, as well as Pangkalpinang and Bogor from Indonesia (see Table 3). The studies of the cities mentioned followed the same methodology to study their pedestrian facilities and rate them.

Metro Manila garnered the highest rating of 72.9, which puts the city into the green category. Pangkalpinang and Bogor city of Indonesia are at par with ratings of 48.88 and 69.58, which puts them in the yellow and the red category, respectively. Surprisingly, Rajshahi city scored the lowest by securing its position in the red category, which puts Rajshahi city in a horrible condition for walking and at the same time makes it not pedestrian-friendly.

Concluding, the research conducted for this project identifies a number of issues that need to be addressed and improved. A major problem also has been noticed, which is that most of the respondents don't understand and follow their rights as pedestrians and have no minimum knowledge of the standards of walkability and pedestrian facilities. Therefore, the overall safety and security measures are undoubtedly very poor. But from the survey, it has become clear that if the present condition won't get improved in the near future, they will shift their travel mode from walking to other motorized facilities. So, the key stakeholders must provide some strategies to form a framework within which a pedestrian-friendly city that values walking can be created.

CONCLUSIONS

Sustainable urban transit depends on pedestrians and supporting infrastructures. Improved pedestrian network access and supporting amenities may promote people's mobility, public-transport efficiency, energy efficiency, social equality and the city's economic growth (Winayanti and Tsaputra, 2015). The research conducted for this project identifies a number of issues that need to be addressed and improved, including the availability and quality of footpaths, cleanliness, facilities for the disabled, amenities, such as public toilets, lighting and shade and community life which provides both enjoyment and safety for those traveling by foot. A major problem also has been noticed, which is that the secondary and tertiary pathways are mostly not continuous (do not form a network) and are not supported by proper signage. Most of the respondents also don't understand and follow their rights as pedestrians and don't have no minimum knowledge of the standards of walkability and pedestrian facilities. The policy and institutional survey revealed several flaws, which were utilized to determine the following key recommendations:

- *Institutions and Resources*: Institutionalizing non-motorized transportation services inside local governments and boosting financial support.
- *Urban and Transport Plans and Projects*: This relates to reviewing design standards for pedestrian- and urban-transportation facilities, allocating special spaces for vendors, utilities and parking and

improving street accessibility for those who rely on other modes of transportation (Gota et al., 2010b).

Additional research is needed in several regions to fully understand the Rajshahi walkability rating.

Limitations

- However, one of the limitations of the field walkability survey is the subjectivity of the responses, as they greatly depend on the individual assessment of the surveyors (Krambeck and Shah, 2006).
- The data-collection methodologies had to be kept simple for practical-implementation purposes, but their simplicity results in a less robust index, diminishing its usability.

REFERENCES

Abaya, E. et al. (2011). "Assessment of pedestrian facilities in major cities of the Philippines". Proceedings of the Eastern Asia Society for Transportation Studies, 2011, 243. Available at: https://www.jstage.jst.go.jp/article/eastpro/2011/0/2011_0_243/_pdf

Al-Masaeid, H.R. (2009). "Traffic accidents in Jordan". Jordan Journal of Civil Engineering, 3 (4), 331-343.

Baobeid, A., Koç, M., and Al-Ghamdi, S.G. (2021). "Walkability and its relationships with health, sustainability and livability: Elements of physical environment and evaluation frameworks". Frontiers in Built Environment, 7 (September). https://doi:10.3389/fbuil.2021.721218

Gota, S. et al. (2010a). "Walkability surveys in Asian cities". Clean Air Initiative for Asian Cities (CAI-Asia), 20.

Krambeck, H., and Shah, J.J. (2006). "The global walkability index".

Leather, J. et al. (2011). "ADB sustainable development working paper series: Walkability and pedestrian facilities in Asian cities-state and issues". Walkability and Pedestrian Facilities in Asian Cities, (17).

Mahajan, I.A. (2019). "Top 10 facts about overpopulation in Asia". Available at: https://borgenproject.org/top-10-facts-about-overpopulation-in-asia/

Minhas, P., and Poddar, A. (2017). "Walkability index by global walkability index method". International Research Journal of Engineering and Technology, 4 (7), 2957-2963. Available at: www.irjet.net

Quader, A. (2021). "Country report: Bangladesh by government of the people's republic of Bangladesh". Available at: https://www.adrc.asia/countryreport/BGD/2020/BGD_CR2020.pdf

Rajshahi City Corporation. (2014). Available at: https://erajshahi.portal.gov.bd/ (Accessed on: 2 March 2020)

Safitri, R., and Amelia, R. (2019). "Evaluation of pedestrian facilities to improve the pedestrian environment in the central market of Pangkalpinang". IOP Conference Series: Earth and Environmental Science, 353 (1), 0-5. https://doi:10.1088/1755-1315/353/1/012034

Sustainable Mobility for All. (2017). "Sustainable mobility for all, global mobility report 2017". Available at: https://sum4all.org/publications/global-mobility-report-2017

Tanan, N., and Darmoyono, L. (2017). "Achieving walkable city in Indonesia: Policy and responsive design through public participation". AIP Conference Proceedings, 1903(November). https://doi:10.1063/1.5011598

Winayanti, L., and Tsaputra, A. (2015). "Walkability and pedestrian facilities in three Indonesian cities: Padang, Yogyakarta and Mataram". Jurnal Manajemen Aset Infrastruktur & Fasilitas, (October), 3-4. Available at: http://www.academia.edu/download/41539180/WALKABILITY_AND_PEDESTRIAN_FACILITIES_IN_THREE.pdf