ASSESSING THE EFFECTIVENESS OF INCLUSIVE BUS TERMINAL DESIGN IN MEETING THE NEEDS OF PHYSICALLY CHALLENGED PEOPLE: IN THE CONTEXT OF KHULNA

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ABSTRACT

Bangladesh is a rapidly growing country, with an estimated 16 million people with disabilities or 10% of the country's population. Public transport plays a crucial role in the lives of physically challenged people who rely on buses for commuting, accessibility, and socializing. However, the country's bus terminals often lack the necessary infrastructure and services to cater to the needs of these people. Basically, they face problems like Lack of accessibility, Inadequate seating, Poor lighting, Insufficient signage, Limited toilet facilities, Security concerns. The purpose of this research paper is to investigate and analyze the current state of bus terminals and their accessibility for physically challenged people, and to propose recommendations for designing and implementing an inclusive bus terminal that meets their unique needs. This research paper utilized a survey-based methodology to investigate the current state of bus terminal design for disabled people. A survey instrument was developed and distributed to a sample of passengers to gather data on their experiences and preferences for bus terminal design. Based on the research findings, the paper proposes recommendations for creating more inclusive bus terminals for physically challenged people, including the integration of universal design principles, collaboration between designers and user groups. This includes the need for features such as ramps, elevators, slip-resistant flooring, and ample seating to reduce the risk of falls and improve mobility. In addition, clear signage, wayfinding, and staff training are essential to providing assistance and support to older passengers and enhancing their overall experience.

Keywords: *Inclusive design, Bus terminal, Accessibility, Physically Challenged people.*

1. INTRODUCTION

Public transportation is pivotal in connecting individuals to their communities, workplaces, and essential services. It is a lifeline for countless individuals, fostering social inclusion and economic opportunities. However, the public transit experience can be fraught with barriers and difficulties for people with physical challenges. Many physically challenged people are restricted from moving freely due to the ineffective accessibility in public transportation terminals. A key impediment to the full involvement of people with disabilities in society, according to research, is the built environment's lack of accessibility (Seyed et al., 2012). Creating an inclusive and accessible transportation system is not only a matter of equality and social justice. However, it is also essential for a diverse society's overall well-being and productivity. The pursuit of a universally accessible public transportation system is not only a matter of societal equity but also a fundamental human right. The importance of inclusivity in ensuring full societal participation for all is emphasised in the United Nations Convention on the Rights of Persons with Disabilities (CRPD), which makes the principle of equal access to public transit a fundamental Tenet. Insofar as physically challenged individuals are concerned, numerous bus terminals continue to be substandard in design, relegating them to the periphery of our collective mobility in spite of these international agreements and a growing awareness of the significance of accessibility. Even if there are modern technology facilities available, not everyone can utilize them because of the limited accessibility for those who have impairments such as wheelchair users' vision and hearing impairments (Lee et al., 2019). Disabled persons are unique and have a disadvantage while using facilities in metropolitan areas; it is urgent to address the fact that they do not receive the same treatment as other people. So, improvements must be made to infrastructure, information, and vehicles (such as buses and trains) in order to make public transportation more accessible for individuals with disabilities (Lee et al., 2019). In general, most physically challenged persons experience formidable obstacles to mobility, including structural, social, and psychological obstacles. When it comes to transportation, structural barriers have a significant role in how mobile persons with physical disabilities are. There is a need to ensure everyone's convenience as many transportation hubs still need the amenities and infrastructure necessary to function correctly. The pedestrian environment may be their first obstacle when physically challenged people travel. The people with disabilities main issues include an inadequate supply of paved roads and uneven terrain. It makes people with disabilities more prone to injuries. In addition, the dangers were not adequately disclosed or warned of, and improper parking of vehicles affects pedestrian safety and accessibility (Lee et al., 2019). The absence of toilets, seating provisions, ramps, or elevators for physically challenged people is another design barrier that affects their accessibility. Again, if these elements are present, sometimes the dimensions or positions of these elements are not appropriate for people with physical disabilities. This research seeks to embark on a thorough exploration of the matter, focusing on a multifaceted approach encompassing architectural and infrastructural assessments, the integration of advanced technologies, policy, and regulatory analysis, as well as a comprehensive examination of the real-life experiences of individuals with physical disabilities in Khulna Bus Terminal. By conducting this inquiry, our objective is to:

- Identify and highlight accessibility in approaching the spaces in the Khulna Bus terminal.
- Evaluate the interior infrastructure that affects disabled accessibilities in the bus terminal
- Advocate for establishing universally designed and accessible bus terminals, promoting a society where the ability to move freely is a universal right.
- Suggest recommendations for improving accessibility in the bus terminals for people with disabilities.

Throughout this research, we will explore a multifaceted approach, encompassing the assessment of architectural and infrastructural features, technology integration, policy and regulatory aspects, and the lived experiences of individuals with physical challenges. Our investigation seeks to reveal the gaps in the current system and propose innovative solutions to make bus terminals accommodating for everyone, irrespective of their physical capabilities.

2. LITERATURE REVIEW

The importance of accessibility in creating a premium, effective, and sustainable transportation network is becoming widely acknowledged. Facilitating greater accessibility to buses, trams, trains, planes, and ships is vital for all of us as transit users. It is essential to consider many elements that offer a thorough picture of the complete route cycle when assessing accessibility in public transportation terminals for people with impairments. People with disabilities benefit from this approach not just in terms of general accessibility but also in terms of identifying obstacles they must overcome (Seyed Hassan Khalifeh Soltani, 2012).

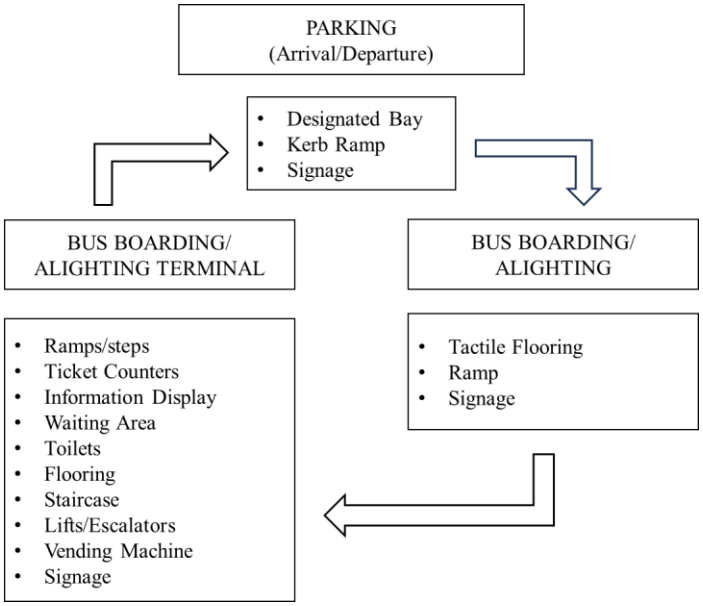
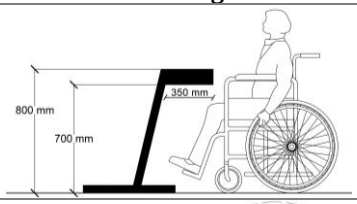
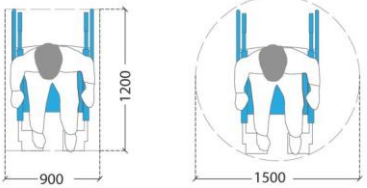
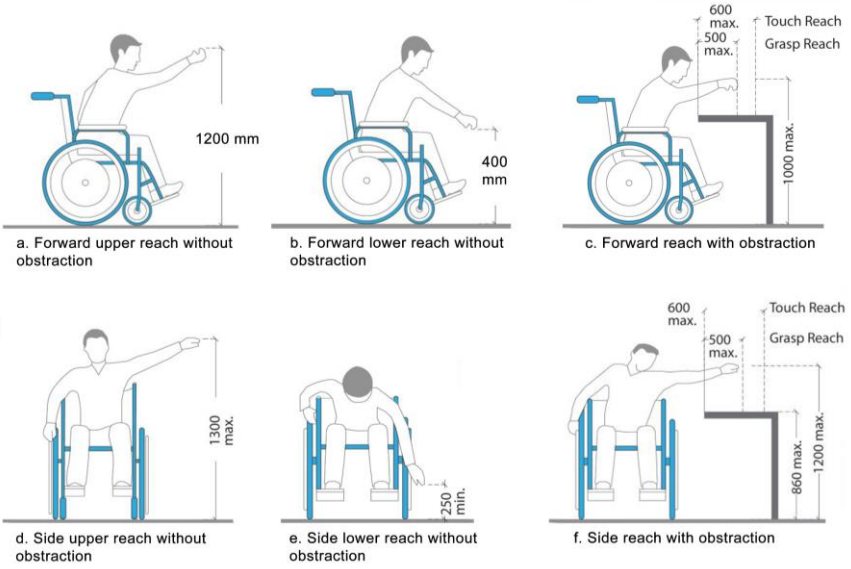
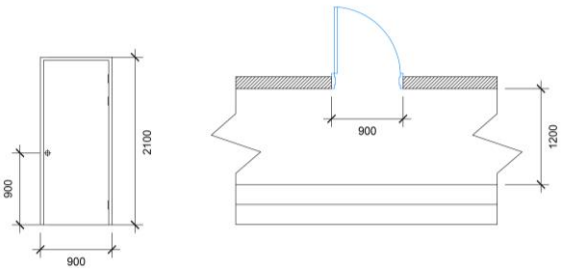
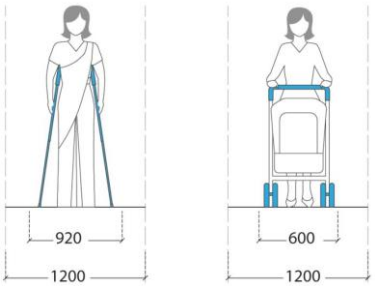
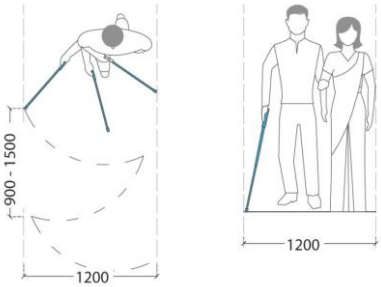
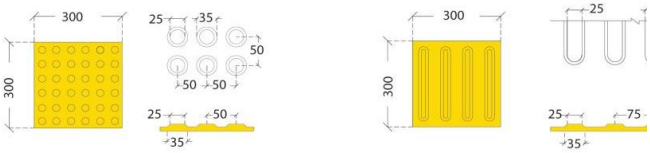


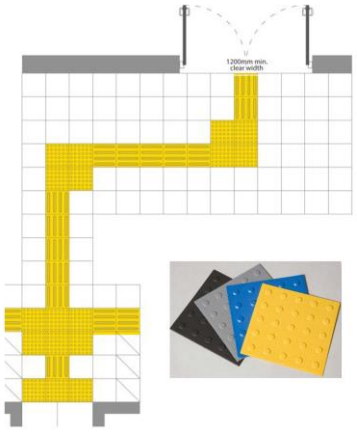
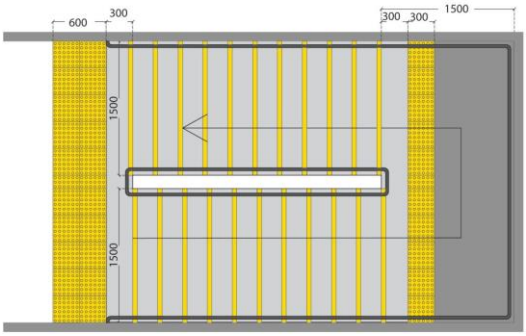
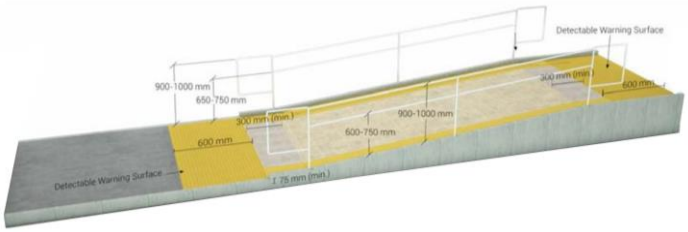
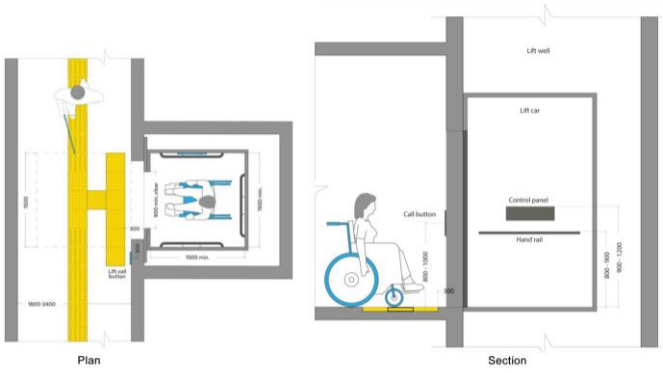
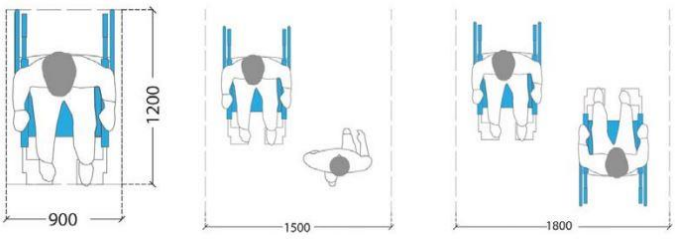
Figure 1: Journey cycle in a bus terminal (Highways, 2022)

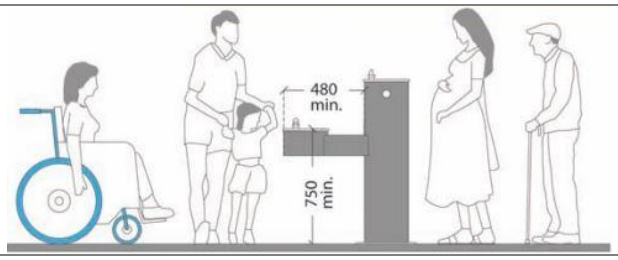
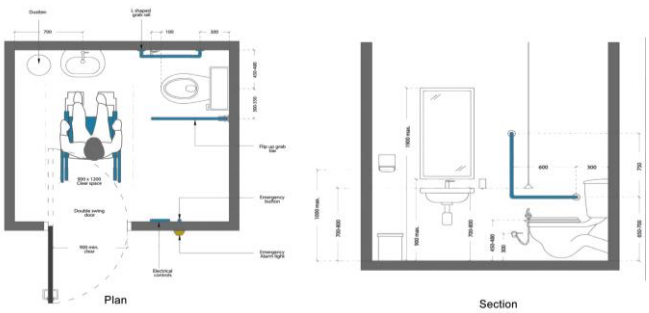
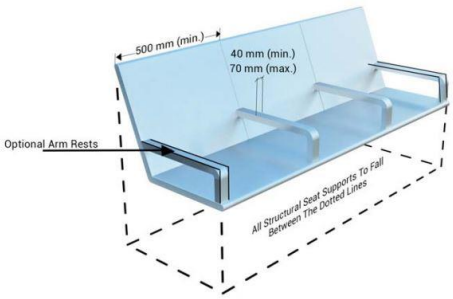
Accessibility is greatly influenced by transportation infrastructure, which is evident from the moment someone leaves their house. Many developing nations have inadequate infrastructure and constructed environments, which create significant obstacles for disabled people who want to move independently. In many cases, these places' road networks do not need more paths, and the existing ones are usually in bad shape and filled with different obstructions. These include street sellers, rubbish, parked autos, and ornamental buildings. The problem is further exacerbated by the lack of ramps and other crucial accessibility components, which makes it difficult for people with disabilities—especially those who use wheelchairs and walking aids—to move (SAJIB, 2022).

Table 1: Accessibility Guidelines for Bus Terminals and Bus Stops (Highways, 2022)
Source: Ministry of Road Transport and Highways, India

Wheelchair Users		
Design Attributes	**Dimension**	**Drawings**
Counter Top	Width-350mm Height-700mm	
The minimum clear floor or ground area **The minimum clear floor ground area for a wheelchair to turn**	Width-900mm Length-1200mm Dia-1500 mm	

Wheelchair Reach		
Minimum Width of Entry/Exit door	900 mm	
Height of Door Handle	900-1000 mm	
Minimum front approach doorway space	1200 mm	
Crutch Users		
Minimum Door Width	900 mm	
Minimum Passageway Width	920 mm	
White Cane Users		
Radial Range	Width- 1200 mm	
Tactile flooring tiles	300*300 mm	

Tactile Flooring		
Service Areas		
Stairs	Width- 1500 mm(min) Riser- 150 mm(max) Tread- 300 mm(min)	
Ramps	Slope 1:12 (min) 1: 20 (max) Width- 1500 mm (min)	
Elevators	Length- 1500 mm (min) Width- 1500 mm (min) Door Width- 900 mm (min) Call button height- 800-1000 mm (min)	
Pedestrian Walkway	Minimum Width- 1200 mm (One way) Minimum Width-1800 mm (Two way) (Preferable) Height – 150 mm (From road level)	

Drinking water fountain	Clear floor space- 900*1200 mm Clear knee space- deep 200 mm height 680 mm	
Toilet	Floor Area- 2200*2000 mm Clear manoeuvring space- 1500 mm diameter All fixture clear space- 900*1200 mm	
Seating	Seat height 450-475 mm Clear floor space 900*1200 mm	

According to BNBC 2020, All public transport terminals, including bus stops and railway stations, shall be accessible to persons with disabilities. The waiting areas of all such facilities shall be provided with seats for such persons who are unable to stand for long periods. Moreover, in BNBC, there are also some guidelines.

Table 2: Accessibility Guidelines for Public Transport Terminals in Bangladesh
Source: BNBC 2020

Design Attributes	**Dimensions**
Minimum floor Area for wheelchair users	900*1200 mm
Minimum turning diameter for wheelchair	1500 mm
Minimum accessible route	1200 mm
Minimum width for wheelchair Crossing	1800 mm
Minimum clearance for headroom of walkways, halls, corridors, passageways or aisles	2000 mm
Ramp slope for 0-75 mm height Ramp slope for 76-150 mm height Ramp slope for more than 150 mm height	1:8 1:10 1:12
Minimum unobstructed width of pedestrian walkways	1200 mm
Pedestrian walkways with obstacles	1500 mm
Minimum door width Door handle height Minimum unobstructed space at doorway	900 mm 900-1100 mm 1200*1200 mm
Counter Top dimension	900 mm wide 480 mm deep 700 mm high

Minimum toilet Dimension	1500*1750 mm
Minimum WC height	450-480 mm
WC centre line to sidewall distance	460-480 mm
WC centre line to rear wall distance	750 mm
Minimum door width of toilet	900 mm
Lift lobby dimension	1500*1500 mm
Minimum size of lift car	1500*1725 mm
Minimum door opening	900 mm
Accessible disabled parking area dimension	3200*4800 mm
Size of symbols	
Up to 7.0 m	60*60 mm
7.0 to 18.0 m	100*100 mm
Above 18.0 m	200*200 to 450*450 mm
Height of letters	✓
1.5 m	50 mm
2.0 m	60 mm
2.5 m	100 mm
3.0 m	120 mm
4.5 m	150 mm
6.0 m	200 mm
8.0 m	250 mm

3. METHODOLOGY

This study employs an explanatory research approach to comprehensively assess the effectiveness of bus terminal design in meeting the needs of physically challenged individuals. It aims to elucidate the relationship between inclusive bus terminal design and the specific needs of physically challenged people. The research commenced with an initial pilot survey to investigate user behaviour patterns, movement, and sentiments regarding the provided services. This pilot study employed non-participant observation techniques. The overall research process was bifurcated into two distinct phases. In the first phase, an extensive framework was established by scrutinizing national and international studies on the analysis of user satisfaction in public transport services. Particular emphasis was placed on studies contextual to the research area to gain a more comprehensive understanding of local attributes. Subsequently, this framework expanded to encompass various factors and sub-factors grouped into three categories. Multiple research methods were utilized to collect on-site data in alignment with the established framework. These included non-participant observation, questionnaires, and discussions for primary data acquisition. In the case of non-participant observation, data was collected during various days of the week and at different times to account for peak and off-peak periods, among other pertinent factors.

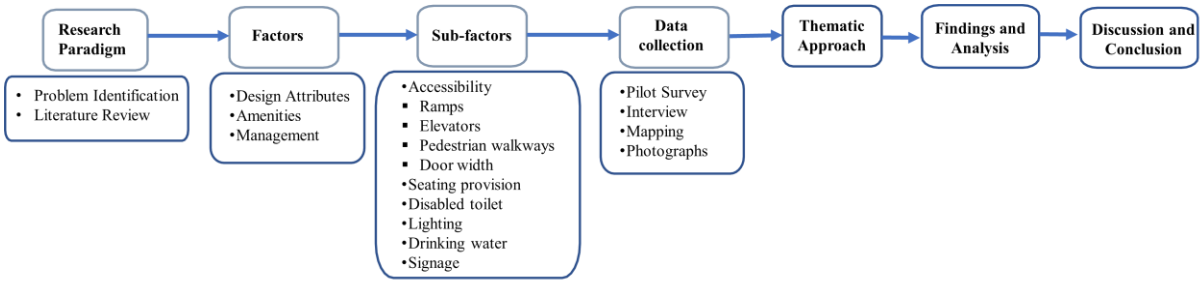


Figure 2: Methodological Framework

3.1 Study Area

The Sonadanga bus terminal in Sonadanga, Khulna, encompasses 12.5 acres. It is positioned at a distance of 3.7 kilometres from Dakbangla More. It is conveniently accessible via three thoroughfares: M.A. Bari Street, Masjid Saroni Road, and Sonadanga Bypass Road, all of which intersect near the Sonadanga Bus Terminal. The surrounding land primarily consists of residential areas with a distinctive mixed land-use pattern encompassing residential and commercial properties. Furthermore, a natural water body adorns the environs of the terminal (Mohammad Faysal, 2018).

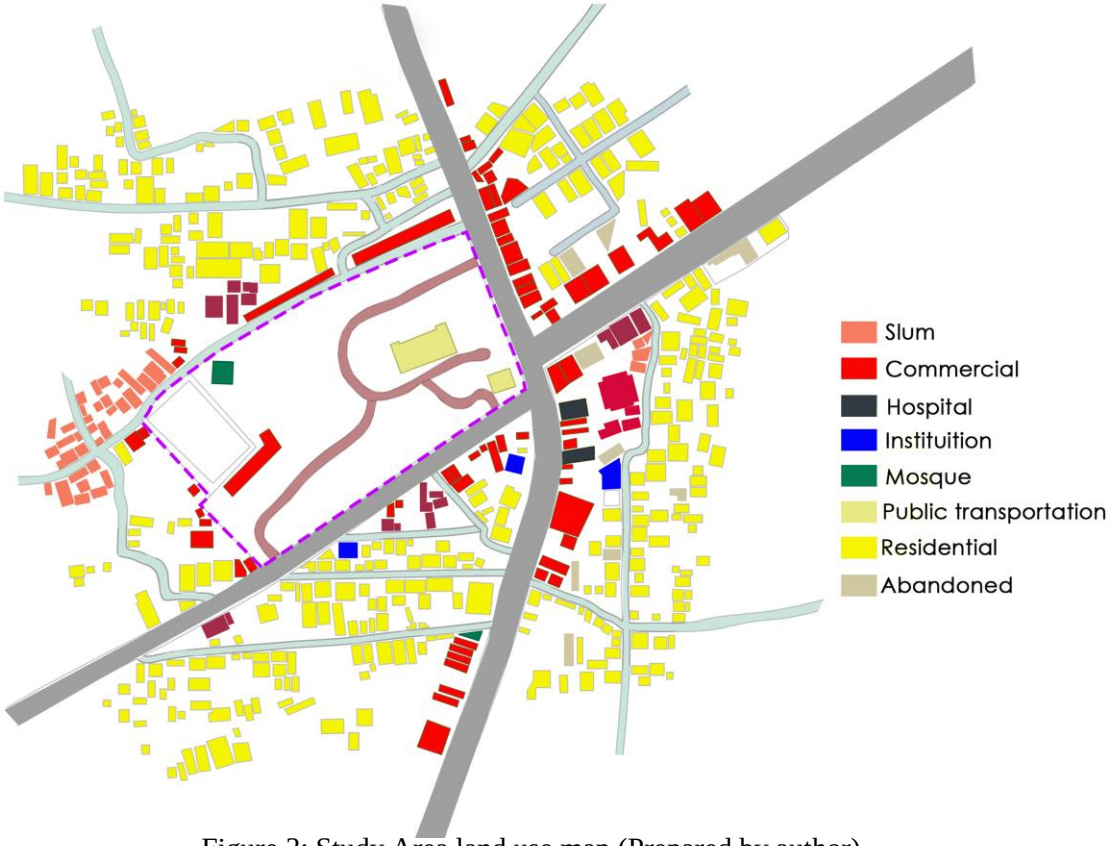


Figure 3: Study Area land use map (Prepared by author)

4. FINDINGS AND ANALYSIS

The Sonadanga Bus Terminal lacks provisions for individuals with physical disabilities. It needs to exhibit a deficiency in the provision of facilities and adherence to the necessary design standards. A comprehensive overview of the amenities available for physically challenged individuals at the bus terminal is presented in Table 3, revealing a significant deficit.

Table 3: Facilities Checklist

Facilities	Availability	Satisfactory Level (0-4)
Wheelchair Parking	N/A	0
Ramp	N/A	0
Pedestrian Walkways	✓	1
Handrail on Walkways	N/A	0
Elevators	N/A	0
Toilet in Terminal Building	✓	0
Toilet for Physically Challenged in Terminal Building	N/A	0

Public Toilet	✓	3
Toilet for Physically Challenged in public Toilet	✓	0
Lighting	✓	2
Seating for physically challenged	N/A	0
	N/A	0
	N/A	0

to cater to the needs of physically challenged individuals are Bus Terminal. Those few facilities that are in place are either ly maintained. For instance, the designated accessible toilet nsistently inaccessible, failing to meet the required design

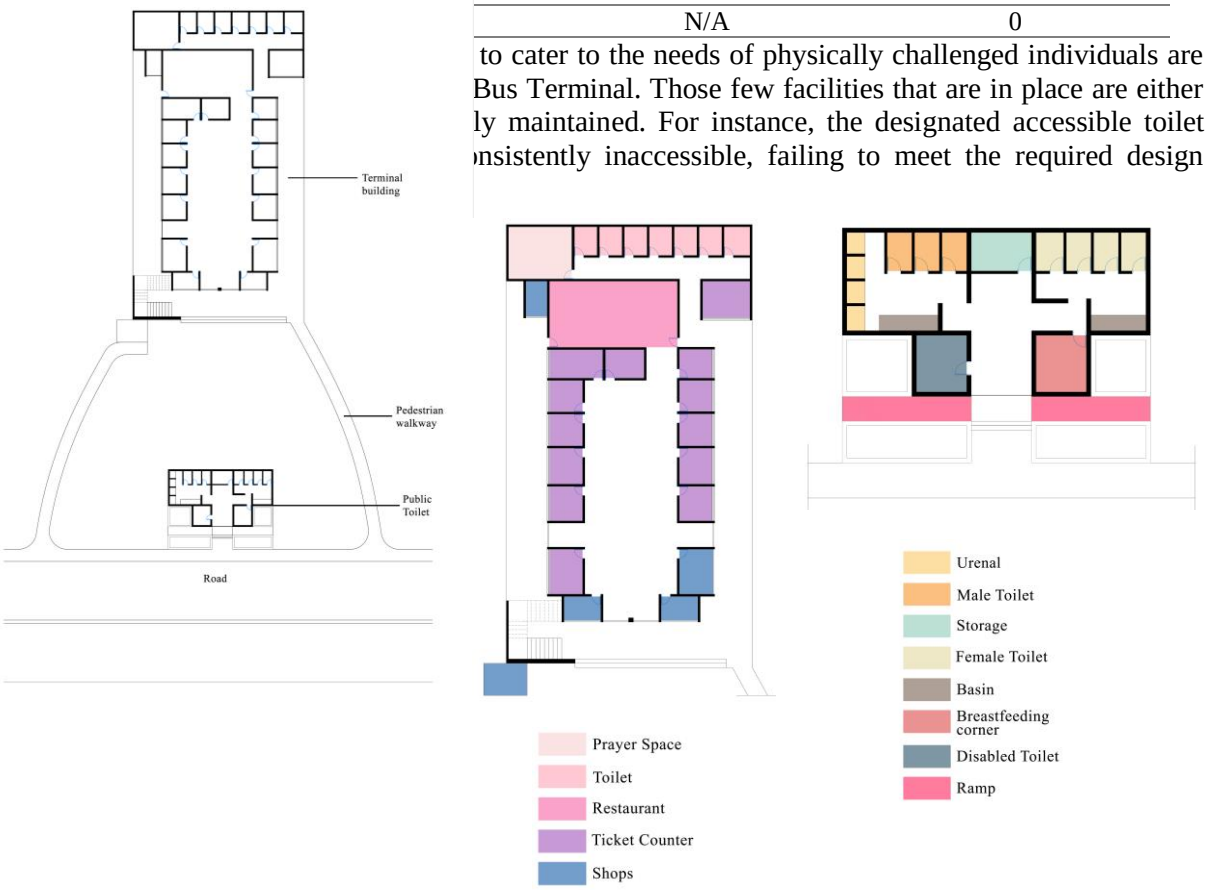


Figure 4: Bus terminal Plan (Left), Terminal Building Plan (Middle), Public Toilet Plan (Right)

In any public facility, the paramount consideration is ensuring fair access and mobility for all, including the physically challenged and elderly individuals. Figure 4 illustrates the absence of critical design elements that enhance accessibility for physically challenged individuals. Notably, the two-story terminal building lacks an elevator or ramp, rendering it difficult for elderly and physically disabled individuals to access higher floors. Moreover, the terminal needs a direct road connection due to obstructed pedestrian walkways created by earth mounds. Although walkways exist, they are hindered, with one end opening onto a shopfront and the other obstructed by buses parked haphazardly. The elevated walkways lack proper railings, posing a safety risk to people with physical disabilities. No provisions have been made for wheelchair or crutch users, and entry to the bus terminal is impeded by an improperly placed ticket counter with steep stairs. Seating is inadequate and inaccessible for physically challenged individuals due to the absence of armrests or grab bars. While the floor material is non-slip, tactile guiding blocks for visually impaired individuals are conspicuously absent. The cafeteria at the terminal's rear is unhygienic, and the provided restroom facilities must be more adequately maintained, with no accommodations for physically challenged individuals.

Figure 5: Entry of the terminal building blocked by mounted earth (Left), Walkway ends at the front of a shop (Right)

Unauthorized bike parking within the terminal area requires more management oversight. The public toilet, despite having a designated accessible toilet, is consistently closed and situated within the main entry lobby, hindering the movement of physically challenged individuals due to high foot traffic.

Figure 6: Seating area (Left), Walkway is blocked by bus parking (Middle), Entry (Right)

5. DISCUSSION AND CONCLUSION

Bus transit is an essential means of transportation for many people every day in developing nations, and it is also a critical factor in supporting sustainable economic and environmental progress. However, for it to be used effectively, high consumer satisfaction must be guaranteed. Surprisingly, few thorough customer satisfaction evaluations exist across different public transportation systems. This is frequently because of a lack of interest, difficulties with administration, and a need for more reliable assessment frameworks. International research on public transportation terminals has emphasized the importance and worth of routinely assessing customer satisfaction to improve service quality. Survey respondents highlighted the significance of particular architectural elements—particularly ramps and lifts—in guaranteeing universal accessibility. Lack of such provisions may restrict an individual's access. Survey respondents said ramps and lifts are more critical design features for guaranteeing universal access. Those with physical disabilities are unable to utilize the higher floor in the absence of this assistance.

The Bangladesh National Building Code (BNBC), which emphasizes universal accessibility in public areas and provides models for consideration, aligns with the principles that address these needs to consider people with disabilities at every turn. Starting with their admittance is a significant finding from the survey. Importantly, people who are visually impaired may find the flooring material to be inconvenient. In addition to better restrooms, respondents felt that better seating places were necessary.

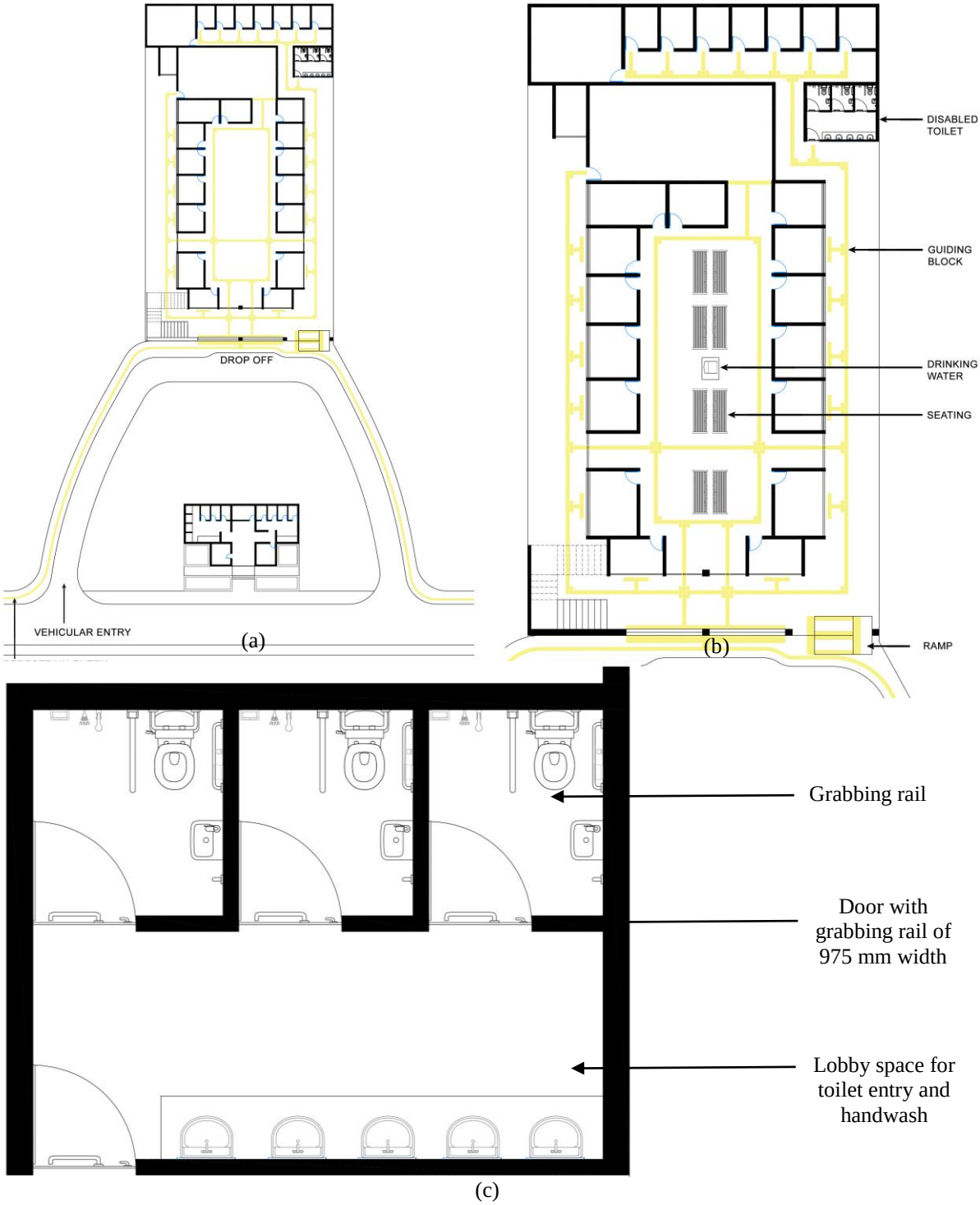


Figure 7: (a) Terminal Building entry, (b) New layout for terminal building, (c) Disabled toilet (prepared by author)

A redesigned arrangement that makes the current terminal accessible has been proposed to meet these concerns. By universal accessibility regulations, the revamped plan includes a pedestrian walkway connected to a paved area with a ramp built with a 1:12 slope. In addition, the design incorporates guide blocks to assist those who are blind or visually handicapped. Significantly, the layout design incorporates an area designated for an accessible lavatory specifically engineered to fulfil the criteria specified in the BNBC 2020. This facility was remodelled to provide accessibility and convenience for people with disabilities, and it is located in a space that was formerly utilized as a ticket counter.

The evaluation of Khulna's inclusive bus terminal design with an emphasis on accommodating the needs of people with disabilities indicates a critical step in guaranteeing inclusivity and accessibility in public transportation infrastructure. The study's conclusions highlight the importance of specially designed features that comply with Bangladesh's National Building Code requirements, like ramps, elevators, visually impaired guiding blocks, and designated accessible restroom spaces. The advancements in this research show a dedication to improving the user experience in general and attending to the particular needs of people with disabilities. The findings support the value of universal access elements in bus terminals and establish a foundation for creating more welcoming and inclusive public areas in Khulna for people of all backgrounds.

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