



TRANSFORMING DHAKA, BANGLADESH INTO A CYCLING CITY

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INTRODUCTION

Dhaka is a rapidly developing city with rapid economic growth. Although it is the political, economic, and cultural centre of Bangladesh, its urban neighbourhoods have poor planning regulations and traffic management generating severe vehicular congestion (Barua & Hoque, 2015), loss of working hours and the wastage of natural resources (Mahmud et al., 2012). The transport sector focuses on building infrastructure to accommodate motorised vehicles (Dey et al., 2014), whereas non-motorised modes are minimally addressed during mobility planning. The lack of inclusive planning of both formal and informal transit has given rise to an inefficient transport system in the city. Effective policies to implement sustainable transport modes are needed to mitigate existing mobility problems, congestion, and pollution in Dhaka (Haroon et al., 2018).

The government of Bangladesh is focusing on achieving the United Nation's Sustainable Development Goals (New Age, 2022), and Dhaka, as a rapidly urbanising megacity, requires a sustainable mobility transition. Due to the rising traffic congestion and increasing public transport fares, some people have switched to commuting with bicycles (Taslim, 2005) as they are sustainable, cheaper and faster through the heavy traffic of Dhaka. However, the lack of infrastructure and cycling-supporting policies in the city makes it difficult to commute by bicycle. Currently, cycling remains neglected in Dhaka's mobility planning, and research on increasing its modal share will give an insight into the benefits. Bicycle-inclusive planning will optimise the benefits of using them in the dense mixed-use neighbourhoods of Dhaka, which generates short-distance trips suitable for cycling. The overall objective of this paper is to understand the role of cycling in Dhaka's current mobility scenario and give insight into methods to shift the paradigm of bicycles to an efficient and sustainable model.

Photo credit: Salman Preeom, A Look Down Aerial view Of Hatirjheel Lake Bridge at Dusk; Dhaka, Bangladesh, 2021.
https://unsplash.com/photos/mO1_udD5iCs

Therefore, the core research question for this paper stands as follows:

How can Dhaka increase its modal share of bicycles and formulate a cycling-inclusive policy framework?

To develop the study and address the core research question, the following questions are considered:

1. Which cities have implemented bicycle-promoting strategies, and how far have they achieved the goal?
2. How did Dhaka evolve in the transportation network?
3. What is the current mobility situation in Dhaka, and what role does cycling play in the existing mobility dynamics?
4. How can the central districts of Dhaka be optimised for maximum bicycle use with the framework of coherence, safety, directness, comfort, and attractiveness?

The study aims to formulate a policy framework for increasing the safety, comfort, and attractiveness of using bicycles in an expanding Global South city. There is a lack of research exploring the substantial role of cycling in developing cities. This paper attempts to minimise the research gap and address the current cycling scenario in Dhaka by analysing the transport challenges and eventually proposing guidelines to enhance the modal share of bicycles in the city's central districts.

RESEARCH METHODOLOGY AND LIMITATIONS

The paper is framed around the research questions and aims to answer them in the following sections. The first part of the paper is the theoretical framework focusing on a literature review with case examples of cities who already implemented cycling promoting strategies. The second part of the paper is the analytical framework focusing on Dhaka's mobility indicators by critically assessing the land-use management, road network system, current transport policies, and modal options using data from secondary sources. It attempts to understand why the current situation failed to accommodate bicycles into the transport system and summarises the problems and potential of cycling in Dhaka. The third section of the paper analyses the inner neighbourhoods of Dhaka, and the current mobility dynamics in the Shahbag-Ramna-Dhaka University area. However, the lack of previous studies regarding the transport situation in this area proved to be the most significant limitation of this research.

This paper has limited discussion on the role of other non-motorised vehicles in Dhaka's transport scenario as this study focuses on cycling. The author selected relevant sources to guide the research. The presented data are from selective years because of the lack of updated data from government agencies and independent organisations, and often cycling is left out in the mobility indicators limiting the analysis. A survey is also carried out on people already using or interested in using bicycles since it is crucial to

address the opinions of active and possible users of bikes before formulating policies for any area. The survey is shared on cycling forums (BD Cyclists and Dhaka University Cycling Club) in Dhaka. The people who participated in the survey varied in age and profession and their responses are analysed in later sections. Reflecting on the initiatives taken by cycling-friendly cities, the mobility analysis, and the opinions of the cyclists from the survey, a general guideline is formulated, which comprises both infrastructural strategies and regulatory policies to promote cycling in the inner neighbourhoods of Dhaka.

LITERATURE RESEARCH

The literature review aims to develop a theoretical framework of bike-inclusive policies and to refer to them later when proposing guidelines and strategies for increasing cycling in the centre of Dhaka. It focuses on initiatives to promote bicycle usage in urban settlements and reflects upon their outcomes by exploring case examples.

1. Expanding Asian Metropolises and their transport situation

Asian cities are experiencing robust economic development (Asian Development Bank, 2019) and urban mobility challenges (Wulffhorst et al., 2013). Migration from rural areas in search of work and better living standards has escalated the expansion of urban territories.

Rising wealth and growing population increase the number of vehicles, and motorised and non-motorised transit has to share the limited road space in the cities (Boquet, 2010). The total area for automobile access is only 8% in Dhaka (Labib et al., 2013 p.140), 12% in Bangkok, 7% in Shanghai and 6% in Kolkata, in contrast to 25% in Paris and 23% in New York (Boquet, 2010, Section: Asian cities: high density, rapid growth and heavy congestion, para.7). Despite a low motorisation level, the dependence on informal transit and non-motorised vehicles such as rickshaws (Asian Development Bank, 2019), Dhaka faces extreme vehicular congestion.

2. Strategies for promoting cycling in a city

Newman and Kenworthy (2006) discussed how city planning has shifted from prioritising cars to formulating alternatives for other modes of transport to help diminish the necessity of cars and decrease the traffic volume. Bicycles are low-carbon vehicles that provide healthier, cheaper, and more flexible commute options. It is essential to have a vision that would cater for the need of the cyclists, along with dedicated political schemes and support from society (Pettinga et al., 2009 as cited in Panthasen et al., 2021, p.3). Cycling requires physical labour, and cyclists get exposed to external conditions of weather, traffic pollution, noise and crashes (Buehler and Pucher, 2017, as cited in Panthasen et al., 2021). Hence, the infrastructure to make cycling comfortable and safe is necessary when planning cycle-inclusive transport policies.

This section addresses the initiatives needed to support cycling in cities and achieve a higher bicycle modal share to apply them later when discussing cycling prospects for Dhaka.

The strategic and integrated planning system

Although urban growth is inevitable, automobile-centred transport development only leads to building more roads, leaving public transport and non-motorised vehicles neglected in the planning process (Kenworthy, 2006). An integrated urban and transport plan implies that a cycling policy alone is insufficient if other city development plans do not consider them in the planning process. Cities that build bicycle lanes and high-speed motor streets simultaneously

will only increase traffic volume and be unsafe for cyclists. However, integrated transport policies by restraining cars, improving the public transport system, and introducing car-free zones give all the transport modes their dedicated space (Deffner et al., 2012, p.15).

Infrastructure planning

It is imperative to have a cohesive cycle network with separate bicycle lanes and safe parking facilities (Deffner et al., 2012, p.21) to ensure a better experience and encourage cyclists even more to use bikes. When planning for a bicycle-friendly city, the parameters of coherence, directness, safety, comfort and attractiveness (Panthasen et al., 2021, p.4; Deffner et al., 2012, p.34) define the outcome of the implemented infrastructure. Coherence refers to a cycling network with the maximum origin and destination in any given area. Directness indicates movement in the shortest distance from the point of origin to the destination, sometimes achieved with preferences in traffic signals and intersections. Cyclists are vulnerable to collisions with other vehicles, and separate bicycle lanes with proper traffic management can ensure the safe movement of cyclists. Smoother roads, uninterrupted passages, adequate bicycle parking, and bike take-on options in public transport make cycling comfortable. Visually pleasing and socially busy routes are prone to more usage than empty routes, especially by women, making cycling attractive and safe (Panthasen et al., 2021, p.4).

Service for cyclists

Public transport that allows bike take-on encourages more people to use them in intermodal trips where cycling is part of the journey (Deffner et al., 2012). Adequate parking facilities in stations and bus stops also raise the use of bicycles as feeder transport. Alongside the guarded service, bike stations can provide bike maintenance, bike rental service, and charging for e-bikes and pedelecs. E-bikes and pedelecs have become increasingly popular as they require less effort to manoeuvre. Bike-sharing schemes are popular in many cities, allowing people to cycle without worrying about the maintenance of a personal bike (Midgley, 2011).

3. Case examples

In this section, the paper analyses the impact of cycling-friendly policies implemented in Bogota, Bangkok and Groningen as case examples. Exploring Bangkok and Bogota's biking infrastructure will give insight into initiatives implemented in growing Global South megacities similar to Dhaka. Although Groningen does not have similarities with Dhaka, its well-developed strategies show how a city can grow from highly car-dependent circumstances to a higher bicycle modal share.

	BOGOTA	BANGKOK	GRONINGEN
Coherence	Exclusive network of bike routes -CicloRutas- connects residential areas, city centre, stations, BRT system and public open spaces.	Lack of connectivity, often isolated bike lanes depending on neighbourhoods. City centres have better connection than residential neighbourhoods.	Interconnected bike network in the entire city, connecting with city centre, university, hospital area, and stations.
Directness	Alleyways and narrow lanes connecting to the bike routes provide shortcuts and decrease travel time.	Non-crossable main roads, lack of connected alleyways and cycle lanes, and frequent "Cul de Sacs" increase travel time.	Frequent shortcuts across the city and priority at traffic lights reduce travel time.
Safety	Separated bike lanes, car-free day and reducing space for cars help keep the cyclists safe to some extent.	Motorised vehicles, limited space for bicycles, obstructions in the bike lanes and driver's unchecked behaviour compromises the safety of cyclists.	Bike-only crossing signal phases, traffic calming, car restrictions and well maintained bike lanes enhance safety of cyclists.
Comfort	Design along the topography, separated bike lanes, car-free days and traffic calming make bicycling comfortable.	Illegal car parking, vendors in the bike lanes, noise and pollution, inadequate parking facilities, and traffic congestion contribute to discomfort when cycling.	Tailored bike parking, integrated multi-modal options, bike lane maintenance importance, and priority in traffic signal operations increase comfort of cyclists.
Attractiveness	Connections to public spaces, parks, wetlands, bridges and hills make cycling rewarding for recreation and health benefits.	Mundane looking streets, poor connectivity to public amenities, heavy traffic congestion reduce the desire to cycle in the streets.	Improved connectivity with city centre, car-free zones, pedestrian and public amenities, and attractive city centre increase cycling in the city.

Table 1: Summary of case examples

Source: Author, 2021

Bogota

Bogota is recognised internationally as a leader in implementing cycling (Teunissen et al., 2015, p-457) in Latin American cities. Its sustainable initiatives minimised access inequalities, decreased traffic congestion and improved quality of life (Teunissen et al., 2015). In 1998, approximately 400km of protected cycle routes were built in the city called 'CicloRutas'. Over the years, there was a rise in the daily share of cycling trips from less than 1% in 1995 to 5%-6% in 2015 (C40 Cities Finance Facility,

2018, p.10), with most trips made for commuting to work or school. The dense and mixed-use neighbourhoods generate trips shorter than 10km, and makes it ideal for cycling rather than using cars in congested Bogota streets. The CicloRutas form an extensive network connecting neighbourhoods and BRT stations, where bicycles are used as feeder mode. Bogota also introduced car-free scheme supported by citizens and politicians. The cycling policies are monitored and updated according to the challenges faced while executing the program.

Bangkok

Bangkok has become extremely traffic-congested due to its rapid urbanisation and car-promoting policies. Despite investment in the public transport sector, the buses and paratransit modes are insufficient. Motorcycle taxis are the most common vehicle for short-distance trips in neighbourhoods. Since 2008, Bangkok Metropolitan Administration (BMA) has built 200km of separate bike lanes as of 2016 (Bakker et al., 2018, p.421). Other initiatives include traffic calming, bicycle parking facilities, and bike-sharing schemes; however, a large portion still commits to cycling as a recreational activity rather than commuting to work or other purposes. There is no reliable source to confirm their modal share, but it is assumed that only 1% of total trips in Bangkok use bicycles (Panthasen et al., 2021, p.6). The lack of enthusiasm despite the improvement in the infrastructure are because the bike lanes lack connectivity and are often isolated, except near the city centre (Panthasen et al., 2021). Most main roads are non-crossable and require detours increasing travel time. The high density of motorised vehicles leaves minimal space for cyclists, while the dedicated bike lanes are often used by motorcycles increasing the chances of collision and jeopardising their safety.

Groningen

Groningen is one of the most bicycle-oriented cities in Europe, with 61% of total trips completed using bikes (City of Groningen, 2015, p.8). More than 90% of the jobs are within a 3km radius of the city centre, ideal for bicycle rides (Pucher and Buehler, 2007, p.18). The main aim of their transport policy is to maintain cycling as a viable, safe and sustainable form of transport instead of using cars (Pucher and Buehler, 2007, p.19). The city approached this with reinforced cycling infrastructure, dense land use and traffic calming measures since 1980. Bike routes are given priority by maintaining a smooth obstacle-free way to make cycling safe and comfortable (City of Groningen, 2015). The route is connected entirely by considering the start and destination point, especially in the city centre, university area, and stations. Bikes are permitted on the trains to ensure multi-modal connection in the transport system, making them feeder modes for long-distance journeys. This city is an excellent example of increasing bicycle modal share through improved infrastructure and car-restricting policies that encourage everyone to adopt

cycling. The table summarises the strategies to compare the case examples using the framework of coherence-directness-safety-comfort-attractiveness.

Bicycle-friendly cities typically have comfortable, safe and well-designed infrastructure to protect cyclists and encourage pro-cycling incentives in the urban area. In Bogotá, their politicians' dedication and vision elevated the cycling scenario. Although Bangkok established bike-promoting infrastructure, the city has not seen a significant change in its modal share. Groningen is the cycling city in Europe that prioritises bicycles in its planning system, which is why people enjoy cycling more than driving cars in the city. The three case cities have different socio-political situations and cultural attitudes, and each showed different outcomes from the implemented bicycle-friendly policies. The case example provides insight into the consequences of implementing sustainable strategies that will help formulate a guideline for the central parts of Dhaka.

DEVELOPMENT OF DHAKA WITH THE TRANSPORT SYSTEM

Dhaka, a constantly growing capital city, has expanded organically over the years. In the last 50 years, Dhaka evolved from a habitat of one million people in underdevelopment to 20 million citizens (The World Bank, 2021) with a growing economy. According to the Bangladesh Bureau of Statistics (2013), Dhaka metropolitan area covers 303 km², with a population density of approximately 30,500 inhabitants per square kilometre (p.15). 30% of the population lives below the poverty line and does not have access to transport services (Ministry of Finance, GoB, 2012, as cited in Alam et al., 2020, p.1). This section of the paper discusses the expansion of Dhaka to understand the city's transport change over the years.

1. Expansion of Dhaka with growth in transportation

Established more than 400 years ago, Dhaka was one of the most influential cities during the Mughal period. However, the first public transport in Dhaka was horse-driven wheel carts brought in 1824. During the 1840s, the British had metal roads and railway tracks built in the city that expanded the city in the southwest direction (Kabir & Parolin, 2012, p.10). The railway network made transportation faster and cheaper (Das & Rahman, 2011).



1960s

1980s

2016

Figure 1: Change in Motijheel CBD over 50 years

Source: Images collected from Bangladesh Old Photo Archives, 2021; Edited by Author (2021)

During World War II, more thoroughfares and roads were built to facilitate Dhaka's growth in the northward direction (Ahmed et al., 2013). The first public buses started operating from the 1940s (The Contextbd, 2020). Many wealthy families in Dhaka began to own private motor vehicles in the 1960s (The Financial Express, 2019), but the lack of public transport made walking popular among the majority. After its independence in 1971, the mass transport sector expanded over time, with public buses, private cars, auto-rickshaws, minibuses, rickshaws, and other informal vehicles taking up significant space on the streets. Before 1970s, there were few motorised vehicles, but as the city's economy grew, it saw a rise in automobiles. Motijheel is the business centre of Dhaka, which grew into a traffic-congested neighbourhood as thousands of people commute here daily for work due to its commercial importance (Figure 1).

2. Land-use change in Dhaka

Dhaka expanded in the north-south direction over the years, with residential areas on the northern peripheries and commercial sectors near the central zone (Kabir, 2013). According to Khaleda et al. (2017), the total urban built-up land has increased more than ten times (11.6 km² to 118 km²) from 1989 to 2014 (p.195). While Dhaka is not easily defined spatially (Kabir & Parolin, 2012, p.5), many planning proposals have been developed to accommodate the growing population.

DHAKA METROPOLITAN DEVELOPMENT PLAN (DMDP) was a 20-year strategy plan (Iqbal, 2013) proposed in 1995, with policies for expansion on the north side as a "low-rise, low-density city form" (Zaman & Lau, 2000, as cited in Kabir & Parolin, 2012, p.17). The strategies recommended more highways and a mass transit system in the north-south corridor to accommodate the growth, connecting the new suburbs (Kabir & Parolin, 2012, p.16); however, increasing the distance that workers were able to commute.

Dhaka has changed the land-use functions to accommodate the high population density and rising economic activities while opening doors to more automobiles. Dhanmondi area transformed from planned residential blocks during the 1950s (Khan & Mitra, 2011) to mixed-use commercial, educational and high-rise residential buildings. It converted from 28% non-residential space in 1984 to almost 50% in 2000 (Khan & Mitra, 2011, p.6) as shopping malls, hospitals, and schools replaced older residences. As most users of these facilities travel from other parts of the city, more traffic accesses (Mahbub-Un-Nabi & Hashem, 2007, as cited by Khan & Mitra, 2011) the roads, which were initially designed for limited vehicular movement. Most neighbourhoods in the city have experienced a similar transition due to a lack of monitoring from authorities and unplanned development.

According to Wegener & Fürst (1999), transport policies supporting land-use plans can help restrain cars in cities (p.19). However, the Bangladesh government focuses on investing in transport infrastructure without planning an inclusive urban plan, which only increases automobiles on the streets. A city with mixed land-use functions generates short-distance trips. However, Dhaka's residents use private cars, rickshaws or public buses to travel these short distances. A more sustainable approach is required to address this rising traffic volume, and bicycles are a space-efficient and environmentally friendly alternative that should be promoted to complete such short trips in Dhaka.

MOBILITY ANALYSIS OF DHAKA

This section comprises the mobility analysis of Dhaka and the current transport policies and infrastructures under development. Its objective is to understand the transport status-quo of the city and investigate the existing transport network, modal share, and cycling in the present road network.

1. Transport plans and policies

In Bangladesh, the government authorities' coordination and policy directions are often conflicted, with complicated organisational structures, mismanagement and duplication of services within them (Ahasan et al., 2021, p.2). Bangladesh Road Transport Corporation (BRTC) and Bangladesh Road Transport Authority (BRTA) are regulatory authorities focused on public bus service and enforcing regulations (The Project on the Revision and Updating of the Strategic Transport Plan for Dhaka, JICA, 2015). Dhaka Transport Coordination Authority (DTCA) is the coordinating authority of the transport sector for Dhaka.

Existing Regulatory framework

The first transport survey, The Greater Dhaka Metropolitan Area Integrated Transport Study (DITS), was conducted in 1991 to formulate Dhaka Urban Transport Project (DUTP), funded by the World Bank, proposing improvements to the existing transportation system in the city. The DUTP was implemented in two phases, and its outcome formulated the Strategic Transport Plan (STP) for Dhaka city (Ahasan et al., 2021). STP was a 20-year-long integrated land use and transport plan,

and proposed a mass transit system in Dhaka. STP was revised to formulate the Revised Strategic Transport Plan (RSTP), where provisions for non-motorised transport are still limited. The report titled "The Project on the Revision and Updating of the Strategic Transport Plan for Dhaka (RSTP) Urban Transport Policy, JICA (2016)" summarised Policies 70 and 71, which stated that separate lanes and prioritised crossings will be implemented in the city (p.47) for safe and comfortable cycling. The government will also promote local cycle manufacturing industries to make bicycles affordable (p.47).

What are the drawbacks of the existing transport system?

Although the government has established numerous laws for the road network, vehicles, and traffic order, the overlapping regulations are hard to maintain. The biggest drawback of having multiple stakeholders in one sector is the virtually non-existent coordination. Four individual ministries are involved in different sectors for transport development and maintenance in Dhaka. Directly working under them are the eight agencies with overlapping responsibilities. Repetition of services has severe financial consequences, as the authorities are doing similar infrastructure work consecutively, wasting resources (Ahasan et al., 2021). Although DTCA is the coordinating authority of the transport sector for Dhaka, the municipalities implement their mobility plans without discussing it with them. The parent ministries need to provide a legislative guideline and bring all the institutions under one umbrella and specify their objectives without duplicating their roles to establish a well-coordinated system.



Photo credit: Al Amin Mir, City Buildings in Dhaka, Bangladesh, 2021.
<https://unsplash.com/photos/jkW9ES-w79Q>

2. Road Network

Dhaka has 8% of its land for road networks (Labib et al., 2013, p.140), with 3000 km of usable road in the urban area. They are categorised according to their usage and location (200 km primary road, 110 km secondary road, 50 km feeder road and 2,640 km narrow road) (SUTI, 2018, p.4). Although a considerable percentage of the trips are by public buses, only 250 km of the road is suitable for bus operation (Labib et al., 2013, p.140). During peak hours, the vehicles create heavy congestion due to insufficient space for all the transport modes. There are 157 bus routes across the city, and only five of them travel in the east-west direction, while the rest are on the north-south alignment (SUTI, 2018, p.4). The population relies on rickshaws for short-distance trips as they are cheaper and takes less time than buses during peak hours on the primary roads.

The idea of “more road, more space” has boosted the growth of the city by adding more lanes to the already occupied roads (The Business Standard, 2023). The car-dependent infrastructure only exacerbates the situation, as the problem is not only inadequate roads but a lack of integrated transport planning for Dhaka. The government has heavily invested in building more elevated roads instead of maintaining and improving the existing ones. In the last 20 years, eight new flyovers have been built in Dhaka to improve connectivity and reduce the traffic on the existing roads.

The first flyover in the Mohakhali area, opened in 2004, and was completed for 9.6 million Euros financed by The World Bank (The Business Standard, 2023). The 11.7km long Mayor Hanif flyover opened in 2014 and was financed by six state-owned banks and financial institutions for a record amount of 193 million Euros (Dhaka Tribune, 2016). Although the proposed budget was much less, corruption, delay and lack of management in construction are reasons for the increased cost of these mega projects. However, the traffic scenario has not changed despite such massive infrastructure built around the city. They provide a temporary ease, as the travellers face the same congestion once they get down from them (The Financial Express, 2017). Although the government has plans for expanding the existing MRT network and implementing the BRT, which aims to improve the

traffic situation, the progress of these projects is slower compared to the construction of flyovers that failed to provide any significant solution to the traffic congestion.

3. Mobility indicators

Transport planning policies in Bangladesh concentrate more on motorised vehicles, whilst non-motorised modes are considered a hindrance to automobile flow. Both private automobiles and public vehicles have seen a rise in recent years with the growing population. Limited road space and an elevating amount of motorised transport have reduced the overall speed of Dhaka’s traffic to 4.5 km/h from 21 km/h within a decade (The Business Standard, 2020). The traffic congestion contributes to the loss of working hours, wastage of fuel, traffic crashes during peak hours and an annual economic loss of Tk 560 billion (5.6 billion euros) at the end of 2021, which drastically increased from Tk 370 billion (3.7 billion euros) in 2018 (The Financial Express, 2021). According to BRTA data, Dhaka has approximately 500,000 motorcycles registered; however, experts believe the actual number is a lot more due to poor public transport service (The Daily Star, 2018). This situation calls for immediate measures to mitigate the traffic congestion problems and look for alternate options to reduce the overall number of motorised vehicles in the street.

In Dhaka, public transport consists of buses, minibuses, autorickshaws, and informal transit such as rickshaws, human hauliers, and other non-motorised vehicles. Despite such unfavourable conditions and the constant struggle for road space, buses and rickshaws provide maximum service to the citizens at an affordable cost. In 2012, the total number of buses operating were 11,060 (Hoque et al., 2014, Section 3.1 Modal Characteristics); however, the quantity is inadequate to fulfil the demand of the growing population of Dhaka. Insufficient and disorganised bus scheduling increases the use of non-motorised vehicles like rickshaws. Approximately 600,000 rickshaws are found in the streets of Dhaka (Rahman, 2007, p.1636), and although a significant share of everyday trips is by non-motorised modes, there is no separate road space allocated for them. Instead, the constant competition for space increases the risk of traffic crashes for operators and passengers.

Figure 2 attempts to show some of the popular vehicles in Dhaka at a glance. Only buses, CNG, and autorickshaws are registered public motorised transport vehicles, while the rest are informal vehicles, sometimes unregistered; hence their actual number is difficult to ascertain. Dhaka is one of the least motorised cities globally; however, the air pollution in the city is soaring. The popularity of non-motorised modes is not only because they are easily accessible and faster than public buses but also because most bus fares are higher than the fixed government charge, making them expensive for low-income citizens. As most of the population is in the lower-income group; therefore, they mostly rely on walking in their everyday commute. Middle-income groups use rickshaws for short-distance trips and public buses when they travel long distances.

Buses are the most popular public transport available in Dhaka. The estimated average length of a bus trip is 9.7 km, whereas a rickshaw trip is 3.6 km, and out of the 21 million trips generated daily, 44.7% are commuting to work, and 17.1% are for travelling to school (JICA and DTCA 2015 as cited in SUTI, 2018, p.4). 28% of all the trips are carried by public buses, whereas cars complete only 5% of them. Nevertheless, buses occupy 5% of the road space, whereas cars take up 80% of it. Although most trips are by walking and non-motorised modes (58%), there is not enough provision for non-motorized vehicles to move around safely and comfortably without struggling for space with automobiles (Fang, 2014, as cited in SUTI, 2018, p.8). Gallagher (2016), in his report, represented the modal share in Dhaka for 2014 from the data collected from the RSTP survey (Figure 3). It deduced that public buses and rickshaws show a significant mobility share, whereas cars, autorickshaws and motorcycles are the second most used vehicles. This data further emphasises that Dhaka needs transport plans that integrate non-motorised modes with public transport.



Figure 2: The different transport modes in Dhaka

Top Row: Left-Rickshaw and CNG congestion in Old Dhaka, Middle-Dhaka University Bus, Right-School van;

Middle Row: Left-Motorised and non-motorised vehicles in Shahbag, Middle-Bicycle, Right-Rickshaws;

Bottom Row: CNG stuck in water-clogged Dhanmondi, Middle-Mini-Bus, Right-Goods-carrying van

Source: Flickr; Edited by author, 2022

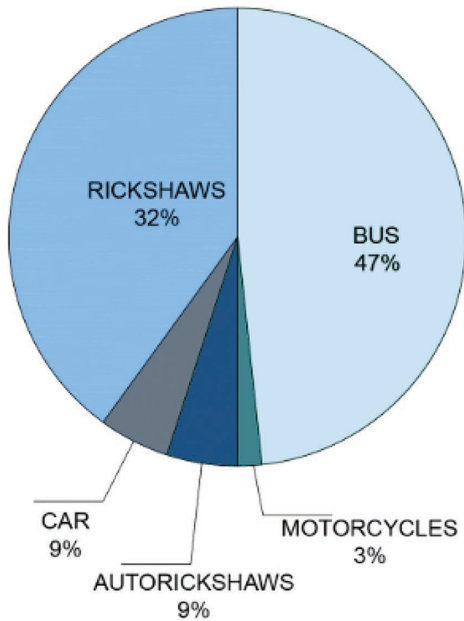


Figure 3: Modal share percentage of different modes in Dhaka, 2014

Source: Data collected from Gallagher, 2016; Edited by author, 2021

4. Current scenario of bicycle usage in the city – challenges and difficulties

This section attempts to describe the current mobility scenario and the growing bicycling interest in Dhaka to develop the parameters required for proposing cycle-friendly policies in the city. The current traffic situation in Dhaka has influenced some people to take up cycling as an alternate mode. As the overall traffic speed has come down to 4.5 km/h, whereas a survey shows bicycles in Dhaka travel at 10 km/h (The Financial Express, 2018), many have switched to cycling instead of spending hours in traffic congestion. It also saves up to Tk.24,000 (240 Euro) per month compared to travelling by public transport (The Financial Express, 2018). The emergence of online stores and food delivery services has employed young cyclists to make delivery fast and affordable for customers. According to Gallagher (2016), there are approximately 200,000 bicycles in Dhaka, making up 2% of the modal share (p.34). Although cycling is an “environmentally, economically and socially sustainable” (Pucher and Buehler, 2017, para.1) non-motorised transport mode, it is currently the “invisible mode in Dhaka” when formulating the transport policies (Gallagher, 2016, p.34). Almost 65% of the trips in the urban area are less than one mile (1.6km) (Hoque et al., 2014, Section 5. Role of NMT in Dhaka’s Transport system, para.1), and the

compact mixed-use neighbourhoods show a potential to use bicycles for these trips. During the imposed lockdown to slow the spread of COVID-19, there was a three-fold increase in the sales of bicycles in Dhaka. Previously the bicycle stores in the city sold 3-4 bikes a day, which has increased to 8-10 since the countrywide lockdown began (Dhaka Tribune, 2020). Social groups and community clubs such as BD Cyclists and Dhaka University Cycling Club encourage potential cyclists from all over Dhaka through events and campaigns.

Despite the growing cycling trend in Dhaka, there is not enough infrastructure to sustain it in the city. There are only two separate bike lanes, which remain illegally occupied and lack integration with the entire road network (Figure 4). According to the Bangladesh Institute of Planners, the city needs a cohesive network of cycle lanes (The Daily Star, 2021) and not segregated routes. Using the bicycle as a feeder mode is not currently possible due to the inefficient and poor quality bus service and parking facilities. Although bicycle-share schemes are an effective way to encourage people to cycle short distances, the first public bike-sharing app in Bangladesh, JoBike, provides limited services in the neighbourhoods of Mirpur DOHS and the Dhaka University area (The Daily Star, 2019).



Figure 4: Bicycle lane in Manik Mia, Dhaka

Source: The Business Standard, 2020; Edited by author, 2021

However, the popularity of the scheme emphasises people's interest in using alternate modes if provided with the infrastructure and services.

Dhaka was named the “traffic capital of the world” (Fang, 2014) because of extreme vehicular congestion. Insufficient road space, poor quality of roads, manually operated traffic signals, illegal parking, unregulated non-motorised modes, and numerous institutional and policy gaps combine to form such devastating traffic conditions on the city streets (Salam, 2012). The absence of separate lanes for non-motorised modes create a constant struggle for road space. This reduce the safety of the operator and passengers of non-motorised transit and lead to traffic crashes. As the majority population of Dhaka is lower or middle-income and cannot afford private vehicles, it is essential to find solutions which are affordable and accessible for everyone. The cycling trend that has picked up the pace during the lockdown requires a cohesive, safe and comfortable bicycle network for the people. The growing cyclist communities, rising bike sales, and public bike-sharing schemes show the potential for a mobility plan prioritising cycling in Dhaka.

ANALYSING THE BICYCLE SITUATION IN CENTRAL DHAKA

This part is an overview of the central area of Dhaka, and discusses the current land use functions and the mobility situation in the area. Due to insufficient literature and data exclusively discussing mobility for this area, the exact modal share was unavailable. The author was a regular commuter of this neighbourhood, and some views in this section are direct experiences. This section also compiles and analyses the survey results of the existing and potential bike users to understand their opinions on the current bicycle infrastructure. The main objective is to find the potential for promoting bicycle usage and explore the possibilities for implementing bike-friendly infrastructure in the central parts of Dhaka.

1. Development of the area – Rise to prominence

Dhaka started developing from the banks of Buriganga and eventually spread towards the north. The city centre grew from the Ramna and Shahbag zone (Kabir, 2013). After 1905, Ramna became the administrative centre

of Dhaka. During this period, Dhaka University and Bangladesh University of Science and Technology were built, making it the educational hub of the city. Post-1971, the district gained importance in cultural, historical and political aspects. Acting as an oasis in the middle of highly dense urban Dhaka, the districts Shahbag, Ramna, and Dhaka University form a threshold between the modern urban fabric and the city's colonial structures.

Today, Ramna is a plush green public open space serving the surrounding residential, commercial and educational institutions (Begum, 2018). The adjacent racecourse, Suhrawardy Uddyan, hosts national festivals, political and social events, attracting thousands of people to the vicinity. (Begum, 2018, p.53). Almost all the government offices were built in this area, making it the most administratively important location of Dhaka in modern times. The street moving alongside Ramna consists of ministries, secretariats and court buildings. The side of Dhaka University is the mixed-use urban fabric of museums, libraries, art institutes and cultural centres. The university campus itself covers approximately 243 hectares, with a student-teacher population of 38,000 (DU, 2021). Apart from the students, the working population consists of government employees, law officials and local vendors entering the area daily.



Photo credit: Sazzad Aryan, Dhaka 1230, Bangladesh, Dhaka, 2018
<https://unsplash.com/photos/olFpgSOSHfE>

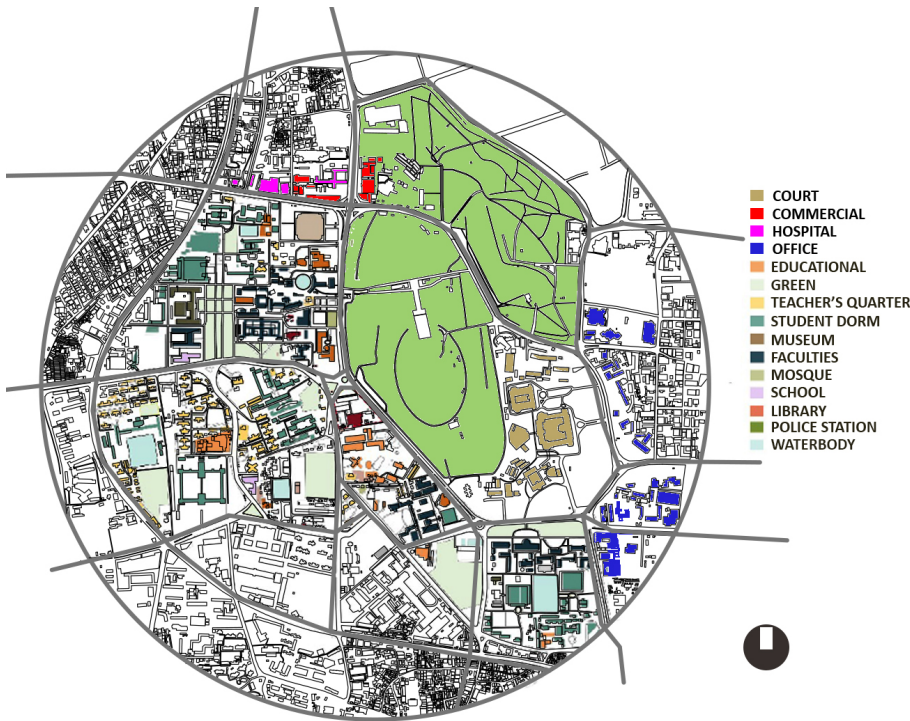


Figure 5: Land-use map of the area
Source: Author, 2021

Figure 5 attempts to mark the essential functions in the area. The map identifies the area as a mixed-use urban space with a mixture of administrative, educational, cultural, health and commercial facilities. Outside the central part are the dense residential neighbourhoods. The compact planning of this area creates numerous short trips ideal to be completed by non-motorised modes, which accounts for the highly rickshaw-congested narrow lanes in the neighbouring parts.

2. Current transport mode

This area has good public transport coverage with numerous overlapping routes because of government institutions and universities (Rahman et al., 2012). Public vehicles include buses, human hauliers, autorickshaws, and rickshaws. Shahbag-Motsho Bhaban road gets heavily congested during the morning and evening office hours. Multiple bus companies serve this area due to the high number of passengers commuting to the neighbourhood (Alam et al., 2020). Majority population, specially students, use buses and autorickshaws, while government employees travel in cars or motorcycles to the offices in the neighbourhood. Amid these motorised vehicles, bicycle usage is low due to insufficient road space.

The Shahbag to Doyel Chottor road is very crowded during the evening hours, and the nodes and intersections are open gathering spaces bustling with people, travelling in rickshaws, motorcycles and sometimes bicycles. Ramna and Suhrawardy Uddyan are busy with residents from the neighbourhood in the evening. During holidays, rickshaws are most common in this vicinity as people from all over the city visit museums, libraries and monuments. The compact planning and close proximity of the public amenities make non-motorised transit an ideal option for such short-distance travel, and the dependence on rickshaws among the students, teachers, and locals emphasises the need to develop measures for non-motorised modes in the area.

Development of MRT in the area

As the city centre, the area is a functionally important neighbourhood in Dhaka; therefore, all the proposed transport plans will create an efficient mobility network. The proposed MRT and BRT lines intersect and circle the city's inner core to have adequate public transport for the zone. According to the STP's estimates, the entire Metro System will carry more than 1.5 million commuters daily once it starts operating at full capacity (Nawaz, 2015). MRT line 6 runs through the middle of the central area and is given priority as it connects vital points of the city with the central area to provide better accessibility (JICA's final report, 2016). However, unless MRT lines 4 and 5 are completed, line 6 is not operating at total capacity. Japan has been funding some of the mega structures in Dhaka, and has partially funded the MRT network to improve the overall traffic congestion of the city. The estimated cost for line 6 was initially 1.8 billion euros; however, it has been revised to 2.8 billion euros due to the delayed construction. Although the project has been delayed due to the pandemic, the MRT line 6 has been currently operating from Uttara to Agargaon for only 4 hours daily, without stopping at intermediate stations in the city (The Daily Star, 2022).

Existing bicycle situation

The bicycle-sharing app, JoBike, started its operation at Dhaka University in October 2019. The budget-friendly scheme has become popular among students and costs only 0.025 Euro for the first five minutes, making it one of the cheapest transport modes in the city (Dhaka Tribune, 2019). A bike parking station opened inside the supreme court area in November 2020 to promote a positive attitude among government officials toward cycling to work. However, the absence of bike lanes and parking facilities on the University campus discourages most people from cycling in the vicinity. This scenario further emphasises that isolated initiatives will not promote cycling. According to the new master plan for Dhaka University, the area will expand with new sustainability goals, improved public transport facilities and separate bicycle lanes with proper bike parking facilities (The Business Standard, 2021).

3. Analysing current and potential bike user's Opinions

As discussed previously, a survey was carried out to understand the perspective of current and potential bike users. Since this survey was conducted online for academic purpose within a short span of time, the number of people participating was few. In total, 140 respondents (108 men and 32 women) answered the eight questions. The respondents were 55 students, 15 businesspeople, and 70 job holders. There were 93 bicycle owners, and one respondent had his bike stolen recently. The survey asked about trip purpose, length, frequency of bicycle usage, the challenges faced when cycling, and reasons behind using bikes as a mode of transport.

Trip Purpose

In the streets of Dhaka, cycling can be hectic and tiring; therefore, the people who choose the bicycle over other transport modes have a specific purpose for the modal choice. According to the survey (Figure 4), 56 people (40.6%) said that they use or might use it for commuting to work and school. 45 (31.2%) of them chose cycling for exercise, and 34 individuals (24.6%) said that they preferred it for recreation. 4 participants (3%) answered that they cycle for all the purposes listed, and only one person did shopping with the bicycle. Although some people preferred cycling for everyday commutes, recreation and exercise combined were more popular choices in Dhaka.

If you own a bicycle or plan to own one in the future, for which purpose would you use a bicycle?

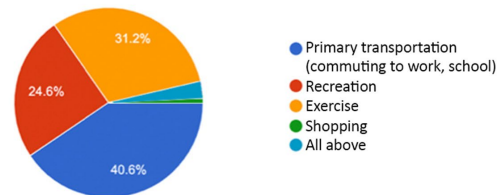


Figure 6: Purpose of cycling in Dhaka
Source: Author, 2021

Trip length

To understand how far people are willing to cycle, it was crucial to identify the distance covered by current users daily. Only 131 respondents answered the question in this case (Figure 5), as the people not owning a bicycle did not participate in this part. 23 participants (17.6%) travelled less than 3km; 41 people (31.3%) cycled an average of 3-7 km daily; 22 people (16.8%) cycled 7-10 km; 21 people (16%) cycled between 10-15 km; and 24 individuals (18.3%) were commuting more than 15km daily. The number of people who cycled more than 7km was almost the same as the number who took shorter trips and travelled less than 7km with bicycles per day.

On an average how many kilometers do you travel using bicycle everyday?

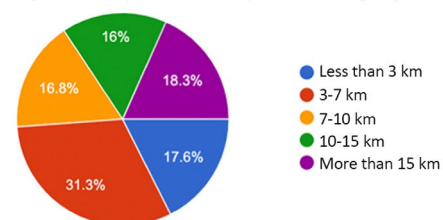


Figure 7: Trip length of cycling daily
Source: Author, 2021

Cycling Frequency

The next question focused on how often people use bikes despite the absence of infrastructure, and 133 people answered the question (Figure 6). 44 respondents (33.1%) use it daily, 38 of them (28.6%) for 2-3 days a week, 21 people (15.8%) for 4-5 days a week, and 18 (13.5%) people use it only once a week. 6 people cycled only once every 15 days, and the remaining 6 cycled once every month. The results portrayed that the highest number of respondents are regular bicycle users, since 103 respondents cycle at least twice per week.

If you own a bicycle how often do you use bicycle for transportation?

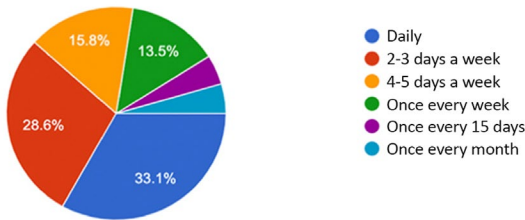


Figure 8: Frequency of cycling

Source: Author, 2021

Challenges in cycling

In the survey, people were asked to rate the problems they face during cycling. All 140 participants answered this question (Figure 7). Among them, 49 people (35%) mentioned that not having a dedicated bicycle lane is the biggest challenge for cycling. 42 people (30%) blamed the safety of roads; 32 individuals (22.9%) indicated the lack of bicycle parking facilities; and 11 (7.9%) of them believed poor traffic management was the primary problem. 3 people (2.1%) felt that extreme weather conditions impacted cycling, while 2 people (1.4%) agreed that all the options were challenges. According to survey results, the absence of a dedicated bike lane is the biggest threat to cycling in Dhaka.

According to you, what is the biggest challenge for cycling in Dhaka?

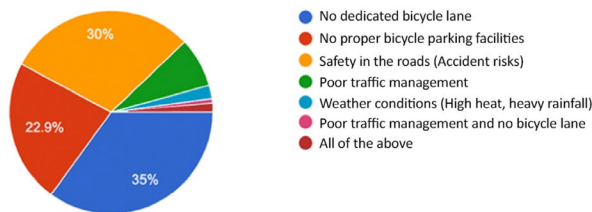


Figure 9: Challenges of cycling in Dhaka

Source: Author, 2021

Reasons to choose the bicycle

The survey asked why the respondents used bikes as their regular mode of transport. 138 participants answered this question (Figure 8). 46 (33.3%) of the survey attendees cycled for health benefits, whereas 37 (26.8%) were cycling to save time in the traffic-congested streets. 25 (18.1%) of them used bikes as it was cheaper than buses; 23 people (16.7%) cycled to contribute to environmental benefits; and 8 respondents (4.4%) were cycling for all the mentioned reasons.

Only 1 person (0.7%) was cycling out of passion. As using bicycles saves public transport fares and is faster than the buses, it is evident that most people prefer cycling for financial and social benefits in the congested Dhaka streets.

If you own a bicycle or plan to own one in the future, why would you use bicycle for transportation?

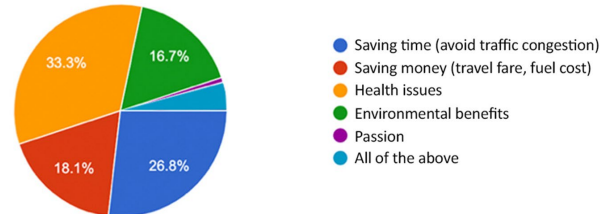


Figure 10: Reasons to use a bicycle in Dhaka

Source: Author, 2021

This section summarises the potential of central parts of Dhaka to promote the already prevailing non-motorised dependency trend and utilise it to formulate a guideline for increasing cycling in the coming chapter.

Listed below are the factors identified to support the idea of improving cycling in the neighbourhoods:

1. Wegener and Fürst (1999) stated that dense mixed-use functions with car-restraining transport policies have a sustainable impact on neighbourhoods. The mixed land-use functions in the inner districts of Dhaka generate a high number of short-distance trips within the vicinity. The public facilities, offices and university are easily accessible by walking or cycling, and they can become popular among the population if the government builds adequate infrastructure in the neighbourhoods.
2. The development of MRT lines and the BRT system will ensure reduced traffic congestion with better public transport facilities, comfortable and time-saving commutes to work and school. However, the success of this transport system is contingent upon other factors (Morshed, 2019). In a city with a majority population from a lower-income group, riding expensive public transit is dubious as the fares may not be as affordable as the existing bus services.

The central parts of the city will have the highest connections to the proposed mass transit system. However, the mega project will be inefficient if integration with other modal choices are not available (Morshed, 2019). It is important to incorporate infrastructure such as bike parking stations, bike take-on options in the MRT carriages and separate lanes to optimise bicycles as a feeder mode to the mass transit system.

3. The existing physical infrastructure within the central parts of Dhaka is not suitable for cycling. Nevertheless, there are initiatives from social clubs to create behavioural change among the citizens to adopt cycling as an alternative transport mode. Campaigns, workshops, and open discussions on the Ramna and Suhrawardy Uddyan are regularly hosted, demanding separate bike lanes for the cyclists in the area. The mayor has approved an integrated bike route for the entire campus, that will connect the nearby public facilities and government offices to facilitate an easier commute for the students, teachers and office employees.
4. JoBike is the first and only public bike-sharing scheme in the city centre. Many students use the service as it is budget-friendly, fast and sustainable; however, it only serves a small portion due to a lack of investment funding. If the scheme expands its service, it will further engage more people towards cycling as a hassle-free commuting choice.
5. Finally, the survey results give an insight into the people's opinions and the challenges in the current cycling situation. Out of the 140 respondents, the majority of participants cycle every day. Most participants use their bikes for commuting to work or school, whereas some use them for exercise and recreation. However, cycling is challenging for Dhaka citizens, and according to the survey participants, the lack of separate bike lanes and parking stations, unsafe roads, and poor traffic management account for discouraging cycling. The respondents believe cycling reduces time and transport costs while saving the environment, which is a motivation to formulate a bicycle-friendly network.

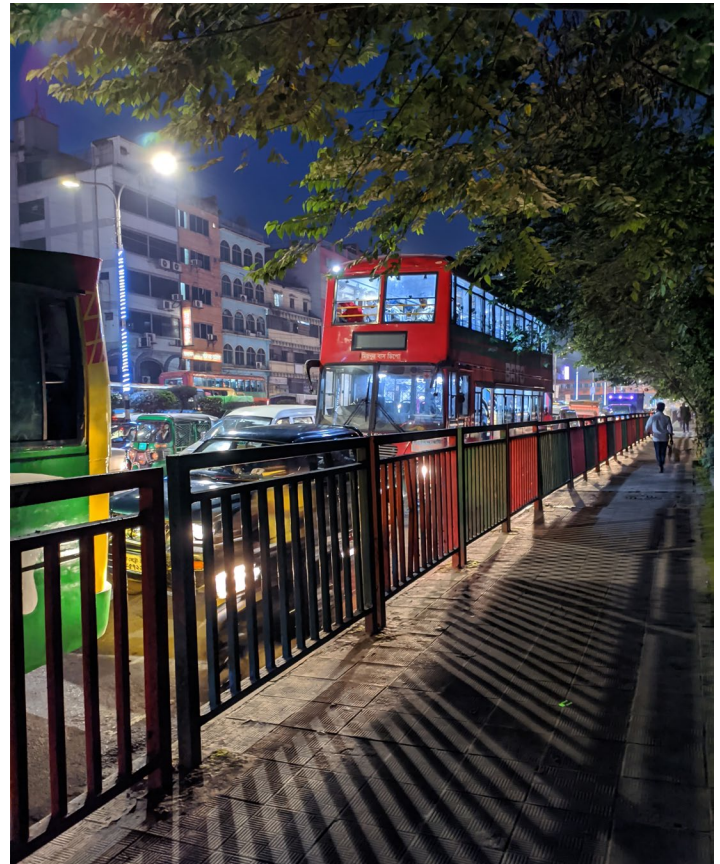


Photo credit: Arif Hossain, Shoinik Club Mor, Dhaka, Bangladesh, 2020. https://unsplash.com/photos/U_pFXR7JF6M

BICYCLE INCLUSIVE PLANNING – GUIDELINES AND RECOMMENDATIONS

Previously, the paper discussed and analysed the overall transportation of Dhaka, eventually establishing bicycles as a growing modal option in the current mobility dynamics. Bicycles are a neglected mode in Bangladesh's transport policies; however, with the growing population and rising number of automobiles, they could be effective in reducing traffic congestion and pollution. They are inexpensive and accessible to everyone in a low-income country like Bangladesh. The main objective of this paper is to develop a framework to increase cycling as a safe, comfortable and attractive mode in Dhaka's urban transport system. As pointed out, the central parts of the city demonstrate a promising situation for implementing inclusive bicycle policies. In the following section, a series of recommendations are developed to increase bicycle modal share through improved infrastructure, upgraded service, and behavioural change of people towards cycling within the framework of coherence-directness-safety-comfort-attractiveness.

1. Integrated transport planning

Many cities have tried incorporating cycling into the urban transport network, but despite having infrastructure, cycling continues to be marginal in some cities. “Planning is a relevant part of cycling promotion” and it is imperative to formulate “integrated, mutually supporting policies” to enhance bicycle use in any area (Pucher and Buehler, 2007, p.3). The success of urban planning, hence, depends vastly on implementing well-developed strategies considering all aspects of mobility and land use. An integrated plan aims to correct the deficiencies in the status quo and balance the mobility dynamics of the city.

As previously discussed, the complex chain of numerous authorities in Dhaka responsible for transport planning, implementation and maintenance has led to poor coordination and execution of the existing projects. The city’s central area falls under the jurisdiction of DSCC (Dhaka South City Corporation), which has an elaborate master plan for constructing coherent bicycle lanes in the zone connecting the university area with the surrounding neighbourhoods. Dhaka University student communities have volunteered to conduct surveys in the surrounding areas to develop a cohesive design of the cycling network and public bus routes. DSCC, as the regulatory and administrative authority, can work with the university to ensure that the project is designed and executed in the best interest.

Inclusion of bicycles as a feeder in mobility plans of Dhaka

The current trend shows that bicycles do not act as feeder transport in Dhaka; instead, they are used as vehicles to complete round trips. However, in cycling cities such as Bogota, Groningen or Bangkok, bicycles are often used as part of the trip (C40 Cities Finance Facility, 2018) (Bakker et al., 2018). Following the case examples, bicycle integration with institutional public transport systems would be a way to increase connectivity and enhance intermodal travelling in Dhaka.

This strategy emphasises the characteristics of ‘coherence’ and ‘comfort’ from the cycle-inclusive planning framework.

MRT line 6 has started operating recently, and the intermediate stations in Shahbagh and Dhaka University will be operational in the coming months. These proposed MRT and BRT systems can introduce bike take-on options and parking facilities to facilitate a multimodal chain in the zone. In the future, when all the MRT and BRT lines operate, it will be an intense network of transport connections, provided the bike lanes are already in place. When more people are using public transport and bicycles, fewer private automobiles will be on the street, thus reducing the current traffic congestion at the Motsho Bhaban and Shahbag intersections.

Traffic calming and traffic off-limit

Traffic is a threat for both cyclists and pedestrians in terms of speed and volume if not curtailed. As mentioned earlier, an integrated plan aims to balance the mobility dynamics of the city. The central area of Dhaka experiences severe traffic congestion at the two critical roads of Motsho Bhaban and Shahbag. Car-restricting policies can be implemented from Shahbag to Motsho Bhaban by limiting the number of cars. Every government car should take the maximum number of passengers to reduce traffic volume and fuel use. This could drastically decrease cars entering the neighbourhood as high-ranking government officials are currently entitled to one car per employee. The road from Shahbag to Doyel Chottor could have car off-limit policies. Since the university area is highly dependent on university buses and non-motorised modes, restricting cars and motorcycles and enhancing public transport options with bicycle facilities for students will reduce the motorisation of the area. Coherent bicycle lanes, attractive pedestrian walkways, and designated bus stops in the University campus will create a safe and better environment for everyone.

2. Infrastructure development

Separate bike lane

According to the RSTP Policies 21 and 71, all types of non-motorised modes will be encouraged as feeder services, with dedicated lanes to create an urban network connecting commercial sectors, city centres and communities (JICA, 2015, p.33) (JICA, 2015, p.45).

However, bicycle lanes should avoid conflicts with other modes at intersections (City of Groningen, 2015), as roads which are overcrowded with automobiles can jeopardise the safety of cyclists. Therefore, it is essential to have a physical barrier separating motorised vehicles and bicycles and protected crossing for bicycles at intersections to avoid conflicts. This idea is already implemented in the bike lane on Agargaon road in Dhaka, where the city corporation built a green divider to separate motorised vehicles from entering the bike lane. This design can be replicated on the dense traffic-congested Shahbag-Motsho Bhaban route and the road adjacent to Dhaka University, where the bicycle lane should have a visible partition to keep automobiles from running and illegally parking in it.

E-bikes and pedelecs

Pedelecs and e-bikes can provide a solution to alternative of bicycles for people who find cycling a difficult physical work. Dhaka has recently started importing e-bikes due to the slowly growing demand for this alternative to traditional bicycles. However, the price starts from 350 euros (E Smart, 2021) and is beyond the affordability of the majority population. However, they can be alternate options for civil servants and politicians who travel in cars in this area. The necessary infrastructure for these advanced transport modes, such as charging facilities, storage, parking stations, and maintenance hubs, must be located at strategic points to facilitate their usage.

Bike Parking facilities

Cycling requires well-organised, convenient and safe public parking facilities to promote a multimodal connection and chained trip by using bicycles as a feeder mode. Additional parking facilities in the University area will encourage more students to cycle to the campus. The central area has thousands of people commuting every day, and increasing bicycle trips will require a mix of distributed parking establishments and secure storage facilities adjacent to the offices, museums, art institutes and cultural centres.

3. Improving services

For the policy framework to work efficiently it is important to share information about the implemented initiatives with the users.

Cyclists will only use the infrastructure and services if they know about the facilities provided for them. When the first bicycle lane was inaugurated in Dhaka, only a portion of the population knew about it, thus reducing the possibility of more people using the infrastructure. Readable maps of the bicycle routes indicating the intersection crossings, parking stations, maintenance hubs, and recharging points will make people aware of the services, making it an attractive hassle-free transport mode. Indicative signposts, boards and maps in the strategic nodes of Dhaka University and the Ramna area will provide relevant and up-to-date information to cyclists for a comfortable commute within the campus and surrounding neighbourhoods.

Bike-sharing schemes or bike rental services are an effective strategy in increasing bicycle modal share. The roads of Dhaka University already have JoBike as the first and only public bike-sharing service in the vicinity, and it is popular among the students and teachers in the area. It can broaden its service to the nearby localities and motivate people to adopt cycling at an affordable price, reducing traffic congestion during peak hours and travel from other parts to the city centre.

4. Communication and behavioural changes

Bicycles often evoke a negative connotation as they are considered old-fashioned, dangerous, and inconvenient in the urban streets of Dhaka. Integrated planning and better infrastructure alone do not promote cycling; rather, socialisation, awareness and a positive attitude towards riding bikes cumulatively contribute to the modal share. Creating a behavioural change among government employees in the district is a challenge. The state officials get the privilege of travelling in cars under government expenses. Therefore, cycling to their respective workplace is considered a sacrifice of their luxury. Only students are keen to travel by bike as they are cheaper than the available public transport in the vicinity. Regular campaigns, workshops, and seminars by cycling clubs and government authorities can create awareness about the available cycling facilities and their benefits. While formulating a bicycle strategy, surveys and participatory processes gives insight into public's view and opinion that will advance the planning process and create an inclusive public-supported bicycle policy for everyone.

	Coherence	Directness	Safety	Comfort	Attractiveness
Bicycle as a feeder mode	It will create an inclusive multimodal system, with coherent connections between non-motorised modes and the proposed MRT.			Long-distance trips will be easier to complete, for people coming to work from other parts of the city to the government offices in the city centre using bikes when part of the journey is carried out with public transport.	
Traffic calming and restricting			Restraining and restricting motorised vehicles will give more space for the cyclists, ensuring safety in the otherwise busy Shahbag-Motsho bhaban route.	Traffic calming methods will reduce vehicular congestion, thus cycling will be comfortable without the emission of greenhouse gases in the extremely congested Shahbag intersection.	Both traffic calming and traffic limiting measures will keep the serene environment of the Dhaka university campus and the adjacent Ramna and Suhrawardy Uddyan intact, making cycling more attractive.
Separate bike lane	An integrated network of separate bike lanes will create a cohesive system of bicycles within the inner-city vicinity of Shahbag and Dhaka University.	Separation of routes promotes faster travelling as there are less obstructions and intersections.	Separating bicycles from motorised vehicles will ensure safety, especially in the highly congested road of Shahbag-Motsho Bhaban.	Not having to compete for road space will make cycling comfortable for students and office employees of the area.	
Using pedelecs and e-bikes				Since they require less effort to operate, they are more comfortable to ride than conventional bikes, and government employees who are inclined to use cars for comfort can switch to this alternate option	These are gaining popularity in the Dhaka market as they remove the negative connotations of traditional bikes. They are faster and easier to operate.
Improved parking facilities				Secured and adequate parking will ensure more people, especially students, cycling with ease and comfort	
Public bike sharing scheme				Renting bikes is more convenient for people who want to avoid bike maintenance costs. Students are keen to use the service as it is cheaper and easily available within the Dhaka University premises.	

Table 2: Summarising the policy frameworks within the five essential criteria of cycling infrastructure

Source: Prepared by author, 2021.

This part attempted to outline the proposed policies to increase the bicycle modal share in the inner neighbourhoods of Dhaka.

The strategies are listed within the framework of the five essential criteria of cycling inclusive transport planning, coherence-directness-safety-comfort-attractiveness.

CONCLUSION

This paper attempted to give an overview of the current mobility situation and the role of the bicycle in Dhaka to propose strategies for enhancing its position in the modal share as a sustainable vehicle within the central parts. This final section will summarise the findings of the mobility analysis of Dhaka, the potential of developing a bicycle-friendly network and the policies to enhance its modal share.

Highly dense urban settlements such as Dhaka, with fast economic progress, lack of an inclusive planning and poor public transport, insufficient road space for both motorised and non-motorised modes, and no car restraining initiatives, cause dreadful traffic congestion and pollution. Hence, the city requires an alternative transport mode, such as bicycles, which are sustainable and space-efficient to eradicate the rising mobility issues. Like most developing Asian cities, Dhaka depends on non-motorised modes, public transport and paratransit vehicles. Despite low motorisation levels, the streets experience severe traffic congestion and contribute to the large volume of greenhouse gases and air pollution.

The complex hierarchy of transport regulatory authorities and lack of integrated planning policies contribute to the city's inefficient mobility system. The city has modified its land use functions over the years to accommodate the growing demand for public facilities, and converted into mixed-use sectors, developing into a compact and highly dense urban morphology. The mixed-use phenomenon has increased short-distance trips mostly completed by rickshaws. The increased traffic flow into the streets has reduced the overall traffic speed to 4.5 km/h, even slower than riding bicycles on Dhaka roads. The small number of poor-quality public buses are always overcrowded, behind schedule, and do not have designated stops for the passengers, making the entire system inefficient.

Bicycles have gained popularity over the years as they move past traffic congestion and easily access the narrow lanes of the neighbourhoods, saving both time and transport fare for the users. Nevertheless, the lack of integration between the different transport modes keeps the cycling trend from utilising its full potential. Bicycles are used for a complete journey which is difficult in the case of longer distances. Although Dhaka has recently constructed bike lanes in two different neighbourhoods, they are disconnected from the entire transport network and remain occupied by vendors or illegal parking.

Before formulating policies, it is essential to identify the potential of cycling. The central part of Dhaka is a place that has seen a growth in cycling among the population. It is the city centre with public functions, green open spaces, and administrative and educational facilities, and famous for its historical and cultural buildings within walking distance. The neighbourhood has frequent bus services to accommodate people commuting for work or study in the district. However, due its administrative importance, numerous cars enter the area causing severe traffic congestion in the crucial nodes. The architecture of the university campus facilitates cycling and walking, and some people have already adopted using bicycles to avoid morning and evening traffic jam in this area. JoBike, a public bike-sharing scheme within the university campus also encourages students to cycle in the neighbourhood.



Photo credit: Kabiur Rahman Riyad, Dhaka, Bangladesh, 2022.
<https://unsplash.com/photos/bbqFB16vY5U>

The research emphasised the importance of finding solutions for the highly dense and traffic-congested Dhaka. Therefore, the question arises:

How can Dhaka increase its modal share of bicycles and formulate a cycling-inclusive policy framework?

The paper focused on finding strategies to promote cycling in the inner neighbourhoods of Dhaka. Analysing Dhaka's mobility situation and the city's inner core, the potential for incorporating bicycles in the current mobility scenario provided the basis for formulating the regulatory framework. The recommendations suggested integrated transport planning, infrastructure development, improving services and behavioural change, framed around the five essential criteria for cycling-inclusive transport planning.

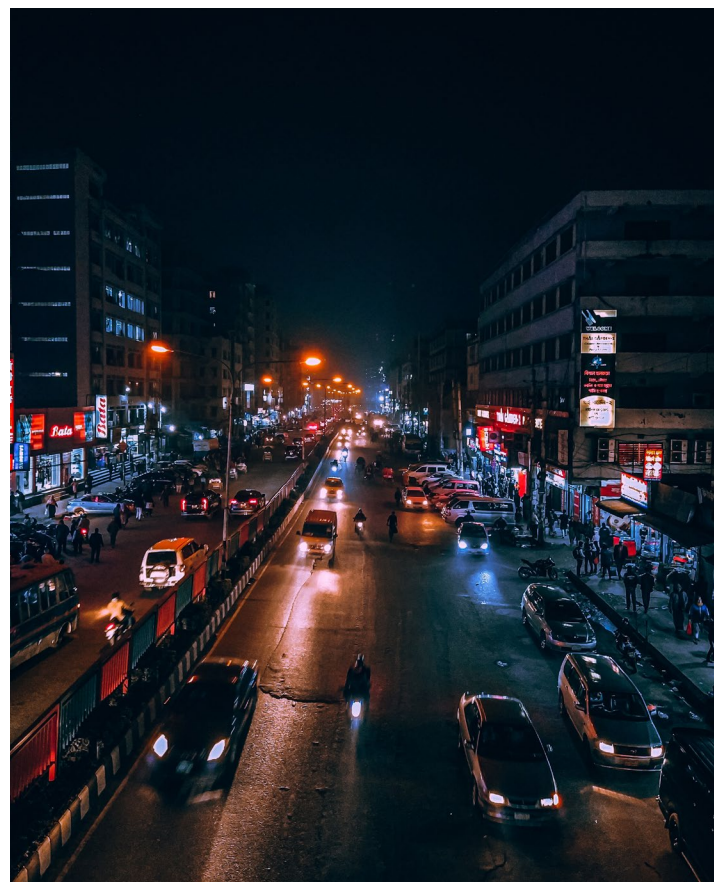
- 1. Planning is essential for promoting bicycle usage, and incorporating bicycles with public transport increases their modal share. In a successful cycling network, connecting bicycles as a feeder mode ensures a multimodal chain in the system, where cycling can be a part of the journey.**
- 2. To ensure safe cycling, it is crucial to have separate bike lanes to avoid collisions with motorised vehicles. Traffic calming methods also create safe streets by reducing the number of automobiles entering. For the inner neighbourhoods of Dhaka, these initiatives can have a positive impact on the growing cycling trend in the serene university campus.**
- 3. Introducing e-bikes may attract more potential users, such as office employees who find cycling a physical a task. Public bike-sharing schemes are also efficient initiatives for people interested in cycling without maintaining a personal bike.**

The policies mentioned are co-dependent, and implementing only one will not deliver the expected result, as we have seen in Dhaka's recent construction of isolated bike lanes.

Therefore, it is essential to develop an integrated system to achieve the maximum modal share of bicycles within the inner vicinities of Dhaka.

Formulating the policy framework of strategies that will increase the modal share of bicycles in the inner parts of Dhaka requires an in-depth analysis of the existing mobility situation. The lack of information explicitly regarding cycling and its modal share was a limitation of this research. However, the suggestions presented in this paper are a compilation of the analysis of the available data on the mobility situation and effective policies from the case examples discussed in the literature review.

The expansion of Dhaka requires integrated strategies that are efficient in reducing traffic congestion and pollution, and in serving the growing population with a comfortable, safe and affordable transit system. The city needs alternate transport modes, such as bicycles which are sustainable, space-efficient and faster in the streets alongside the proposed mass public transport network. As the trend of cycling grows, it strengthens the fact that cycle-friendly infrastructure and services are essential for further increasing the cycling modal share in the streets of Dhaka.



Ahnaf Tahsin Rafi, Dhaka, Bangladesh, 2020.
https://unsplash.com/photos/1S-ciO_OdO

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