OPTIMIZING BUS TRANSPORT INFRASTRUCTURE: PROPOSAL FOR A FULLY FUNCTIONAL BUS TERMINAL WITH AN INTEGRATED PUBLIC BUS MANAGEMENT SYSTEM IN RAJSHAHI CITY

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ABSTRACT

The transportation system is an inherent element that is crucial to the functioning of society. Bus services are a key element of this transit framework. But in our country, no bus terminal has good facilities along with proper management. In Rajshahi, the newly constructed terminal remains non-operational, primarily due to the absence of an integrated public bus management system. Establishment of such integration would be able to enhance the overall management of the transportation system by mitigating the extreme congestion and overcoming the challenges that arise from the current management deficiencies across all relevant authorities. This project addresses two objectives: firstly, to conduct a comprehensive analysis of the current bus transportation infrastructure at Nowdapara Bus Terminal, Rajshahi. The second aim is to develop policy recommendations for the functionality and management of the Nowdapara Bus Terminal, Rajshahi. In order to achieve these objectives, we conducted community-based analysis and both social and physical surveys using questionnaires. Our findings show that Rajshahi's citizens are generally dissatisfied with the terminal's facilities and infrastructure, which has led bus operators, associations, and passengers to use other temporary bus stands in the city that cause major inconveniences for the public. A coordinated approach by the RDA, RCC, and RMP, among other authorities, is a solution to these problems according to experts and data-driven decision-making. It is possible to move the terminal to its intended location and establish an integrated public bus management system by providing the necessary transportation infrastructure, enforcing clear regulations, and providing incentives. The study highlights the importance of optimizing Rajshahi's bus transportation system by addressing the insufficient use of the Nawdapara Bus Terminal due to inadequate facilities, a lack of integration, and political obstacles. Our project further proposes suitable routes for shuttle and intercity bus services and recommends policies covering fares, facilities, and management strategies to promote an efficient, integrated bus system. Future research could further explore route constraints, fleet management, and feasibility studies to ensure the successful implementation of the proposed integrated shuttle bus service.

Keywords: *Terminal, integrated public bus management, regulations enforcement, incentives & Shuttle Bus*

1. INTRODUCTION

The Inter-District Bus Terminal located in Rajshahi City was established 19 years ago with the primary intention of reducing the traffic crisis coupled with transportation additions (Daily Observer, 2018; Banglapedia, 2021). However, it is now best with numerous operational and structural issues. The terminal has the capacity for full load of about 500 buses, however the terminal is limited in that there is no integrated bus counters, CCTV, lights, cloakrooms, and designated rickshaw and auto rickshaw stands (RHD & BRRL, 2017; Rajshahi Metropolitan Police, n.d.). The lack of drainage system enhances the issues, and flood waters often take over during the rainy season making the terminal uncomfortable for passengers and migrants (Masum & Rahman, 2007).

To address these issues, it is necessary to relocate the operation of the terminal to the specified area of the Nawdapara Bus Terminal. On the other hand, with the introduction of proper management systems and overall policies, it is possible to provide the city of Rajshahi with integrated public bus transportation that will be efficient and sustainable within the city (Salim et al., 2023). Through this study we conduct a comprehensive analysis to examine the current bus transport infrastructure and on the basis of this analysis try to build up policies which will help to enhance functionality and ensure better management of the terminal (Wang et al., 2013; Almasi et al., 2018; Arya Omnitalk, n.d.).

Bus stations usually signify off-road structures that offer minimal passenger services while bus terminals can vary from completely equipped facilities to just simple roadside stopping points. The position and layout of terminals have a major impact on the movement of vehicles and the effectiveness of the system. Although central terminals make it easier to get around, they often lead to traffic jams; thus, bigger cities are more and more using outer terminals together with feeder and shuttle services as a way to cut inner-city traffic and enhance operational efficiency (PPIAF, 2006).

The feeder bus service is an essential component providing connectivity for passengers traveling from local or neighborhood areas to major transit terminals for access to primary corridors and terminals. Feeder bus services provide supplemental links in a multimodal transportation system. They shorten travel time, enhance access, and improve the efficiency of the system. Feeder bus routes can increase the efficiency of the primary bus or rail corridor through improvements in timing and passenger load, cost-effectiveness of operations, and a reliable public transit system (Almasi, 2018).

Technological advancement and changing travel preferences have reduced reliance on long-distance bus services in some developing contexts, as passengers increasingly prioritize speed, comfort, and security. Inadequate terminal facilities and weak management structures further accelerate this decline, posing challenges for transport authorities responsible for terminal operations (Legowo & Kaharmies, 2023).

Urban bus systems operate optimally when in place with clear policies that guarantee coordination, regulation, and investment. Effective planning and enforcement create a reliable transit service that earns public trust while excellent transport policies set a precedent for effective and sustainability mobility (David Banister, 2008).

2. METHODOLOGY

2.1 Study Area:

We select Nawdapara Bus Terminal located at Rajshahi City Corporation Area. This terminal covers around 7.41 acres of land, and it was constructed in 2004 by RDA.The research included the more frequently used informal bus stands at Vodra and Sheroil, located within the city center. While all three bus stations contribute to congestion in the area, the more frequently used bus stands at Vodra and Sheroil are physically in a more congested area.

2.2 Evaluation of sample

Bangladesh's 2021 Census has reported that the population of Rajshahi City Corporation is 388811 and that of Rajshahi District is 2,909,622 and 775,260 households, out of which 37.6% live in areas classified as urban (Banglapedia, 2021). From all the methods of drawing a sample, we opted for simple random sampling. A sample size of 97 was determined for this study at 95% level of confidence, 50% population proportion, and 10% margin of error.

2.3 Data collection

2.3.1 Reconnaissance survey

First, a reconnaissance survey was conducted in the study area to ascertain its current state. This survey also evaluated the information's availability, its source, and the method for obtaining data from the study area. A reconnaissance survey is a crucial step in the data collection process and is carried out at the very beginning of the investigation to assess the study's potential viability.

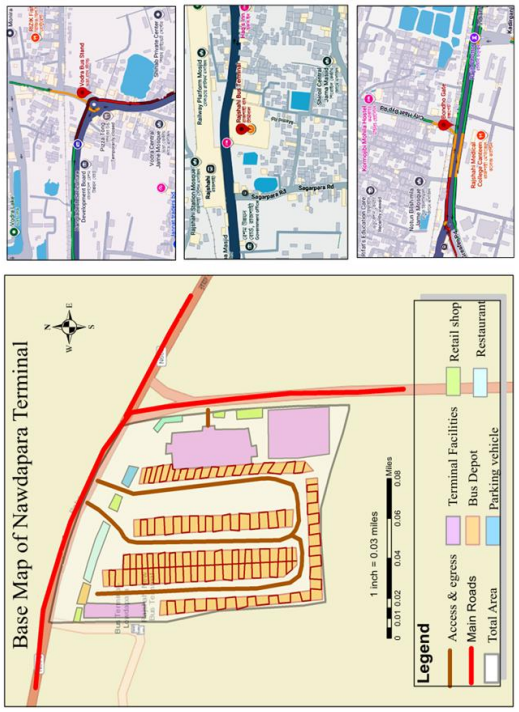

Figure 1: Base Map

2.3.2 Primary data collection

A thorough site survey was done to gather primary data, and a pertinent questionnaire was created for a questionnaire survey to be carried out in the selected area. The questionnaire was developed following a review of related research materials and a literature analysis. Both passengers and employees completed the questionnaire survey. These facts provided quantitative support. The information retrieved from key informant interviews provides insightful information for the study. The key informants' information played a role in the qualitative methodology.

2.3.3 Secondary data collection

Secondary data typically refers to information that is available quickly or that has already been acquired from a variety of sources. Additionally, when it comes to gathering information about Rajshahi City Corporation, Rajshahi's BBS data serves as the primary source for secondary data. In addition to BBS, research papers, journals, local, national, and online news portals served as reliable sources to gather important data for the work.

2.4 Data analysis

After the questionnaire survey was finished, the data was entered into the IBM SPSS Statistics 27 program. The survey's respondents had the option of providing multiple answers. We used this software to analyze this aspect. To analyze the responses, we defined the variables. After analysis the results are then shown in bar, column, and pie charts. We also created ANOVA tests for a better understanding of quantitative data (version: Microsoft office LTSC professional plus). The map of the study area was created using ArcMap 10.8.1. Google Earth Pro, Open Street Map, and Adobe Illustrator 2022 were used to create the site's base map.

2.5 Preparation of proposed plan and policy

3 routes to the terminal from different parts of the city which are Vodra to Nawdapara bus Terminal via Vodra bypass, Rail gate to Nawdapara bus terminal via Am chottor and Bondho Gate to

Nawdapara bus terminal via City Hat are proposed based on shortest path analysis. These policy recommendations have been developed based on comprehensive analysis and insight sought through the review of relevant policies as well as consultations with expert authorities. Following the review of literature on the role of policy in development, the proper role of policy in respect of Nawdapara Bus Terminal is discussed.
Also, the policy is added to guide the development smoothly. The SketchUp Pro 2021 program was used to create the 3D model. Lumion 6.5 has been used to render the project to give it a lively appearance.

2.6 Ethical Considerations and Limitations

There were a number of limitations that this study encountered. Detailed operational data remained a secret in most cases due to the unwillingness of bus owners and workers to cooperate, and access to relevant authorities was also limited due to administrative and time constraints. Besides, passenger surveys were difficult because of the time pressure, as many of the potential respondents were in a rush to catch the transport. Furthermore, official maps of the terminal layout were not available, which restricted spatial analysis to a limited extent and thus led to an exclusive dependence on field observations and secondary data.

3. RESULTS:

3.1 Existing Conditions & Scenarios

3.1.1 Nawdapara Bus Terminal

People prefer short and easy travel. Therefore, they avoid the Nawdapara bus terminal because of the additional transport costs associated with getting there. Political resistance also affects terminal relocation. No CNG, auto, or rickshaw stands are available for passengers after getting off the bus, limiting their travel options. There is also a lack of a drainage network and waste management system. There is not adequate space for all buses, and all buses cannot fit at once. The reconnaissance survey reveals a lack of food stalls, hotels, proper washroom facilities, and wayfinding; additionally, this terminal does not operate any long-distance buses and is located on the backside of the Rajshahi city center.

Figure 2: Existing Conditions of Nawdapara Bus Terminal

3.1.2 Vodra & Sheroil Stand

Bus stops in busy areas (Sheroil, Vodra) are creating traffic and hindering people's movement, and there is also a lack of a drainage network and waste management system, a lack of parking facilities, and a lack of signage and wayfinding. In bus stands, buses create excessive noise and pollution.

Figure 3: Existing Conditions of Vodra & Sheroil Bus Stand

Vodra and Sheroil are busy areas but do not have any traffic control police or signal.

3.2 Assessment of Current Situation

3.2.1 Efficiency of Current Bus Route

The research on the responses of passengers revealed that, according to them, the perceived route efficiency was divided into four levels: Very Efficient, Efficient, Moderately Efficient, and Not Efficient at All. A majority, 56.67% of the respondents rated the routes as Moderately Efficient, while 30% of the respondents stated Not Efficient at All.

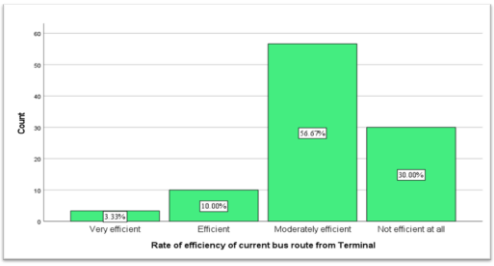

Figure 4: Rate of Efficiency of Current Bus Route from Terminal

In general, most of the respondents perceive the bus routes to be moderately efficient, which indicates the potential for improvement. On the contrary, a high percentage of dissatisfied passengers, 30%, indicate that actions should be taken without delay to raise the service performance. Infrastructure up-gradation, quality of the service, passenger experience, and technological integration also hold prime importance in order to raise efficiency.

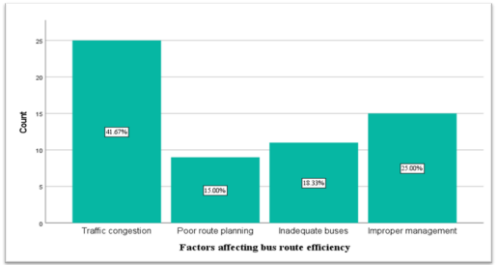

Figure 5: Factors Affecting Bus Route Efficiency

Additionally, the analysis identified the four factors that were having an impact on route efficiency. These included: traffic congestion 41.67%, improper management 25%, inadequate buses 18.33%, and poor route planning 15%. Of these, it was very clearly identified that the major issues which had impacted on the movement and reliability of the buses were related to traffic congestion and poor management.

3.2.2 Key Challenges in Public Bus Integration

68% indicates lack of coordination as the greatest challenge in the integration of public buses. 20% is the second largest segment represents the overlap of varying routes with each other.

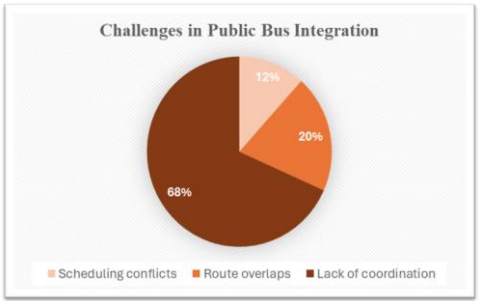

Figure 6: Key challenges in Public Bus Integration

This illustration justifies that the most significant problem is lack of coordination among the bus owners, which caused route overlaps, scheduling conflicts, and many other issues. The application of this data is very important for studies that aim to enhance the effectiveness and interconnectedness of public transportation networks and systems, since such data helps in pinpointing the planning and developmental concerns in each area.

3.3 Recommendations for Improvement

3.3.1 Suggestions for Improving Bus Route Efficiency

The dominant combined strategy of the respondents indicates a strong belief among the respondents that the improvements required in the frequency of the buses, planning of routes, and dedicated bus lanes have to happen at the same time to ensure maximum efficiency. In this scenario, it appears that the community has increasingly expressed the urgency for

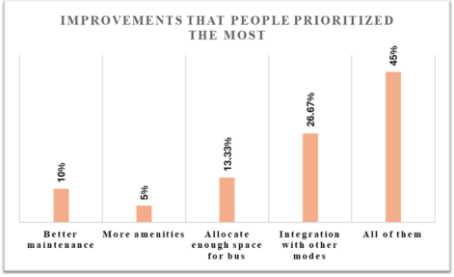

Figure 7: Improvements that Most of the People Prioritized

the upgrade required due to the accumulated delay because of the traffic.

In the same way, figure 8 shows the most important transport improvements the respondents were looking towards. The selection of combining all the improvements together contributed close to half of the responses, followed by other modes of transport at 26.67%. This was followed by sufficient allocation for buses at 13.33%, improved maintenance at 10%, and more amenities at 5%. The above findings have identified the need for a comprehensive and holistic approach that combines infrastructure development, intramodality, and management services so as to improve efficiency in the area of urban bus transport.

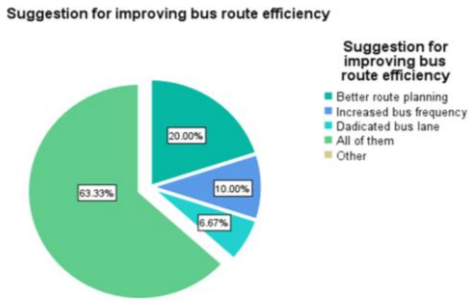

Figure 8: Suggestion for Improving Bus Route Efficiency

3.3.2 Suggested Policies for Improving Bus Transport

The question also led the respondents to suggest policies on how bus transport support can be improved. Of the respondents, **58.33%** recommended **improved enforcement** measures, **33.33%** said **regulations** should be improved, **3.33%** called for **more funding** and **5%** recommended that a comprehensive policy addressing **all three** of the approaches be called for.

Most of the respondents believe that through improved enforcement it's possible to enhance the bus transport service condition, and shifting of terminals will be successfully done with the integration of this enforcement, more funding, and better regulations.

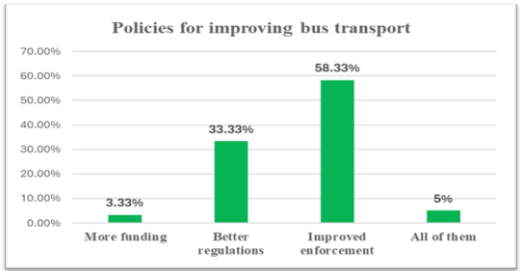

Figure 9: Suggested Policies for Improving Bus Transport

3.4 Satisfaction of overall service at Nawdapara

From the crosstabulation, we realize that the Sheroil bus stop is the most preferred by passengers across all satisfaction levels of passengers: satisfied, unsatisfied, and very unsatisfied. It shows that it is popular irrespective of how passengers feel about the Nawdapara terminal. At Vodra bus stop, a greater percentage of passengers are in the category of very unsatisfied at 33.3%. Nawdapara terminal is the least choice of all the bus terminals, especially among the passengers who do not like it and those who are very dissatisfied.

The results of the ANOVA test indicate that there is no significant difference in the satisfaction of passengers at all three stops. Although Vodra stop has the highest mean satisfaction, Nawdapara terminal is at the lowest, and these differences are not statistically meaningful. This indicates that the level of satisfaction is almost uniform at

Table 1: Crosstabulation within satisfaction and Bus stop

Satisfaction of overall service at Nawdapara * Bus stop that prefer for traveling from city Crosstabulation						
			Bus stop that prefers for traveling from city			Total
			Vodra stop	Siroil stop	Nawdapara terminal	
Satisfaction of overall service at Nawdapara	satisfied	Count	1	5	1	7
		% within Satisfaction of overall service at Nawdapara	14.3%	71.4%	14.3%	100.0%
	Unsatisfied	Count	8	34	5	47
		% within Satisfaction of overall service at Nawdapara	17.0%	72.3%	10.6%	100.0%
	Very unsatisfied	Count	2	4	0	6
		% within Satisfaction of overall service at Nawdapara	33.3%	66.7%	0.0%	100.0%
Total		Count	11	43	6	60
		% within Satisfaction of overall service at Nawdapara	18.3%	71.7%	10.0%	100.0%

Table 2: Satisfaction of overall service at Nawdapara through ANOVA test

ANOVA					
Satisfaction of overall service at Nawdapara					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.264	2	.132	.592	.557
Within Groups	12.719	57	.223		
Total	12.983	59			

the stops; however, there is a need for some improvement at Nawdapara Terminal.

The analysis of Nowdapara Bus Terminal, however, indicates that there is a lack of efficiency and coordination in the bus transportation system of Rajshahi. Most complaints in the survey was about delays and that passengers were not satisfied with present services, which reflects operational difficulties of bus scheduling, driving frequency and terminal administration. These become sources of inconvenience to commuters and determine the overall reliability of public transport in the city (A. B. Salim, 2023). One of the primary causes of these traffic delays and inefficient road systems is due to congested traffic and insufficient roads. These issues contribute to delays and make the system less reliable. " Random parking on streets" Illegal parking, narrow roads, and lack of effective traffic management further exacerbate delays and decrease bus system reliability (Nisat Tabassum Prova,2024).

Rajshahi had no organised city bus service up to the time of this study; it is heavily dependent on rickshaw and other non-motorised transportation. This historical lack of organized services is the root cause for problems such as route overlaps, poor coordination, and inefficient scheduling even now (S.M. Abdullah Al- Masum, 2007). Service quality of the transports also affect passenger commuting behavior. When the public transport network is not reliable, many people tend to use their private cars more often generating traffic jams and a vicious circle that impacts on the whole urban mobility system (Muhaiminul Islam, 2019).

Participants in the current study expressed a need for more stringent rules and implementation as well as more unified management. Evidence from other cities in Bangladesh, such as Dhaka suggests that increasing institutional coordination, scheduling systems and enforcement of traffic laws can also increase the efficiency and integration of buses (M. Shafiq-Ur Rahman, 2012).

3.5 Proposed Solutions

3.5.1 Proposed Routes Plan & Stands

Proposed 3 routes to the terminal from different parts of the city which are Vodra to Nawdapara bus Terminal via Vodra bypass, Rail gate to Nawdapara bus terminal via Am chottor and Bondho Gate to Nawdapara bus terminal via City Hat. Proposed 3 bus stop's locations in the different parts of the city which are Vodra Bus Stop (In Vodra Mor, beside 'Otithi' Hotel), Sheroil Bus Stop (Opposite of the Rajshahi Railway Station) and Bondho Gate stop (Beside the Station Road adjacent to Bondho Gate).

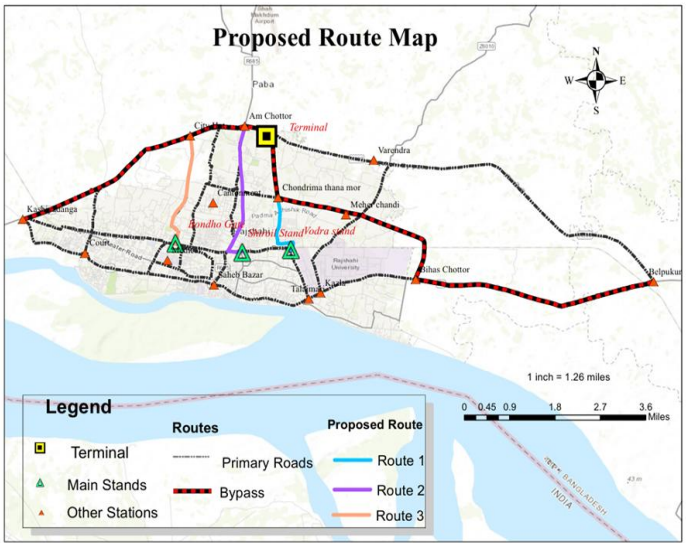

Figure 10: Proposed Route Map

Bus services for the three routes mentioned above will interlink Vodra, Sheroil, and Bondho gate bus stops with a shuttle bus to reach Nawdapara bus terminal. This will ensure ease of access to that route. In this case, multimodal integration will ensure smooth travel from one mode of transport to another. Fixed charges against buses with time intervals will make it reliable and convenient for the passengers.

Passengers from different parts of the city will arrive at these three buses stands first, which are close to the city center and easy to access. From there, the determined shuttle buses will take them to the Nawdapara Bus Terminal. Long-distance buses (intercity buses) will use the Notun bypass and Bihas Chottor to leave the city directly from the terminal without re-entering the city. This change will eliminate the traffic congestion these buses currently cause throughout the city. Coordinating

schedules between intermediate transport modes and intercity buses is crucial for improving connectivity and reducing passenger wait times.
In Vodra, Shiroil and Bondho Gate stops, there is a need for enhancement in the facilities and infrastructure as the incoming passengers will have to arrive at those areas before going to the terminal.

Route	Distance	Shuttle Bus Fare (As bus fare for per kilometer in Bangladesh is 2.12 Taka) (BSSNEWS, 2024)	Time Required (As average bus speed in Rajshahi city is 37 km/h)(RHD & BRRL, 2017)	Current Autorickshaw Fare & Time
Bondho Gate to Nowdapara bus terminal via City Hat	3.70 Miles/ 5.95 km	5.95*2.12 = 12.614 Taka	9-10 minutes	20 Taka, almost 30 minutes
Rail Gate to Nowdapara bus terminal via Am Chottor	3.13 Miles/ 5.04 km	5.04*2.12 = 10.6848 Taka	8-9 minutes	15 Taka, 20-25 minutes.
Vodra to Nowdapara bus terminal via Vodra bypass	2.55Miles/ 4.1 km	4.1*2.12 = 8.692 Taka	6-7 minutes	15 Taka, 12-18 minutes.

Table 3: Proposed Bus Fares for Shuttle Buses

3.5.2 Proposed Bus Fares

At present, the lack of intermediate bus routes means that people living in the city have no other option but to use rickshaws and auto-rickshaws, the former being expensive and slow. The rickshaw rate is about Tk. 2.5–3.5 per kilometer, while the proposed bus rate is Tk. 2.12 per kilometer, so the latter is 2–3 times cheaper than auto-rickshaw travel. Therefore, the passenger bus service in the city would lead to a major reduction in transport costs.
Other means of transportation have a capacity of just 2 to 10 passengers, while shuttle buses (the small ones or the big ones) can take up to 40 passengers which in turn helps to lessen the amount of congestion on the roads. Along with this, the average travel time per trip today is around 30 minutes, and over 50% of trips are made by slow-moving modes like rickshaw, walking, or bicycle. Considering that bus speeds are 5–10 times faster than non-motorized vehicles (Masum & Rahman, 2007), the proposed service would greatly cut travel time and improve the mobility of people overall.
Hence, the proposed shuttle bus system is a way to go not only in terms of money and costs but also in terms of improving the city's affordability, efficiency, and traffic flow.

3.5.3 Proposed Bus Terminal & Bus Stop Facilities

Facilities to be installed inside Nawdapara, Rajshahi bus terminal should take into consideration comfort for the passengers and the drivers, with a view towards community concern. The following are simple facilities that should be included in the facility design at the bus terminal:

1. Passenger Facilities:

Figure 11: 3D model of Nawdapara Bus Terminal

In waiting areas for ensure safety, there is a comfortable seating arrangement. Restrooms facilities are provided for all passengers which are clean, easily accessible, well- maintained and spacious enough. Information Displays are given which display information regarding departure and arrival in real time. Ticket counters and machines are easily accessible to the customers to avoid rushing into the counters. In Nawdapara Terminal, there are also free access to Wi-Fi, device charging stations, concessions or vending machines, luggage storage and retail stores.

Figure 12: 3D model of Vodra Bus Stand

2. Access of Features:

Wheelchairs Ramps is a facility where all customers can access with ease. Braille Signage, for friendly use by visually impaired travellers. Tactile Ground Indicators used assist in the directional movement of passengers.

Figure 13: 3D model of Sheroil Stand

3. Safety and Security:

CCTVs are used for surveillance and enhancing security. The terminal should be equipped with emergency services to maintain passenger safety and operational security. There has enough lighting. Safe zones are always provided with lights.

4. Driver Amenities

Facilities that should be extended to the driver include the provision of rest areas, shower rooms, and allocated bus parking slots. There should have Additional Features Information Centre which is a desk providing information staffed by personnel. Desks for information, community areas for local events, bike racks, and green landscape areas are among the proposals that would not only incorporate sustainability but also promote community interaction.

Figure 14: 3D model of Bondho Gate Bus Stand

Additionally, well-appointed bus stops improve accessibility, safety, and passenger satisfaction. While travelers are waiting, shelters protect them from the sun and rain, and seating is another feature that makes them feel comfortable. Easy access to route and schedule information is ensured by information displays, timetables, and maps. Additionally, the area is maintained safe and clean by appropriate lighting and garbage disposal. The whole scenario is made more convenient and safer by the existence of amenities like bike racks, emergency phone booths, and security cameras. Finally, amenities like Wi-Fi and restrooms significantly improve passenger comfort, making the entire transit space safer and more user-friendly.

3.6 Administrative Procedure and Policy Guidelines

3.6.1 Case Study

A likely similar example can be-

In 2015, Dhaka North City Corporation (DNCC) mayor Annisul Haque visited Gabtoli Bus Terminal and said it would be freed from traffic congestion by December 30. The Bus-Truck Owners Association and workers union agreed to remove their vehicles from Gabtoli and Amin bazar bus terminals by December 29, the DNCC mayor told reporters after a meeting with bus-truck owners and workers at Gabtoli bus terminal in the capital. He also added that the situation in this area will change

soon as the bus-truck owners and workers agree to clear the place. Earlier on 29th December 2015 morning, flanked by local public representatives and traffic police, the DNCC mayor ordered the leaders of bus-truck owners and workers to remove the vehicles from the roads adjacent to the terminal. Gabtoli Bus Terminal Workers Association convener Mofizul Haque, Dhaka District Vehicle Workers Union president Abbas Uddin, and Dhaka District Truck Owners Association president Md. Obaidullah were also present during the mayor's visit. After 30th December 2015, the Gabtoli bus terminal was fully freed from traffic congestion and illegal occupation of spaces (DhakaTribune, 2015).

3.6.2 Administrative Procedures and Policies

Proposed Administrative Procedure and Policy Guidelines for the Shifting of Bus Terminal from Sheroil to Nowdapara:

3.6.2.1 Official Notification and Stakeholder Engagement:

The Rajshahi Development Authority (RDA) holds jurisdiction over both the Shiroil bus stop and the Nowdapara bus terminal. RDA will convene a meeting with the Bus-Truck Owners Association and Workers Union of Rajshahi to discuss the relocation plans. After this consultation, a formal announcement will be made to notify all concerned individuals regarding the resolution to move operations from Sheroil to Nowdapara. This preliminary engagement allows constituent members to be aware of the developments and raise issues or make suggestions, hare by enabling the transition process.

3.6.2.2 Bus Route Permit Regulation by BRTA

Bangladesh Road Transport Authority (BRTA) is the apex Government Organization & regulatory body to control manage and ensure discipline in the road transport sector under the Ministry of Communication for carrying out the purposes mentioned in the "Motor Vehicle Ordinance-1983". This department is working presently for providing services namely Registration of Motor Vehicles, Issuance of fitness certificate of motor vehicles, Issuance of Route permit for Transport Vehicles, Issuance of Motor Driving License and so on.(*About BRTA | Brta*, n.d.)

- Following the relocation notice and successful transition of the bus terminal, the Bangladesh Road Transport Authority (BRTA) will oversee the issuance of route permits for buses operating to and from the new terminal.
- The designated routes are as follows:
  - ✓ Bondho Gate to Nowdapara bus terminal via City Hat.
  - ✓ Rail Gate to Nowdapara bus terminal via Am Chottor.
  - ✓ Vodra to Nowdapara bus terminal via Vodra bypass.
- To maintain order and ensure compliance, any buses that do not adhere to these established routes or attempt to enter the city will face **license cancellation** by BRTA. This strict regulation aims to control traffic flow and ensure the safety of passengers.

3.6.2.3 Traffic Management by RMP

The Traffic Division of Rajshahi Metropolitan Police has been entrusted to ensure smooth flow of traffic in Rajshahi. The traffic Division also works diligently and efficiently in close collaboration with the Ministry of Communication, Rajshahi City Corporation (RCC), Bangladesh Road Transport Authority (BRTA) and other concerned authorities (*Rajshahi Metropolitan Police*, n.d.).

The Traffic Division of the Rajshahi Metropolitan Police (RMP) is expected to facilitate the implementation of the approved bus routes and control the traffic situation both during and after the terminal switch. There will be regular checks on the level of compliance; necessary fines and penalties to be stated according to the national traffic laws and regulations should be imposed on drivers and bus operators who commit violations. This is incredibly important and needed because it ensures that safety and order are maintained within the streets.

3.6.2.4 Enforcement of Authority and Maintaining Discipline

Maintaining order at the new terminal and on the respective routes may require the intervention of magistrates and law enforcement agencies during the relocation exercise. These authorities will utilize traffic control, road discipline, terminal management, and any political or other disruptive activities related to the movement. Their Presence will help to facilitate the smooth transition of the activities.

3.6.2.5 Coordination by the Rajshahi Divisional Commissioner

The Rajshahi Divisional Commissioner will oversee the entire relocation process, coordinating efforts between RDA, BRTA, and RMP. This centralized coordination is essential for ensuring that all aspects of the transition are aligned and that communication flows seamlessly among the involved authorities. The Commissioner's leadership will facilitate effective problem-solving and decision-making throughout the process.

Divisional Commissioner	Rajshahi Development Authority (RDA)	Bangladesh Road Transport Authority (BRTA)	Rajshahi Metropolitan Police (RMP)	Rajshahi City Corporation (RCC)	Bus-Truck Owners Association and Workers Union

Table 4: Engaged Authority and Stakeholders

3.6.3 Barrier in Policy Implementation

Main Barriers and Demands of the Bus-Truck Owners Association and Workers Union other Authorities-

The main reason that does not want to move from Sheroil to Nowdapara is that if they move, then they have to double or triple the number of staff and counters of buses. Then they will have to take counters in Sheroil and Vodra beside the Nawdapara terminal. They will have to also increase the number of items; thus, there will be a significant rise in expenditure for the bus owners. The bus owners are afraid of adapting to the new place as they are settled and comfortable in Sheroil for a lengthy period. They fear that the passengers will take their faces away from their service if the terminal moves to a new place. There is lack of desire and coordination of the legislative authorities (RDA, RCC). There are also political problems like extortion and lack of desire of the policy-making politicians. The terminal is little bit outward and distant from the city center which makes it out of their comfort zone.

3.6.4 Solutions of Barriers

Once the policy has been made then it will have to be strictly applied so that the people and the bus owners are bound to go there. There must be less rent for the bus counters and provide adequate bus and stuff management and maintenance facilities. The bus terminal should be designed with all necessary facilities and standards so that the bus owners and passengers would like to go there. The legislative authorities (RDA, RCC, RMP) have to force the bus owners to move there. We will have to stop extortion from the terminal and buses and goodwill off the policy-making politicians. Government incentives will have to be paid for the bus counter allocation and the feeder bus service implementation.

4. CONCLUSION

This study highlights the urgent need for optimizing Rajshahi's bus transport infrastructure, focusing on the Nawdapara Bus Terminal. The comprehensive analysis revealed significant challenges in the current system, including the underutilization of the terminal due to poor facilities, lack of integrated services, and political resistance. The reliance on informal bus stops, like Sheroil, leads to congestion, environmental degradation, and inefficiency in public transportation.

To address these issues, a data-driven solution has been proposed, emphasizing the development of a fully functional bus terminal at Nawdapara, integrated with a public bus management system. Key recommendations include implementing shuttle bus services, improving terminal facilities, enhancing coordination among stakeholders (RDA, RCC, RMP), and enforcing regulatory measures to manage bus routes and reduce congestion.

The success of this proposal will depend on strong governance, stakeholder collaboration, and continuous policy enforcement. Future research should explore further improvements in fleet management and passenger experience to ensure the long-term viability of Rajshahi's transportation infrastructure.

DECLARATION OF USE OF AI

The authors declare that artificial intelligence tools were used only for language correcting and clarity improvement during manuscript preparation. The research methodology, data analysis, modeling, interpretation, and conclusions were conducted entirely by the authors without the use of AI tools. The authors take full responsibility for the content of this work.

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