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Selection of Bus Rapid Transit Corridor for Kabul City, Afghanistan: A Case Study

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ABSTRACT

This thesis presents a comprehensive study on the selection of a Bus Rapid Transit (BRT) corridor in Kabul. The objective of this study is to identify the most suitable corridor for BRT implementation, based on the needs and preferences of the local population, as well as the technical and operational requirements of the BRT system. The study employed a combination of qualitative and quantitative methods, including field surveys, interviews, and literature reviews. A multi-criteria decision-making (MCDM) framework was used to analyse the data, taking into account a variety of factors including travel demand, land use characteristics, road infrastructure, and environmental implications. The results of the study indicate that [*Kote Sangi-Deh Afghanan-Sara Shamali*] is the most suitable corridor for BRT implementation, based on its high travel demand, mixed land use characteristics, and existing road infrastructure. The study also identified a set of key success factors and challenges for BRT implementation in the selected corridor, such as the need for adequate financing and institutional support, the importance of stakeholder engagement and public awareness, and the need for effective integration with other modes of transport. The present methodology combines both, existing travel demand estimates and feasibility analysis in terms of traffic and road infrastructure characteristics for selection and phasing of BRT corridors. Overall, this study contributes to the body of knowledge on BRT corridor selection, and it provides valuable insights for policymakers, planners, and transit professionals who are interested in implementing BRT systems in similar contexts. The study also highlights the importance of conducting rigorous and transparent selection processes that consider a range of factors, beyond technical and operational considerations, to ensure the success and sustainability of BRT systems.

Keywords: BRT corridor, Ridership, Feasibility checking, MCDM, Travel demand, Feasibility, and Analysis.

INTRODUCTION:

Transportation planning plays a crucial role in the development & sustainability of urban areas (Wright L., 2007) As cities grow and populations increase, the demand for efficient and reliable transportation becomes more pronounced (Levinson, 2012). Effective transportation planning helps to address the diverse mobility needs of residents, promotes economic development, enhances social equity, & contributes to environmental sustainability (UITP, 2019). Efficient and sustainable transportation systems are crucial for the overall development of cities (Transportation Cooperative Research Program. Report 90, 2003). They enable the smooth movement of people & goods, supporting economic activities & enhancing productivity. Reliable transportation networks facili-tate the daily commute, ensuring that individuals can access education, healthcare, employment opportunities, and other essential services efficiently. Additionally, efficient transportation infrastructure is instrumental in attracting investments, fostering business development, and promoting economic vitality within urban areas (PACIONE, Urban Geography (2nd Edition), 2008).

Fig. 1: Multi Model Urban Planning, MoUD.

Kabul city, like many urban centers, faces significant challenges related to transportation. Traffic congestion is a pressing issue, resulting in long travel times, increased fuel consumption, and productivity losses (Samiullah, 2019). The lack of well-planned road networks, inadequate public transportation options, & limited alternative modes of transport further increase the problem (Zafari, 2016). This congestion not only hampers economic activities but also impacts the overall quality of life for residents, leading to frustration and reduced livability. Inadequate public transportation is another challenge faced by Kabul city (Ministry of Urban Development and Housing, 2019). A reliable and comprehensive public transportation system is vital for providing affordable and accessible mobility options to a large population. However, Kabul's existing public trans-portation infrastructure may not adequately meet the needs of the growing population (Aziz, Assessment of Sustainable Transportation Planning in Kabul City: Problems and Prospects, 2017; Niazy *et al*., 2023).

Fig. 2: Urban Planning & Management, MoUD.

This situation places a heavy reliance on private vehicles, further contributing to traffic congestion and air pollution. Environmental concerns are also significant in urban areas, including Kabul city. Air pollution and greenhouse gas emissions from the transportation industry have a negative impact on both the environment and public health. As the population increases and vehicle ownership rises, the environmental impact becomes more pronounced. Promoting sustainable forms of mobility, such as public transportation, walking, and cycling, and mini-mising the use of private vehicles can help solve these issues (Zafari, 2016). Transportation planning is of paramount importance in urban areas, including Kabul city. An efficient and sustainable transportation system is crucial for the development, economic growth, and improved livability of cities. Addressing challenges related to traffic congestion, inadequate public transportation, and environmental concerns requires comprehensive transportation planning strategies that prioritize the needs of the population and promote sustainable mobility options. By focusing on these aspects, Kabul city can work towards creating a more efficient, accessible, & environmentally friendly transportation system that benefits its residents and supports its overall development.

An Overview of the BRT system

Bus Rapid Transit (BRT) is a high-quality public transportation system that combines rail transit's efficiency with buses' flexibility. It is intended to satisfy the mobility needs of urban regions by providing rapid, dependable, & comfortable transit services. BRT systems, like other kinds of public transit, have the potential to have a considerable impact on urban economic, social, and environmental growth, however the economic impact of BRT has received less attention to yet (Nelson, 2011). Here is an overview of BRT systems, including their characteristics and advantages:

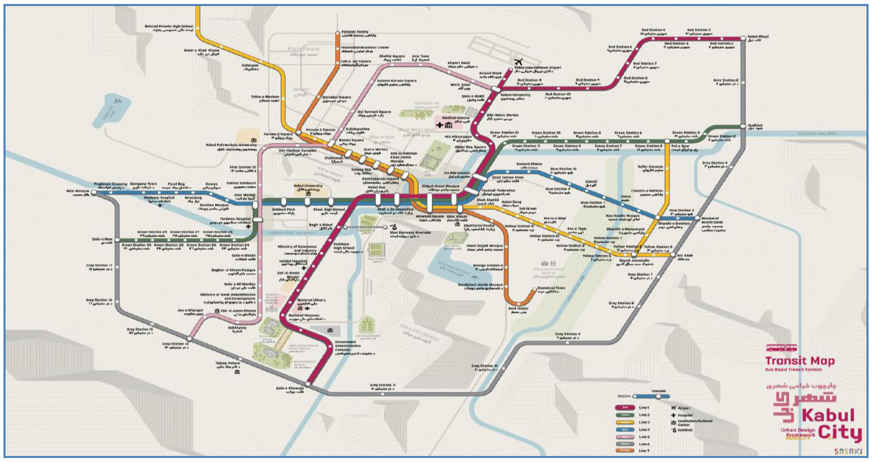


Fig. 3: Transit Map of Kabul city, Source: (SASAKI, 2015).

The Definiation & Features of BRT

The Federal Transit Administration defines BRT as a "rapid mode of transportation that can combine the quality of rail transit with the flexibility of buses." (Thomas, 2001).

Fig. 4: BRT Elements ((UITP), 2019).

Bus Rapid Transit is a high-quality, customer-oriented mode of urban transportation that provides quick, comfortable, & low-cost urban mobility. BRT systems include some or all of the following components; many of them can also help to improve normal bus services (Anwar, 2012).

- Modern bus stops that are more like bus "stations," with pre-board ticketing and comfort-table waiting areas;
- Dedicated bus corridors with strong physical separation from other traffic lanes.
- Big, roomy, comfortable, and ideally low-emission buses.
- Physical avoidance of buses (such using under-passes) or signal priority for buses at crossings.
- Coordinating the development of new feeder routes to the bus station with drivers of smaller buses and Para transit vehicles.
- Integrated ticketing, which, where possible, permits free transfers across transit operators and modes (bus, tram, metro).
- The use of GPS or other locating technologies with a central control centre that keeps track of the location of the bus at all times and enables quick problem-solving.
- Information about anticipated bus arrival timings is displayed in real-time.
- Convenient station access for taxis, pedestrians, and cyclists, as well as sufficient bike storage.
- New licensing, regulation, and operator payment procedures for buses.
- Park and ride lots for stations outside the urban center;
- Land-use reform to promote larger densities near to BRT stations.

BRT services are faster, more frequent, have better information, and are more comfortable than normal bus services. BRT is an umbrella term for infrastructure, vehicles, urban design, and administration (Wright, 2007).

Advantages of BRT Systems (Belhaj, 2017)

There are many reasons for developing BRT systems.

1. Reduced Travel Times: BRT systems, with their dedicated bus lanes and efficient operations, significantly reduce travel times compared to regular bus services. This is achieved by by-passing traffic congestion and ensuring faster and more reliable journeys. Furthermore, when comparing average boarding and alighting times between the BRT system and the current bus service, it is clear that the BRT system is 20 times faster (Anwar, 2012).
2. Improved Reliability: By operating in dedicated lanes and having priority at intersections, BRT systems offer greater reliability in terms of scheduling & adherence to timetables. Passengers can rely on BRT services for predictable and consistent travel times.
3. Increased Capacity: BRT systems can accommodate large volumes of passengers due to their high-capacity vehicles & efficient boarding processes. This helps address the demand for public transportation in densely populated urban areas. The passenger capacity of a bi-articulated bus is 250 and even more in double bi-articulated bus.
4. Enhanced Passenger Experience: BRT systems often provide improved passenger amenities, such as comfortable stations, real-time informa-tion displays, & efficient fare collection systems. These features contribute to a more pleasant and user-friendly travel experience.
5. Environmental Benefits: BRT systems help reduce greenhouse gas emissions by encouraging a shift from private vehicles to public transporta-tion.
6. By providing an attractive and efficient alternative, BRT can contribute to decreased traffic congestion and improved air quality in urban areas (Project, 2016).
7. Higher Speed - It is found that the average speed of large and double decker buses are 13.7 and 17.22 km/hr respectively, whereas average operating speed of BRT is 25 km/hr.
8. Decrease Delay of Intersection - Intersection is the most critical part of the road network and the significant delay occurs in every intersection particularly in mix mode operation like Dhaka. From a study on Uttara to Motijheel route, it is found that there are 8 critical intersections where, the total delay time on these intersections vary from 25 to 60 minutes, 42.5 minute on in average in the peak hour especially evening peak hour (Rahman 2008). Because of signal priority, BRT would not experience this issue, and thus has the ability to decrease a large source of delay in bus operations.
9. Increased operational cost-efficiency - When BRT service is introduced to a corridor, indicators of operating efficiency such as the passengers per revenue hour, subsidy per passenger mile, and subsidy per passenger can improve.
10. Improved environmental quality - By attracting high-quality users & employing modern automobiles with cleaner engine systems and emissions controls, BRT may enhance air quality, noise levels, and general congestion.
11. transport-friendly land development - Investments in BRT infrastructure and related streetscape enhancements, like other high-quality transport modes, may result in favourable development effect.

Overall, BRT systems offer numerous advantages that make them an effective solution for urban transportation challenges. The combination of dedicated lanes, high-capacity vehicles, efficient boarding processes, & passenger amenities results in reduced travel times, improved reliability, increased capacity, and environmental benefits. These factors make BRT an attractive option for cities looking to enhance their public transportation infrastructure and provide efficient mobility solutions to their residents.

Global Trend of implementing BRT systems

BRT (Bus Rapid Transit) systems have achieved outstanding success in many cities all over the world. These systems, which stand out for their designated bus lanes, premium vehicles, and excellent operations, have shown to be successful in managing urban transit issues. The success figures associated with BRT implementation are impressive. For instance, the TransMilenio BRT system in cities like Bogotá, Colombia, has cut commute times by 27% and accident rates by 48%. More than 75% of trips in the Brazilian city of Curitiba are now taken on public transportation as a result of the Rede Integrada de Transporte (Integrated Transportation Network) BRT system's installation. BRT systems also have improved air quality and reduced greenhouse gas emissions, which have positive effects on the environment.

These success statis-tics demonstrate how BRT may be a sustainable, cost-effective way to increase accessibility, improve urban mobility, & offer citizens excellent transport services. Bus Rapid Transit (BRT) systems have become widely used, with many cities and nations accepting the latest form of urban transit. Here is a succinct rundown of the effective BRT systems that have been implemented around the world, along with their effects on sustainability and urban mobility:

Curitiba, Brazil: Curitiba is often recognized as the pioneer of BRT systems (Levinson H. Z., 2003). In the 1970s, it established the Rede Integrada de Transporte (Integrated Transportation Network), which became a model for BRT around the world. The system features dedicated bus lanes, high-frequency services, & efficient integration with other modes of transportation.

Fig. 5: Curitiba Metrobus - tube station and typical vehicles.

Bogotá, Colombia: The TransMilenio BRT system in Bogotá is one of the most renowned BRT projects globally. It has significantly improved mobility and accessibility for residents, reducing travel times and providing a reliable transportation option. The system incorporates dedicated bus lanes, modern stations, and high-capacity articulated buses.

Fig. 6: Bogotá TransMilenio - median busway and stations.

- Guangzhou, China: The Guangzhou BRT system, launched in 2010, has been highly successful in improving urban mobility. It features dedicated bus lanes, efficient fare collection systems, and real-time information displays. The system has reduced travel times, increased the efficiency of public transportation, and encouraged a shift from private vehicles to buses.
- Istanbul, Turkey: Istanbul's Metrobüs system is another notable BRT project. It has played a crucial role in the addressing the city's traffic congestion and improving public transportation options. The system offers dedicated bus lanes along major corridors, high-capacity buses, and advanced fare collection systems.

In recent years, numerous Asian cities have adopted BRTS more often. The 12.9 km Trans Jakarta bus route was established in 2004 and runs through the heart of the city. As part of the city's public transportation reform, Seoul erected BRT routes, while Beijing began first-stage commercial BRT operation (Naoko, 2006). The BRT system's initial phase has been implemented place in Delhi, India (RITES, 2005). On that specific BRT section, however, this created a few accidents and traffic snarls, and the extension of the same has been put on hold until some of the design concerns are resolved.

Integration into Transportation Networks

- BRT systems have been integrated into the transportation networks of various cities, comple-menting existing modes of transportation. They often connect with rail systems, providing seam-less transfers and enhancing overall mobility options for passengers.
- BRT systems have demonstrated success in lowering the use of private vehicles and traffic congestion. They encourage people to use public transport for their regular travels by offering a dependable and effective substitute, lowering the number of cars on the road.
- BRT systems have helped to lower greenhouse gas emissions and improve air quality. These programmes aid in lowering pollution and the environmental impact of transportation by encouraging the use of buses rather than private vehicles.
- Successful BRT projects have also influenced urban planning strategies, leading to the deve-lopment of transit-oriented development (TOD) around BRT corridors. This approach fosters mixed-use development, walkability, & impro-ved access to services and amenities.

The global trend of implementing BRT systems has demonstrated their effectiveness in enhancing urban mobility, sustainability, & public transportation options. Successful projects in various cities and countries have showcased the positive impact of BRT systems, such as reduced travel times, improved accessibility, reduced congestion, & environmental benefits. Integration of BRT into transportation net-works has contributed to a modal shift from private vehicles to public transportation, leading to more sustainable and efficient urban transportation systems.

BRT in the context of Kabul city

The capital city of Afghanistan, Kabul, is located in the country's northeastern region among mountains at an elevation of roughly 1800 metres above sea level, at 34°31′ north latitude and 69°11′ longitude. Figure following illustrates the city's 22 districts and total area of 1023 km2 (JICA, 2011). The city is divided into two sections by the Asmaye and Sher Darwaza moun-tains. Due to the inefficiency of the two main roads connecting these areas relative to the demand for city transportation, the transportation routes were structured using a radial model (Noori, 2010). Kabul City's population and traffic are both expanding quickly. There are approximately 600,000 automobiles using the city's existing transport system, and the population is close to 5 million (Alami, 2018) .

Table 1: Vehicles in Kabul City (Directorate, 2016).

Transportation means	Year 2018
Private cars	410,543
Taxis	26,761
Trucks	53,947
Buses	23,560
Merorcycles	14,660
Govt. Vehicles	42,897
Trmporary No. Plates	12,131
Govt. & NGOs Vehicles	6,367
UN Vehi	5,977
Core Diplomat	1,831
Total	598,674

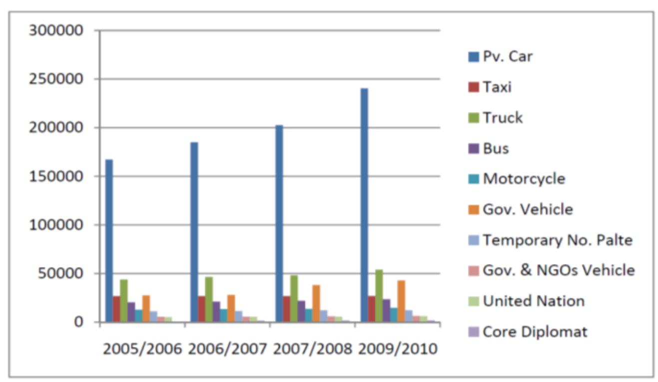


Fig. 7: The number of vehicles in Kabul is increasing accordingly (Alami, 2018).

In Kabul, roads have a radial shape and extend outward from the city's centre. The network is made up of paved arterial roads, which are wider; secondary roads, which connect arterial roads and often have 2-3 paved lanes; and neighbourhood and local or country roads, which are normally 1-2 lanes and unpaved. Nearly all of the important roads have been resurfaced as a result of the effective KM Development Programme, and several subsidiary and neighbourhood roads are paved every year. (SASAKI, 2015). The existing transport system in Kabul faces several challenges, including:

- Traffic congestion: Kabul is a rapidly growing city, and the existing road network is unable to handle the increasing volume of traffic. As a result, traffic congestion is a major challenge, leading to long travel times and increased air pollution (Haroun, 2019).
- Lack of infrastructure: Kabul lacks modern transportation infrastructure, including dedicated bus lanes, bus stops, and terminals, which makes it difficult to implement a reliable and efficient public transportation system (Noori, 2010).

Fig. 8: Maiwand Avenue, Kabul (Alami, 2018).

Fig. 9: Road Traffic Condition, Kote Sangi (Hanak, 2016).

- Poor quality of roads: Many of the roads in Kabul are in poor condition, with potholes and other damage, which increases travel time, leads to increased vehicle maintenance costs, and makes transportation more difficult.
- Inadequate public transportation system: The existing public transportation system in Kabul is largely informal and unregulated, with shared taxis and mini-buses dominating the market. These modes of transportation lack standards for safety, reliability, and comfort, which results in overcrowding, long waiting times, and poor service quality (Alami, 2018).

Fig. 10: Millie Bus Public Transportation in Kabul (Hanak, 2016).

- Lack of resources: Afghanistan is a poor country with few resources for investing in transport infrastructure and services. This makes addressing existing transport issues and improving the quality of Kabul's transport infrastructure difficult.
- Safety Concerns: The informal transportation sector in Kabul raises safety concerns, as there is a lack of regulations and proper monitoring. This can impact the safety and security of passengers.

These transportation challenges in Kabul contribute to reduced mobility, increased travel times, environmental degradation, and overall dissatisfaction among residents. Addressing these challenges requires a comprehensive transportation planning approach, including the introduction of efficient and sustainable solutions like a well-designed BRT system, which can alleviate congestion, improve air quality, enhance accessibility, and provide a reliable public transportation option for the residents of Kabul.

The need for a BRT corridor in Kabul

Currently, around a third of total trips in Kabul rely on walking, and the most popular public transportation is Micro Bus. The current number of vehicles per day (VPD) is around 419,000. However, with the rapid increase of transportation demand, and the foreseeable increase in private car ownership, this VPD number could increase 10 times (SASAKI, 2015). Without an implemented BRT network and substantial ridership, the road network will be non-functional as private vehicles would be the only way to get long distances across the city. In this scenario, private cars would overwhelm the roads. A fully operational BRT system will reduce private car ownership and reduce VPD by nearly 75%. This is because one BRT can hold roughly 100-200 passengers, while a private car can only hold 4 at maximum. If no BRT system were built, private vehicles could reach 40% in Kabul's modal split, which would result in almost 4 million VPD for cars only. With one BRT system, the number drops to 1 million. Based on this analysis, implementing BRT should be, by far, the highest priority for the mobility sector if not all infrastructure systems. To improve the city's transport issues and enhance the general mobility and livability for its citizens, Kabul must develop a Bus Rapid Transit (BRT) route. Here are key justifications for the need of a BRT corridor in Kabul:

1) Addressing Traffic Congestion: Kabul experiences severe traffic congestion, resulting in prolonged travel times and reduced productivity. A dedicated BRT corridor with exclusive bus lanes can bypass traffic congestion, providing faster and more reliable travel for the commuters. By offering efficient alternative to private vehicles, A BRT system can assist minimise traffic congestion by reducing the number of cars on the road (JICA, 2011).
2) Improving Air Quality: Kabul faces significant air pollution, partially due to vehicle emissions. Introducing a BRT system can encourage a shift from private vehicles to buses, leading to a reduction in the greenhouse gas emissions and air pollutants. By improving the efficiency of public transportation and reducing reliance on individual cars, a BRT corridor can contribute to improving air quality and creating a healthier environment for residents (Alami, 2018).
3) Enhancing Accessibility: The existing public transportation system in Kabul has limitations in terms of coverage, reliability, and comfort. A BRT corridor would provide a well-planned, high -quality transportation service with dedicated stations, efficient boarding processes, and reliable schedules. This would enhance accessibility for a larger population, including those who currently face challenges in accessing essential services, employment centers, education, and healthcare facilities (Bank, 2020).
4) Promoting Sustainable Urban Development: A BRT corridor supports the objectives of sustainable urban growth. It emphasises a compact, development that emphasises transit, promotes the use of public transportation, and decreases the use of private vehicles. By integrating land use planning and transportation, a BRT corridor can stimulate the economic growth, enhance social equity, and create vibrant and walkable neighborhoods along the corridor.
5) Boosting Economic Productivity: A well-designed BRT corridor can enhance economic productivity by providing efficient transportation options for businesses, commuters, and visitors. Reduced travel times, reliable schedules, and improved accessibility contribute to increased efficiency in the movement of goods and services, attracting investments, and fostering economic development in Kabul (Ministry of Transport and Civil Aviation, 2020).
6) Enhancing Quality of Life: A BRT corridor would significantly improve the overall quality of life for residents in Kabul. It would offer a reliable and comfortable transportation option, reduce travel times, and provide a safer and more efficient mobility experience. Additionally, the improved public transportation options reduce the financial burden of car ownership, making transportation more affordable for residents (SASAKI, 2015).

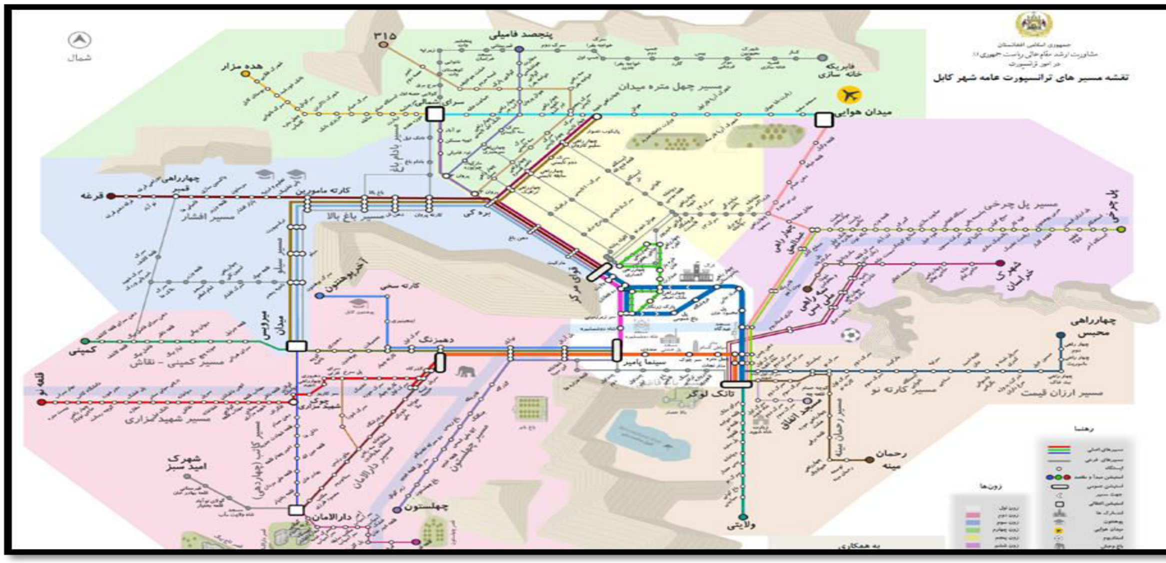


Fig. 11: A map of current transportation routes in Kabul city (Municipality, 2017).

A BRT corridor in Kabul is necessary to address the city's transportation challenges. It can efficiently reduce traffic congestion, enhance accessibility, improve air quality, support sustainable development, increase economic productivity, and improve inhabitants' overall quality of life. Making a BRT system a top priority will help Kabul get far closer to being a more effective, sustainable, and livable city..

Objectives of the study

The objective of this thesis is to identify possible Bus Rapid Transit (BRT) corridors for implementation in Kabul city and subsequently rank or prioritize these corridors for phasing. BRT systems have proven to be efficient and effective modes of transportation in various cities around the world, providing fast and reliable transit options for urban residents. In order to address the growing transportation needs in Kabul, it is crucial to determine suitable corridors that can accommodate a BRT system. This research aims to analyze the existing transportation infrastructure, traffic patterns, population density, and other relevant factors to identify potential BRT corridors. Furthermore, a ranking or prioritization mechanism will be developed to determine the order in which these corridors should be implemented, taking into account factors such as feasibility, impact on traffic congestion, potential ridership, and connectivity with major destinations. The results of this research will be helpful for Kabul's urban planners and policymakers in helping them decide on and construct BRT lanes, thereby strengthening the city's transport system and the quality of life for its citizens.

- Identifying potential/possible BRT corridors
- Prioritising or ranking potential BRT channels (corridors) for phasing

Problem Statement

The public transportation system in Kabul city is inadequate and inefficient, resulting in significant traffic congestion and air pollution. The existing bus system is slow, unreliable, and does not adequately serve the needs of the city's residents. Private vehicles are a dominant mode of transportation. Additionally low-income populations often lack access to affordable transportation options, limiting their access to essential services and opportunities. To address these issues, the selection of a Bus Rapid Transit (BRT) corridor for Kabul city is proposed. Therefore through this paper we try to identify the most suitable corridor for implementing a BRT system that meets the needs of the city's residents, improves the quality of life, and promotes sustainable development. The selection process should consider factors such as traffic flow, passenger demand, feasibility, physical and the social impacts, financial and economic viability, and accessibility to low-income populations.

Importance of the study

The study on the selection of BRT (Bus Rapid Transit) corridor for Kabul city holds significant importance for several reasons. First and foremost, Kabul city is currently facing significant traffic congestion, which has resulted in increased travel time, air pollution, and decreased productivity. By supplying a quick, capacious, and dependable mode of public transit, the establishment of a BRT system in the city might be able to address these problems. Furthermore, the selection of a suitable BRT corridor is crucial to the success of the system. A poorly chosen corridor could result in low ridership, financial losses, and limited benefits to the city. Hence, the study on the selection of a BRT corridor in Kabul city is essential in identifying the most suitable route based on several factors such as passenger demand, travel patterns, physical and environmental constraints, and socio-economic factors. Additionally, the study is relevant in the context of sustainable development and the reduc-tion of greenhouse gas emissions. A well-designed BRT system has the potential to reduce private vehicle usage, resulting in reduced emissions and improved air quality. This aspect is particularly important in the context of Kabul city, which has been grappling with high levels of air pollution in recent years. Overall, the study on the selection of BRT corridor for Kabul city holds immense importance in addressing the city's transportation challenges, improving air quality, and promoting sustainable development. It is expected to provide valuable insights to policymakers and transportation planners, facilitating informed decision-making and contributing to the overall development of the city.

Review of Literature

Factors to consider in selecting a BRT corridor

For urban planners and politicians, choosing a Bus Rapid Transit (BRT) corridor for Kabul city is a crucial factor. BRT systems have grown in popularity recently as a viable and economical replacement for conventional mass transit systems. When choosing a BRT line for Kabul city, the following analysis of the literature gives a general overview of the important aspects to take into account.

1) Population Density: the area's population density is one of the most crucial considerations when choosing a BRT path. A high population density will ensure that the BRT system will have a high ridership and will be financially sustainable in the long run. Kabul city has a population of over 4 million people, which makes it an ideal location for a BRT system.
2) Traffic Congestion: Another important factor to consider is the level of traffic congestion in the proposed BRT corridor. A BRT system can only be effective if it can operate efficiently in a corridor with minimal traffic congestion. Kabul city is known for its high traffic congestion, which makes it important to select a BRT corridor that can minimize traffic congestion and reduce travel times.
3) Existing Transit Infrastructure: The existing transit infrastructure in Kabul city should also be considered when selecting a BRT corridor. This includes existing bus routes, train lines, and other forms of mass transit. A BRT system should be designed to complement existing transit infrastructure and fill gaps in the current transit system.
4) Accessibility: Accessibility is another important factor to consider when selecting a BRT corridor. The BRT system should be designed to provide easy access to major destinations such as residential areas, commercial centers, and educational institutions. This will ensure that the BRT system is convenient for users and will encourage ridership.
5) Cost: When choosing a BRT corridor, implementation costs should also be taken into consideration. Depending on the size and complexity of the system, different BRT systems can be implemented at different costs. It is important to select a corridor that can be implemented within the budget constraints of the city.
6) Environmental Impact: Finally, the environmental impact of the BRT system should also be considered when selecting a BRT corridor. By lowering carbon emissions and supporting environmentally friendly transportation, a BRT system can benefit the environment. The BRT corridor should be chosen to reduce the system's negative environmental effects.

In conclusion, a number of criteria, including population density, traffic congestion, existing transit infrastructure, accessibility, cost, & environmental impact, should be taken into account while choosing a BRT path for Kabul City. Planners and policymakers can choose a corridor that is economically viable, effective, and user-accessible by taking these aspects into account.

A glance to the proposed BRT corridors in Kabul Master Plans

As we some agencies worked with relevant ministries to prepare a master plan for Kabul city. Two of them were made master plan for Kabul. One was JICA and the other was SASAKI. The SASAKI master plan is approved by the president Ashraf Ghani and presented to Kabul Municipality for implementation. The JICA master plan is not approved and still remain as draft. Both master plans proposed a BRT system as first need of improvement of public transportation system. We are going to have a brief look here to this BRT plans.

JICA:

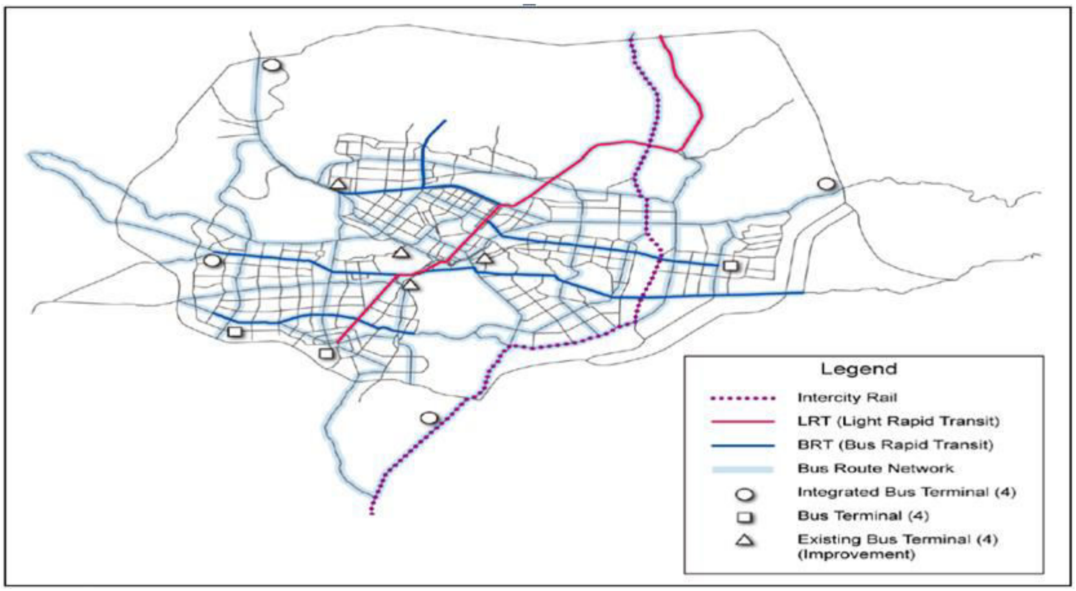


Fig. 12: Location of public transport project.

Proposed BRT in JICA Master Plan

JICA Team first identify the effectiveness of public transport project and for achieving of this purpose they conducted traffic assignments. Four (4) different scenarios involving public transit are presumpted in this study. The assumed modal share of public transport is displayed in Table below. After creating OD tables based on the aforementioned modal share, traffic allocations for the future road network are carried out. **Fig. 12** displays the traffic assignment outcomes for each potential case in 2025, and Table below provides a summary.

Alternative 1	Present public transport pattern	No consideration of new public transport projects
Alternative 2	Use of large size vehicle	In order to improve the efficiency of bus transport operation, large size bus will be introduced in major arterial roads.
Alternative 3	Introduction of BRT system	Introduction of three BRT lines (see Figure 5.40 (2/2)) + alternative 2
Alternative 4	Introduction of BRT and LRT system	Introduction of LRT connecting Deshab new city and Darulaman city via city center + alternative 3 (see Figure 5.40 (2/2))

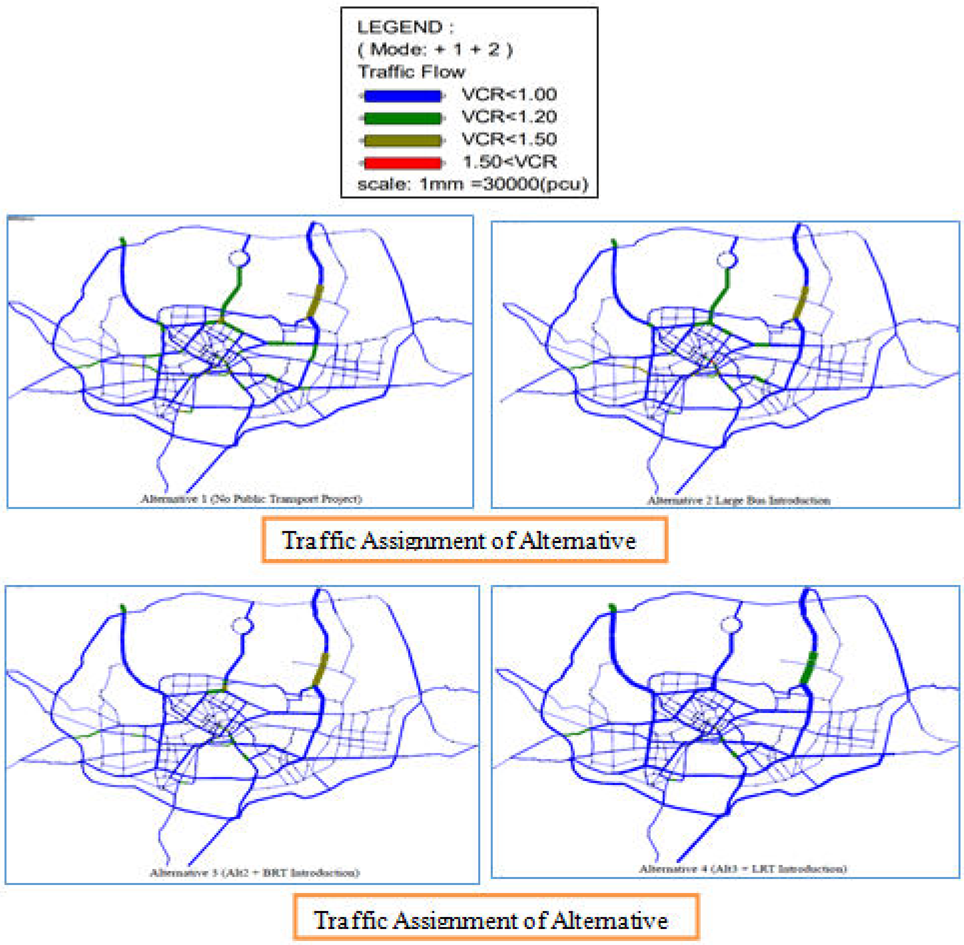
Table 2: Assumed model share on person trip.

Case		Public Transport Strategy	Private Vehicle	Public Transport					Walk	Total
				Taxi	Microbus	Bus	BRT	LRT		
Year2008			18%	12%	17%	21%	0%	0%	33%	100%
Year 2025	Alternative1	Present Pattern	24%	12%	18%	21%	0%	0%	25%	100%
	Alternative2	Large bus	23%	10%	16%	26%	0%	0%	25%	100%
	Alternative3	Alt2+BRT	21%	9%	14%	26%	5%	0%	25%	100%
	Alternative4	ALT3+LRT	19%	8%	12%	26%	5%	5%	25%	100%

Table 3: Traffic assessment result of public transport alternative (Year 2025).

Case	PCU*km ('000)	Total PCU*hr	VCR	Speed (km/h)
Do Nothing (No road improvement and pubic transport plan)	14,354	757,377	1.81	19.0
Alternative 1 (Road Improvement only, no public transport plan)	9,649	218,936	0.54	44.1
Alternative 2 (Alt.1 + Large Bus Introduction)	9,270	208,572	0.52	44.4
Alternative 3 (Alt.2 + BRT Introduction)	8,183	180,555	0.46	45.3
Alternative 4 (Alt.3 + LRT Introduction)	7,260	158,031	0.41	45.9

As previously indicated, certain severely congested parts are seen in the absence of public transport initiatives (Alternative 1). If BRT and/or LRT systems are implemented in 2025, traffic conditions on the routes that connect the New City and the current Kabul City will be improved. Based on the results of the demand prediction discussed above, the alternative-4 is chosen as the public transport development plan in this master plan.



Proposed BRT in SASAKI Master Plan

The primary design principles described in the infrastructure component of this plan serve as the foundation for the mobility strategy for the Kabul Framework Plan's long-term vision. The basis of the approach to planning for the transport sector in Kabul is based on principles of sustainability, resiliency, financial sustainability, and practical implementability.

The following design concepts show how SASAKI team select the BRT corridors for Kabul city?

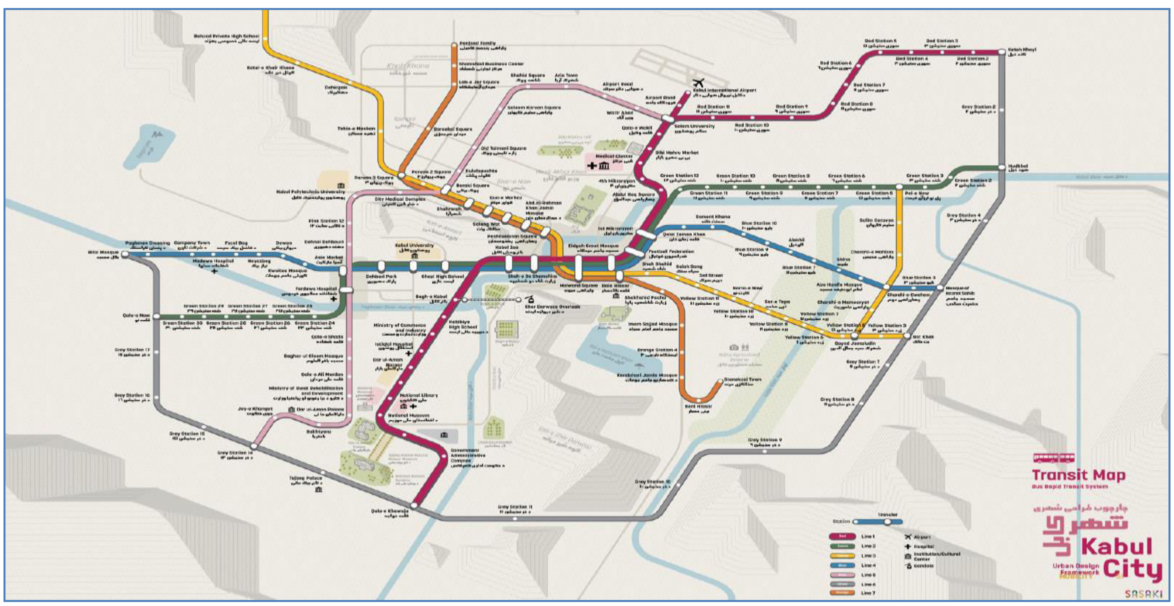
Trip Generation

As the population of Kabul City continues to grow, the number of daily trips will soar as well. This great mobility demand calls for a comprehensive transportation system. Trips per person per day will also increase as the socioeconomic conditions improve. More people will go to work, school, for entertainment, and for daily urban life. Different districts show the different trip growth patterns. In District 1, for example, the trip generation rate is already quite high. The increase of the future trips mainly results from population growth and expansion of the city to the east.

Mode Split

Currently, around a third of total trips in Kabul rely on walking, and the most popular public transportation is Micro Bus. The current number of vehicles per day (VPD) is around 419,000. However, with the rapid increase of transportation demand, and the foreseeable increase in private car ownership, this VPD number could increase 10 times. Without an implemented BRT network and substantial ridership, the road network will be non-functional as private vehicles would be the only way to get long distances across the city. In this scenario, private cars would overwhelm the roads. A fully operational BRT system will reduce private car ownership and reduce VPD by nearly 75%. This is because one BRT can hold roughly 100-200 passengers, while a private car can only hold 4 at maximum. If no BRT system were built, private vehicles could reach 40% in Kabul's modal split, which would result in almost 4 million VPD for cars only. With one BRT system, the number drops to 1 million, as shown in Table. Based on this analysis, implementing BRT should be, by far, the highest priority for the mobility sector if not all infrastructure systems.

To enhance public transit and provide alternative modes of transport, a BRT system consisting of 7 lines is proposed. The network traverses the city in the north-south and east-west directions. A full-scale BRT system has the potential to dramatically mitigate traffic congestion in Kabul. Eventually, Kabul might have a BRT system that connects the entire city. The network is built to perform similarly to a high-capacity public transit system, such a tube system, but at a far lower cost and with a capacity that is equivalent.



Proposed BRT in Khatib and Alami Master Plan

A traffic model covering the existing road network within the study area was developed with help of JICA, 2011 report and other relevant information provided by Kabul Municipality. The model was developed using PTV VISUM software. The model developed to the analyze the traffic flow conditions pertaining to the Base year (2018) and Horizon Year (2030). The traffic flows in the Kabul city without and with BRT have been compared using the goal year 2030 predicted model. Using PTV VISUM software, the road network, including all 43 zones, 499 nodes, and 1,204 linkages, was coded in order to create the base year (2018) traffic model for the city of Kabul.

In order to develop the Base Year 2018 Model based on the traffic count survey data OriginDestinations (O-D) surveys were analyzed and expanded using Average Daily Traffic (ADT) to estimate the base year O-D matrices.

Estimated 2017 Total Daily Trips = 4,660,000 trip/d

Estimated Long-Term Scenario Total Daily Trips = 13-18,000,000 trip/d

Current Low-Range Trip-Gen Rate: 0.2 trips / person

Current High-Range Trip-Gen Rate: 4.8 trips / Person

Based on JICA 2011

Long-Term Scenario Low-Range Trip-Gen Rate: 1.0-3.0 trips / person

Long-Term Scenario High-Range Trip-Gen Rate: 3.0-5.0 trips / Person

Table 2.1 Population-Based Trip Generation Estimates

	Current Planning Scenario			Medium-Term Planning Scenario*			Long-Term Planning Scenario**		
District	Estimated Total Population	Trip Gen Rate Trips/day/person	Estimated Trips/Day	Estimated Total Population	Trip Gen Rate Trips/day/person	Estimated Trips/Day	Estimated Total Population	Trip Gen Rate Trips/day/person	Estimated Trips/Day
1	57,000	4.7	271,000	144,000	4-5	720,000	154,000	4-5	770,000
2	74,000	3.1	230,000	242,400	3-4	793,000	252,000	3-4	820,000
3	297,000	1.7	513,000	617,000	2-3	1,600,000	624,000	2-3	1,620,000
4	348,000	1.5	527,000	446,000	2-3	1,015,000	462,000	2-3	1,160,000
5	419,000	1.3	556,000	560,000	1-2	1,116,000	569,000	1-2	1,130,000
6	317,000	0.6	187,000	488,000	0.5-1	433,000	500,000	1-2	600,000
7	49,000	0.5	24,000	65,000	0.5-1	48,000	67,000	1-2	60,000
8	125,000	0.6	78,000	165,000	0.5-1	155,000	170,000	1-2	187,000
9	81,000	1.1	86,000	106,000	1-2	169,000	110,000	1-2	174,000
10	205,000	1.5	302,000	385,000	2-3	852,000	396,000	2-3	912,000
11	235,000	0.9	220,000	573,000	1-2	806,000	581,000	1-2	930,000
12	307,000	0.5	137,000	397,000	1-2	489,000	403,000	1-2	726,000
13	193,000	0.2	44,000	258,000	0.5-1	89,000	261,000	1-2	157,000
14	221,000	0.8	173,000	263,000	1-2	309,000	266,000	1-2	312,000
15	42,000	1.6	367,000	239,000	2-3	557,000	783,000	2-3	1,957,000
16	173,000	0.4	65,000	373,000	0.5-1	227,000	379,000	1-2	492,000
17	255,000	0.3	66,000	418,000	0.5-1	163,000	412,000	1-2	329,000
18	290,000	0.2	53,000	334,000	0.5-1	92,000	341,000	1-2	273,000
19	262,000	3.8	998,000	647,000	4-1	2,592,000	654,000	4-5	2,750,000
20	21,000	0.9	19,000	107,000	1-2	151,000	144,000	1-2	216,000
21	75,000	0.5	36,000	152,000	1-2	274,000	166,000	2-3	365,000
22	30,000	0.3	10,000	564,000	0.5-1	292,000	1,119,000	1-2	671,000
Total	4,074,000		4,660,000	7,550,000		12,940,000	8,810,000		13-18,000,000

* Based on potential population growth to 7.5 million people
** Based on potential population growth to 8.8 million people

Current Passengers per Vehicle Rates

Mode	Pass/veh
Private Car	2.0
Motorcycle	1.2
Local Bus	15
BRT	n/a

Long-Term Scenario Passengers per Vehicle Rates

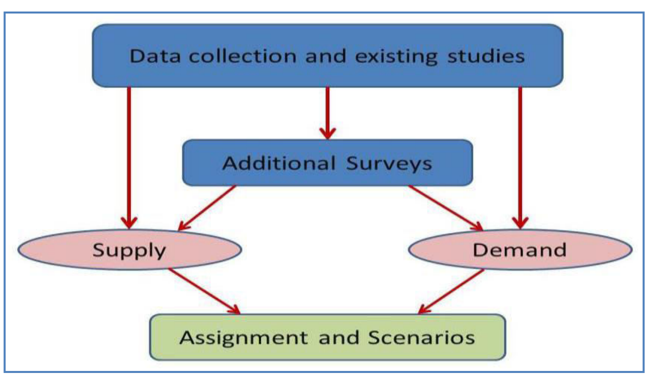
Mode	Pass/veh
Private Car	1.5
Motorcycle	1.2
Local Bus	15
BRT	100-180

Table 2.2 Mode Split and VPD Estimates

	Current Planning Scenario			Medium-Term Planning Scenario*			Long-Term Planning Scenario**		
Mode	Estimated % of Trips***	Trips/Day	Vehicles Per Day (VPD)	Estimated % of Trips***	Trips/Day	Vehicles Per Day (VPD)	Estimated % of Trips***	Trips/Day	Vehicles Per Day (VPD)
Walking	33%	1,011,000	-	30%	3,880,000	-	25%	4,152,000	-
Private Car	4%	133,000	66,000	6%	777,000	388,000	10%	1,660,000	1,017,000
Mini Bus	6%	198,000	20,000	5%	647,000	65,000	3%	498,000	50,000
Micro Bus	18%	541,000	36,000	10%	1,290,000	86,000	3%	498,000	33,000
Large Bus	14%	436,000	15,000	10%	1,290,000	43,000	5%	830,000	28,000
Taxi	12%	359,000	179,000	8%	1,040,000	518,000	5%	830,000	554,000
Bike	9%	278,000	278,000	10%	1,290,000	-	12%	1,993,000	-
Motorcycle	2%	62,000	52,000	2%	259,000	216,000	5%	830,000	692,000
Trucks	2%	62,000	52,000	2%	259,000	216,000	2%	332,000	277,000
BRT	0%	0	0	17%	2,200,000	12,000	30%	4,982,000	28,000
Total	100%	3,080,000	419,000	100%	12,900,000	1,540,000	100%	16,600,000	2,770,000

* Based on potential population growth to 7.5 million people
** Based on potential population growth to 8.8 million people
*** Primary mode on a single trip

From the daily total mode wise matrices, peak hour matrices have been estimated for the A.M. peak which is the worst case scenario.



The average occupancy for the car and bus is considered as 3.3 and 50 respectively. Target year 2030 model is developed with help of forecasted and calibrated base year model.

The development aim of target year traffic model is to review the prevailing traffic condition and to study the feasibility of public transit primarily high speed BRT in order to reduce the traffic congestion and maximise the saving in travel time. At present taxi mode share is varying between 30 – 40 % among all available private modes of transportation so it was expected to observe the potential modal shift from taxi to BRT with strong inclusion of political will, support and transport poli-cies. Four (4) scenarios for the target year have been developed to study the feasibility of high speed BRT;

1) Scenario 1(With BRT Introduction)
2) Scenario 2(With BRT Introduction and considering 15% modal shift from cars to public transport)
3) Scenario 3(With BRT Introduction and considering 20% modal shift from cars to public transport)
4) Scenario 4(With BRT Introduction and considering 25% modal shift from cars to public transport)

The summaries of BRT demand for all potential BRT route and for all scenarios considered for the target year have been presented below;

Summary of BRT Demand

BRT Routes	BRT (No Modal Shift) Scenario 1	BRT+15% Modal Shift Scenario 2	BRT+20% Modal Shift Scenario 3	BRT+25% Modal Shift Scenario 4
BRT 1	21,071	35,119	38,778	44,327
BRT 2	7,375	14,718	15,778	16,954
BRT 3	21,755	27,950	30,130	33,091
BRT 4	8,545	12,193	13,586	14,725
BRT 5	6,909	14,427	17,113	19,600
BRT 6	21,863	30,674	33,443	37,535
BRT 7	822	3,724	4,589	6,412

It is advised that BRT be proposed with scenario 4, which calls for a 25% modal shift from cars to buses, for the target year. Adopting it is advised in order to decrease travel time, traffic, the frequency of accidents, and pollution. The priority of BRT phasing is proposed to start from BRT route 1, BRT route 6, BRT route 3, BRT route 5, BRT route 2 and BRT route 7.

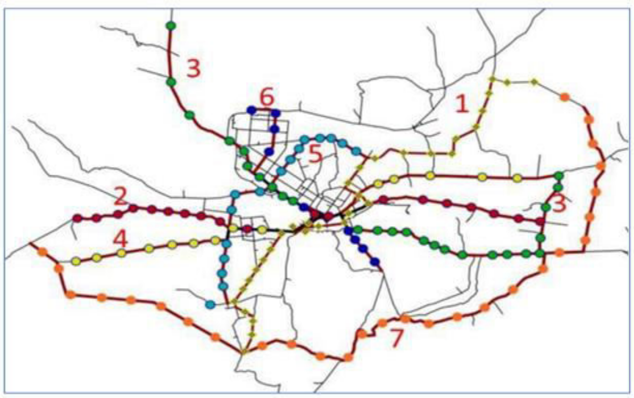


Fig. 13: Kabul BRT masterplan network 200 for model input.

METHODOLOGY:

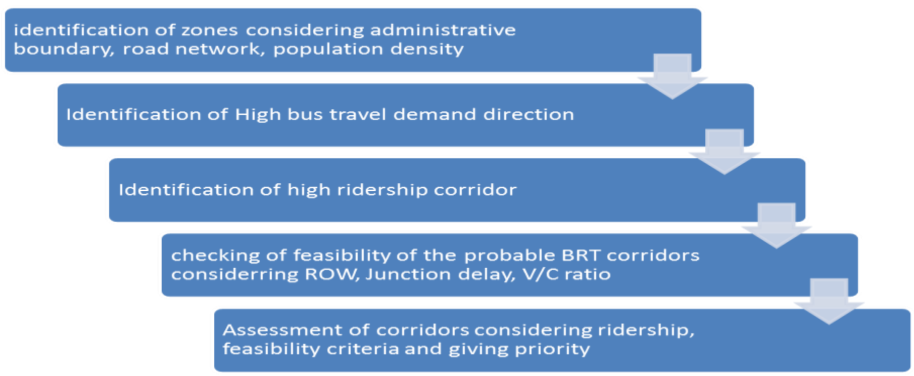
Study Area & Data Collection

The study region for "selection of BRT corridor for Kabul city" would be Afghanistan's capital city, Kabul. The study would focus on identifying potential corridors for the BRT system and evaluating them based on various criteria such as traffic flow, passenger demand, feasibility, physical and social impacts, financial and economic viability, and accessibility to low-income populations. The data for this paper is collect and prepare from different agencies and authorities which breifly describe as follow:

- Existing transportation system data:
- The information on the current bus system, including routes, schedules and passenger volume is collect from Kabul Municipality, Millie Bus company and Khatib & Alami surveys. the data also include road network & traffic flow in Kabul city.
- Socio-economic data: Data on population density, demographics, income levels, and employment patterns is collected from Kabul Municipality and JICA 2011 Master plan for Kabul city,
- Land use data: Information on land use patterns and the location of major activity centers such as residential areas, commercial areas, and educational institutions is collected from Public Transportation Directorate of Kabul Municipality.
- Geographic data: Geographic information system (GIS) data would be collected to create maps of the study area, including administrative boundaries, land use, and transportation networks.
- The data collection methods are include a combination of primary and secondary sources, such as literature review, interviews, and data from government agencies and other organizations. The data would be analyzed using statistical techniques and GIS software to identify potential corridors for the BRT system and evaluate them based on various criteria.

The research methodology involves five steps that are aimed at identifying the most suitable corridors for implementing Bus Rapid Transit (BRT) in a given urban area (Debapratim Pandit, 2010). The first step : Partitioning the urban area into separate zones for traffic study is the first step, and it is based on a number of variables including administrative boundaries, land use patterns, population distribution, and current road and bus routes. This stage is crucial since it gives the rest of the research methodology's steps an organised structure. In the second step, you identify the routes or links that meet the travel demands of the population in the various zones. You then concentrate on the bus routes that serve these links to select the routes with high travel demand, which are potential candidates for BRT. The third step involves estimating the ridership along the initially identified routes to identify probable BRT corridors. This stage is essential because it makes sure that the routes chosen have a high potential for ridership, which is a significant component in evaluating whether BRT can be implemented. The fourth phase involves evaluating road inventory data, such as right of way, right of way, number of important intersections, delay, and existing volume to capacity ratio, to assess the viability of establishing BRT along the designated corridors. This step checks that the identified corridors match the requirements for BRT implementation and assesses how feasible it would be to establish BRT along those lines. Finally, in the fifth step, you determine the priority of developing the identified corridors based on the ridership potential and feasibility criteria. You assign scores for each aspect and then calculate the total score for each corridor. The corridors with higher scores are deemed more suitable for BRT implementation and thus given priority.

In summary, The research methodology provides a structured approach for identifying the most suitable corridors for implementing BRT in a given urban area. The methodology ensures that the corridors selected have high ridership potential, meet the necessary feasibility criteria, and are given priority based on their overall suitability for BRT implementation.



The type of BRT system implemented, such as an open or close type BRTS, will depend on implementtation concerns, operational considerations, and integration issues, even though potential BRT corridors might be identified using the current methodology (Wright, 2007).

District/Zones Identification

In order to achieve homogeneity in the distribution of land uses as well as opulation and density in a comprehensive manner, Kabul city is split into 22 districts based on administrative boundaries, existing road and transit networks, and other factors. **Table 1** lists the administrative boundaries of the zones and key locations within each zone. Table displays various zone characteristics, including area, total population, population density, and the dominating land use.

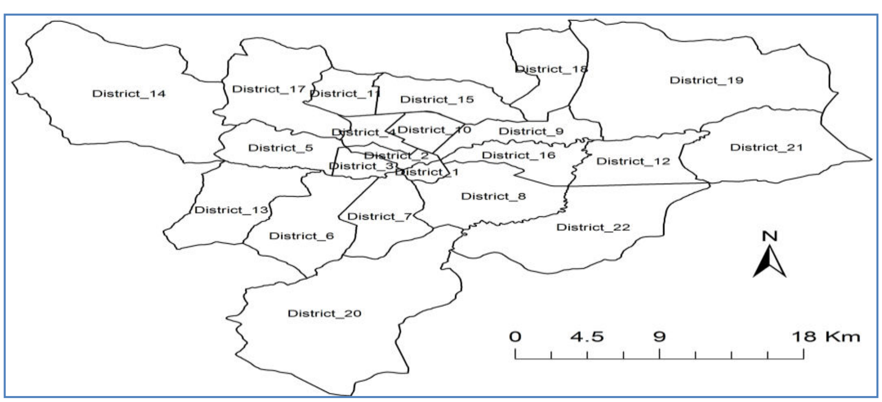


Fig. 14: Kabul City Districts (JICA, 2011).

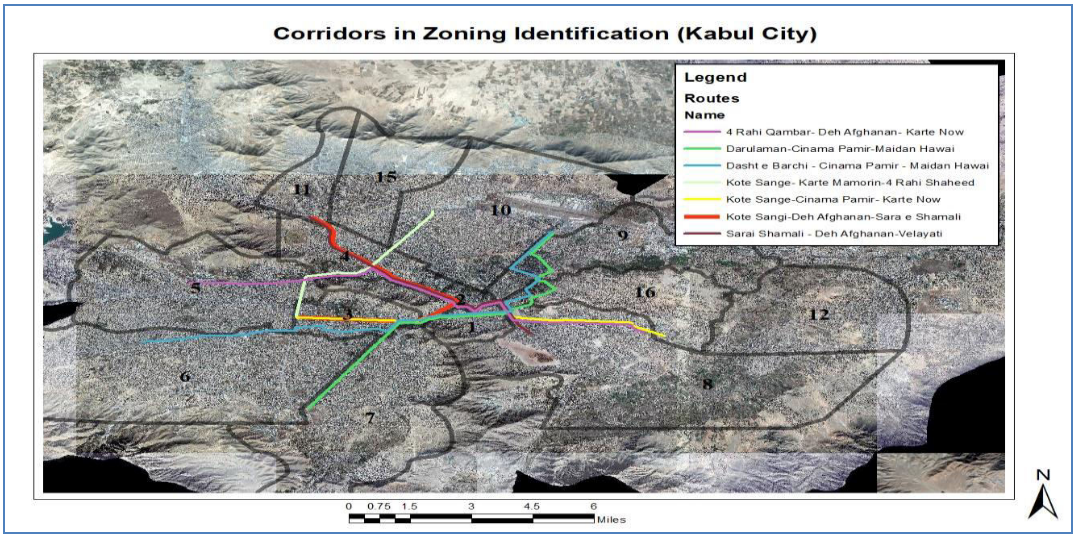


Table 4: Kabul City Population (Source JICA, 2011).

District	Area Km2	Population	Density
1	4.83	190,000	39337.5
2	6.84	72,472	10595.3
3	9.11	162,000	17782.7
4	11.72	450,000	38395.9
5	28.45	650,000	22847.1
6	49.18	200,000	4066.7
7	33.34	300,000	8998.2
8	48.25	236,676	4905.2
9	24.33	237,774	9772.9
10	13.03	380,288	29185.6
11	17.42	280,000	16073.5
12	34.9	156,000	4469.9
13	47.19	230,000	4873.9
14	119	130,000	1092.4
15	32.53	383,826	11799.1
16	25.07	110,000	4387.7
17	56.02	220,000	3927.2
18	33.88	13,500	398.5
19	141.4	45,000	318.2
20	142.9	61,867	432.9
21	63.95	3,300	51.6
22	79.25	20,000	252.4
	1022.59	**4,532,703**	

Identification of high travel demand routes:

To identify high travel demand routes for a proposed BRT system, several methods can be used:

1) Conducting a travel demand survey: A travel demand survey can be conducted to identify the most popular routes and travel patterns among commuters. This can be done through a combination of online surveys, in-person interviews, and other data collection methods.
2) Analyzing existing public transportation data: Existing public transportation data can provide the insights into which routes have the highest ridership and demand. This data can be collected from the ticket sales, transit card usage, and other sources.
3) Conducting traffic and mobility analysis: Traffic and mobility analysis can provide insights into the most congested routes and corridors in the city. This analysis can be conducted using tools such as GIS and traffic simulation software.
4) Examining land use patterns: Land use patterns can provide insights into the areas with the highest concentration of residential and commer-cial activity. These areas are likely to have the highest travel demand and may be the most suitable for a BRT system.
5) Engaging with stakeholders: Engaging with the stakeholders such as community groups, businesses, and government agencies can provide the valuable insights into the transportation needs and priorities of different groups. This can help to identify high travel demand routes that may have been overlooked in other analyses.

By using a combination of these methods, it is possible to identify the high travel demand routes in a city and develop a BRT system that meets the needs of commuters and improves mobility and accessibility. An essential first step in choosing high travel demand routes for a proposed Bus Rapid Transit (BRT) system in Kabul city is the analysis of current public transportation data. In this regard, it may be possible to determine the most well-liked and in-demand routes in the city using the information gathered from the Millie Bus Agency and KM (Kabul Municipality). These sources can provide data on the sale of tickets as well as other pertinent information about the use of public transport in Kabul. Based on variables including the quantity of passengers, the frequency of service, and journey times, this data can be used to discover the routes with the most ridership and demand. Each of the current bus routes operating along a corridor chosen for BRT trunk infrastructure will typically be ranked according to two criteria: Frequency (and, if possible, occupancy) of bus routes in each direction; The percentage of the existing bus route that travels the corridor.

A certain minimum cutoff for the above two criteria is typically used to decide which routes should be included in the system and which routes should be left to operate outside the system, rerouted, or cut. This applies a policy minimum of four buses per hour and at least 20% of the total length inside the BRT corridor before a route can be considered for inclusion in the BRT system (ITDP), 2016). According to BRT guideline, the following routes have been proposed for consideration based on their length and potential for BRT implementation.

Table 5: Proposed Routes for BRT Corridor (Aman, 2022).

No.	Name of Routes	Length (m)
1	Kote Sange-Cinama Pamir- Karte Now	11,910
2	Darulaman-Cinama Pamir-Maidan Hawai	15,978
3	Sarai Shamali - Deh Afghanan-Velayati	11,233
4	4 Rahi Qambar- Deh Afghanan- Karte Now	17,085
5	Dasht e Barchi - Cinama Pamir - Maidan Hawai	21,393
6	Kote Sangi-Deh Afghanan-Sara e Shamali	12,614

1) Kote Sange-Cinema Pamir-Karte Now: This route is 11,910 meters in length and connects Kote Sange to Karte Now via Cinema Pamir. It passes through several busy areas and could potentially serve as a major BRT corridor in the city.
2) Darulaman-Cinema Pamir-Maidan Hawai: With a length of 15,978 meters, this route connects Darulaman to Maidan Hawai via Cinema Pamir. It passes through residential areas as well as commercial districts and could provide an efficient transit option for commuters.
3) Sarai Shamali - Deh Afghanan-Velayati: This route is 11,233 meters in length and connects Sarai Shamali to Velayati via Deh Afghanan. It passes through several densely populated areas and could serve as an important BRT corridor to improve mobility and accessibility.
4) Rahi Qambar-Deh Afghanan-Karte Now: With a length of 17,085 meters, this route connects 4 Rahi Qambar to Karte Now via Deh Afghanan. It passes through busy commercial areas and residential neighborhoods, making potential BRT corridor.
5) Dasht e Barchi - Cinema Pamir - Maidan Hawai: This route is the longest proposed corridor, with a length of 21,393 meters. It connects Dasht e Barchi to Maidan Hawai via Cinema Pamir and passes through several residential and commercial areas. It has the potential to significantly improve public transportation options for residents in these areas.
6) Kote Sangi-Deh Afghanan-Sara e Shamali: This route is 12,614 meters in length and connects Kote Sangi to Sarai Shamali via Deh Afghanan. It passes through several commercial districts and residential areas, making it a potential BRT corridor to improve mobility and accessibility in these areas.

To ensure that the BRT system is put in place in locations where it would have the most impact on decreasing congestion and satisfying the demands of the population for transport, it is essential to identify high travel demand routes. For further investigation, routes with a higher density of bus routes or a higher number of overlapping bus routes were chosen. However, as the majority of the bus routes in Kabul are quite roundabout in character, different links within a same route have varying numbers of bus lines. As a result, the table below considers and displays bus routes that connect the relevant travel demand zones and essentially cover the whole trip. The number of buses and ridership increase as the number of overlapping bus routes increases.

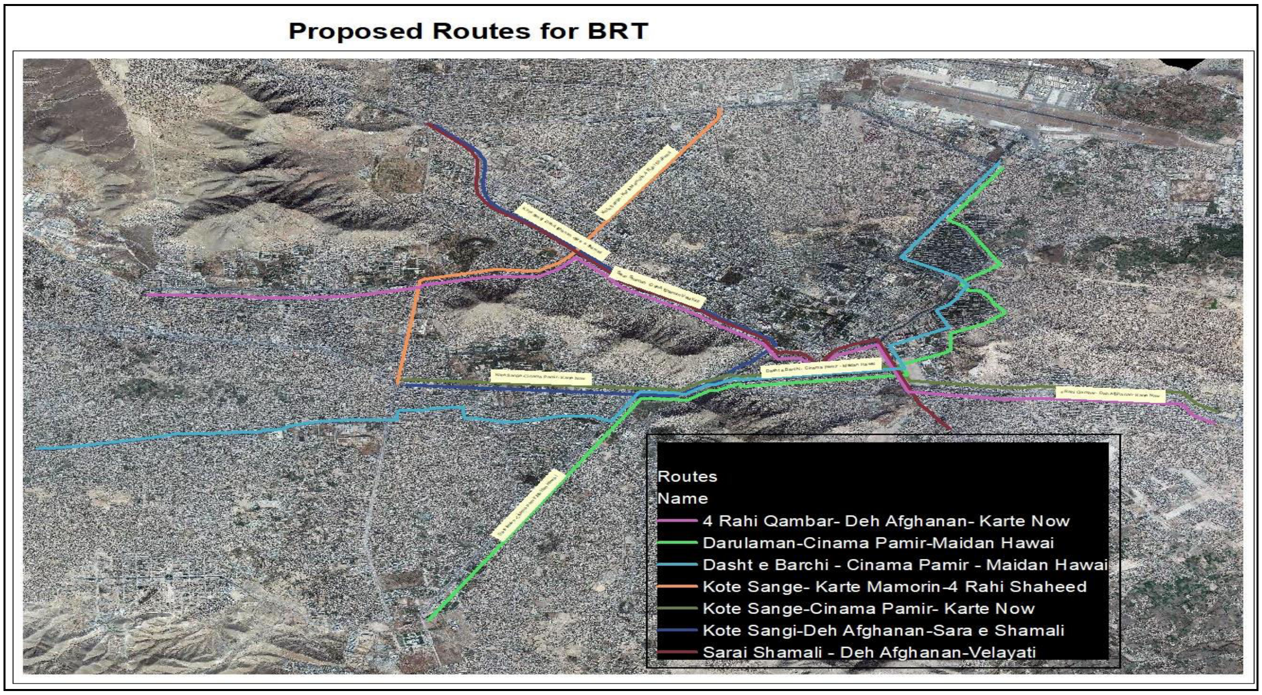


Fig. 15: Routes for Proposed BRT, ArcMap (Source: Drafted by author).

Table 6: Overlapping Bus routes, high travel demand.

No.	Routes	Overlapping Bus Routes
1	Kote Sangi-Deh Afghanan-Sara e Shamali	15
2	Kote Sange-Cinama Pamir-Karte Now	12
3	Sarai Shamali - Deh Afghanan-Velayati	9
4	4 Rahi Qambar- Deh Afghanan- Karte Now	9
5	Dasht e Barchi - Cinama Pamir - Maidan Hawai	14
6	Darulaman-Cinama Pamir-Maidan Hawai	13

The chart lists the number of bus routes that cross each other on various routes and links in an urban area. A key element in estimating the likelihood of establishing Bus Rapid Transit (BRT) along these routes is the number of bus lines that cross each other. Route 1, which runs from Kote Sangi to Sara e Shamali via Deh Afghanan, has the highest number of overlapping bus routes at 15. This indicates that the route has a high ridership potential and could benefit from BRT implementation. Similarly, Route 5, which runs from Dasht e Barchi to Maidan Hawai via Cinama Pamir, has 14 overlapping bus routes, indicating that it also has a high potential for BRT implementation. The routes 2, 3, 4, and 6 also have a significant number of overlapping bus routes, ranging from 9 to 13. These routes could be potential candidates for BRT implementation, although further feasibility studies would be required to determine their suitability.

Table 7: Population - Based Trip Generation (SAS-AKI, 2015).

Current Planning Scenario			
District	Estimated Total Population	Trip Gen Rate Trips/day/ person	Estimated Trips/ Day
1	57,000	4.7	271,000
2	74,000	3.1	230,000
3	297,000	1.7	513,000
4	348,000	1.5	527,000
5	419,000	1.3	556,000
6	317,000	0.6	187,000
7	49,000	0.5	24,000
8	125,000	0.6	78,000
9	81,000	1.1	86,000
10	205,000	1.5	302,000
11	235,000	0.9	220,000
12	307,000	0.5	137,000
13	193,000	0.2	44,000
14	221,000	0.8	173,000
15	42,000	1.6	367,000
16	173,000	0.4	65,000
17	255,000	0.3	66,000
18	290,000	0.2	53,000
19	262,000	3.8	998,000
20	21,000	0.9	19,000
21	75,000	0.5	36,000
22	30,000	0.3	10,000
Total	4,074,000		4,660,000

Table 8: Trip-Gen Rate, Source (SASAKI, 2015).

Estimated 2017 Total Daily Trips = 4,660,000 trip/d

Estimated Long-Term Scenario Total Daily Trips = 13-18,000,000 trip/d

Current Low-Range Trip-Gen Rate	0.2 trips / person
Current High-Range Trip-Gen Rate	4.8 trips / Person

Currently, around a third of total trips in Kabul rely on walking, and the most popular public transportation is Micro Bus. The current number of vehicles per day (VPD) is around 419,000. However, with the rapid increase of transportation demand, and the foreseeable increase in private car ownership, this VPD number could increase 10 times (JICA, 2011).

Table 9: Mode Split and VPD.

Mode	Estimated %o of Trips***	Trips/ Day	Vehicles Per Day (VPD)
Walking	33%	1,011,000	-
Private Car	4%	133,000	66,000
Mini Bus	6%	198,000	20,000
Micro Bus	18%	541,000	36,000
Large Bus	14%	436,000	15,000
Taxi	12%	359,000	179,000
Bike	9%	278,000	278,000
Motorcycle	2%	62,000	52,000
Trucks	2%	62,000	52,000
BRT	0%	0	0
Total	100%	3,080,000	419,000

Current Passengers per Vehicle Rates

Mode	Pass/veh
Private Car	2.0
Motorcycle	1.2
Local Bus	15
BRT	n/a

Ridership estimation

Analysing current travel patterns, demographic information, and the features of a possible BRT system, such as the number of stops and the frequency of service, are all necessary for estimating ridership. Surveys, passenger counts, and GPS tracking of public transportation vehicles can all be used to gather information on travel patterns and passenger demand. Statistical models can then be used to estimate ridership based on the collected data. The models can take into account factors such as population density, employment centers, and educational institutions along the BRT route, as well as the availability and accessibility of alternative modes of transportation.

The ridership estimation can help in the design and planning of the BRT system by determining the appropriate size and capacity of buses, the number and location of stations, and the frequency of service. It can also help in estimating the revenue potential of the BRT system and its economic viability. Average ridership was estimated for the selected corridors. First, a relationship was established between fleet strength and frequency of buses using sample data from a few routes during peak hour and the same was used to determine the frequency of buses for the routes given in Table below. As the data on fleet strength of different routes was available and taken by Kabul Municipality & Millie Bus Company. Then, frequency of buses in each route was multiplied by average bus occupancy to get the number of passengers per hour per direction for a particular route.

Table 10: Ridership of Corridors, Source: (Municipality, 2017).

Ridership for Different Routes in Kabul						
CN	Routes	Frequency (buses/hr)	Avg. ridership pphpd)	Max. ridership (pphpd)	Freq*Ave. Ridership	Ranking
6	Kote Sangi-Deh Afghanan-Sara e Shamali	52	1,421	2,773	73,909	1
1	Kote Sange-Cinama Pamir- Karte Now	51	1,394	2,720	71,094	2
2	Darulaman-Cinama Pamir-Maidan Hawai	30	820	1,600	24,600	3
3	Sarai Shamali - Deh Afghanan-Velayati	29	793	1,547	22,987	4
5	Dasht e Barchi - Cinama Pamir - Maidan Hawai	29	793	1,547	22,987	5
4	4 Rahi Qambar- Deh Afghanan- Karte Now	27	738	1,440	19,926	6

It is found that the carrying capacity of BRT system varies in different cities starting from 800 passengers per hour per direction as in case of Santa Monica to 45,000 passengers per hour per direction as in case of Bogota (Vaghela, 2007). In the present study, BRT corridors were identified when average ridership exceeded 1,200 passengers per hour per direction, considering 2 minutes of headway for buses having seating capacity of 40. Table below shows these identified BRT routes along with frequency of buses, average ridership and maximum ridership in a link within the corridor. Ranking has been assigned according to average ridership in that corridor which also indicates the demand of passenger for BRTS along that corridor. The table provides information on the ridership for different bus routes in Kabul, based on their frequency (buses per hour), average ridership per hour per day (pphpd), maximum ridership (pphpd), and the product of frequency and average ridership. The ranking is based on the product of frequency and average ridership. Route 6, which runs from Kote Sangi to Sara e Shamali via Deh Afghanan, has the highest frequency of 52 buses per hour and the highest average ridership per hour per day (pphpd) of 1,421. It also has the highest maximum ridership (pphpd) of 2,773 and the highest product of frequency and average ridership of 73,909. This route is ranked first in the table and has the highest potential for BRT implementation. Route 1, which runs from Kote Sange to Karte Now via Cinama Pamir, has a frequency of 51 buses per hour and an average ridership of 1,394 pphpd. It is ranked second and has a high potential for BRT implement-tation. Routes 2, 3, 4, and 5 have lower frequencies and average ridership compared to routes 1 and 6, but still have significant ridership potential. Routes 2, 3, and 5 have the same average ridership and frequency, and are ranked 3rd, 4th, and 5th, respectively, based on the product of frequency and average ridership. Route 4 has the lowest frequency and average rider-ship, and is ranked 6th.

Feasibility checking

After this initial identification of probable BRT routes based on existing passenger travel demand, feasibility analysis was conducted considering the following aspects for implementation of BRT corridor.

- Existing right of way (ROW) of roads: The wider the road the greater will be the scope for BRTS.
- No. of Junction: The lesser the number of major junctions the lesser will be the number of right turns and the total delay at signals resulting in higher average speed and better scope for BRTS.
- Volume/Capacity (V/C) ratio: In case of high V/C ratio, separating buses in one lane may lead to congestion in the other lanes or in the bus lane itself. Therefore, Lesser V/C ratio means lesser congestion and thus better scope for BRT.

Existing Right of Way

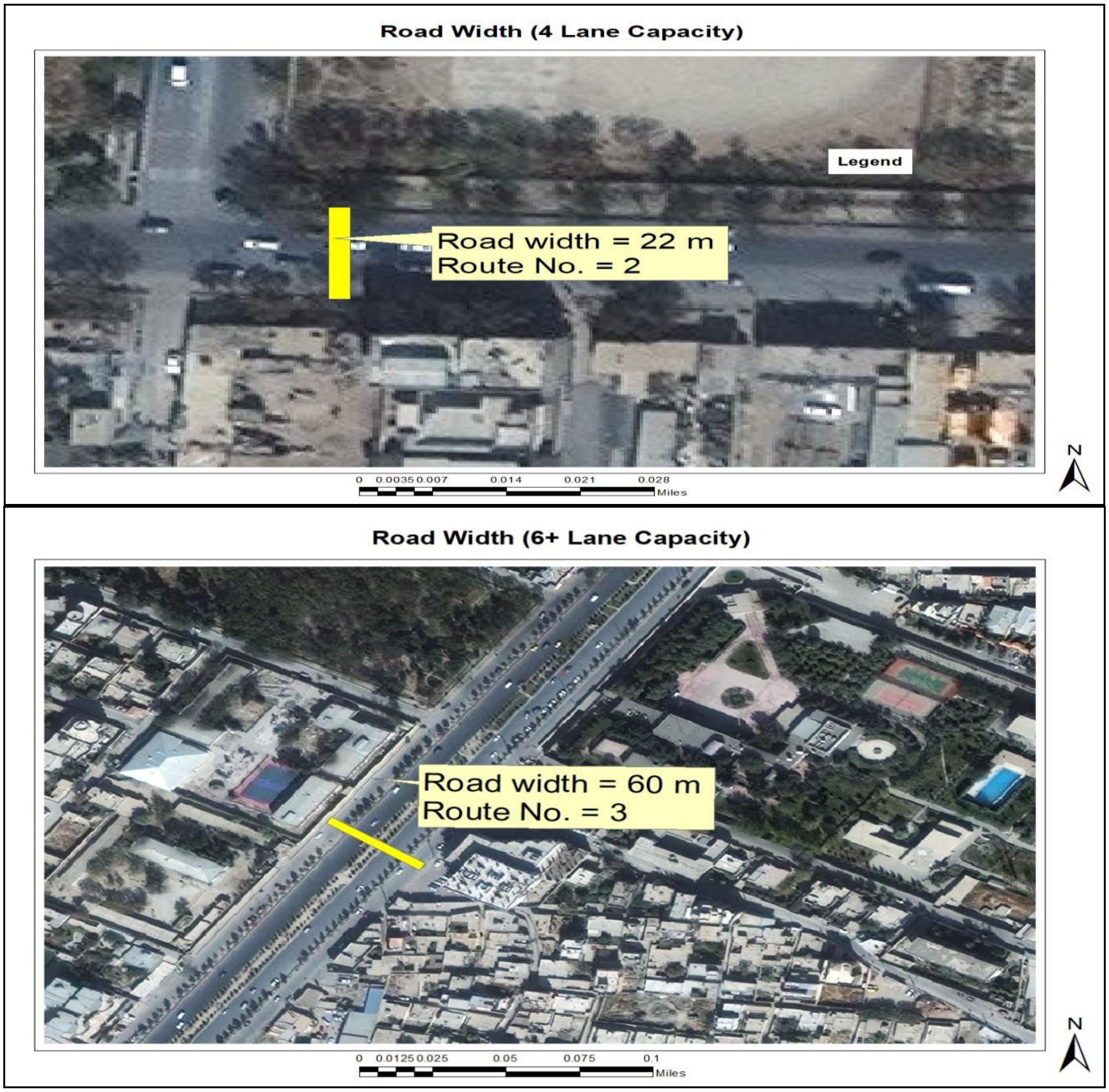
When conducting a feasibility study for a BRT line, it's crucial to take into account the existing right of way (ROW) of roadways. The wider the road, the greater the potential for a BRT system, as it allows for the creation of dedicated lanes for the BRT buses, separate from regular traffic. This can improve the speed and reliability of the BRT system, as the buses can avoid congestion and travel faster. The width of the road also affects the ability to construct stations and provide other necessary infrastructure, such as bike lanes and sidewalks. Therefore, while evaluating the viability of building a BRT system, a large ROW is a crucial consideration. ((ITDP), 2016). **Table 11** shows the right-of-way (ROW) of initially identified BRT corridors in Kabul in terms of number of lanes in different stretches of the route.

Table 11: Road Type and Road width of Kabul city master plan (Municipality, 2017).

Type of Roads	Width in meter	Foot pad width in meter	Total
Residential streets	12	3	20
Residential streets	22	3	25
Arterial highways of local importance	27	3	30
Arterial highways of local importance	35,5	4,5	40
Arterial highways of local importance	36,5	8,5	45
Controlled traffic arterial highways of city wide-importance	48,5	6,5	50
Controlled traffic arterial highways of city wide-importance	54	6	60
Controlled traffic arterial highways of city wide-importance	64	6	70
Municipal expressway	140		140

Table 12: Road width for selected corridors, Source: author draft.

CN	Routes	Length (km)	6 or more Lane (%)	4 Lane (%)	2 Lane (%)
1	Kote Sange-Cinama Pamir- Karte Now	11.910	40	50	10
2	Darulaman-Cinama Pamir-Maidan Hawai	15.978	67	27	6
3	Sarai Shamali - Deh Afghanan-Velayati	11.233	80	5	15
4	4 Rahi Qambar- Deh Afghanan- Karte Now	17.085	82	10	8
5	Dasht e Barchi - Cinama Pamir - Maidan Hawai	19.361	10	84	6
6	Kote Sangi-Deh Afghanan-Sara e Shamali	12.614	55	30	15



The given table represents the road width for different corridors in Kabul. The road width is an important aspect to consider when planning for any transport system, especially for a Bus Rapid Transit (BRT) system. The capacity of the road to manage the additional traffic and the economic feasibility of the BRT system are both highly dependent on the road's width.

The table shows that Route 4, which covers the 4 Rahi Qambar- Deh Afghanan- Karte Now corridor, has the highest percentage of roads with six or more lanes at 82%. This indicates that this route has a wider road network and has the potential to handle more traffic compared to the other routes. Route 3, which covers the Sarai Shamali - Deh Afghanan-Velayati corridor, has 80% of its road network with six or more lanes, which also suggests that it can handle a high volume of traffic. In contrast, Route 5, which covers the Dasht e Barchi - Cinama Pamir - Maidan Hawai corridor, has only 10% of its road network with six or more lanes, but has 84% of its road network with four lanes. This suggests that the road network can handle moderate traffic but may not be able to support high-volume BRT traffic. Route 2, which covers the Darulaman-Cinama Pamir-Maidan Hawai corridor, has the highest percentage of roads with four lanes at 27%. This indicates that this route can handle moderate traffic and can be considered for BRT implementation.

No. of Junctions

The number of junctions is another important aspect to consider for the implementation of a BRT corridor feasibility analysis. The lesser the number of major junctions, the lesser will be the number of right turns and the total delay at signals, resulting in higher average speed and better scope for a BRT system. This is because the BRT buses can travel through the corridor with fewer stops, resulting in faster travel times and improved reliability. Additionally, a lower number of junctions may also reduce the need for signal prioritization and other traffic management measures, which can further improve the efficiency of the BRT system. Hence, when evaluating the feasibility of building a BRT system, the number of intersections is a crucial issue to take into account.

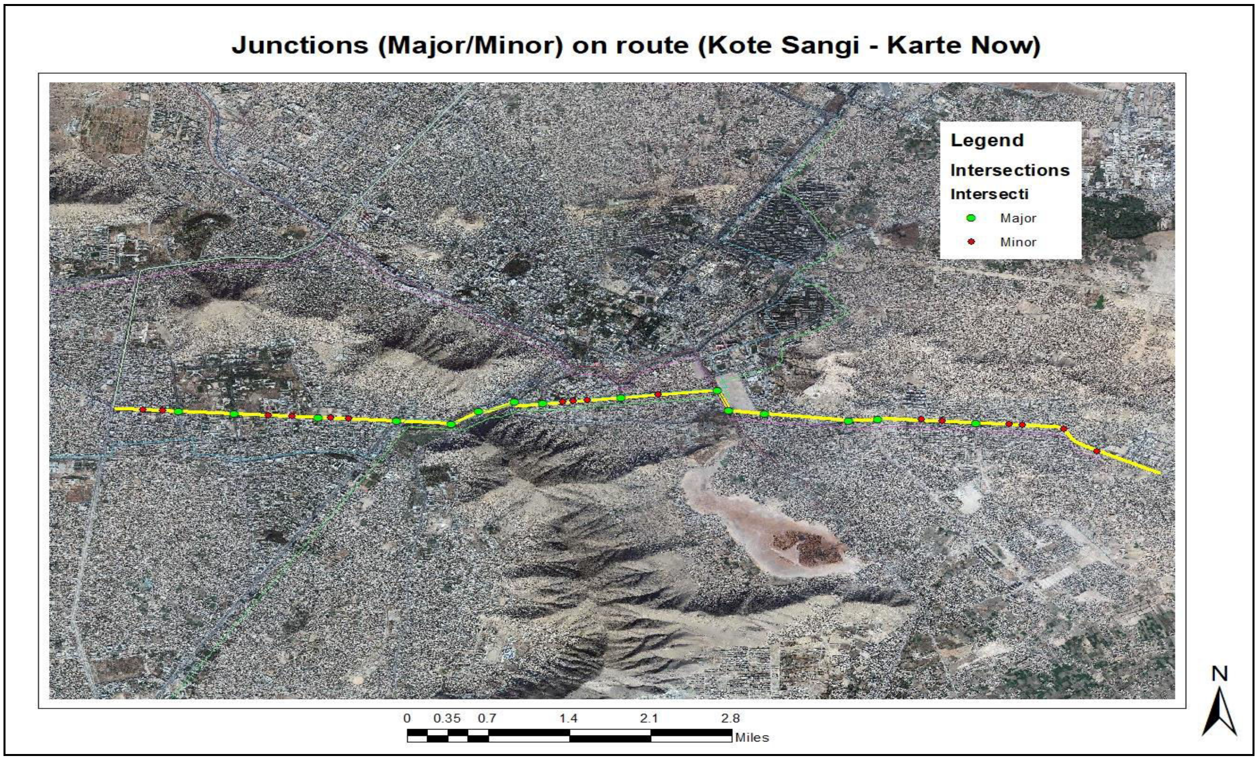


Table 13: Junction Delay for different Corridors (Alami, 2018).

Routes	Length (km)	Avg. Speed (km/h	Travel Time (min)	Major Junction (No.)	Minor Junction (No.)	Delay (min)	Delay/ Travel Time
Kote Sange-Cinama Pamir- Karte Now	11.910	22	32.48	11	18	39.1	1.20
Darulaman-Cinama Pamir-Maidan Hawai	15.978	25	38.35	18	11	46.45	1.21
Sarai Shamali - Deh Afghanan-Velayati	11.233	15	44.93	14	6	33.7	0.75
4 Rahi Qambar- Deh Afghanan- Karte Now	17.085	20	51.26	18	14	49.3	0.96
Dasht e Barchi - Cinama Pamir - Maidan Hawai	19.361	15	77.44	26	20	71	0.92
Kote Sangi-Deh Afghanan-Sara e Shamali	12.614	18	42.05	12	9	32.55	0.77

Table 13 shows the length, average bus running speed and travel time without considering delay, total number of major and minor road junctions and delay at these junctions for the initially selected BRT corridors. First, average delay at signals for buses was found out using sample data from a few routes during peak hour through primary survey. Using this data travel delays for other corridors were estimated. Some roads have a very high Delay/Travel Time ratio making them the unsuitable for BRT.

The table presents data on the delay at major and minor junctions along different corridors in Kabul, along with the length of the corridor, average speed, travel time, and delay per travel time. The delay at major and minor junctions is an important consideration for transportation planners because it affects the overall travel time and user experience. The data suggests that the delay per travel time varies across different corridors, ranging from 0.75 to 1.21.

The corridor from Kote Sange to Cinama Pamir to Karte Now has the highest delay per travel time, indicating that the junctions along this corridor are causing significant delays. On the other hand, the corridor from Dasht e Barchi to Cinama Pamir to Maidan Hawai has the lowest delay per travel time, indicating that the junctions along this corridor are causing relatively less delay. This information can be used to prioritize the improvement of major and minor junctions along the high-delay corridors to reduce travel time and enhance user experience. The table also presents information on the length of each corridor, average speed, travel time, and the number of major and minor junctions. Based on the corridor's average speed and length, the travel time for each corridor is determined. According to the data, travel times vary throughout routes and might take anywhere from 32.48 and 77.44 minutes. The corridor from Dasht e Barchi to Cinama Pamir to Maidan Hawai has the longest travel time, while the corridor from Kote Sange to Cinama Pamir to Karte Now has the shortest travel time.

V/C (Volume/Capacity) Ratio

The V/C ration is another important aspect to consider for the implementation of a BRT corridor feasibility analysis. The V/C ratio is a measurement of a road's ability to handle the amount of traffic it is carrying. In the case of a high V/C ratio, separating buses in one lane may lead to congestion in the other lanes or in the bus lane itself. Therefore, a lesser V/C ratio means lesser congestion and thus a better scope for a BRT system. This is because the BRT system requires dedicated lanes that are separated from regular traffic to ensure efficient and reliable operation. A low V/C ratio means that there is more capacity on the road, which can allow for the creation of dedicated bus lanes without causing significant congestion. As a result, while considering the viability of building a BRT system, the V/C ratio is an important factor to consider. The volume to capacity ratio (V/C) is used to assess road congestion. The average V/C in 2008 is 0.47, which is a reasonably excellent value, however the average V/C in 2025 will be 1.81, which is an undesirable level (JICA, 2011).

Corridors are analyzed for the volume/capacity ratio and their respective V/C ratio is shown in Table above. The Volume to Capacity (V/C) ratios for various routes are shown in the table. The link between the volume of traffic on a route and its capacity to manage that volume is reflected by the V/C ratio, which is a significant indicator of traffic congestion. When the volume of traffic exceeds the capacity of the road, or when the V/C ratio is more than 1, the route is crowded. The route is underutilised if the V/C ratio is less than 1.

Table 14: Volume Capacity Ratio (JICA, 2011).

V/C Ratio		
CN	Routes	V/C
1	Kote Sange-Cinama Pamir- Karte Now	0.9
2	Darulaman-Cinama Pamir-Maidan Hawai	0.95
3	Sarai Shamali - Deh Afghanan-Velayati	0.85
4	4 Rahi Qambar- Deh Afghanan- Karte Now	0.80
5	Dasht e Barchi - Cinama Pamir - Maidan Hawai	0.79
6	Kote Sangi-Deh Afghanan-Sara e Shamali	1.01

Looking at the table, we can see that the most congested route is the Kote Sangi-Deh Afghanan-Sara e Shamali route, with a V/C ratio of 1.01. This suggests that the amount of traffic on this route is just a little bit more than its capacity. It is crucial to remember that a number of variables, including road design, traffic volume, and time of day, have an impact on the V/C ratio. The V/C ratio for a particular route can change significantly during peak traffic hours. Therefore, it is essential to regularly monitor and update the V/C ratios for different routes to effectively manage traffic congestion and ensure the safety of commuters on the road.

BRT Periority Ranking

After analyzing the six corridors in Kabul city based on different parameters, it is evident that the Kote Sangi-Deh Afghanan-Sara e Shamali corridor has the highest potential for development and should be given priority. This corridor scored the highest in all the evaluated parameters, including accessibility, potential for growth and development, and socio-economic impact. The Sarai Shamali-Deh Afghanan-Velayati corridor is the second-best option for development, scoring well in all parameters except accessibility. While this corridor may require additional investment and resources to match the potential of the Kote Sangi-Deh Afghanan-Sara e Shamali corridor, it should still be considered as a viable alternative for development.

The 4 Rahi Qambar-Deh Afghanan-Karte Now, Kote Sange-Cinama Pamir-Karte Now, Darulaman-Cinama Pamir-Maidan Hawai, and Dasht e Barchi-Cinama Pamir-Maidan Hawai corridors scored lower in the evaluation and may not be the best options for urban development in Kabul city. However, these corridors should not be ignored entirely, and further analysis should be conducted to determine if they can be improved with targeted investments.

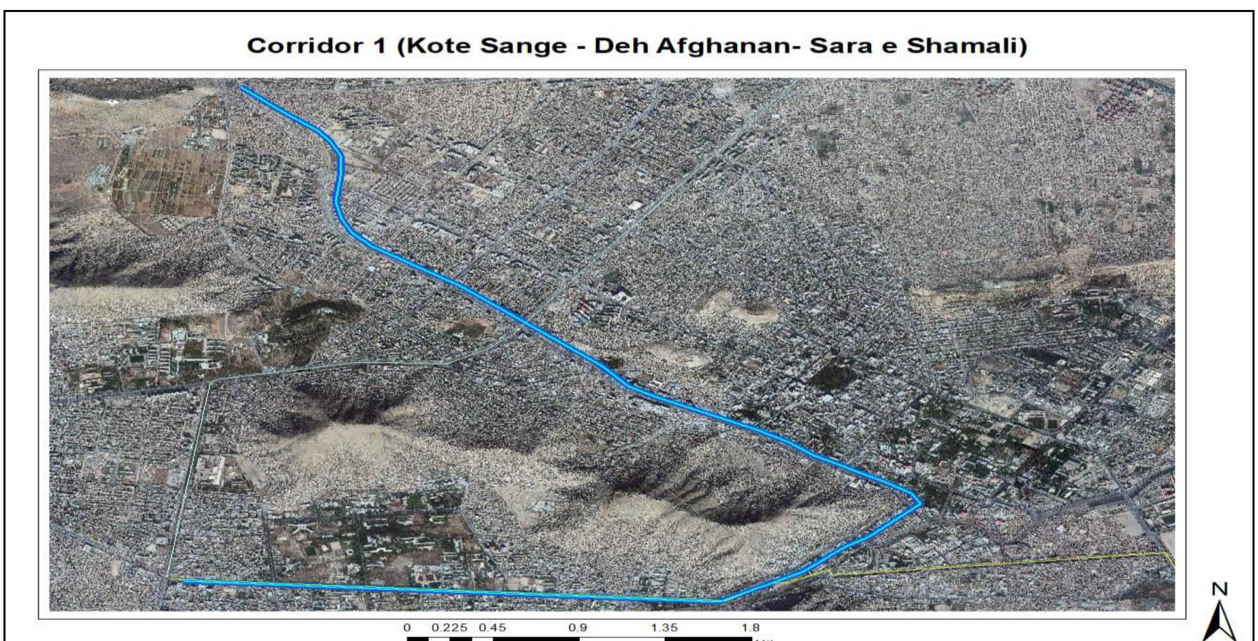
In conclusion, policymakers and the urban planners should prioritize the Kote Sangi-Deh Afghanan-Sara e Shamali and Sarai Shamali-Deh Afghanan-Velayati corridors for development in Kabul city. By allocating resources and implementing targeted investments in these corridors, the city can ensure sustainable and inclusive growth, leading to a better quality of life for its citizens.

CN	Routes	Ridership Score	ROW score	Junction Delay score	V/C score	Total Score	Periority Ranking
3	Kote Sangi-Deh Afghanan-Sara e Shamali	100.00	55	96.88	78.22	330.10	1
4	Sarai Shamali - Deh Afghanan-Velayati	55.78	80	100.00	92.94	328.72	2
2	4 Rahi Qambar- Deh Afghanan- Karte Now	51.94	82	77.98	98.75	310.66	3
1	Kote Sange-Cinama Pamir- Karte Now	98.10	40	62.31	87.78	288.18	4
5	Darulaman-Cinama Pamir-Maidan Hawai	57.71	67	61.92	100.00	286.62	5
6	Dasht e Barchi - Cinama Pamir - Maidan Hawai	55.80	10	81.80	98.75	246.37	6

RESULTS:

The study findings suggest that the Kote Sangi-Deh Afghanan-Sara e Shamali corridor is the most favorable option for development in Kabul city. The corridor scored the highest in all the evaluated parameters, including accessibility, potential for growth and development, and socio-economic impact. The study recommends that policymakers and urban planners should prioritize the development of this corridor to ensure sustainable and inclusive growth for the city.

CN	Routes	Ridership Score	ROW score	Junction Delay score	V/C score	Total Score	Priority Ranking
3	Kote Sangi-Deh Afghanan-Sara e Shamali	100.00	55	96.88	78.22	330.10	1
4	Sarai Shamali - Deh Afghanan-Velayati	55.78	80	100.00	92.94	328.72	2
2	4 Rahi Qambar- Deh Afghanan- Karte Now	51.94	82	77.98	98.75	310.66	3
1	Kote Sange-Cinama Pamir- Karte Now	98.10	40	62.31	87.78	288.18	4
5	Darulaman-Cinama Pamir-Maidan Hawai	57.71	67	61.92	100.00	286.62	5
6	Dasht e Barchi - Cinama Pamir - Maidan Hawai	55.80	10	81.80	98.75	246.37	6

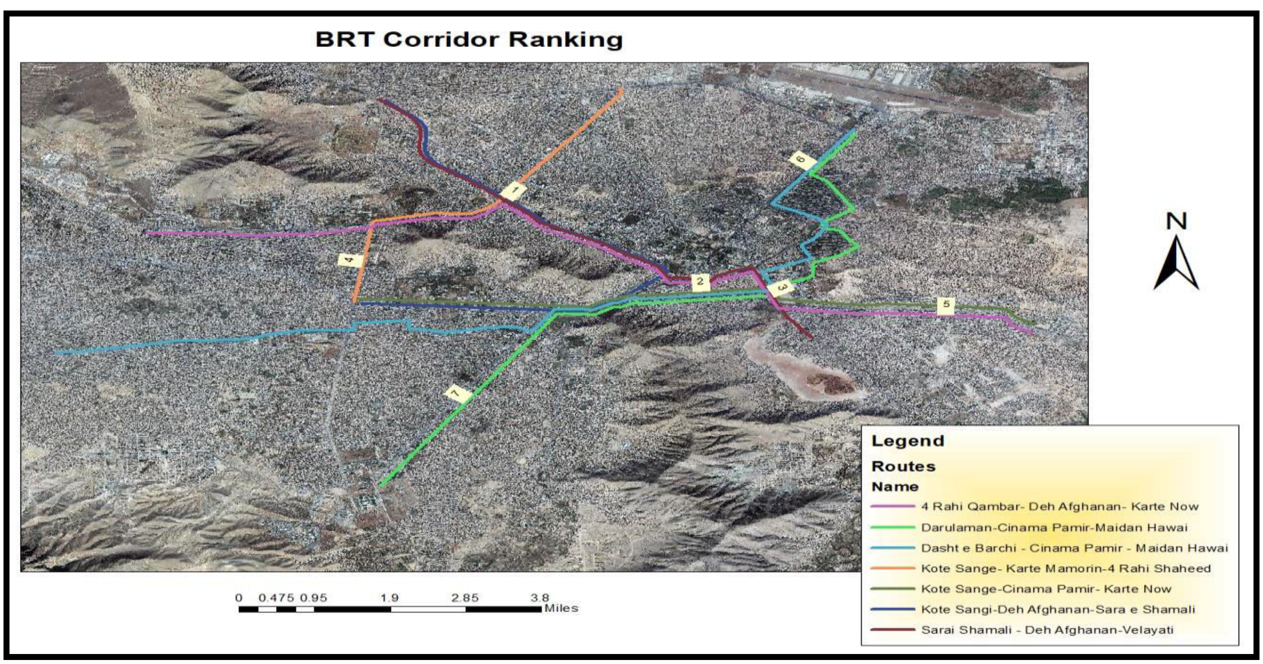


Additionally, the Sarai Shamali-Deh Afghanan-Velayati corridor also scored well in the evaluation and can be considered as a viable alternative for development. However, it may require additional investment and resources to match the potential of the Kote Sangi-Deh Afghanan-Sara e Shamali corridor. The other corridors evaluated, including 4 Rahi Qambar-Deh Afghanan-Karte Now, Kote Sange-Cinama Pamir-Karte Now, Darulaman-Cinama Pamir-Maidan Hawai, and Dasht e Barchi-Cinama Pamir-Maidan Hawai, scored lower in the evaluation and may not be the best option for urban development in Kabul city.

Comparative analyses

To perform a comparative analysis for the given table, we can start by comparing the different routes based on their total scores and priority rankings. We can also analyze the individual scores of each route based on the different parameters such as ridership score, ROW score, junction delay score, and V/C score. The table indicates that the "Kote Sangi-Deh Afghanan-Sara e Shamali" route has the highest total score (330.1) and is ranked first in terms of priority. This is mainly due to its high ridership score (100) and high junction delay score (96.88). The route also has a relatively high V/C score (78.22) and ROW score (55). The "Sarai Shamali - Deh Afghanan-Velayati" route has the second-highest total score (328.72) and is ranked second in terms of priority. This route has a high ROW score (80) and a perfect score for junction delay. The route also has a high V/C score (92.94) but a relatively low ridership score (55.78) compared to the top-ranked route. The third-ranked route is "4 Rahi Qambar- Deh Afghanan- Karte Now" with a total score of 310.66. This route has the highest V/C score (98.75) among all the routes, which compensates for its lower scores in other parameters such as ridership score (51.94) and junction delay score (77.98).

The fourth and fifth-ranked routes are "Kote Sange-Cinama Pamir- Karte Now" and "Darulaman-Cinama Pamir-Maidan Hawai," respectively. These two routes have relatively similar total scores (288.18 and 286.62, respectively) and have similar scores in all the parameters, except for the ridership score, which is higher for the fourth-ranked route. Finally, the sixth-ranked route is "Dasht e Barchi - Cinama Pamir - Maidan Hawai" with a total score of 246.37. This route has a relatively low ridership score (55.8) and ROW score (10), which significantly reduces its total score despite having a high junction delay score (81.8) and a high V/C score (98.75). In summary, the "Kote Sangi-Deh Afghanan-Sara e Shamali" route is the most promising one among all the given routes based on the total score and priority ranking. However, different routes have different strengths and weaknesses based on the parameters analyzed. Therefore, a more detailed analysis that considers the specific context and requirements of the transportation system is necessary to determine the best route for a particular situation.



DISCUSSION:

The results of a study aimed at the ranking six different bus routes based on their ridership score, right-of-way (ROW) score, junction delay score, volume/ capacity (V/C) score, and total score. The priority ranking for each route is also provided. The results indicate that the Kote Sangi-Deh Afghanan-Sara e Shamali route has the highest total score and, therefore, the highest priority ranking. This route has a ridership score of 100, which means that it is the most popular among the six routes studied. It also has a high ROW score of 55, indicating that it has a dedicated right-of-way, which helps to improve its reliability and travel time. Additionally, the route has a high junction delay score of 96.88, indicating that it experiences minimal delays at intersections.

The Sarai Shamali-Deh Afghanan-Velayati route has the second-highest total score and priority ranking. This route has a high ROW score of 80, indicating that it has a dedicated right-of-way. It also has a perfect junction delay score of 100, indicating that it experiences no delays at intersections. However, its ridership score is lower than that of the Kote Sangi-Deh Afghanan-Sara e Shamali route. The 4 Rahi Qambar-Deh Afghanan-Karte Now route has the third-highest total score and priority ranking. This route has a high V/C score of 98.75, indicating that it has a high volume of passengers relative to its capacity. However, its ridership score and junction delay score are lower than those of the Kote Sangi-Deh Afghanan-Sara e Shamali and Sarai Shamali-Deh Afghanan-Velayati routes. The Kote Sange-Cinama Pamir-Karte Now route has the fourth-highest total score and priority ranking. This route has a high ridership score of 98.10, indicating that it is very popular. However, its ROW score is relatively low compared to the top three routes.

The Darulaman-Cinama Pamir-Maidan Hawai route has the fifth-highest total score and priority ranking. This route has a high V/C score of 100, indicating that it has a high volume of passengers relative to its capacity. However, its ridership score and junction delay score are lower than those of the top four routes. The Dasht e Barchi-Cinama Pamir-Maidan Hawai route has the lowest total score and priority ranking. This route has a low ROW score of 10, indicating that it does not have a dedicated right-of-way. However, it has a high junction delay score and V/C score. In conclusion, the study shows that different bus routes in the area perform differently based on various performance indicators. The study's results can help policymakers and transit planners to identify the strengths and weaknesses of each route and develop strategies to improve their performance.

CONCLUSION AND RECOMMENDATIONS:

The selection of a Bus Rapid Transit (BRT) corridor for Kabul city is a critical step towards addressing the growing transportation challenges faced by the city's residents. This study has found a possible BRT corridor that can assist increase the accessibility and effecttiveness of public transportation in the city through an in-depth analysis of many aspects, in-cluding population density, traffic flow, and economic development potential. The selected corridor is expected to offer a safe, reliable, and affordable trans-portation option that can reduce traffic congestion and air pollution, while also stimulating economic growth along the route. However, the success of the project will depend on effective implementation, proper planning, and active engagement with stakeholders and the public. Therefore, it is crucial for the relevant authorities to prioritize the implementation of the BRT corridor and ensure its sustainability in the long term. Overall, this thesis provides light on how Kabul City chose its BRT path and can be used as a foundation for future studies and the creation of sustainable transport systems in other urban areas.

This paper aims to deliver a methodology and planning framework for selection of BRT corridors for bus transit reform and redesign in urban areas in Afghanistan and Kabul in particular in the context of the present challenges of increasing traffic congestion, car ownership, and lack of road and transport infrastructure and gradual deterioration of LOS of bus transit system. Detailed design for BRTS on these corridors or integration of bus transit services in between these corridors is not undertaken in the present paper. For estimation of bus ridership on different corridors, average occupancy and frequency of buses were estimated based on sample survey data. However, for detail design, extensive surveys should be conducted to get more accurate ridership estimates for these routes. The present methodology combines both existing travel demand estimate and feasibility analysis in terms of traffic and road infrastructure characteristics for selection and phasing of BRT corridors. A thorough review of many different aspects, such as the current infrastructure, the travel demand, ridership estimation, and feasibility testing, goes into choosing a BRT path for Kabul city. The study region and data gathering are crucial in identifying feasible routes for the BRT system's installation. Identifying routes with significant travel demand and measuring ridership can also be used to assess whether the suggested corridors are feasible. To ensure the effective and dependable functioning of the BRT system, feasibility testing entails a thorough examination of a number of factors, including the right of way already in place, the quantity of junctions, and the volume/capacity ratio. Implementing a BRT system in Kabul city can help improve the quality of public transportation, reduce traffic congestion, and promote sustainable transportation options. However, careful consideration of the various factors involved in the selection of a BRT corridor is crucial to ensure the success of the project. With proper planning and implementation, a BRT system can provide a safe, affordable, and efficient transportation option for the residents of Kabul city.

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CONFLICTS OF INTEREST:

The authors state that there is no potential conflict of interest in publishing this research article.

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