2021

A COMPREHENSIVE CITY BUS SERVICE PLAN

Contents

List of Tables

List of Maps

1. Introduction

1.1. Background

Thimphu, the capital city of Bhutan, has experienced rapid urbanization due to increasing socio-economic opportunities. This growth has led to a steady influx of population from across the country, putting pressure on infrastructure and services. While the Central Government has promoted regionally balanced development, Thimphu continues to dominate due to economic centralization and urban migration.

This shift—from a predominantly agrarian society to one centered on modern education and urban employment—has created a mismatch between job opportunities and the evolving workforce. Government efforts to encourage rural livelihoods have seen limited success, leaving youth in a vulnerable position as they are often forced to move to urban areas for work.

As the city expands, transport and mobility have become critical. Public transport is essential for equitable access to employment, education, and healthcare. Thimphu's city bus service was introduced in 2002 by Bhutan Post. However, with a limited fleet and poor coverage, the system became known for its inefficiency and long travel times. This discouraged widespread use, confining ridership to those without access to alternative modes of transport.

Car ownership, therefore, became a necessity rather than a luxury. Of the 115,067 registered vehicles in Bhutan, approximately 61,636 (54%) are concentrated in Thimphu alone. This has led to significant traffic congestion, limited parking, overcrowded buses, and increased pollution and fuel consumption.

To break this cycle, the city bus service was transferred under the direct management of the Thrompon. In 2021, Thimphu Thromde undertook a major revision of the city’s bus routes in response to growing demand and urban sprawl.

Following extensive studies and stakeholder consultations, a transit network model was proposed. This model allows passengers to make complex journeys using an interconnected system of routes, increasing overall system efficiency. Under this new model, 14 routes were proposed—including 4 supplementary routes connecting Hongtsho, Debsi, Ngabiphu, and Chamgang to the city. A total of 168 bus stops were identified: 150 within city limits and 18 in the periphery.

2. Current Scenario of the City Bus Service

2.1. Routes

The existing route planning is primarily destination-based, often designed around specific institutions such as schools and colleges to cater to the student population. While this serves the main target group to some extent, it has also led to limited flexibility and accessibility for the general public. Many areas—especially emerging residential zones and peripheral settlements—remain poorly served or completely unserved, forcing residents to rely on private vehicles.

Due to the limited fleet, these destination-based routes stretch across large catchment areas, making them long and inefficient. This setup has confined ridership mostly to students, while others find the system inconvenient and unreliable due to the restricted coverage, lack of feeder routes, and minimal service outside peak school hours.

2.2. Travel Time

Travel time has been significantly affected by the lack of holistic route planning. Instead of designing a comprehensive, efficient network from the ground up, the current system has evolved by merely extending existing routes in an attempt to reach more areas. This approach has compromised overall efficiency.

These extensions often result in long, circuitous routes that increase travel duration and reduce reliability. Consequently, buses take more time to complete trips, leading to irregular intervals, overcrowding during peak hours, and long waiting periods. The inefficiency of the system has discouraged other potential users, reinforcing dependency on private vehicles.

2.3. Amenities

A major drawback has been the lack of critical supporting amenities. Facilities such as depots, terminals, and well-maintained bus stops are essential for safety, management, and maintenance. For students in particular, the absence of proper shelters, designated waiting areas, and footpath access to stops poses additional challenges. Furthermore, connectivity between bus stops and schools, colleges, and residential areas remains weak, making the service less accessible even to its main user group.

3. Proposed City Bus Service Plan

3.1. Objectives

The main goal is to develop and efficient and sustainable public transport system for Thimphu with specific objectives being:

- Ensuring affordability for students, low-income groups, and daily wage earners.
- Reducing private vehicles dependency to ease congestion and emissions.
- Enhancing connectivity to education, healthcare and employment.
- Promoting environmentally sustainable mobility.
- Expanding services to underserved and peripheral areas.

3.2. Project Scope

The scope of this project is to design and implement a data-driven, geographically sensitive bus network tailored to Thimphu’s terrain, population and mobility needs.

3.3. Route Optimization Strategy

To ensure an efficient, inclusive, and well-integrated public transport system, the city bus service will adopt a hierarchical route structure consisting of trunk, subsidiary, and supplementary routes**,** each serving a specific function within the network.

Stop-wise transit and wait times are provided in Appendix 10.D.

3.3.1. Trunk Route

The Trunk route form the primary transit spine of the city bus network, running along the north–south axis of Thimphu valley, which naturally shapes the city's urban layout. This linear alignment is designed for high frequency and high-capacity ridership**,** trunk routes serve as the backbone of the public transport system**,** supporting seamless transfers with subsidiary and supplementary routes. Their predictable and direct routing supports faster travel times and provides the most reliable alternative to private vehicle use within the Thromde.

3.3.2. Subsidiary Routes

The Subsidiary routes are designed to feed into the trunk routes by servicing local neighborhoods and lower-density areas. They ensure last-mile connectivity by collecting passengers from within communities and transporting them to nearby trunk route hubs or transfer points. These routes operate on a moderate frequency but are synchronized to align with trunk route schedules to minimize waiting time and improve overall journey efficiency. Their flexible routing allows buses to navigate narrower roads and more challenging topography, enhancing accessibility.

3.3.3. Supplementary Routes

The Supplementary routes are intended to extend service beyond the Thromde boundary to outlying areas such as Hongtsho, Debsi, Ngabiphu, and Chamgang. These routes are particularly important for servicing peri-urban and rural populations who need access to the city's socio-economic services. Supplementary routes also cater to areas with lower daily demand by offering reduced-frequency services—such as weekend-only or limited daily schedules—to match travel patterns in these regions. These routes ensure inclusivity by preventing transport exclusion in remote or sparsely populated zones.

Detailed route information and maps are provided in Appendix 10.A.

3.4. Bus Stop Identification

The stops are strategically identified and established based on population density, land use patterns, and user accessibility. Major considerations have been given to schools, hospitals, government offices, markets, and densely populated residential areas for locating stops to ensure accessibility and ridership. Pedestrian access and safety, with proper signage, lighting, and waiting areas has been prioritized for connectivity to the stops from the catchment.

To ensure ease of accessibility, a criterion of 5-minute walking distance (approximately 400 meters) of a bus stop has been ensured during planning. This standard promotes equitable access and encourages public transport use.

However, terrain and road layout constraints**,** such as steep slopes, narrow lanes, and discontinuous pedestrian infrastructure limits universal access to bus stops within this ideal range. As a result, a greater number of bus stops had to be provided to adequately serve all neighborhoods, particularly in peripheral or topographically challenging zones. While this may increase the number of stops along certain routes, it ensures that no area is left underserved but consideration to balance the numbers with the fare structure (i.e. based on number of stops) had been taken into account.

Details of the bus stops details are provided in Appendix 10.B.

3.5. Bus Specifications

The plan takes into account Thimphu's unique terrain and elevation differences when designing routes, ensuring operational feasibility and minimizing wear on vehicles. The approach and departure angles of buses are crucial considerations to ensure safe and efficient operations. These angles refer to the maximum incline and decline that a bus can safely navigate without risking damage to the vehicle or the passengers.

3.5.1. Terrain Considerations

Due to Thimphu's uneven terrain, buses need to navigate steep gradients and sharp inclines/declines in certain areas of the city. The design specifications for bus routes and vehicle type must take these geographical constraints into account to prevent damage, delays, or safety hazards. The approach and departure angles should be adjusted to ensure the vehicle can safely navigate the city's inclines without damage, while maintaining passenger safety and comfort.

3.5.2. Maneuverability on Subsidiary Routes

Given the topography and the zigzag nature of roads in the east-west direction, bus length and maneuverability are key factors to consider for subsidiary routes. Longer buses may struggle with narrow, winding roads, so vehicle size and turning radius must be carefully balanced with the city's geography. A larger bus (e.g., 12-meter standard buses) typically has a larger turning radius, which makes it difficult to maneuver around tight corners as compared to make sharp turns more effectively in winding or zigzag roads.

4. Infrastructure and Amenities

A well-functioning public transport system relies not only on buses and routes but also on supporting infrastructure that enhances user experience, safety, and system reliability.

4.1. Bus Stops

Bus stops will be designed to ensure safety, comfort, and accessibility for all users. The infrastructure will include:

- Bus Stop Shelters with Bays (88 units):
  These include dedicated pull-in bays for buses to stop without disrupting traffic, as well

as covered waiting areas with seating, lighting, and information displays. They will be prioritized along trunk and major subsidiary routes.

- Bus Stop Shelters without Bays (140 units):
  These stops provide covered shelters and seating but are located where road width does not allow for full bays. They serve areas with moderate traffic or constrained space.
- Simple Bus Stop Posts (92 units):
  Marked with clear signage and route information, these are used in low-traffic or narrow-road areas, particularly along supplementary routes or at less frequented stops.

This tiered approach allows for efficient use of resources while ensuring wide coverage, visibility, and accessibility.

4.2. Supporting Facilities to Bus Stops

To improve last-mile access and the usability of public transit supporting facilities to bus stops, the following must be improved:

- Footpaths and pedestrian crossings connecting to stops
- Bicycle racks and parking zones
- Waste bins for users

4.3. Bus Depots

A dedicated bus depot is essential for the secure storage, maintenance, and efficient deployment of the city bus fleet. The proposed depot will be located near the truck parking area in Babesa, selected for its relatively open space and proximity to key routes.

However, due to space limitations and existing road infrastructure, the depot has easy access primarily to the Ngabiphu Terminal and moderate access to the Ola Rongchhu Terminal. This limits direct servicing to other terminals, but these constraints have been considered in route planning and operational logistics to minimize impact.

4.4. Bus Terminal

Terminals will serve as key transit hubs where passengers can transfer between different routes (trunk, subsidiary, and supplementary), enhancing connectivity across the city. These hubs are strategically located to ensure efficient access from all regions of Thimphu.

- Ngabiphu Terminal (South):
  Located in the southern region of Thimphu, this terminal will serve as a major transfer point for passengers from peripheral areas like RTC and Khasadrapchu. It will connect southern residential and commercial zones to the core city.
- Dangrina Terminal (North):
  Situated in the northern part of the city, this terminal will facilitate smooth transit for passengers traveling to and from outlying areas in the north, offering easy access to institutions and healthcare in the centre.

- Ola Rongchhu Terminal (South Central):
  This terminal will serve as a key node for travelers from the supplementary routes towards Hongtsho and Chamgang,, ensuring easy connections to the core and north of the city. It will also help alleviate congestion by providing a transfer point for cross-city commuters.
- Lungtenzampa Terminal (Core):
  Located at the current CBS office in the city center, Lungtenzampa Terminal will act as the central hub for the entire public transport system. With its proximity to major government offices, markets, and residential zones, it will be the focal point for all major bus routes.

These terminals are designed to handle high traffic volumes, with multiple bays, ticket counters, waiting lounges, and commercial facilities to support passengers during transfers.

5. Bus Types and Suitability

Bus selection is guided by topography, passenger volume, and route design. Each route tier requires vehicles tailored to its function and terrain. While all buses must feature strong braking systems, favourable approach/departure angles and high ground clearance to navigate Thimphu's hilly terrain:

- Trunk Routes must be operated with high-capacity standard buses, suitable for the main north–south corridor. The planned fleet is 20 buses.

- Subsidiary Routes must operate with medium-sized buses which offer better maneuverability on narrow, winding roads in residential and peripheral zones. The planned fleet is 77 buses.

- Supplementary Routes could be operated with smaller, more flexible buses. These cater to low-demand, peri-urban areas where roads may be steeper or less developed.

The vehicle size, type, and number have been carefully aligned with route geography, passenger demand, and operational efficiency.

6. Mobilization Strategy

This section outlines operational readiness and how the bus service will be rolled out.

6.1. Phased Rollout

The bus service will be implemented in phases to ensure operational readiness and service optimization. The pilot phase will begin on selected routes to evaluate demand patterns and operational performance. Full deployment across all routes will follow progressively, subject to the availability of buses and supporting infrastructure. Priority will be given to high-demand corridors and underserved areas.

Bus frequency and fleet numbers will be increased during peak hours to accommodate commuter volume and reduce wait times.

6.2. Fare System

A distance-based fare to be introduced with cap to ensure affordability. It should account for concessions to students and senior citizens. Smart ticketing system (card-based and mobile payments) to improve convenience and loss of revenue due to cash handling. Daily or monthly pass options could also be introduced.

6.3. Public Engagement

Awareness to promote ridership could be carried out via social media, print materials and campaigns in schools to encourage ridership. Real-time updates via apps should also improve ridership.

6.4. Announcements

System announcements for delays, route changes via app and displays could keep users informed. Announcements in the bus for stops could also enable users get to correct locations.

6.5. Operational Assumptions and Fleet Planning

To estimate service frequency and fleet requirements, the permissible speed limit is 30 km/hr on trunk routes and 25 km/hr on subsidiary routes had been considered. Based on these speeds and projected demand, buses are planned to operate at a 10-minute interval during peak hours. This frequency aims to ensure reliability, minimize wait times, and accommodate high passenger volumes efficiently.

The fleet requirement worked out were 20 buses for the trunk route and 77 for the subsidiary routes. These fleet requirements have been calculated based on round-trip travel time, route length, dwell times, and operational buffers. They are essential to meet service demand, maintain schedule reliability, and support seamless integration between route tiers.

Supplementary route fleet estimates can be detailed separately based on lower frequency needs.

Details on fleet and frequency given in Appendix 10.C.

6.6. Service Timing and Frequency

To ensure timely and reliable service, buses on trunk routes will operate at 10-minute intervals during peak hours, while subsidiary routes will follow a 10–15 minute frequency, adjusted based on demand.
Operational timing assumptions are based on permissible speed limits:

- 30 km/h for trunk routes
- 25 km/h for subsidiary routes

Timing estimates, including stop-to-stop durations, turnaround times, and route schedules, are provided in **Appendix [X]**.

7. Signage Strategy

Effective signage is essential for enhancing user navigation, safety, and accessibility across the public transport system. A comprehensive signage strategy will support both commuters and fleet operators in efficiently planning and executing journeys.

- Key components of this strategy include:
- Wayfinding and Route Signage: Street signs will guide passengers and operators by providing clear directions and route information, facilitating smoother navigation throughout the network.
- Bus Stop Signage: All bus stops will feature clearly visible signs displaying route numbers, schedules, and service information, helping users make informed travel decisions.
- Priority Lane and Accessibility Signage: Signage will clearly indicate dedicated bus lanes, priority boarding areas, and wheelchair-accessible zones, ensuring equitable use of public transport.
- Safety Signage: Speed limit signs, pedestrian crossings, and safety zones will be installed to enhance commuter and pedestrian safety in high-traffic areas.
- Multilingual Support: All signage will be provided in both Dzongkha and English, ensuring clarity and inclusivity for all user groups.

8. Congestion Management and Mode Shift Strategies

8.1. Public Transport-only Corridors on Working Days

To address chronic traffic congestion and promote sustainable transport choices, a policy of exclusive public transport access on selected corridors during working days will be piloted. Under this policy:

- Private vehicle access will be restricted during peak hours on designated high-traffic corridors.
- Piloting the restriction on specific weekdays to encourage gradual behavioral adaptation among commuters.
- Only buses, emergency vehicles, and bicycles will be permitted on these roads during the restricted hours.
- This will improve travel speed and reliability for public transport users, incentivizing a modal shift away from private cars.

Potential implementation areas include the Norzin Lam SE corridor and the north-south spine (S Doebum Lam and N Doebum Lam) served by trunk routes.

8.2. Lane Expansion Where Feasible

Strategic widening of existing roads will be pursued to improve traffic flow and accommodate dedicated bus lanes where possible. A priority intervention zone is:

- CSI Junction to Memorial Chorten, which regularly experiences bottlenecks.
- Where physically feasible, additional lanes will be created to allow for:
    - Dedicated bus lanes
    - Safe pedestrian paths and cycle lanes

These enhancements will not only reduce congestion but also provide the infrastructure necessary to support a high-performing public transport system.

8.3. Indirect Benefits

These measures are expected to:

- Encourage commuters to shift to public or non-motorized modes
- Reduce idling and fuel wastage in traffic jams
- Enhance air quality and public health
- Support Bhutan's broader goals for environmental sustainability and low-carbon urban mobility

9. Conclusion and Recommendations

9.1. Conclusion

Thimphu's rapid urbanization has created urgent challenges in mobility, accessibility, and environmental sustainability. The current public transport system, while essential for many—especially students—remains limited in coverage, reliability, and inclusivity. Dependence on private vehicles has contributed to congestion, pollution, and inequitable access to opportunities.

The proposed city bus service plan addresses these issues through a comprehensive, data-driven strategy that reimagines route structures, enhances supporting infrastructure, and integrates topographic and demographic considerations. By introducing hierarchical routing**,** improving bus stop amenities, ensuring fleet adaptability to terrain, and expanding fare and mobilization systems**,** the plan aims to make public transport a preferred and viable mode for all.

Furthermore, policy-level interventions**,** such as public transport-only corridors and lane expansions**,** are crucial steps toward reducing congestion and promoting sustainable urban mobility.

9.2. Recommendations

To realize the full potential of this plan, the following recommendations are proposed:

- Public transport-only corridors (Priority Lane) has to be enforced during peak hours.
- Roll out pilot routes and infrastructure improvements in high-demand corridors.
- Monitor performance and user feedback before city-wide expansion.
- Develop depots, terminals, and modernized bus stops with real-time information systems.
- Implement smart ticketing and digital schedule tracking.
- Conduct outreach with communities, institutions, and businesses to build ridership.
- Provide training for drivers and technicians in handling new vehicle types with digital enhancements.
- Establish performance indicators such as ridership growth, wait times, and fuel savings.
- Regularly review and adapt services to reflect user needs and urban growth patterns.

With strong governance, strategic investment, and public participation, this city bus service plan has the potential to transform urban mobility in Thimphu, offering residents a safe, efficient, and sustainable alternative to private transport.

10. APPENDICES

10.A. Route Details

The table below presents the details of all planned routes, including their classification, route IDs, and the number of designated stops. Routes have been categorized into Trunk**,** Subsidiary, and Supplementary based on their operational roles within the network.

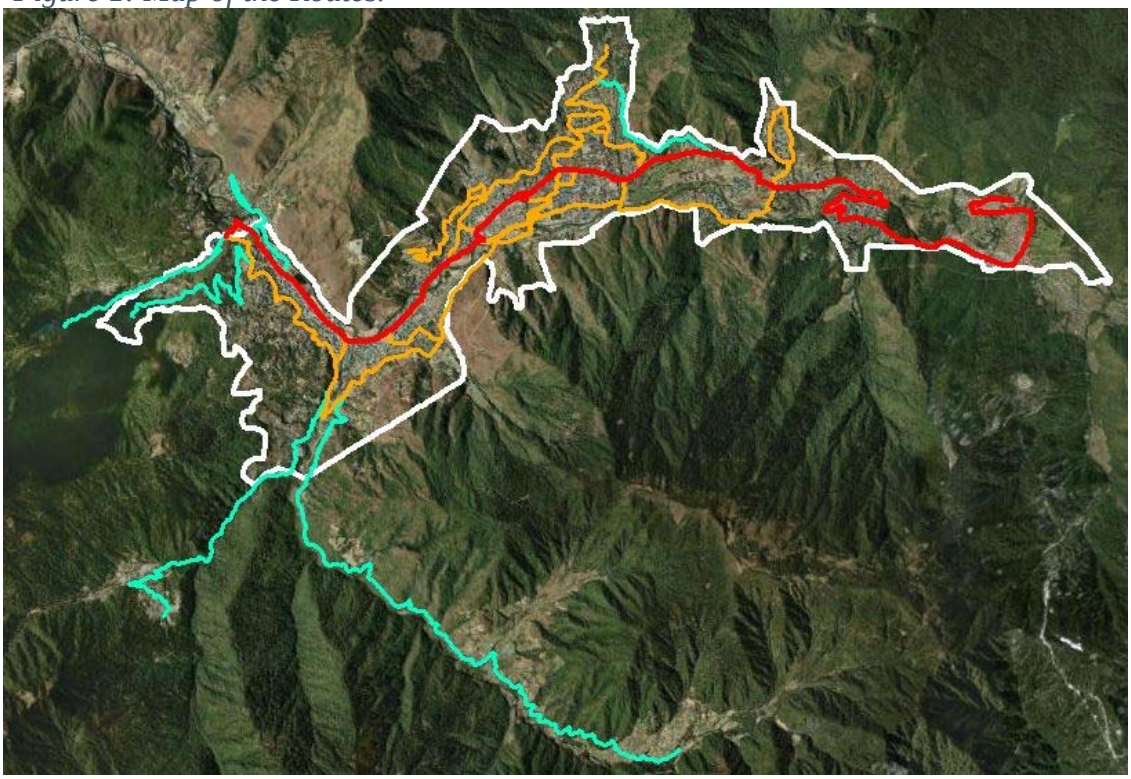
Table 1. Route Details

Sl. No.	Route Name	Route_Id	Route Type	Number Of Stops	Remarks
1	Dangrina Terminal-Ngabiphu Terminal	1	Trunk	48	Including terminals
2	Ngabiphu Terminal-Ngabiphu	2	Supplementary	8	
3	Ngabiphu Terminal-Do Zhabjey	3	Supplementary	11	
4	NgabiphuTerminal-Ola Rongchhu Terminal	4	Subsidiary	11	
5	Barp Gochukha-Debsi	5	Supplementary	13	
6	Ola Rongchhu Terminal-Chang Jalu	6	Subsidiary	12	
7	Ola Rongchhu Terminal-Chamgang ThangGom	7	Supplementary	9	
8	Ola Rongchhu Terminal-Hongtsho Checkpoint	8	Supplementary	13	
9	Chang Gidhaphu-RBA HQ	9	Subsidiary	26	
10	Thangu F-O-Thangu F-O	10	Subsidiary	25	
11	Thangu F-O-Kuenselphodrang School	11	Subsidiary	11	
12	Kuengacholing-Yangchenphu	12	Subsidiary	16	
13	Yangchenphu-Samteling	13	Subsidiary	27	
14	Jigme Namgyel School-Tashichhodzong	14	Supplementary	9	

The map below illustrates the spatial layout of the proposed network:

- Thromde boundary: White outline
- Trunk route: Red, forming the spine of the city
- Subsidiary routes: Orange, connecting surrounding areas to the trunk line
- Supplementary routes: Teal, including extensions beyond the Thromde boundary for commuters from nearby Dzongkhags

Figure 1: Map of the Routes.



10.B. **Bus Stop Details**

The bus stop infrastructure has undergone a systematic and culturally informed transformation to better support the public transport system in Thimphu. Previously, bus stop names were temporary, often lacking connection to the local geography, heritage, or community identity. Recognizing this, Thromde authorities, through the active engagement of local Tshogpas and consultations with long-time residents, undertook the task of reviewing and renaming stops to reflect the local significant place names.

- This initiative aims to achieve multiple goals:
- Preserve cultural heritage through recognition of traditional toponyms.
- Enhance user orientation by assigning recognizable and location-relevant names.
- Standardize stop identification for operational consistency, mapping, and digital service integration.

Each stop has been assigned a unique stop number, geographic coordinates, and categorized by stop type ranging from simple signposts to fully developed shelters with bays to accommodate increased ridership and ensure safety. The categorization was based on projected passenger volumes, spatial constraints, and proximity to key landmarks, institutions, or residential hubs.

Table 2 below lists the 170 officially designated bus stops under the Thimphu city bus network. It includes the name, stop number, geographic coordinates, and type of infrastructure provided:

Table 2: Stop Details

Stop Number	Name	Type	X_Coordinate	Y_Coordinate
1	Ngabiphu Terminal	Terminal	214813.191	3034814.101
2	Chhubu Gangkha	Only Stop Signage	214612.675	3035019.982
3	Barp Lhakhang	Shelter with Bay	214958.959	3035348.788
4	Barp Gochukha	Shelter with Bay	215331.175	3035645.204
5	Tshalu Barp	Shelter with Bay	215592.903	3035935.520
6	Janglo Lum	Shelter with Bay	215948.430	3036211.049
7	Tshalu Marphey	Shelter with Bay	216147.003	3036391.470
8	Ola Rongchhu Terminal	Shelter with Bay	216355.308	3036628.358
9	Olakha Overpass	Shelter with Bay	216418.768	3036968.773
10	Naazhingna	Shelter with Bay	216219.805	3037369.770
11	Rishi Lhakhang	Shelter with Bay	215999.334	3037591.943
12	Changjiji	Shelter with Bay	215797.429	3037785.206
13	Chang Bangdu	Only Stop Signage	215495.262	3037911.182
14	Thanju	Shelter with Bay	215199.214	3038284.101
16	Kashitsawa	Shelter with Bay	214995.832	3038589.723
17	CSI	Only Stop Signage	214857.863	3038721.808
18	Chang Khorlo	Only Shelter	214489.319	3038907.897
19	Gong Dzok Chorten	Only Shelter	214174.896	3039293.865
20	Chang Gaynyen	Only Shelter	214056.078	3039594.234
21	Gaynyen Junction	Shelter with Bay	213797.781	3039939.566
22	Changangkha School	Only Shelter	213823.807	3040459.367
23	Chhuba Chhu	Shelter with Bay	213950.490	3040816.205
24	Bhutan Telecom	Shelter with Bay	213895.919	3041056.762
25	Tashichhodzong	Shelter with Bay	213529.001	3041984.592
26	Dechenphodrang	Only Shelter	213610.590	3042502.056
27	Lhadrong	Only Stop Signage	213988.237	3043020.150
28	India House	Shelter with Bay	214054.548	3043221.065
29	Jungzhina 1	Shelter with Bay	214059.567	3043824.512
30	Jungzhina 2	Only Shelter	213977.122	3044097.351
31	Pamtsho 1	Only Shelter	214137.794	3044523.265
32	Pamtsho 2	Only Shelter	214155.937	3044741.194

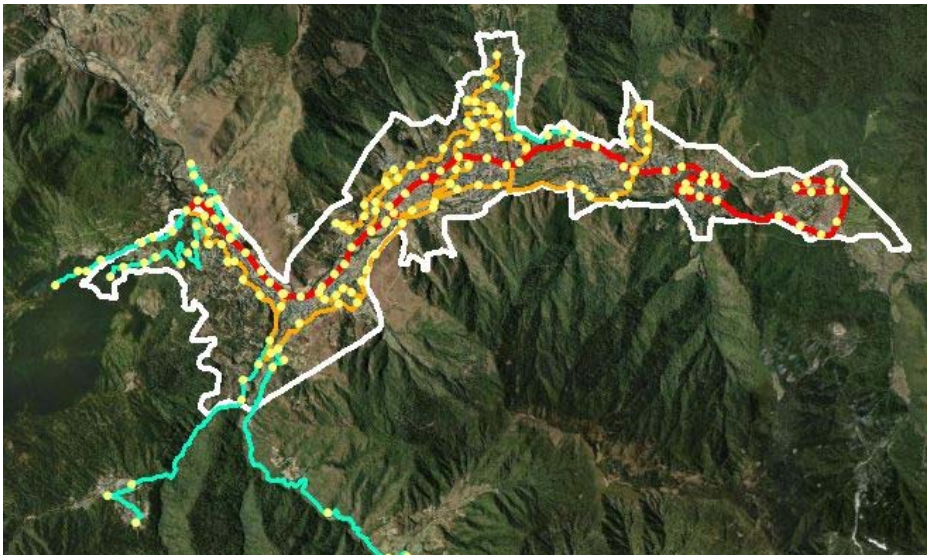
Stop Number	Name	Type	X_Coordinate	Y_Coordinate
33	Gaykha 1	Shelter with Bay	214306.135	3044760.551
34	Gaykha 2	Shelter with Bay	214262.072	3044476.786
35	Gaykha 3	Shelter with Bay	214289.502	3044179.222
36	Shongchuna	Only Stop Signage	214421.045	3044123.671
37	Babe Zhing	Only Stop Signage	214439.197	3044267.037
38	Taba Chorten Tsawa	Only Shelter	214538.173	3044447.877
39	Nima School	Shelter with Bay	214618.233	3044775.091
40	Dechencholing School	Only Shelter	214905.791	3045931.603
41	RBG Gate	Only Shelter	215088.196	3046321.212
42	Pangri Zam	Only Shelter	215261.981	3046737.938
43	Pangri Zam Dolma Lhakhang	Only Shelter	215024.409	3047025.149
44	Dechenphu Junction	Only Shelter	214442.182	3047148.453
45	Drongtoed	Only Shelter	214429.514	3046883.879
46	Siluna	Only Shelter	214461.925	3046550.586
47	Drongmoed	Only Shelter	214377.207	3046249.581
48	Dolangdro	Only Shelter	214264.539	3046456.948
49	Dangrina Terminal	Terminal	214265.763	3046872.321
50	Ku Jabthued	Only Shelter	214915.060	3035164.102
51	Wangchhu Taba Junction	Shelter with Bay	215205.085	3035230.895
52	Babesa School	Shelter with Bay	215428.158	3035241.093
53	Naashing Gang	Shelter with Bay	215431.473	3035481.754
54	Gepjakha	Shelter with Bay	215754.022	3035584.446
55	Dolay Gang	Shelter with Bay	215749.586	3035718.410
56	Khamdo Lum	Shelter with Bay	216101.226	3035868.975
57	Kemkha	Shelter with Bay	216388.847	3036186.440
58	Tinchukha	Only Shelter	216614.528	3036580.449
59	Simtokha Chorten Kangnyim	Only Shelter	217227.500	3036385.801
60	RIM	Only Shelter	217482.643	3036403.267
61	Olakha Substation	Only Stop Signage	216906.898	3036928.236
62	Lubding junction	Only Shelter	216556.756	3037674.680
63	RBA HQ	Only Shelter	216531.073	3038027.511
64	Chang Lutey	Only Stop Signage	216325.157	3037921.492
65	Do Jabhu	Only Shelter	216263.732	3037746.802
66	Omkha	Shelter with Bay	216400.495	3037622.429
67	Dzongchu	Only Shelter	216458.408	3037413.295
68	Chang Jalu	Shelter with Bay	216325.327	3037300.563
69	Lungtenphu	Only Shelter	216131.718	3038092.602
70	Chang Denglo	Only Shelter	215926.011	3038206.365

Stop Number	Name	Type	X_Coordinate	Y_Coordinate
71	Ramilog	Only Shelter	215612.288	3038369.051
72	Samazingkha	Only Shelter	215043.259	3038867.114
73	Yangchenphu	Shelter with Bay	214761.566	3039446.443
74	Zhungna	Only Stop Signage	214731.043	3038625.204
75	Yamigu	Only Shelter	214633.587	3038378.438
76	Thoulumu	Only Shelter	214329.882	3038608.645
77	Gidha Junction	Only Stop Signage	214196.400	3038793.852
78	Bangdu Junction	Shelter with Bay	214247.543	3038545.444
79	Chang Gidhaphu	Only Shelter	214045.524	3038702.581
80	Thangu F-O	Only Shelter	215177.173	3038279.002
81	Jashimaam	Only Shelter	214792.371	3038367.184
82	Chundu Zingkha	Only Shelter	214684.622	3038157.382
83	Chorten Gang	Only Shelter	214916.378	3038158.208
84	Tshatsha	Only Shelter	215179.412	3037889.850
85	Bangadungsa	Only Shelter	215106.570	3037749.489
86	Kuenselphodrang School	Only Shelter	215032.685	3037621.429
87	Chang Zeri	Shelter with Bay	213962.126	3039029.715
88	Phetsi Luma	Shelter with Bay	213628.503	3039627.634
89	Rinchen Kuenphen School	Only Stop Signage	213378.718	3040231.276
90	Changangkha Lhakhang	Only Shelter	213223.217	3040170.826
91	Simi Pang	Only Shelter	213146.532	3040072.072
92	Simi Hang	Only Shelter	212948.838	3040276.731
93	Motithang BOD	Only Shelter	212925.392	3040523.155
94	Veterinary Hospital	Only Shelter	212999.540	3040677.605
95	RUB	Only Stop Signage	213235.084	3040613.108
95	RUB	Only Stop Signage	213234.171	3040652.511
96	Kawang Damisa	Shelter with Bay	213417.798	3040701.991
97	Democracy House	Shelter with Bay	213421.896	3041037.430
98	Kawang Jangsa	Only Stop Signage	213631.586	3041201.473
99	Tarayana	Only Shelter	214338.494	3040633.016
100	Bhutan Post	Only Shelter	214339.410	3040295.832
101	Chang Limithang	Only Shelter	214415.509	3039909.481
102	Tsenden Tsawa	Only Shelter	215031.262	3038539.842
103	Lungtenzampa	Terminal	214643.635	3039479.790
104	Kuensel	Only Shelter	214802.684	3039063.419
105	Norzin	Only Shelter	214305.702	3039759.872
106	Thai Pavilion	Only Shelter	214037.059	3039884.769
107	Tebshing Tsawa	Only Shelter	213959.646	3040117.977

Stop Number	Name	Type	X_Coordinate	Y_Coordinate
108	YDF	Shelter with Bay	213562.768	3039961.968
109	Do Nglamchhey	Only Shelter	213155.879	3040404.765
110	Jigme Namgyel School	Shelter with Bay	212851.014	3040544.891
111	Motithang School	Only Shelter	212773.569	3040255.123
112	Jashing Tsawa	Only Stop Signage	212737.201	3040087.648
113	Chhimchukha	Only Stop Signage	212459.139	3040444.283
114	Kishing Thangkha	Only Stop Signage	212211.198	3040491.545
115	Kuengachholing	Only Stop Signage	211901.952	3040639.702
116	Dotshangna	Only Shelter	213402.321	3042061.351
117	Zilukha	Only Shelter	213296.276	3041884.072
118	Anim Dratshang	Only Stop Signage	213392.634	3041586.569
119	Chhutso Phakha	Only Stop Signage	212983.740	3040881.814
120	Dam Dajo	Only Stop Signage	212468.764	3040786.446
121	Gyalyong Tshokhang	Only Shelter	214329.385	3042006.870
122	Ludrong Phakha	Only Shelter	214395.995	3042286.816
123	Throbaasa	Shelter with Bay	214541.635	3042383.275
124	Zhichhenkhar	Only Shelter	214548.949	3042839.845
125	Sigayna	Only Shelter	214324.400	3043094.516
126	Baybina	Only Shelter	213680.849	3043442.283
127	Baybi Chorten	Only Shelter	213518.435	3043160.421
128	Phochhena	Only Shelter	213163.992	3043138.336
129	Samteling 1	Only Shelter	212873.354	3043303.505
130	Samteling 2	Only Shelter	213212.142	3043443.067
131	Baybi Duethrey	Only Shelter	213442.723	3043465.287
132	Ngabephu 1	Only Stop Signage	215212.821	3034542.709
133	Ngabephu 2	Only Stop Signage	215316.483	3034183.508
134	Ngabephu 3	Shelter with Bay	215417.278	3033980.611
135	Tenziling SC Junction	Only Stop Signage	215734.713	3033217.236
136	Dumrana 1	Only Stop Signage	215932.913	3032932.398
137	Dumrana 2	Only Stop Signage	215946.476	3032774.909
138	RTC	Only Shelter	216203.944	3032347.141
139	Wangchhu Taba	Only Stop Signage	215099.593	3034993.211
140	Tech Park	Only Stop Signage	215445.696	3034991.478
141	Botonical Garden	Only Shelter	215587.162	3034833.780
142	Babesa High School	Only Stop Signage	215808.197	3034718.457
143	NBC	Only Stop Signage	215677.490	3034234.386
144	Damruna	Only Shelter	215780.585	3034033.174
145	Serbithang	Only Stop Signage	215853.354	3033630.993
146	Do Zhabjey	Only Shelter	216056.274	3033390.317
147	Barpi Rinchhenthang1	Only Stop Signage	215020.562	3035549.279

Stop Number	Name	Type	X_Coordinate	Y_Coordinate
148	Debsi Zam	Only Shelter	214589.134	3035406.953
149	Debsi 1	Only Stop Signage	214390.656	3035143.350
150	Debsi 2	Only Shelter	214154.217	3034961.335
151	Debsi 3	Only Stop Signage	213935.566	3034888.367
152	Lhakhang Tsawa	Only Stop Signage	214675.708	3035252.340
153	Barpi Rinchhenthang 2	Only Stop Signage	215185.847	3035744.022
154	Simtokha Dzong Junction	Only Shelter	217686.315	3036156.961
155	Simtokha Substation	Only Stop Signage	217982.109	3035880.460
156	Zashing Thangkha	Only Stop Signage	218350.675	3035843.775
157	Chamgang Thang Wom	Only Stop Signage	219943.095	3033790.420
158	Chamgang	Only Stop Signage	220144.147	3033342.366
159	Chamgang Thang Gom	Only Stop Signage	220642.208	3033855.486
160	Simtokha Roundabout	Only Stop Signage	217396.778	3036551.616
161	Simtokha Lum	Only Stop Signage	217611.348	3036655.640
162	Tshatsho Baykha	Only Stop Signage	217752.267	3036427.048
163	Yusipang LW Factory	Only Stop Signage	220468.262	3037453.276
164	Yusipang NCOA	Only Stop Signage	221316.187	3038601.504
165	Yusipang	Only Stop Signage	221284.569	3038935.276
166	Hongtsho Throm 1	Only Stop Signage	222611.170	3040776.625
167	Hongtsho Throm 2	Only Stop Signage	222755.633	3041026.022
168	Hongtsho Check Post	Only Stop Signage	222704.771	3041768.184

Figure 2: Map of Bus stops



10.C. **Fleet details**

A total of 97 buses will be required for full implementation. This number is based on careful analysis of route lengths, expected passenger demand, and scheduling requirements.

The table below outlines the fleet allocation by route, including details such as the duration of each route, the number of buses required. Routes have been designed to balance coverage, frequency, and operational efficiency.

Each route has been optimized for travel time and coverage. For example, longer and more heavily trafficked routes, such as the Ngabiphu Terminal to Dangrina Terminal (90 minutes), require up to 20 buses to maintain regular headways, especially during peak hours. In contrast, shorter local routes, such as the Ngabiphu Terminal to Ngabiphu (15 minutes), are adequately served with 4 buses, enabling frequent circulation within neighborhoods.

Routes operating as round trips are denoted accordingly, as they influence both scheduling and vehicle turnaround times. Stops have been carefully selected to align with peak demand periods, primarily in the morning, to ensure coverage of schools, workplaces, and residential areas.

Table 3: Fleet Allocation Details

Sl. No.	Route Name	Time (m)	Number of Buses Required	Starting Stop
1	Ngabiphu Terminal-Dangrina Terminal	90	20	Ngabiphu Terminal
2	Bap Lhakhang-Debsi (Round Trip)	20	3	Bapbi Rinchhenthang 1 towards Debsi
3	Ngabiphu Terminal-Ngabiphu	15	4	Nagbiphu Terminal
4	Ngabiphu Terminal-Do Zhabjey	21	6	Ngabiphu Terminal
5	Ngabiphu Terminal-Ola Rongchhu Terminal	19	5	Ngabiphu Terminal
6	Ola Rongchhu Terminal-Chamgang Thang Gom	23	6	Ola Ronchhu terminal
7	Ola Rongchhu Terminal-Hongtsho Check Post	40	9	Ola Ronchhu terminal
8	Ola Rongchhu Terminal-Chang Jalu	22	6	Ola rongchhu terminal
9	RBA HQ-Chang Gidhaphu (Round trip)	48	6	Norzin Stop towards Gidhaphu
10	Core Round Trip	44	10	both directions
11	Yangchenphu-Kuengachholing	27	6	norzin stop towards motithang
12	Yangchenpu-Samtenling (Round Trip)	53	6	Chang limithang Stop towards Samteling
13	Tashichhodzong-Jigme Namgyel School	19	5	Tashichhodzong stop
14	Chang Zamtog F-O-Kuenselphodrang School	18	5	Chang Zamtog F-O

This allocation serves as the baseline requirement for procurement, scheduling, and operational readiness, and it will guide decisions related to depot locations, driver shifts, and maintenance planning.

10.D. Stop-wise Transit and Wait Times

This appendix presents a detailed sample of stop-wise arrival and departure timings specific to the trunk route (Ngabiphu–Dangrina–Yangchenphu corridor), highlighting efficient connections and minimal wait times achieved through coordinated scheduling. The timings reflect real-time alignment and passenger convenience, supporting smooth transitions across the city bus system.

- Bap Lhakhang *(Connecting: Bap Lhakhang–Debsi)*
  - Arrival Time: 7:01:43 AM
  - Next Departure: 7:06:01 AM
  - Wait Time: 4 minutes 18 seconds
- Ola Rongchhu Terminal
  - Arrival Time: 7:05:35 AM
  - Next Departure: 7:10:47 AM
  - Wait Time: 5 minutes 12 seconds
- Naazhina
  - Arrival Time: 7:07:15 AM
  - Next Departure: 7:10:04 AM
  - Wait Time: 2 minutes 49 seconds
- Chang Zamtog F-O
  - Arrival Time: 7:10:08 AM
  - Next Departure: 7:10:55 AM
  - Wait Time: 47 seconds
- Chang Khorlo
  - Arrival Time: 7:12:30 AM
  - Next Departure: 7:22:24 AM
  - Wait Time: 10 minutes 24 seconds
- Gaynyen Junction
  - Arrival Time: 7:15:05 AM
  - Next Departure: 7:23:45 AM
  - Wait Time: 8 minutes 40 seconds
- Tashichhodzong
  - Arrival Time: 7:19:26 AM
  - Next Departure: 7:21:06 AM
  - Wait Time: 1 minute 40 seconds
- India House
  - Arrival Time: 7:22:28 AM
  - Next Departure: 7:30:05 AM

While this sample focuses on the trunk route, comparable scheduling analyses have been carried out for all other subsidiary and supplementary route, ensuring system-wide optimization and connectivity throughout Thimphu.