PUBLIC TRANSPORT PROPOSAL FOR LEH

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Prepared under TUMI E-Bus Mission

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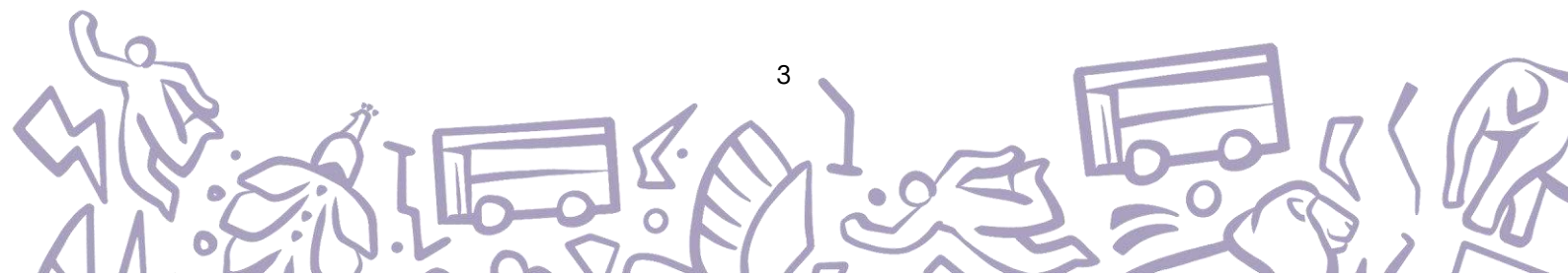

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EXECUTIVE SUMMARY

Leh, the administrative capital of Ladakh, is undergoing rapid transformation due to increased tourism, governmental presence, and infrastructural investments. This growth has significantly heightened mobility demands, resulting in intensified traffic congestion and environmental pressures on Leh's fragile ecosystem. Currently, public transport in Leh is fragmented, dominated by private operators with limited route coverage, and suffers from operational inefficiencies, insufficient infrastructure, and minimal institutional coordination. Recognizing these challenges, Leh aims to transition towards sustainable mobility solutions, particularly through the adoption of electric public transport vehicles.

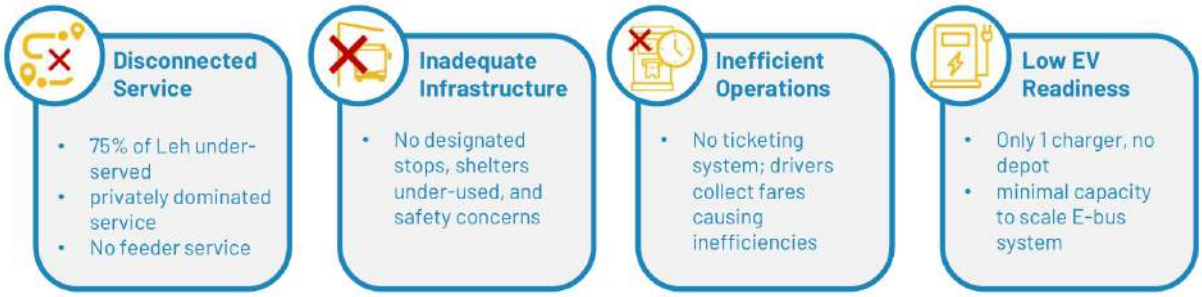


Figure 1: Shortcomings in existing PT service

The public transport proposal aims to expand coverage in Leh from 25% to 85% through eight new trunk and feeder routes, using 7-meter e-mini buses for wider corridors and 4-meter e-micro buses (e.g., Tata Magic EV) for narrower routes. A 12,000 sqm depot is proposed near Bamghar playground, with capacity for 40 mini and 30 micro buses, along with fast-charging infrastructure. The plan includes an Intelligent Transport Management System (ITMS) and proposes unified operations under SIDCO. Financial strategies leverage incentives from the Ladakh EV Policy 2022, PM E-bus Sewa, alongside non-farebox revenue options. Lastly, a three-year phasing plan shall ensure structured rollout and system refinement.

Table 1 Existing vs proposed system comparison

Existing vs Proposed System Comparison			
Sl. no	Description	Existing system	Proposed system
1	Coverage	25%	85%
2	No. of routes	2	8 (4 trunk, 4 feeder)
3	Fleet size	130 diesel buses (Mazda), 10 e-midi buses (SIDCO)	34 e-mini buses, 23 e-micro buses
4	Headways	Range: 5mins to thrice/day	Range: 3-60mins
5	Bus stop distance	No set distance	450-500m
6	Bus stop infrastructure	Not available	30 bus shelters, 76 pole stops
7	Depot	Not available, 1 fast charger	Parking: 40 mini & 30 micro buses Charging: 7 mini & 5 micro bus fast chargers
8	ITMS	Not available	System wide ITMS proposed
9	Operating model	Fully government (SIDCO)& Net cost contract (Mazda)	Gross cost contract

Table 2 Proposed routes & fleet requirements

Proposed Routes & Fleet Requirements							
No.	Origin	Destination	Vehicle type	Route length (Km)	Proposed headway (min)	Vehicles needed	Km/ day/ bus
T1	Leh Gate	Choglamsar	Mini Bus	7.67	3	22	220
T2	Leh Gate	Leh Gate (Ring)	Micro Bus	9.3	30	4	150
T3	Leh Gate	Agling	Mini Bus	6.24	5	12	200
T4	Leh Market	Leh Market (Ring)	Micro Bus	15.19	60	4	120
F1	Leh Market	Industrial area	Micro Bus	4.12	30	3	90
F2	Martyrs chowk	Dambuchan	Micro Bus	2.5	30	3	55
F3	Leh Gate	Skampari	Micro Bus	3.2	15	4	100
F4	KV school	KV school (Ring)	Micro Bus	12.96	30	5	165

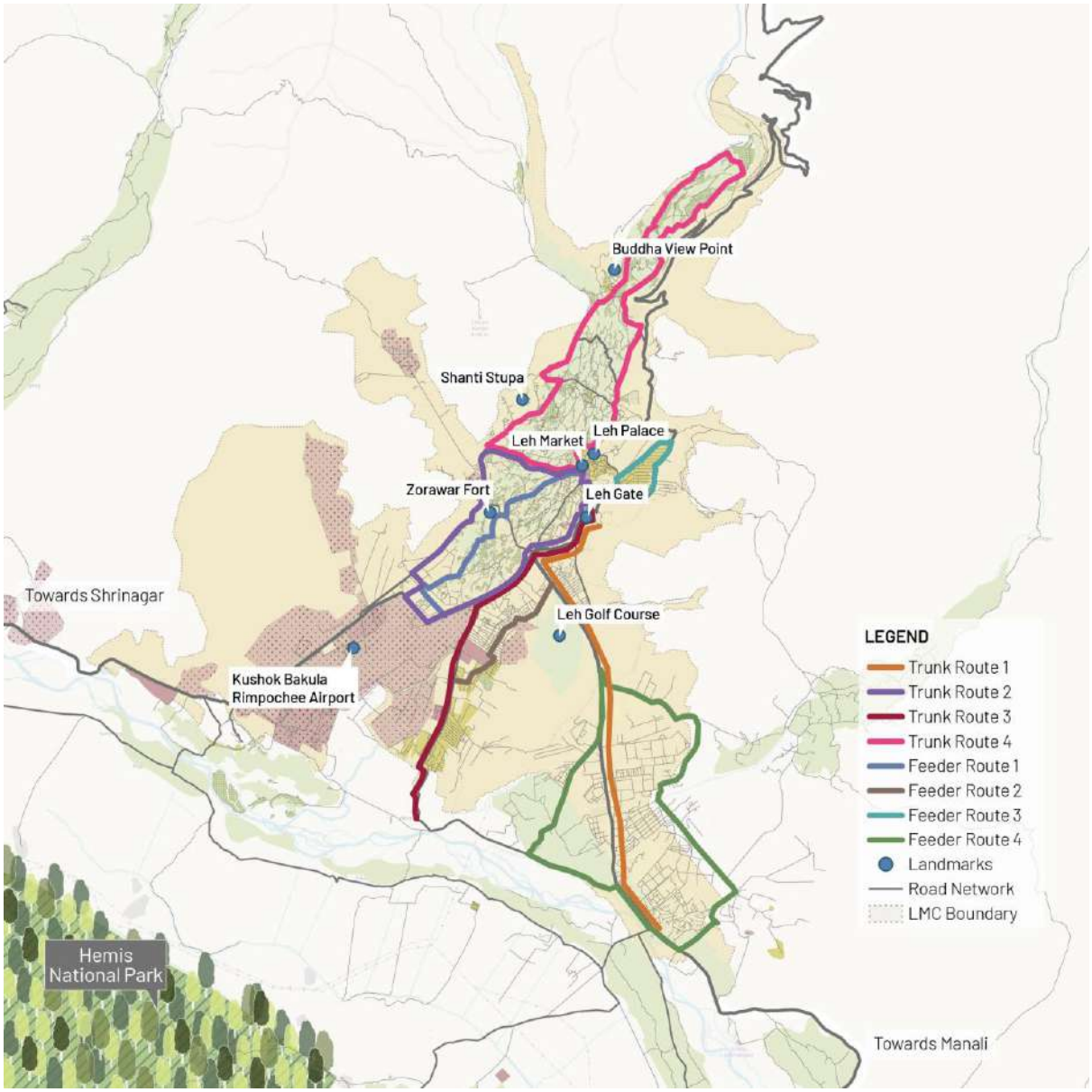


Figure 2: Proposed PT routes

Table 3: Capital block cost for proposed system

Capital Block Cost for Proposed PT System				
Sl. No	Particular	Quantity	Unit Cost (INR Crore)	Total cost (INR Crore)
1	E-Mini bus	34	1.00	34.0*
2	E-Micro bus (TATA Magic EV)	23	0.10	2.3*
3	Depot (Includes charging & maintenance infrastructure)	1	10.00	10.0
4	Bus shelter	30	0.05	1.5
5	Bus stop	76	0.01	0.8
6	Central control station	1	7.00	7.0
7	Bus terminal augmentation	1	0.50	0.5
	Total			56.1

*Note: As vehicles are proposed to be procured through a Gross Cost Contract (GCC) model, their capital costs shall not be incurred upfront by the city at the implementation stage.

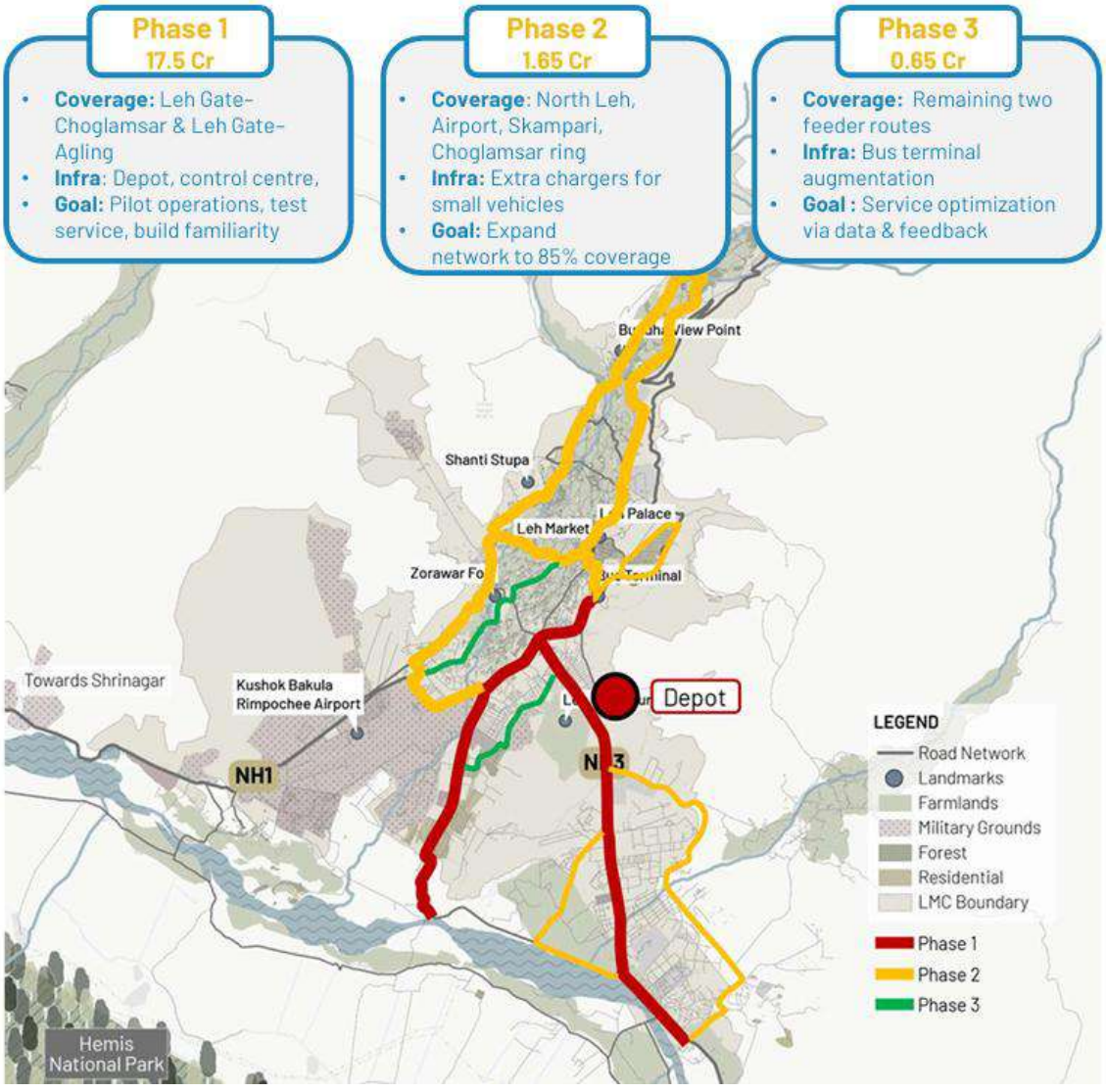


Figure 3: Proposed phasing plan

Chapter 1
BACKGROUND

Leh is the administrative capital of the Union Territory of Ladakh. Traditionally a small town with a sparse population and limited vehicular movement, Leh is now witnessing rapid transformation. With an increase in tourism, government presence, and infrastructure investments, mobility demands have rapidly grown. This growing pressure, however, poses significant challenges for the region's fragile ecosystem and public infrastructure. The steep rise in motorized traffic, especially during the peak tourist season, has led to worsening air quality and traffic congestion. Recognizing these challenges, local authorities and national stakeholders are shifting focus toward sustainable mobility solutions. Among these, electric buses (e-buses) have emerged as a promising alternative. Currently, Leh experiences a fragmented and rudimentary public transport system characterized by presence of two services – private Mazda buses and SIDCO's E-bus service. Although, there is existing presence of E-buses in Leh, there is a need to re-assess and revamp the system, conducting a thorough analysis to transform it into an efficient network capable of effectively meeting the city's mobility demands.

As part of the broader push toward electrified urban transport, Leh has been identified under the Transformative Urban Mobility Initiative (TUMI) E-Bus Mission, led by ICLEI. This initiative supports cities in the Global South—especially in India and Brazil—to accelerate the transition to electric mobility. In Leh's case, the deployment of e-buses is not just a technological shift but a strategic step toward resilient, low-emission, and people-centric urban transport.

However, the success of e-bus deployment depends on more than just procurement. It requires detailed planning and the creation of a supportive ecosystem—dedicated depot and stoppage infrastructure, route optimization and capacity building. With this understanding, *a comprehensive public transport proposal for Leh is being developed.* This will act as a guiding document for ensuring that Leh's transition to e-buses is efficient and sustainable

1.1 Scope of Work

The scope of work includes:

- Assess Leh's existing public transport system, including fleet size, routes, ridership, and operational challenges
- Review existing policies and initiatives relevant to e-mobility in Leh and Ladakh
- To identify PT routes based on land use, prominent origins and destinations, trip pattern, stakeholder discussions & primary surveys

- To identify route-wise fleet size based on frequency, proposed waiting time at stations and bus speeds
- To recommend context specific vehicle specifications for the system
- To recommend context specific institutional structure & operating model for the system
- Develop financial requirements and funding strategies
- Develop implementation roadmap with phased timeline

1.2 Methodology

The following methodology is undertaken to prepare a comprehensive public transport proposal for Leh.

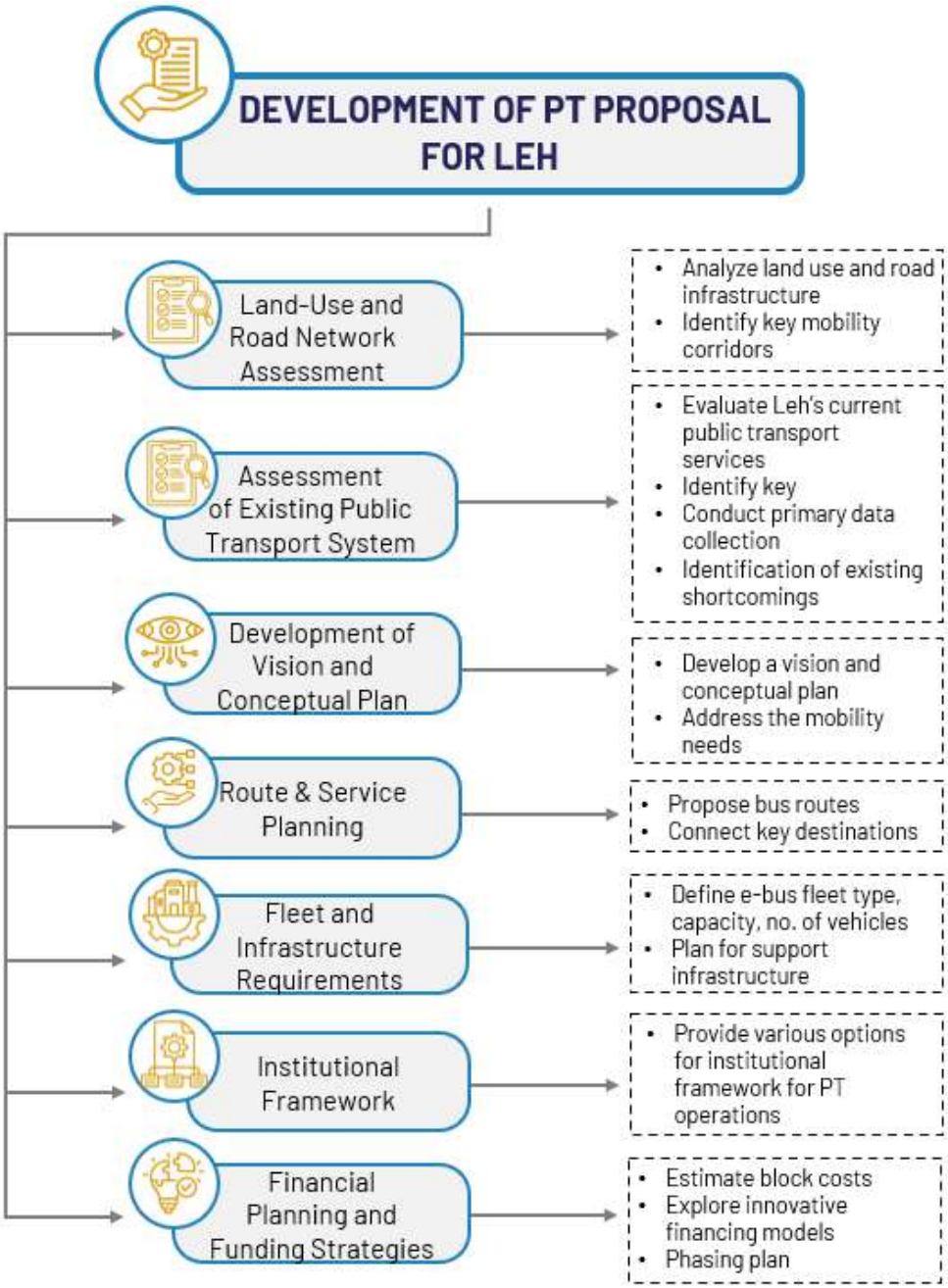


Figure 4: Study Methodology

Chapter 2

OVERVIEW OF LEH

Leh, the largest town and administrative capital of the Union Territory of Ladakh, with an area of 56 sq.km. It stands out for its unique terrain, climate, ecology, and strategic importance. Situated in the trans-Himalayas at altitudes ranging from 3,310 to 3,915 meters, Leh lies in a cold mountain desert with fragile ecosystems and limited carrying capacity. Its dramatic landscape and harsh winters pose significant challenges to development, mobility, and daily life.

Once a part of the state of Jammu & Kashmir, Leh became part of the newly formed Union Territory of Ladakh in 2019, owing to its distinct geopolitical and cultural identity. The town has witnessed rapid growth since the 1990s, driven by internal migration for better amenities and a tourism boom since 2008. The full-time resident population was estimated at around 43,440 in 2021, with a seasonal floating population pushing the total close to 66,000. This seasonal variation is further influenced by the 20,000–25,000 army personnel stationed in or transiting through Leh, who also rely on the town's limited resources.

2.1 Access and Connectivity

Leh's primary air connection to the rest of India is through the Kushok Bakula Rimpochee Airport, the only commercial airport in the Union Territory of Ladakh. Located in the South-West part, the airport operates daily flights to major cities including Delhi, Jammu, Srinagar, and Chandigarh, serving as a crucial lifeline for passengers and cargo. At present, Ladakh lacks a railway connection, but significant progress is being made toward developing the Bhanupali–Leh all-weather railway line. The Bhanupali–Bilaspur–Beri (63.1 km) section, approved by the Cabinet Committee on Economic Affairs in 2008 at a projected cost of ₹6753.42 crore (in partnership with the Himachal Pradesh government), marks the initial phase of this ambitious project. (Government of India, 2023)

Leh is also accessible by two key national highways—NH1 (Baramulla–Srinagar–Kargil–Leh) and NH3 (Amritsar–Manali–Leh). However, both these routes are typically closed during the harsh winter months due to heavy snowfall at high-altitude passes, limiting overland access

To address this, major infrastructure works are underway to enable year-round connectivity. Notably, the 14.15 km Zoji La tunnel, once completed (expected by 2026), will provide all-weather access between Leh and Srinagar, significantly improving regional connectivity and resilience. (NIUA, 2024)

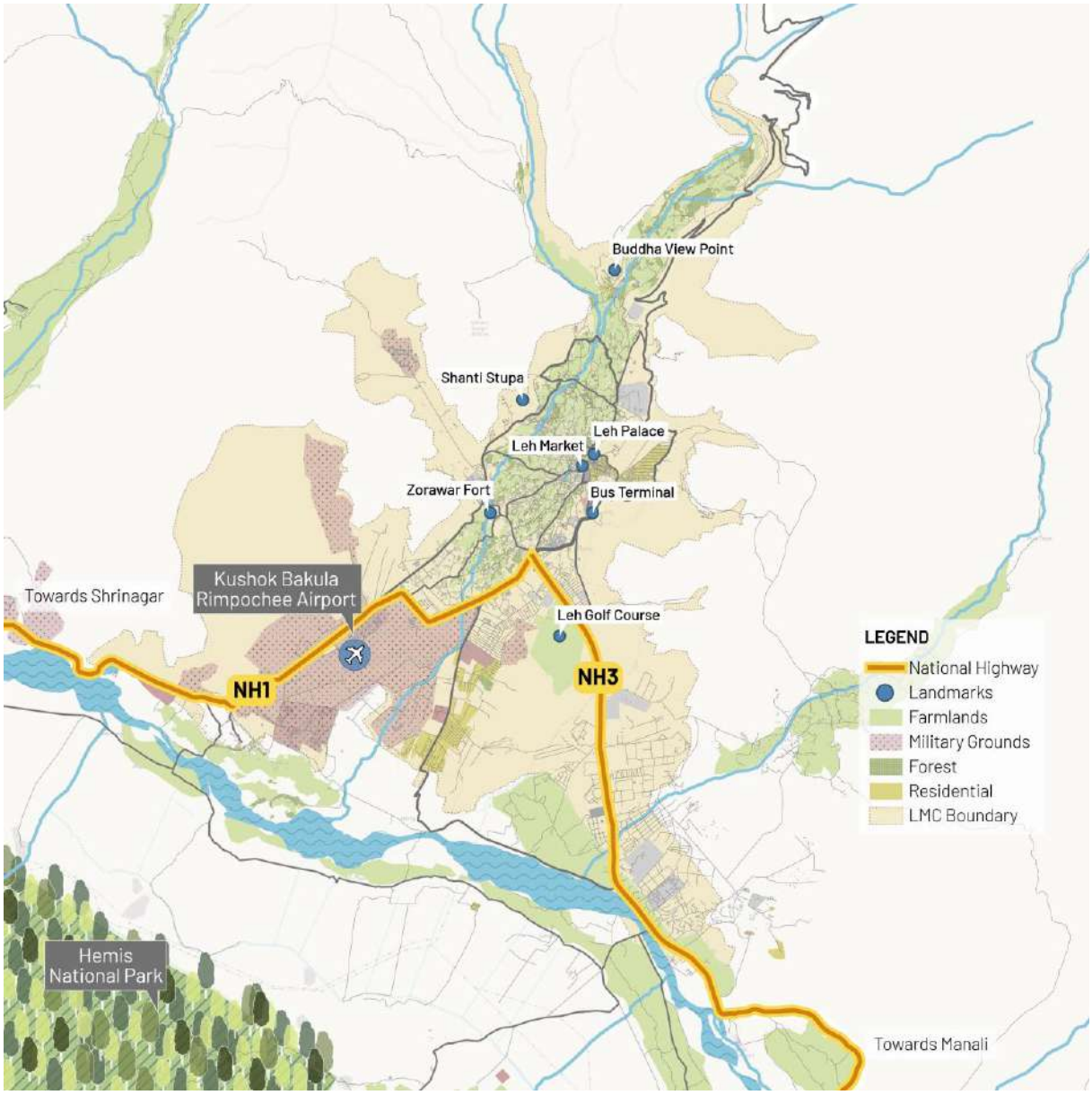


Figure 5: Leh macro level connectivity

2.2 Demography

Leh had a population of 30,870 in 2011, which is projected to have grown to around 42,352 by 2021, and is expected to reach approximately 64,217 by 2047. The town's population is unevenly distributed—over 51% reside in Wards 11 and 13, while Wards 1 and 12 have significantly lower densities due to agricultural land and difficult terrain, respectively. Some areas like Wards 3 and 4, though low in gross density, exhibit higher residential densities owing to the presence of hotels and homestays, which have increased the demand for residential land.

Leh's sex ratio is heavily skewed, with about 70% of the population being male, primarily due to employment-driven male migration from rural areas. Despite this, the town boasts a high literacy rate of 90%, well above the national average of 76.3%.

Tourism is a major driver of seasonal population surges. Since Ladakh was opened to foreign tourists in 1974, Leh has witnessed a steady rise in tourist footfall—over 300,000 tourists annually, with most concentrated in Wards 3 (Changspa), 4 (Tukcha), 5 (Shenam), and 13 (Leh Main Market), where the majority of hotels and guesthouses are located.

Migration patterns in Leh are both seasonal and long-term. While rural Ladakhis migrate to the town for better education and livelihoods, significant seasonal migration occurs from other Indian states and Nepal, with workers employed primarily in construction and the tourism industry. These migrants typically reside in low-rent areas like Ward 12 (Skampari). In 2019, up to 50,000 migrant workers were estimated to be present in Leh.

Additionally, Leh hosts a significant military presence. On any given day, around 20,000–25,000 army personnel are stationed in or transit through the town. While they are housed separately from the civilian population, they share key infrastructure and resources, impacting urban planning and resource management, especially during times of heightened border activity. (LEDeG, 2020)

2.3 Land Use and Urbanization

Leh is administratively divided into 13 wards. The town's land use pattern is shaped by its unique topography, tourism-driven economy, and historical growth. Approximately 53% of the land in Leh is under agriculture, primarily concentrated in the north-western part of the town. These areas also host a large number of hotels and guesthouses, creating a unique mix of agricultural and tourism-oriented land use with relatively low population density.

Ward-wise characteristics further reflect the diverse urban fabric. Ward 13 serves as the town's main commercial hub, housing the central market and dense mixed-use development. Ward 1 retains a rural character with dominant agricultural land use. Wards 2 preserves the town's historic core, while Wards 3, 4, and 5 cater heavily to tourism, with a high concentration of hotels and guesthouses. Industrial activities, mostly micro, small, and medium enterprises (MSMEs), are confined to Ward 7. Wards 9, 10, and 12 are witnessing newer residential developments, with Ward 12 emerging as a key area for migrant workers. (LEDeG, 2020) (NIUA, 2024)

Leh's urban landscape can be broadly categorised into the following land use zones:

- Urban Centres: Densely built-up areas like Ward 13, functioning as commercial and administrative cores with diverse land uses and economic activities.
- Hub Urban Villages: Mixed-use areas with a balance of housing and employment, moderately dense, and serving surrounding neighbourhoods.
- Residential Areas: Spread across most wards, these house nearly 70% of Leh's population and consist predominantly of housing clusters.
- Agricultural Villages: Areas like Ward 1 (Gonpa/Gangles) where agriculture is still prevalent alongside residential use.
- Tourist Areas: Commercial pockets in Wards 3, 4, and 5, characterised by high hotel density and services catering to tourists.
- Institutional Areas: Zones with significant government and semi-government establishments.
- Manufacturing/Service Industry Zones: Primarily in Ward 7, with small-scale industrial units and service-related businesses like automotive workshops.

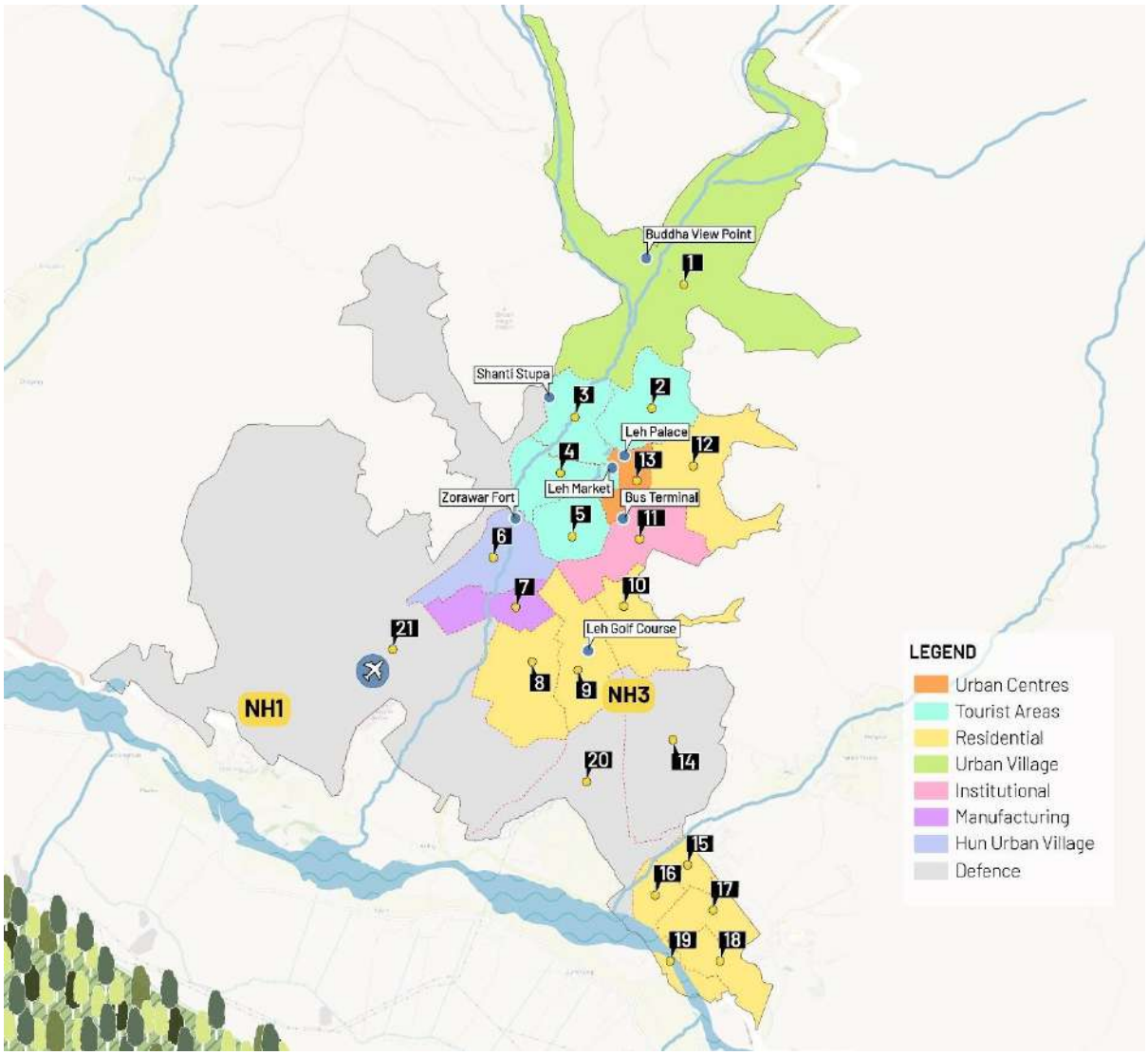


Figure 6: Existing predominant land us in Leh

2.4 Travel Characteristics

The main destination in the town remains Leh market (the town centre). Over 80% trips are made to Ward 13 or Leh main market as it is the major commercial area and is home to government offices.

Ward 15-19 (Choglamsar) is the most important origin point as a huge amount of people travel to Leh for business, education & leisure activities. Most people from Ward 6 and Ward 8 travel to Zone 7 as Ward 6 lacks a commercial area. Ward 7 (Skalzangling) also serves as a major market street in the southern part of the town. People from Ward 12 travel to almost every other ward as it has the highest concentration of daily wage labourers (LEDeG, 2020). The figure below illustrates the major travel patterns and key trip movements within the study area measured in 2020.

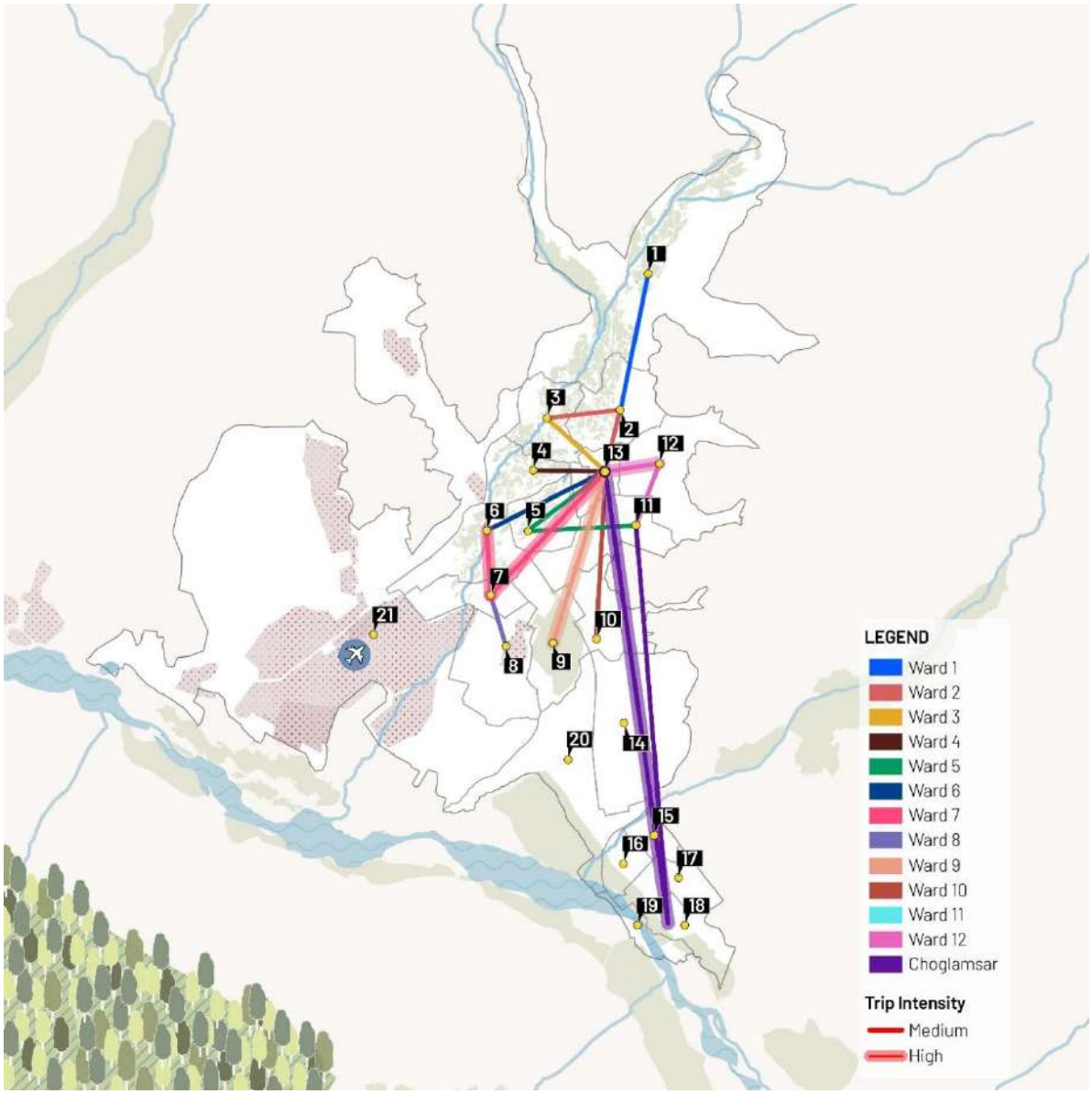


Figure 7: Travel patterns in Leh (LEDeG, 2020)

2.5 Ladakh EV Policy, 2022

The Ladakh Electric Vehicle and Allied Infrastructure Policy was implemented on 17th August 2022 and is valid for 5 years. It outlines Ladakh's strategic commitment towards promoting electric mobility, in alignment with its broader Vision-2050 of becoming a carbon-neutral region. The policy provides clear targets, incentives, and infrastructure support for the adoption of electric vehicles across various segments.

Specifically for public transport, the policy emphasizes the electrification of buses and four-wheeler passenger transport vehicles, establishing clear adoption targets to facilitate this transition. It provides significant financial incentives—up to 25% of the ex-showroom price or INR 50 lakh per electric bus (whichever is lower), and up to 10% of the ex-showroom price or INR 3 lakh (whichever is lower) for smaller public transport vehicles. Additionally, the policy underscores the importance of developing dedicated charging infrastructure at strategic locations, alongside structured operational frameworks to ensure effective deployment and management of EVs. (Transport Department of Leh, 2022)

The major strength of this policy is provision of financial incentives, which will enable smaller operators to participate more readily in the emerging electric public transport ecosystem and substantially aid Leh in developing a robust public transport system.

Table 4: Subsidies for EV buyer provided in the policy

Subsidies for EV buyer			
Sl. No	Vehicle segment	Subsidy (INR) (Whichever is lower)	Maximum ex-showroom price to avail (INR)
1	Bus	25% of ex-showroom price or INR 50,00,000	2,00,00,000
2	LCV/state carriage/maxi cabs	10% of ex-showroom price or INR 3,00,000	30,00,000

Chapter 3
ROAD NETWORK AND INFRASTRUCTURE IN LEH

Extensive primary and secondary studies were undertaken to understand the road network characteristics of Leh. A primary reconnaissance study was done to understand the road network and its characteristics and previously published documents like Leh Vision Plan 2030, Leh Climate Action Plan 2047, etc. were studied to gain an overall understanding.

3.1 Road Hierarchy

Leh's road network spans approximately 133 km within the municipal limits, translating to a road density of 10.2 km/sq.km. The network lacks a clearly defined hierarchy and has evolved in a mostly organic manner, particularly in the older parts of the town. While the NH-1D and select state highways form the backbone of long-distance and regional connectivity, the town itself is served by only two primary arterial roads, limiting structured internal circulation. Unlike planned cities, Leh's internal roads do not follow a strict hierarchical order. The older parts of town reflect organic development with irregular alignments and narrow widths, which often create bottlenecks under high traffic conditions. On the other hand, newer colonies exhibit more planned layouts, often with grid-like patterns that improve local connectivity.

Collector and local roads play a critical role in mobility within the town. Many of these roads serve as de facto connectors, linking residential areas with commercial and institutional zones. However, limited road widths and lack of continuous corridors in several segments restrict efficient traffic flow, especially during the tourist season or army movements. In absence of ring roads or bypasses, most vehicular traffic is channelled through the same internal corridors, leading to localised congestion, particularly in the central wards. (LEDeG, 2020)

Table 5: Road hierarchy in Leh

Road hierarchy in Leh			
S. no	Road type	Length (km)	Percentage
1	National highway	5.9	3%
2	Arterial	20.8	12%
3	Sub-arterial	17.3	10%
4	Collector	51.6	30%
5	Local	78.2	45%
	Total	173.8	100%

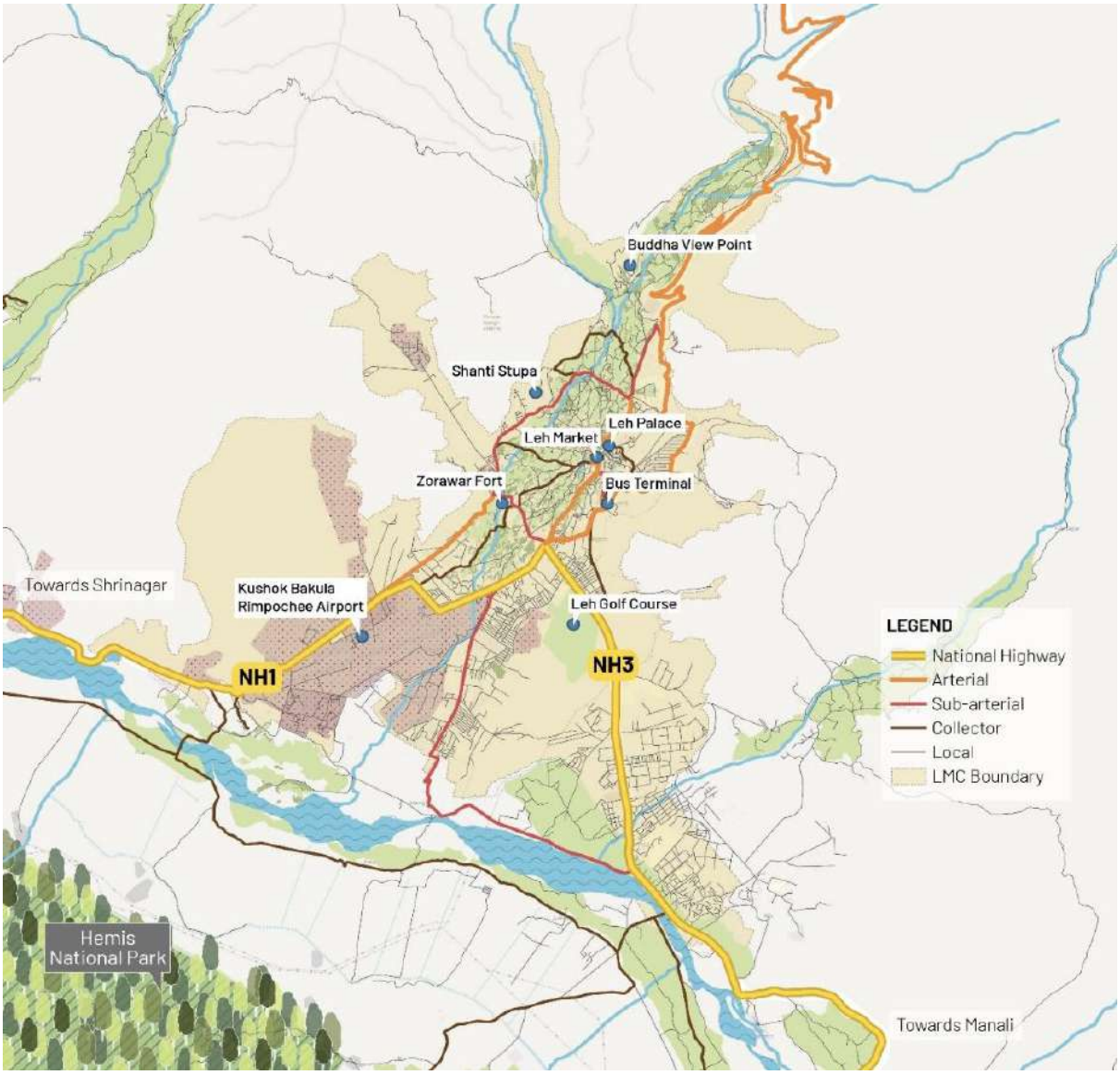


Figure 8: Road hierarchy in Leh

3.2 Right of Way

Leh's road network is characterized by narrow Right of Way (RoW) corridors, with nearly 90% of the roads having a width of less than 15 metres. This constraint poses significant limitations for the inclusion of pedestrian infrastructure and plying of bigger vehicles like buses. The arterial roads in the town have RoWs ranging between 11 to 21 metres, while other road categories — including sub-

arterial and local roads — often range between just 4 to 10 metres. Only a handful of roads such as Skalzangling Road, SNM Road, and Choglamsar Road have RoWs wide enough to accommodate proper road infrastructure. Despite the narrow widths, many roads are further compromised by infrastructural obstructions like electricity poles, uneven edges, and a lack of dedicated pedestrian pathways. The constrained RoW, combined with inconsistent edge conditions, results in informal and often unsafe street use — with pedestrians sharing space with vehicles, and vehicles parked haphazardly along the edges. (LEDeG, 2020)

Table 6: Right of Way in Leh

RoW in Leh			
S. no	ROW (m)	Length (km)	Percentage
1	15 to 24m	17	10%
2	11 to 15m	10	6%
3	7 to 10m	16	9%
4	6 to 7m	27	16%
5	4 to 6m	57	33%
6	Less than 4m	47	27%
Total			100%

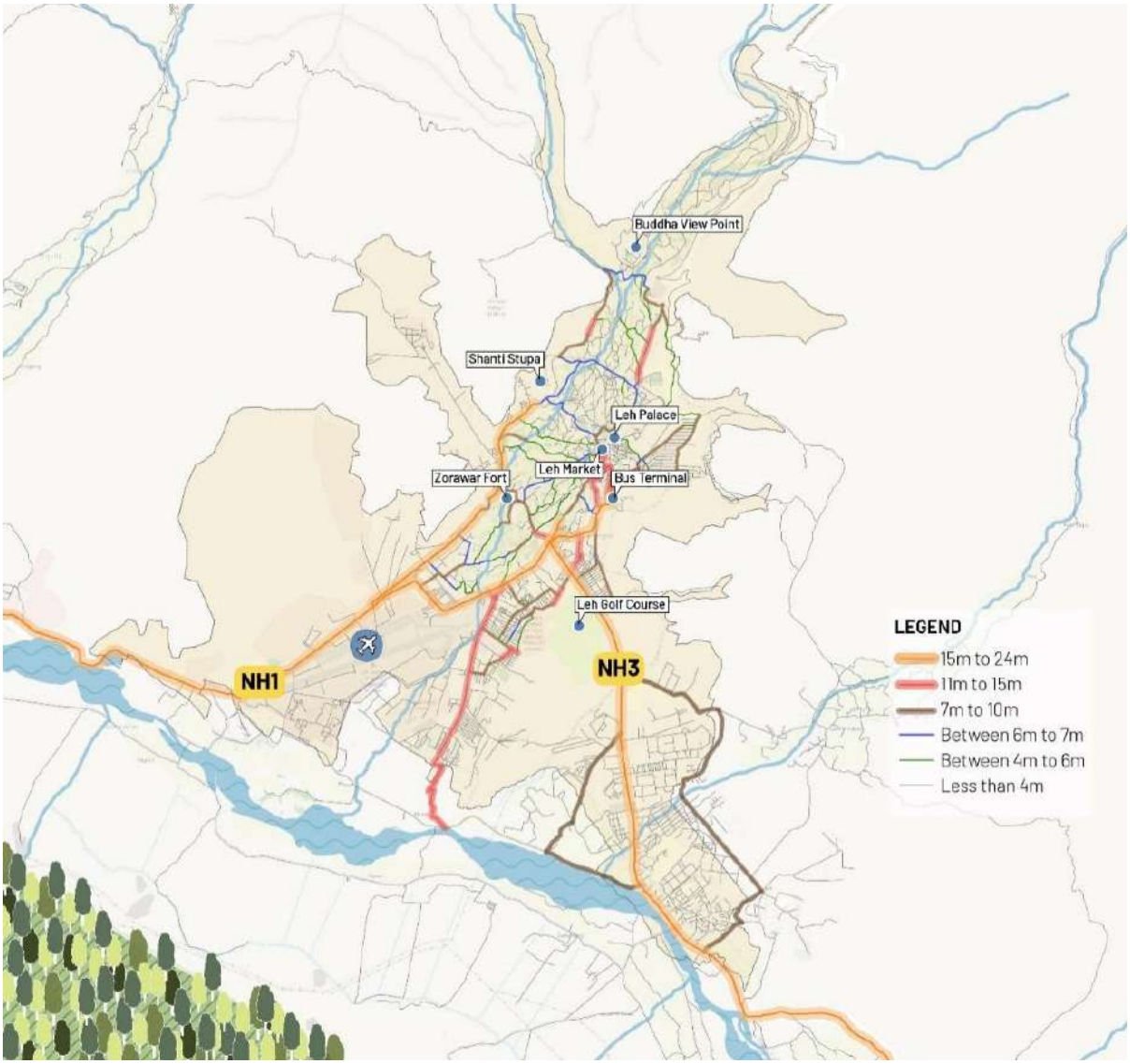


Figure 9: Right of Way in Leh

Chapter 4
EXISITING PUBLIC TRANSPORT IN LEH

A comprehensive understanding of the existing public transportation system in the city of Leh has been developed through a combination of methodologies. A thorough examination of previously published documents such as the Leh Vision Plan 2030 and the Leh Climate Action Plan 2047 was undertaken to get insights into the city's public transportation. This was complemented by a primary reconnaissance survey, allowing for an on-ground assessment of the system's nuances.

To gain a first-hand perspective, the team engaged in the experience of traveling across the city via various public transportation modes. This approach facilitated an immersive understanding of the operational dynamics and challenges faced by commuters. Additionally, interactions were conducted with operators involved in different transportation modes (Mazda Union). This provided valuable insights into operational intricacies, concerns, and potential areas of improvement.

Further, meetings with key government agencies responsible for overseeing transportation and urban development in Leh were undertaken. Discussions with entities such as the LMC (Leh Municipal Committee), Regional Transport Office (RTO), SIDCO (Sindh Infrastructure Development Corporation) and traffic police contributed to a comprehensive understanding of the institutional framework and PT operations of different modes.

As a result of these steps, the current public transportation landscape in the city can be classified into two distinct modes. These modes include the established private Mazda bus service and the newer SIDCO E-bus service, each of these modes will be detailed out in subsequent sections to provide a thorough understanding of their characteristics, operations, and institutional framework.

4.1 Private City Bus Service (Mazda Service)

The public transportation landscape in Leh is primarily serviced by a fleet of privately operated city buses. Currently, there are 130 diesel-powered 7m long mini buses, each capable of seating 26 passengers with an additional 15% standing capacity. Most buses in the fleet are between 5 to 8 years old. The city buses operate along two main routes: a linear route from Leh Gate to Choglamsar (6.5 km) and a circular route connecting Leh Gate to Agling and back (16 km). These routes primarily serve the central and southern parts of the town. Passengers are charged INR 1.68 per kilometre. Leh Gate serves as the principal node for passenger boarding and alighting, and the average headway on both routes' ranges from 5 to 10 minutes, as observed through primary surveys. A dedicated parking facility accommodating approximately 30 buses is available at the new bus terminal in the town centre, which also houses the Mazda Union office.

Institutionally, bus operations are governed by the Regional Transport Office (RTO) and operations are overseen by Mazda Union. RTO issues stage carriage permits valid within a 105 km radius of Leh town. These permits are renewable every five years. The Mazda Union is responsible for route planning, scheduling, and daily operational oversight. Typically, each bus is individually owned and operated, with the owner often serving as the driver. These private operators bear full responsibility for ownership, maintenance, and directly collect fare revenues from passengers.

The existing bus service faces several operational challenges. A major issue is the absence of designated bus stops, causing buses to halt wherever passengers signal, sometimes as frequently as every 50 to 100 metres. This practice results in operational inefficiencies and poses safety risks. Although the government has installed "winter-friendly" bus stops at selected locations, these remain largely unused due to the informal stopping practices. Additionally, onboard ticketing systems are non-existent; drivers directly collect fares from passengers upon alighting, causing confusion and unnecessary delays. Limited overnight parking at the central bus terminal forces most bus operators to park at their residences, though the Leh Municipal Committee (LMC) has identified a site on the outskirts for a dedicated terminal to accommodate the entire fleet. Finally, since route selection and operation are under Mazda Union's jurisdiction, only economically viable routes are serviced, leaving many areas underserved or without public transportation entirely.

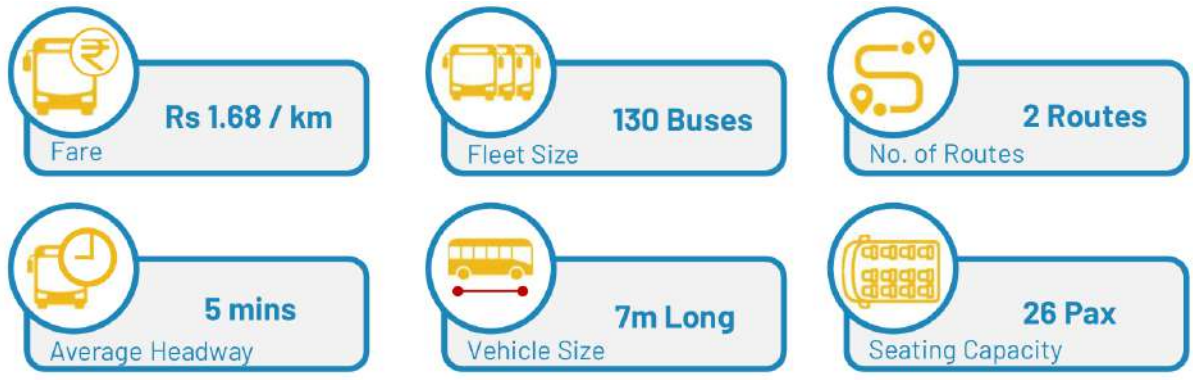


Figure 10: Private bus service characteristics

Figure 11: Parked private buses at bus terminal

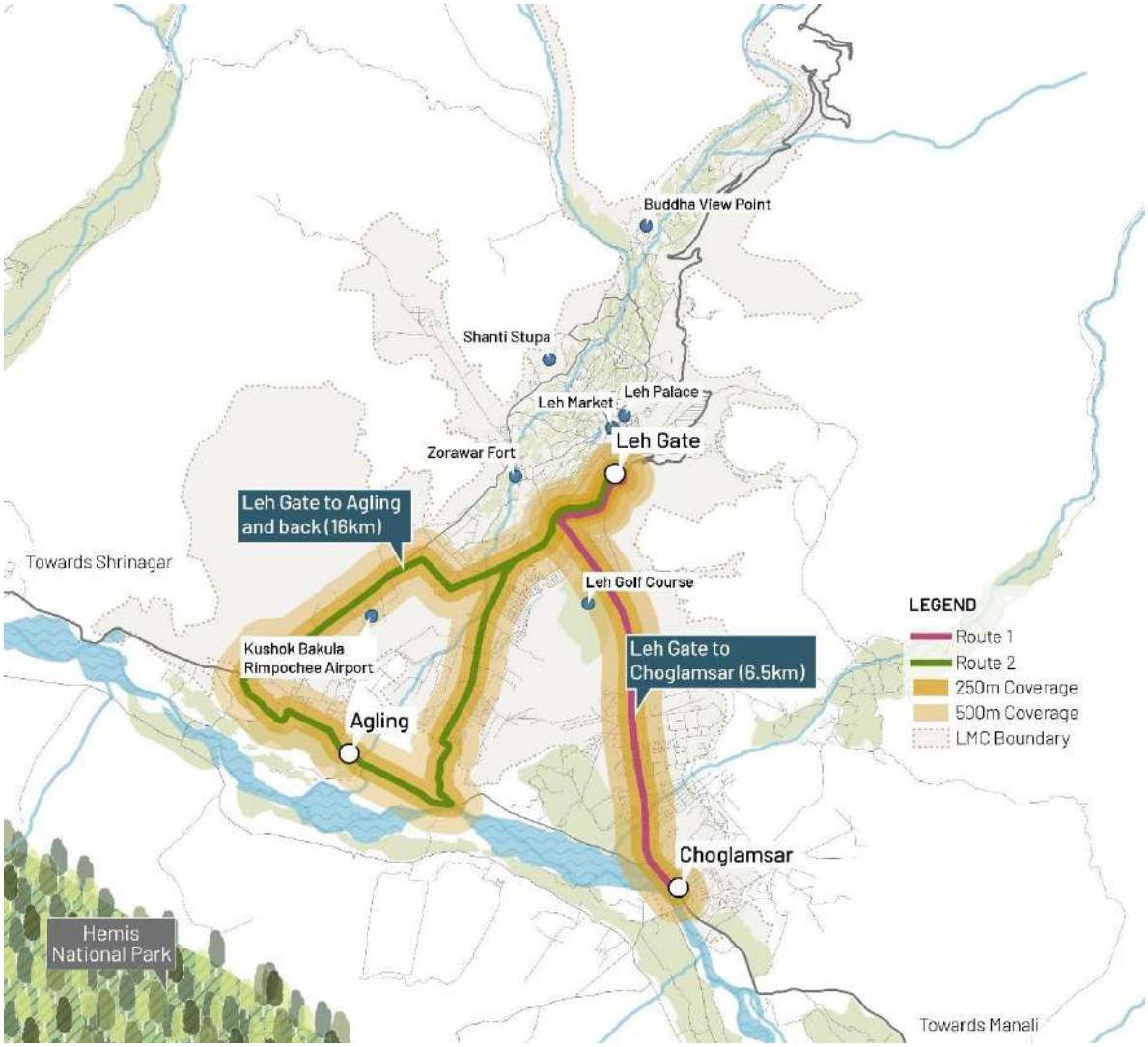


Figure 12: Private Mazda bus service in Leh

4.2 SIDCO E-bus Service

The Sindh Infrastructure Development Corporation (SIDCO) operates the government-run electric bus (E-bus) service in Leh, introduced in 2022 to enhance sustainable mobility. Currently, SIDCO has a fleet of 10 PMI-manufactured E-midi buses, each 9 meters long, accommodating 28 seated passengers with an additional 15% standing capacity. Each bus is powered by a 204-kWh battery, offering a maximum driving range of up to 220 km per charge, and includes a limited self-charging capability beneficial during uphill climbs. The buses operate daily from 8 AM to 4 PM, covering eight long distance routes ranging from 9 to 190 km from Leh. In the city, it primarily serves the central and southern parts of the town. Leh Gate acts as the main origin and destination node from which buses connect to various nearby settlements. Due to the limited fleet size and extended route lengths, service frequency is restricted to a maximum of thrice per day per route. Passenger fares are set at INR 1.3 per kilometre. At present, the service lacks onboard ticketing and Intelligent Transport Management Systems (ITMS). Furthermore, discussions with SIDCO officials indicate that there have been no operational challenges during winter regarding battery depletion or vehicle performance in the last two years of operations.

Currently, there is no dedicated depot for the service, all buses have parking space at the bus terminal located in the town centre. Charging facilities currently comprise a single fast charger located at the Leh Garage Department, near the bus terminal, where all buses return for charging once battery levels reach approximately 20%. The charger can replenish one bus in about 25 minutes and two buses simultaneously in around one hour. Currently, drivers are trained to charge buses independently and no dedicated staff is stationed for the same.

Institutionally, SIDCO exclusively oversees and manages the E-bus operations without any involvement from private parties. SIDCO directly handles route planning, scheduling, operations, and staffing—hiring drivers and operational personnel. PMI maintains a small team of technical staff in Leh, primarily for vehicle monitoring and maintenance. All fare revenue collected directly goes to SIDCO, and currently, there are no non-farebox revenue mechanisms in place.

Despite the modern fleet, SIDCO faces operational challenges similar to those affecting private buses. A major concern is the lack of dedicated bus stops; buses typically halt informally whenever a passenger signals, often every 50-100 meters in town areas, creating inefficiency and safety risks. Additionally, no onboard ticketing system or conductors are available; fares are directly collected by the driver upon passenger alighting, leading to potential confusion and delays. While a single fast charger currently meets the charging needs, scaling up the fleet and service frequency would require a dedicated E-bus depot with multiple charging points and trained operational staff.

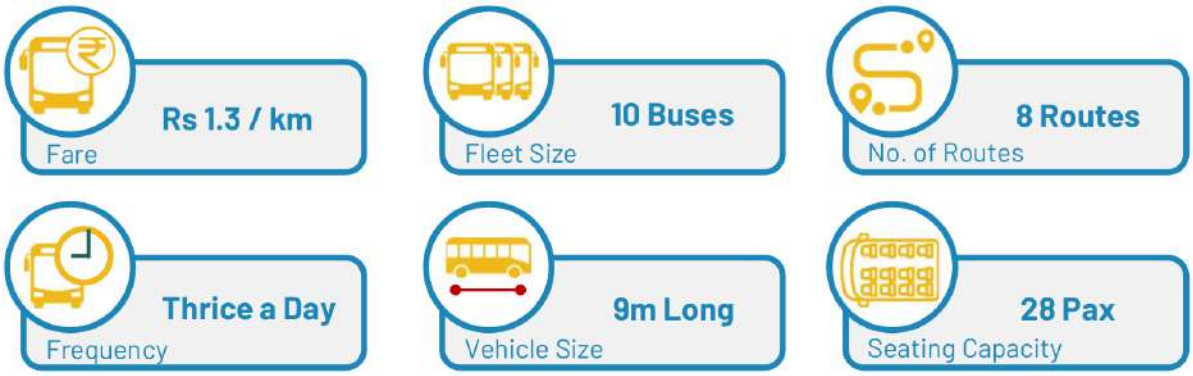


Figure 13: SIDCO E-bus service characteristics

Figure 14: E-bus at bus terminal

Figure 15: E- bus charging

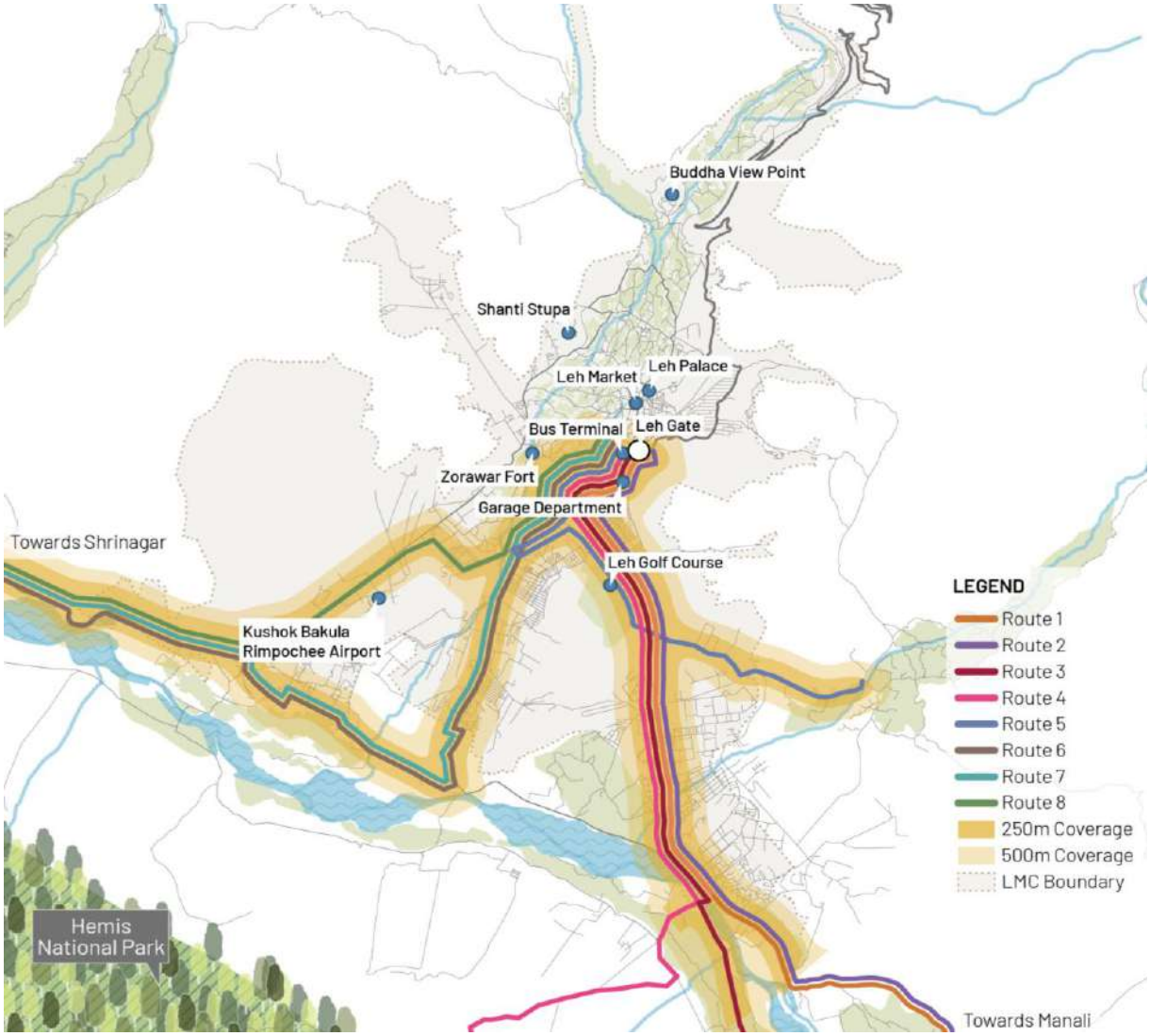


Figure 16: SIDCO E-bus service routes in Leh

Table 7: SIDCO E-bus service routes

SIDCO E-bus routes				
S. no	Origin	Destination	Frequency	Length (km)
1	Leh Gate	Kharu	Thrice a day	34
2	Leh Gate	Shara	Once a day	55
3	Leh Gate	Chuchot	Thrice a day	19.5
4	Leh Gate	Stok	Thrice a day	15
5	Leh Gate	Saboo School	Twice a day	9
6	Leh Gate	Ladakh University	Twice a day	25
7	Leh Gate	Alchi	Once a day	55
8	Leh Gate	Kargil	Once a day	190

4.3 Existing PT Service Coverage

After thorough mapping of all the different PT modes available in Leh, it is observed that about 25% of the total developed area is covered under PT.

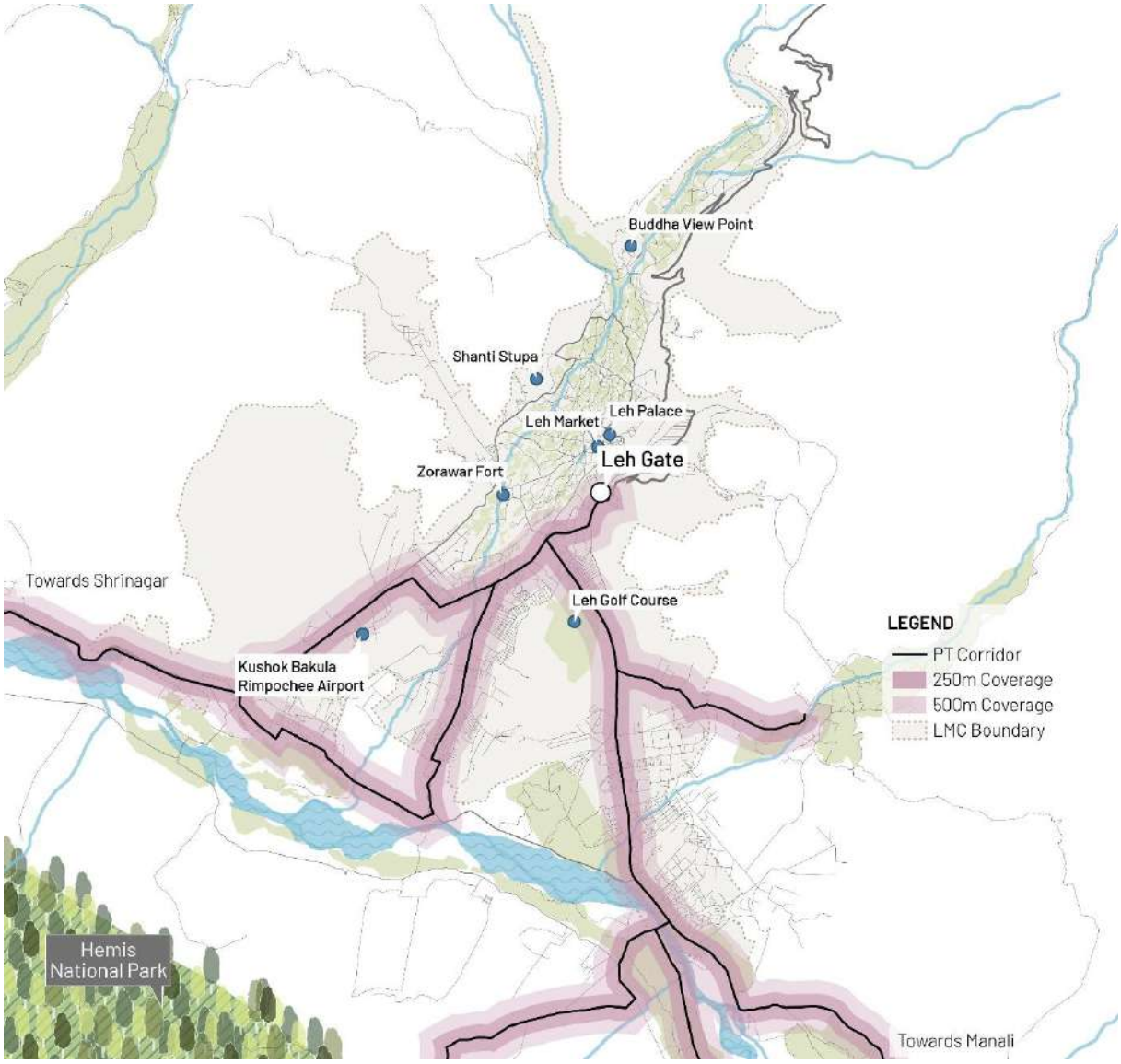


Figure 17: Existing PT coverage in Leh

4.4 Primary Surveys

4.4.1 Primary survey to measure PHPDT

Primary surveys were undertaken at high PT demand stretches of the city to understand peak hour public transport volume & propose the new system accordingly. Mode wise count & occupancy was captured on a weekday at peak hour & PHPDT (Peak hour peak direction traffic) is calculated accordingly. Findings from the survey shall assist in assigning right headways & number of buses for the proposed system. Three stretches were identified with the assistance of LMC, SIDCO & Mazda union:

- Stretch between Singay Namgyal Chowk & Martyrs Chowk
- Stretch between Singay Namgyal Chowk & Airport
- Stretch between Singay Namgyal Chowk & SNM Hospital

Table 8: PHPDT survey data from location 1

From Singay Namgyal chowk Towards Airport		Survey Time- 3:00pm to 3:30pm	
S. no	Mode	Count(per hour)	PHPDT
1	Private bus	15	225
2	E-Bus	0	0
	Total		225

Table 9: PHPDT survey data from location 2

From Singay Namgyal chowk Towards Choglamsar		Survey Time- 3:45pm to 4:15pm	
S. no	Mode	Count(per hour)	PHPDT
1	Private bus	20	476
2	E-Bus	0	0
	Total		476

Table 10: PHPDT survey data from location 3

From Singay Namgyal chowk Towards Leh Gate		Survey Time- 4:30pm to 5:00pm	
S. no	Mode	Count(per hour)	PHPDT
1	Private bus	28	510
2	E-Bus	2	30
	Total		490

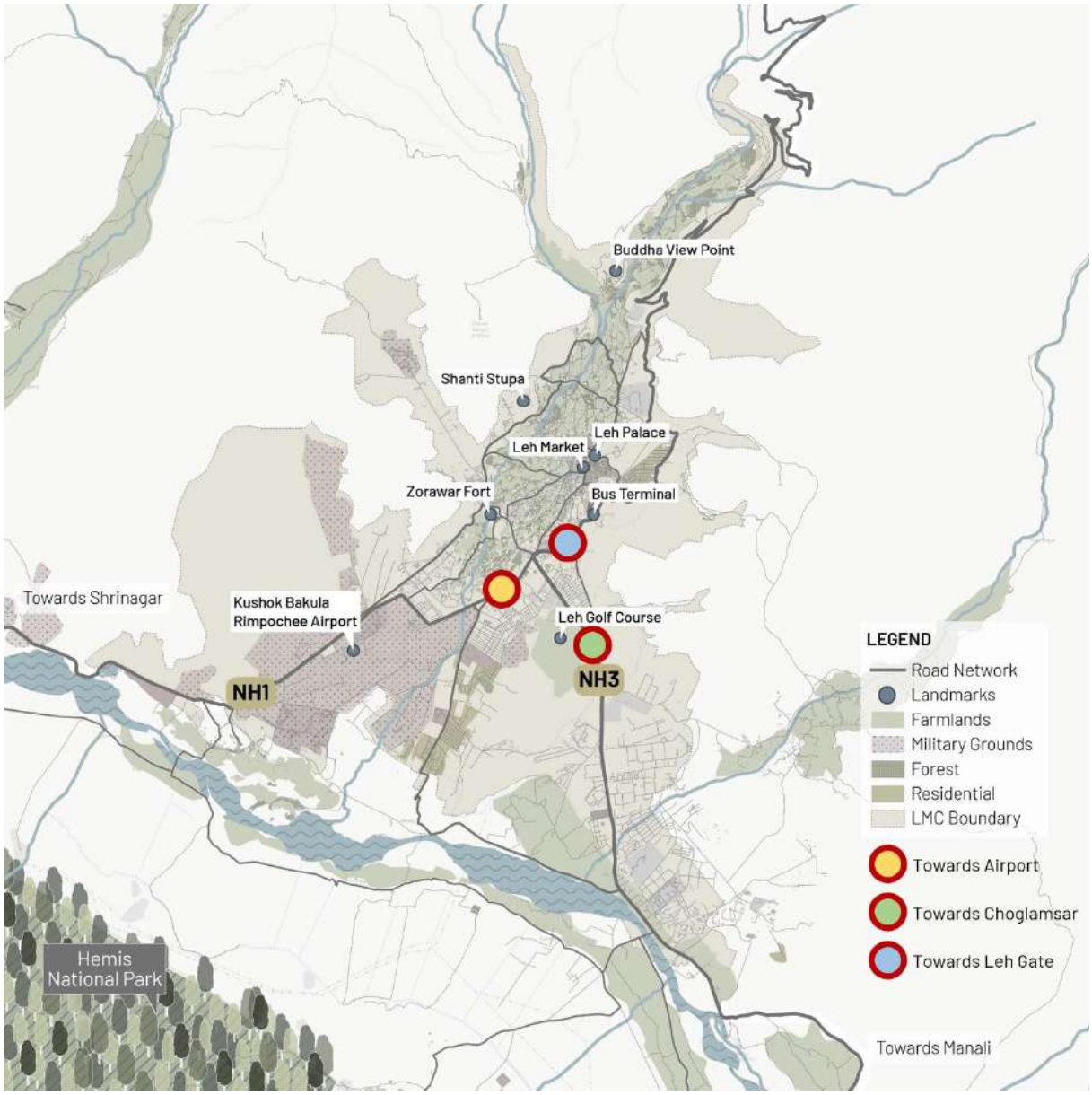


Figure 18: PHPDT survey locations

4.4.2 Ride check survey

A primary ride-check survey was conducted to assess bus travel speeds, stoppage points and durations, vehicle occupancy, and onboard operational practices. The insights from this survey will inform precise recommendations for optimal headways, travel speeds, appropriate locations for bus stops, and overall quality-of-life improvements for Leh's future public transportation system. The survey focused on two specific routes: the SIDCO E-bus service from Leh Gate to Kharu during morning peak hours, and the Mazda-operated private bus service along the Leh Gate to Agling ring route during evening peak hours. The key findings from these surveys are outlined below.

From the ride check survey, it is observed that average travel speed of 15-19 km/hr can be kept for the proposed bus service in the urban area and minimum headway of 3-5 minutes can be achieved in peak hours on major routes.

Table 11: Ride check survey data from route 1

Ride check survey: Leh Gate-Kharu			
S. no	Description	Unit	Value
1	Travel mode	-	SIDCO E-bus
2	Distance	Km	35
3	Travel time	Minutes	66
4	Number of stoppages	Value	18
5	Maximum stoppage time	Seconds	15
6	Minimum stoppage time	Seconds	5
7	Average bus travel speed	Km/hr.	27 to 32
8	Maximum speed	Km/hr.	66

Table 12: Ride check survey data from route 2

Ride check survey: Leh Gate-Agling-Leh Gate			
S. no	Description	Unit	Value
1	Travel mode	-	Mazda private bus
2	Distance	Km	17.4
3	Travel time	Minutes	55
4	Number of stoppages	Value	37
5	Maximum stoppage time	Seconds	30
6	Minimum stoppage time	Seconds	5
7	Average bus travel speed	Km/hr.	15 to 19
8	Maximum speed	Km/hr.	56

4.5 Shortcomings in Existing PT Services

Leh's public transport system currently faces several critical shortcomings, significantly limiting its efficiency and reach. Public transportation is virtually non-existent in approximately 75% of the town, leaving many neighbourhoods in the Northern parts underserved or entirely unserved. Where available, services are predominantly dominated by private operators, resulting in fragmented, profit-driven route planning that excludes less lucrative areas. Moreover, the city lacks feeder services that could effectively connect residential neighbourhoods to main transit corridors, forcing many residents to rely on private vehicles or informal transportation options.

Further compounding these issues, there are no clearly designated bus stops or supporting infrastructure. Buses typically halt at arbitrary locations, often causing traffic disruptions,

confusion among passengers, and safety hazards. This informal stopping practice also renders existing government-built stops—such as the winter-friendly shelters—redundant and underutilized. Additionally, the absence of a formal ticketing process and onboard conductors leads to operational inefficiencies, confusion during fare collection, and prolonged stoppage times. Beyond these immediate operational gaps, Leh's EV readiness for public transport remains at a nascent stage, with limited infrastructure and institutional capacity. Currently, the city operates with a single bus charger and no dedicated depot, which is shared by the entire E-bus fleet. As per standard industry guidance, one charger is ideally required for every 3–5 buses—making the current ratio in Leh significantly inadequate. Additionally, charging operations are primarily managed by drivers with minimal technical support, further limiting efficiency and scalability. As Leh looks to expand its electric fleet, it is imperative to build its EV readiness in parallel.

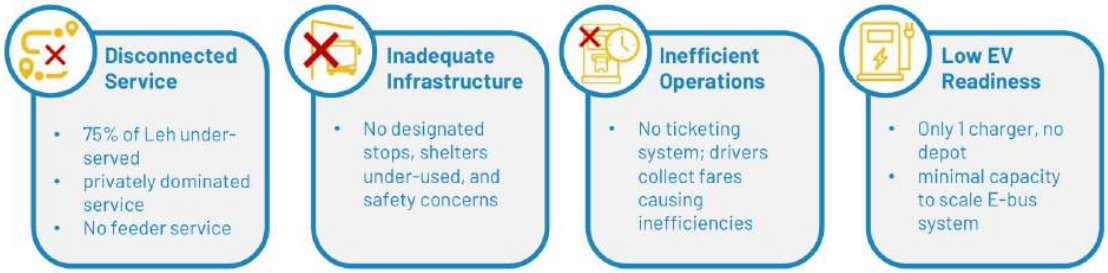


Figure 19: Shortcomings in existing PT service

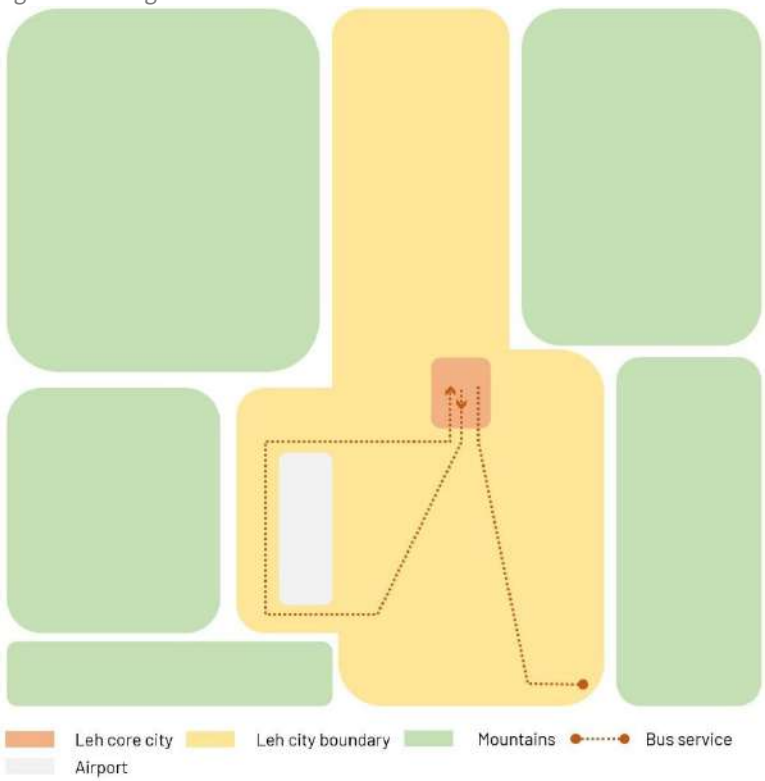


Figure 20: Conceptual diagram of existing PT service in Leh

In addressing these shortcomings, it becomes imperative to strategize measures that enhance coverage, streamline routes, foster collaboration among stakeholders, and invest in the essential support infrastructure & capacity needed to build a more efficient and user-friendly public transportation system for Leh.

Chapter 5
PROPOSED PUBLIC TRANSPORT PLAN FOR LEH

The existing public transport system in Leh is fragmented, inefficient, and dominated by private operators, leaving large parts of the town underserved and residents heavily dependent on informal or private modes of transport. To effectively address these challenges, Leh requires a comprehensive, integrated public transport strategy. This proposal aims to transform Leh's mobility landscape by establishing a unified public transport service managed by a single dedicated agency, ensuring coordinated planning, operation, and management of services. The goal is to provide Leh's residents and visitors with a comfortable, convenient, and reliable commuting experience, while enhancing sustainability, reducing congestion, and improving overall quality of life. The following vision has been set for the future public transportation in Leh.

"Having a single unified public transport service overseen by one agency, providing comfortable & convenient commute for citizens of Leh"

5.1. Principles of Route Planning

5.1.1. 'Make it Simple" Approach

Public transport networks should be organised on the principle of 'one-section – one line'. The fundamental principle is to provide simple and direct lines whose physical routes can be easily remembered whether individually or within the wider network. (Neilsen, 2006) Simplicity aids legibility and direct routes are typically quicker and shorter.

Hence, in Leh, bus routes are planned into simpler lines which can offer higher frequencies, minimum overlaps, and direct routes to key attractions and destinations.

Figure 21: One Section-One line concept, (Neilsen, 2006)

5.1.2 Route Integration

As a consequence of selecting the 'one section – one line' principle, it is important to focus on measures that keep the need for transfers at a reasonable level and to plan for easy transfers between different routes and modes. The most important measure that can be taken to reduce the need for transfers, is to create long routes that connect important travel origins and destinations such as densely developed housing areas, local and regional commercial centres, concentrations of work places, etc. By connecting two such lines in a well-designed interchange, a significant additional part of the region can relatively easy be reached by one transfer only. (Neilsen, 2006)

Hence, in Leh, bus routes are planned into simple and long lines with minimal overlaps. This can cater all origins and destinations in each section by a combination of direct journeys and journeys with one transfer. The key role of interchanges and transfers shall be recognised and given priority to enable passengers to gain more benefit. Radial routes with high frequency will connect important origins and destinations within the city and suburbs, whereas the ring route will bind all other routes.

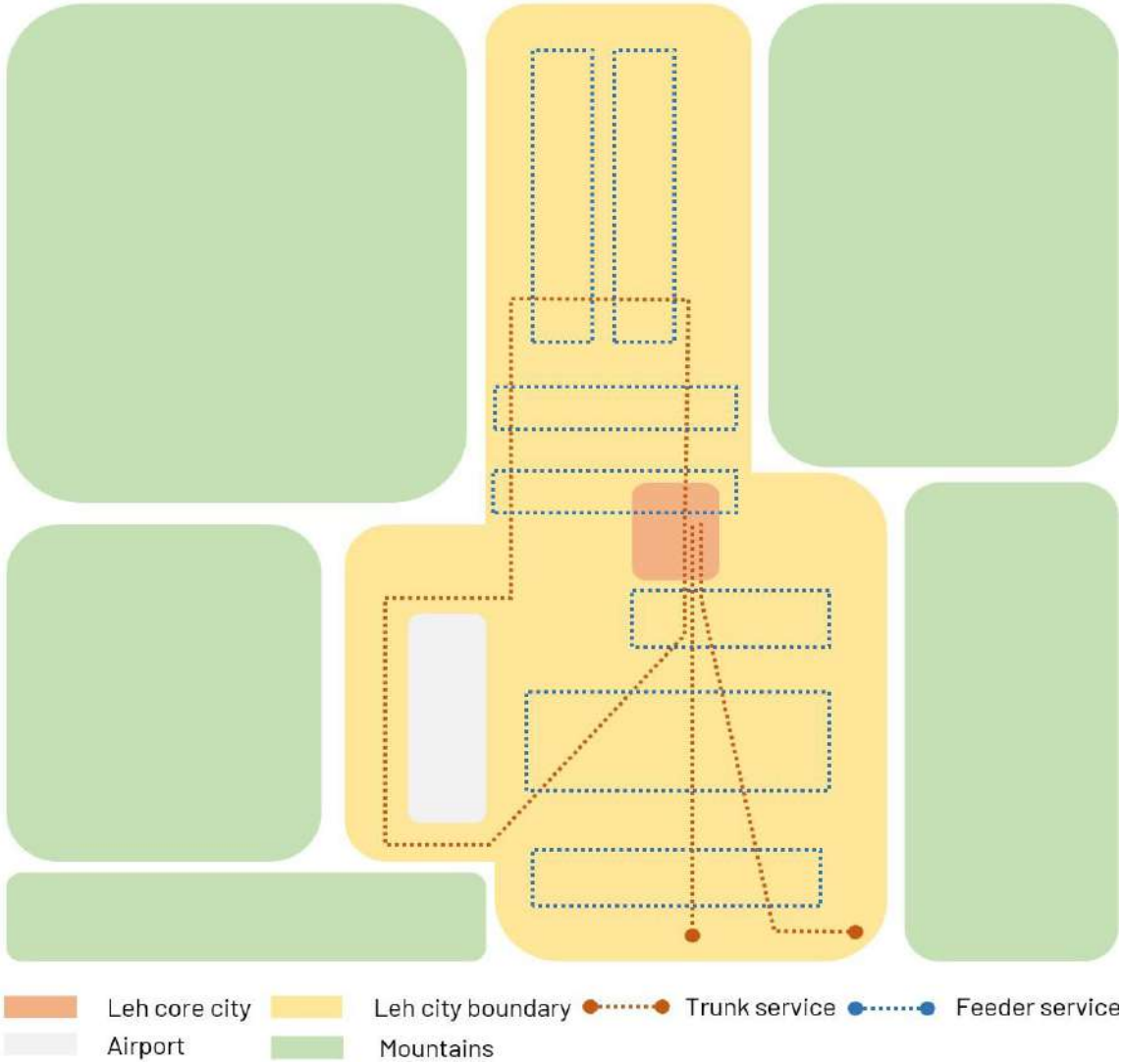


Figure 22: Conceptual diagram of proposed PT service in Leh

5.2. Factors assisting in Route Planning

1. Primary Site Visit and Reconnaissance Study: A detailed site visit and reconnaissance study formed the foundation of the route planning process. This involved physically mapping the city's existing transport corridors, understanding road widths, slope gradients, land use patterns, and key commuter hotspots. These ground-level insights helped identify feasible corridors for public transport, ensuring that proposed routes align with real-world conditions and mobility needs.

2. Stakeholder Discussions: Extensive consultations were held with a wide range of stakeholders, including the Leh Municipal Committee (LMC), SIDCO, traffic police, the Mazda union, individual bus drivers, and daily users. These interactions were instrumental in identifying gaps in the current system, understanding operational challenges, user pain points, and gathering support for future improvements. The collaborative process helped build consensus around the need for a structured and unified public transport network. Also, based on discussions with different agencies, Leh market, Choglamsar, Agling, Colony, Gonpa, Sankar, Skara, Ibex colony, etc. emerged as important activity nodes in Leh.

3. Discussions with Local Experts: Engagements with local experts such as Ladakh Ecological Development Group (LEDeG, 2020), urban planners, and architects provided valuable contextual knowledge and future-oriented design insights. Their understanding of Leh's topography, ecological sensitivities, and cultural landscape contributed to route planning that is not only technically feasible but also socially and environmentally responsive.

4. Study of Secondary Data: Key documents like the Leh Vision Plan 2030 and Leh Climate Action Plan 2047 were reviewed to ensure that the route planning aligns with broader city development and sustainability objectives. These documents offered crucial secondary data and strategic priorities, allowing the proposed network to integrate with future urban growth and climate resilience goals.

5. Primary Surveys: Two key surveys—the Ride Check Survey and the Peak Hour Passenger Demand per Trip (PHPDT) survey—were conducted to gather real-time operational data. These surveys captured essential details such as bus speeds, stop durations, boarding and alighting patterns, and peak demand volumes. The findings directly informed decisions on route alignment, service frequency, and stop locations, ensuring a data-driven approach to route planning.

5.3. Identified Trunk Routes

5.3.1. Route 1: Leh Gate to Choglamsar

Table 13: Route 1 description

Route : Leh Gate to Choglamsar									
Route no.	Origin	Major stops	Destination	Type	Length (km)	ROW (M)	Vehicle capacity	No. of stops	One way time (mins)
T1	Leh Gate	New bus terminal SNM hospital SN chowk EJM college Housing colony KV school Choglamsar Zampa	Choglamsar	Linear	7.7	12 to 22	26	15	31

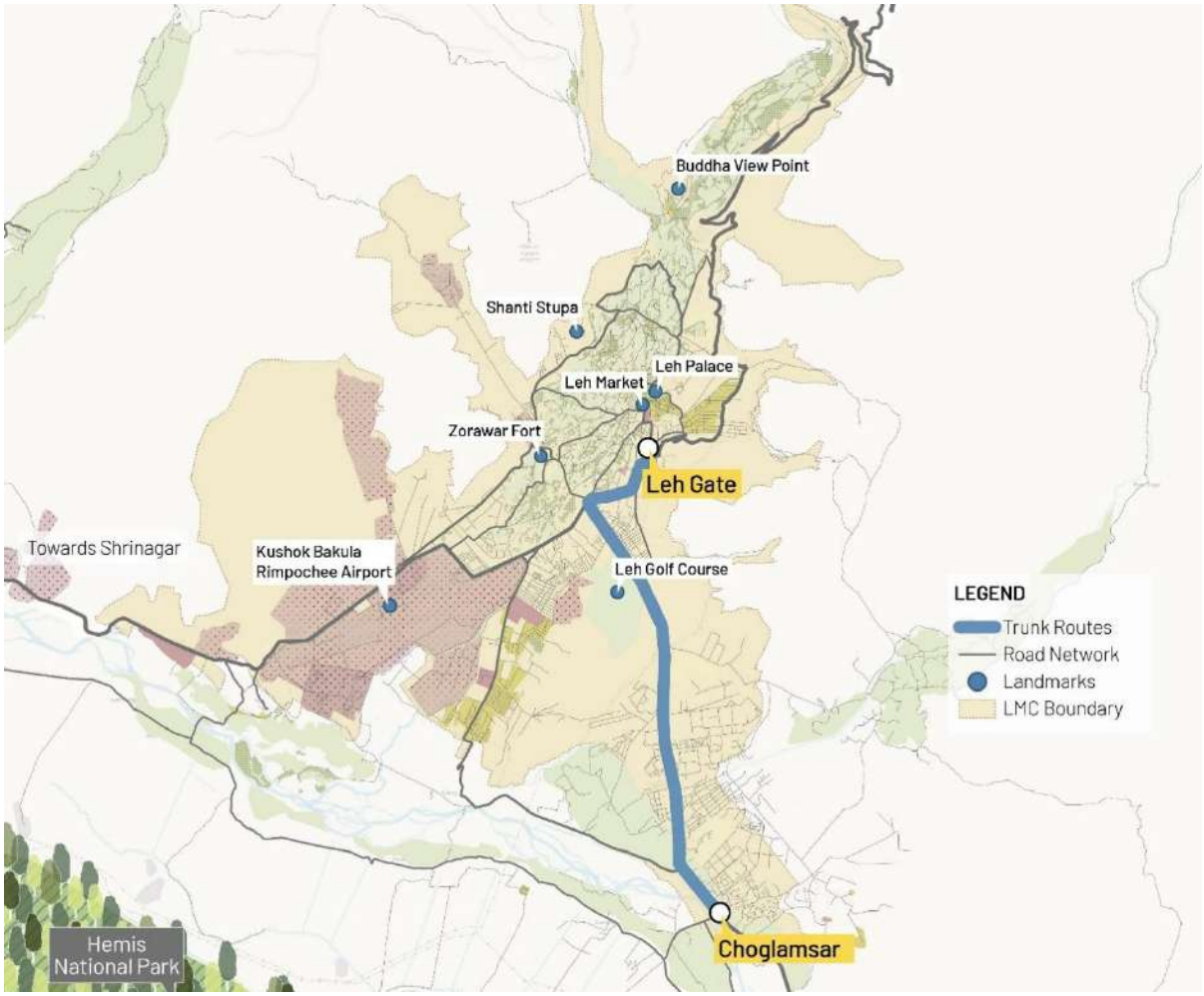


Figure 23: Route 1 map

Figure 24: Route 1-Towards Singay Namgyal chowk

Figure 25: Route 2-Towards Choglamsar

5.3.2. Route 2: Leh Gate-Airport-Tukcha-Leh Gate Ring

Table 14: Route 2 description

Route: Leh Gate-Airport -Tukcha-Leh Gate Ring Route									
Route no.	Origin	Major stops	Destination	Type	Length (km)	ROW (M)	Vehicle capacity	No. of stops	One way time (mins)
T2	Leh Gate	New bus terminal SNM hospital SN chowk Skalzangling Industrial area Airport Tukcha Leh market	Leh Gate	Ring	9.3	4 to 24	10	19	37

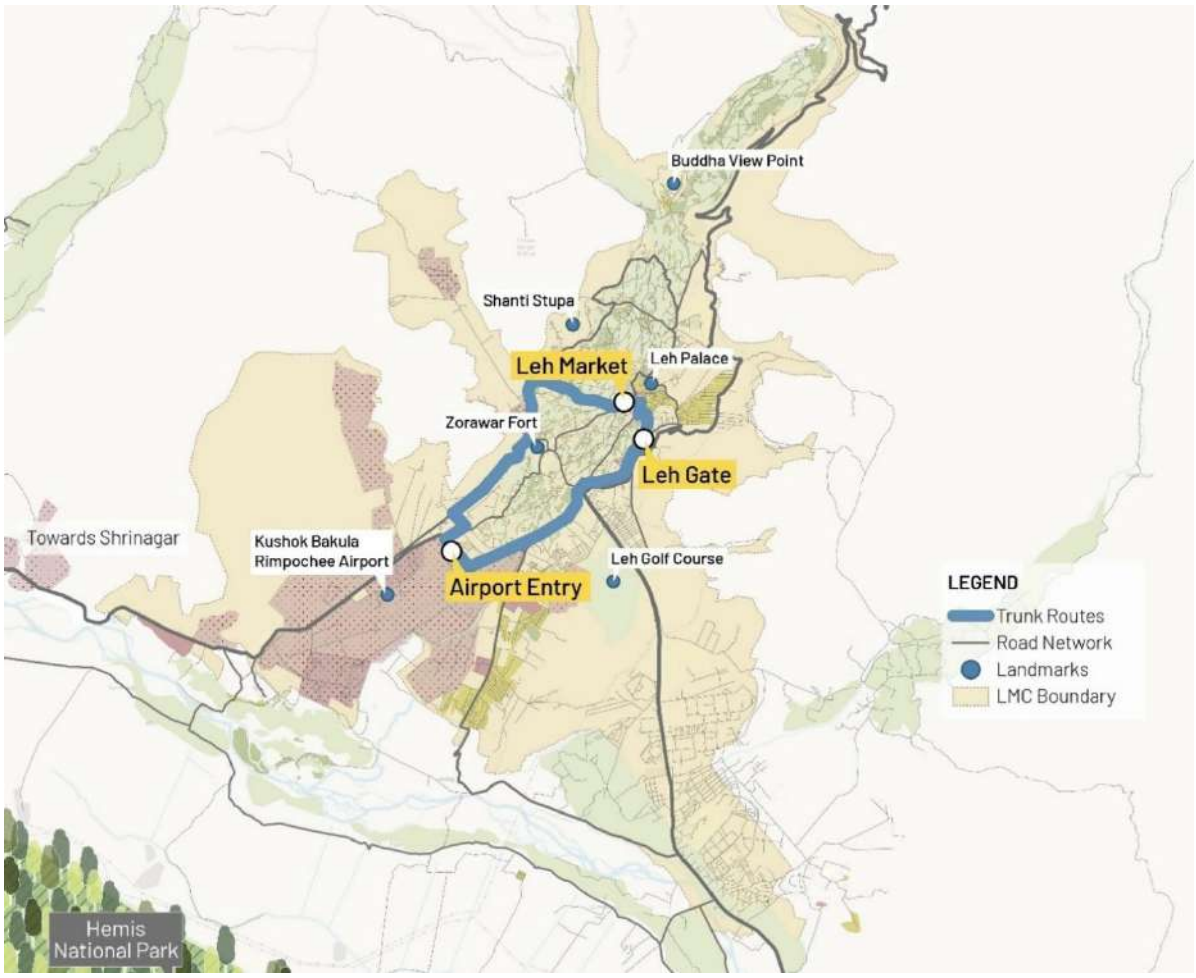


Figure 26: Route 2 map

Figure 27: Route 2-Near SNM hospital

Figure 28: Route 2-Near Skara Yokma

5.3.3. Route 3: Leh Gate to Agling

Table 15: Route 3 description

Route: Leh Gate to Agling									
Route no.	Origin	Major stops	Destination	Type	Length (km)	ROW (M)	Vehicle capacity	No. of stops	One way time (mins)
T3	Leh Gate	New bus terminal SNM hospital SN chowk Skalzangling Agling chowk Ibex colony HF chowk TCV Agling	Agling	Linear	6.3	10 to 24	26	12	25

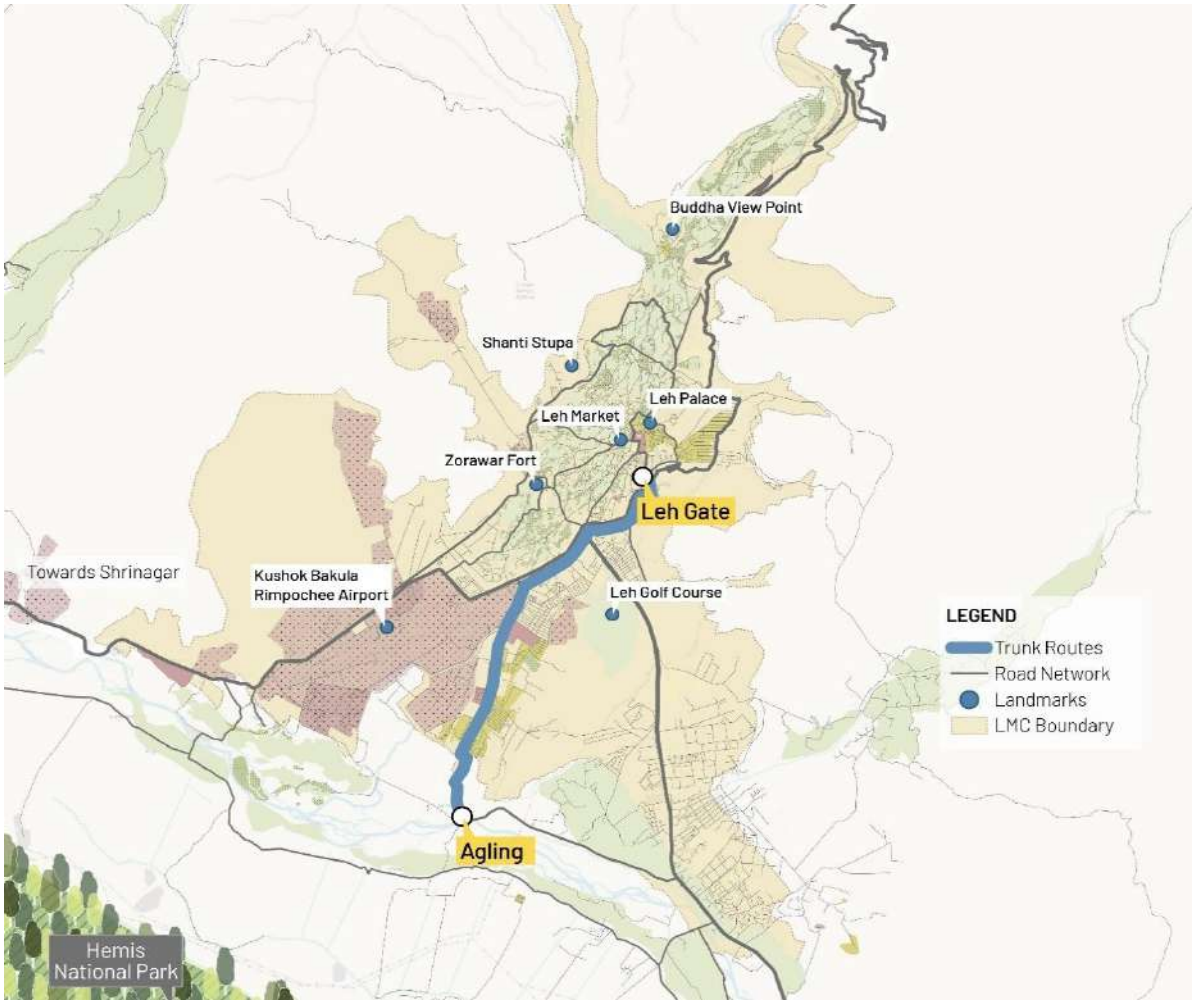


Figure 29: Route 3 map

Figure 30: Route 3- Near Ibex colony

Figure 31: Route 3- Towards Agling

5.3.4. Route 4: Leh Market-Gonpa-Shanti Stupa-Leh Market Ring

Table 16: Route 4 description

Route: Leh Gate to Agling									
Route no.	Origin	Major stops	Destination	Type	Length (km)	ROW (M)	Vehicle capacity	No. of stops	One way time (mins)
T4	Leh Market	Lamdon school Khakshal Food craft institute Gonpa Gangles Sindhu Sanskriti Kendra Shanti Stupa Tukcha	Leh market	Ring	15.2	4 to 12	10	30	61

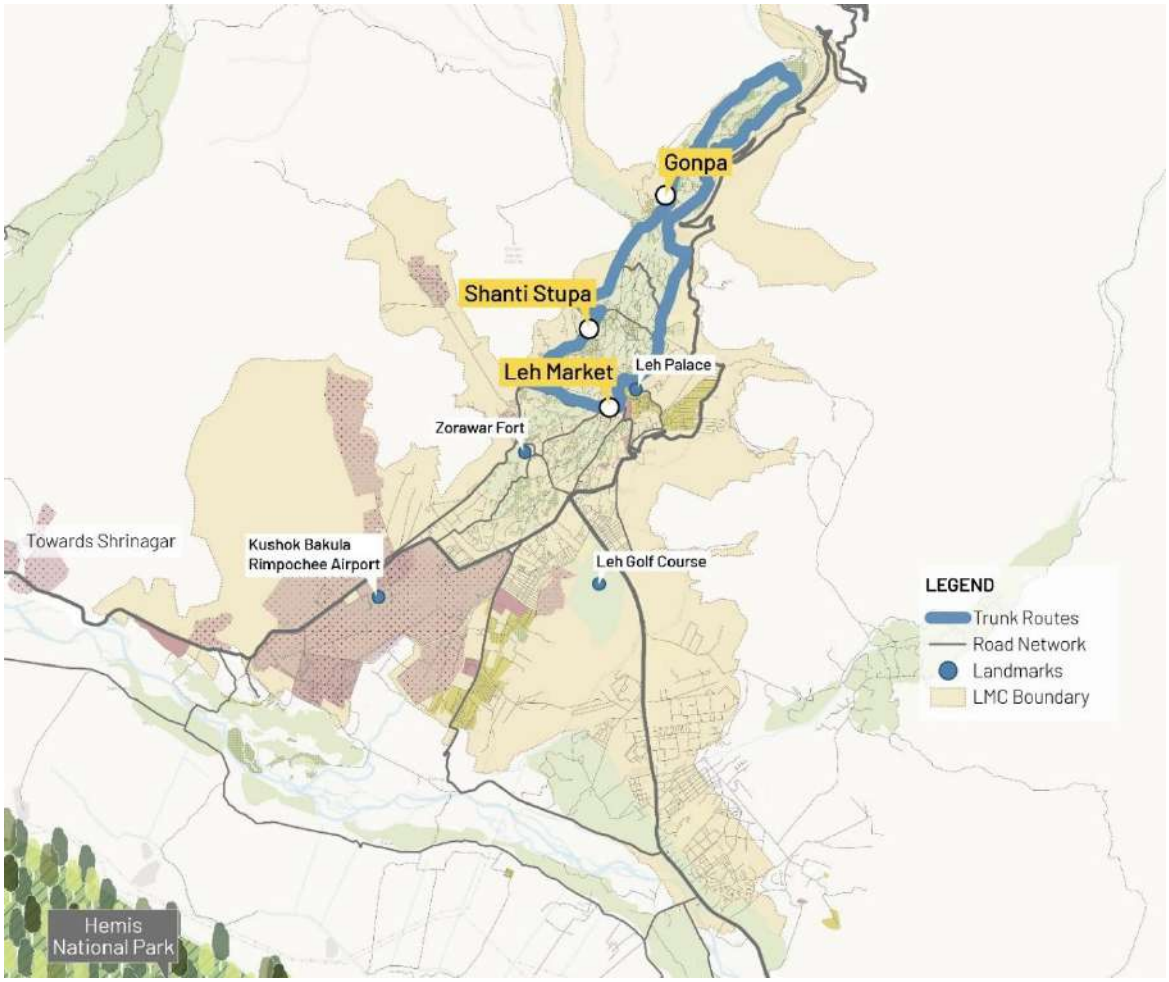


Figure 32:Route 4 map

Figure 33:Route 4- Lamdon School

Figure 34:Route 4- Towards Gonpa

5.4 Identified Feeder Routes

Feeder public transport services have been introduced to enhance connectivity within the inner areas of Leh. These areas are characterized by the following features:

- Residential land use concentration
- Low density built-up areas
- Narrow ROWs 4-10M
- Sharp turns

Four area-specific feeder routes have been proposed to provide internal public transport connectivity. These routes have been designed with minor overlaps with the trunk corridors to facilitate convenient interchange opportunities. The feeders ensure maximum coverage of developed areas while also extending connectivity to remote rural settlements.

Table 17: Feeder route description

Feeder Route Description									
Route no.	Origin	Major stops	Destination	Type	Length (km)	ROW (M)	Vehicle capacity	No. of stops	One way time (Mins)
F1	Leh Market	Lower Tukcha Zorawar Fort Leh Valley School Skara Yokma	Industrial Area	Linear	5.1	4 to 7	10	8	16
F2	Martyrs Chowk	Murste colony Upper Ibex colony RTO War hero colony	Dambuchan	Linear	2.5	4 to 9	10	5	10
F3	Leh Gate	Polo ground Skampari market Skampari	Leh gate	Ring	3.2	4 to 6	10	6	13
F4	KV School	Pema Jive Stal Devachan Solar colony	KV School	Ring	13	4 to 21	10	26	52

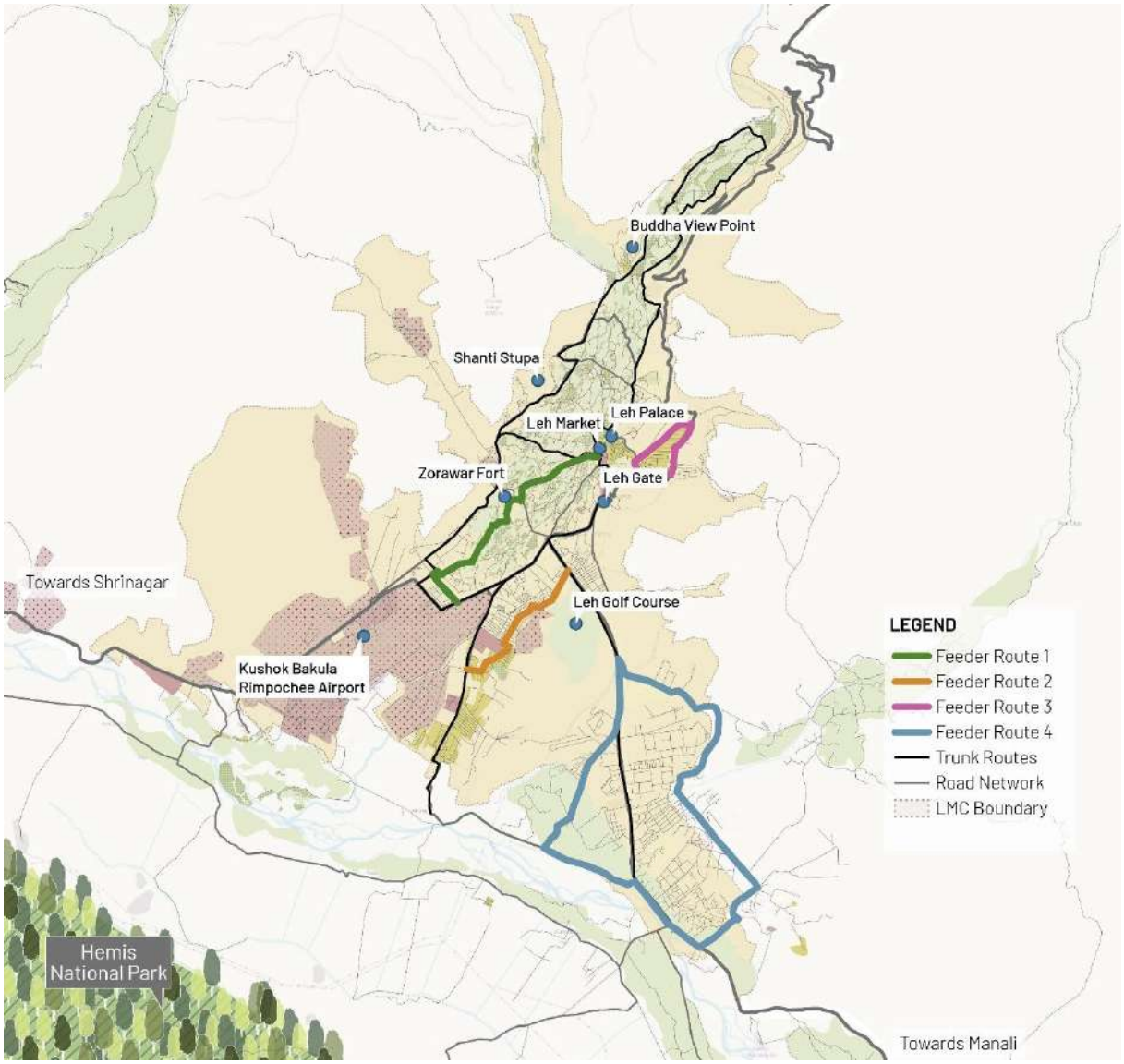


Figure 35: Feeder Route map

Figure 36:Feeder route 4- Near Solar colony

Figure 37: Feeder route 3- Skampari area

Figure 38: Feeder route 2- Towards RTO office

Figure 39: Feeder route 1- Lower Tukcha

5.5 Service Coverage

Figure below illustrates service coverage provided by the proposed public transport system. Taking into account a buffer of 500 meters on either side of the routes, it is observed that 85% of the developed area is effectively covered by the proposed service.

The proposed system will significantly enhance accessibility, reliability, and comfort for users across Leh. With expanded coverage through trunk and feeder routes, residents will benefit from more convenient access to key destinations, including markets, institutions, and tourist areas. The introduction of electric buses will offer a smoother, quieter, and cleaner travel experience, while designated stops and improved frequency will reduce waiting times and make commuting more predictable. Overall, the system will promote greater mobility for all, including students, workers, women and the elderly, encouraging a shift away from private modes towards a more inclusive and sustainable public transport system.

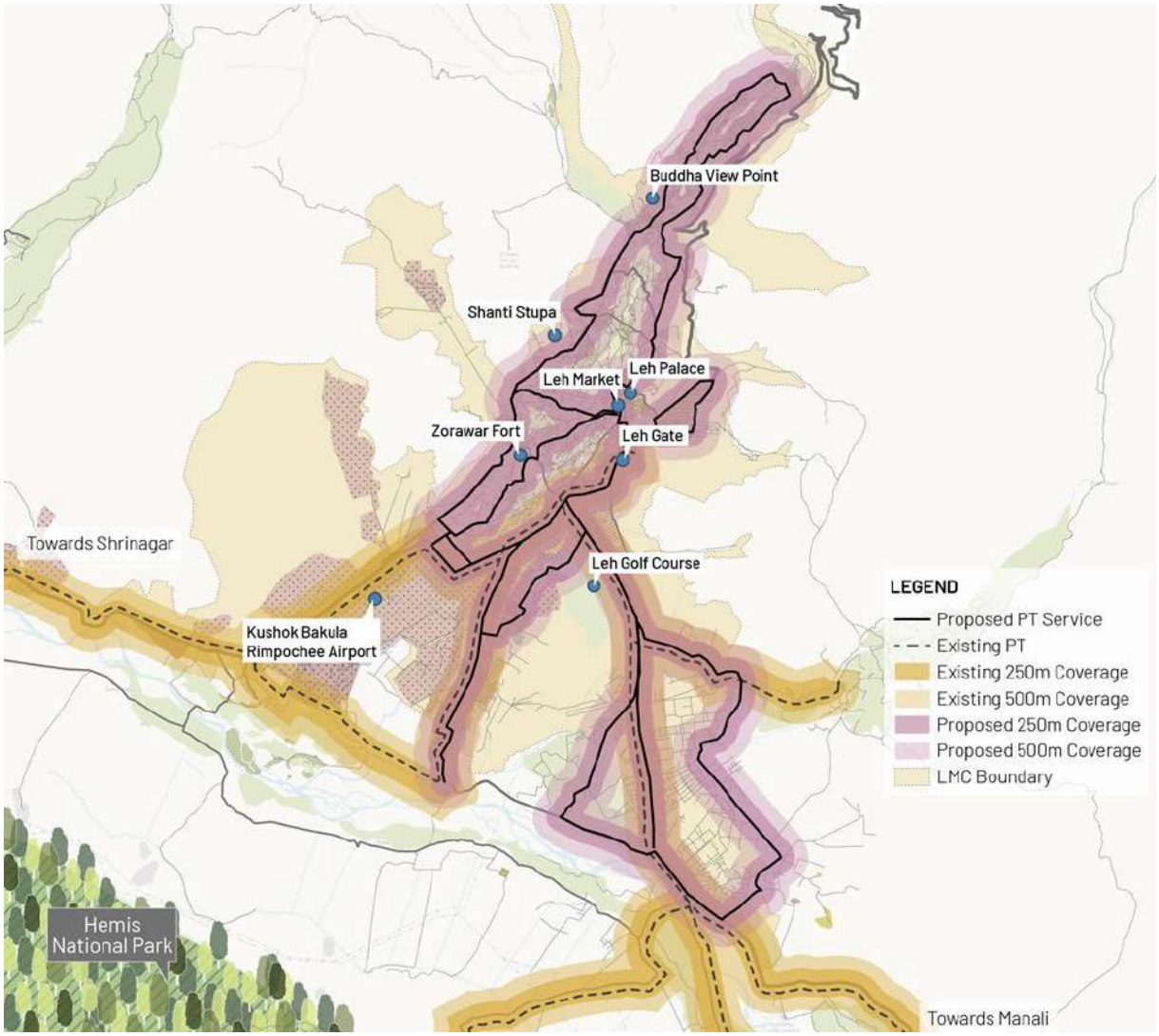


Figure 40: Proposed service coverage

5.6 Proposed Vehicle Types

Two types of vehicles are proposed for deployment in Leh's public transport system to suit varying road conditions and service needs. Mini buses will be used on trunk routes with adequate right-of-way (ROW), ensuring high-capacity service along major corridors. For routes with narrower roads and lower ROW—both on trunk extensions and feeder routes—micro buses (TATA Magic EV) will be introduced to ensure coverage. The specifications and intended applications of both vehicle types are detailed below.

5.6.1 Mini Buses

Bus Type and Specifications

The recommended vehicle type is a 7-meter electric mini bus, designed for high-altitude performance and ease of manoeuvrability on Leh's narrow roads. The specifications align with the current SIDCO fleet and are subject to further refinement based on procurement developments.

Indicative Technical Specifications:

- Bus Length: 7 meters
- Floor Height: 900 mm (high-floor)
- Seating Capacity: 26 passengers
- Standing Capacity: 5–7 passengers (Additional)
- Battery Capacity: 180–210 kWh (Lithium-ion or LFP) (To be confirmed with OEM)
- Range: Up to 180–220 km per charge
- Charging Type: fast charging (25–30 mins for full charge)
- Motor Type: Permanent Magnet Synchronous Motor (PMSM)
- Max Power Output: 100–120 kW
- Gradeability: 17–20% (suitable for hilly terrain)
- Emission: Zero tailpipe emissions

Design Features Based on Local Feedback

Based on consultations with the Leh Municipal Committee (LMC), SIDCO officials, and regular bus users, the following design recommendations have been made to enhance user experience and operational efficiency:

- Air Conditioning: Buses should be equipped with heating and cooling systems suitable for extreme weather conditions. AC units should be complemented with openable windows to allow ventilation when needed.
- Seating Arrangement: Instead of fixed individual seats, continuous bench seating is recommended to allow greater flexibility and accommodate more passengers, especially during peak hours.
- Passenger Information System: Each bus should include a stop information display and automated voice announcements in multiple languages, including Hindi, English, and Ladakhi, to improve accessibility and awareness among both residents and tourists.

Figure 41:Existing E-bus in Leh

5.6.2 Micro buses (TATA Magic EV)

To ensure comprehensive coverage of areas with narrow roads, low travel demand, or limited right-of-way (ROW), 10-seater passenger vans will be introduced as part of the proposed public transport system in Leh. These vehicles are ideal for operating on feeder routes and select trunk corridors that cannot accommodate larger buses. Their compact size and flexibility make them well-suited for the service.

Vehicle Type and Specifications

The recommended vehicle type is a 10-seater electric passenger van, comparable to the Tata Magic or similar models. These vans are especially effective in hilly terrain and congested or informal settlement areas where larger buses are operationally constrained.

Indicative Technical Specifications:

- Vehicle Type: Electric passenger van (L5 or small LCV segment)
- Seating Capacity: 10 passengers
- Dimensions: Approx. 3.7–4.2 meters in length
- Battery Capacity: 10–15 kWh (Lithium-ion) (To be confirmed with OEM)
- Range: 100–120 km per charge
- Charging Time: 2–3 hours (slow charging)
- Top Speed: 60–70 km/h

- Gradeability: 16–20% (suitable for Leh's terrain)
- Emission: Zero tailpipe emissions

Operational Benefits and Design Recommendations

- Manoeuvrability: Small turning radius and compact form factor allow efficient operation in dense, irregular neighbourhoods and peripheral rural areas.
- Cost Efficiency: Lower capital and operational costs make them ideal for high-frequency service on low-demand routes.
- Design Features:
    - Basic ventilation with openable sliding windows
    - Overhead luggage rack for passenger utility
    - Rear and side access doors for easy boarding/alighting in tight spaces

Figure 42: TATA Magic EV, source: TATA Motors

5.7 Fleet Requirements

The following considerations are taken for the fleet calculation:

- Service hours for buses – 6am to 10pm
- Halt time for buses at terminal station – 5 minutes
- Bus stops are considered at every 450-500 meters
- Fleet on routes is calculated considering buses starting from two end points of the route
- Average speed of 15km/ hr is considered

Table 18: Proposed Fleet requirement

Fleet Requirement						
Route name	Vehicle type	Route length (Km)	Average speed (Km/hr)	Proposed headway (min)	Vehicles needed	Km/day/bus
T1	Mini Bus	7.67	15	3	22	200-220
T2	Micro Bus	9.3	15	30	4	130-150
T3	Mini Bus	6.24	15	5	12	180-200
T4	Micro Bus	15.19	15	60	4	100-120
F1	Micro Bus	4.12	15	30	3	70-90
F2	Micro Bus	2.5	15	30	3	40-55
F3	Micro Bus	3.2	15	15	4	80-100
F4	Micro Bus	12.96	15	30	5	145-165

The total network length is ~55 km and total fleet requirement is ~34 mini-e-buses & ~23 micro-e-buses.

5.8 Bus Stop Infrastructure

An essential component of a well-functioning public transport system is the provision of accessible, safe, and user-friendly bus stops. For Leh, two types of bus stops are proposed, based on road width and route demand.

1. Shelter-Type Bus Stops: These will be developed along wider roads and on high-demand routes. Shelter-type stops will offer overhead protection from sun, wind, and snow, along with seating, route maps, service information displays. Additional features may include advertisement panels, CCTV surveillance, solar lighting, and space for small kiosks or vending units, enhancing the passenger experience and enabling non-farebox revenue generation.

Figure 43: Shelter type bus stop (Representative image)

2. Pole-Type Bus Stops: On roads with narrower right-of-way or lower demand, simple pole-type bus stops will be installed. These will consist of clearly marked poles with signage, route information and maps. Where space permits, these may include integrated seating, solar-powered lighting, CCTV surveillance, and limited advertisement space. These stops are cost-effective and can be deployed widely without major land or construction requirements.

Figure 44: Pole type bus stop (Representative image)

Furthermore, to enhance the safety of passengers—including women, children, the elderly, and other vulnerable groups—specific safety features can be integrated into the design of bus stops. The following measures are recommended:

- CCTV Surveillance: Installing security cameras at bus stops can deter harassment and enhance real-time monitoring. Footage can be linked to the city's central control system for quick response.
- Lighting: Ensuring well-lit bus stops with solar-powered LED lighting will improve visibility during early mornings and late evenings, making users feel safer and more visible.
- Clear Visibility and Location: Positioning bus stops in open, visible, and active areas (near shops, public buildings, or roads with consistent activity) discourages unsafe behaviour and increases passive surveillance.
- Emergency Contact Points: Installing SOS buttons or help lines that connect directly to local authorities can offer immediate assistance in case of distress.

For the proposed public transport network in Leh, a total of 106 bus stops are estimated. Of these, 30 stops will be shelter-type, located at key nodes and along major corridors, while the remaining 76 stops will be pole-type, distributed across lower-density and feeder routes. Bus stops are planned at an average spacing of 450–500 meters along all public transport corridors, ensuring good accessibility without compromising service speed.

To maintain operational discipline and efficiency, it will be mandatory for all drivers to stop only at designated bus stops. Random or informal halts will not be permitted, as they compromise both service reliability and passenger safety. The design, location, and amenities of bus stops will be finalized in coordination with the Leh Municipal Committee (LMC), SIDCO, and relevant local authorities, ensuring they are context-sensitive and accessible to all users, including women, elderly and differently-abled.

5.9 Dedicated E-bus Depot

In addition to the existing terminal space in the city centre, a dedicated depot is essential for the efficient and long-term operation of electric buses in Leh. Discussions with the Leh Municipal Committee (LMC) and SIDCO revealed that a site has already been identified for this purpose. The proposed location is situated along the Leh–Manali highway, near the Bamghar playground, 3km away from Leh Gate, offering strategic connectivity to existing and future route networks. The site is government-owned and designated for transport-related operations as per land use.

This site is planned to function as the primary E-bus depot, equipped with facilities for bus parking, fast charging infrastructure, routine maintenance, and administrative operations. The proposed space for depot spans approximately 12,000 sqm and shall accommodate parking for 40 mini buses and 30 micro buses. Based on the fleet requirements, the depot shall be equipped with 7 fast chargers for mini buses and 5 fast chargers for micro buses. Adequate space will also be reserved for the installation of additional chargers in the future, as and when the need arises.

Figure 45: Proposed depot characteristics

Figure 46: Proposed depot location

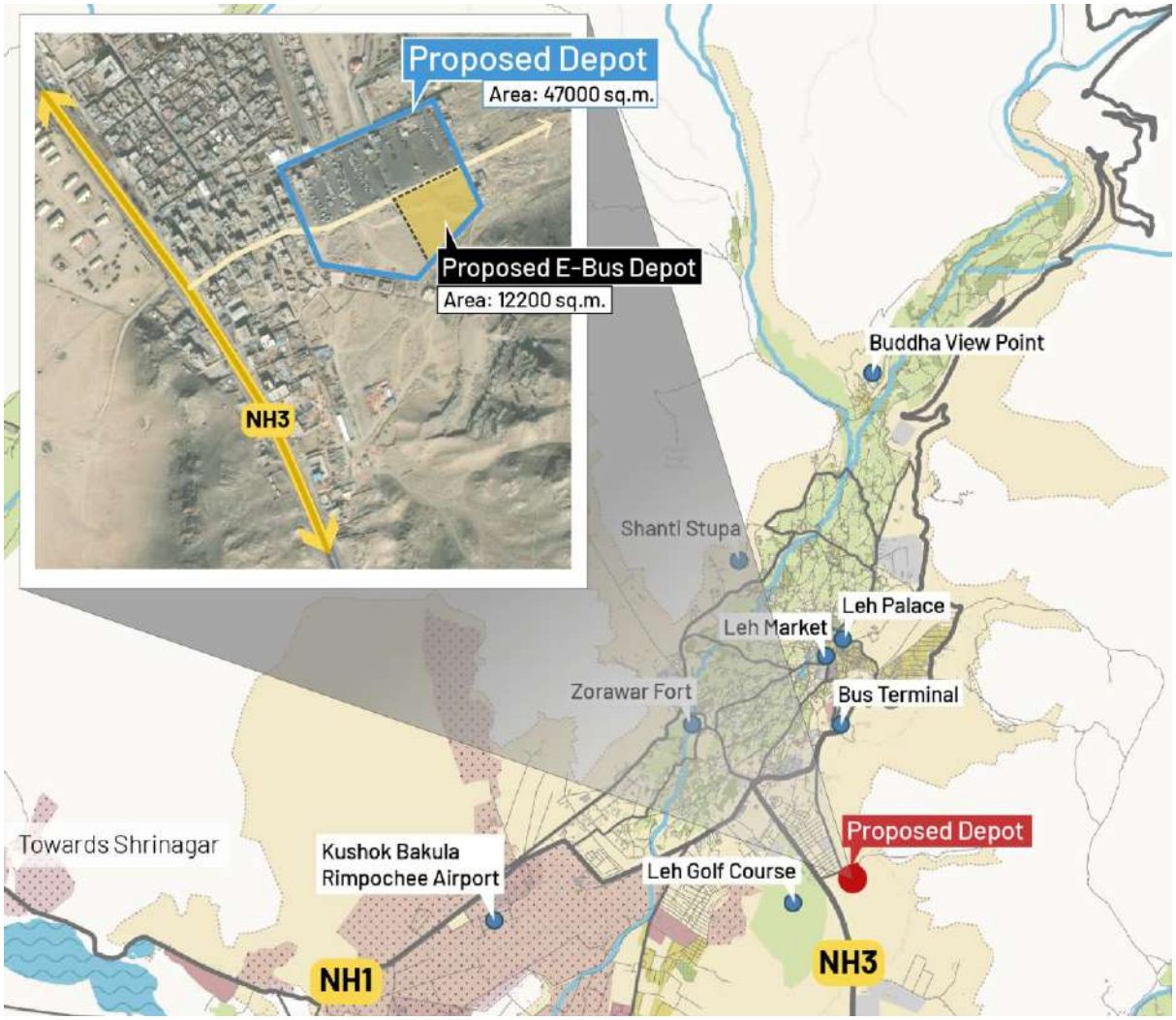


Figure 47: Proposed depot location map

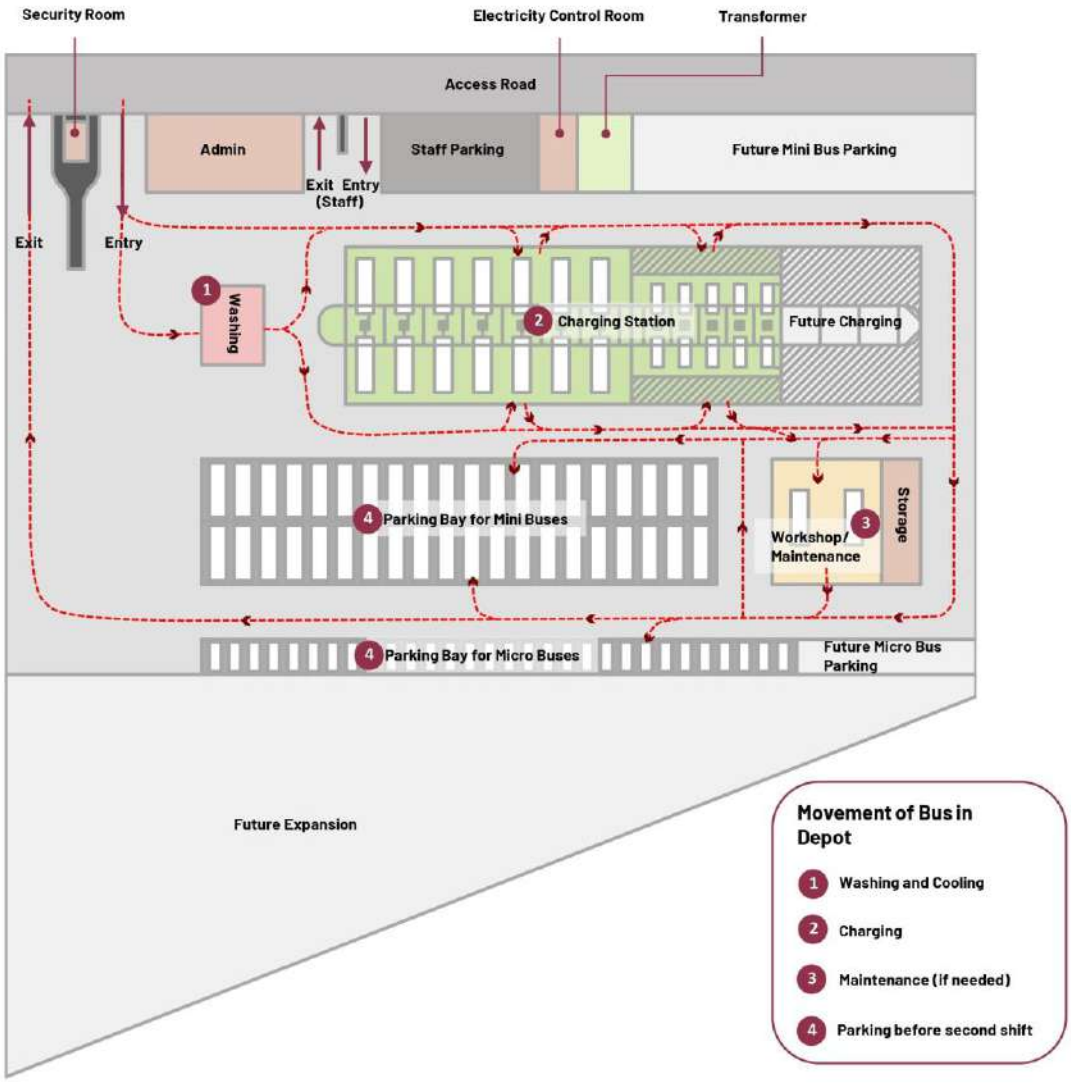


Figure 48: Conceptual plan for proposed depot

5.10 ITS and Control Systems

Innovative technologies can play a crucial role in encouraging use of public transport by enhancing the user experience. Such solutions hold great potential to improve the efficiency of public transit systems through initiatives such as smart-ticketing, one nation-one card, security surveillance, fleet management, traffic management and real-time passenger information. Following ITS solutions could be adopted for Leh PT service.

• Deployment of GPS based Automatic Vehicle Location (AVL) system on all vehicles to monitor operation of fleet, obtain over-speeding reports, depot, vehicle and route wise reports and distance travelled.
• Installation of CCTV cameras in buses to strengthen safety and security of passengers.
• Installation of on-board passenger information system integrated with GPS, voice announcement and display of names of approaching bus stops. Passenger information displays can be installed at

bus stations with dynamic update of approaching buses with their route numbers, destination, ETA and departure.

• Adopting a single ticket system, which a passenger can use to interchange buses to their respective destination. On-board electronic ticketing systems can be introduced with technology for issuing new tickets and QR scan to scan the issued tickets.

• Arrangement of control centre to provide the ITS equipment, maintenance and real time management of bus operations.

In addition to improving operational efficiency, these ITS solutions can significantly enhance the safety and comfort of women and other vulnerable passengers. Features such as CCTV surveillance, real-time vehicle tracking, and passenger information systems create a more transparent and predictable travel environment, reducing risk and uncertainty during travel. Smart ticketing and centralized monitoring further support safer commuting by minimizing physical contact, enabling quicker boarding/alighting, and allowing rapid response to emergencies. Collectively, these interventions can help foster greater trust in public transport, making the system more inclusive and secure.

5.11 Inclusive Growth and Workforce Opportunities

The transition to electric public transport in Leh not only supports environmental sustainability but also presents a unique opportunity to promote social equity and empowerment. Electrification can create new job opportunities across vehicle operations, maintenance, depot management, and ITMS functions—many of which can be accessed by local youth and women through targeted skilling programs. By designing inclusive recruitment policies and capacity-building/training initiatives, SIDCO and other implementing agencies can ensure that women and young professionals are actively integrated into the evolving public transport ecosystem.

Additionally, the proposed improvements in accessibility, service reliability, and coverage through feeder routes will benefit vulnerable user groups, contributing to a more equitable and inclusive urban mobility system for all.

Chapter 6
PROPOSED INSTITUTIONAL STRUCTURE

6.1 Institutional Structure for the System

It is recommended that Sindhu Infrastructure Development Corporation (SIDCO) be the governing body for Leh's proposed public transport operations. SIDCO is suggested to oversee all public transport operations in the city. Roles and responsibilities recommended for the SPV are listed below:

- Initiating contracts with potential operators, including conducting tenders for new bus procurement, and it is recommended to integrate existing private operators into the proposed system.
- Implementation of an Intelligent Transportation Management System (ITMS) is recommended, along with the development of an automatic fare collection system.
- It is recommended that SIDCO manages branding & marketing activities and secure land for depots and terminals.
- Contracting architects for the design of depots, terminals, and bus stops is recommended.
- It is also recommended that SIDCO be responsible for finalizing non-farebox revenue mechanisms to ensure the sustainability and financial viability of the system.

6.2 Operating Model for the System

The proposed operating model for Leh represents a shift from the existing fragmented framework. Currently, public transport operates under a mixed structure, comprising approximately 130 privately operated buses running under a Net Cost Contract (NCC) model, and a fully government-run SIDCO service with 10 electric buses. The new model aims to streamline operations, introduce modern electric vehicles, and create a unified and user-centric system. Several operational scenarios have been explored, as outlined below.

1. Continuation of Existing SIDCO E-bus Services

The existing SIDCO-operated E-bus services, which primarily function as long-distance inter-city services across Ladakh, are recommended to remain independent from the proposed intra-city public transport system. These services will continue without disruption. However, they will be allowed shared access to new infrastructure developed under the proposed system—such as depots, charging facilities, and Intelligent Transport Management Systems (ITMS)—to ensure resource optimization and interoperability.

2. Scenario 1 – Retain Existing Mazda Services Separately

a) Way Forward for Mazda Service: Under this scenario, the existing private Mazda bus services will continue operating independently and will not be integrated into the new public transport framework. While this maintains the status quo, it risks perpetuating system inefficiencies and limiting coordinated service delivery.

b) New Vehicle Operator Contracts: Mini electric buses under the PM E-bus Sewa scheme will be introduced under a Gross Cost Contract (GCC) model. In addition, SIDCO will issue tenders inviting private operators to run micro electric vehicles (such as TATA Magic EVs) on feeder and narrow routes. Requests for Proposals (RFPs) will be floated for procurement and operations, with government support in the form of per-kilometre operational subsidies. All aspects of service delivery—including routes, schedules, stops, and fares—will be managed by SIDCO. All fare box revenue shall remain with SIDCO. Operators will not bear any financial risk and will be evaluated based on clearly defined Key Performance Indicators (KPIs).

3. Scenario 2 – Full Phase-out of Mazda Services

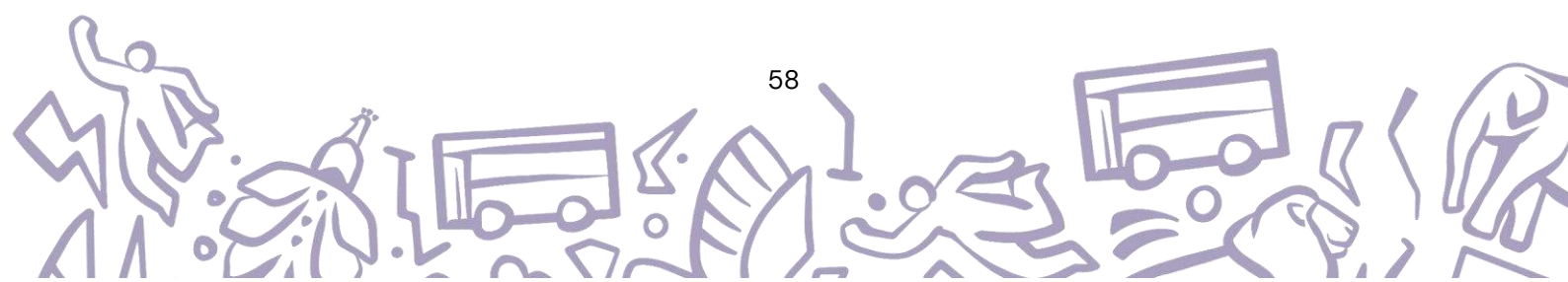
a) Way Forward for Mazda Service: This scenario recommends a gradual phasing out of all existing Mazda bus services. As the current buses reach the scrappage age of 15 years, their permits will not be renewed. This will allow for a complete transition to a modern, standardized fleet.

b) New Vehicle Operator Contracts: As in Scenario 1, SIDCO will procure and operate mini-E-buses under the PM E-bus Sewa scheme on a GCC model. Tenders will also be floated for micro-bus operators, with the opportunity extended to current Mazda operators to join the revamped system. Government financial support, including operational subsidies, will ensure viability. All aspects of service delivery—including routes, schedules, stops, and fares—will be managed by SIDCO. All fare box revenue shall remain with SIDCO. Operators will not bear any financial risk and will be evaluated based on clearly defined Key Performance Indicators (KPIs).

4. Scenario 3 – Gradual Integration of Mazda Service with SIDCO

a) Way Forward for Mazda Service: This approach recommends restructuring existing Mazda operator contracts and integrating them into the new system. Operators can continue as individual entities or form cooperatives/consortia. A phased bus replacement plan will be implemented, supported by capital subsidies (up to 50%) and/or full operational subsidies per kilometre. This support may be offered on a first-come, first-served basis. A regulatory framework shall be developed for non-renewal or cancellation of permits for non-compliant operators, ensuring a smooth and accountable transition.

b) New Vehicle Operator Contracts: As in Scenario 1, SIDCO will procure and operate mini-E-buses under the PM E-bus Sewa scheme on a GCC model. Tenders will also be floated for micro-bus operators, with the opportunity extended to current Mazda operators to join the revamped system. Government financial support, including operational subsidies, will ensure viability. All aspects of service delivery—including routes, schedules, stops, and fares—will be managed by SIDCO. All fare box revenue shall remain with SIDCO. Operators will not bear any financial risk and will be evaluated based on clearly defined Key Performance Indicators (KPIs).



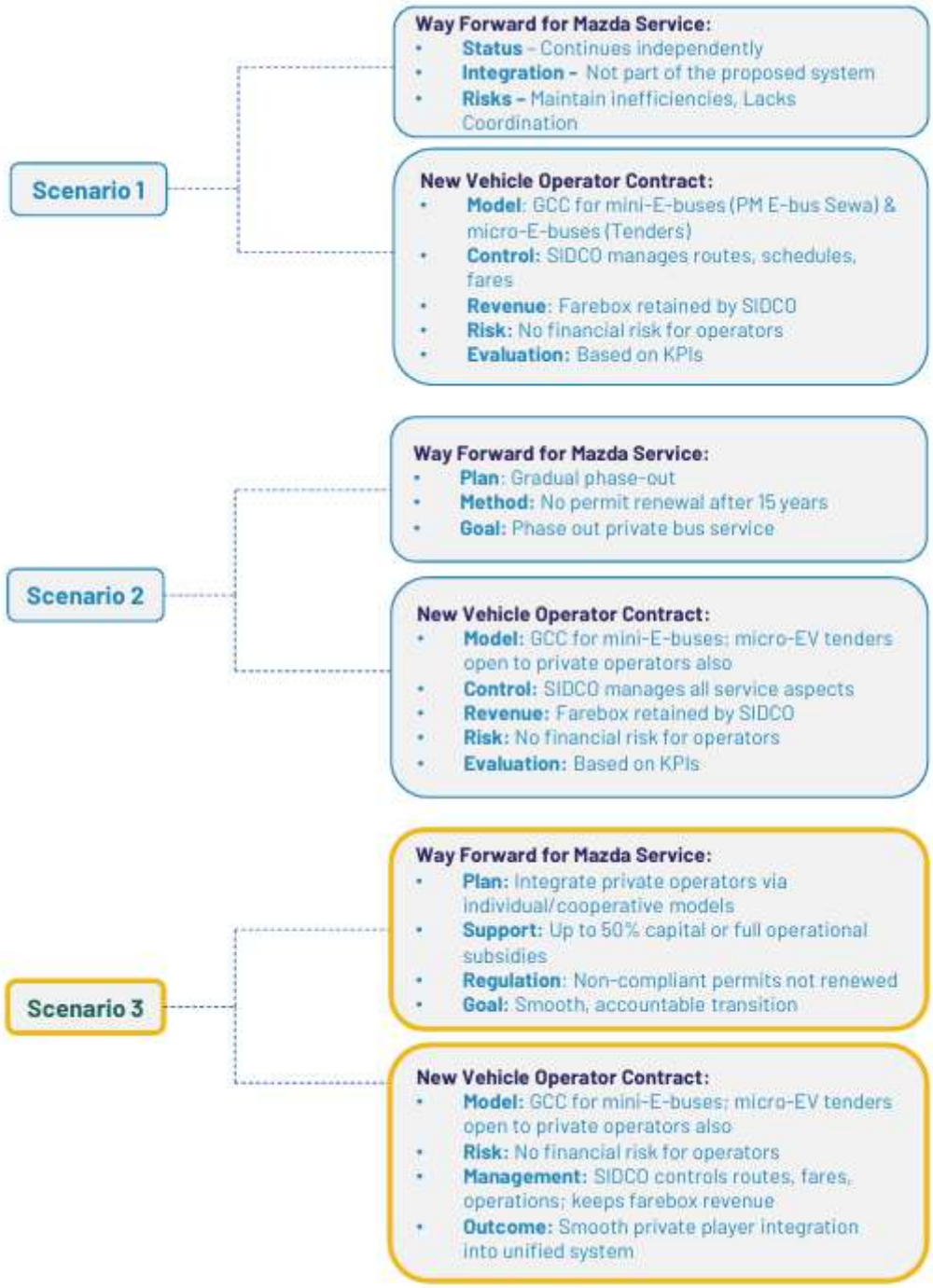


Figure 49: Scenarios for operating model

Scenario 3 is recommended as the most balanced and future-ready option. It ensures a seamless transition for existing private operators while moving toward a fully integrated, government-overseen public transport system. This unified model will foster operational efficiency, service quality, and affordability—offering a convenient and reliable mobility solution for the people of Leh.

Chapter 7
FINANCE AND PHASING

Establishing a robust and sustainable public transport system in Leh also requires a clear strategy for financing capital investments and managing implementation in phases. This chapter outlines the estimated capital block costs associated with infrastructure development, fleet procurement, depot setup, and supporting systems such as ITMS. In addition, it explores alternate funding mechanisms—including central government schemes, taxes, non-fare box revenue sources, etc.—to bridge financial gaps and ensure long-term viability. A phasing plan is also presented to guide the staged rollout of the system, balancing financial feasibility with operational priorities.

7.1 Capital Block for the Proposed System

The estimated capital block costs for the proposed public transport system are outlined below. It is important to note that these figures are indicative and subject to change based on market conditions, detailed design, and implementation timelines.

Table 19: Capital block cost for the proposed system

Capital Block Cost for Proposed PT System				
Sl. no	Particular	Quantity	Unit Cost (INR Crore)	Total cost (INR Crore)
1	E-Mini bus	34	1.00	34.0*
2	E-Micro bus (TATA Magic EV)	23	0.10	2.3**
3	Depot (Includes charging & main. Infra.)	1	10.00	10.0
4	Bus shelter	30	0.05	1.5
5	Bus stop	76	0.01	0.8
6	Central control station	1	7.00	7.0
7	Bus terminal augmentation	1	0.50	0.5
	Total			56.1

*Note: As the E-mini buses are proposed to be procured under the PM E-bus Sewa Scheme through a Gross Cost Contract (GCC) model, their capital cost will not be incurred upfront by the city and shall be excluded from the capital block cost at the implementation stage.

**Note: Similarly, the E-micro buses (e.g., TATA Magic EVs), also planned to be procured under GCC arrangements, will not require upfront capital investment and their cost will be excluded during the implementation phase.

7.2 Alternate Funding Sources

To ensure the long-term financial sustainability of Leh's public transport system, it is essential to diversify funding streams beyond fare-box revenue. One of the primary recommendations is to establish an Annual Public Transport Corpus Fund, which can act as a dedicated and ring-fenced financial resource for operations, infrastructure maintenance, and service expansion. This corpus may draw from multiple recurring and one-time sources such as:

- Green Cess: Levied on fuel or high-emission vehicles, this cess aligns with Leh's environmental goals and helps internalize the environmental cost of private vehicle usage.
- Motor Vehicle Tax (MVT): A share of the MVT collected by the local or UT administration can be earmarked for public transport improvements.
- Parking Fees: Revenue collected from on-street and off-street parking in the town can be partially diverted to support public transport operations.
- Tourism Surcharge: Considering the high tourist inflow in Leh, a small surcharge on tourism-related services (such as hotel stays or permits) can be justified to support mobility infrastructure used heavily by visitors.
- UT Budgetary Support: Annual allocations under the Ladakh UT budget can provide capital and operational support, especially in the early years of system rollout.
- Viability Gap Funding (VGF): To make public-private partnerships attractive for micro-EV operations or depot management, VGF can be sought from central or UT sources.

In addition to institutional funding, non-fare box revenue streams must be actively explored to supplement operational costs and reduce dependence on subsidies. Key strategies for Leh include:

- Advertising Rights: Allowing commercial advertisements on buses, bus shelters, terminals, and digital screens can generate substantial revenue.
- Retail and Commercial Leasing: Kiosks or vending zones within terminals or key bus stops can be leased to generate steady rental income.

By combining these alternative funding sources with targeted financial planning, Leh's public transport system can move toward a self-sustaining model that supports expansion, quality enhancement, and long-term viability.

7.3 Phasing Strategy

A three-year phasing strategy has been developed for the rollout of Leh's public transport system, guided by demand, operational feasibility, and financing availability. This is an initial phasing plan and may be revised based on stakeholder feedback. The phased approach ensures a gradual and manageable rollout, allowing for system testing, infrastructure readiness, and responsive adjustments over time.

Phase 1 – Year 0 (Initiation Phase): By the end of the first implementation year (Year 0), operations will commence on two high-demand trunk routes—Leh Gate to Choglamsar and Leh Gate to Agling. This phase will also include the development of key infrastructure such as the central bus depot, control centre and designated bus stops along these corridors. This foundational phase will serve as a pilot to test service delivery, assess on-ground challenges, and build public familiarity with the system. Total capital cost required for this phase shall be ~INR 17.5 Crores.

Phase 2 – Year 1 (Coverage Expansion): In the first half of Year 1, services will be extended to the northern part of Leh, launching key routes including the Airport and Gonpa ring routes. The second half will see the rollout of two crucial feeder routes—Skampari and the Choglamsar ring route—which will enhance last-mile connectivity. Also, additional charging infrastructure for smaller vehicles shall be added to the depot in this period. By the end of this phase, 85% of the proposed network will be operational. Total capital cost required for this phase shall be ~INR 1.65 Crores.

Phase 3 – Year 2 (Completion and Optimization): Final phase will begin with initiation of the remaining two feeder routes, completing the planned service coverage. Simultaneously, the bus terminal will be augmented to accommodate expanded operations. This phase will also focus on service refinements, using data gathered over the previous 18 months and public feedback to improve efficiency, coverage, and user satisfaction. Total capital cost required for this phase shall be ~INR 0.65 Crores.

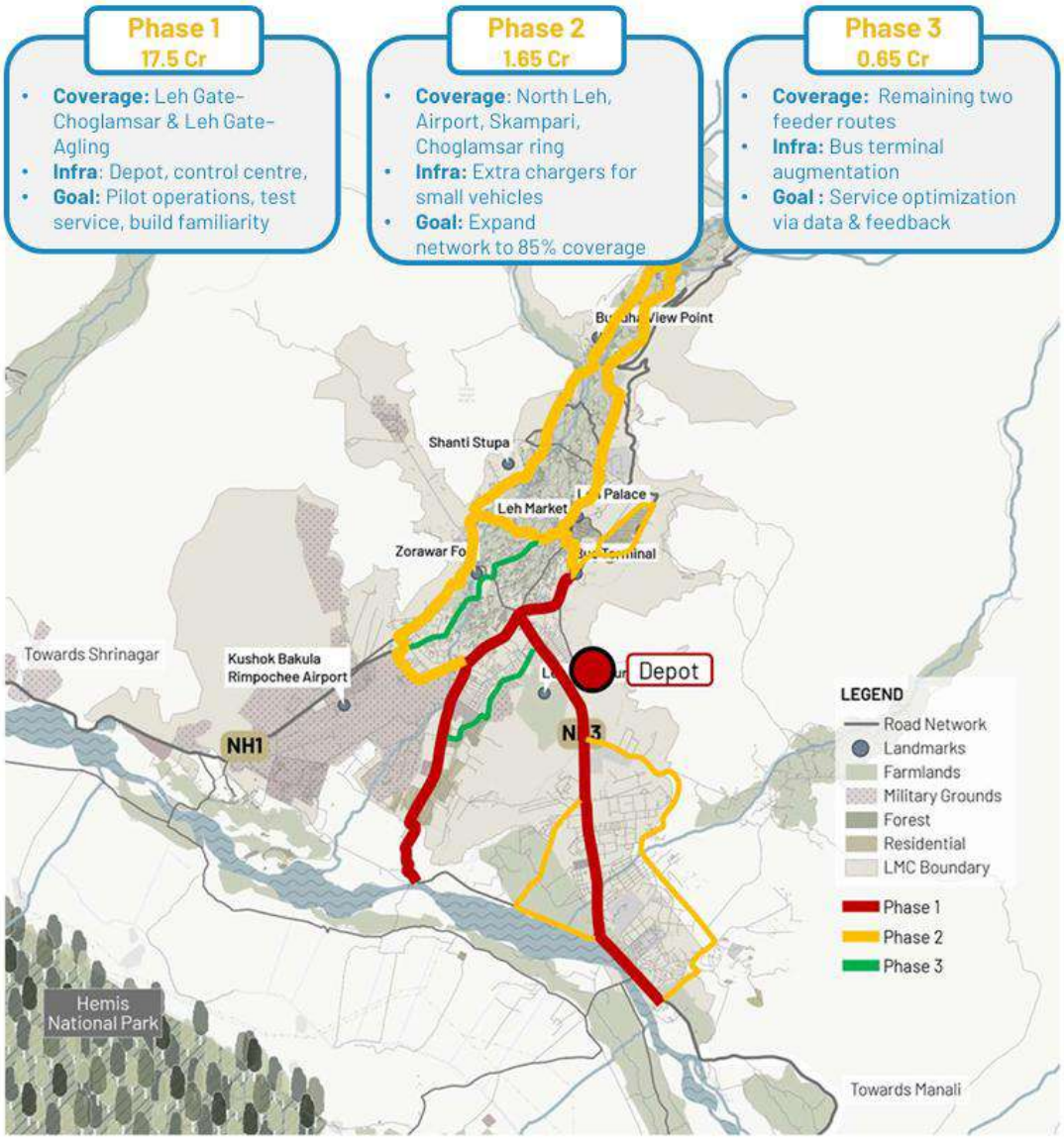


Figure 50: Phasing of the proposed system

Chapter 8
WAY FORWARD

The public transport system in Leh is currently fragmented, limited in coverage, and lacks the infrastructure and institutional coordination needed to support the town's growing mobility demands. With increasing tourist influx, rising vehicle ownership, and environmental sensitivities unique to the region, there is a need for an efficient, accessible, and sustainable public transport system. This study presents a comprehensive framework to address the gaps through the introduction of a unified public transport system comprising mini & micro electric buses, guided by a structured institutional model & phasing plan. The proposal not only builds on field surveys, stakeholder consultations, and secondary data analysis, but also aligns with Leh's broader sustainability goals and national EV transition priorities. It outlines practical interventions across fleet planning, operations, infrastructure, and governance—alongside clear options for integrating or transitioning from the existing private bus system. By adopting the recommended approach, Leh can establish a future-ready and environmentally sustainable public transport system that enhances mobility for Leh.

It is also important to recognize that buses, as a flexible mode of public transport, offers the advantage of route and service adaptability. This flexibility allows for iterative improvements based on operational feedback. Therefore, once the system is piloted, it will be essential to implement a structured monitoring and evaluation framework. This will help identify on-ground issues, assess user satisfaction, and make timely adjustments to routes, frequencies, and infrastructure—ensuring that the service continues to evolve and meet the needs of Leh's residents and visitors over time.

A key next step in this process is to initiate comprehensive consultations with all major stakeholders. As this proposal represents the first iteration of Leh's public transport plan, it must undergo a thorough review by stakeholders to incorporate their feedback and refine the plan accordingly. Following these consultations, the proposal will be finalized and submitted under the PM E-bus Sewa Scheme, enabling the initiation of vehicle procurement and operator selection for the service.

Chapter 9
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