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Electric Mobility in Rural Nepal: A Pre-feasibility Study of the Galkot–Badigad–Nisi Corridor

IMPRINT

This study was part of the interventions implemented within the WISIONS Innovation Lab Nepal. Its overarching goal is to strengthen the livelihoods of mountain communities of Nepal by applying sustainability solutions in the fields of energy access and landscape management in an integrative way. The WISIONS Innovation Lab is implemented in Nepal by a consortium of local organizations led by Winrock International Nepal and which comprises the collaboration with People, Energy & Environment Development Association (PEEDA) and RECOFTC Nepal.

The Innovation Lab Nepal is part of the WISIONS of Sustainability, which is led by the Wuppertal Institute for Climate Environment and Energy.

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Authors:
Nisha Jaishwal[1], Subodh Ghimire[1], Shritu Shrestha[2], Badri Baral[1],

Contributors:
Govinda Khanal[1], Rabin Shrestha[1], Willington Ortiz[2]

Layout:
Yasin Imran Rony[2]

1 Winrock International, 2 Wuppertal Institute

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LIST OF ABBREVIATIONS

BFIs	Bank and Financial Institutions
CFUGs	Community Forest User Groups
EV	Electric Vehicle
GHG	Greenhouse Gases
GoN	Government of Nepal
ICE	Internal Combustion Engine
IRR	Internal Rate of Return
KII	Key Informant Interview
KM	Kilometer
LG	Local Government
NEA	Nepal Electricity Authority
NPV	Net Present Value
PCS	Public Charging Station
PEEDA	People, Energy & Environment Development Association
RECOFTC	Regional Community Forestry Training Center
RM	Rural Municipality
ROE	Return on Equity

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EXECUTIVE SUMMARY

Nepal's expanding electricity access, particularly through hydropower generation and rural electrification presents a significant opportunity to transform transport systems through electric mobility. The Galkot-Badigad-Nisi corridor, a rural area in Baglung District of Gandaki Province, offers a compelling case for exploring such interventions.

The Pre-feasibility Study for Electric Mobility in the Galkot-Badigad-Nisikhola Corridor explores the opportunities for deploying electric vehicles (EVs) as an alternative to the region's urgent need for affordable and sustainable public transport. To evaluate this potential, the research combined field visits, key informant interviews (KIIs), structured surveys with driver and passengers to capture the local mobility pattern and service needs. It also employs financial modelling to assess the technical, socio-economic, and operational feasibility of deploying EVs along key routes in the corridor.

Key Findings:

Public transport in the Galkot-Badigad-Nisi corridor is largely informal, limited to small private vehicles and pick-up jeeps that are often overcrowded, irregular, and inaccessible beyond major stops, leaving many communities underserved.

There is strong demand for affordable, reliable public transport connecting market hubs such as Galkot, Narethanti and Burtibang.

The technical and financial viability of public transport options in the corridor indicates the following:

- **Electric Vans:**
  - Well-suited to the rural, hilly terrain and dispersed settlements due to their maneuverability, operational flexibility, and ability to match demand-based capacity.
  - The **14-seater electric van** is the most financially attractive option, with a high return on investment (Net Present Value (NPV)) of Nepalese Rupees (NPR)[1] 3.81 million, an Internal Rate of Return (IRR) of 28%, and a Return on Equity (ROE) of 49%, delivering payback within **3.3 years.**
  - The **11-seater electric van** is also viable, particularly for smaller operators, offering moderate returns and a payback period of around **4 years**.

- **Electric Buses (26-seater):**
  - Financial feasibility is highly dependent on maintaining high occupancy levels, making them suitable mainly for **inter-town routes with higher demand**.
  - Returns are modest, with an NPV of NPR 0.16 million, IRR of 10%, and an estimated **5-year payback period**.

1 NPR = 0.00625 Euros = 0.00724 US Dollar (as of August 2025)

- **Conventional ICE Vehicles:**
  - Larger buses (30-seater) demonstrate strong financial performance **only under large-scale deployment**, but their high emissions reduce long-term sustainability.
  - Smaller ICE vans show limited profitability and relatively higher emissions, underscoring the comparative financial and environmental advantages of transitioning to EVs.

The wider adoption of EV across the corridor still requires to address the challenges such as limited charging infrastructure along or near the corridor, lack of local EV repair services, and high upfront costs of the vehicles.

Recommendations:

To realize these opportunities, a Detailed Feasibility Study (DFS) is recommended to validate assumptions and refine implementation models. Piloting electric vans through community cooperatives or private operators, coupled with developing charging infrastructure and blended financing models, will be essential. Capacity building for operators and alignment with national EV policies are also critical.

Way Forward:

With strong financial, environmental, and social justification, the study recommends prioritizing electric mobility over ICE-based transport. A well-planned, community-driven EV initiative in the Galkot-Badigad-Nisikhola corridor can serve as a replicable model for rural Nepal, contributing to sustainable mobility, energy transition, and improved livelihoods.

1. INTRODUCTION

Nepal's expanding electricity access, particularly through hydropower generation and rural electrification presents a significant opportunity to transform transport systems through electric mobility. The Galkot-Badigad-Nisi corridor, a rural area in Baglung District of Gandaki Province, offers a compelling case for exploring such interventions due to its growing electricity access in the region, favorable terrain, and increasing demand for efficient and affordable local transport.

With the expansion of rural roads, mobility options for public services in this region rely primarily on fossil fuel-based vehicles, which are environmentally harmful. Taxis, while available as a shared service, are costly and sometimes unreliable due to supply disruptions. However, recent improvements in electrification - both through the national grid and local generation - combined with growing community interest in energy-based livelihood opportunities create a conducive environment for piloting electric vehicle (EV) adoption as a public transport solution in this region.

This study, conducted under the WISIONS Innovation Lab project, is a part of the broader agenda to strengthen the livelihoods of mountain communities through renewable energy solutions and sustainable landscape practices. It examines the feasibility of introducing electric mobility options in the Galkot-Badigad-Nisi corridor, a region with an interesting combination of energy and landscape conditions: a) the area has a rather high density of microhydro plants, b) the national grid has been recently extended along the corridor and c) the region features a series of valleys interconnected through the "mid hill highway", which is representative of several hilly regions of the country. The pre-feasibility study was undertaken, combining insights from local stakeholders with detailed assessment, mainly technical and financial viability of electrified public transport. The goal is to provide a data-informed, context-sensitive basis for potential pilots and long-term scaling of e-mobility solutions tailored to remote, hilly regions.

2. OBJECTIVES AND METHODOLOGY

2.1 OBJECTIVES

The primary objective of this pre-feasibility study is to assess the viability of introducing electric mobility solutions in the Galkot-Badigad-Nisi corridor of Baglung District. To achieve this, the study carried out following activities:

- Assessed current transport patterns, modes, and challenges in the corridor to better understand mobility needs and the passenger transport supply chain.
- Examined how the introduction of electric vehicles (EVs) for public transport could support the transition to sustainable mobility and meet local transport demand
- Conducted detailed technical and financial assessment to evaluate the feasibility and adoption potential of EV options.

2.2 METHODOLOGY

The study applied a combination of desktop research on relevant literature and policy documents, as well as the collection of qualitative and quantitative data through surveys, interviews, and stakeholder consultations. This comprehensive methodology was designed to assess the suitability and feasibility of introducing electric vehicles (EVs) in the Galkot-Badigad-Nisi corridor and to identify enablers and barriers related to operations, technology, finance, and policy. The methodology was structured into three main components: 1) Data Collection, 2) Analysis and Report Preparation, and 3) a Validation Workshop.

DATA COLLECTION

Data collection combined secondary and primary sources to ensure comprehensive coverage of technical, operational, financial, and policy dimensions relevant to EV deployment. This involved desk reviews, field surveys, site inspections, and stakeholder consultations.

Desk study and Secondary Data Review: A thorough review of relevant policies, guidelines, and demographic statistics was conducted to provide context and policy alignment for the study. Key reviewed documents included:

- Nepal Electricity Authority (NEA) reports on EV charging tariffs and infrastructure requirements
- Gandaki Province EV Operation Standard Guideline 2080 BS
- Nepal Census Study 2021
- Local government policies promoting EV adoption

Site visits, surveys and key informant interviews:
Site visits and stakeholder consultations were conducted in the municipalities of Galkot, Badigad, and Nisikhola. The aim was to observe the existing passenger transport systems, assess their demand and supply needs, evaluate road conditions, settlement patterns, and electricity access, and gather stakeholder perspectives on the socioeconomic factors influencing EV adoption. A key focus of these visits was evaluating road conditions and determining the technical feasibility of EV operations in rural, hilly terrain. This included assessing road surface types (gravel or paved), measuring road length and connectivity to off-highway settlements, and identifying areas prone to risk, particularly those affected by landslides or monsoons. Due to the geographic challenges of the hilly region, on-site visual inspections were supplemented by Google Earth analysis and validated through input from local governments and transport providers.

Additionally, structured surveys were conducted at key transportation nodes and hubs along the Galkot-Badigad-Nisi corridor. The “purposive sampling” method was used to ensure diversity in geography, gender, and stakeholder roles. The survey questionnaires (see Annex 1) were shared with 78 respondents (63 passengers and 15 drivers) and administered in the local language. Data was collected using the KOBO tool to maintain consistency. The focus was on route usage patterns, fare structures and travel costs, occupancy trends, passenger concerns and drivers’ perspectives on vehicle operations, maintenance challenges, and perceptions of EVs.

Key informant interviews (KIIs) were conducted with local government officials from Badigad, Nisikhola, and Galkot; provincial government officials; representatives of local transport cooperatives (e.g., Burtibang Dhorpatan Yatayat); community electricity user committees; and local entrepreneurs (see KIIs questionnaire in Annex 2). Interviews with transport operators provided insights into the operational environment for passenger services. Most KIIs were conducted in person during site visits, while a few were conducted via telephone with EV dealers, banks, and financial institutions (BFIs).

ANALYSIS

The collected data were systematically analyzed to assess the corridor's current socio-economic profile, existing public transportation options, and the challenges faced by commuters. The analysis also assessed the technical and financial viability of electrified public transportation options, such as e-buses and e-vans, and identified supporting policies.

Technical viability analysis
Data from field assessments, surveys, and consultations assisted in analysing:

- The feasibility of EV operations in the corridor's rural and hilly terrain.
- Road infrastructure suitability for different EV types

Financial analysis:
The financial model aimed to inform both private operators and local governments about the economic sustainability of EV operations compared to those using internal combustion engines (ICEs).. A financial viability assessment was carried out to examine:

- **Capital costs** for procuring EVs (11-seater electric van and 14-seater electric van and 26-seater electric bus) and similar ICE buses and vans
- **Operating costs** including energy consumption, maintenance, insurance, and driver and helper salaries.
- **Revenue estimation** based on fare structures, occupancy levels, and passenger demand.
- **Profitability indicators** such as Return on Equity (ROE) and payback period.

Additionally, sensitivity analysis was conducted to test the impact of fare levels and vehicle occupancy rates on overall viability.

Policy and Institutional Analysis
Findings from the desk review and stakeholder consultations were synthesized to assess how national, provincial, and local policies enable and promote EV adoption.

RESULTS VALIDATION

The validation workshop took place in Burtibang, Baglung, in July 2025. The aim was to present the preliminary findings of the pre-feasibility study to key local stakeholders and solicit their feedback to further refine the analysis. A diverse group of participants attended the workshop, including local government officials, transport cooperative representatives, local transport operators, Community Forest User Group (CFUG) members, hotel association representatives, residents, micro-hydro power (MHP) officials, and prospective EV investors.

The highly interactive workshop enabled participants to articulate concerns, identify op-

portunities and provide recommendations for strengthening public transport services and supporting EV adoption. Specific attention was given to stakeholder perspectives on road infrastructure readiness for EV operations, community awareness and interest in electric mobility, and financial and policy expectations to support EV adoption. Preferred implementation models were also discussed, such as public–private partnerships (PPPs).

The feedback collected during the workshop was incorporated into the analysis to validate the findings, ensuring that the study reflected local perspectives and priorities and was thus more relevant and aligned with community mobility needs.

3. OBSERVATIONS & ASSESSMENTS

3.1 SOCIO-ECONOMIC PROFILE OF THE CORRIDOR

Understanding the area's geographical, demographic and socio-economic context is crucial for evaluating the current transport situation and the feasibility of electric mobility solutions. With this in mind, input was gathered from stakeholders across all segments of the corridor to ensure that any new transport solution reflects user needs. This section presents the key findings from the Galkot–Badigad–Nisi corridor in the mid-hill region of Baglung District in Gandaki Province, based on field visits and local data collection.

GEOGRAPHY AND TERRAIN

The corridor extends from Galkot Municipality to Badigad Rural Municipality reaching the remote settlement of Nisi (See Figure 1). It spans over 71.3 km and can be divided into three distinct sections based on major mobility hub or centre points for mobility transit: Narethanti to Kharbang (24.1 km), Kharbang to Burtibang (22.9 km), and Burtibang to Bhalkot (24.3 km) (see Figure 2).

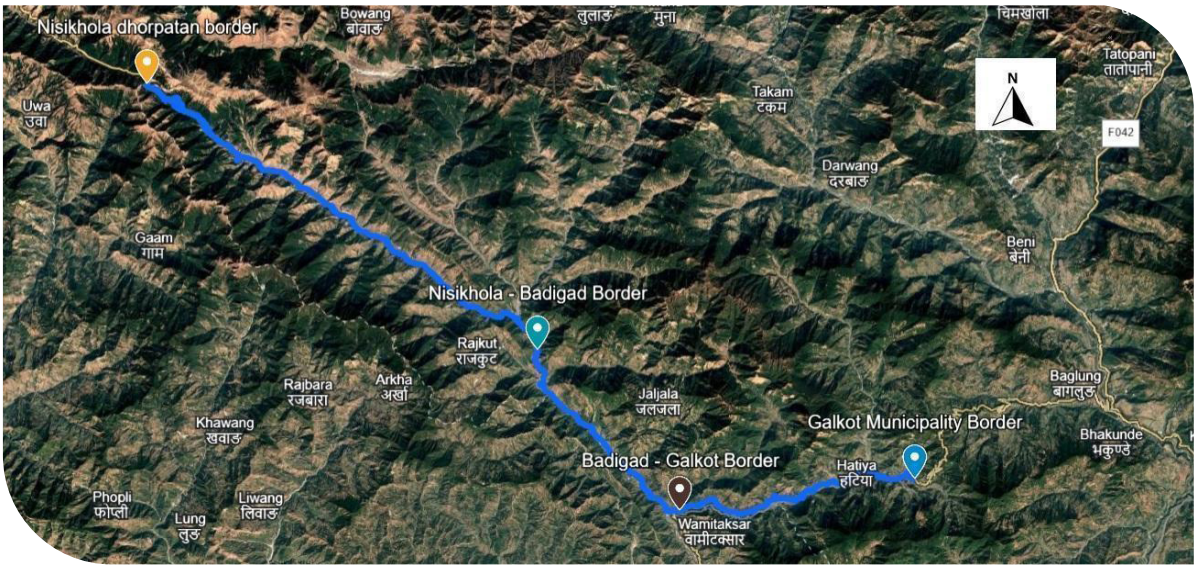


Figure 1: Galkot-Badigad-Nisi corridor from Narethanti to Bhalkot (source: Google maps)

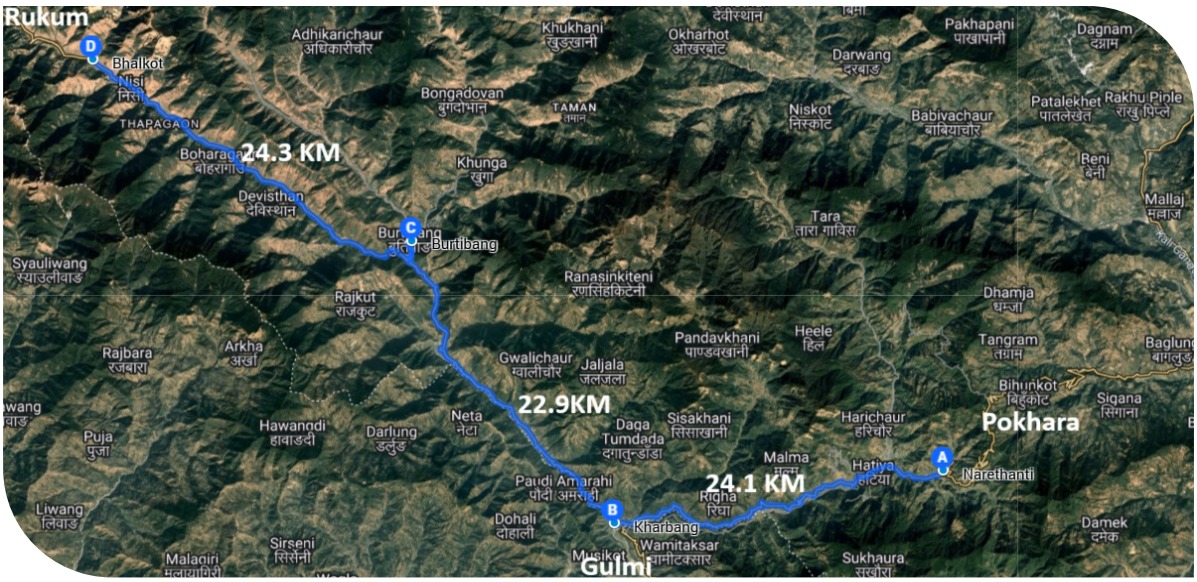


Figure 2: Location of three key sections in Galkot-Badigad-Nisi corridor: Narethanti to Kharbang, Kharbang to Burtibang, and Burtibang to Bhalkot (source: Google maps)

The route traverses a mix of black-topped and gravel roads with moderate gradients, ranging in elevation from 745 meters at Kharbang to 1,884 meters at Bhalkot. As the corridor is part of a highway, vehicle speeds along certain stretches are relatively high, raising safety concerns, particularly on narrow and winding segments. These conditions make the corridor well suited to small- to mid-sized electric vehicles (EVs), which offer better manoeuvrability, can manage moderate gradients and generate lower noise and emissions. This is important for the environment and the communities along the route. Although road connectivity has improved in recent years, vehicle access is still limited during the monsoon season due to landslides and road damage in several sections. The Galkot–Badigad–Nisi corridor plays a vital role in regional development by supporting inter-municipal connectivity, promoting trade and improving access to services such as education, healthcare, banking and government services.

POPULATION AND LIVELIHOOD PATTERNS

The region is home to a diverse population of subsistence farmers, seasonal migrants, traders, and government employees. Table 1 provides an overview of the region's main socio-economic aspects. The combined population of the Nisikhola, Badigad, Galkot and Dhorpatan municipalities totals 112,614, and most households rely on agriculture for their livelihood. However, this trend is currently decreasing due to significant out-migration for foreign employment, particularly among young people and adults. Badigad and Galkot have more diversified economies, with contributions from the public service, businesses, education, and non-governmental sectors. Dhorpatan shows additional livelihood diversification through seasonal tourism, handicrafts, portering and mule-based transport. These socio-economic dynamics shape mobility patterns along the main road, necessitating transport systems that support the daily commuting needs of farmers, workers, and students, as well as efficient connectivity for those accessing urban centers (see the following section for details on local mobility). Remittances from abroad play a significant role in household incomes. Most residents rely on agriculture and livestock, supplemented by small-scale businesses and

government services. Access to markets, health facilities, and administrative services remains challenging due to poor or expensive transport.

Table 1: Socioeconomic and Demographic Statistics

Metric	Nisikhola Rural Municipality	Badigad Rural Municipality	Galkot Municipality	Dhorpatan Municipality
Area	244.97 km²	178.68 km²	194.39 km²	222.85 km²
Population	23,119	28,839	30,588	30,068
Population Density	94.37/km²	161.4/km²	157.3/km²	134.9 /km²
Female	54.3%	53.5%	53%	53.5%
Households	5,635	6,745	7,714	7,485
Literacy Rate	72%	81.5%	80.5%	73.7%
Primary Livelihood	3,332 households (agriculture, livestock, etc.)	7,371 farmers	Majority rely on agriculture	Predominantly agriculture, animal husbandry, and seasonal tourism
Foreign Employment	1,049 households	3,225 individuals	Increasing reliance on foreign jobs	High migration
Other Key Employment Sectors	N/A	• 463 Government employee • 463 business owners • 472 teachers • 402 self-employed • 759 laborers • 233 NGO workers	• Military recruitment • Shift away from agriculture	Seasonal tourism, handicrafts, portering, mule transport
Notes	Low income in agriculture	High literacy rate and diverse employment	Gradual decline in agricultural workforce due to migration	Remote terrain; limited infra-structure; high out-migration

Sources: https://ourgalkot.com/, https://badigadmun.gov.np/, https://nisikholamun.gov.np/, https://dhorpatanmun.gov.np/

3.2 EXISTING PUBLIC TRANSPORT OPTIONS IN THE CORRIDOR

PUBLIC TRANSPORT OPTIONS IN THE CORRIDOR

The selected Galkot-Badigad-Nisi corridor forms part of a highway where public transport is primarily provided through inter-village services. However, these services are fragmented and largely informal, with no organized, large-capacity system in place. Instead, local mobility is primarily managed through small, privately owned vehicles such as four-seater taxis, seven-seater vans, and even pick-up jeeps. Figure 3 illustrates the types of vehicles that operate along the routes connecting key market centers such as Burtibang and Hatiya.

Three main transport service providers operate across the corridor: Burtibang Dhorpatan Yatayat Private Limited, Nisi Bhuji Uttarganga Private Limited, and Galkot Ghumti Yatayat Private Limited. These providers operate taxis and vans across three key segments of the corridor: Narethanti to Kharbang (35 taxis and 9 vans), Kharbang to Burtibang (40 taxis and 25 vans), and Burtibang to Nisi/Bhalkot (15-20 taxis and vans). These services cater both long- and short-distance commuters, but the quality and reliability of the service vary across the corridor. Smaller vehicles, such as taxis and vans, are often overcrowded, particularly on market days, and services usually finish operating at 17:00. After this time, passengers must rely on expensive rental services. Residents living away from major transport hubs often experience long and unpredictable waiting times due to limited vehicle availability. Beyond the main highway, transport options are even more limited, with pick-up jeeps often being the only accessible option. Although pick-up jeeps are primarily intended for transporting goods, they often carry passengers due to a lack of alternatives.

Another observation is on how commuters informally rely on vehicles dedicated for long-distance travel services and what type of vehicles they use to access from hilly village to the highway

Long-distance travel services: Long-distance travel in the corridor is mainly facilitated by long-route buses. These buses primarily serve regional hubs such as Baglung, Pokhara, and Butwal, and generally follow the main highways. However, they do not stop everywhere and only serve certain points along the route. This means that travellers from smaller villages or settlements in the corridor often find it difficult to access these buses, as they are not usually used for local journeys. The limited accessibility and infrequent stops of these buses mean that people wishing to travel for long distances must adjust their schedules to match the limited availability of these services.

Access from hilly villages to the highway: Most trips between hilly villages and the highway are served by pick-up jeeps, which are adapted for the steep terrain and unpaved roads that characterize the area. However, this service is informal, and vehicles are often unavailable unless booked in advance. As a result, residents of hilly villages and other uphill settlements often have no choice but to walk or use animal transport, which can be time-consuming and physically demanding. The terrain and the lack of accessible roads for regular vehicles pose a significant barrier to expanding public transportation to these areas. Consequently, this part of the corridor is particularly underserved and has limited mobility options.

DEMAND FOR IMPROVED TRANSPORT CONNECTIVITY

The corridor has a daily passenger demand of between 200 and 300 people over a 20 km stretch (i.e. for each section of the Galkot–Badigad–Nisi corridor; see chapter 3.1.1 for more details) . This was identified through surveys and key informant interviews (KIIs) with drivers and transport associations. While the current public transport system in the corridor is functional to a degree, it primarily caters to immediate commuting needs through informal, fragmented, and demand-driven services. The transition to a more reliable, inclusive, and formalized public transport system should aim to make current travel safer, cheaper, and more efficient, while also unlocking new mobility alternatives that could foster broader socio-economic development across the valley. The site visit observations and stakeholders' consultations highlight the need for improved transport connectivity for:

- Strengthening local economies by connecting with surrounding areas and markets and facilitating the exchange of goods and sharing of resources.
- Promoting cultural and religious tourism by enabling easier access to heritage sites and religious landmarks for residents of Nisi, Galkot and the surrounding area.
- Increasing access to educational and health services

7-seater Eco Van

Pick Up/ Jeep

4-seater Taxi

Long route bus to Kathmandu

Figure 3: Types of vehicles operating in the Galkot-Badigad-Nisikhola area

3.3 OPERATION AND FARES

OPERATIONAL HOURS AND FREQUENCY

In the Nisi-Hatiya corridor taxis and vans provide regular services between 5:00 AM and 5:00 PM, with peak demand occurring from 9:00 to 11:00 AM and 3:00 to 5:00 PM. After 5 PM these services are available only by prior reservation, which makes evening travel difficult for most local users.

Pick-up jeeps, which carry both goods and passengers, typically operate one round trip per day, departing from villages between 9:00 and 10:00 am and returning between 3:00 and 5:00 pm.

A major limitation across all modes is the absence of fixed or published schedules, resulting in an unpredictable and unreliable service, particularly for passengers with urgent or time-sensitive travel needs.

FARES AND AFFORDABILITY

Fares are generally determined by the distance travelled, the time of day (with potential surcharges for early morning or evening trips) and the number of stops or the complexity of the route.

Typical fares range from around NPR 100 for short distances of 4–5 km (e.g. Hatiya to Narethanti or Galyang) to approximately NPR 400 for longer distances of 19–29 km (e.g. Hatiya to Kharbang or Burtibang to Sipa). Rates vary by route, vehicle type, and remoteness, often leaving passengers with few affordable alternatives. A detailed fare structure and route information are provided in Annex 3.

Although a general fare structure exists, passengers often have to negotiate directly with drivers, particularly in remote or less competitive areas. This results in inconsistent pricing and widespread dissatisfaction, with many passengers reporting in surveys that fares are too expensive, even for short trips, and expressing a strong demand for more affordable options.

3.4 DEMAND PATTERNS OF EXISTING PUBLIC TRANSPORTATION OPTIONS

Most daily travel in the Galkot–Badigad–Nisikhola corridor is concentrated along the inter-village highway, particularly between Narethanti and Kharbang, Kharbang and Burtibang, and Burtibang and Bhalkot. These locations serve as key hubs for economic and social activity.

A survey of 63 residents revealed that the main reasons for travelling were shopping at market centres, accessing health services in Burtibang, Hatiya and Baglung, visiting family or relatives, conducting banking transactions and carrying out administrative tasks at government offices.

Most of these activities are concentrated in or around market centres, making them the most frequent destinations for trips. Less frequent but notable travel purposes include business-related travel (e.g. transporting goods), educational travel (private school students use dedicated school buses or vans, which are paid for separately) and commuting to workplaces outside the immediate village.

Travel choices also vary by socio-economic status and geography. Households with higher incomes, particularly business owners and those living near market areas, are more likely to own private two-wheelers, which they prefer to public transport due to the convenience, time savings, and independence they offer. In contrast, residents of hill settlements rely on pick-up jeeps to reach market centres within the corridor. Where services are irregular or absent, many people are forced to walk long distances or use animal transport, particularly in steep and rugged terrain.

Overall, mobility patterns in the corridor are shaped by socio-economic needs, geographic challenges, and the dominance of informal transport services. While small internal combustion engine (ICE) vehicles meet some immediate demand, they fall short in terms of accessibility, affordability, and sustainability. Irregular schedules, unpredictable service, and poor road conditions further limit effectiveness. These challenges highlight the urgent need to address service gaps and operational constraints, issues which are explored in the following section in order to guide the development of a more inclusive and resilient public transport system.

4. CHALLENGES AND SOLUTIONS FOR LOCAL TRANSPORT

4.1 EXISTING PUBLIC TRANSPORT CHALLENGES

Field observations and comprehensive surveys have revealed significant challenges in the existing transport services in the Galkot–Badigad–Nisikhola corridor. As highlighted in Section 3, the major deficiencies include limited service coverage, poor predictability, high costs and a lack of inclusiveness, all of which severely restrict mobility for local communities. While informal transport options do exist, they are often irregular, costly and inaccessible, particularly for residents of settlements located uphill.

Transport services are dominated by small, privately operated vehicles, including four-seater taxis, seven-seater vans and pick-up jeeps. Although they are primarily designed for transporting goods, pick-up jeeps are frequently used to carry passengers due to the absence of more suitable alternatives. These services are often irregular, costly and inaccessible, particularly for residents in remote and uphill settlements. The absence of a formal, reliable and accessible public transport system leaves many communities underserved, especially during emergencies, off-peak hours or for individuals with limited financial means.

The quality of service is further undermined by the age and condition of the vehicles, many of which are old and poorly maintained, resulting in higher operational costs and reduced passenger comfort. Additionally, limited route coverage leaves remote settlements underserved, reflecting infrastructure constraints and service management gaps.

From the drivers' perspective, although passenger demand remains steady, rising fuel prices, deteriorating road conditions (particularly during monsoons, as shown

in Figure 4) and increased maintenance costs are significantly reducing earnings (as shown in Figure 5). Maintenance expenses for older vehicles are especially burdensome, with major repairs (e.g. to engines, clutch plates and gearboxes) reportedly costing between NPR 15,000 and NPR 80,000. Fuel efficiency is also a concern reported by drivers, with mileage varying significantly by vehicle type and road conditions. For example: Eco vans average 13 km/l, taxis average 12–20 km/l, and pick-up jeeps average only 5–10 km/l.

Figure 4: Damaged road in Galkot–Badigad–Nisikhola Corridor

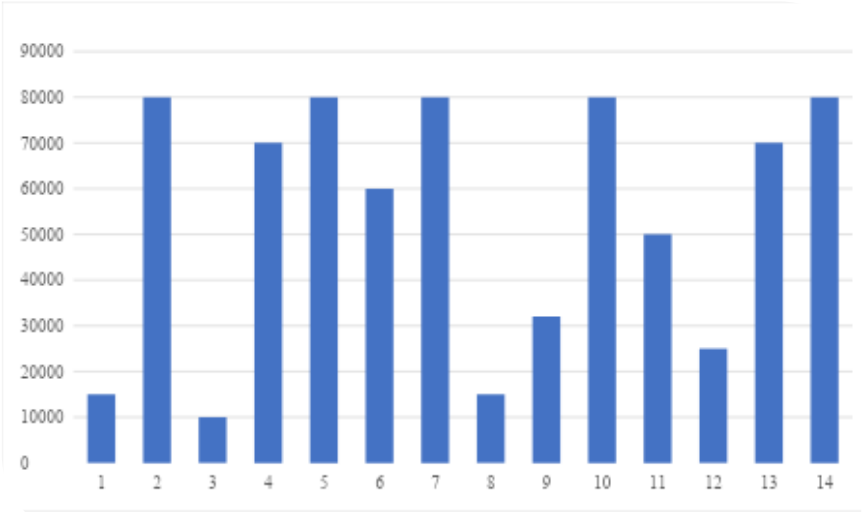


Figure 5: Maintenance costs reported by drivers

4.2 SOLUTIONS FOR PUBLIC TRANSPORT

Table 2 summarises the identified the challenges on transport services in the corridor and point at possible alternatives for addressing them.

Table 2: Identified problems and suggestions in the corridor

Problems Identified	Suggested Improvements
Lack of local transportation services	Ensure formal and regular public transport services, with increased frequency on peak demand period
Low carrying capacity of vehicles	Introduce vehicles with larger occupancy that can reduce fares too
Vehicles departing only at full occupancy, especially at night	Introduce smaller vehicle options for night services
Most of the conventional vehicles are old and unsafe	Require to replace with efficient and cleaner vehicles, enforcing regular inspection and maintenance
Lack of organized fare collection system	Introduce and enforce standardized per-km fare, as provisioned by Gandaki Province
Damaged roads	Improve road quality and invest in slope stabilization measures such as bioengineering techniques

4.3 VEHICLES OPTIONS: BUSES AND VANS

In order to strengthen public transport in the Galkot–Badigad–Nisikhola corridor, the study suggests two categories of vehicle: buses and vans, which could provide a more formalised service. Compared to the current small, privately operated vehicles, these options offer higher passenger capacity, a more organized and affordable fare structure, and improved accessibility and reliability.

- **Buses** with a seating capacity of 26–30 passengers could play a key role in improving connectivity along major road corridors, particularly between key market hubs such as Galkot, Badigad, and Nisikhola. Their larger capacity makes them well suited for high-demand routes, enabling more cost-effective transport and reducing per-passenger emissions. However, buses face constraints in narrow, steep, or winding rural roads, particularly on uphill routes where manoeuvrability is limited. Demand patterns also pose challenges: to ensure sufficient occupancy, buses may wait longer at initial stops, leading to delayed departures and fewer daily trips. During peak periods, passengers could also face longer wait times or limited boarding capacity. Despite these constraints, buses can serve a strategic role within

a hub-to-hub service model, operating on fixed schedules between major market centers. Over time, as infrastructure improves and ridership grows, bused could be complemented by smaller vans operating on feeder routes to provide a more integrated and reliable transport network.

- **Vans** with 11-14 seating capacity are particularly well suited to the hilly, narrow, and dispersed geography of the corridor. Their smaller size offers greater manoeuvrability on winding roads and allows for flexible operations based on passenger demand. They can provide frequent, short-distance services, linking villages with larger towns or highway corridors and filling an important connectivity gap.

At present, both buses and vans already operate in the region, but they rely on fossil fuel, which contribute to air and noise pollution as well as greenhouse gas emissions. Transitioning these services to electric alternatives would be a clear pathway towards sustainable mobility.

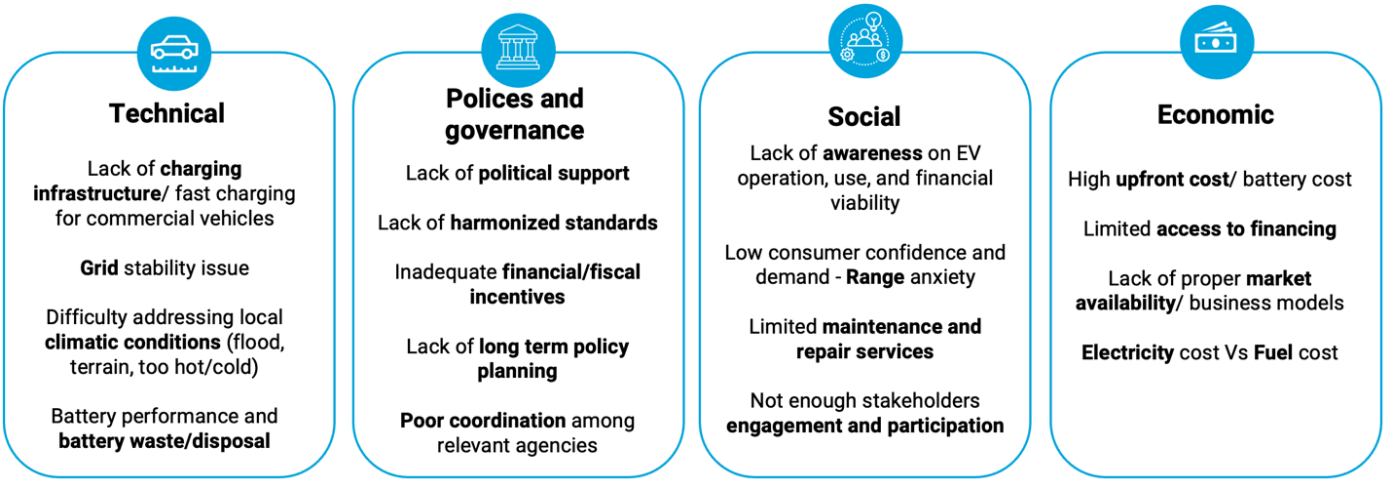
5. ELECTRIC MOBILITY FOR PUBLIC TRANSPORT IN THE CORRIDOR

5.1 WHY TRANSITION TO ELECTRIC MOBILITY?

Electric mobility is crucial for transforming the transport system. Shifting towards electric mobility, especially when powered by renewable energy, is an effective way to promote sustainable development. It directly supports several of the UN's Sustainable Development Goals[2] (see Figure 6). Although the wider adoption of electric mobility bears several challenges, it also unlocks a range of strategic advantages across sectors (see Figure 7 and Figure 8). Transitioning to electric mobility (e-mobility) is not only an environmental priority for transport transformation but also a practical response to the transport challenges faced in Nepal's rural and semi-urban regions, like illustrated by the case in the Galkot–Badigad–Nisikhola corridor.

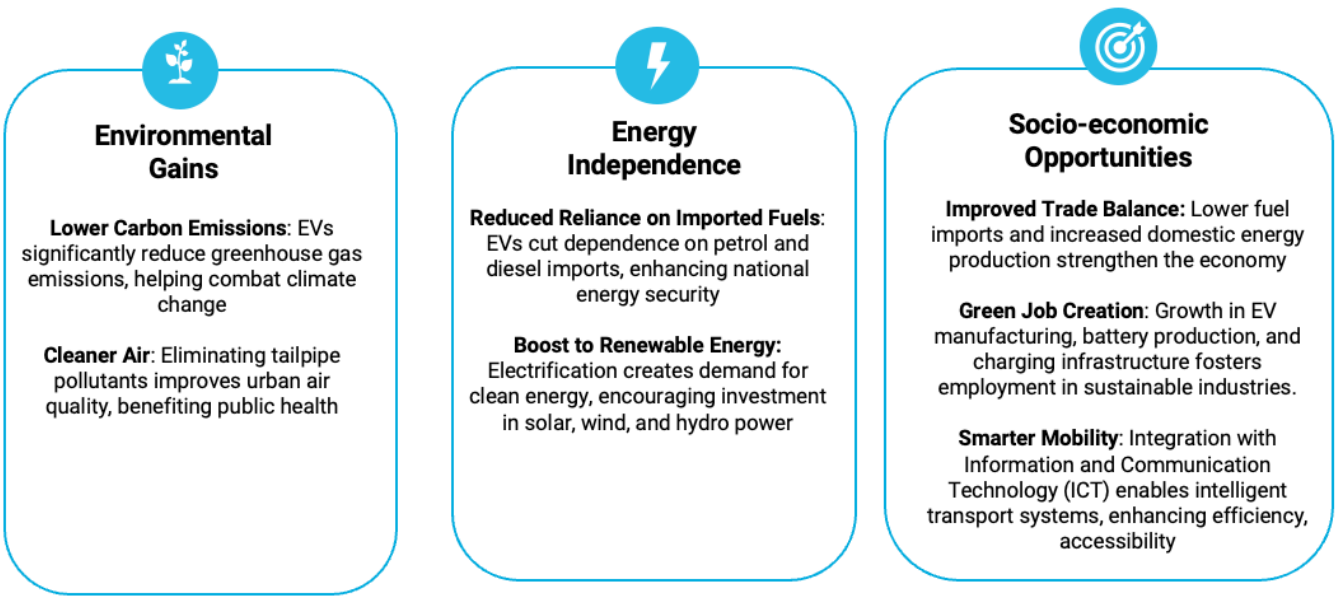
2 http://sdgs.un.org/goals

Figure 6: E-mobility and Sustainable Development Goals (SDGs)



Source: Shrestha 2025

Figure 7: Barriers to uptake electric vehicles



Source: Shrestha 2025

Figure 8: Co-benefits of electric vehicles

5.2 OPPORTUNITIES FOR ELECTRIC MOBILITY IN NEPAL

Despite barriers for e-mobility adoption in Nepal, similar to the one listed in box 1, several potentials exist such as high clean energy potentials, increasing demand for mobility, infrastructure development and support policies. The key enablers for electric mobility in Nepal are:

Harness hydropower and decrease fossil fuel import

Nepal does not have fossil fuel reserves, meaning that it is 100% import dependent. On a positive note, the majority of Nepal's electricity is from hydropower generated within the country. In the near future, Nepal will have surplus electricity (mainly in the wet season and during off-peak hours) through new hydropower projects which are in different stages of development and construction. Nepal needs to tap this electricity generation plan and go into the direction of an environmentally friendly transport system (Shrestha and Panagakos 2021). Electric mobility offers an opportunity to utilise this renewable energy productively, thereby reducing dependency on imported fossil fuels.

Lower operating costs and increased comfort

The high upfront cost has been a challenge for the deployment of Electric Vehicles (EVs) in Nepal. Therefore, the operators are reluctant to invest in this technology. However, when considering the total life cycle cost of the EVs (including the externalities related to the use of fossil fuels), it makes sense to embrace such technology. In addition, EV will have lower operating costs and will increase passengers' comfort. The improved comfort level could induce additional demand leading to higher revenues or lower total cost (Shrestha and Panagakos 2021).

Rising demand for mobility

Nepal's rapid urbanization, growing population, and increased vehicle ownership have intensified the demand for efficient and reliable transport services. This rising demand creates the urgent need for sustainable alternatives to conventional fossil fuel–based transport. Without viable interventions, issues such as air pollution, greenhouse gas emissions, road safety concerns, and limited access to essential services will continue to worsen. Adopting clean and affordable transport solutions, such as electric vehicles and organized public transport networks, can address these challenges while enhance connectivity, reduce operational costs, and support Nepal's climate and energy goals.

Infrastructure momentum

The Nepal Electricity Authority (NEA), the state-owned power utility, has taken significant strides to develop the country's charging infrastructure. Notably, six of these stations are operational within the Kathmandu Valley. The project was funded through NEA investments and concessional loans from the Asian Development Bank (ADB), with technical support provided by the Norwegian government. Through further collaborative efforts with the private sector (Thapa et al. 2024), the NEA has facilitated the installation of 45 additional charging stations across the country, enhancing accessibility to EV charging infrastructure. The NEA's overarching aim is to establish one charging station approximately every 60 kilometres along the country's main highways, facilitating long-distance EV travel.

The NEA has set following guidelines for installing charging infrastructure:

- Establishing a Public Charging Station (PCS) requires prior approval and meet compliance set by the Government of Nepal (GoN), which must include:
  - 11,000/400 or 33,000/400 volt substation transformer
  - Appropriate distribution lines, cables, terminations, metering, and safety equipment
  - Sufficient space for vehicle entry, charging, and exit
  - Chargers that conform to NEA standards

- If PCS services are provided by an online Network Service Provider (NSP) instead of the NEA, the service provider must share real-time charging data with NEA.

Along the corridor, electricity is available and relatively affordable, with the availability of several micro-hydro plants (MHP) in the region. However, the electricity supply can sometimes be intermittent. The NEA is also planning to expand the public charging infrastructure, a project that is supported by the local government.

Local governments initiatives

- Badigad Rural Municipality is designing an e-mobility operation plan and has budgeted for EV procurement and charging infrastructure, while also exploring collaborative EV initiatives with neighboring LGs.
- Galkot Municipality is coordinating with adjacent municipalities to introduce EV routes connecting key locations such as Hatiya, Hadikhola, and Narenthati, aiming to provide an environmentally friendly and economical transport solution.
- Nisikhola Rural Municipality is actively promoting electric vehicles (EVs) s an alternative to conventional public transport services, which are expensive.

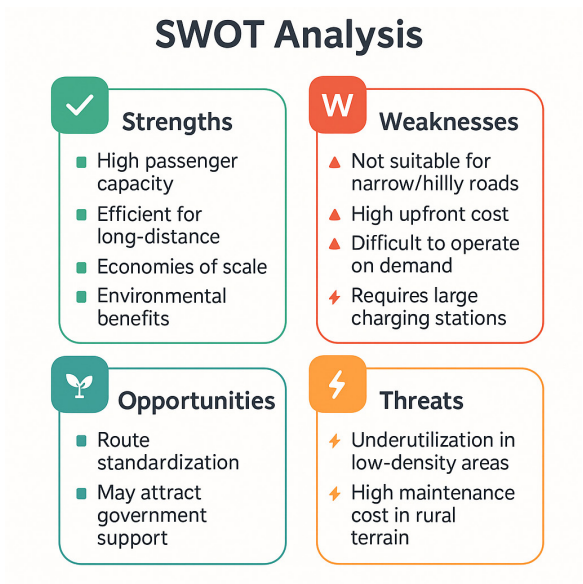
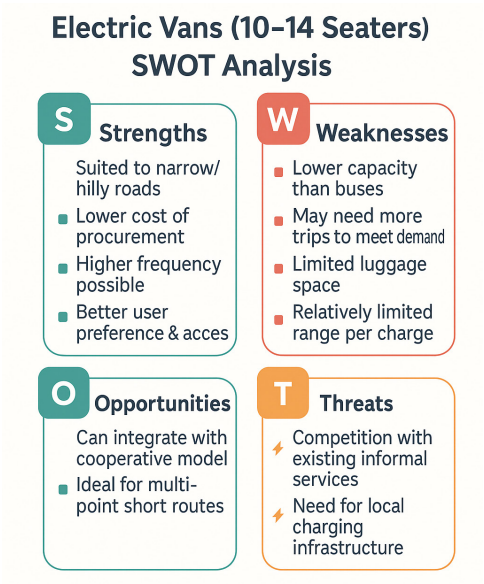
Gandaki province's electric vehicle operation standard guideline 2080

- Individuals, companies, or organizations intending to establish EV charging infrastructure must obtain approval from the Nepal Electricity Authority (NEA) or the relevant government ministry.
- Gandaki Province may provide government land for charging stations and infrastructure development to encourage EV adoption.
- Vehicle dealers in the province are required to set up at least one repair and maintenance (R&M) workshop along with charging infrastructure.
- Electric buses, taxis, and vans used for public transportation must adhere to the technical specifications outlined in the Guideline 2080.
- Public transport fares for EVs must align with the rates set by the provincial government.

5.3 SWOT ANALYSIS OF EV OPTIONS IN THE CORRIDOR

After understanding the key enablers for adopting e-mobility in section 5.2, this section assesses what types of EVs - electric buses (e-buses) and electric vans (e-vans) are technically and economically viable for public transport within the corridor, given the terrain, road conditions, and transport demand. The following Strength, Weakness, Opportunities and Threats (SWOT) analysis compares these options to determine their suitability for the region's mobility needs (see Table 3).

Table 3: SWOT Analysis of electric buses and electric vans

Option 1: Electric Buses	Option2: Electric Vans
	

The analysis suggests that both EV options have the potential to improve mobility in the corridor. E-vans appear particularly well-suited to rural routes, given their flexibility and ability to navigate narrow, hilly roads. E-buses, on the other hand, are better suited to high-demand inter-town routes where adequate infrastructure exists. A combination of EV types, tailored to route conditions and user needs, offers the most comprehensive and scalable solution for the corridor's transport system. However, several challenges remain. These include the limited availability of charging infrastructure and local repair services, and the high upfront investment costs associated with EV deployment. Addressing these barriers will be critical for successful implementation.

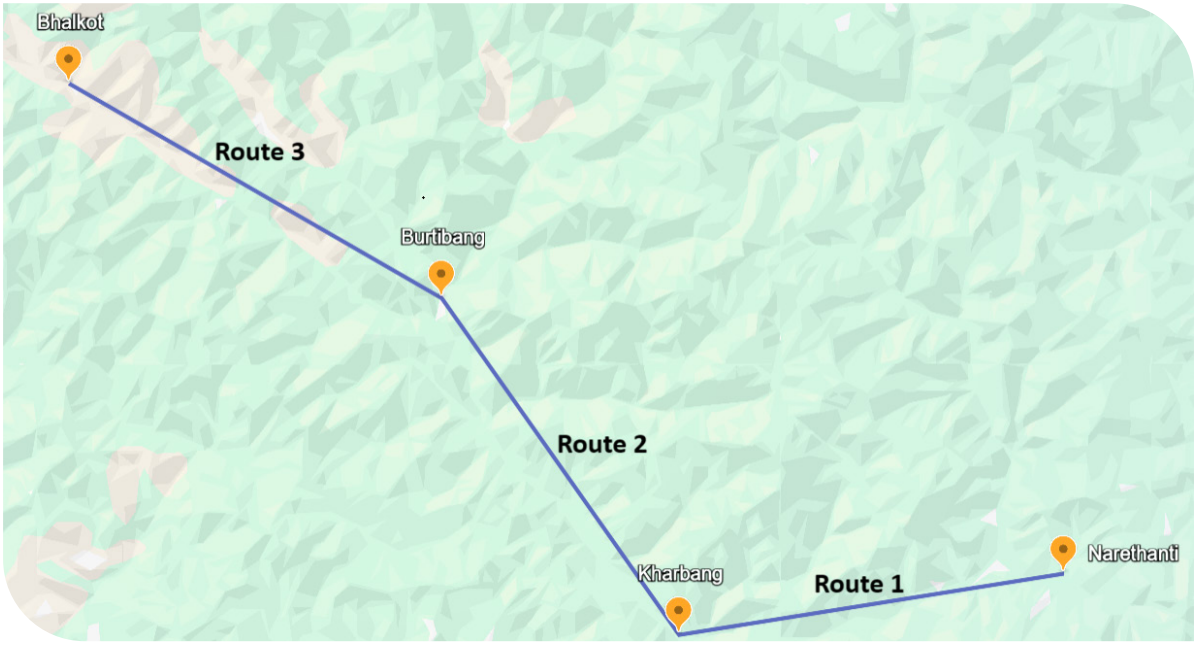
A comprehensive assessment of these alternatives, their operational feasibility is detailed in the analysis of e-mobility alternatives section below.

6. ASSESSMENT OF VIABILITY OF E-BUSES AND E-VANS

While electric mobility offers clear environmental advantages and lower long-term operating costs, its suitability for the Galkot–Badigad–Nisikhola corridor requires a detailed assessment of both technical and financial feasibility. The analysis focuses on two types of electric vans (11- and 14-seaters) and a 26-seater electric bus, assessing their applicability in relation to corridor's terrain, passenger demand, and infrastructure readiness. To provide a robust comparison, these electric vehicle options are benchmarked against commonly used internal combustion engine (ICE) vehicles that are either currently operating or considered viable for this corridor, such as the 7-seater Eco Van, 16-seater HiAce, and 30-seater bus. Through this side-by-side analysis, this section examines whether electric vehicles can provide a feasible and sustainable alternative to conventional transport modes, and identifies the conditions under which they may be more-or-less-advantageous.

In the analysis, the 71.3 km long Galkot–Badigad–Nisikhola corridor is divided into three sections, based on major mobility hub or centre points for mobility transit (see Figure 9):

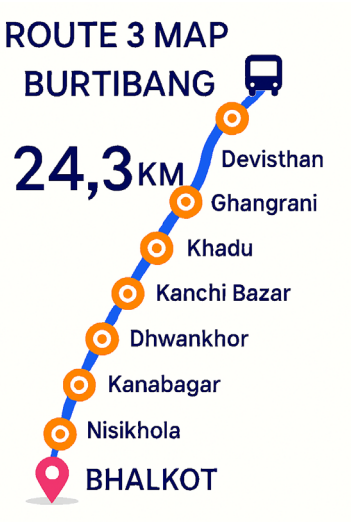
- Narethanti to Kharbang - 24.1 KM
- Kharbang to Burtibang - 22.9 KM
- Burtibang to Bhalkot - 24.3 KM



Three Section Routes

Route 1:
Narethanti to Kharbang

Route 2:
Kharbang to Burtibang



Route 3:
Burtibang to Bhalkot

Figure 9: Three routes in Galkot–Badigad–Nisikhola corridor

The reasons for dividing into sections are based on practical and operational considerations:

- **Existing transport associations:**

  Currently, three independent transport associations operate within the corridor, each responsible for its own section. Their services are limited to their designated segment and do not extend across the entire corridor. This arrangement has resulted in formation of transit hubs at the boundaries between sections. While division may appear fragmented, it reflects the existing local transport structure and ensures continuity by maintaining established service patterns within each area.

- **Passenger Demand Distribution and travel patterns:**

  Daily passenger demand across the corridor is estimated to range from 200 to 300 individuals, with ridership evenly distributed among the three sections. Most passengers tend to travel only within their own section, and cross-sectional travel is relatively rare. This supports the need for localized service provision rather than a single corridor-wide operation.

- **Operational efficiency and Occupancy:**

  Operating vehicles along the full 71.3 km corridor could lead to long passenger wait times and inefficient service frequencies, particularly if disruptions occur along the route. This may result transport services remain unaddressed in certain areas. Additionally, maintaining timely operations across the entire stretch could lead to low occupancy rates, making the model financially unsustainable and less attractive for public transport operators.

6.1 TECHNICAL VIABILITY OF E-VAN AND E-BUS

The feasibility of deploying 10–14-seater E-vans and 26-seater E-Buses as a public transport solution along the Galkot-Badigad-Nisikhola corridor is supported by several technical factors:

- **Passenger Demand:** Surveys and KIIs with drivers and transport associations indicate a daily demand of 200–300 passengers across a 20 km stretch (each of three sections) of the corridor.
  - E-vans (11 and 14 seats): Assumed to operate two vehicles every 30 minutes, each completing three round trips per day. This would adequately meet this demand without the risk of overcrowding or underutilization.
  - E-buses (26 seats): Two buses operating hourly, each completing two round trips per day, would serve demand efficiently meet this demand.

- **Road Infrastructure:** The Galkot-Badigad-Nisikhola corridor is part of the Mid-Hill Highway, and most of the roads are black-topped. EVs are already successfully operating in similar terrains across the country. This indicates that the road conditions are favorable for EVs, which are more efficient on well-maintained roads compared to traditional vehicles.

- **Electricity Infrastructure:** The corridor benefits from various micro-hydro power plants, and ongoing national grid expansion, reinforced by hydropower projects in Baglung and a substation at Burtibang set to enhance grid reliability. Although the grid is currently prone to power outages, the addition of new power sources and infrastructure improvements ensures sufficient electricity supply to support EV charging stations in the near future.

- **Charging Infrastructure:** Although there are no operational EV charging stations in the corridor yet, one is under construction near Burtibang (see Figure 10). The Nepal Electricity Authority (NEA) has expressed readiness to supply necessary transformers for additional stations upon request. Potential sites identified for future charging stations include Jhiwakhola, Hatiya, and Kharbang. These developments highlight the corridor's strong potential for establishing a reliable EV charging network to support sustained EV operations.

Figure 10: EV charging station under construction near Burtibang

Summary: The assessment indicates that the technical requirements for operating 11–14-seater E-vans and 26-seater EV buses in Galkot-Badigad-Nisikhola corridor are largely favourable, with adequate passenger demand, suitable road conditions, and expanding electricity infrastructure. However, challenges remain, including: the absence of fully functioning charging stations; limited availability of maintenance expertise, spare parts, and service networks in the area. While ongoing infrastructure improvements are expected to strengthen viability, the long-term success of EV operations will depend on timely implementation of these upgrades and the establishment of strong technical support systems.

6.2 FINANCIAL VIABILITY OF E-VANS AND E-BUSES

This section assesses the financial feasibility of deploying E-vans and E-buses along the Galkot–Badigad–Nisikhola corridor, comparing them with internal combustion engine (ICE) vehicles. The analysis considers capital costs, operating expenses, and returns over a seven-year period, reflecting the average battery lifecycle and to accurately capture the full economic cycle of the EV. Investment costs are derived from supplier quotations for 2025 (received via phone interview), and all vehicle types are evaluated under consistent operational scenarios. Table 4 provides an overview of the main assumptions for the financial analysis. The analysis modelled vehicle ownership under individual or cooperative operation, assessing profitability, return on equity (RoE), and payback period based on realistic fare and occupancy assumptions.

VEHICLE INVESTMENT COSTS

- **E-vans:**
  - **14-seater:** NPR 5,450,000
  - **11-seater:** NPR 4,550,000
- **E-bus:**
  - **26-seater:** NPR 1,26,50,000
- **ICE Vehicles**
  - **16-seater HiAce:** NPR 9,000,000
  - **7-seater Eco Van:** NPR 3,440,000
  - **30-seater Bus:** NPR 41,50,000

OPERATIONAL ASSUMPTIONS

- Route: Fixed 20 km section,
- Trips:
  - Vans (EV and ICE): 3 round trips per day (6 total trips leads to 120 km range daily)
  - Buses (EV and ICE): 2 round trips per day (4 total trips leads to 80 km range daily)
- Financing: 60% bank loan at 9% interest rate, and 40% owner equity
- Depreciation: 20% diminishing value method
- Corporate tax: 25% of profit befor tax
- Employee bonus: 10% of basic salary

Table 4: Detailed operational assumptions for the financial assessment

Parameters	E-vans (11-14 seater)	E-bus (26 seater)	ICE vans (HiAce and Eco van)	ICE Bus (30 seater)
Analysis period	7 years (aligned with battery lifecycle)	7 years (aligned with battery lifecycle)	7 years	7 years
Labour cost	Driver: NPR 30,000/month; Helper: NPR 17,300/month; 5% annual increment; 10% annual bonus	Driver NPR 30,000/month; Helper NPR 17,300/month; 5% annual increment; 10% annual bonus	Driver NPR 30,000/month; Helper NPR 17,300/month; 5% annual increment; 10% annual bonus	Driver NPR 30,000/month; Helper NPR 17,300/month; 5% annual increment; 10% annual bonus
Operations	Trip duration 1–1.5 hours; 6 trips/day (3 round trips)	Trip duration 2–2.5 hours; 4 trips/day (2 round trips)	Trip duration 1–1.5 hours; 6 trips/day (3 round trips)	Trip duration 2–2.5 hours; 4 trips/day (2 round trips)
Charging for EV/ Fuel consumption for ICE Vehicle	Home-based AC charging; 40 units per charge cycle; NPR 11/unit (NEA tariff)	60 units per charge cycle; NPR 11/unit	• HiAce: 8 km/litre → ~15 litres/day • Eco Van: 13 km/litre → ~9.5 litres/day • Fuel Cost: NPR 158/litre	4 km/litre → ~20 litres/day; NPR 158/litre
Expenses	Insurance NPR 28,000/year (5% inflation); Maintenance NPR 30,000/year (5% inflation)	Insurance NPR 35,000/year (5% inflation); Maintenance NPR 100,000/year (5% inflation)	• HiAce: Insurance NPR 28,000/year; Maintenance NPR 120,000/year (+5% inflation) • Eco Van: Insurance NPR 28,000/year; Maintenance NPR 80,000/year (+5% inflation)	Insurance NPR 35,000/year; Maintenance NPR 120,000/year (+5% inflation)
Loan structure	60% @ 9% interest	60% @ 9% interest	60% @ 9% interest	60% @ 9% interest
Corporate income tax	25%	25%	25%	25%
Occupancy rate in Year (Y)	40% (Y1); 50% (Y2), 60% (Y3), 70% (Y4), 75% (Y5), 80% (Y6) and 85% (Y7)	40% (Y1); 50% (Y2), 60% (Y3), 70% (Y4), 75% (Y5), 80% (Y6) and 85% (Y7)	• For HiAce : 40% (Y1);50% (Y2) ; 60% (Y3) ; 70% (Y4) ; 75% (Y5) ; 80% (Y6) and 85% (Y7) • For Eco Van : 70% (Y1) ; 75% (Y2) ; 80% (Y3) ; 85% (Y4) ; 90% (Y5) ; 95% (Y6) ; 100% (Y7)	40% (Y1); 50% (Y2), 60% (Y3), 70% (Y4), 75% (Y5), 80% (Y6) and 85% (Y7)
Fare	NPR 175 (25% below current average fares to respond to high fare rate in previous service, per survey feedback)	NPR 175 (25% below current average fares, per survey feedback)	NPR 175	NPR 175

FINANCIAL VIABILITY ASSESSMENT

Fare per trip selection

Although Fare of NPR 175 per trip was assumed (see Table 6), viability assessment with one more fare (a bit lower fare rate with NPR 110 per trip) was carried out to see which fare gives positive financial returns.

Financial assessment with fare: NPR 110 per trip

An initial financial analysis was conducted using a fare of NPR 110 per trip, based on the Gandaki Province's transport incentive of NPR 5.5 per Kilometer for a 20 Km route. This rate was considered to evaluate whether operations could be financially sustainable purely under the support of provincial policy incentives. As the results indicated in Table 5:

- All six vehicle types result in negative Net Present Value (NPV)
- Internal Rate of Return (IRR) and Return On Equity (ROE) fall below acceptable benchmarks
- Payback periods are either excessively long or not achievable at all.

The financial analysis of all six vehicle types at a fare of Rs 110 reveals that the revenue generated is insufficient to cover operating expenses, capital costs, and loan repayments. As a result, the operations are not only unprofitable but also financially unsustainable under this fare level.

Table 5: Financial assessment with fare: NPR 110 per trip

Vehicle type	NPV (Rs)	IRR (%)	ROE (%)	Payback Period	Viable
E-van (14-seater)	-10,138	10%	12%	5 years	No
E-van (11-seater)	-1,030,415	3%	-4%	6 years 5 months	No
E-bus (26-Seater)	-5,071,845	-4%	-24%	8 years	No
ICE van (16-Seater, HiAce)	-2,018,848	3%	-4%	6 years 5 months	No
ICE van (7-seater, Eco Van)	-2,747,848	-27%	-	39 years 11 Months	No
ICE bus (30-seater)	-68,169	10%	11%	5 years 3 months	No

Financial assessment with fare: NPR 175 per trip:

A second financial analysis was conducted using a fare that is closer to the current range applied in the Corridor. For that aim the average of the current applied fares along all the three segments of Galkot-Badigad-Nisikhola corridor was estimated: NPR 234 per trip. A 25% discount was applied to that figure in order to test if a reduction of the current level of mobility costs can be supported through the shift to EVs, in this way an average fare of NPR 175 per trip was assumed. Table 6 provides an overview of these estimations.

Table 6: Derivation of fare NPR 175 per trip

Destination	Fare (Rs)
Average Fare From Narethanti to Kharbang	208
Average Fare From Burtibang to Kharbang	275
Average Fare From Burtibang to Bhalkot	220
Total Average Fare along the Corridor (Narethanti to Bhalkot)	**234**
Offering a 25% discount on fares charged by active public transport services	
Average Discounted Fare From Narethanti to Kharbang	156
Average Discounted Fare From Burtibang to Kharbang	206
Average Discounted Fare From Burtibang to Bhalkot	165
Total Average Discounted Fare along the Corridor (Narethanti to Bhalkot)	**175**

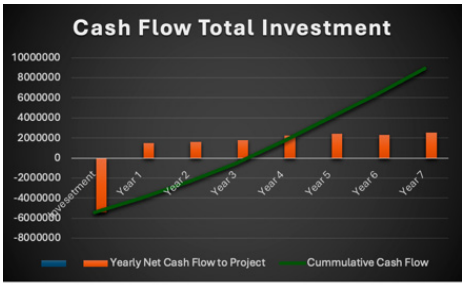
Table 7 presents the results of the financial analysis assuming an average fare of NPR 175 and Figure 11 shows the corresponding cash flow projections for each type of vehicle. In summary:

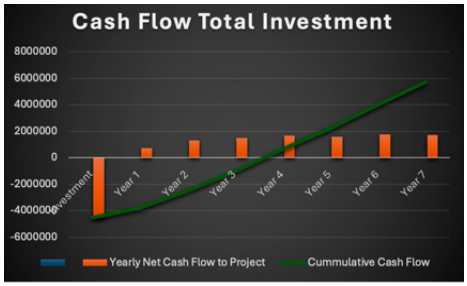
- All six vehicle types result in positive NPV
- IRR and ROE exceed acceptable benchmarks.
- Payback periods are shorter than with fare of NPR 110

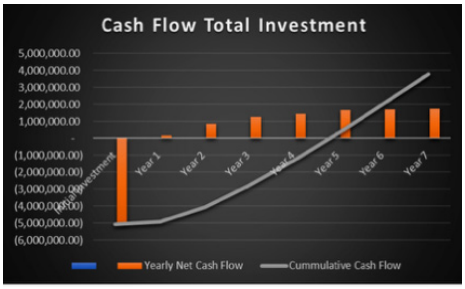
This fare offers a realistic and sustainable pricing model that ensures financial feasibility for public transport operations while remaining affordable for passengers. Therefore, Rs 175 has been used as the base fare throughout the financial feasibility analysis presented in this study.

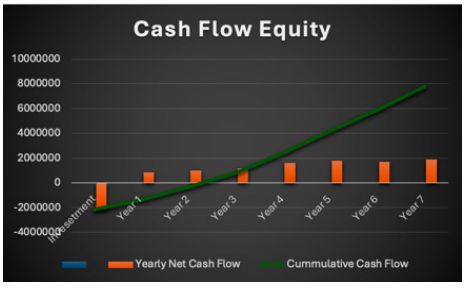
Table 7: Financial assessment with fare: NPR 175 per trip

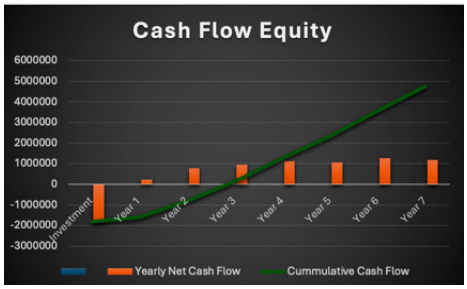
Vehicle type	NPV (Rs)	IRR (%)	ROE (%)	Payback Period	Financial Performance
E-van (14-seater)	3,808,391	28%	49%	3 years 4 months	Strong and relatively short investment recovery period
E-van (11-seater)	2,117,876	22%	37%	3 years 7 months	Moderate returns with reasonable period of capital recovery
E-bus (26-Seater)	161,461	10%	13%	5 years	Low financial returns relative to the scale of investment
ICE van (16-Seater, HiAce)	2,534,997	18%	28%	4 years 1 month	Satisfactory equity returns over a moderate recovery period
ICE van (7-seater, Eco Van)	1,287,569	11%	15%	4 years 10 months	Moderate profitability and manageable investment recovery
ICE bus (30-seater)	5,363,684	39%	68%	2 years 11 months	Robust financial returns and a short period for capital recovery

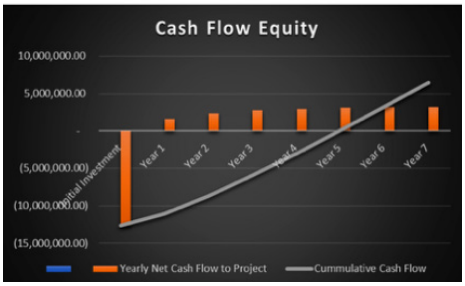




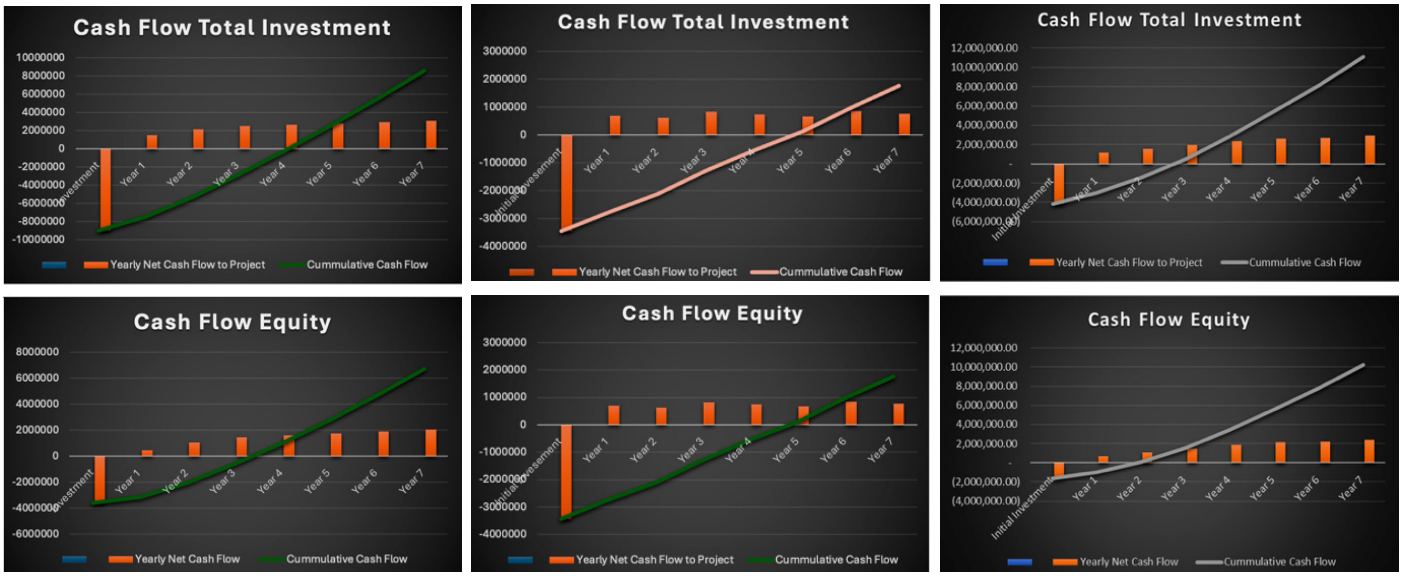








E-van (14-seater) E-van (11-seater) E-bus (26-Seater)



ICE van (16-Seater, HiAce) ICE van (7-seater, Eco Van) ICE bus (30-seater)

Figure 11: Cash flow total investment and equity of six vehicle types

This dual cash flow approach (cash flow based on total investment and cash flow based on equity contribution) provides a comprehensive financial evaluation by integrating investment expenditures, operating costs, and revenue generation from both the total project perspective and the investor's equity standpoint. The analysis facilitates the assessment of key financial indicators such as net present value, payback period, and return on equity, thereby supporting informed decision-making regarding the adoption and financing of e-mobility solutions within the corridor.

Table 8 presents summarises key financial, environmental and operational factors of all the analysed vehicles in a way that facilitates a systematic comparison.

Table 8: Comparison of Electric Vans with ICE Vehicles

Vehicle	E-van (14-seater)	E-van (11-seater)	E-bus (26 seater)	ICE van (HiAce 16-seater)	ICE van Eco van 7-Seater)	ICE bus (30-seater)
Vehicle Price/ Initial cost (NPR)	5,450,000	4,550,000	12,650,000	9,000,000	3,440,000	4,150,000
Fare (NPR)	175	175	175	175	175	175
Annual Maintenance Cost (NPR)	30k	30k	100k	120k	80k	120k
Occupancy	40%	40%	40%	40%	70%	40%
Annual Occupancy Growth (Year 1–3)	10%	10%	10%	10%	5%	10%
Annual Occupancy Growth (Year 1–3)	10%	10%	10%	10%	5%	10%
Initial Investment Comparison						
NPV (Rs)	3,808,391	2,117,876	161,461	2,534,996	1,287,57	5,363,684
IRR (%)	28%	22%	10%	18%	11%	39%
Payback Period	3 yrs 4 mo	3yrs 7 mo	5 yrs	4 yrs 1 mo	4 yrs 10 mo	2 yrs 11 mo
Equity Investment Comparison						
ROE (%)	49%	37%	13%	28%	15%	68%
Performance of the investments						
Financial	Strong returns, short payback	Moderate returns, longer project payback	High investment, Low returns	Higher investment, decent equity returns	Decent Returns, Moderate profitability with Manageable Payback	Very strong return , short payback
Emissions	Zero	Zero	Zero	High (CO_2 and particulate)	High (CO_2 and particulate)	High (CO_2 and particulate)
Noise	Very low	Very low	Very low	High	Medium	High

Which vehicle is the best suitable for public transport in Galkot-Badigad-Nishikhola corridor?

- E-van (14-seater) is the most attractive option overall, with the environmental benefits (zero emissions, low noise) and the highest financial returns (NPV: NPR 3.81 million, IRR: 28%, and ROE: 49%), along with a short payback period (3.3 Years). It is also a competitive solution for scale-up in this corridor.

- E-van (11-seater) is financially viable with moderate returns (NPV: NPR 2.53 million, IRR: 18%, and ROE: 28%) and a payback period of 4.1 years and provide environmental benefits (zero emissions, low noise). It is suitable for smaller operators with budget constraints.

- E-bus (26 seater), while offering environmental benefits (zero emissions, low noise), shows relatively lower financial performance (NPV: NPR 0.16 million, IRR: 10% and ROE: 13%) and a longer payback period of nearly 5 years. It is better suited where higher capacity and environmental performance outweigh over short-term profitability.

- ICE van (HiAce 16 seater), despite being a conventional choice, shows lower returns relative to EVs and has high emissions and noise.

- ICE van (Eco Van7 seater) shows the lowest performance of all financial indicators (NPV: NPR 1.29 million, IRR of 11%, and ROE: 15%) and long payback period of 4.8 years, making it suitable in niche or short-term scenarios.

- ICE bus (30-seater) demonstrates strong financial performance (NPV: NPR 5.36 million, IRR: 39%, and ROE: 68%), with a short payback period (2.9 years). However, operational challenges include the need for consistently high occupancy, potential longer passenger waiting times, and manoeuvrability issues on narrow or step rural roads.

STAKEHOLDERS' PERSPECTIVES ON ELECTRIC MOBILITY IN THE CORRIDOR

A validation workshop was held in Burtibang, Baglung in July 2025, to present the findings of the pre-feasibility study and gather feedback from local stakeholders. Participants included local government officials, transport cooperative and operators, members of community forest user groups (CFUGs), hotel Associations, residents; and MHP officials and prospective EV investors. Stakeholders were divided into two groups (users and operators) to share their views on introducing EVs as a public transport.

Group 1 (Users): CFUGs, Hotel Associations, Local User Groups

Users generally support for electric mobility but raised several concerns. Poor road conditions, especially during the monsoon, were identified as a key barrier for EV operations. Participants highlighted the importance of dependable services and the establishment of charging infrastructure as a prerequisite for adoption. They also noted that a gradual shift from conventional fuel vehicles could help lower travel expenses and improve community health.

Group 2 (Operators): Transport Committees, Electric Mobility Investors and MHP Representatives

Operators viewed electric mobility as both technically viable and economically promising. Key motivations for investment included government subsidies, reduced operating costs, opportunities to lower fares rates and improve rural transport access, environmental and health benefits from reduced emission, and greater utilization of electricity (additionally underused MHP-generated electricity). They also recognised the potential for job creation and entrepreneurship.

This group put forward several key recommendations:

- Adopting a Public–Private Partnership (PPP) model to attract investment and share operational risks.
- Strengthening local government support through policies, incentives, and coordination.
- Leveraging MHP cooperatives to supply electricity, manage charging stations, and collaborate with municipalities and transport committees on pilot projects.
- Ensuring policy clarity, careful route planning, and vehicle standardization in the next stages.

The workshop underscored that while technical and financial feasibility is essential, the success of electric mobility in the corridor will largely depend on stakeholder readiness, local government support, and improvements to infrastructure.

7. CONCLUSION

The pre-feasibility study indicates that public transport in the Galkot–Badigad–Nisikhola corridor is currently inadequate, relying on informal, fossil fuel-based services that are costly, irregular, and environmentally unsustainable. Electric vehicles, particularly 14-seater vans, emerge as the most financially viable and operationally suitable option for the corridor's terrain and dispersed settlements, while 11-seater vans present a feasible alternative for smaller operators. Larger electric buses show limited returns unless operated on high-demand routes, and conventional ICE vehicles, though sometimes profitable, present long-term environmental and cost disadvantages.

Adoption of EVs, however, faces practical challenges, including limited charging infrastructure, high upfront investment requirements, and lack of local repair capacity. Addressing these gaps through targeted interventions such as pilot programs, charging station development, financing mechanisms, and operator training will be necessary to move forward. A detailed feasibility study can provide further clarity on implementation pathways and risk management.

Overall, the study points to the potential of EV-based public transport to fill existing service gaps in the corridor, provided that supporting systems and investments are developed in parallel.

8. RECOMMENDATION AND WAY FORWARD

This pre-feasibility assessment provides an initial evaluation of the potential for electric mobility in the corridor. To move forward, a comprehensive Detailed Feasibility Study (DFS) is essential to validate assumptions, assess infrastructure readiness, and refine implementation models. In parallel, significant investment will be required for: vehicle procurement to ensure adequate fleet availability, charging infrastructure to ensure reliable operations, capacity building to prepare local operators and technicians, and maintenance services to ensure long term reliability. Together, these steps can lay the groundwork for a viable and scalable EV-based public transport system in the Galkot-Badigad-Nishikhola corridor.

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10. ANNEXES

10.1 ANNEX 1: SURVEY QUESTIONNAIRE DRIVERS

Section 1: Demographic Information

Age:
- Under 18
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65 and above

Gender:
- Male
- Female
- Diverse
- Prefer not to say

Years of Experience as a Public Transport Driver:
- Less than 1 year
- 1-3 years
- 4-6 years
- 7-10 years
- More than 10 years

Where do you live? In which Ward/village?
- [Open text field OR one can prepare a list with all the villages/wards within the Region (?)]

How do you normally move from your home to the parking place of the vehicle that you drive?
- Walking; I normally park the vehicle near my home
- Bicycle
- Motorbike
- My own Car
- Public transport (taxi, jeep, van)

Section 2: Current Operations
What type of public transport vehicle do you operate?
- Bus
- Taxi (4 seater)
- Van (7 seater)
- Jeep
- Other

How many days do you typically work as driver per week?
- [Integer Number]

At what time do you typically start working?
- [Daytime]

At what time do you typically stop working?
- [Day/night time]

What is your average daily driving route distance? (In Kilometers)
- [Integer number]

How many trips do you typically make per day?
- [Integer number]

Please indicate how good the following sentences apply to public transport services that you provide
- I start a trip only when the vehicle is full
  - True
  - Rather true
  - Rather false
  - False

- During the trips the vehicle never become fully empty,
  - Some times
  - Rarely
  - Never

What is the route that you drive the most?
- From x to y

Which are the three stops where most people get in or get off along the highway?

Name of the stops

What are the peak hours in which those stops become most congested with users?
- Open question

What is the fare cost in your route?
-

How is the fare cost determined? (Multiple choice)
- Per km
- Follow local government ticket fare price
- Depend on the time of the service (Morning/Day/Night?)
- Depend on the number of stops traveled

Are there many passenger with luggage?
- Yes
- No

Does your vehicle accommodate?
- Yes
- No

If yes, do you take additional cost for the luggage carried ?
- If yes, how much?

How often do you make trips off-side the highway?
- Never: All my trips are to places off-side the highway
- Regularly: in average at least one per day
- Infrequently: in average one or two times per week
- Very rare: in average one or two times per month
- Never

Section 3 Costs of operation

What have been the most expensive repair or maintenance checks in the last two years?
- Open question

(Do you have to do repair and maintenance even if you rent it?)

How much did that repair cost?
- Integer

What is the average cost of regular maintenance services/expenses? Fill out the table if (driver) agrees to give number, otherwise indicate lump-sum (per month or per year)

Type of maintenance service	Regularity (every X months)	Average cost
Oil changes		
Filter replacement		
Tire replacement		
Brake replacement		
Battery replacement		
Cleaning (out and in-side)		
Taxes		
Permits		
Insurances		

How often you refuel your tank?
(Integer)

What is your fuel tank capacity and how many kms it provides?

What is the fuel cost you paid in last six months?
- Lowest:
- Highest:

Section 4: Business model and role

For which company/operator/owner do you currently work?
- [Open question]

Which sentence better describe your role
- I own the vehicle that I drive
- I rent the vehicle, pay the owner a fixed amount per day/week,
- I'm employed by an owner/operator, and receive a fixed salary per day/week/month
- I'm employed by an owner/operator, my own earnings depend on the amount of fares collected per day/week

How profitable is your business? (Multiple choice)
- It is going good throughout the year
- Not profitable in some circumstances
  - Less passenger due to roadblock during rainy season
  - Due to rising fuel cost
  - Due to old vehicle I run (and frequent maintenance cost)

Section 5: Perceptions about the service

How do you perceive the current public sentiment about public transport in the region?
- Very positive
- Positive
- Neutral
- Negative
- Very negative

How do you rate the following sentences:
- The current supply of public transport services is sufficient for the people in the region
  - Strongly agree
  - Agree
  - Neutral
  - Disagree
  - Strongly disagree

What needs to be done to improve the public transportation supply in the region?

Section 6: Awareness on e-Mobility

Have you read or heard about electric public transport options?
- Yes/no

Have you ever driven or traveled with an electric vehicle?
- Yes/no

If yes: how was that experience?
[Open question]

What do you think are the main benefits of using electric vehicles for public transportation? (Multiple choice)
- Less maintenance and repair cost and save operational and overall cost
- No worry about re-fueling and increasing fuel cost
- Use (hydro)electricity produced in the country for charging
- Easy to drive
- Comfortable and passenger prefer them these days
- Add if any:

What are your main concerns of using an electric vehicle? (Multiple choice)
- Availability of charging stations
- Cost of vehicle
  - Higher renting cost
  - Higher cost to own (if you own and drive)
- Lack of service stations
- Resale value concern (if you own and drive)
- (Enough) charging facilities in the depot
- Continuous availability of electricity
- Add if any:

Do you (or the operators/owners you work for) have plans to acquire an electric vehicle?
- Yes/no

If yes,
- How is your fleet replacement plan (replacing old vehicles to EV)?

- Are you planning for coordinating for charging facilities in your depot or in the major highway stops?

Closing the interview

Do you have any final comment or question?

Thanks for your time and cooperation

10.2 ANNEX 2: SURVEY QUESTIONNAIRE PASSENGERS

Section 1: Demographic Information

Age:
- Under 18
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65 and above

Gender:
- Male
- Female
- Diverse
- Prefer not to say

Main occupation:
- Student
- Self-employed in Agriculture, forestry and/or fishery
- Worker for Agriculture, forestry and/or fishery
- Self-employed in own entrepreneurship/business
- Employed full or part-time
- Housework
- Unemployed
- Retired

Neighborhood:

Where do you live? In which Ward/village?
[Open text field or you prepare a list of villages within the Region]

How many persons live with you in your house?
- Integer

Section 2 Access to transport modes

How do you normally commute to your destination?
- Bicycle
- Motorbike
- Three-wheeler
- Car
- Jeep
- Van
- Bus
- Taxi

Which vehicle do you and your family member at your home own (Multiple selection):
- Bicycle
- Motorbike

- Three-wheeler
- Car
- Jeep

When you need to take public transport along the highway, how do you reach to the stop/station of public transport vehicles?

- Walking
- Bicycle
- Motorbike
- Car
- Jeep

How long it takes for you to reach the public transport station/stop along the highway from your place/home?

- 0 to 5 min
- 5 to 10 min
- 10 to 20 min
- 30 to 30 min
- More than 30 min

Section 3 Common Trips with public transport

When was the last time that you used a public transport service (taxi, van or jeep)

- Today
- Yesterday
- Some days ago
- 1 week ago
- More than 2 weeks ago

What was the route you travel that last time?

- From x to y and back to x

Which type of vehicle you used for it?

- Taxi
- Van
- Jeep
- Bus

What was the main purpose of the travel?

- Education (going to school, training, similar)
- Work (going to work, employment)
- Trade (selling and/or buying products related to your own business)
- Health services (attending appointment in a health center)
- Settlements with official authorities
- Leisure
- Other:

How much costed the whole round trip?

What is the trip that you travel more often with public transport vehicles?

- From x to y

How much does that common travel (the round trip) cost?

How often do you make that common trip using public transport services (taxi, van or jeep)

- 5-7 days per week
- 3-4 days per week
- 1-2 days per week
- 1-2 days per Month
- Very rare

Besides you, does your family members uses public transport regularly?

If yes who and to which destination (e.g. shopping, school, hospital, work, ...)

- My Wife (use case:)
- My Husband (use case:)
- My Father or may father in law (use case:)
- My mother or may mother in law (use case:)
- Son (use case:)
- Daughter (use case:)
- Brother (use case:)
- Sister (use case:)
- Other (use case:)

Section 4 Challenges of mobility

What do you think is the pressing problem with the public transport today in your area? Please rate from 1 to 5. 1 is the most critical problem and 5 is less critical

- Trips are too expensive (1 2 3 4 5)
- Lack of fixed schedules (1 2 3 4 5)
- Long waiting time for getting the service in peak hours (1 2 3 4 5)
- Too many stops along the route (1 2 3 4 5)
- Uncomfortable vehicles (1 2 3 4 5)
- Vehicles do not have proper spaces for transporting luggage (1 2 3 4 5)

How do you wish to improve the public transportation services in your area? Please rate from 1 to 5. 1 is the most critical problem and 5 is less critical

- Lower the fare cost (1 2 3 4 5)
- Vehicles being available and with increased frequency (1 2 3 4 5)
- Vehicles running inside the village (1 2 3 4 5)
- Service with van (1 2 3 4 5)
- Service with bus (1 2 3 4 5)

Section 5: Awareness on e-Mobility

Have you read or heard about electric public transport options?

- Yes/no

Have you ever driven or traveled with an electric vehicle?

- Yes/no

If yes: how was that experience?
[Open question]

Closing the interview

Do you have any final comment or question?

Thanks for your time and cooperation

10.3 ANNEX 3: KEY INFORMANT INTERVIEWS QUESTIONNAIRES

1. LOCAL GOVERNMENT (GALKOT, BADIGAD AND NISIKHOLA)

- **Current public transportation system**

1. Is there a formal public transportation (PT) in the area?
   - › If yes, are the existing services enough to cater to the population adequately? How?
   - › What can be done to improve the local transportation services?
   - › Have you received any complaints or demands regarding the transportation services operating in your area?
   - › If no, is there a demand for formal PT services in your area?

- **E-mobility for Public transportation**

1. How does the local government perceive the feasibility of electric vehicle (EV) adoption in the Nisi-Burtibang-Badigad corridor?
   - › If no, what barriers to electric mobility for the public transportation do you foresee in the region?
   - › If yes, Do you have any e-mobility project planned in your municipality? If so, with who are you collaborating with?
   - › Is there any funding and financing e-mobility by national authorities/ provincial government and international doners?

- **Infrastructure Planning**

1. Are there any plans for upgrading roads or electricity grids in the corridor to support electric vehicles?
2. What is the status of charging infrastructure (existing or planned) in this region?
3. How do you foresee the integration of public EV charging stations along the corridor?

- **Environmental and Social Considerations**

1. Is vehicle generated air pollution a problem (PM, NOx) in your area (except road dust)? Do you agree that adoption of EV will help solve the pollution?
2. What environmental impact assessments have been conducted for this corridor?
3. Are there any anticipated social or environmental concerns with adopting electric mobility in the area?

2. PROVINCIAL GOVERNMENT

1. What current policies and regulations exist regarding electric mobility in this region? How is the provincial government supporting the adoption of EV in the corridor area? Budget, technical study?
2. Are there any incentives, subsidies, or tax exemptions for electric vehicles or related infrastructure?

3. LOCAL TRANSPORT COOPERATIVES (VEHICLE OWNERS, DRIVERS, TRANSPORT ASSOCIATION)

- **Current Fleet and Operations**

1. What types of vehicles (bus, van, 3-wheelers, freight, etc.) have you been operating in the Nisi-Burtibang-Badigad corridor?
2. How many vehicles do you operate and on which routes?
3. What is the general and peak hour occupancy?
4. Do you operate vehicles locally or intracity? If you operate long-distance vehicles, do you allow local passengers traveling short distances to ride your vehicle?
5. Are there designated stops for local passengers? Which are the stops that most people get in or get off along the route (...)? Peak hours, general hours?
6. What are the average monthly operating costs (maintenance, fuel) for your fleet?
7. Do you think current transportation service is sufficient for the people in the area? What needs to be done to improve the transportation system further?
8. What challenges do you face with conventional vehicles in terms of efficiency and cost, such as fuel cost?

- **Electric Vehicle Adoption**

1. Have you considered adopting electric vehicles in your fleet?
   - › If yes: What type of public EV are you planning to introduce in the area – 3W, van, micro-bus, mini-bus? Is there enough charging services available in the area? Availability of repair and maintenance services locally?
   - › If no: What are your main concerns about switching to EVs (charging type, charging time (fast vs slow chargers), infrastructure, cost, repair and maintenance service)?
2. How many charging stations or refueling points would be necessary along the corridor to support your fleet?

- **Logistics and Infrastructure**

1. How do you envision integrating EVs into your logistics operations?
2. Would you be willing to invest in electric mobility if there were government incentives or subsidies?

4. LOCAL ELECTRIC VEHICLE (EV) MANUFACTURERS AND DEALERS (REGIONAL, NATIONAL)

- **Product Offerings**

1. What types of electric vehicles do you manufacture or sell?
   - › Do you know if the vehicles from your company or dealership are currently running in the corridor for public services?
2. Are your vehicles designed to handle the terrain and altitude of the Nisi-Burtibang-Badigad region?
3. How does the cost of electric vehicles compare to conventional vehicles, both in terms of initial investment and long-term operational costs?

- **Charging and Maintenance**

1. What is the average range of your electric vehicles under standard conditions (based on the vehicle brand)? How would this change in the hilly terrain of Badigad, Burtibang and Nisikhola?
2. What charging infrastructure do you recommend for optimal performance of your vehicles in rural areas?

3. What are the typical maintenance needs of EVs compared to conventional vehicles for the public transportation services with daily average range of 100 km?

- **Market Expansion**

1. How do you plan to expand your market in rural areas like Nisi-Burtibang-Badigad?
2. What kind of partnerships or collaborations are you interested in to promote electric mobility in this corridor?

5. COMMUNITY ELECTRICITY USER COMMITTEES

- **Power Supply and Capacity**

1. What is the current capacity of the electricity grid in the Nisi-Burtibang-Badigad corridor?
2. Are there plans to upgrade the grid to support an increase in electric vehicle charging stations?
3. What renewable energy sources (hydro, solar) are being explored for (electricity in general) powering EVs in this area?

- **Cost and Tariff Structure**

1. How would the increased electricity demand from EVs affect electricity pricing in this region?
2. Are there any special tariff rates or incentives for EV charging?
3. Tariff difference for locals and companies – charging service providers?

- **Infrastructure Development**

1. What challenges do you foresee in rolling out sufficient charging infrastructure in rural areas?
2. Would you consider installing fast-charging stations along the corridor? What conditions would make this feasible?

6. FINANCIAL INSTITUTIONS (BANKS AND FINANCIAL INSTITUTIONS)

- **Financing Options**

1. What types of financial products (loans, leasing options) do you offer for electric vehicle buyers or fleet operators, to increase adoption of EV?
2. Are there specific conditions or terms for financing electric vehicles as compared to conventional vehicles?

- **Risk Assessment**

1. How do you assess the risk associated with electric mobility investments in rural areas?
2. Would you be willing to invest in the electric mobility ecosystem (charging infrastructure, EV manufacturing)?

7. FREIGHT OPERATORS

1. What type of freight services do you run in the area? (Mini-truck, vehicle with trailer?)
   - What type of businesses ask for the services? Fares?
2. Interest in operating electric freight vehicles. If so, what kind?
3. Anticipated opportunities and challenges of operating electric freight
4. Any support required to operate electric freight

10.4 ANNEX 3: DETAILED FARE STRUCTURE AND ROUTE INFORMATION

The schematic diagrams illustrate the existing local transportation service in the area with major stops, distance between the stops, and modes of transport available in the area.

Hatiya to Narethanti and Hatiya to Kharbang

Destination		Taxi/van Fares	Distance
Hatiya	Narethanti	NPR100	4.9 km
Hatiya	Galyang	NPR100	4.4 km
Hatiya	Kadebas	NPR150	7.7 km
Hatiya	Kaucha	NPR200	10.6 km
Hatiya	Manewa	NPR300	13.6 km
Hatiya	Kharbang	NPR400	19.2 km

Figure 12: Geographical Map from Narethanti to Burtibang including Major Stops

Burtibang to Kharbang

Destination		Taxi/van Fares	Distance
Burtibang	Bhimgithe	NPR150	7.7 km
Burtibang	Khala Bazar	NPR200	10.5 km
Burtibang	Khaular Bazar	NPR250	14.5 km
Burtibang	Nwara Bazar	NPR300	17 km
Burtibang	Rakse	NPR350	21 km
Burtibang	Kharbang	NPR400	22.9 km

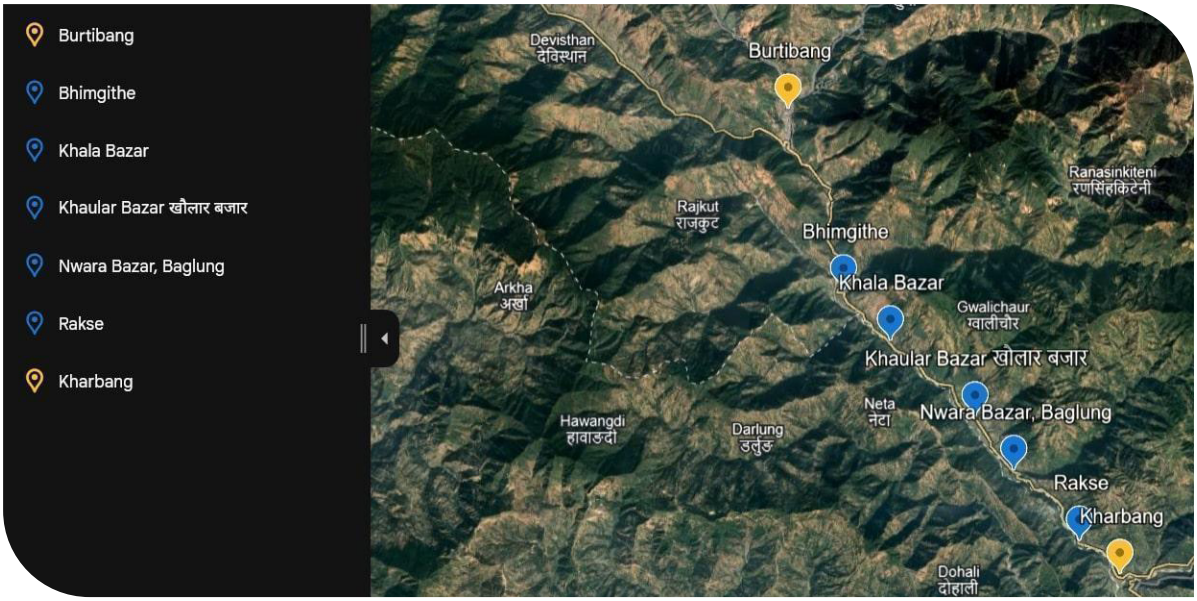

Figure 13: Geographical Map from Burtibang to Kharbang including Major Stops

Burtibang to Bhalkot to Sipa

Destination		Taxi/van	Pick-up jeep	Distance
Burtibang	Devisthan	NPR100	NPR50	5.7 km
Burtibang	Ghangrani	NPR130	NPR60	7.3 km
Burtibang	Khadu	NPR150	NPR90	8.6 km
Burtibang	Kanchi Bazar	NPR200	NPR100	9.9 km
Burtibang	Dhwankhor	NPR230	NPR120	12.5 km
Burtibang	Jhiwakhola	NPR250	NPR140	15.6 km
Burtibang	Kanabagar Bazar	NPR270	NPR160	17 km
Burtibang	Nisikhola	NPR300	NPR180	21.3 km
Burtibang	Bhalkot	NPR350	NPR230	24.3 km

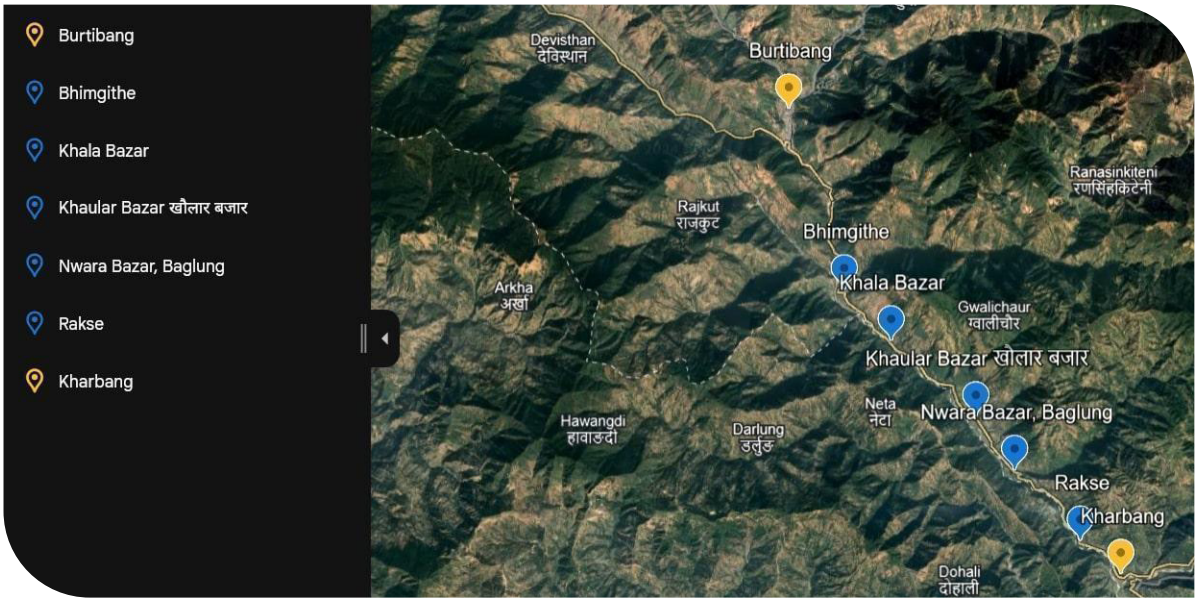

Figure 14: Geographical Map from Burtibang to Bhalkot to Sipa including Major Stops