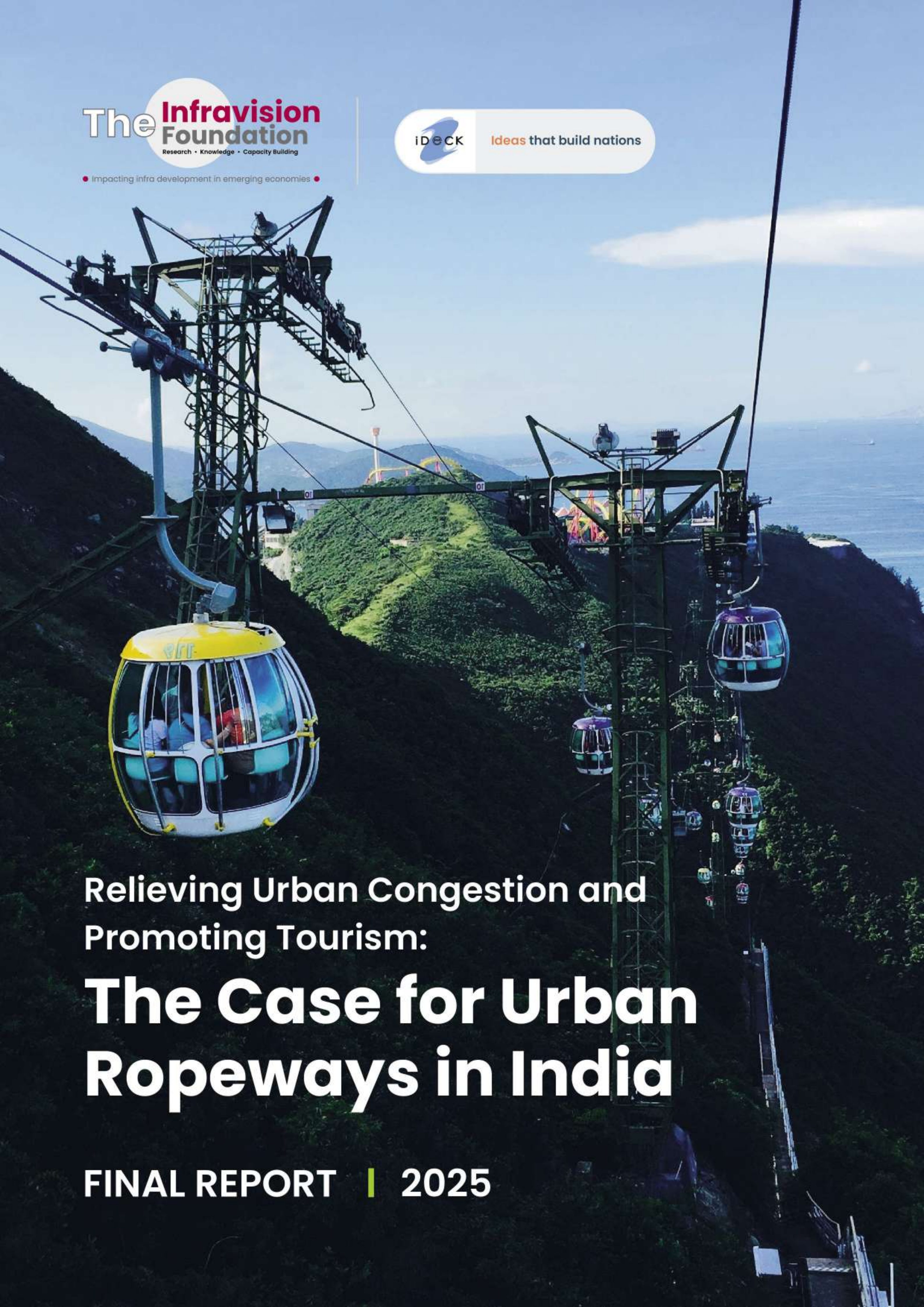


The Infravision Foundation
Research • Knowledge • Capacity Building

Impacting infra development in emerging economies

iDECK Ideas that build nations

Relieving Urban Congestion and Promoting Tourism:

The Case for Urban Ropeways in India

FINAL REPORT | 2025

Table of Contents

CHAPTER 1

CONTEXT SETTING

- Ropeways as an alternative public transit system for urban mobility and tourism.
- Objectives and the scope of work.

1.1 Introduction

India, home to over 1.4 billion people, is experiencing rapid urbanization, placing immense pressure on its cities. Driven by economic growth, rural-to-urban migration continues to rise as people seek better employment opportunities and improved living standards. It is estimated that by 2050, more than 50% of India's population will reside in cities and towns, contributing to over 75% of the country's GDP[1]. This rapid urban expansion has led to an exponential increase in the demand for urban mobility, straining existing transport infrastructure.

The growing need for urban mobility has overwhelmed public transit systems and road networks. Major cities face severe traffic congestion, with daily commutes stretching for hours due to poor road planning, frequent bottlenecks, and outdated infrastructure. Also, with the increasing demand for connectivity, the need for efficient and accessible public transportation has surged. Despite this, public transport systems in Indian cities remain inadequate, leading to a widening gap between its demand and supply.

Although significant investments have been made in metro rail networks and bus services, these systems struggle to meet demand due to high capital costs, long implementation timelines, and operational inefficiencies. Even where public transit is available, it often operates beyond capacity, affecting commuter safety and comfort. Additionally, poor last-mile connectivity and a lack of integration between different transport modes limit accessibility, disproportionately affecting lower-income groups. As a result, an increasing number of commuters rely on private vehicles, further exacerbating congestion, air pollution, and carbon emissions, ultimately slowing economic productivity. Addressing these challenges requires alternative and innovative mobility solutions that can efficiently complement existing public transport networks.

The following sections explore the major urban mobility challenges in detail, making the case for ropeways as an alternative public transit system that can enhance urban connectivity and promote tourism.

1.2 Current Mobility Issues for Urban Connectivity and Tourism

Ever-Growing Urban Traffic Congestion

India's rapid urbanization is transforming its urban transport landscape, leading to severe congestion in major metropolitan cities like Kolkata, Bengaluru, Hyderabad, and Pune. These cities consistently rank among the most congested worldwide, impacting economic productivity and causing daily traffic gridlock. According to the TomTom Traffic Index 2024[2], Kolkata has surpassed Bengaluru as India's most congested city, with an average travel time of 34 minutes to cover just 10 kilometers. Globally, both Kolkata and Bengaluru rank among the top five cities with the slowest traffic speeds, underscoring the urgent need for improved urban mobility solutions. The detailed ranking list is available in the annexure for reference.

1 https://pib.gov.in/PressReleasePage.aspx?PRID=2010349

2 https://www.tomtom.com/traffic-index/ranking/

The map below illustrates the intensity of traffic congestion in Indian cities, based on their global ranking in the TomTom Traffic Index 2024.

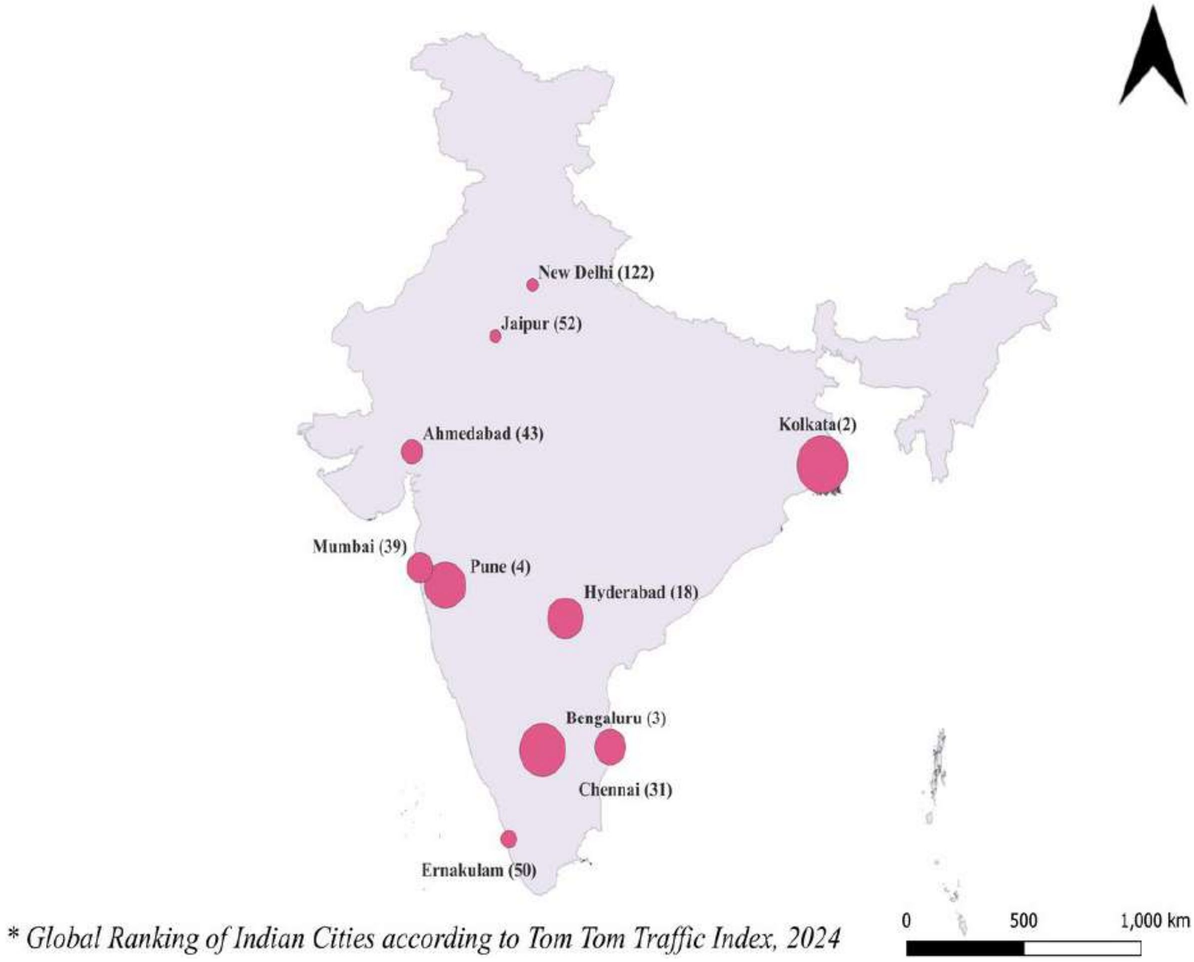


Figure 1: Mapping the intensity of traffic congestion in Indian cities (Data Source: Tom Tom Traffic Index[3], iDeCK Analysis)

Few of the primary reasons for India's severe congestion is poor urban planning and inadequate infrastructure. Many cities are not designed to handle the current volume of vehicles, resulting in narrow roads, frequent bottlenecks, and insufficient parking facilities. A well-developed urban transport system is crucial for seamless connectivity, reduced travel time, and improved productivity. To achieve this, cities must address key challenges such as infrastructure gaps, the need for equitable access to public transport, and the growing demand for sustainable mobility solutions. Investing in efficient, multimodal, and eco-friendly transit options is essential to easing congestion and ensuring a more accessible urban transport in the future.

Significant Demand-Supply Gap for Bus-Based Urban Public Transport

India's bus-based public transport system, though extensive, struggles to meet rising demand, often operating beyond capacity in major urban centers. Cities like Kochi (42%) and Mumbai (45%) exhibit a high reliance on public transportation (refer to annexure), underscoring the urgent

3 https://www.tomtom.com/traffic-index/ranking/

need for expanded and well-developed transit infrastructure. Many major cities face severe bus overcrowding during peak hours, posing safety risks and discomfort for commuters. The underlying causes of this shortfall vary across cities but commonly include limited investment in bus fleets, financial constraints of urban transport agencies, and a lack of strategic planning and prioritization of bus-based transit. The table below illustrates the number of buses per 1,000 population in various Indian cities, further highlighting the demand-supply gap in urban public transport.

Table 1: Buses per 1000 population for selected Indian cities (Source: ORF Report, 2024)[4]

City	Buses per 1000 Population
Delhi	0.50
Mumbai	0.28
Chennai	0.40
Bengaluru	0.45
Ahmedabad	0.16
Kanpur	0.11
Nagpur	0.21
Kochi	0.20
Jaipur	0.10

The World Bank recommends maintaining 1.2 buses per 1,000 people in urban areas to ensure adequate public transportation, while the Ministry of Housing and Urban Affairs (MoHUA) sets a considerably lower benchmark of 0.4 to 0.6 buses per 1,000 people. This disparity reflects India's chronic underestimation of urban mobility needs, leading to an inadequate public transport network. None of the above listed cities meet the World Bank's standard, and even under MoHUA's lower benchmark, most cities still fall short, exacerbating congestion and limiting access to efficient urban mobility solutions.

Given the current limitations of the bus-based public transport system, it is essential to enhance urban mobility by integrating alternative transit solutions like ropeways. Expanding public transport options will help meet the increasing demand, improve accessibility, and ease congestion for urban commuters.

Emphasis on Mass Public Transit Systems with Huge Investment Cost

As metro systems expand across Indian cities, there has been a noticeable shift in urban transport priorities—from ensuring efficient intermodal connectivity to investing in projects that serve as symbols of urban development. While metros are often viewed as a solution to urban mobility challenges, their high capital costs and long implementation timelines raise concerns about their financial viability and planning efficiency. The per-kilometer cost of metro construction ranges between ₹200-600 crore, making it one of the most expensive public transport investments. With significant funds allocated to metro projects, other crucial public transport modes, such as buses and alternative systems like ropeways, receive inadequate investment, despite their ability to provide flexible, cost-effective, and widespread connectivity. Since 2010, India has invested over $25 billion in metro systems, spanning 17 cities and nearly 1,000 kilometers of operational networks[5]. However, the anticipated benefits of these projects have not always materialized as expected.

4 https://www.orfonline.org/research/towards-a-comprehensive-framework-for-public-transport-system-planning-in-india

5 https://www.newindianexpress.com/cities/bengaluru/2024/Dec/06/last-mile-connectivity-the-key-tounlocking-metro-rails-potential

While metros are often touted as a solution to ease urban congestion, data reveals that ridership levels fall short of projected estimates across most cities. Many metro networks operate well below their intended capacity, with some failing to achieve even the ridership figures forecasted in their Detailed Project Reports (DPRs). This mismatch raises questions about demand forecasting accuracy, last-mile connectivity, and overall urban transport planning. Research suggests that nearly 70% of potential metro users cite inadequate connectivity to and from stations as a major deterrent, often leading them to choose alternative, less sustainable modes of transport[6]. The figure below highlights the gap between actual and projected daily metro ridership in select Indian cities, underscoring the need for a more balanced approach—one that integrates various public transport modes rather than disproportionately prioritizing metro expansion. (refer annexure for detailed figures)

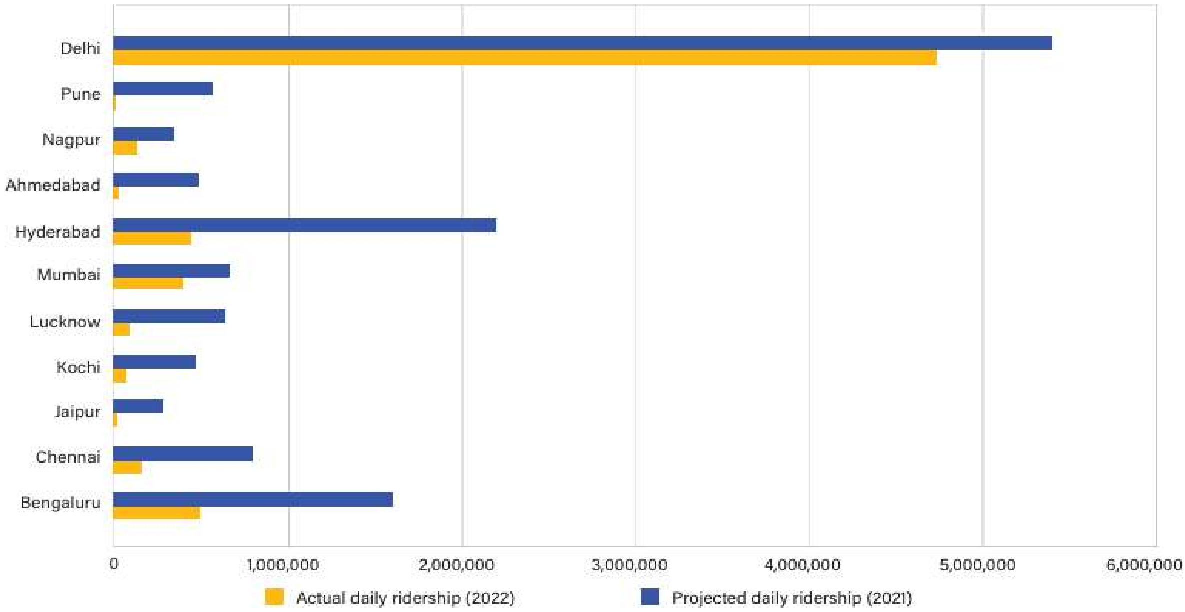


Figure 2: Projected vs Actual Metro Ridership in Indian Cities (Data Source: WRI India Working Paper[7])

The figure highlights the significant gap between forecasted and actual daily ridership across various Indian cities, indicating an underperformance of urban transit systems. While Delhi and Mumbai having achieved relatively higher ridership percentages, most cities have failed to meet projected figures, showing extremely low ridership realization.

This shortfall suggests multiple drawbacks, of which one of the pertinent aspect is that the success of metro systems depends on more than the network itself. Seamless access to and from the metro (last-mile connectivity) is essential to ensuring that the benefits of these systems are fully realized. Currently, commuters either walk, use a bus, autorickshaw either on-demand service basis or through ride-hailing platforms. While on-demand options like ride-hailing services are available, their higher costs make them unviable for a significant portion of commuters[8].

6 https://www.wricitiesindia.org/STAMP/sites/default/files/1-s2.0-S2352146519305319-main.pdf
7 https://wri-india.org/sites/default/files/Improving%20metro%20access%20in%20India_%20Working%20Paper.pdf
8 https://wri-india.org/sites/default/files/Improving%20metro%20access%20in%20India_%20Working%20Paper.pdf

Thus, alternative cheaper systems like ropeways can plug the gap by acting either as a main-haul public transit system in smaller cities with lower penetration of public transit services or as a feeder system to existing metro/ bus networks in bigger cities.

Increasing Private Vehicle Use

India is experiencing a steady rise in private vehicle ownership, fueled by rapid urbanization and an inadequate public transport system. With limited reliable transit options, commuters increasingly prefer personal vehicles, particularly cars and two-wheelers, contributing to severe congestion, rising pollution levels, and growing pressure on urban infrastructure. This trend underscores the urgent need for efficient, sustainable, and well-integrated public transport solutions to curb the over-reliance on private modes of travel. The figure below illustrates the share of vehicular registrations across different years from 2016 to 2025. Two-wheelers and four-wheelers have been growing at a CAGR of approximately 8% since 2021, indicating a rising trend in private vehicle ownership and its implications for urban mobility.

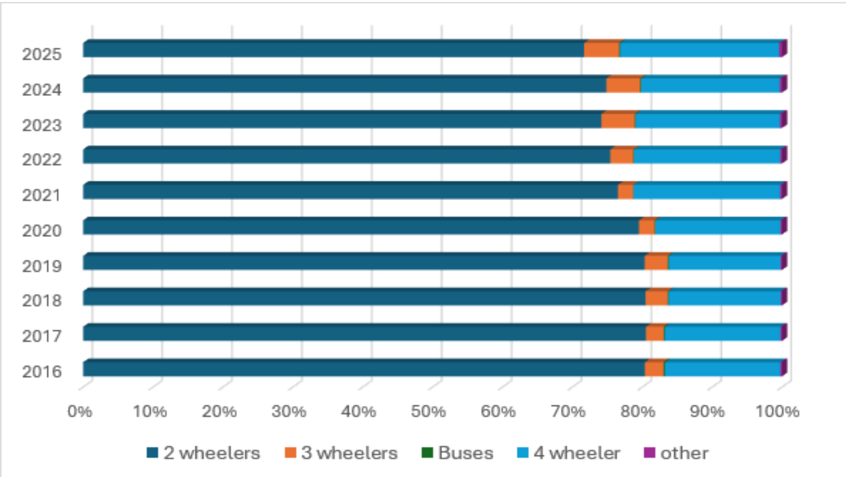


Figure 3: ***Growth of registered motor vehicles across different vehicular segments between 2016-2025 (in millions) (Data Source: Vahan Dashboard[9], GoI, iDeCK Analysis) (refer annexure for detailed figures)***

The trend highlights varying growth rates across different vehicle segments, with personal transport dominating—two-wheelers and cars accounting for approximately 80% of total registrations in 2024. Rising disposable incomes and limited public transport options have driven this surge in private vehicle ownership, particularly in urban areas. The two-wheeler and four- wheeler segments have grown by around 10%, reinforcing the increasing reliance on personal mobility[10].

This growing dependence on private vehicles has worsened traffic congestion, extended commute times, and diminished overall urban livability. Addressing these challenges requires a strategic shift in public transportation planning, with a focus on alternative transit systems that can effectively bridge gaps where conventional modes fall short.

9 https://vahan.parivahan.gov.in/vahan4dashboard/vahan/view/reportview.xhtml
10 https://vahan.parivahan.gov.in/vahan4dashboard/vahan/view/reportview.xhtml

Lack of Tourism-Specific Urban Mobility Strategies

India, a global tourism hub with nearly 9.5 million foreign tourist arrivals (FTAs) in 2023 and a domestic tourist volume exceeding 1.7 billion, lacks dedicated urban mobility strategies tailored to the needs of tourists[11]. Most public transport systems in Indian cities primarily cater to daily commuters, often overlooking tourist-friendly connectivity. Major tourist destinations like Jaipur, Agra, and Varanasi experience a surge in seasonal visitors, yet suffer from poorly integrated transport options, including limited airport-to-city transit, last-mile connectivity, and multilingual travel assistance. As a result, tourists often rely on expensive private transport, adding to congestion and environmental concerns.

Despite the growing contribution of tourism to India's GDP (pre-pandemic level of around 6.8% in 2019)[12], urban transport policies remain disconnected from tourism development. Many historic city centers and popular attractions lack well-planned public transit or suffer from overcrowded and outdated transport infrastructure. While metro rail networks have been expanded in cities like Delhi, Mumbai, and Bengaluru, their integration with key tourist hotspots remains inadequate. Implementing tourism-centric mobility solutions, such as dedicated ropeways, could significantly enhance the tourist experience while promoting sustainable urban transit.

1.3 Scope and Objectives of the Study

Having discussed and established with the existing paradigm of the urban mobility landscape in India, there is a significant need to enhance urban mobility by integrating alternative transit solutions like ropeways. Expanding alternative public transport options will help meet the increasing demand, improve accessibility, and ease congestion for urban commuters.

The scope of the study includes the following:

Workstreams	Scope of Work
Ropeways As A System For Urban Transport & For Promoting Tourism	• To examine ropeway system in comparison with other road, rail and water-based transportation systems. • Literature survey regarding the technical and financial aspects of ropeways that make them suitable and desirable for urban locations.

11 India Tourism Data Compendium 2024, Ministry of Tourism
12 https://www.sciencedirect.com/science/article/pii/S2666957924000089

Workstreams	Scope of Work
Current Framework For Ropeway Implementation & Operations In India	• To take stock of the current framework for ropeway operations in India- Review and analyze the existing Acts, Regulations/Guidelines and Policy Framework at the central and state level. • To examine the roles of Central and State Governments in implementing ropeways. • Mapping of institutional roles and responsibilities • To examine the SOP of Government departments and agencies that are related to the operations of urban ropeways • Analysis and assessment of ropeway systems in India- Review the designing and implementation pathway of ropeway systems in India (technical and financial- At least two National cases each, where ropeway systems have been used as or have been proposed to be used as mass transit systems for mobility • To analyse and describe the various challenges/ barriers involved in the implementation of ropeway projects in India cities
Global Insights: Lessons For India	• Collate global examples that are relevant for the Indian context- At least two international cases, where ropeway systems have been used as mass transit systems for mobility.
Financial Assessment Of The Ropeway System For India	• Assessment of ropeway systems in India- A broader assessment of financials for different use cases in India
Policy Recommendations & Way Forward	• Strategies to balance supply and demand • To suggest additions and qualifiers for the current indicative list of standard infrastructure and facilities suggested by NHLML for provision in ropeways projects. • Appraisal of the 'Make in India' and Atmanirbhar Bharat case

CHAPTER 2

ROPEWAYS AS A TRANSIT SYSTEM

- Technical and financial aspects of the cable propelled transit system.
- Assess the efficacy of the ropeways system

2.1 Historical Growth of Ropeways

Ropeways have been used for centuries, originating in ancient civilizations where ropes and pulleys facilitated movement across difficult terrains. Early Chinese and Japanese systems, such as the Gao Zhuan Tong Che and Taiheiki, primarily transported goods across rivers and mountains. During the Middle Ages and early Modern Age, ropeways became essential for moving construction materials and mining resources, gradually evolving with stronger ropes and improved pulley systems.

The Industrial Revolution marked a turning point for ropeway technology. In 1804, Austrian engineer Joseph Gainschnigg developed a 1.4 km-long funicular ropeway to transport gold ore, demonstrating the potential of these systems. A key breakthrough came in 1834 when Wilhelm Albert invented the steel cable, significantly enhancing ropeway strength and durability. By 1872, ropeway technology expanded into urban passenger transport with the introduction of the San Francisco Cable Car Line, paving the way for movement of the people.

In the 20th century, ropeways transitioned from industrial use to passenger mobility, particularly in mountainous regions. Ski resorts in Switzerland, Austria, and France adopted gondolas and chairlifts, while military forces leveraged ropeways for wartime logistics. Aerial cable cars also gained popularity in urban settings where traditional land-based transport infrastructure was difficult to implement.

Today, ropeways are increasingly integrated into urban transport, offering efficient and sustainable solutions for congested cities. Examples like the Medellín Metrocable in Colombia and La Paz Cable Car in Bolivia showcase how modern ropeways enhance public transit while reducing traffic congestion and emissions. With advancements in automation, lightweight materials, and renewable energy, ropeways continue to evolve as a viable alternative for both urban mobility and tourism.

Below shown is a broad timeline of the growth of the ropeways.

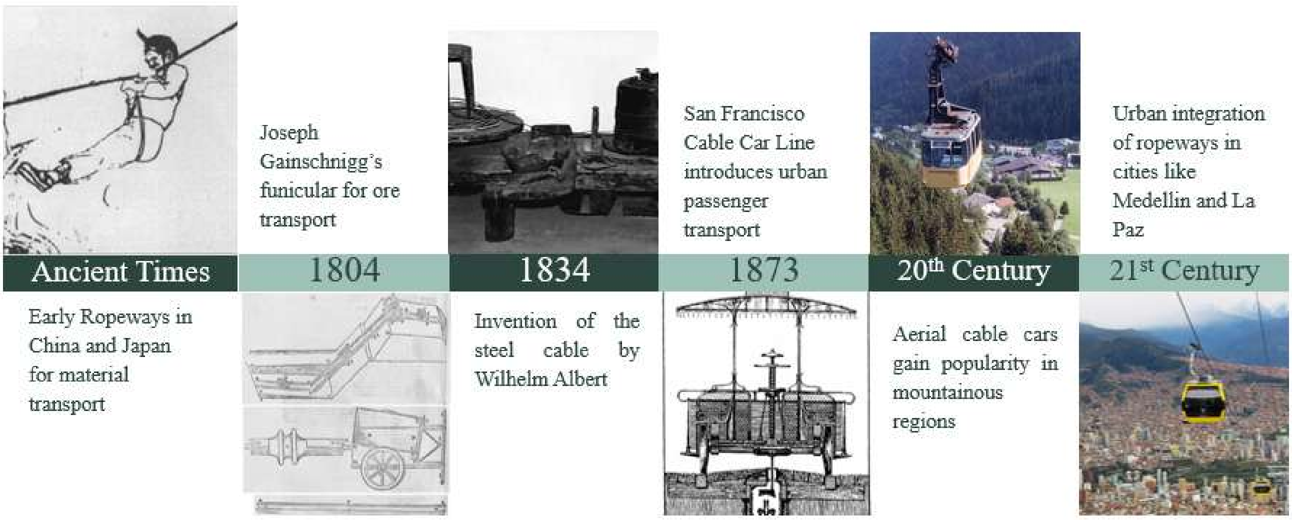


Figure : Broad timeline of the growth of ropeways in the world

2.2 Ropeways- Technical Background

Almost all ropeway systems have the same basic components, irrespective of the technology used. The basic components of any ropeway system include carriers (cabins), terminals, towers, ropes, and evacuation and rescue system. The details of the components are discussed below.

Technical Components of Ropeways

Ropeways are composed of several integrated technical components that enable the safe and efficient movement of passengers or goods via suspended cabins. These include:

- The haul rope is the moving cable that pulls the cabins along the route, powered by a motor typically located at the drive station. In systems with more than one cable, a separate track rope or support cable carries the weight of the cabins, allowing for greater stability and capacity.
- Cabins are attached to the haul rope using either fixed grips, which are permanently connected, or detachable grips, which allow cabins to slow down at stations for boarding and alighting while the cable continues moving.
- The ropeway is supported along its route by a series of towers or pylons, which guide the rope using rollers known as sheave assemblies.
- At the end of the line, a return station houses a bull wheel where the haul rope loops back and often includes a tensioning system—either hydraulic or counterweight-based—to maintain optimal rope tension.
- Ropeways also feature control and monitoring systems that track key operational parameters such as rope speed, tension, cabin spacing, and emergency status.
- Safety is a critical aspect, with systems often including emergency evacuation setups, backup power supplies, and manual rescue mechanisms.
- Ropeways are designed with features such as detachable cabin systems, which improve passenger experience and efficiency, and a low ground footprint, making them especially useful in congested urban areas or rugged terrain.

Intermediate and transfer stations play a crucial role in making ropeway systems more functional and scalable, particularly in urban environments.

- Intermediate stations are located along a single ropeway line and allow passengers to board or alight mid-route. To enable this, cabins temporarily detach from the continuously moving haul rope using a special grip-release mechanism. Once detached, the cabin slows down inside the station—usually via conveyor belts or rollers—allowing safe passenger movement. Afterward, it is reattached to the cable to continue the journey. These stations also help manage tension and sometimes allow for slight directional changes in the route.
- Transfer or interchange stations, on the other hand, facilitate movement between two or more separate ropeway lines. Each line operates independently with its own cable, motor, and cabins. At the transfer station, cabins from different lines arrive at nearby platforms. Passengers disembark from one cabin and walk a short distance to board a cabin on the next line. These stations are designed much like metro interchanges, with clear signage, short transfer paths, and integrated passenger flow to make the transition efficient.

Both types of stations require additional engineering features such as detachable grips, slowing mechanisms, and platform infrastructure. Together, they enable ropeways to function as modular, flexible networks, especially well-suited for challenging terrains and congested urban corridors.

Ropeways generally have practical limitations on the total length of a single line, typically kept under 5 kilometres. This can be seen in the case studies as discussed in chapter 3. This is due to a combination of engineering, safety, and economic considerations. The reasons include:

- Economically, ropeways are best suited for short-distance or terrain-challenged routes where traditional modes like buses or metro are less viable. For longer corridors, systems like metro or BRT offer higher capacity and better cost-effectiveness. To overcome these limitations, many cities implement ropeways as modular systems, connecting shorter segments of 3–4 kms each through interchange stations. This approach helps manage mechanical loads, simplify maintenance, and improve passenger flow, as seen in successful examples like Medellín's Metrocable and La Paz's Mi Teleférico (discussed in the case studies section).
- As ropeway lines get longer, the total weight of the cable and cabins increases significantly, putting greater tension on the system and requiring more support towers. These structural requirements become increasingly complex and expensive to manage over longer distances, particularly in challenging terrains like urban environments or steep slopes.
- Additionally, ropeways are usually powered by a single drive system located at one end or mid-line, which limits the feasible length the motor can efficiently power.
- Safety regulations also play a crucial role—longer travel times make emergency evacuation more difficult and riskier. Most safety standards limit maximum travel times to about 15–20 minutes, which naturally restricts line length based on operating speed.

Types of Ropeways

Aerial Ropeway Transit (ART) can be broadly classified into two types:

- Bottom-Supported Aerial Cars
- Top-Supported Aerial Cars

This study limits itself to just the top-supported system. The details of the bottom-supported aerial systems are discussed briefly in the annexure.

Top-Supported System is a cable-propelled transit system where cabins or gondolas are suspended from an overhead cable and transported between stations. The system operates using one or more steel cables for support and propulsion, typically powered by a central motor at a station. In 1856, Englishman Robert got the patent for a monocable aerial ropeway, and in 1861, German Freiherr von Ducker got the patent for a bi-cable aerial ropeway. The different types of top-supported systems include monocable detachable gondolas (MDG), bicable detachable gondolas (BDG), tricable detachable gondolas (TDG), aerial tramways etc.

Monocable Detachable Gondolas (MDG)

The Monocable Gondola is a single cable with a detachable grip system where cabins detach and attach to the moving haul cable in the stations. In the Monocable Detachable Gondola (MDG) System, cabins are suspended and pulled by the same cable (a moving loop) and are set at regularly spaced intervals. They detach from the cable at the terminal/intermediate stations for boarding and de-boarding. The haul cable serves both as the support and guidance mechanism for the cabins, eliminating the need for a separate track cable. The tensioned haul cable provides the necessary stability and alignment for the gondolas as they move between stations.

The MDG system can be used for short and long-distance travel and can have multiple stations. It has an average speed of 7 m/s and a capacity of 4500 PPHPD with a low construction cost. The MDG system has been widely used for tourism and urban mobility in La Paz (Bolivia), Medellin (Colombia), and Yanganag (India), among many others. The schematic diagram is as shown below. Pictures of the existing MDG systems have been included in the annexure.

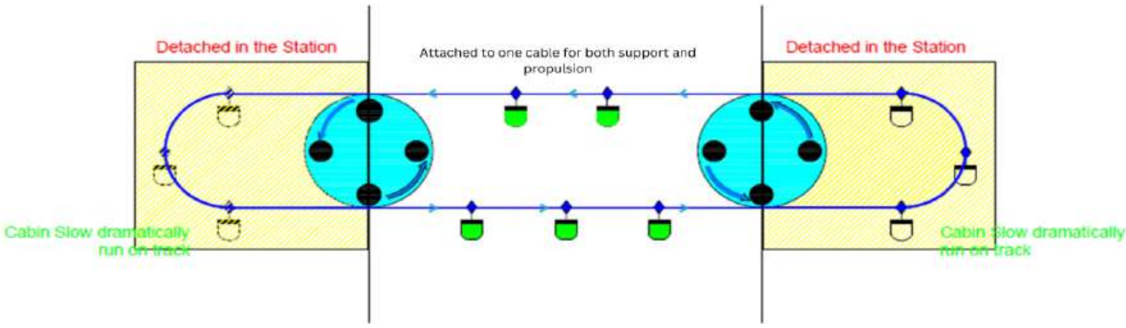


Figure: Schematic Diagram on Functioning of BDG System (Source:)

Bicable Detachable Gondolas (BDG)

The Bi-Cable Detachable Gondola (BDG) System combines the features of a Gondola and Reversible Ropeway System. It has two ropes serving different functions: one for static support or track cable and the other for moving a haul rope. Unlike the MDG System, which is both propelled and suspended by the same cable, the BDG uses two ropes for different functions. The usage of two ropes provides the BDG System with enhanced support that requires fewer support towers.

The BDG System is designed to have multiple stations with a carrying capacity of 6000-7000 PPHPD and has an average speed of 7 m/s. The construction cost of a BDG System is slightly higher than that of an MDG System. The BDG System is widely used in high passenger capacity, longer distances and greater wind resistance.

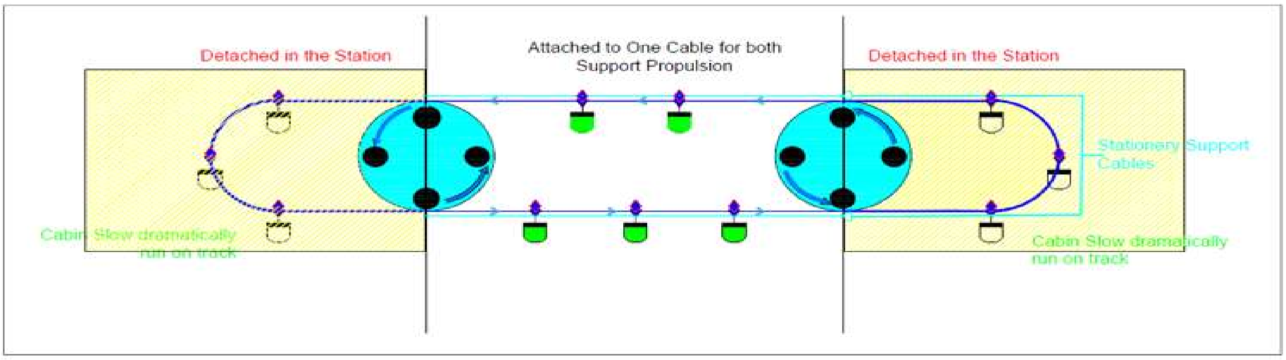


Figure: Schematic Diagram on Functioning of BDG System (Source:)

Tricable Detachable Gondolas (TDG)

The Tri-Cable Detachable Gondola (TDG) System operates on three cables: two fixed track cables for supporting the cabin and a separate haul rope for propulsion. A second track cable is used for additional stability, especially in high-wind conditions or for carrying heavier loads. The system has evolved from earlier bi-cable systems to accommodate higher passenger volume, longer span, and reduction in wind resistance.

The TDG systems are more expensive than the BDG and MDG systems due to higher advantages such as higher passenger capacity with increased speed. The system can achieve a passenger-carrying capacity of 8000-12000 PPHPD, with an average speed of 8.5 m/s.

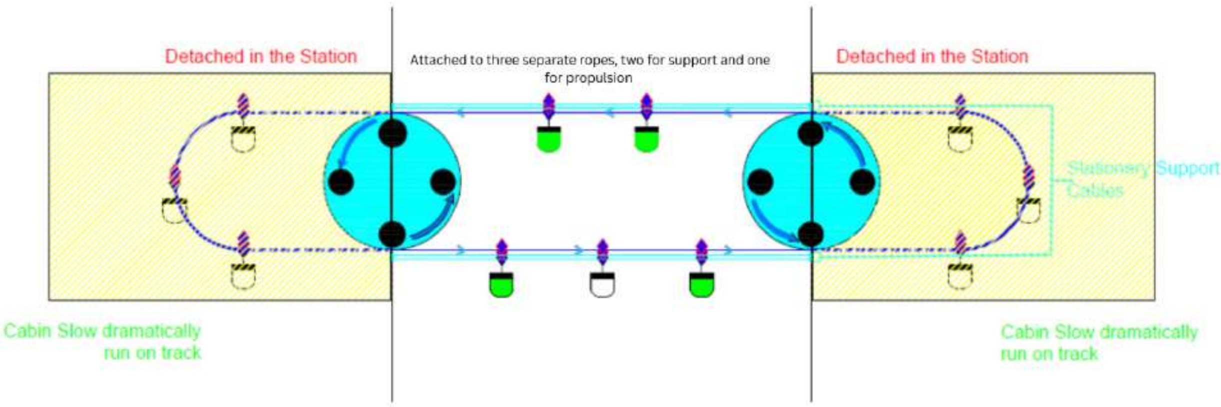


Figure: Schematic Diagram on Functioning of TDG System (Source:)

Aerial Tramway

Aerial Tramway, also known as Jig-back Ropeway or Reversible Ropeway, is an aerial lift in which two passenger cabins that are suspended from one or more fixed cables (track cables) and are pulled by the other (haulage rope). The fixed cables provide support to the cabins that cannot be detached from the moving cable. The haulage rope is driven by an electric motor and is connected to the cabins. They are referred to as Jig Back due to the power source, and the electric engine at the bottom of the line effectively pulls one carrier down, using the weight to push the carrier up. A similar concept is used in bottom-supported funicular ropeways. The two passenger cabins are situated at opposite ends of the loops of the cable. Aerial Tramways are designed for short distances up to 1,000 m with an average speed of 11 m/s and have a passenger carrying capacity of 2000 PPHPD. The two cabins have a synchronized movement.

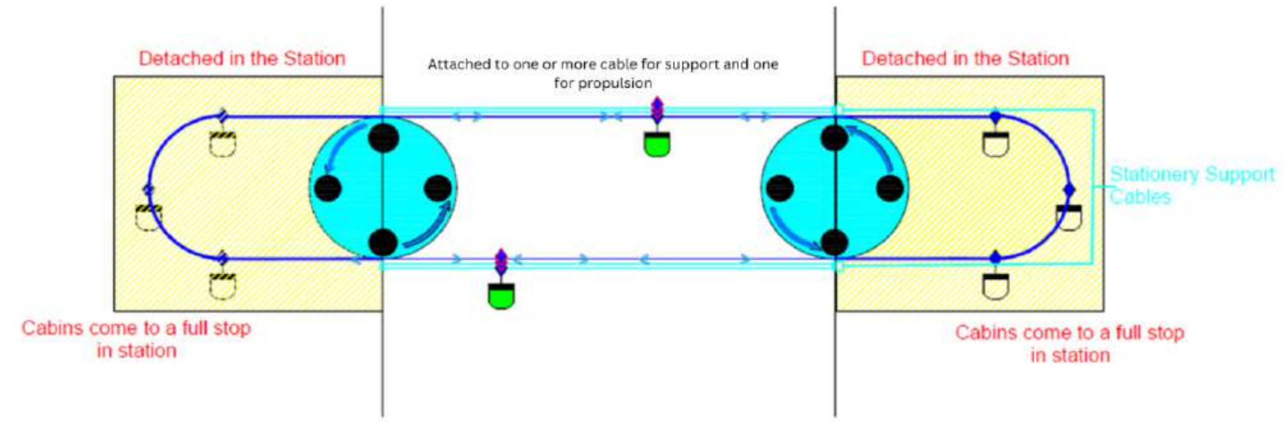


Figure: Schematic Diagram on Functioning of Aerial Tramway System

2.3 MDG as a System for Scaled Adoption

Monocable Detachable Gondola (MDG) systems are among the most prevalent aerial cable car technologies globally, particularly in urban public transportation. Approximately 70-80% of all the ropeway installations in the world use Monocable Detachable Gondola (MDG) system. For instance, the Medellín system in Colombia, inaugurated in 2004, was the first urban transit system to utilize MDG technology. Additionally, MDG systems have been implemented in cities such as La Paz (Bolivia), Guayaquil (Ecuador), Greater Mexico City, Caracas (Venezuela), London, Constantine (Algeria), among many others. This is examined in detail in the case studies section (Chapter 5).

Their widespread adoption is attributed to their relatively low infrastructure capital costs and suitability for urban environments. A detailed assessment of MDG system with other top and bottom-supported ropeway systems is discussed below.

Table: Comparison of Cable Propelled Transit Systems

Aerial Ropeway Transit (ART)	Speed (m/s)	Free Span (m)	Cost	Carrying Capacity (PPHPD)
Monocable Detachable Gondola System	7	900	Low	4500
Bi-Cable Detachable Gondola System	7	1200	Low-Medium	7000
Tri-Cable Detachable Gondola System	8.5	3000	Medium-High	12000
Aerial Tramway	11	1000	Medium-High	2500
Funitel	7.5	1000	Low6	4000
Funicular Rail	13		High	4000
Inclined Lift	2.7		High	600

Monocable Detachable Gondola (MDG) systems are the most cost-effective options, offering moderate speeds (7–7.5 m/s) and carrying capacities of 4,000–4,500 PPHPD. Bi-Cable (BDG) and Tri-Cable (3S) systems provide higher capacities (7,000–12,000 PPHPD) and longer spans but come at increased costs.

Given its widespread global adoption, this study focuses exclusively on the Monocable Detachable Gondola (MDG) system for both technical comparisons with other mass transit modes and financial assessments.

2.4 Safety Standards of Ropeways

Ropeway safety standards are a set of regulations and guidelines designed to govern and ensure the safe operations of cable cars and gondolas. The safety standards regulate the design and conduction to regular maintenance and emergency protocols, minimising risks such as mechanical failure, passenger mishaps, and cable wear. Safety standards vary by country, with each nation enforcing its regulations. While international guidelines such as ISO and CEN provide a broad framework, individual countries adapt according to their operational needs. India follows the Bureau of Indian Standards (BIS), while America adheres to the American National Standards Institute (ANSI).

Each of the following organizations has set specific guidelines to regulate the ropeway design, maintenance and operations. Their framework allows for compliance with safety protocols, minimising risk and enhancing passenger security.

CEN (Europe)- The responsibility for approving cableway installations is vested in a service of the national authorities. Approval of components cannot be obtained beforehand but only when the customer applies for such approval. The CEN follows a rigorous certification process, requiring approval at each stage of the value chain, ranging from design to manufacture. The safety component should bear the CE marking to be affixed either by the manufacturer or by his authorized representative. The installations include funicular railways, cable cars, drag lifts, gondolas, and chair lifts. All planned installations are subject to a safety analysis which covers all safety aspects of the system and its surroundings, which makes it possible to identify from experience risks likely to occur during operations. The safety analysis shall also be subject to a safety report recommending measures.

BIS (India)- The Indian safety standards in India are regulated by the Bureau of Indian Standards (BIS). Ropeways for installations have to comply with the necessary certifications listed by BIS. Certifications are provided after a detailed review of the project's design, construction and maintenance protocols. Separate approval at each step is not required. BIS lists standards for welding that need to be conducted, along with specifications on standards for haulage rope and mechanical components. Testing post-installations are not followed by BIS. (www.services.bis.gov.in)

ANSI (America)- The Ropeways' safety standards in America are governed by the American National Standards Institute (ANSI). America follows a very stringent monitoring of pre-operational inspections, ensuring that the reports reflect the accurate condition of the ropeways. For the developing ropeways, a review of site development, terminals, and other ancillary buildings is conducted. The installations include aerial tramways, aerial or surface lift, tow, conveyer or funicular ropeway. The ANSI lists a meticulous procedure for inspection done by the authorised officers. Before the public operation of a new, relocated or modified ropeway, authorised officers follow a minimum procedure for construction and modification. The ANSI has also listed procedures and tests that require approval for the construction of the ropeways. (blog.ansi.org), (www.fs.usda.gov)

Table 8 Comparative Analysis of Different Safety Standards

Point of Differentiation	CEN (Europe)	BIS (India)	ANSI (America)
Modes of Transport covered	Aerial Ropeways Funicular Ropeways Surface lifts	Aerial Ropeways	Aerial Tramways Funicular Ropeways Surface Lifts Tow Conveyers
Certification criteria	Approvals are required at each stage after completion in the value chain, from design to installations.	Specifies the general norms across the value chain and does not require approval at each stage of construction.	Certifications are required at each step of the construction and implementation of the ropeways.

Point of Differentiation	CEN (Europe)	BIS (India)	ANSI (America)
Testing Technology	Detailed and stringent. Specifies the test to be conducted along with equipment details, procedures, performance requirements, and qualification of personnel. After installation, the system should be tested for 50 hours with the main drive, at least 5 hours of which should be at full load.	Less stringent It has similar specifications for components as CEN but requires fewer tests. BIS does not have a test to be conducted after installation to access the operations of the ropeway system. Visual, ultrasonic, and Magnetic Particle testing to enhance safety	Stringent testing is carried out before public operations.
Inspection Procedures	Testing is conducted for every sub-component mandatorily at specified intervals by certified personnel. The agencies are approved by the respective ministries of the countries.	Testing is done at request and does not have a mandatory frequency of tests. Before starting the daily operation, a check must be made on the condition of the Ropeway BIS does not have a certifying agency for ropeway components The person conducting the test may not be certified personnel.	Inspection is carried out by a Ropeway Engineer. Testing is conducted by the State-certified agency with the authority to regulate ropeways.
Specifications	Component design guidelines are updated as per the latest technological advancements	Not as frequently updated as the CEN	Are updated as per the latest advancements.

2.5 Comparison of Ropeways with other Mass Transit Systems

This section presents a comparative analysis of various urban transit modes based on key technical and operational aspects. The insights from this comparison help in identifying the most suitable transit mode considering city-specific needs, budget constraints, and geographic challenges. Water-based public transit systems have not been included in the assessment, due to the unavailability of uniform data across parameters. The table below provides a detailed evaluation of these factors.

Table : Comparison of ropeways with other mass public transit systems (ORF Report 2024, iDeCK Analysis)

Aspects	Right of Way	Grade Separation	Route Adapt-ability	Carrying capacity (in thousands passengers/ hour)	Unit Cost (Cost/km) (in cr.)	Fuel	Opera-tional Speed (kmph)	Terrain Suitability
Metro Neo	Exclusive (6-8m)	Elevated/At grade	Medium	5-8	80-100	Electric	30-40	Urban and suburban areas, flat to moderately undulating terrain
Metro Lite/ LRT	Exclusive (7-10m)	Elevated/At grade	Low	8-15	120-150	Electric	25-45	Urban and suburban areas, flat to moderately undulating terrain
Metro Rail	Exclusive (7-10m)	Underground/ Elevated	Low	40-80	200-600*	Electric	30-50	Metro cities, Non-hilly conditions
Monorail	Exclusive (6.5-9m)	Elevated	Low	10-12	100-200	Electric	30-40	Flat terrain, Urban areas
Conventional Bus System	Shared	At-grade (unsegregated)	High	2-5	0.5-1.5 (per bus)	Diesel/ CNG/ Electric	15-20	Flat, Mild steep terrain, Urban and suburban areas
Priority Bus System/ BRTS	Partially Shared/ Exclusive	At-grade/ Elevated (Segregated)	High	5-10/ 20-40	1-2/ 20-40	Diesel/ CNG/ Electric	20	Flat, mild steep terrain, Urban areas
Suburban rail	15-20m (for two lane rail corridor)	At-grade (Segregated)	Low	60-90	100-120	Electric	35	Flat to moderately undulating terrain

Aspects	Right of Way	Grade Separation	Route Adapt-ability	Carrying capacity (in thousands passengers/ hour)	Unit Cost (Cost/km) (in cr.)	Fuel	Opera-tional Speed (kmph)	Terrain Suitability
Paratransit/ IPT modes	Shared	At-grade (Unsegregated)	High	NA	NA	Diesel/ CNG/ LPG Electric	15-20	Flat terrains, Urban areas
PRT/ Pod Taxi	Exclusive (6-8m)	At-grade (Segregated)	Low	12-15	60-90	Electric	30-40	Urban areas, Flat terrains
Ropeway (MDG)	Exclusive (6-8m)	Elevated	Low	2-5	60-150	Electric	25-30	Hilly terrain, Congested Urban Areas, Large Institutional Areas

* Cost of metro system ranges between INR 200 to 600 crore per kilometer, depending on whether the alignment is elevated, at-grade, or underground

- Metro/suburban rail systems offer the highest carrying capacity, making them ideal for high-demand corridors, while ropeways and personalized rapid transit (PRT) cater to medium-capacity needs. In terms of capital expenditure (CAPEX), metro and light rail require the highest investment whereas ropeways, priority bus, and conventional bus systems present more cost-effective alternatives, making them viable for budget-constrained cities
- Ropeways excel in route adaptability, especially in dense urban areas and challenging terrains where land acquisition is difficult, whereas rail-based systems are the least flexible. Operational speed is highest for metro/suburban rail, followed by light rail, while ropeways provide moderate speeds and buses face congestion-induced delays. Land requirements are lowest for ropeways, making them a space-efficient solution for cities facing land scarcity. Overall, ropeways emerge as a flexible, cost-effective, and space-efficient urban mobility option.

Ropeways offer a flexible, cost-effective, and space-efficient solution for urban mobility, particularly in congested or geographically constrained areas.

When compared with respect to the life cycle carbon emissions of various transit systems, measured in grams of CO_2 per passenger-kilometer (gms of CO_2/pass-km), ropeways emerge as one of the lowest emitters, indicating their strong environmental advantage[13]. This comparison highlights the sustainability potential of ropeways in urban transport, positioning them as a cleaner alternative to conventional modes, particularly in cities striving to reduce carbon footprints and promote green mobility solutions.

13 Transport Capacity of a Cable Car System – OITAF 2024 (PDF)
Electric Buses: Benefits and Trade-offs – MDPI
Urban Cable Cars in Public Transport – WCTRS
Fuel Consumption of Two-Wheelers in India – ICCT

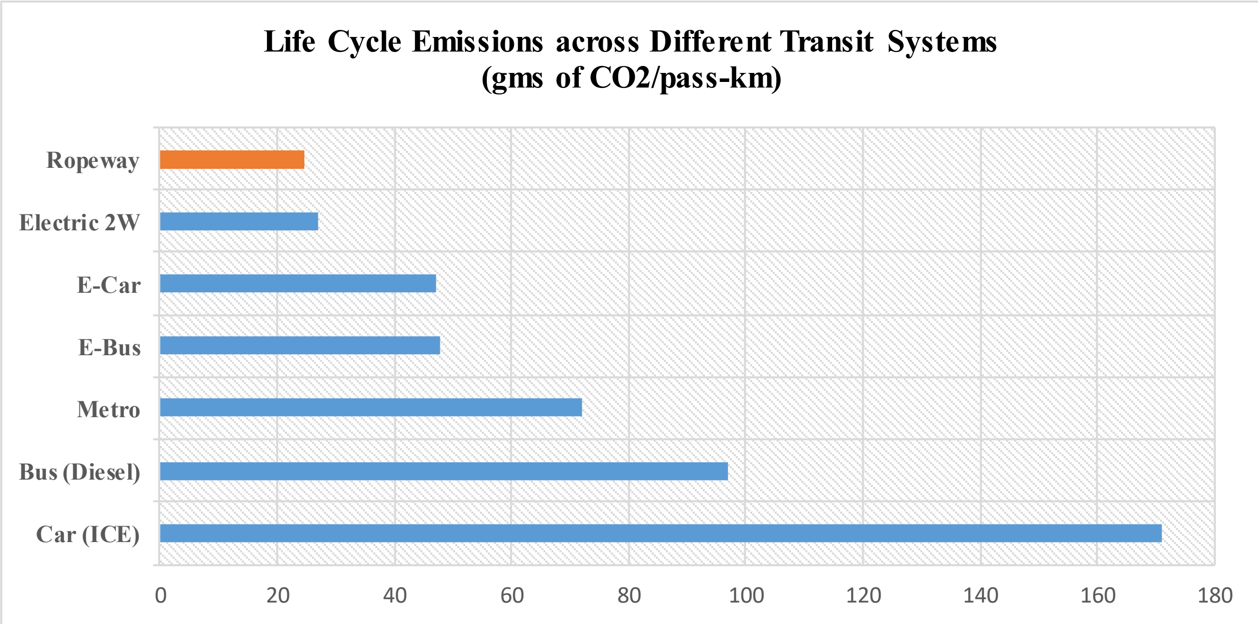
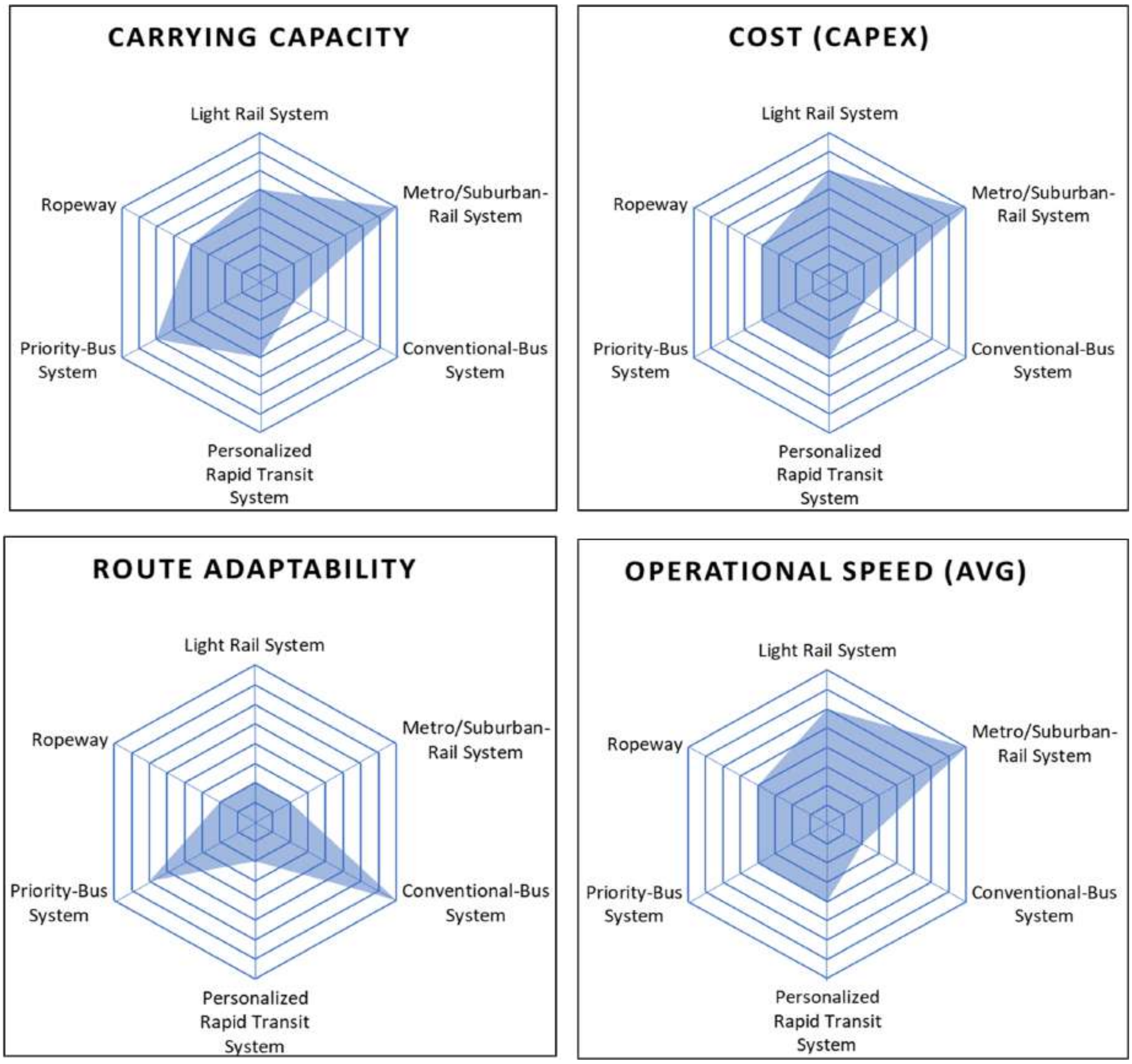


Figure: Life Cycle Emissions across Different Transport Systems



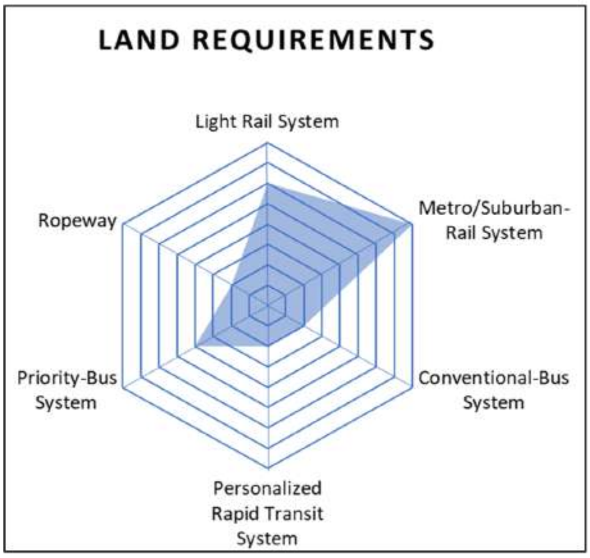


Figure: Technical parameters-wise comparison across mass public transit systems (Data Source: ORF Report 2024, iDeCK Analysis)

2.6 Efficacy of Ropeways as a Transit System for Urban Connectivity and Tourism

This section provides a comprehensive SWOT analysis of the ropeway system, evaluating its strengths, weaknesses, opportunities, and threats in the context of urban transportation and tourism.

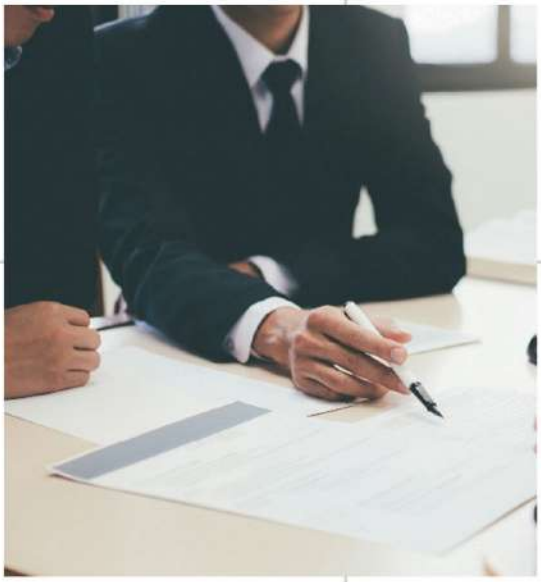
One of the key advantages of ropeways is their ability to efficiently traverse rivers and hilly terrains, offering a unique and practical solution to urban mobility challenges in cities with such natural obstacles. In areas divided by water bodies or characterized by undulating landscapes, traditional infrastructure like bridges or flyovers often demands significant investment, time, and land acquisition. Ropeways present a cost-effective and quicker alternative, with minimal ecological disruption. As electric-powered systems with low emissions, they also align well with the sustainability goals of cities aiming to reduce their carbon footprint.

In addition to overcoming geographical barriers, ropeways can play a crucial role in enhancing last-mile connectivity within existing urban transport networks. One of the key challenges affecting the ridership of mass transit systems—particularly metros—is the lack of seamless first- and last-mile access. Research suggests that nearly 70% of potential metro users cite inadequate connectivity to and from stations as a major deterrent, often leading them to choose alternative, less sustainable modes of transport[14]. By operating above ground, ropeways can bridge these critical gaps between major transit hubs and underserved or hard-to-reach neighbourhoods. Their ability to bypass congestion and topographical hurdles makes them a reliable, efficient, and eco-friendly option for short-distance urban travel, thereby strengthening the overall effectiveness and inclusivity of urban transit systems.

The following graphic summarizes the ropeway system's strengths, weaknesses, opportunities, and threats.

14 chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.wricitiesindia.org/STAMP/sites/default/files/1-s2.0-S2352146519305319-main.pdf

Figure: SWOT Analysis of the Ropeways System



CHAPTER 3

CASE STUDIES AND INSIGHTS

- Assess in detail the different examples of ropeways implemented across the globe and in India
- Draw specific insights for India from the selected case studies

3.1 Global Mapping of Ropeways

As the world moves toward sustainable and efficient transit solutions, ropeways are emerging as a practical and innovative mode of transportation, enhancing both urban mobility and tourism infrastructure. Global ropeways have been mapped, highlighting their current presence and planned expansions across various countries. It details the number of operational ropeways, the total kilometers covered, and future projects aimed at enhancing urban transport and tourism.

Ropeways are transforming mobility worldwide, with some countries using them to cut through urban congestion and others to elevate tourism experiences. In cities like Medellín, Mexico City, and La Paz, they offer a smart solution for daily commutes, seamlessly gliding over traffic. Meanwhile, places like the Alps, Yellowstone, Zhangjiajie, and Queenstown have embraced ropeways to give visitors breathtaking views of their landscapes. While nations like France, Switzerland, and Japan focus on enhancing tourism, countries such as Mexico, Bolivia, Ecuador and Colombia are betting on ropeways for urban transport. India, with its growing network, is currently leveraging them for pilgrimage and tourism. This global analysis underscores the increasing adoption of ropeways as an eco-friendly and efficient transport mode in diverse geographic and urban settings.

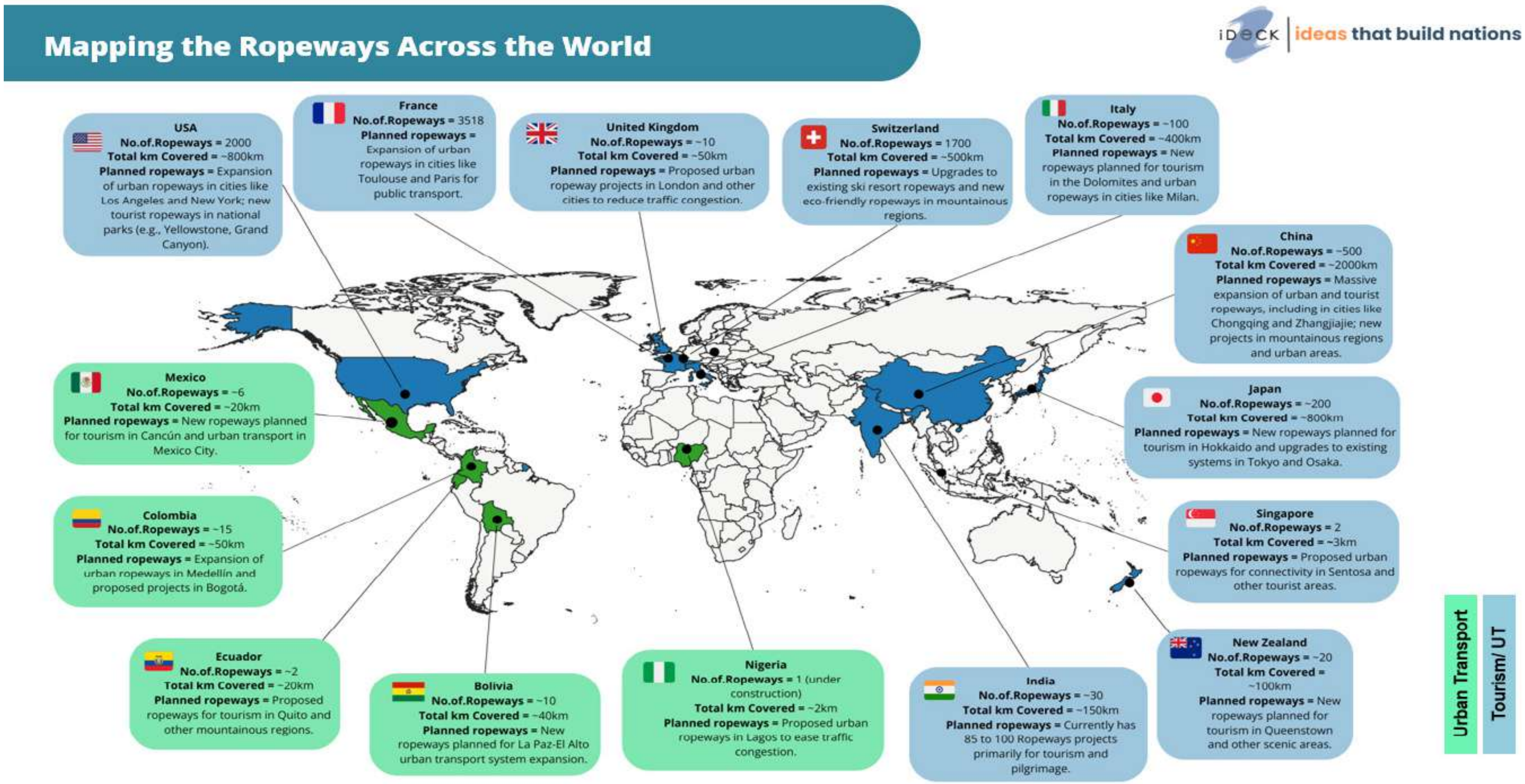


Figure Ropeways Across the World

3.2 Selection of Ropeways for Analysis

The global and Indian case studies have been categorized and selected based on the terrain type (plain or hilly) and their primary purpose (urban transport-specific or tourism/urban transport).

	Urban Transport Specific	Tourism/ Urban Transport
Plain Terrain	*International: Ecuador, Mexico* *National: Varanasi*	*International: Nil* *National: Guwahati*
Hilly Terrain	*International: La Paz-El-Alto (Bolivia)* *National: Shimla, Dehradun*	*International: Sentosa (Singapore), Medellin (Colombia)* *National: Sikkim*

These locations were selected to capture the varied applications of ropeways in both urban and tourism contexts across diverse terrains. International examples demonstrate how ropeways serve dense urban environments as well as scenic, tourist-oriented regions. Similarly, the domestic case studies encompass projects in both hilly and plain areas, highlighting the differing operational challenges and design considerations. This comprehensive selection provides valuable insights into how geographic and socio-economic factors influence ropeway performance.

3.3 Indian Case Studies

3.3.1 Case Study 1 (Plain Urban): Varanasi Pilot Ropeway Project, Uttar Pradesh

Project Description

The proposed ropeway in Varanasi, India's religious capital, aims to be the country's first urban mobility ropeway. Designed to tackle the city's transportation challenges and rugged terrain, it will help decongest the narrow streets and enhance the pilgrim experience. Varanasi, located on the banks of the Ganges, had a population of 11,98,491 (Census 2011) with a 1.71% growth rate. In 2019, the city saw 67,97,775 tourists, growing annually at 4.167% (Final Feasibility Report, VDA, 2021). The influx of a significant number of pilgrims, especially to the Kashi Vishwanath Temple, worsens traffic congestion. The ropeway will offer a fast, reliable, and eco-friendly solution, marking a transformative step in urban transport.

Technical/ Operational Specifications

Status: Under Construction

Type of System: MDG System

Total Length: 3.65 km

Number of Lines: 1

Average Speed: 7m/s

Number of Cabins: 268

Capacity per Cabin: 10

Average Commute Time: 15 minutes

Number of Stations: 4

Number of Towers: 30

Free Span Between Towers: 350 meters

System Capacity PPHPD: 4500

Projected Demand: 100000

Operational Hours: 16 hours

Governance and Financing Aspects

Estimated Cost: ₹ 807 crore (₹200 cr/km)

Estimated O&M Cost: ₹236.30 crore

Finance/ Business Model: PPP under Hybrid Annuity Mode (HAM)

Tariff: ₹ 30 (₹8/km)

Projected IRR: 15%

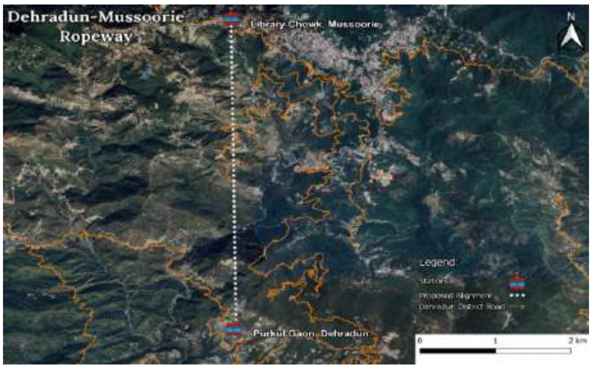
Governing Agency: Varanasi Development Authority

Construction Company: Vishwa Samudra Engineering Private Limited with Bartholet Maschinenbau AG of Switzerland

Central Scheme: Parvatmala Pariyojna

3.3.2. Case Study 2 (Hilly Tourism/Urban): Dehradun-Mussoorie Ropeway

Project Description



The proposed Aerial Passenger Ropeway between Dehradun (Purkul Goan) and Mussoorie aims to transform transportation by addressing the region's unique topography and logistical challenges. The excessive reliance on automobiles has led to severe congestion on the 35 km Dehradun-Mussoorie Road, the only access route between the two places. This persistent issue has restricted tourism growth to just 1.21% over the past five years, as visitors face long delays and difficult commutes, reducing the region's overall appeal. Traditional solutions, such as road expansion, are unfeasible due to land availability, further impacting accessibility and the local economy, which heavily depends on tourism. To achieve the national tourism growth target of 5% and revitalize Mussoorie's tourism potential, the ropeway emerges as the most viable solution, offering a fast, efficient, and sustainable alternative that enhances connectivity while preserving the region's natural landscape.

Technical/Operational Specifications

Status: Under Construction
Type of System: MDG System
Total Length: 5.5 km
Number of Lines: 1
Average Speed: 6 m/s
Number of Cabins: 54
Capacity per Cabin: 8
Average Commute Time: 20 minutes
Number of Stations: 2
Number of Towers: 25
Free Span Between Towers: 229.1 meters
System Capacity PPHPD: 1000
Operational Hours: 12 hours
Projected Demand: 25,000 people daily

Governance and Financing Specifications

Estimated Cost: ₹ 285.2 crore (₹51.85 cr/km)

Finance/ Business Model: PPP

Tariff: ₹ 1000 (₹90/km)

Governing Agency: Uttarakhand Tourism Development Board

Construction Company: Mussoorie Sky Car Company Private Limited

3.3.3 Case Study 3 (Hilly Tourism/Urban): Shimla Urban Mobility Ropeway

Project Description

Shimla, the capital of Himachal Pradesh, is known for its picturesque landscapes, colonial architecture, and growing tourism. Located 355 km from the National Capital, the city saw a tourist inflow of 25,65,269 in 2022 (DPR, Volume 1, 2023), with an annual growth rate of 13.25% (2008-2022) and a tourist growth rate of 3.81%. This increasing influx has put immense pressure on the city's infrastructure, making it challenging to manage traffic congestion while preserving its natural beauty. To tackle these issues, authorities have proposed a passenger ropeway system as a transformative and sustainable transport solution. The ropeway will connect key locations, ease urban mobility, and reduce the burden on road transport, ensuring Shimla remains a top tourist destination while improving travel for both residents and visitors.

The proposed ropeway will have 3 lines:

- Apple (Red) Line connecting Taradevi Station to Tutikandi Parking
- Deodar (Green) Line connecting Tutikandi Parking to the Secretariat
- The Monal (Blue) Line connecting ISBT to the Secretariat

Technical/Operational Specifications

Status: Under Construction
Type of System: MDG System
Total Length: 13.79 km
Number of Lines: 3
Average Speed: 6 m/s
Capacity per Cabin: 10
Ticketing System: Automatic Fare Collection

Average Commute Time: 32 minutes
Number of Stations: 14
System Capacity PPHPD: 2500-3000
Number of Cabins: 290
Operational Hours: 16 hours

Governance and Financing Specifications

Estimated Cost: ₹ 1554.78 crore (₹112.74 cr/km)
Estimated O&M Cost: ₹929.99 crore
Finance/ Business Model: PPP
Tariff: ₹ 12 (inclusive of 18% GST) for trips shorter than 2km
Projected IRR: (-) 0.13%

Governing Agency: Government of Himachal Pradesh
Construction Company: Rapid Transport System Development Corporation (RTDC)

3.3.4. Case Study 4 (Plain-Urban/Tourism): Guwahati-Umananda Ropeway

Project Description

The Guwahati-Umananda Ropeway, India's longest river ropeway, plays a key role in both tourism and urban mobility. Guwahati, the gateway to Northeast India, has grown rapidly due to its strategic location and strong connectivity, making it a major trade hub. The Brahmaputra River enhances the city's significance as a riverine port and a center for nature-based tourism (Brahmaputra River Tourism Development in Guwahati Metro). Initially developed as a tourist attraction, the ropeway also serves as an alternative transport link between North and South Guwahati. With limited land on the southern bank, urban expansion has shifted northward, increasing the need for improved infrastructure. Guwahati, with a population of 1.3 million (Census of India, 2011), faces severe congestion, particularly on the overloaded Saraighat Bridge, the main connection between both banks.

Launched in 2020, the Guwahati-Umananda Ropeway has become a transformative, sustainable transport system. It provides a fast, reliable, and eco-friendly alternative to road transport while also serving as a major tourist attraction, further boosting Guwahati's status as a key destination in the Northeast.

Technical/Operational Specifications

Status: Operational, 2020
Type of System: Twin Track, Single Haul, Bi-Cable Double Reversible Jig Back System
Total Length: 1.82 km
Number of Lines: 1
Average Speed: 6 m/s
Capacity per Cabin: 30+1 (Operator)
Ticketing System: Physical Ticketing

Average Commute Time: 7 minutes
Number of Towers: 5
Free Span Between Towers: 455 meters
Number of Stations: 2
System Capacity PPHPD: 250
Number of Cabins: 2
Operational Hours: 8 hours

Governance and Financing Specifications

Actual Cost: ₹ 56.08 crore (₹30.81 cr/km)

Finance/ Business Model: PPP

Tariff: ₹ 100 (one way trip) & ₹200 (two-way trip)

Governing Agency: Guwahati Metropolitan Development Authority (GMDA)

Construction Company: Samir Damodar Ropeways Pvt. Ltd.

3.3.5 Case Study 5 (Hilly-Tourism): Dhapper-Bhaleydunga Ropeway

Project Description

Sikkim, situated in the Himalayan Mountain range, has a longstanding tradition of mountain worship, deeply rooted in the beliefs and practices of its people. This reverence symbolizes a commitment to the safety and prosperity of the land and its inhabitants. Devotees from the surrounding eleven blocks regularly journey to the hilltop for worship and to visit the millennium old Maenam Monastery, a site of profound spiritual importance. This is also a very popular tourist destination for trekking and attracts many from across the world. Reaching Bhaleydunga from Dhapper typically takes about 1 hour and 32 minutes. Traditionally, accessing the peak required a challenging 6-hour trek, limiting its accessibility to a broader audience.

The introduction of the ropeway in 2024 has significantly reduced travel time while offering passengers breathtaking views of the hilltop's stunning landscape. Ropeway has made Bhaleydunga Peak accessible to everyone, transforming it into a destination that can be easily reached by people of all age groups and fitness levels (Sikkim Herald). The extremely difficult terrain of South Sikkim had made it very difficult for any other mode of public transportation. The ropeway is an eco-friendly solution, minimizing the environmental impact.

Technical/Operational Specifications

Status: Operational, 2024
Type of System: MDG System
Total Length: 3.5 km
Number of Lines: 1
Average Speed: 5 m/s
Number of Cabins: 20
Capacity per Cabin: 8
Ticketing System: Physical Ticketing

Average Commute Time: 13 minutes
Number of Towers: 22
Free Span Between Towers: 166.67 meters
Number of Stations: 2
System Capacity PPH: 400
Operational Hours: 6 hours

Governance and Financing Specifications

Actual Cost: ₹ 210 crore (₹ 60 cr/km)
Finance/ Business Model: PPP
Tariff: ₹950 (₹135/km)
Growth Return: 34%
Central Scheme: PM-DevINE and Pradhan Mantri Gram Sadak Yojna (PMGSY)

Governing Agency: Department of Tourism and Civil Aviation, Government of Sikkim
Construction Company: POMA Group of France

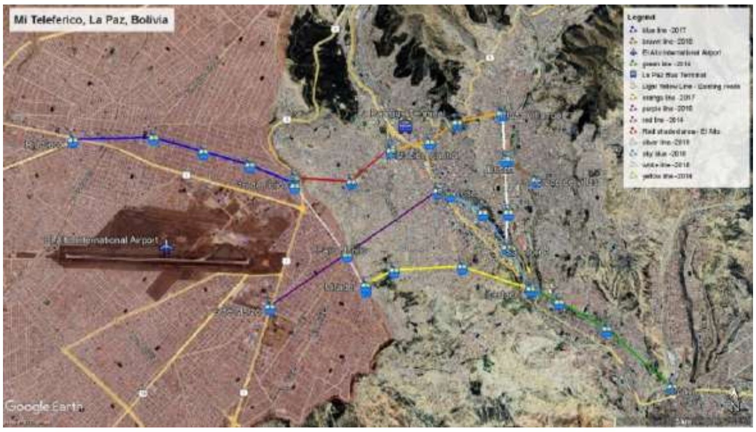
3.3.6 Specific Learnings from Indian Cases

<table>
<tr><th>Aspect</th><th>Specific Learnings</th></tr>
<tr><td>System Selection</td><td>Out of the chosen case studies, the system mostly employed is the Monocable Detachable Gondola (MDG) system, due to it being the most cost-effective alternative.</td></tr>
<tr><td>Governance, Institutional & Funding Mechanism</td><td>Ropeways are primarily managed by the government agencies, while the technicalities are handled through Public Private Partnership (PPP).
In the Guwahati-Umananda Ropeway case, which was state government financed on a turnkey basis, was proposed in 2003 and initiated in 2009. It opened in 2020 after an 11-year delay due to technical and archaeological hurdles, including ASI's denial of a tower on Urvashi Island.</td></tr>
<tr><td>Unit Cost</td><td><table>
<tr><th>Unit Cost (Cost/km) in ₹ Crores</th><th>Plain</th><th>Hilly</th></tr>
<tr><td>Urban</td><td>Varanasi - -₹120 crores</td><td>Shimla - ₹112.78 crores
Dehradun- ₹51.85 crores (20% of the number of cabins in Varanasi and Shimla)</td></tr>
<tr><td>Tourism</td><td>Guwahati - ₹30.81 crores</td><td>Sikkim - ₹ 60 crores (10 times more cabin than Guwahati)</td></tr>
</table></td></tr>
<tr><td>Safety Standards-</td><td>The Indian Ropeways are broadly governed by the Bureau of Indian Standards (BIS) and the Aerial Ropeways Act that empower the state governments to grant licenses for the ropeway projects.</td></tr>
<tr><td>Revenue Strategy</td><td>The tariff structure varies vastly with the tourist Ropeways having a higher cost than the urban mobility Ropeways. While both Varanasi and Shimla have the tariff per kilometer set between ₹6 to ₹8, the tourist ropeways vary between ₹100 to ₹135.
Ropeways catering specifically to tourism usually pose a higher fare as compared to the urban transport. Tourism operated cable cars leverage from the demand to produce additional revenue.
The Non-Fare Box Revenue is largely collected with advertisements displayed at the stations, alongside parking fees collected at the terminals.</td></tr>
<tr><td>Policy/ Legal Backing</td><td>The Varanasi pilot Ropeway Project is being developed under the Central Scheme of 'Parvatmala Pariyojna' while the Dhapper-Bhaleydunga Ropeway was developed under the Central Scheme of PM-DevINE.</td></tr>
</table>

3.4 International Case Studies

3.4.1. Case Study 1 (Hilly-Urban): Mi Teleferico- La Paz, Bolivia

Project Description



Mi Teleférico in La Paz, Bolivia, is one of the world's largest urban cable car networks, designed to tackle the region's transportation challenges and rugged terrain. The La Paz-El Alto metropolitan area, home to 2.8 million people, earlier faced severe mobility issues, with over 400,000 daily commuters traveling from El Alto to La Paz. The city's narrow streets and a single congested highway couldn't keep up with the tripling of vehicles between 2003 and 2012 (inclusiveinfra.gihub.org). An outdated public transport system with aging buses further worsened the situation, making commutes slow and inefficient. Launched in 2014, Mi Teleférico has emerged as a transformative and sustainable public transport solution, effectively addressing long-standing mobility challenges. Offering a fast, reliable, and eco-friendly alternative to road transport, the system delivers up to 80% time savings for commuters. It has also become an iconic symbol of innovation and urban development in La Paz and the surrounding areas.

Technical/Operational Specifications

Status: Operational

Type of System: MDG System

Total Length: 30.6 km

Number of Lines: 10

Average Speed: 5-6 m/s

Number of Cabins: 1398

Capacity per Cabin: 10

Headway (sec): 12

Ticketing System: Mobile Apps, Smart Cards

Average Commute Time: 12 minutes

Number of Towers: 254

Free Span Between Towers: 120 meters

Number of Stations: 25

System Capacity PPHPD: 29000 (3000/line)

Existing Demand: 270000 (60-70%)

Operational Hours: 16 hours

Governance and Financing Specifications

Actual Cost: $ 700-800 million USD

Finance/ Business Model: PPP

Tariff: $ 0.43 (one-way trip)

Governing Agency: Empresa Estatal de Transporte por Cable Mi Teleférico

Construction Company: Doppelmayr Garaventa Group

3.4.2. Case Study 2 (Plain-Urban): Aerovia, Guayaquil, Ecuador

Project Description

The Aerovia Cable Car System in Guayaquil, Ecuador, is a pioneering project designed to enhance urban connectivity by providing an alternative mode of transport between the cities of Guayaquil and Durán. Inaugurated in December 2020, the 4.1 km cable car system is the first of its kind in Ecuador and serves as an eco-friendly, time-efficient, and congestion-reducing transit solution. Developed as part of Guayaquil's integrated urban mobility plan, Aerovia addresses critical transportation challenges, including traffic congestion, pollution, and long commute times (time savings of about 60%). The 80 system consists of five strategically located stations, facilitating seamless movement across the Guayas River while complementing existing transport networks such as Metrovia (BRT) and pedestrian pathways (World Bank studies).



Technical/Operational Specifications

Status: Operational

Type of System: MDG System

Total Length: 4.1 km

Number of Lines: 1

Average Speed: 5 m/s

Number of Cabins: 154

Capacity per Cabin: 10

Headway (sec): 12-15

Average Commute Time: 12 minutes

Number of Towers: 27

Free Span Between Towers: 150 meters

Number of Stations: 5

System Capacity PPHPD: 2600

Existing Demand: 40000 (2200/hr)

Operational Hours: 18 hours

Ticketing System: No fare integration

Governance and Financing Specifications

Actual Cost: $ 134 million USD (32.6 mn USD/km)

Finance/ Business Model: PPP

Tariff: $ 0.70 USD ($0.17 USD/km)

Governing Agency: Aero Suspendido Guayaquil consortium

Construction Company: POMA Group of France

3.4.3. Case Study 3 (Plain-Urban): Mexicable, Mexico State, Mexico

Project Description

The Mexicable is an aerial cable car system in Mexico City, Mexico, designed to improve urban mobility in densely populated areas. Launched in 2016, it serves as an efficient and eco-friendly transportation solution, reducing travel times (time savings of about 60%) and enhancing connectivity for commuters in areas with limited road infrastructure. The system operates in Ecatepec, a municipality in the State of Mexico, and integrates with other public transport systems like the Metro and Metrobús. With modern gondolas, it provides a safe and scenic commute while promoting sustainable urban mobility.

Technical/Operational Specifications

Status: Operational	**Average Commute Time:** 20-35 minutes
Type of System: MDG System	**Number of Towers:** 100
Total Length: 13.2 km	**Free Span Between Towers:** 150 meters
Number of Lines: 2	**Number of Stations:** 13
Average Speed: 6 m/s	**System Capacity PPHPD:** 6000
Number of Cabins: 470	**Existing Demand:** 5200 (90%)
Capacity per Cabin: 10	**Operational Hours:** 18 hours
Headway (sec): 10-12	**Ticketing System:** Mobile apps, Smart Cards

Governance and Financing Specifications

Actual Cost: $ 220 million USD (18 mn USD/km)	**Governing Agency:** Mexiteleferícos. S.A
Finance/ Business Model: PPP	**Construction Company:** Leitner Group
Tariff: $ 0.40 USD (0.1 USD/km)	

3.4.4. Case Study 4 (Hilly-Urban/Tourism): Metrocable, Medellin, Colombia

Project Description

Medellín, Colombia, is renowned for its innovative urban mobility solutions, and the Metrocable system stands as a key example of how cable cars can transform transportation in a city facing topographical challenges. The Metrocable was introduced in 2004 as an extension of Medellín's existing metro system, designed to improve accessibility to the city's steep, isolated hillside neighbourhoods. The Metrocable system, in operation since 2004, consists of six lines serving as both a transportation network for residents and a vital link between neighborhoods and the central metro. As the world's first urban mass transit aerial cable car, it plays a crucial role in overcoming Medellín's challenging hilly terrain, where traditional public transport struggles. The system has helped reduce travel times (time savings of about 80%), ease traffic congestion, and enhance social inclusion by connecting marginalized communities to economic, social, and educational opportunities in the city centre.

Technical/Operational Specifications

Status: Operational
Type of System: MDG System
Total Length: 14.4 km
Number of Lines: 6
Average Speed: 5-6 m/s
Number of Cabins: 498
Capacity per Cabin: 10-12
Ticketing System: Mobile apps, Smart Cards
Operational Hours: 18 hours

Average Commute Time: 10 minutes
Number of Towers: 124
Free Span Between Towers: 120 meters
Number of Stations: 19
System Capacity PPHPD: 15,500 (2500/line)
Existing Demand: 40000 (80% of its capacity)

Governance and Financing Specifications

Actual Cost: $ 200-250 million USD (19 mn USD/km)

Finance/ Business Model: Publicly Funded Project with the Municipality of Medellín as the primary investor and jointly financed by Empresa de Transporte Masivo del Valle de Aburrá

Governing Agency: Empresa de Transporte Masivo del Valle de Aburrá

Construction Company: Pomagalski Columbia S.A.S

Tariff: Col $ 1,090- Col $4,150 (US $0.29-US $1.11)

Line L: Col $10,000 (US $2.67)

3.4.5 Case Study 5 (Hilly-Urban/Tourism): Singapore Cable Car, Sentosa, Singapore

Project Description

The Singapore Cable Car connects Mount Faber, HarbourFront, and Sentosa Island, offering stunning aerial views of the city and coastline. Mount Faber, one of Singapore's oldest parks, is a lush hilltop retreat with panoramic city and island views. HarbourFront, a bustling commercial hub, features VivoCity mall, cruise terminals, and business centres, serving as the gateway to Sentosa. Sentosa Island, known as the "State of Fun," is a premier resort destination with sandy beaches, adventure parks, luxury hotels, and attractions like Universal Studios Singapore and S.E.A. Aquarium. The cable car provides a scenic and convenient way to explore these popular destinations. Launched in 1974, the Singapore Cable Car was the first in Southeast Asia to span a harbor, offering a unique and scenic mode of transportation. In 2015, the system expanded with the Sentosa Line, enhancing connectivity within Sentosa Island. This second route links key attractions such as Merlion Station, Imbiah Lookout Station, and Siloso Point Station, providing easy access to Fort Siloso, Siloso Beach, and entertainment hubs. Complementing the Mount Faber Line, the Sentosa Line offers a convenient way to explore the island with breathtaking aerial views of its lush landscapes and vibrant attractions (biblioasia).

Technical/Operational Specifications

Status: Operational
Type of System: MDG System
Total Length: 2.6 km
Number of Lines: 2
Average Speed: 5 m/s
Number of Cabins: 118
Capacity per Cabin: 10
Ticketing System: Digital Online Platforms
Average Commute Time: 12 minutes
Number of Towers: 6
Free Span Between Towers: 350 meters
Number of Stations: 19
System Capacity PPHPD: 5000
Existing Demand: 5480
Operational Hours: 18 hours

Governance and Financing Specifications

Actual Cost: Mount Faber Line = SGD 8 million in 1974

Sentosa Lin = SGD 73 million ($28 mn/km) in 2015

Finance/ Business Model:

Mount Faver Line - Financed by a private consortium led by Singapore Cable Car Pte Ltd (through a Government grant from Singapore Tourism Board)

Sentosa Line - financed by Sentosa Development Corporation (SDC)

Governing Agency: The Mount Faber Leisure Group

Construction Company: Doppelmayr

Tariff: Mount Faber Line – SGD 29.7 for adults and SGD 19.8 for children

Sentosa Line – SGD 17 for adults and SGD 12 for children

3.4.6. Specific Learnings from International Case Studies

Aspect	Specific Learnings
System Selection	MDG have been widely incorporated, because of cost-effectiveness, urban and terrain versatility, and quicker installation process. Average length/ line- 3-4 kms for MDG
Governance, Institutional & Funding Mechanism	Different governance and financing models with institutional structure have been identified. Broadly, the pattern observed is that in the 2000s and early 2010s it was a government owned and operated model, either through a self-financing model or financing through credit. It was after mid 2010s that different forms of PPP arrangements were adopted. In the case of Medellin system, Colombia, it is interesting to note that it was the city government being the nodal institution which owned and operated the system. The construction and technical execution are often entrusted to the cable car manufacturers (POMA, Doppelmayr) through either a government entity or designated private partners.
Unit Cost	The terrain, number of elements (stations, towers, cabins etc.), and the location of the system impacts the unit cost of construction. However, there isn't much difference seen in the unit cost between hilly and plain terrains, with the cost for hilly terrain varying between $25-30 mn (INR 200 cr) and for plain terrain varying between $15-25 mn (for similar number of gondolas)
Safety Standards-	The ropeway manufacturers cum installers usually follow European cable car standard (CEN). Doppelmayr follows EN 12929, the European standard for the design, installation, operation, and maintenance of cableway systems. ISO 9001 – Quality Management; ISO 14001 – Environmental Management
Revenue Strategy	In addition to the farebox revenue, income is generated through ancillary services such as commercial rentals, parking facilities, advertising spaces, and branding opportunities, which is significantly contributing to the operational sustainability of the ropeway system. Tariff structures are designed to align with the system's purpose. Tourism-oriented cable car systems are seen to have a higher fare structure compared to urban transport systems, leveraging the tourism demand to generate additional revenue and support operational costs.
Policy/ Legal Backing	Most of the systems have a policy/ legislation backing, to support the planning, development and implementation of the ropeway systems.

CHAPTER 4

REGULATORY FRAMEWORK FOR ROPEWAY DEVELOPMENT

- Understand and assess the legal and policy framework governing the ropeways sector
- Institutional framework of ropeways and its comparison with other sectors

The development of ropeways in India has gained significant momentum as an alternative mode of transport, particularly in hilly and mountainous regions in the last few decades. To complement the same, the legal and regulatory framework have also evolved to ensure smooth administration process, safety of passengers, environmental sustainability in the development of Ropeway projects. Various States have framed legal and policy frameworks to govern the planning, approval, inspection, construction, operation and regulation of ropeways. This chapter explores and analyses the legal landscape in the matter relating to ropeway development and outlines various laws, policies, programmes and guidelines that govern the development of ropeway systems at central as well as state government level with a focus on the following aspects:

- **Legislative and Regulatory Framework:** Legislations that govern planning, approval, inspection, construction, operation and regulation of ropeway projects and the key authorities responsible in this regard.
- **Policy Frameworks:** Government initiatives and policies promoting ropeway infrastructure as a sustainable transport solution.
- **Environmental and Social Consideration:** The role of environmental and social regulations respectively in ensuring minimal disruption to ecosystems and protection of rights and welfare of the workers involved in the ropeway development

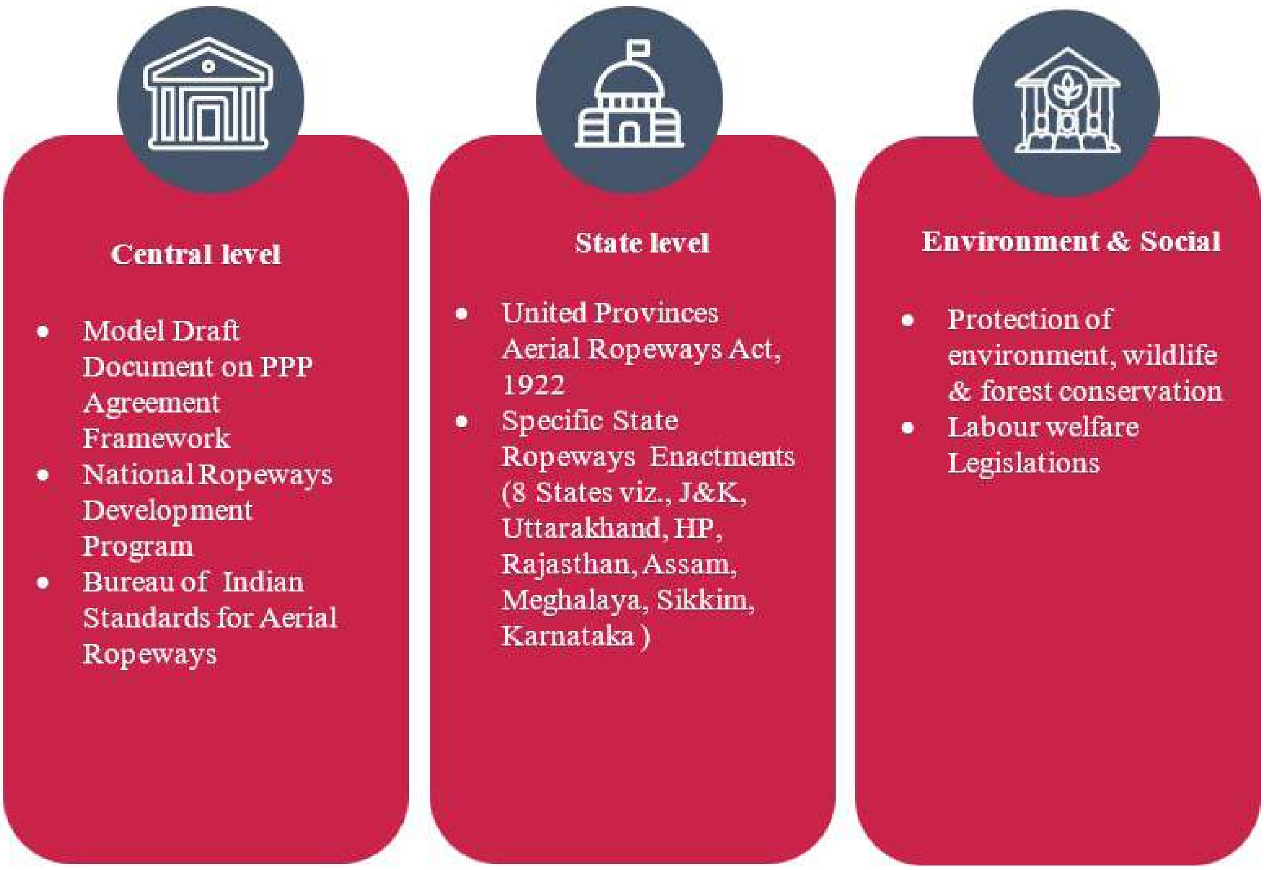


Figure: Public Sector Initiatives at Different Levels

4.1 INITIATIVES TAKEN BY CENTRAL GOVERNMENT TO PROMOTE ROPEWAYS

Model Draft Document on PPP Agreement Framework for Ropeways Development

Prior to 2018, the ropeways were developed with a focus of promoting tourism industry and as an alternative mode of transportation mainly restricted to hilly areas such as Himachal Pradesh, Uttarakhand and North-eastern states. NITI Aayog in 2018 released the draft Model Concession Agreement for development of Ropeways under a Public Private Partnership Framework on Develop, Build, Finance, Operate and Transfer (DBFOT) basis with the objective of guiding the State Governments on the quality and implementation of ropeways projects in the country. However, the model document is still in draft stage. This is a major step taken in the direction of guiding the State Governments in designing, engineering and implementing world-class ropeways infrastructure using private investment and standardization of the contractual conditions in relation thereto.

Like any other infrastructure project developed under the DBFOT model, the conditions provided in the model agreement obligate the private player to build the infrastructure, design the layout of ropeways, raise the finances for a project, operate and maintain the ropeways while focusing on passenger safety for a pre-determined period. On the expiry of the concession period, the entire ropeways system gets transferred to the public authority.

This model document for ropeways development is based on the best practices from other infrastructure sectors. The risk and responsibilities shared between the Public Authority and the Concessionaire (Selected agency) are akin to the risk sharing envisaged in development of other core infrastructure projects. Annexure 3A provides the risks shared between government and private entity as provided in the Ropeways Model Draft Document.

However, unlike the model documents issued by NITI Aayog for other sectors such as roads, ports, and airports, the technical section of this document requires further refinement. This is due to the fact that the standards and specifications, safety regulations, maintenance requirements, etc., specific to ropeways are not well developed in the document. Moreover, much more needs to be done in the sector as a whole from a regulatory standpoint. At present the draft agreement provides for the European CEN standards in the development of ropeways to ensure safety and quality services to the users.

It is relevant to note that the National Ropeways Development Programme, which was launched after the FY 22-23 central budget, envisages development of the ropeways projects under Hybrid Annuity Model (HAM). In HAM, unlike DBFOT model, the financial risk and demand risk are vested with the Government, since the major funding for the Project is by the Government. Accordingly, the current Ropeways Model Concession Agreement, which is based on the DBFOT model, is not in line for implementing ropeways projects being developed under the National Ropeways Development Programme.

The model document is meant to be used where the development of Ropeways is undertaken on PPP –DBFOT framework. Ropeways projects under the ongoing Parvatmala scheme are being developed under the PPP-HAM Model.

National Ropeways Development Programme:

The National Ropeways Development Programme also known as the "Parvatmala Pariyojana" was announced in Union Budget 2022-23. The primary objective of the programme is to promote the development of ropeways as an alternative mobility solution in the challenging terrains like hilly areas and remote locations and aimed to de-congest urban centres where conventional mass transit system is not feasible. The initial focus of the programme thus includes regions such as Uttarakhand, Himachal Pradesh, Manipur, Jammu & Kashmir and the other North-Eastern states.

A Ropeway project under this programme can be implemented through PPP (Public Private Partnership) Hybrid Annuity mode with around 60% contribution support by Government of India. National Highway Logistics Management Limited (NHLML), a special purpose vehicle of the National Highway Authority of India (NHAI) is the nodal entity to implement the programme, which aims to develop more than 250 projects with Ropeway length of over 1,200 km. in 5 years.

Under this scheme, amongst other ropeway projects, a ropeway connecting Varanasi Cantt to Godowlia Chowk, Varanasi in Uttar Pradesh covering 5 stations with total length of 3.85 km are planned. This is the first urban ropeway project catering to the urban public in India and Varanasi will be the first Indian city to use ropeway for public transport. This pilot project initiated under the scheme is expected to be a benchmark in promoting ropeway as the means of urban transport. Thus, though the focus of the programme is to provide last mile connectivity in the hilly areas, the projects like Varanasi Cantt to Godowlia Chowk, Varanasi in Uttar Pradesh shows the intention of Government take up the ropeway projects to provide an alternative mass transit solution across the busy urban roads, and also emphasises on one of the objectives of the Parvatmala Programmes i.e. development of ropeway projects within the urban centres where the mass transit system is not found to be feasible.

The Ropeway project under the Parvatmala scheme are implemented through PPP mode with around 60% contribution support by Government of India. Ropeway connecting Varanasi Cantt to Godowlia Chowk in Uttar Pradesh is the first urban ropeway project being implemented under this scheme in India.

Safety Standards Of Ropeways

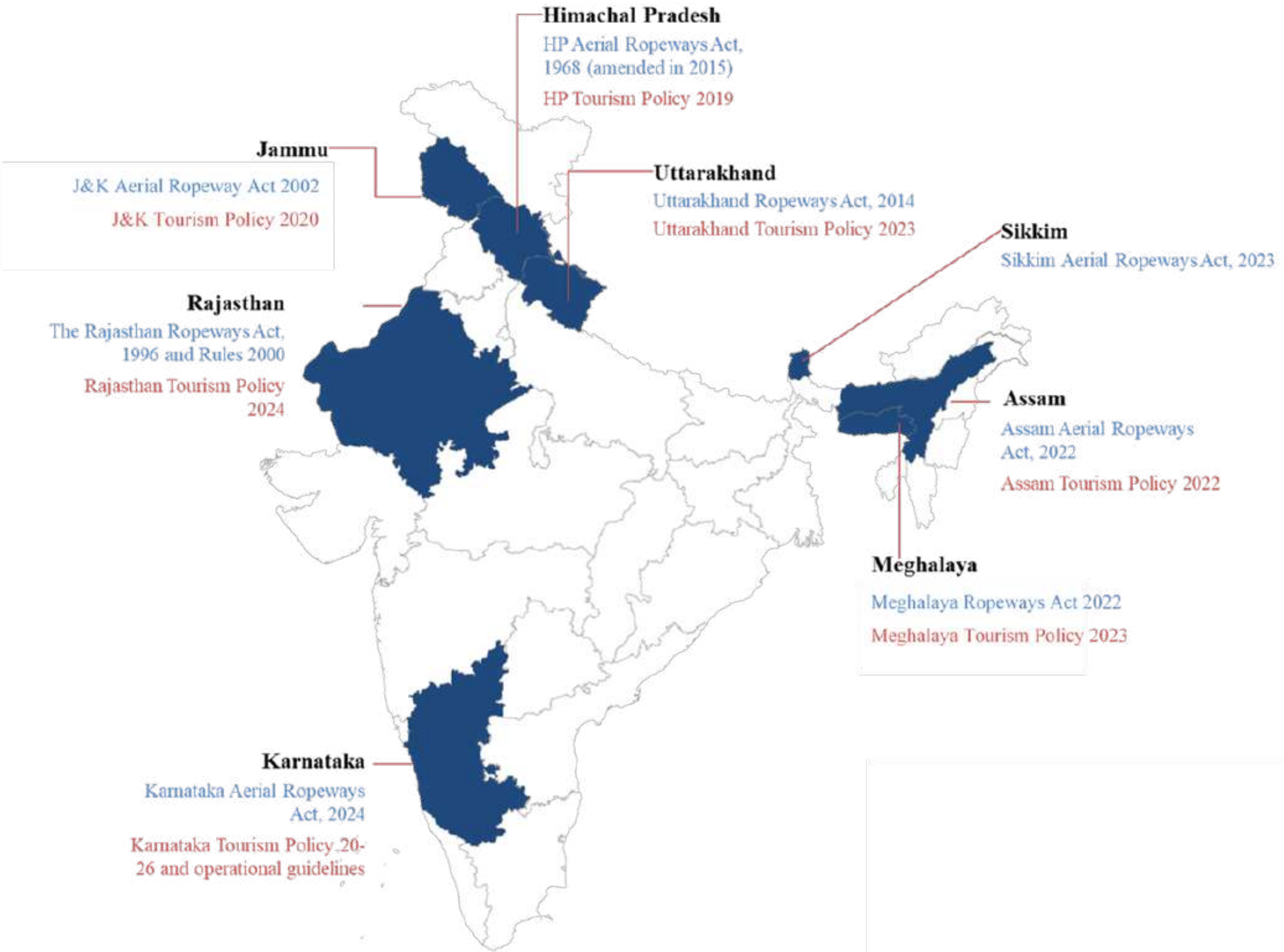
Ropeway safety standards are crucial for ensuring the safe operation of cable cars or gondolas. These standards regulate all aspects from design and construction to maintenance and emergency protocols, aiming to reduce risks such as mechanical failures or passenger accidents.

While international frameworks like ISO and CEN offer general guidance, countries adapt them based on local needs. The Indian safety standards in India are regulated by the Bureau of Indian Standards (BIS). Ropeways for installations have to comply with the necessary certifications listed by BIS. Approval at each step is not required according to the safety standards. Certifications are provided after a detailed review of the project's design, construction and maintenance protocols. BIS lists standards for welding that need to be conducted, along with specifications on standards for haulage rope and mechanical components. Testing post-installations are not followed by BIS.

4.2 LEGAL FRAMEWORK AT STATE LEVEL

The **United Provinces Aerial Ropeways Act, 1922** is one of the first legal framework which particularly addressed aerial ropeways in India, which laid down the foundation for future ropeways legislative and regulatory development in the country. This Act was introduced during British India in response to the increasing use of aerial ropeways, especially for transporting goods and passengers in hilly and mountainous region where traditional transport infrastructure was difficult and expensive to develop. The Act regulated the establishment and operation of aerial ropeways in the United Provinces (now part of Uttar Pradesh and Uttarakhand) and formalizes the operation of aerial ropeways, ensuring their safety, and providing a framework for their use in the region. Following the United Provinces Aerial Ropeway Act, 1922, several other states, especially sates with hilly and mountainous terrain, have passed similar enactment from both transport and tourism point of view, to regulate the construction and operation of aerial ropeway systems.

Considering States which have the operational ropeways and where the legal frameworks are in enforcement following eight states and their respective governing laws are considered for the purpose of studying the legal framework relating to ropeway at the state level in this chapter.



While the overall legal framework provided under each of the enactment studied remains similar, the institutional framework is found to be varying. *Annexure 3B* shows the organizations responsible for development of ropeway projects in their respective States under each of the States under the study and also gives the functions of each such institution set up. The following are the key observations based on the analysis of the state level legislative framework.

- Licensing authorities constituted under each of the State Act, are primarily responsible for issuing license for construction of Ropeways and fixing of tariff. Licensing being a critical role considering the complex nature of the ropeway system, it is preferred to be entrusted with the state level body having technical expertise in the ropeway operation. However, it is seen that in a few of States, the District Magistrate is the licensing authority.
- A planning authority plays a very important role in ensuring orderly and systematic development of ropeways in a given jurisdiction. It is important to have a planning authority at the state level to advise and guide on the execution of ropeway projects to ensure their alignment with the long-term development plans of the State, both from the transport and tourism point of view. The study shows that not much emphasis is given on the planning aspects in the legislation and the planning of ropeway development are restricted to municipal level. Only two of the States viz. Meghalaya and Karnataka under this study have a planning/advisory authority constituted at the state level.
- For attracting private investments in the ropeway sector, it is essential to have a streamlined approach for development of ropeway under PPP framework. For a private entity to do its business in ease, the approval and regulatory processes for ropeway development must be facilitated under one roof. The need for such a single point agency arises from the complexities involved in navigating multiple regulatory, legal, and administrative processes required for ropeway projects. Having such a single agency enhances investors' confidence, ensures transparency, reduces delay and is both time and cost effective. The legislative analysis shows that only two of the States viz. Uttarakhand and Rajasthan under the study envisages having such a single agency for facilitating approvals and clearances.

As mentioned earlier, the overall coverage under each of the enactments studied is mostly found to be common across the enactments. The broad provisions covered under the legislation in this regard from the Ropeway development point of view are given below.

Approval for Primary survey	• Intended promoter of Ropeway seeks approval of the Licensing Authority for undertaking preliminary survey for the proposed Ropeway and upon approval, undertakes Preliminary Survey
Application for License	• Application by the Promoter to Licensing Authority for grant of license for undertaking construction of proposed ropeway along with the details captured as part of the preliminary survey.
Grant of License	• Issuance of license for construction of ropeway by Licensing Authority after following due process and giving hearing opportunity to the owner/ occupiers of the land over which the ropeway route is proposed.

Construction and Maintenance	• Construction and maintenance of ropeway by the Promoter, subject to conditions of the License granted in this regard and applicable land acquisition laws
Approval to commence operation	• On completion of construction and on on the recommendation of Ropeway Inspector/Expert Committee on fitness of the ropeway, approval by Licensing Authority to commence operation.
Operation of Ropeway and fixation of Tariff	• Commencement of Commercial operation of Ropeway by the Promoter while ensuring the safety requirement and fixation of tariff based on the tariff range given by the License Authority.

Apart from the above, the provisions relating to handling of emergency situations, dis-continuation of ropeway operation, purchase of ropeway by State or local authority and penal provisions for non-compliance of legal provisions by Promoter etc. are provided in each of the legislations under study. The detailed discussion and analysis on the coverage of the legal enactments along with the comparison of provisions of the States under study are provided in *Annexure 3C*.

4.3 POLICY FRAMEWORK AT STATE LEVEL

Policy guidelines on Ropeway development across the States are specifically focused from tourism point of view and mostly it is the State tourism policies which provide policy guidelines on development of ropeway and encourages its implementation to attract tourists and enables access to remote tourist destinations. The policies generally envisage extending certain benefits including capital subsidy, allotment of government land, concessions on stamp duty/conversion/ development/land use change charges and other fiscal incentives. The present tourism policies of each of the States under the Study and its coverage from a ropeway point of view are briefly provided in *Annexure 3D.*

4.4 ENVIRONMENT & SOCIAL MANAGEMENT LEGISLATION

The commissioning of any development project including ropeway projects can lead to significant impacts on environmental resources of the project area and its surroundings. An aerial ropeway project can result in a wide range of impacts on the environment through pre-construction and construction activities, reclamation, excavation, O&M etc. As such, it is essential to have a sound legal and regulatory framework to ensure environmental soundness and sustainability in project implementation.

Considering the same, legislations with respect to environmental and social management applicable to the ropeway project is reviewed and the recent amendments made in this regard are discussed below.

Sl No	Legislations	Relevance to the Development of Ropeway Project
1.	Environment (Protection) Act, 1986	Central Government in pursuance of this Act has taken various measures necessary for matters relating to environmental protection, which includes implementation of nationwide programmes and plans, providing environmental quality standards and formulation of Rules specific to environment variables.
2.	EIA Notification, 2006 issued by the MoEF, Govt. of India	The EIA guidelines were promulgated by MoEF, Govt. of India to make Environmental Clearance (EC) mandatory for the establishment, expansion or modernisation of any activity or for setting up new projects. The Aerial Ropeway which was under the activity 7 (g) of the EIA notification, 2006 and requiring EC, was however excluded from the purview of the Act through Notifications No. S.O. 1953(E) dated 27th April, 2022. To ensure environmental safeguard both during the construction and operation of Aerial Ropeways, the said notification provides following guidelines to the promoter of the ropeway. • Obtain all the required statutory clearances and comply with the provisions of all necessary acts/rules including procuring approval from the Competent Authority on Disaster Management Plan under the Disaster Management Act. • Undertake plantation with heavy foliage, broad leaves and wide canopy as per applicable state law. • Provide Appropriate Air Pollution Control (APC) system and comply with noise level standards to comply prescribed standards (both during the construction/operation). • Provide Diesel power generating sets as a source of power backup. • Undertake wastewater treatment to avoid its discharge in open area. • Adopt energy conservation measures to reduce the carbon footprint. • Implement a detailed traffic management and a traffic decongestion plan. • Undertake annual self-environmental audit and external audit.
3.	File No. 11/137/2024-FC issued by Ministry of Environment Forest and Climate Change (FC Division) dated November 2024	Keeping in mind larger public interest and eco-friendly nature of the ropeways, through this notification, the ropeway project constructed in hilly areas of the country were excluded from application of the Forest Conservation Act, 1980. This exclusion is however applicable only for hilly areas and is subject to fulfilment of the following key conditions set out in F. No. 5-2/2017-FC dated 05.08.2019.

Sl No	Legislations	Relevance to the Development of Ropeway Project
	File No. 11/137/2024-FC issued by Ministry of Environment Forest and Climate Change (FC Division) dated November 2024	• The dispensation shall be allowed for construction of public utility ropeways, • The lowest point of the proposed ropeway shall be at least 5 meters above the tree line. The forest area under ropeway passage shall not be included in the total area requested for diversion for the project under the provisions of FCA 1980. • The forest area under the terminal stations and intermediate line towers shall be considered for diversion under the provisions of FCA 1980. • The user agency will have no claim on the forest land under the ropeway. • Permission of laying the ropeway above 5 meter of tree line do not give any right to the user agency to use the forest land, under the ropeway, for any non-forestry purpose in future without approval under Forest (Conservation) Act, 1980.
4.	The Forest (Conservation) Act, 1980 and the Rules made thereunder (FCA)	Where the ropeway project is planned to be developed on any forest land, the Act provides for payment of compensatory afforestation for the land that is diverted and Net Present Value (NPV) by the user agency as compensatory levy. However, Public utility ropeways have been excluded from the ambit of the FCA, subject to the conditions provided in F. No. 5-2/2017-FC dated 05.08.2019 (specific to Himachal Pradesh) and later through File No. 11/137/2024-FC by Ministry of Environment Forest and Climate Change dated November 2024 (applicable to all other projects in hilly areas of the country) as discussed in S.No. 3 above.

Apart from the above legislations, other legislation as discussed in *Annexure 3E* are required to be adhered in development of ropeway project from environment protection and labour welfare perspective.

4.5 INSTITUTIONAL FRAMEWORK

The institutional structure of the ropeway sector refers to the various organizations, authorities, and regulators that govern the planning, development, operation, and safety of ropeway systems. A number of institutions both at Central and State level are established for the planning and execution of ropeway projects in India, which are discussed in this part of the report.

Existing Central Institutional Framework

Ropeways being a State subject under the Constitution of India has not seen any push from Central Government until recently. The sector got a major boost with the "Parvatmala scheme/ National Ropeway Development Programme" which was initiated pursuant to an announcement in the Union Budget 2022-23. The Ministry of Road Transport and Highways (MoRTH) is made responsible for implementing ropeway projects under this Programme by means of an amendment to the Government of India (Allocation of Business) Rules 1961. The National Highways Logistics Management Limited (NHLML), which is a 100% subsidiary of the National Highways Authority of India (NHAI), is the implementing agency for development of all the ropeway projects in the country. All the projects under the scheme are being implemented through PPP arrangement, between the NHLML and the private entity (Concessionaire).

Existing State Institutional Framework

Having listed under item number 13 of schedule 7 under the State list of the Constitution, the ropeway sector is predominantly governed by State legislations as discussed above. The institutions for governing the development of ropeways are also prominently at State level and they regulate aspects such as planning, licensing, monitoring, coordinating and implementation of Ropeway Projects. The role and responsibilities of these institutions in this regard prevailing under each of the States under the study are covered as part of Section 3.2 of this chapter and are further detailed in *Annexure 3B.*

Comparison of Institutional Framework of other core sectors with Ropeway

(i) PORTS

The Indian Ports Act, 1908 classifies ports into Major Ports and Minor Ports. Under Schedule 7 of the Indian Constitution the subject matter relating to Major Ports clearly falls under the ambit of Union list and that of the minor ports are under the State list. The institutional framework relating to port sector in India also reflects the said constitutional mandate. Major Ports in India comes under the control of the Central Government, while Minor Ports are under State Government jurisdiction. The key stakeholders in this regard are discussed below.

- **Ministry of Ports, Shipping and Waterways (MoPSW):** MoPSW is responsible for the making of policies, regulations, and standards for the maritime sector, including port operations and its development. Initiatives such as the 'Sagarmala Programme', 'Amrit kaal 2047', Vision Plan on Port Sector in India, by the Ministry focus on overall port-led development in the country.
- **Major port authorities:** Constituted under the Major Port Authorities Act, 2021 these authorities are made responsible for administration, control, and management of the Major Port under their jurisdiction. Presently there are 12 such Major Port Authorities[15].
- **Tariff Authority for Major Ports (TAMP):** Prior to the enactment of Major Port Authorities Act, 2021, the Major Ports were governed under the Major Ports Trusts Act, 1963 wherein the Tariff Authority for Major Ports (TAMP) was constituted to regulate the tariffs for major port trusts. However, with the enactment of Major Port Authorities Act, 2021, the TAMP has been abolished and its powers are passed on to the Board of Major Port Authorities (successor of Board of Trustees of Major Port). As such at present, the Major Port Authorities have the power to set tariffs as per market conditions.
- **Maritime Boards:** All the maritime States have set up Maritime Boards as a governing and regulatory body responsible for the administration, development, management including tariff regulation of maritime infrastructure related activities in their respective States viz., Maharashtra Maritime Board, Gujarat Maritime Board, Karnataka Maritime Board etc. These Boards are under the administrative control of the concerned state department.

15 Deendayal Port, Mumbai Port, Jawaharlal Nehru Port, Mormugao Port, New Mangalore Port, Cochin Port, V.O. Chidmabaranar Port, Chennai Port, Kamarajar Port, Visakhapatnam Port, Paradip Port and Syama Prasad Mookerjee Port

- **Minor Ports:** There are about 213 non-major ports managed by and under the control of the respective State Maritime Boards.

Major Ports	Minor Ports
Central Government	State Government
Ministry of Ports, Shipping and Waterways	State Maritime Boards/State Gov Department
Major Port Authorities	Non-major Ports

Ropeways being the subject item under the State list are governed by the State Governments. Like Sagarmala programme, the Parvatmala Programme focuses on overall ropeway development in the country. To promote ropeways as an alternate means of transportation, like Amrit Kaal 2047 it is suggested to have a vision document aiming at holistic development of ropeways sector in India which focuses on establishing ropeway as safe, sustainable and efficient means of transportation.

(ii) AIRPORTS

Under Schedule 7 of the Indian Constitution the subject matter relating to Airways; aircraft and air navigation; provision of aerodromes; regulation and organization of air traffic and of aerodromes etc. falls under the ambit of Union list (item 29) and as such the subject relating to "Aviation" is governed by the Central Government.

In India, the Ministry of Civil Aviation (MoCA) leads the institutional framework for the airport sector and is responsible for formulation of policy and regulation, planning and implementation of schemes for the growth and expansion of civil air transport, airport facilities, air traffic services and carriage of passengers and goods by air. Various statutory bodies are constituted under the administrative control of MoCA each being made responsible for key aspects such as safety, security, tariff regulation and project execution in connection with the sector.

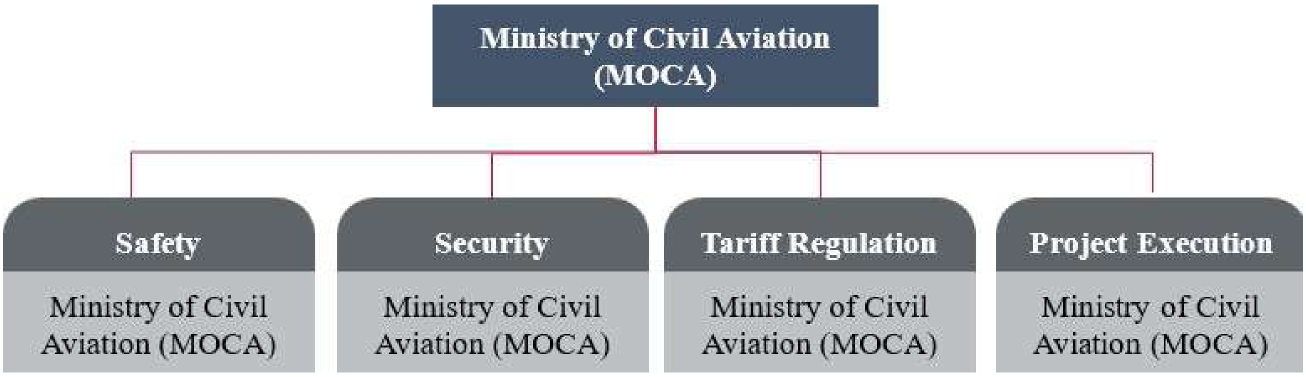
(i) **Directorate General of Civil Aviation (DGCA)** - Primarily governs the matters relating to safety issues and is responsible for regulation of matter in this connection such as air transport services, air safety and airworthiness standards etc.

(ii) **Bureau of Civil Aviation Security ("BCAS") -** Mainly responsible for laying down standards and measures with respect to security of civil flights, Aviation Security Standards for airport operators, airlines operators and matters relating to planning and coordination of aviation security.

(iv) **Airport Economic Regulatory Authority ("AERA")** - AERA determines the tariff for aeronautical services, other airport charges for services rendered at major airports and is also responsible for monitoring the performance standards of the airports.

(iv) **Airports Authority of India ("AAI") -** AAI is responsible for Design, Development, Operation and Maintenance of international and domestic airports and civil enclaves.

Though all these institutions are under the Central Government, the State Governments are also considered as one of the key stakeholders in the civil aviation sector and are responsible for providing land for airport development along with other inter-linking infrastructure facilities. State Governments often provide fiscal incentives by way of exemption from state taxes and other assistance that they deem fit.



Both aviation sector and ropeway sector rely on sophisticated technology and safety standards to ensure efficient services and safety of the passengers. Considering the same, similar to the institutional structure of aviation which provides a separate entity like DGCA at the center, it is useful to have a government agency at the center which can monitor the advancements in ropeway technology (e.g., automated systems, remote monitoring, energy-efficient designs) and set standards for adopting innovative technologies to improve safety and efficiency. The said agency can provide standardized safety protocols for design, construction, inspection, operation, and maintenance of ropeway.

(iii) METRO RAIL

Metro railway is a "railway" as per List 1 Entry 22 of the Constitution and are as such implemented as a central sector projects. The implementing structure and institutional mechanism adopted for development of metro projects in India has been varied in nature. While the metro projects in cities like Delhi, Bangalore, Chennai and Kolkata (east west corridor) are taken up by the joint ownership SPV of Central Government (Ministry of Urban Development) and concerned State Government, the Jaipur metro (Stage I) is by 100% state owned SPV and Kolkata (North South corridor) is central owned SPV (Ministry of Railway). All metro rail projects are covered under legislations such as the Metro Railways (Construction of Works) Act, 1978; the Metro Railways (Operation and Maintenance) Act, 2002; and the Railways Act, 1989.

As per the Allocation of Business Rules of the Government of India regarding rail based urban transport, the Ministry of Housing and Urban Affairs is the nodal agency for policy and planning at the national level while the technical planning and safety is the responsibility of the Ministry of

Railways. Further, the Ministry of Railways is also responsible for providing safety certification and technical clearances for the metro systems.

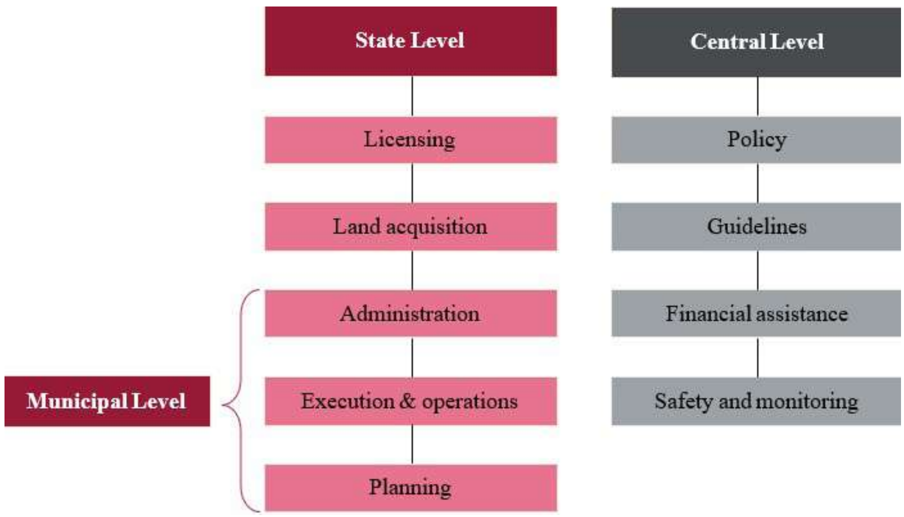
Metro rail in India comes primarily under governance of Ministry of Housing and Urban Affairs, which carries out policy and planning activities for the sector. From the safety and technical perspectives, the Ministry of Railways takes the responsibility of certifying and giving technical clearances. Similarly, with respect to Ropeways sector it is suggested that the urban planning aspect of Ropeways could be guided through policy guidelines by the Ministry of Housing and Urban Affairs.

Suggested Institutional Framework for Ropeways

Based on the analysis of the institutional framework of the above discussed infrastructure sectors and considering that Ropeways is a state subject, it is felt that aspects such as planning, administration (including land acquisition), licensing, execution and operations of ropeways are better governed at the State Government level. This is also because the Ropeways project being considerably smaller in size compared to the other core infrastructure projects like port, airport and metro, the local authorities are placed in a better position to understand and manage the development of ropeway projects. Unified Metropolitan Transport Authorities. a state level planning authority, established with the purpose of overseeing the integrated and holistic planning of all modes of urban transport can be made responsible in this regard to plan and advice implementation of urban ropeway transport programme/projects from a larger urban development strategy point of view for the State.

However, considering that the ropeway is still in the nascent stage of being recognized as the mainstream urban transport, it is prudent to provide support from the Central Government in terms of guidelines, policy, planning and funding/financial assistance.

Further, since various technologies for development of ropeway are emerging and different safety standards such as BIS, European Standards and American Standards are available, it may be prudent to have a centralized safety agency to formulate, monitor and evaluate the ropeway projects.



CHAPTER 5

FINANCIAL FEASIBILITY ASSESSMENT FOR ROPEWAYS IN URBAN CONTEXT

- Financial feasibility assessment for the urban ropeway
- Project structuring framework and sensitivity analysis

Background for Financial Feasibility Analysis

Aerial ropeways are emerging as a viable mode of public transport, beyond their traditional use for tourism in hilly regions. In terrain-constrained cities and complex urban areas, they offer a technically feasible solution—but their adoption must also be financially viable when compared to existing systems. This is especially relevant in middle-income countries, where limited public funds necessitate private sector participation to bring in efficiency and innovation.

Involving private players brings the focus on project viability and returns on investment. This chapter outlines the financial assessment framework for promoting and implementing urban ropeways through private participation, while also considering the broader economic benefits of government-led initiatives.

5.1 Context for Financial Assessment

Based on the case studies from the earlier section, the Monocable Detachable Gondola (MDG) system has been identified as the most commonly employed technology for ropeway projects in India, primarily due to its cost-effectiveness and operational efficiency. This system is also well-suited for medium-distance urban transport, offering a practical solution for areas with high traffic congestion.

One of the key operational constraints of the MDG system is its maximum feasible length of 4 km for a continuous linear length, since the system is ropeway propelled, compared to the other metro rail which are self-propelled and can transit for longer distances. The MDG system can handle maximum passenger capacity of 4,500 PPHPD (Passengers Per Hour Per Direction), making it a significant addition to urban mobility solutions by easing congestion and offering a high-capacity transit option.

Beyond ridership capacity, fare structure plays a critical role in determining the adoption of urban ropeways as a primary transport mode. Since urban ropeways are designed to function as an alternative to public transport, affordability directly influences commuter preferences. High fares for public transport may discourage usage, reducing ridership and limiting the system's effectiveness in alleviating congestion. Daily commuters, who form a significant portion of public transport users, are particularly sensitive to fare pricing, making affordability a key determinant of success.

Unlike premium transit services, urban ropeways are intended to complement and integrate with existing public transport networks, rather than operate as standalone, niche services. However, pricing flexibility is limited due to the high price elasticity of demand in urban transport systems. Studies and global trends indicate that even a modest fare increase can lead to a significant drop in ridership. Therefore, it is essential to strike a balance between financial sustainability and affordability, ensuring that fares remain competitive to encourage widespread adoption.

An appropriately priced ropeway system can attract passengers who might otherwise rely on personal vehicles, contributing to reduced traffic congestion and lower urban emissions. Conversely, if fares are not competitive with existing public transport options, commuters may opt for alternative modes, undermining the ropeway's effectiveness as a sustainable transport solution. To better understand how urban ropeways compare in terms of affordability, the below table presents a comparative analysis of fare structures across different public transport modes in Bengaluru.

Table: Comparative Analysis of Fare Structure

	Rate in Rs. for 4 km	Remarks
Metro	20	Rs. 5 per km
Public bus	15	Rs. 5 for two kilometers
Taxi	100	Rs. 100 for first 4 kilometers
Auto	60	Rs. 30 for the first 2 kilometers

Based on this analysis, the proposed fare for an urban ropeway over a 4 km stretch is assumed as Rs.20, aligning it with the metro fares, to ensure affordability and encourage adoption among daily commuters. This fare is considered reasonable given that the average inter-station distance on the metro is approximately 1 to 1.2 km, with fares typically starting from Rs.10 and increasing with distance (for a 4 km trip is approximately Rs 20). Hence, a 4 km ropeway fare of Rs.20 places it at par with metro fares for similar distances; ensuring users perceive it as a viable, cost-effective mode of transport. Moreover, based on commuter behaviour, ropeways are expected to be attractive for trips longer than 2 km, making Rs.20 an appropriate average fare for the feasible trip length.

Currently, commuters use the feeder system such as autos or other intermediate transport modes to travel to and from major public transit hubs. These feeder modes have higher costs than the alternative intermediate public transport modes currently available, especially over short distances. Introducing a ropeway as a direct, feeder service to any major transport node could significantly reduce end to end trip cost involving multi-modal transit. By integrating the ropeway into the urban transit ecosystem at an affordable rate of Rs.20, commuters benefit from seamless, end-to-end connectivity with reduced overall travel costs and greater convenience, thereby enhancing the appeal and effectiveness of public transport.

With respect to the MDG system cost, the case studies presented in the earlier chapter indicate that the estimated cost of implementing the MDG system is approximately Rs.100 crore per kilometre. This estimate excludes certain additional expenditures, such as the cost of utility shifting, statutory approvals, land diversion (if applicable), right of way (RoW) compensation for a 16-meter-wide corridor, and the cost of implementing fire protection measures for houses located directly under the alignment that may be prone to fire hazards. Of the total construction cost, approximately 60% is attributed to electromechanical components. These include critical system elements such as cables, carriers, grips, drive motors, bull wheels, towers with sheave assemblies, control panels, and the control room. The remaining 40% covers civil components, which primarily consist of infrastructure development at station and tower locations, including the construction of platforms, access facilities, and any integrated commercial development within the ropeway station premises.

The table below compares the per-kilometre cost of various urban public transport systems, including ropeways, light rail, metro rail, monorail, BRTS and suburban rail.

Table 1: Comparative Analysis of per-kilometre cost of Various Urban Public Transport Systems

Sl. No	Urban Public Transport Systems	Unit Cost (Cost/km) (in cr.)
1	Ropeway (MDG)	60-150
2	Metro Neo	80-100
3	Metro Lite/ LRT	120-150
4	Metro Rail	200-600
5	Monorail	100-200
6	Bus Rapid Transit System (BRTS)	20-40
7	Suburban rail	100-120

From this comparison, we understand that metro rail projects are significantly more expensive, with per-kilometre costs ranging between Rs.200 crore and Rs.600 crore (this wide cost variation is attributed to the system either being overhead or underground). On the other hand, the Bus Rapid Transit System (BRTS) is the most cost-effective option, with costs ranging from Rs.20 crore to Rs.40 crore per kilometre.

Metro Neo, while more affordable than traditional metro systems, costs between Rs.80 crore and Rs.100 crore per kilometre making it more expensive than BRTS. Among the remaining transport systems, all have per-kilometre costs exceeding Rs.100 crore, except for ropeways (MDG), which have a relatively lower cost range of Rs.60 crore to Rs.150 crore, making the ropeway a relatively cost-effective solution in the context of urban mobility infrastructure.

Financial Analysis

The financial analysis aims to evaluate the project's ability to recover initial investments and meet recurring costs, ensuring long-term financial sustainability. The assessment is based on key assumptions derived from case studies, as outlined in the background section. These assumptions help establish a realistic framework for analysing the project's revenue potential, cost structure, and overall financial feasibility.

Key profitability indicators, such as the Internal Rate of Return (IRR) and Net Present Value (NPV), have been assessed against industry benchmarks and threshold values to determine the project's attractiveness, particularly from a private sector investment perspective. Additionally, the analysis considers critical financial parameters, including the proposed funding mix and user charges, to assess the overall financial viability of the project.

This chapter, therefore, provides a comprehensive financial assessment to determine the project's viability, ensuring that the investment is justified and aligned with long-term financial sustainability.

The financial feasibility of the project is carried out for a period of 30 years including 2 years for construction.

Project Cost Assumptions

The estimated cost for the MDG system is approximately Rs.100 crore per kilometre. During construction, the estimated cost is subject to escalation and other associated cost like contingency, administrative expenses and Interest during construction are factored in for arriving the total project cost.

Table 2: Total Project Cost

Sl. No	Project Components	Landed Cost (in Rs. lakhs)
1	Cost of Civil Components	16,772
2	Cost of Electromechanical Components	25,157
3	Cost of Ropeway Construction	41,929
4	Contingency @ 5%	2,096
5	Administrative Cost & Pre-op Expenses @ 2 %	839
6	Financing Charges @ 2%	839
7	Hard Cost	45,703
8	Interest During Construction	897
	Total Project Cost	46,600

The indicative total project cost for a 4 Km aerial ropeway is arrived at Rs. 466 Crore which is about Rs.116.5 Crore per km.

Project Financing Assumptions

For the initial financial assessment, the funding has been assumed through a combination of debt and equity. The associated cost of capital and the repayment period for the debt component is detailed in the table below.

Table 3: Financing Assumptions

Sl.No	Particulars	Unit	Value
1	Equity	% of TPC*	30%
2	Debt	% of TPC	70%
3	Interest Rate	%	11.0%
4	Equity Returns		15.0%
5	Weighted Average Cost of Capital (WACC)	%	10.26%
6	Repayment Period	Years	10
7	Repayment start date	Date	1-Apr-27
8	Repayment end date	Date	31-Mar-37

Sl.No	Particulars	Unit	Value
Tax			
9	Corporate Tax Rate	%	25.17%
Depreciation			
Useful life of Building			
10	Civil Works	Years	30
11	Plant & Machinery	Years	15
As per Companies Act 2013 - SLM			
12	Civil Works	%	3.33%
13	Plant & Machinery	%	6.67%
As per Income Tax Act 2013 - WDV			
14	Civil Works	%	4.87%
15	Plant & Machinery	%	40.00%

**TPC: Total Project Cost*

Revenue Assumptions

The financial viability of the urban ropeway project is largely dependent on its ability to generate sustainable revenue streams. The assumptions underlying the revenue streams are critical for estimating the project's financial performance and long-term sustainability. The primary source of revenue would be through the fare-box revenue and the non-fare-box revenues that may arise from the project are not considered for evaluating the financial assessment.

Table 4: Revenue Assumptions

Sl.No	Particulars	Unit	Value
1	Maximum Design Capacity	PPHPD	4500
2	Initial Utilization	%	30
3	Initial Traffic	PPHPD	1350
4	Tariff	Rs.	20
5	Escalation in Tariff	%	5
6	Periodicity of increase in Tariff	Year	3

Table 5: Capacity Utilization and Revenue

Particulars	2028	2029	2030	2031	2032	2033	2034	2035
Capacity Utilization (%)	30%	40%	50%	60%	70%	80%	90%	90%
Traffic (PPHPD)	1350	1800	2250	2700	3150	3600	4050	4050
Revenue (Rs. lakhs)	2138	2851	3564	4277	4990	5702	6415	6415

The revenues have been computed such that the initial occupancy of the system would be 30% of the total capacity with staggering the occupancy over the period of years until the ridership reaches 90% of the overall system design capacity.

Operation & Maintenance Expenses Assumptions

The operations and maintenance expenses comprises of the electricity, manpower, utilities and other maintenance expenses. The major component of the O&M cost is the power consumption which is more or less a fixed cost as the electric drive propels the ropeway irrespective of the occupancy. Therefore, increasing the capacity of the system by adding additional gondolas would have only marginal incremental effect on the power consumption. The O&M assumptions made for assessment of the financial analysis is given below.

Table 6: Operation & Maintenance Expenses Assumptions[17]

Sl.No.	Particulars	Unit	Value
1	No of Hours of operations per Day	Hours	12
2	Annual Operational Days	No. of Days	330
3	Power Consumption	kWh/ Km/Hr	150
4	Electricity Rate	INR/ kWh	6[18]
5	Increment in Electricity Rate	%	5
6	No. of Stations	in Nos.	4
7	Per Station Salary	INR (Lakhs)/ Month	5.7
8	Annual Increment in Salary	%	5%
9	Repair & Maintenance • For First 10 Years • From 11th Year	% of TPC	 1 2
10	Public Utilities & Consumables	INR (Lakhs)/ Month/ station	1
11	Escalation factor	%	5

Project Viability

From the above inputs and assumptions, the financial viability of the ropeway from the urban context has been assessed across different periods. Key financial indicators, including the Internal Rate of Return (IRR) and Net Present Value (NPV), provide critical insights into the project's profitability and attractiveness.

Table 7: Project Viability Indicators

Project Period	15 Years	20 Years	25 Years	30 Years
Project IRR (%)	2.37%	5.47%	6.98%	7.81%
Project NPV (Rs. lakhs)	-17,769	-13,613	-10,907	-9,127
Equity IRR (%)	-2.80%	3.54%	6.05%	7.29%
Equity NPV (Rs. lakhs)	-17,131	-15,166	-14,128	-13,575

17 Based on the WAPCOS report prepared for Varanasi ropeway project (Nov 2021)
18 Tariff charged for BMRCL (Bangalore Metro)

The analysis reveals that, in case of private investment under PPP framework, the project is not financially self-sustainable at the current level of tariff structure of Rs.20 per passenger per trip. The project IRR and equity IRR is less than the cost of capital which may not attract the private investment under the existing capital structure and the tariff levels.

The estimated cost for implementing a 4 km aerial ropeway is Rs.466 crore. Additionally, when factoring in the Net Present Value (NPV) of Operations & Maintenance (O&M) costs, which is estimated at Rs.73 crore at a 12% discount rate, the total life-cycle cost of the project is Rs.539 crore. The revenue accrued from the project is less than the project cost making the project financially less viable.

While the government could undertake the project independently, suitable project structuring mechanism could be adopted for implementing the ropeway through private sector participation. The tariff and the occupancy play a critical role in determining the viability of the ropeway as the system design and O&M expenses are more or less fixed for the entire project duration. Therefore, for improving the viability of the ropeway under private sector participation, an assessment of viability gap funding would provide the extent of support that would be required from the government for such urban ropeway system.

Alternative project structuring mechanisms could also be explored by the implementation agency which include sharing the construction risk and transfer of the civil component or the support in procurement of the gondolas that are similar to the metro rail project structuring models to enable private participation.

Assessment on Requirement of Viability Gap Funding (VGF)

Public transport projects require significant capital investment. With fare levels set at reasonable rates, ensuring adequate debt servicing and a satisfactory return on investment often becomes challenging. To make the project financially viable, fares would need to be substantially increased. However, excessive fare hikes could make the service unaffordable, leading to a significant drop in ridership. Since urban ropeways aim to provide an accessible and affordable public transport solution, steep fare increase would undermine the core objective of the project.

An assessment has been done to understand the impact of tariff adjustments on revenue generation and overall financial viability. The analysis evaluates the Equity Internal Rate of Return (EIRR) and Project Internal Rate of Return (PIRR) at an initial capacity utilization of 30%:

Table 8: Impact of Tariff Change on Project Viability Indicators

Tariff (in Rs.)	20	25	30	35	40
Project IRR (%)	7.81%	10.12%	12.14%	13.97%	15.65%
Project NPV (Rs. lakhs)	-9,127	-567	7,849	16,171	24,435
Equity IRR (%)	7.29%	10.45%	13.35%	16.08%	18.70%
Equity NPV (Rs. lakhs)	-13,575	-8,253	-3,059	2,045	7,093

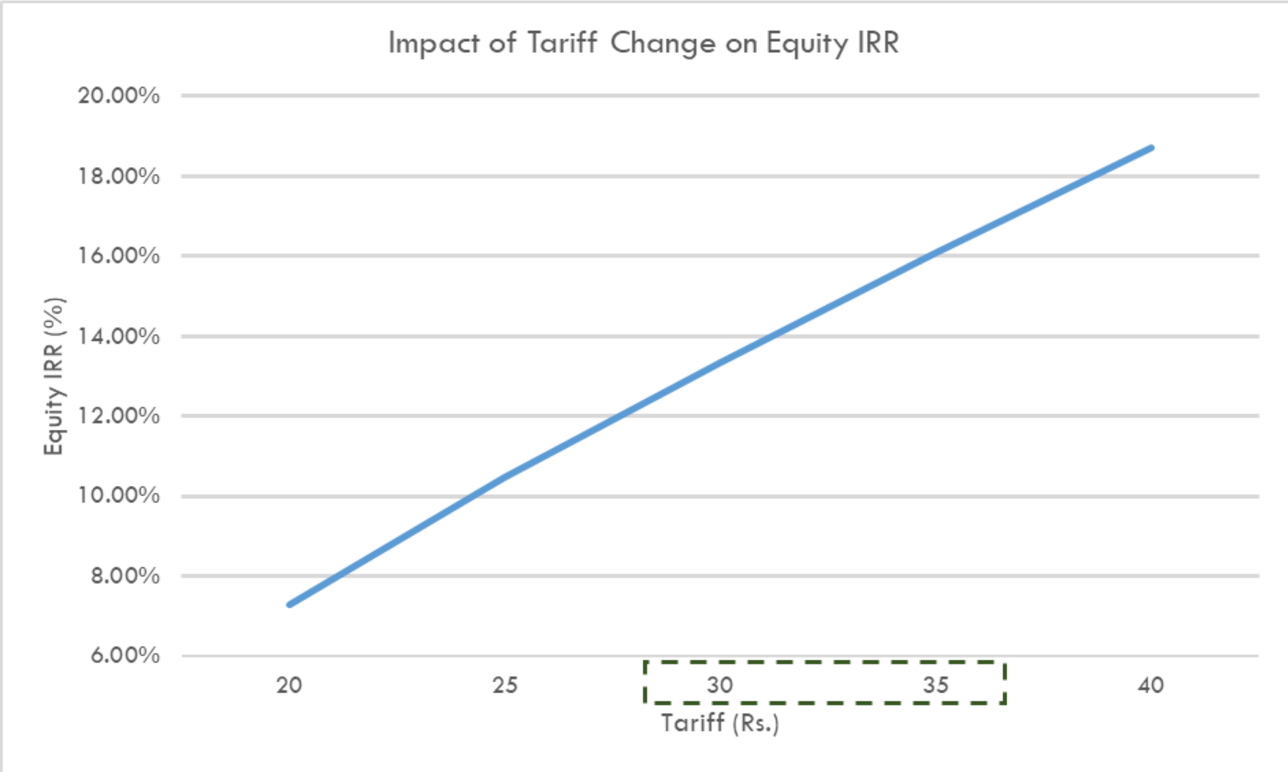


Figure 1: Impact of Tariff Change on Equity IRR

This comparative assessment provides insights into the financial feasibility of the project under different tariff structures. From the table, it could be seen that the project would be viable on a standalone basis, if the initial average tariff for the journey is set set between Rs. 30 and Rs. 35 per trip per passenger.

However, compared to the tariffs of existing public transport systems, this fare level appears relatively high which may discourage the ridership. While the economic benefits of ropeways outweigh those of other systems, their viability remains highly dependent on system utilization. Given this, Viability Gap Funding (VGF) may be required to ensure affordability while maintaining financial sustainability. Hence an assessment on providing VGF is also examined to understand the viability of the project on standalone basis.

Detailed assessment on the requirement of Viability Gap Funding (VGF) support has been carried out at different tariff levels to showcase the optimal tariff structure along the VGF support for the urban ropeway system. This assessment would determine the level of support and tariff structure that could be benchmarked to attract the private capital. This would cap the outflow from the government and at the same time crowd in the private investment in the ropeway sector.

Table 9: Impact of Tariff and VGF on Project Viability Indicators

Tariff (Rs.)	VGF (%)	Project IRR (%)	Equity IRR (%)
20	20%	7.77%	9.97%
	25%	7.76%	10.76%
	30%	7.75%	11.69%
	35%	7.74%	12.74%
	40%	7.72%	13.92%

Tariff (Rs.)	VGF (%)	Project IRR (%)	Equity IRR (%)
25	20%	10.08%	13.55%
	25%	10.07%	14.45%
	30%	10.06%	15.53%
	35%	10.04%	16.76%
	40%	10.03%	18.14%
30	20%	12.10%	16.84%
	25%	12.09%	17.83%
	30%	12.08%	19.06%
	35%	12.06%	20.46%
	40%	12.05%	22.03%

The assessment shows that the project becomes financially viable if the tariff is capped to Rs. 25 with at least 30% VGF support. However, the VGF support and tariff may vary with the variation in project cost which is again contingent upon the location, terrain and the system design.

Therefore, it is proposed to establish a uniform standard of the ropeway system for the urban setting as it would fix the critical cost factors in terms of system design, ropeway system components etc. This would enable to create a financing framework and ease of funding the urban ropeways.

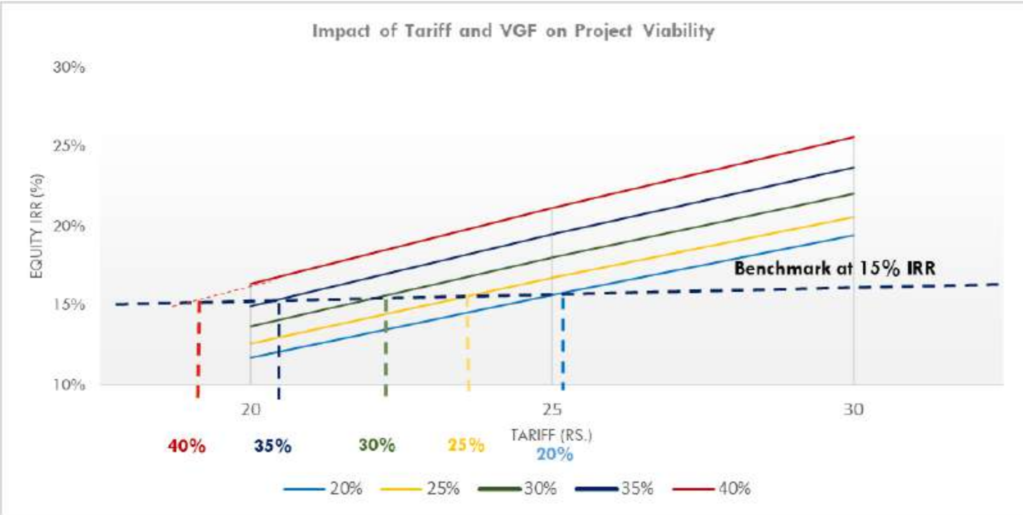


Figure 2: Impact of Tariff change and VGF on IRR

The above chart clearly illustrates the impact of changes in tariff and VGF on the project's financial viability. At 30% VGF support, the project becomes viable only if the average tariff is above Rs. 23 per trip.

Government intervention through VGF can play a crucial role in enhancing the financial feasibility of the project. By reducing the factor of high tariff for improving the viability, VGF ensures that the ropeway remains affordable and accessible to the public while still attracting private investment. This approach helps in achieving a balanced financial structure, ensuring both social and economic benefits.

To understand the impact of per km project cost on project viability, an assessment has been conducted by varying the per km project cost from Rs. 60 crore to Rs. 140 crore. The below heat map illustrate how changes in tariff and per km project cost impact Equity IRR (EIRR).

Impact of Tariff and per km Project Cost on Equity IRR at 30% Initial Capacity Utilisation

Change in per km Cost (Rs. in Cr)

Change in Tariff (Rs.)

EIRR	140	120	100	80	60
20	3.62%	5.23%	7.29%	10.10%	14.34%
25	6.27%	8.08%	10.45%	13.73%	18.74%
30	8.64%	10.68%	13.35%	17.10%	22.88%
35	10.84%	13.10%	16.08%	20.30%	26.82%
40	12.91%	15.40%	18.70%	23.37%	30.58%

At 30% initial capacity utilization, the most favourable EIRR outcome (30.58%) occurs when per km project cost is reduced to Rs.60 crore per km and the tariff is Rs. 40 per trip. On the other hand, the least favourable EIRR outcome (3.62%) is observed when per km project cost is Rs.140 crore and the tariff remains at Rs. 20 per trip.

To further understand the impact of initial capacity utilization on project viability, an assessment has been conducted by varying the initial capacity to 40%, 50%, and 60%. The below heat maps illustrate how changes in tariff and VGF influence Equity IRR (EIRR) at different initial capacity utilization.

Impact of Tariff and VGF on Equity IRR at 40% Initial Capacity Utilisation

Change in VGF (%)

Change in Tariff (Rs.)

EIRR	0	20	25	30	35	40
20	8.01%	10.99%	11.88%	12.93%	14.12%	15.48%
25	11.49%	15.01%	16.03%	17.27%	18.70%	20.31%
30	14.76%	18.78%	19.91%	21.33%	22.97%	24.82%
35	17.90%	22.39%	23.60%	25.18%	27.00%	29.05%
40	20.93%	25.85%	27.12%	28.84%	30.82%	33.02%

The analysis shows that as VGF increases to 40% and the tariff reaches Rs. 40, the IRR improves across all scenarios. At 40% initial capacity utilization, the most favorable EIRR outcome (33.02%) is achieved when both VGF is at 40% and tariff is Rs.40 per trip. On the other hand, the least favourable EIRR outcome (8.01%) occurs when there is no VGF and the tariff is set at Rs.20 per trip.

Impact of Tariff and VGF on Equity IRR at 50% Initial Capacity Utilisation

Change in VGF (%)

Change in Tariff (Rs.)

EIRR	0	20	25	30	35	40
20	8.69%	11.98%	12.97%	14.15%	15.50%	17.05%
25	12.52%	16.47%	17.62%	19.04%	20.67%	22.53%
30	16.17%	20.75%	22.02%	23.65%	25.54%	27.66%
35	19.73%	24.87%	26.22%	28.03%	30.12%	32.45%
40	23.33%	28.82%	30.22%	32.18%	34.44%	36.94%

At 50% initial capacity utilization, the most favorable EIRR outcome (36.94%) occurs when VGF support reaches 40% and the tariff is Rs.40 per trip. On the other hand, the least favorable EIRR outcome (8.69%) is observed when no VGF is provided and the tariff remains at Rs.20 per trip.

Impact of Tariff and VGF on Equity IRR at 60% Initial Capacity Utilisation

Change in VGF (%)

Change in Tariff (Rs.)

EIRR	0	20	25	30	35	40
20	9.98%	13.64%	14.74%	16.07%	17.61%	19.36%
25	14.21%	18.66%	19.94%	21.55%	23.41%	25.51%
30	18.32%	23.49%	24.88%	26.71%	28.84%	31.22%
35	22.26%	28.13%	29.58%	31.60%	33.93%	36.52%
40	26.33%	32.54%	34.01%	36.18%	38.69%	41.46%

At 60% initial capacity utilization, the project demonstrates improved financial viability across all tariff and VGF scenarios. The highest EIRR (41.46%) is achieved when VGF support is 40% and the tariff is Rs.40 per trip, while the lowest EIRR (9.98%) is observed when no VGF is provided and the tariff remains at Rs.20 per trip.

The above heat maps demonstrate a clear correlation between capacity utilization, financial sustainability, and the role of government support in reducing tariff dependency. Higher initial capacity utilization significantly enhances financial feasibility, minimizing the need for substantial fare hikes or extensive government assistance.

Even at an initial capacity utilization of 60%, the project achieves only a 9.98% Equity IRR (EIRR) under a self-sustaining model (without VGF), which remains below typical investor expectations. However, with 40% VGF support, the EIRR improves significantly to 19.36%, making the project far more attractive for private investment, even with a tariff of Rs.20 per trip. This suggests that incorporating capital support can enhance financial feasibility while keeping tariffs at a socially acceptable level.

A detailed analysis of the impact of changes in tariff, VGF, and initial capacity utilization on Project IRR and Equity IRR is enclosed as Annexure.

Inference from the Financial Assessment

The financial feasibility of the ropeway system has been assessed through a comprehensive framework, considering both maximum design capacity and varying occupancy levels to evaluate its viability in an urban setting. This analysis provides insights into the cost-effectiveness and operational sustainability of the system under different demand scenarios.

To ensure that urban ropeway projects remain financially viable while maintaining affordable user tariffs, a balanced approach is required. Public transport systems are inherently capital-intensive, and their financial sustainability depends on the ability to recover costs, service debt, and provide reasonable returns to investors. However, urban transport demand is highly price-sensitive, and excessive fare increases can lead to reduced ridership, defeating the core objective of providing an accessible and efficient public transit solution.

As demonstrated in the financial analysis, achieving profitability by deploying the private capital at the nominal tariff level is challenging, necessitating capital support for improving the viability of the ropeways in the urban context. The capital support is particularly critical for public transportation projects, as they offer significant social benefits, including reduced traffic congestion, lower carbon emissions, improved urban mobility, and enhanced accessibility for economically weaker sections of society.

As an alternative to direct capital support, various PPP models may be explored. One such model is the Delhi Airport Metro Line, where the government bore the cost of civil construction (approximately 40% of the total project cost), while the private concessionaire was responsible for the electromechanical systems (approximately 60%). Another viable model is that of the Hyderabad Metro Rail, where the private entity (L&T) infused the entire equity component, and Viability Gap Funding (VGF) was sanctioned by the Government of India (through the Ministry of Urban Development) and the Government of Andhra Pradesh to support project viability.

Furthermore, the Hybrid Annuity Model (HAM) may also be explored for implementing the ropeway project following the approach adopted by National Highways Logistics Management Limited (NHLML). However, in the larger context, the implementation framework (DBFOT, HAM) of the ropeway project shall be explored on a case-to-case basis. The urban ropeway in India is in nascent stage and therefore for implementation a broad framework could be designed in terms of the design requirements, fund creation and availability, location context, tariff setting etc., which could set as a benchmark for the development of the ropeway system.

CHAPTER 6

MARKET ASSESSMENT FOR URBAN OPERATIONS

- Potential demand for urban ropeways in Indian cities
- Present the context for an exclusive urban ropeways program

6.1 Market Assessment Framework for Urban Operations

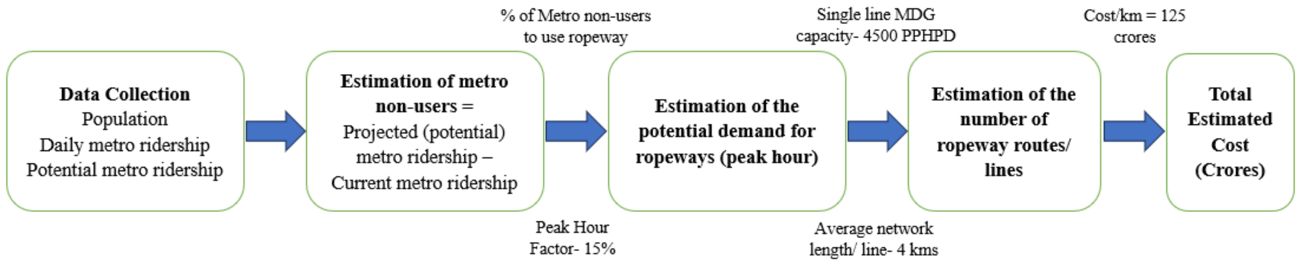
Having established ropeways as a sustainable, efficient, and reliable alternative to conventional urban transit solutions, it is important to understand the market landscape for the adoption of ropeways for urban mobility. Urban ropeway systems can serve two key roles: they can function as feeder systems to existing public transport networks—enhancing last-mile connectivity and improving access to major transit hubs—or as primary transit modes, helping to reduce urban congestion and improve overall accessibility.

This section explores the potential demand for urban ropeways in Indian cities. This potential demand represents the overall universe of estimated need, which may ultimately translate into a smaller, actionable share based on practical supply-side parameters such as site conditions, actual on-ground demand, feasibility constraints, and implementation readiness. The different city categories for demand assessment include:

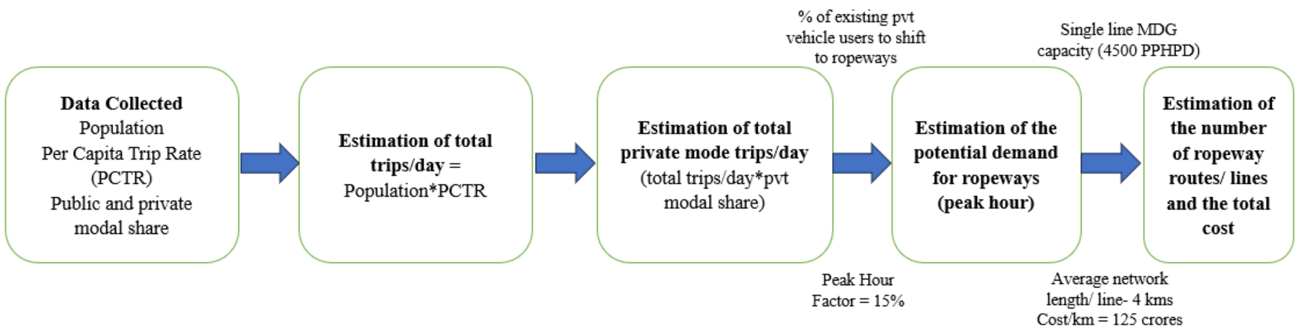
1. As a feeder system to existing metro systems in Indian cities to tap the latent demand
2. Complimentary public transit system in hill cities with a population of over 2 lakhs
3. As a complimentary public transit system in all million-plus population cities without a major exclusive public transit system

Different methodologies were employed to estimate the demand, as illustrated in the flowcharts below. The data used for the estimation is entirely based on secondary sources.

Methodology for estimating demand in category 1 cities[19]



Methodology for estimating demand in category 2 and 3 cities[20]



19 Projected 2024 population used, Metro ridership from metro websites/ reports

20 PCTR and modal shares from different Comprehensive Mobility Plans (CMP)/ city reports

6.1.1 As a feeder system to existing metro systems in India to tap the latent demand

India's metro rail systems currently operate across 17 cities, with a combined network length of close to 1000 km. While metros have significantly improved urban mobility in cities like Delhi, Bengaluru, and Hyderabad, most systems have a huge latent demand, consistently fallen short of their projected ridership targets. For instance, cities such as Bengaluru, Hyderabad, Chennai and Jaipur report actual ridership figures far below initial estimates—often achieving only 20% to 40% of the projected demand[21] (refer to annexure for detailed figures). One of the key factors contributing to low ridership in metro systems is the lack of effective last-mile connectivity. Studies indicate that nearly 70% of potential metro users cite inadequate first- and last-mile access as a major barrier, often leading them to opt for alternative modes of transport despite the availability of metro services[22].

In many cities, metro stations are not adequately linked to residential, commercial, or institutional hubs through feeder services like buses, shared autos, or pedestrian-friendly infrastructure. The absence of seamless, affordable, and safe first- and last-mile options discourages commuters from using metro systems for end-to-end travel. This disconnect highlights the need for public transit systems like ropeways to plug the gap and develop comprehensive multi-modal ecosystems to support the avoid-shift-improve (ASI) paradigm.

Two scenarios have been analyzed—optimistic and conservative—with the primary difference being the assumed percentage of existing non-metro users who are expected to shift to the metro system following the introduction of ropeways as a feeder mode. The percentages have been determined based on sectoral experience and insights from various city-specific studies.

- In the optimistic scenario, it is assumed that 50% of existing metro non-users would shift to using the metro with the introduction of ropeways as a feeder system.
- In contrast, the conservative scenario assumes a more modest shift of 20%.

The table below presents the projected demand for ropeways in Indian cities, where they function as a feeder system to metro networks. This potential demand reflects the total estimated need, which may convert into a smaller, actionable share based on factors like site conditions, on-ground demand, feasibility, and implementation readiness etc.

Table Potential demand for ropeways as a feeder system to metros in Indian cities

City	Scenario	Potential demand for ropeways (peak hr)	Number of ropeway lines	Total kms	Total CAPEX (Cr.)
17 Indian cities with operational metro systems	Optimistic	7,16,431	159	637	79,603
	Conservative	2,86,572	64	255	31,841

The detailed table of all the 17 cities with its current and projected ridership is included in the annexure.

21 https://wri-india.org/sites/default/files/Improving%20metro%20access%20in%20India_%20Working%20Paper.pdf
22 https://www.wricitiesindia.org/STAMP/sites/default/files/1-s2.0-S2352146519305319-main.pdf

6.1.2 Hill cities with a population of over 2 lakhs

Hill cities in India present a strong case for the adoption of ropeways as a viable mode of urban transport, owing to their challenging topography, narrow road networks, and frequent traffic congestion. Traditional road-based systems often struggle in these environments due to land constraints and high construction costs. Ropeways, with their minimal footprint and ability to navigate elevation changes and densely built areas, offer an efficient, safe, and environmentally friendly alternative.

Recognizing the need for improved mobility in smaller and geographically constrained cities, the Government of India has mandated that all urban areas with a population of more than 2 lakh must have an organized public transport system[23]. In this context, ropeways can serve as a cost-effective, scalable solution to meet mobility needs while supporting tourism, economic activity, and environmental sustainability.

Two scenarios have been analyzed—optimistic and conservative—with the primary difference being the assumed percentage of private vehicle users who are expected to shift to the ropeway system following the introduction of ropeways as a public transit system. The percentages have been determined based on sectoral experience and insights from various city-specific studies.

- In the optimistic scenario, it is assumed that 40% of existing private vehicle users would shift to using the ropeways with the introduction of the system.
- In contrast, the conservative scenario assumes a more modest shift of 20%.

The table below presents the projected demand for ropeways in Indian hill cities with populations exceeding 2 lakhs, where ropeways are envisioned to function as a primary mode of public transit. This potential demand reflects the total estimated need, which may convert into a smaller, actionable share based on different on-ground factors.

Table Potential demand for ropeways in Indian hill cities with population exceeding 2 lakhs

City	Scenario	Potential demand for ropeways (peak hr)	Number of ropeway lines	Total kms	Total CAPEX (Cr.)
6 Indian hill cities with population more than 2 lakhs	Optimistic	165260	37	147	18,362
	Conservative	82630	18	73	9,181

The detailed table of all the 6 Indian hill cities with its per capita trip rate and modal shares is included in the annexure.

23 Working Group Report on Urban Transport for 12th Five Year Plan

6.1.3 One million-plus population cities without a major exclusive public transit system

The Working Group's report on Urban Transport for the Twelfth Five-Year Plan (2012–2017) emphasized the urgent need for enhancing public transport infrastructure to address growing urbanization and mobility challenges in Indian cities. It recommended the introduction of metro rail systems in cities with a population exceeding two million, recognizing the capacity and efficiency of metro systems to cater to high-density corridors. For cities with populations over one million, the report suggested the implementation of Bus Rapid Transit Systems (BRTS) or Light Rail Transit (LRT) as more cost-effective and scalable solutions suited to medium-density urban areas. Since the carrying capacity of both BRTS and LRT is almost comparable to that of ropeways, we have used their population threshold—one million—as a reference point to assess the potential demand for ropeway systems. This benchmark allows for a more contextually appropriate evaluation of urban areas where ropeways could serve as a viable and efficient mode of public transport, particularly in medium-density cities or areas with challenging topography, thus support the avoid-shift-improve (ASI) paradigm.

Two scenarios have been analyzed—optimistic and conservative—with the primary difference being the assumed percentage of private vehicle users who are expected to shift to the ropeway system following the introduction of ropeways as a public transit system. The percentages have been determined based on sectoral experience and insights from various city-specific studies.

- In the optimistic scenario, it is assumed that 20% of existing private vehicle users would shift to using the metro with the introduction of ropeways.
- In contrast, the conservative scenario assumes a more modest shift of 10%. In both the scenarios, those cities have been considered without a major exclusive public transit system, such as a metro or a BRTS.

The table below presents the projected demand for ropeways in Indian cities with populations exceeding 1 million that currently lack a major exclusive public transit system. This potential demand reflects the total estimated need, which may convert into a smaller, actionable share based on different on-ground factors.

Table Potential demand for ropeways in Indian cities with population exceeding 1 million and lacking a major exclusive public transit system

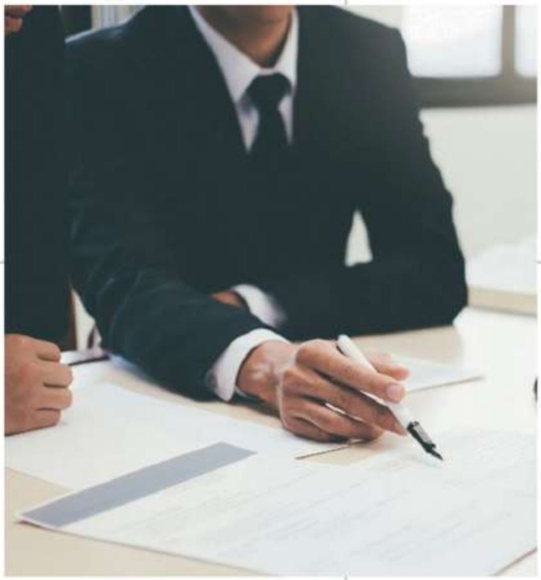
City	Scenario	Potential demand for ropeways (peak hr)	Number of ropeway lines	Total kms	Total CAPEX (Cr.)
Around 40+ such cities	Optimistic	12,21,600	270	1085	1,35,700
	Conservative	6,10,805	136	543	67,867

The detailed table of all the 40+ Indian cities with its per capita trip rate and modal shares is included in the annexure.

The consolidated summary of the three scenarios of city categories is as shown below.

Table Potential demand for an urban ropeways program in India

City	Scenario	Potential demand for ropeways (peak hr)	Number of ropeway lines	Total kms	Total CAPEX (Cr.)
All three categories of cities	Optimistic	2,103,290	465	1,870	2,33,660
	Conservative	9,80,000	215	870	1,08,890
17 Indian cities with operational metro systems	Optimistic	7,16,431	159	637	79,603
	Conservative	2,86,572	64	255	31,841
6 Indian hill cities with population more than 2 lakhs	Optimistic	1,65,260	37	147	18,362
	Conservative	82,630	18	73	9,181
Around 40+ one million-plus population cities without a major exclusive public transit system	Optimistic	12,21,600	270	1085	1,35,700
	Conservative	6,10,805	136	543	67,867



CHAPTER 7

POLICY RECOMMENDATIONS

- Guidelines for system selection and recommendations on institutional framework and financing mechanisms
- Need for an exclusive urban ropeways program

7.1 Guidelines for Ropeway System Selection and Implementation

Ropeways present a flexible, cost-effective and space-efficient solution for urban mobility and tourism, particularly in congested or geographically constrained areas. They can complement existing urban transport networks by improving last-mile connectivity, easing road congestion, and offering an eco-friendly alternative for both daily commuters and tourists.

Monocable Detachable Gondola (MDG) systems are among the most widely used aerial cable car technologies globally, especially for urban public transport. They offer moderate speeds and passenger capacities, making them well-suited for city environments. Their popularity is largely due to their relatively low infrastructure costs and adaptability to varied urban contexts. It is therefore recommended that MDG systems be widely adopted, with limited exceptions.

Bi-Cable (BDG) and Tri-Cable (TDG) systems, while more expensive, offer higher capacity, faster speeds, and the ability to span longer distances. These systems are recommended in specific situations, such as:

- High wind areas, where BDG or TDG systems provide superior wind stability.
- Corridors with large natural or built obstacles (e.g., rivers, highways, valleys), where fewer intermediate towers are desirable due to the systems' longer span capabilities.
- High-demand corridors, where greater passenger capacity and reduced travel time are essential.

These considerations can guide technology selection based on contextual needs and project requirements.

Several guidelines and recommendations have been issued by the Government of India to assist in selecting appropriate public transport modes for cities. These include the National Urban Transport Policy (2006), the Ministry of Housing and Urban Affairs (MoHUA) Toolkit and Guidelines for Comprehensive Mobility Plans (CMPs), the Report of the Working Group on Urban Transport for the 12th Five-Year Plan (2012–2017), the National Transport Development Policy Committee (NTDPC) Report on Urban Transport, and the Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines (2014) issued by MoHUA. These documents provide strategic frameworks and criteria for aligning transport investments with city size, travel demand, and long-term mobility goals.

The table below presents a comparison of mode-wise urban transit benchmarks, drawing on guidelines issued by the Government of India and proposed recommendations specifically for ropeways.

Table Urban Transit Benchmarks for Indian Cities

Criteria	Mode	Guidelines as per Government of India reports/ documents	Recommended Guidelines
Passengers per Peak Hour per Direction (PPHPD)	BRTS	7,500-15,000	
	LRTS	15,000-45,000	
	MRTS	>40,000	
	Ropeway	-	3,000-12,000
Population	BRTS	>1 million	
	LRTS	>1 million	
	MRTS	> 2 million	
	Ropeway	-	~1 million

For passenger capacity measured in Passengers per Peak Hour per Direction (PPHPD), existing guidelines specify a range of 7,500–15,000 for BRTS, 15,000–45,000 for LRTS, and over 40,000 for MRTS. In comparison, the recommended guideline for ropeways is 3,000–12,000 PPHPD. Regarding population thresholds, BRTS and LRTS are advised for cities with populations exceeding one million, while MRTS is recommended for those with over two million. For ropeways, the recommended guideline suggests adoption in cities with populations close to one million (anywhere between 0.5-1 million or more), aligning them with medium-capacity public transit solutions.

7.2 Legal Framework for Promoting Ropeways as an Alternative Urban Mobility Solution

7.2.1 Centralised Regulation for Ropeways

Ropeways fall under List II, Entry 13 under Schedule 7 of the Constitution of India. Being under the State list, the state governments are empowered to enact laws regarding the construction, operation, and regulation of ropeways within their jurisdiction. As such, the entire ropeway construction and operations in India is State driven with licensing and approvals, urban specific safety monitoring, periodic inspection etc., undertaken by the state or municipal authorities. The Central Government is playing a supportive role by initiating schemes like Parvatmala Program under specific institution such as National Highways Logistics Management Ltd (NHLML), formulating model documents, etc.

However, each State having its own legislation/policies makes it challenging for the private entities to stay compliant with the specific regulations of each State and to keep themselves updated about the changing legislative and regulatory developments in every state. Considering the same, it is recommended to have a national level Ropeway Policy/guidelines by the Ministry of Housing and Urban Affair MoHUA to guide every state to adopt similar standardised licensing, inspection, public safety measures in the development and operations of the ropeways and thereby establish a clear and standardized regulations on safety, operation, design standards & specification etc., to harmonise the process across the country. Such national level policy may include matters such as, guidance to State Governments on having a nodal department for aerial ropeways, single-window agency arrangements for clearances & approvals, provisions to address environmental issues and climate change mitigation measures, guidelines for regulating passenger capacity and crowd control measures especially at the ticket counters, prevention of overloading and ensuring of efficient operations during peak hours of commuting in the urban areas including guidelines on maximum passenger limits for each cable car and emergency contingency plans for peak loads or during breakdowns etc.

7.2.2 Special Regulations to acquire Right of Way

Acquisition of Right of Way is essential for developing ropeway projects, wherein a legal right to cross or pass through someone else's property like building, field etc., or to use a portion of it for a specific purpose is involved. Considering the fact that the part of the land below a ropeway line can still be put to use for the purposes which are not obstructing the operation of the ropeway or are not detrimental to the safety and security of the passengers, the permanent acquisition of such land is not a feasible proposition. For the projects involving laying of underground utilities like telecom lines, gas pipelines, water pipelines etc., few states such as Gujarat, Haryana, Madhya Pradesh etc. have enacted a special land acquisition laws[24], wherein only the Right of User is acquired whereby the landowners continue to use the land above such underground utilities subject to the regulations provided under the said special land acquisition laws. Similar simplified land acquisition laws may be formulated for the development of ropeway projects, covering aspects such as the right of the landowner over acquired land, compensation for private property (including TDR), restrictions on use of the land, restrictions on construction near ropeway facilities etc.

7.2.3 Regulations Specific to Urban Ropeways

Many of the ropeway projects in India are indeed tourism-centric and are mainly operated to improve the overall tourist experience by enhancing accessibility, reducing travel time, and offering unique aerial views of the landscapes. The number of ropeways developed in India to de-congest the urban traffic are few in number, which clearly shows that the ropeways in India have not yet been widely adopted as a significant mode of urban transport. Ropeways are still largely seen as niche solutions rather than mainstream urban transport options. Considering this trend, even the legislative and regulatory framework of the States in India are formulated to promote ropeways as means of transportation for challenging routes of tourist attraction. As such for the ropeways to become a viable part of urban transport infrastructure in India and to bring them as a mainstream transport solution, regulations on matters such as safety, environment, integration with other urban transport infrastructure and other related operational matters will be required. Such regulations should address the unique challenges relating to ropeway in urban areas such as high density of population, integration with existing infrastructure, safety concerns and environmental impact etc.

24 Refer The Gujarat Water and Gas Pipelines (Acquisition of Right of User in Land) Act, 2000, Maharashtra Underground Pipelines and Underground Ducts (Acquisition of Right of User in Land) Act, 2018; and Haryana Underground Pipelines (Acquisition of Right of User in Land) Act, 2008

7.2.4 Ropeway Safety Regulation

Given the emergence of various ropeway technologies and the availability of multiple safety standards—such as European, and American safety standards—it is both timely and prudent to establish a national-level, standardized, and unified safety regulation for ropeways in India. The ropeway safety standards in India, which is presently being regulated by Bureau of Indian Standards, needs to be aligned more closely with international norms to enhance safety and operational efficiency. A consistent regulatory framework would not only enhance passenger safety but also improve the overall efficiency, interoperability, and reliability of ropeway systems across the country.

Ropeways operate on sophisticated technologies and require stringent safety protocols to ensure reliable and secure passenger services. In line with the institutional models seen in aviation (DGCA) and railways (Ministry of Railways), there is a strong case for setting up a centralized safety authority for ropeways. This agency should be tasked with formulating and enforcing safety standards, conducting audits and inspections, certifying manufacturers, operators, and maintenance agencies, and coordinating with international bodies to align Indian regulations with global best practices. Such a dedicated entity would bring clarity, accountability, and consistency to the sector's safety governance and help facilitate the rapid and safe expansion of ropeway infrastructure in India.

7.2.5 Model Document under PPP HAM Model for Urban Ropeway Projects

The draft Model document presently prepared by NITI Aayog for Development of Ropeway projects is to implement the project PPP framework on Develop, Build, Finance, Operate and Transfer (DBFOT) model. Generally, DBFOT model may be adopted only for the ropeway projects that are financially viable. However, considering the challenges such as limited carrying capacity, fixed routes and limited coverage, accessibility issues, etc., ropeway projects may find very difficult to attract private sector participation, especially at those locations that may have uncertain or low initial revenue streams. Such projects may need to be developed under HAM model, where financial risk would substantially be with the Government. The present Parvatmala Scheme is also being developed under the HAM model. Considering the same, it is suggested that a standard document on HAM model be prepared. Further considering that the States are the primary implementing agencies of Ropeway projects, developing the State Model Documents for Ropeway development also needs to be emphasised and encouraged.

As an alternative to direct capital support in the form of viability gap funding, various project structuring models may also be explored by the implementing agency as discussed in the financial chapter, such as sharing of the construction work or sharing of the operations etc to enable the private participation.

7.3 Need for an Exclusive Urban Ropeway Program

7.3.1 Potential Demand for an Urban Ropeway Program

Having established the demand for ropeways in urban areas as a sustainable, efficient, and reliable alternative to conventional urban transit solutions, it is recommended that a national-level program be launched under the Ministry of Housing and Urban Affairs (MoHUA) to promote the adoption of ropeways for urban mobility.

The program under the Ministry of Housing and Urban Affairs (MoHUA) can be implemented in phases, with each phase prioritizing a different category of city that may be identified after suitable analysis. This phased approach will allow for targeted planning, efficient allocation of resources, and gradual scaling based on learnings from earlier phases.

The table shown below outlines the potential demand for an urban ropeways program in India under two scenarios—optimistic and conservative—across cities categorized based on population and existing transit infrastructure. In the optimistic scenario, ropeways could cater to a peak hour demand of approximately 2.4 million passengers across 535 lines spanning 2,141 kms, requiring a total capital expenditure (CAPEX) of ₹2,67,634 crore. Under the conservative scenario, the estimated demand is about 9.8 lakh peak hour passengers, with 218 ropeway lines covering 871 kms, involving a lower CAPEX of ₹1,08,890 crore. This highlights the significant potential of ropeways as a cost-effective urban mobility solution in cities.

Table Potential demand for an urban ropeways program in India

City	Scenario	Potential demand for ropeways (peak hr)	Number of ropeway lines	Total kms	Total CAPEX (Cr.)
All three categories of cities	Optimistic	2,103,290	465	1,870	2,33,660
	Conservative	9,80,000	215	870	1,08,890

7.3.2 Financial/ Funding Mechanisms

The government can play a pivotal role in incentivizing both public and private sector investments in ropeway infrastructure by offering subsidies or tax benefits to enhance the financial viability of such projects. Currently, the National Highways Logistics Management Limited (NHLML), operating under NHAI, is spearheading ropeway development under the Parvatmala scheme. However, to implement ropeways as part of urban transport systems—aligned with projected demand—there is a need to establish a dedicated financing mechanism, similar to those used for metro rail projects. With an estimated implementation cost of approximately ₹2,70,000 crore (under an optimistic scenario), mobilizing sufficient funding over time will require strategic planning and resource identification.

Given the fiscal constraints, it would be challenging for the government to bear the full cost through budgetary provisions alone. Therefore, alternative and innovative funding sources must be explored. Public-Private Partnerships (PPP) offer a viable model, allowing private developers to invest, bring in technology and operational efficiency, while the government focuses on planning, regulation, and supporting financially unviable projects. While PPP-based ropeway projects have seen some success in tourist and hilly areas like Uttarakhand and Himachal Pradesh, their implementation in urban settings remains largely unexplored. Key concerns in an urban context include user willingness to pay, ridership levels, and scalability limitations.

To promote urban ropeways under PPP, the existing Viability Gap Funding (VGF) scheme—which allows up to 40% government support—can serve as a foundational model. Based on financial assessments, capital support is essential to attract private investment while also reducing the government's expenditure compared to full implementation by the public sector. Assuming widespread adoption of the PPP model, the required government contribution via VGF could be around ₹1,00,000 crore. In contrast, ropeways implemented under the Hybrid Annuity Model, like those by NHLML, would require full lifecycle funding from the government, further increasing financial demands. Hence, a case-by-case evaluation approach is recommended to determine the appropriate implementation framework and level of government support.

Moreover, urban ropeways offer substantial indirect benefits—such as climate-friendly transportation, reduced land acquisition and rehabilitation costs—which should be factored into cost-benefit assessments. The government could further strengthen this sector by introducing guidelines tailored to sustainable and environmentally responsible urban ropeway development. Incentives for adopting low-emission technologies—such as solar-powered stations or energy-efficient systems—and green certifications could accelerate the adoption of ropeways as a viable component of urban mobility infrastructure.

Additionally, to accelerate the adoption of ropeways as a viable mode of urban transport, a targeted policy recommendation would be to make the sector eligible under the Government of India's Urban Challenge Fund. This fund, designed to support innovative and scalable urban mobility solutions, can be leveraged to pilot and implement ropeway projects in cities facing topographical, spatial, or congestion-related challenges. By explicitly including ropeways as an eligible mode under the fund's framework—particularly for first- and last-mile connectivity, low-emission transit corridors, and underserved urban areas—cities would be encouraged to explore ropeways as part of their integrated mobility plans. This inclusion would help de-risk early-stage investments, support project preparation and feasibility studies, and enable demonstration projects that can inform broader replication. Moreover, linking funding eligibility to performance-based outcomes such as ridership, emissions reduction, and integration with existing public transport would ensure the ropeway sector not only benefits from public financing but also contributes meaningfully to urban sustainability and accessibility goals.

7.3.3 Integrated Planning and Regulatory Framework

To effectively integrate ropeways into the broader urban transport ecosystem, it is essential that each State mandatorily includes ropeway systems in all future urban mobility plans, city development plans, and other relevant planning documents. This strategic inclusion will ensure that ropeways are systematically considered alongside metros, buses, and other transport modes, enabling their efficient integration into multimodal networks. Such planning will help cities address mobility, environmental, and resilience needs by offering cost-effective and congestion-free transport options, especially in areas with topographical constraints or dense urban form. Moreover, mandating this inclusion will support optimized land use planning, prevent conflicts with other infrastructure developments, and serve as a basis for structured funding, inter-agency coordination, and streamlined regulatory processes under central or state urban mobility schemes.

From an institutional and regulatory perspective, there is a need to strengthen the governance framework around urban ropeway development. Unified Metropolitan Transport Authorities (UMTAs), which are established to oversee integrated urban transport planning, may be entrusted with the responsibility of planning and advising the implementation of ropeway projects as part of a comprehensive urban mobility strategy. A robust institutional framework should ensure coordination among relevant departments—urban transport, planning, development, and infrastructure agencies—so that ropeways are seamlessly incorporated into multimodal transit systems. For example, ropeway stations can be strategically co-located with metro stations, bus terminals, or railway hubs to enhance first- and last-mile connectivity. State legislation governing ropeways should be updated to include representation from various urban transport and planning bodies, enabling the design and execution of ropeway projects that are aligned with long-term urban development goals, such as linking high-density residential zones to employment centres, commercial hubs, and key urban destinations.

The broad institutional framework recommended is outlined below, with detailed discussions provided in Chapter 4.

7.3.4 Integration of Ropeway into National Programs/ Policies

The inclusion of ropeways into the Gati Shakti platform is essential to strengthen multimodal connectivity, particularly in hilly terrains, congested urban areas, and regions with limited ground infrastructure. This integration would enable coordinated planning across ministries and departments, streamline clearances, and accelerate implementation timelines. It would also ensure that ropeways are considered during early-stage infrastructure planning, rather than as standalone or afterthought projects, thereby optimizing land use, reducing urban congestion, and improving access in underserved areas.

Along with that, inclusion into the Government of India's Harmonised Master List of Infrastructure Sectors, would help the sector to tap various financial and regulatory benefits, including priority lending, tax incentives, viability gap funding, and faster project clearances. Currently, ropeways are included under the "social and commercial infrastructure" category, primarily as part of tourism-related development. However, given their increasing potential for urban mobility, especially in congested, hilly, or hard-to-reach areas, there is a strong case for including ropeways under the "transport and logistics" category—specifically under urban public transport. This reclassification would better reflect their evolving role as a viable mode of mass transit, not just a tourist attraction. Inclusion under urban public transport would unlock a range of benefits for the ropeway sector, such as improved access to infrastructure financing, easier integration into city mobility plans, and recognition in government urban transport policies and schemes. This would ultimately accelerate promote sustainable, low-emission mobility solutions.

7.3.5 Creating Fast-Track Approval Mechanisms

Getting the necessary licenses and approvals for development of ropeway project may involve dealing with several departments, such as state transport departments, tourism boards, and sometimes specialized ropeway authorities. It may require multiple layers of bureaucracy to approve a project, leading to delays in project timelines. These aspects underscore the need for a more streamlined regulatory approach to ease the compliance burden and support growth of ropeway projects. Considering the same constituting a single-window clearance system, involving authorities from related department such as urban development, transport and municipal corporations or alternatively appointing a nodal department at each state with the responsibility to co-ordinate with other relevant government agencies for issues related to transport, land, environment and tourism to work as a single window clearance system is suggested.

7.4 Appraisal of the Technology for 'Make in India'

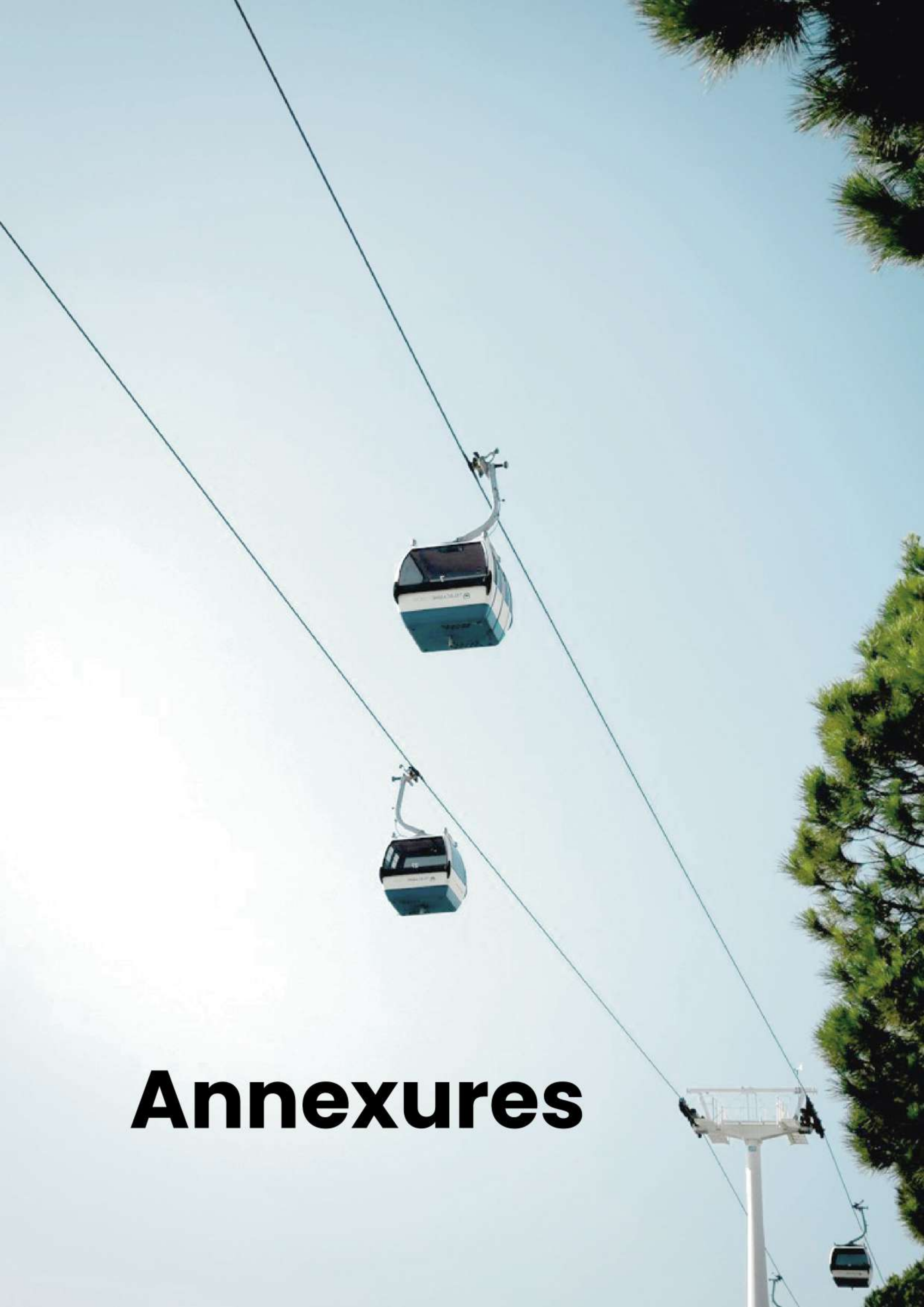
India's ropeway sector is still at a nascent stage when it comes to domestic manufacturing. Currently, a significant portion of ropeway technology—particularly critical components like cabins, propulsion systems, and control technologies—is imported, primarily from European countries such as Austria, Switzerland, Italy and France. Some of the leading ropeway manufacturers globally include the Doppelmayr Garaventa Group (Austria/Switzerland), Leitner Group (Italy), POMA (France), and Bartholet Maschinenbau AG (Switzerland).

While India has some domestic capacity in civil construction, structural fabrication, and installation services, the country largely depends on foreign firms for turnkey solutions. This reliance not only escalates project costs but also limits scalability and self-reliance in the sector.

A limited number of Indian companies have begun entering into technical collaborations or joint ventures with global players, but the local ecosystem remains underdeveloped in terms of both R&D and manufacturing depth. The lack of a standard regulatory framework and absence of economies of scale further constrain the growth of indigenous manufacturing. To foster a robust "Make in India" ecosystem for ropeways, a multi-pronged policy approach is essential. Few of the pertinent recommendations include:

- The government may introduce a Production-Linked Incentive (PLI) scheme specifically tailored to ropeway technologies and related components and support its indigenised production.
- Create a National Ropeways Mission (a cross-cutting mission between MoHUA and MHI), which could help standardize guidelines, support indigenous R&D, and streamline clearances.
- Encouraging technology transfer partnerships, offering fiscal incentives for domestic manufacturers, and integrating ropeway projects into broader urban mobility and smart city plans can stimulate demand and provide a stable pipeline for local industries.
- Additionally, setting up centres of excellence for aerial mobility engineering within premier technical institutions (e.g., IITs) can help build long-term R&D capacity and skilled workforce for the sector.

Annexures



Chapter- 1

Annexure 1A: Tom Tom Traffic Index, 2024

City	World Rank	Country Rank	Average Travel Time per 10 km
Kolkata	2	1	35 min
Bengaluru	3	2	34 min
Pune	4	3	33 min
Hyderabad	18	4	32 min
Chennai	31	5	30 min
Mumbai	39	6	29 min
Ahmedabad	43	7	29 min
Ernakulam	50	8	29 min
Jaipur	52	9	28 min
New Delhi	122	10	23 min

Annexure 1B: Modal Shares in selected Indian Cities (Comprehensive Mobility Plan Reports)

<table>
<tr><th>City</th><th>Two-wheeler</th><th>Car</th><th>Auto</th><th>Cycle</th><th>Walk</th><th>PT</th></tr>
<tr><td>Bengaluru</td><td>27.1</td><td>7</td><td>6.8</td><td>0.7</td><td>26.5</td><td>31.9</td></tr>
<tr><td>Chennai</td><td>29.6</td><td>7.1</td><td>7.1</td><td>2.9</td><td>25.1</td><td>28.2</td></tr>
<tr><td>Jaipur</td><td>31</td><td>8</td><td>10</td><td colspan="2">32</td><td>19</td></tr>
<tr><td>Mumbai</td><td colspan="2">15</td><td>7</td><td>6</td><td>27</td><td>45</td></tr>
<tr><td>Vizag</td><td>15</td><td>2</td><td>10</td><td>3</td><td>52</td><td>18</td></tr>
<tr><td>Kochi</td><td>26</td><td>10</td><td>7</td><td>3</td><td>12</td><td>42</td></tr>
</table>

Annexure 1C: Table: Projected vs Actual Metro Ridership in Indian Cities

	Actual Ridership (2022)	Projected Ridership (2021)	Actual Ridership (2024)	CAGR (%)
Delhi	48,00,000	54,00,000	78,00,000	27.48
Bangalore	5,00,000	16,00,000	8,00,000	26.49
Hyderabad	4,50,000	22,00,000	5,63,000	11.85
Kochi	80,000	5,00,000	1,00,000	11.80
Chennai	2,00,000	8,00,000	2,80,000	18.32
Jaipur	40,000	3,00,000	55,208	17.48
Lucknow	70,000	6,50,000	90,000	13.39
Pune	35,000	5,00,000	1,20,000	85.16
Ahmedabad	65,000	5,00,000	90,000	17.67
Mumbai	3,50,000	7,00,000	5,00,000	19.52

Annexure 1D: Growth of New Registered Motor Vehicles across different Vehicular Segments between 2016-2025 (in millions)

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	CAGR
	New Vehicle Registrations (in million)										
2- wheelers	16.500	18.080	19.590	18.660	14.310	13.930	15.600	17.100	18.940	3.420	1.74
3- wheelers	0.550	0.570	0.770	0.770	0.410	0.400	0.680	1.110	1.220	0.240	10.53
Buses	0.038	0.033	0.026	0.026	0.180	0.006	0.013	0.022	0.033	0.007	-1.92
4- wheelers	3.390	3.720	3.910	3.730	3.220	3.820	4.330	4.766	5.020	1.090	5.02
Other	0.047	0.047	0.041	0.043	0.400	0.049	0.050	0.700	0.081	0.020	6.87

Chapter -3

Annexure 3A: Risk sharing under model draft document of ropeway

Risks	Description of Risk	Party Responsible
Land related Risk	Failure to provide right of way and suitable access; diversion of private rights of way across site to the Concessionaire.	Authority
Design Risk	The design of the ropeway system is inadequate/faulty/non-confirming with the technical drawings and as such is incapable of delivering the required services or negatively impacting on the life of project.	Concessionaire
Construction Risk	Risk of non-adherence to safety measures at the construction site Concessionaire fails to meet the required construction requirement	Concessionaire
Completion of Construction work	The concessionaire fails to complete the construction work within the scheduled date of completion. The risk that events occur during construction prevents the facility being delivered on time and on cost.	Concessionaire
Operation Risk	Concessionaire fails to meet the operation standards. Poor operation of the ropeway	Concessionaire/IE
Financial Risk	Failure of anticipated financial resource	Concessionaire
Environmental risks	Concessionaire fails to carry out works in compliance with the Environmental standards and regulations	Concessionaire
Force Majeure risk	Risk that events beyond the control of either entity may occur, resulting into a material adverse impact on either party's ability to perform its obligations under the operations /construction contract	Authority/ Concessionaire.

Annexure 3B: Institutional setup in different states

Name of the State	Institutional Set-up				
	Planning / Advisory	Licensing (License for survey and construction)	Inspection & Monitoring (Construction & maintenance)	Single window system (Assist in clearances)	Tariff Regulation
Sikkim	Not Provided	State Government	Inspectors Expert committee having knowledge in Ropeway sector (except Assam)	Not Provided	State Government
Himachal Pradesh					
J&K					
Assam					
Uttarakhand		Empowered committee headed by Chief Secretary	Chief Inspector of Ropeway at state level District Inspectors at district level	District level committee headed by District Magistrate	Empowered Committee/ Licensing Authority
Rajasthan		District Magistrate		Not Provided	District Magistrate/ Licensing Authority
Meghalaya	Meghalaya Ropeway Development Authority headed by secretary and above level official and assisted by Technical cell	Empowered committee headed by Chief Secretary	Chief Inspector of Ropeway at state level District Inspectors at district level Experts Committee having knowledge in Ropeway Sector	Project Committees at district level chaired by the Deputy Commissioner	Empowered Committee/ Licensing Authority For PPP projects - the State Government
Karnataka	Advisory Authority headed by Minister in charge of Tourism Department	District Magistrate	Chief Inspector of Ropeway at state level District Inspectors at district level	Not Provided	District Magistrate/ Licensing Authority

Licensing: Each of the Acts constitutes/notifies the Licensing Authority, who is primarily responsible for grant of sanction for undertaking preliminary survey to any intended promoter of the ropeway, grant of license for construction of ropeway, fixing of maximum rates for operation of ropeway and close or reopen a ropeway.

Few States viz., Sikkim, Himachal Pradesh, J&K and Assam provides State Government as the Licensing Authority, District Magistrate is the responsible for issuing license in Rajasthan and Karnataka. However, considering the complex technical nature of ropeway projects, it is recommended that the licensing authority having experience and expertise in the ropeway sector at state level is made responsible for grant of license. For example, in State of Meghalaya and Uttarakhand a Empowered Committees is constituted which is entrusted with the obligation of Licensing Authority. Empowered committees in both these states are headed by the Chief Secretary and is represented by departments such as Tourism, Transport etc along with nominated experts from the ropeway sector. Meghalaya also envisages the constitution of a technical cell with experts to guide the Empowered Committee.

Planning and Advisory: Only the States of Meghalaya and Karnataka constitute planning and advisory bodies under their respective Act. Meghalaya Ropeway Development Authority established under the Meghalaya Ropeway Act, 2022 is the nodal agency for the matter relating to ropeway in the State of Meghalaya. The Authority comes under the Tourism Department and has jurisdiction over all the areas declared as Ropeway Development Area under the Act. The Authority formulates Vision Paper for the State and is in charge of planning, coordinating, promoting, securing the development, safe operation and maintenance of Ropeway and associated ropeway development Area activities in the State of Meghalaya. It is the body made responsible for ensuring execution of ropeway development in the declared area as per the approved plan either on its own or under PPP or through any Promoter.

Under Karnataka Tourism Ropeway Act, 2024 provision for constitution of Advisory Authority for ropeway is provided. The Minister in charge of Tourism Department is the Chairman of this body. However, duties of this body are yet to be notified.

Inspection & Monitoring: Every Acts under study envisages the appointment of inspectors who are primarily made responsible for inspection of the aerial ropeways both during the construction as well as during its operation to determine its conditions both from convenience and safety perspective. These inspectors are generally appointed at the district level and in few States both at district and State level (eg. In Uttarakhand, Rajasthan and Karnataka). Further to the inspectors, the Acts also provides for constitution of Expert Committee in a few of the States such as Sikkim, Himachal Pradesh, Jammu & Kashmir and Meghalaya comprising members having knowledge in design, setting up and operation of ropeways to aid and advise State Government/Licensing Authority and inspector in discharge of their duty under the Act.

The Acts also provides the frequency in which the said Inspectors both district as well as State level shall undertake inspection of the ropeways in their jurisdiction to determine whether they are maintained in a fit condition and works to the convenience and safety of the persons using them and of the general public, and consistently with the provisions of Act[26].

Approvals and clearances: Only the States of Uttarakhand and Rajasthan envisages constitution of Committees at district level who plays the role of single window agency and acts as a single point of contact to the promoter in procuring necessary clearances like forest land diversion and state pollution control board clearances, acquisition of land, supply of utilities to the project site, diversion of transmission lines, electric and pipelines in the route alignment, resolution of issues relating to relocation and rehabilitation etc.

Tariff Regulation: The maximum and minimum rates to be charged to provide the ropeway services are generally fixed by the Licensing Authority. However, with respect to PPP projects, the State of Meghalaya provides for regulation thereof by the State Government at the recommendation of Licensing Authority or Meghalaya Ropeway Development Authority.

26 Generally, the Chief Inspector shall at least once a year and District Inspector once in every six months or quarterly shall inspect ropeways.

Annexure 3C: Legal provisions covered under state ropeway legislations

I. Approval for undertaking preliminary survey

- Every promoter intending to develop ropeway project (other than State Government) shall apply and procure permission from the licensing authority for undertaking preliminary investigation[27]. The application shall inter-alia provide for information such as, details of the promoter, route to be followed by the proposed ropeway, description of the system of construction and management, the advantages to the community from the project, estimates of the cost of construction, working expenses and profits, rates proposed to be charged for the service offered, maps, plans, sections, diagrams etc.
- The licensing authority in according permission for preliminary survey shall consider provision of Land Acquisition, Rehabilitation and Resettlement Act, 2013[28]. The outcome of preliminary survey which would provide the details about estimates, plan, sanctions, specifications relating to structural design, quality of materials, factor of safety etc. are crucial information to take informative decision by the licensing authority at later point in time to grant license for construction. Considering the same, the Acts of the States like Sikkim, Assam and Himachal Pradesh provides promoter to confirm that such estimates, plan, sanctions, specifications are in conformity with Bureau of Indian Standards/International Standards and are certified by a qualified structural engineer.

II. Grant of license for construction of ropeway

- Post preliminary survey and investigation, the intended promoter would require making an application to the Licensing Authority along with the details of the preliminary survey seeking order/license from the Licensing authority authorising the promoter to construct the ropeway. The Licensing Authority on such application take the decision of passing/granting order/license after considering the details given in the application and hearing objections for grant of such license/order from the owner or occupiers of the land over which the proposed ropeway route

27 In Meghalaya, the promoter is required to apply to the Licensing Authority with the recommendation of the Meghalaya Ropeway Development Authority

28 The provisions of this Act relating to compensate the owners or occupiers of the land which is likely to be get effected by the survey undertaken by the promoter shall be applicable.

lies. The Acts envisages the manner in which the licensing authority shall publish the draft order seeking such suggestion and the contents of such order or license[29].

- The Acts also provides for cessation of powers given by the license/order in favour of the promoter generally for the reasons where the promoter (i) fails to raise capital required for the project (ii) in the opinion of the licensing authority fails to do the substantial progress/make progress according to the schedule of progress approved by licensing authority or complete the ropeway in the given period under the license/order.

III. Construction and maintenance of ropeway

- Upon issue of order/grant of license to construct, the promoter is empowered to execute the work and undertake activities such as (i) survey (ii) placing or maintaining post on any immovable property (iii) suspend or maintain a rope over, along or across any immovable property (iv) make bridges, culverts, drains, embankments and roads (v) erect and construct machinery, offices, stations, warehouses and other buildings, works and conveniences as may be necessary and to do all other acts necessary for constructing, maintaining altering, repairing and using the aerial ropeway. The execution of the work by the promoter shall be subject to the provisions of any enactment for the time being in force for the acquisition of land for public purposes and for companies. The collector/deputy commissioner is given powers to fix the amount of compensation or/and annual rent to the owner or occupier effected due to the project development.
- However, considering the special nature of Ropeway, where the land below the ropeway alignment is still usable with certain restrictions, a specific acts similar to acquisition of Right of Way for implementation of underground utilities like pipelines, cables etc. may be formulated for ropeway projects enabling acquisition of RoU with specific compensation mechanism.

---

29 Generally, the order would provide for following details and conditions;

a) Period within which the capital for the construction of the ropeways shall be raised ;

b) Period within which the construction shall be commenced and completed ;

c) the conditions under which a concession, guarantee, or financial assistance may be given by the Government or a local authority to the promoter;

d) the right of purchase of ropeway by the Government or a local authority;

e) the specifications relating to structural designs, quality of the material, factors of safety, method of computing stresses and other such technical details as may be considered necessary;

f) the rules relating to the construction of the aerial ropeway over road and other public ways of communication, except railways as defined by the Constitution and, with the previous sanction

g) of the Central Government, over such railways ;

h) the conditions under which the promoter may sell or transfer his rights to the Government or to a local authority or to a person ;

i) the conditions under which the aerial ropeway may be taken over by the Government to be worked by itself or by a local authority or by a person other than the promoter ;

j) the minimum headway to be maintained under different parts of the rope ;

k) the traffic which may be carried on the ropeway,

l) the maximum and minimum rates that may be charged by the promoter and the circumstances in which and the manner in which these rates may be revised by the Government ;

m) the amount of security, if any, to be deposited by the promoter

- Further, the State Acts envisages, the promoter to approach the Deputy Commissioner/ Collector for removal of any tree standing or lying near a public ropeway or any structure or object which interrupts or interferes with the construction, maintenance or use of such ropeway. In such cases, the DC/ Collector after giving an opportunity of hearing to the affected parties, cause such tree, structure or object to be removed after payment of compensation by the promoter.

IV. Commencement of Commercial operation of Ropeway

- Every Act provides for procuring approval from Licensing Authority by the promoter for commencement of operation of ropeway for any kind of traffic. Such approval may be accorded by the Licensing Authority only after considering the report from the Inspector or Chief Ropeway Inspector/Expert Committee[30] about the fitness of the ropeway from technical, operational and safety perspective. Accordingly, a duty is imposed on the Inspector or Chief Ropeway Inspector/Expert Committee to inspect aerial ropeways to determine whether they are constructed in a fit condition and are working properly to the convenience and safety of the persons using them.

V. Fixation of rates

- The promoters are given the power to fix rates for the ropeway operations. However, the fixing of such rates by the promoters is regulated by the concerned regulating agencies who are empowered to fix the maximum and minimum rates to be so charged. The promoter is thus bound by the rates so fixed by the tariff regulating agencies in fixing the rates.

VI. Handling of emergency situations

- In the event of any accidents in operation of the ropeway, the promotor is immediately required to report the incident to the nearby police station, the licensing authority, collector/district magistrate and to nearby hospital or dispensary. States like Sikkim, J&K, HP, Assam and Meghalaya require the promoter to compensate the victims of any accident and to pay the expenses incurred by the state government in taking up rescue operation in such situation. Promoters are obligated to take insurance cover in this regard in Assam and Meghalaya.

VII. Dis-continuation of ropeway operation

- Where the promoter at any time after opening of the ropeway discontinues its operation without sufficient reasons for a period as specified in the license/order granting approval for construction or where no such period is specified, than for a period of three months, the Licensing Authority after giving an opportunity of hearing can cease powers of the promoter with respect to the ropeway and remove aerial ropeway.

30 Acts for the State of Sikkim, HP, J&K and Assam provides for seeking of report from Inspector and Expert committee by the Licensing Authority while States like Uttarakhand, Rajasthan, Meghalaya and Karnataka provides for seeking report from Chief Ropeway Inspector by the Licensing Authority.

VIII. Purchase of Ropeway

- All the States under the present study except Rajasthan and Karnataka provide provisions for purchase of a Ropeway. Where the State is the promoter of a ropeway, it may transfer the undertaking to any local authority or any other person under the agreed terms.
- Where the State government is not the promoter, powers are vested with the State Government or a Local Authority to purchase such ropeway under certain conditions as laid down in the respective legislations. Few States like Sikkim, J&K, HP and Assam also lay down the cost of purchase of such ropeways[31].

IX. Penalties

- Penal actions including punishment with fine is envisaged for offences such as (i) failure on the part of Promoter to comply with the Act (ii) unlawful obstruction to promoters servant in discharge of their duty under the Act, (iii) Unlawful interference with aerial ropeways and (iv) for acts or attempts tendering to endanger safety of persons travelling in aerial ropeways.
- The Act lays down provisions relating to arrest for offence against certain sections and procedure thereupon.

Annexure 3D: Ropeways under different tourism policies

State	Policy Document	Description
J&K	JK Tourism Policy 2020	Entity developing ropeway in the state is recognised as the tourism unit and are made eligible to receive incentives as set in the policy. The Policy while extending the definition of "Aerial Ropeway" as provided under the J&K Aerial Ropeway Act, provides for inclusion of any transport mode that have cables and used for transport of tourists as Ropeway under this category.
Uttarakhand	Uttarakhand Tourism Policy 2023 & its Operational Guidelines	The Policy provides for capital subsidy for Ropeway Funiculars (Other land transport services) where the minimum investment involved is Rs. 10 crore and are developed for public/tourism purposes under Uttarakhand Ropeway Act[32].
HP	HP Tourism Policy 2019	Provides facilitation of Ropeway projects to provide last mile connectivity in tough/remote terrain as one of the short term action points. In this regard, it envisages the following; • Taking up forest clearance for ropeway projects as a priority. • Formation of handholding committees to monitor the progress and get clearances from the respective departments. • Appointment of nodal officer from the Department to coordinate with operator/agencies to get the clearances.
Rajasthan	Rajasthan Tourism Unit Policy 2024	Ropeway is recognised as the tourism unit under the Policy and subject to conditions provided in the policy, are eligible for various benefits such as (i) earmarking and allotment of government land (ii) Concession in stamp duty/conversion/development/land use change charges and other fiscal and incentives as provided in the policy

31 Cost of purchase is to be as provided in the order/license granting approval for construction. Where the same is not specified therein than it shall be 25 times the average yearly net earning in the last 3 years of ropeway operation by promoter, however not exceeding 20% of the total capital expenditure of the promoter on the ropeway.

32 Such projects should be on freehold land, or if being developed on leasehold land should have a residual lease term of >10 years. Further, the PPP projects of the State Government are not be eligible.

State	Policy Document	Description
Assam	Assam Tourism Policy 2022	Policy recognises that Ropeways are not only meant to efficiently facilitate movement of tourists but also provide an opportunity to passengers to enjoy the scenery at attractive locations. The policy as such encourages development of ropeways by Government through private sector participation. The Department of Tourism is further encouraged to explore the possibility of investment in ropeways by the NHAI and its subsidiaries.
Meghalaya	Meghalaya Tourism Policy 2023	To attract a range of tourists and prolong their stays, the State Government encourages the building of new infrastructural works recognised as 'Iconic Infrastructure'. In this regard, the policy envisages building ropeways amongst others.
Karnataka	Karnataka Tourism Policy 20-26 and its operational guidelines	Ropeway is recognised as a Tourism Project which is eligible for incentives, subsidies and concessions under the Policy. Few of the support provided under the policy for the tourism projects are set out below; • Institutional arrangements would be made to secure accelerated development of Tourism Projects and to address interdepartmental issues. • Necessary support will be provided to procure necessary approvals, sanctions, clearances, licenses, certifications, NOCs and other similar permissions from the concerned governmental authorities. • Marketing support such as promotion through featuring the project in promotional contents, marketing collaterals, brochures, print media, social media, website, etc. would be undertaken. • Special recognition will be accorded to the projects, which have undertaken sustainability measures or have displayed commitment to responsible tourism practices, by displaying them in the Karnataka Tourism website. • Financial assistance up to Rupees one lakh is given for projects that have adopted sustainable initiatives such as water conservation and harvesting, renewable energy, pollution control measures. • A mechanism to recognize aggregators and online travel agents operating in the tourism sector will be instituted • shall • The Tourism Department will collaborate with the aggregators and online travel agents to roll out programs and initiatives beneficial to tourism stakeholders. • Certain market development assistance is extended to tourism service providers for promoting Karnataka tourism in domestic and international markets. • Concessions such as exemption on stamp duty, concession on registration charges, reimbursement of land conversion fee etc. are accorded to new tourism projects and expansion of tourism projects in the State. The operational guidelines provided under the policy lay down the mandatory specifications, operational Requirements and desirable specification for Ropeway Projects as given below; Mandatory Specifications provides for adhering to internationally approved norms for setting up, running and maintaining the ropeway facilities and taking all necessary licenses / no objection certificate (NOC) from the relevant local authorities and any other concerned authorities, as may be applicable. From safety point of view, it provides for maintaining full capacity generator set to drive the ropeway in case of power failure, provide for emergency brake in addition to normal brake and provide for fire exit signs and emergency / backup power for all guest areas.

State	Policy Document	Description
		The mandatory specification from passenger safety and convenience perspective provides for maintaining a study and aesthetic cabins, ensuring that the transportation is continuous and waiting time is minimum, disable friendly cabins and their approach and other basic facilities for comfort of the passengers. Operational requirement mainly provides for operational norms regarding the staff operating the system. It requires to engage trained staffs, ensure adequate medical equipments and first aid to respond to medical emergency.

Annexure 3E: Other environmental and social legislations

Sl No	Legislations	Relevance to the Development of Ropeway Project
	The Wildlife (Protection) Act 1972 and the Rules made thereunder	Where the ropeway project is planned to be developed in Protected Area such as viz., Sanctuaries, National Parks Conservation Reserves, Community Reserves, Tiger Reserves or where the wildlife flora and fauna are likely to be impacted by the project, the concerned authority would be required to take necessary permits and approvals under this Act. Further, the conditions, if any provided under this Act to protect the wildlife would require to be complied in the development of the projects.
	Air (Prevention & Control of Pollution) Act, 1981	Construction of ropeway project may result in air pollution due to usage of diesel generators, movement of heavy transport etc. Necessary consent/approvals required under the Air Act shall be taken and the air quality standards prescribed by the concerned Pollution Control Board shall be adhered to.
	Water (Prevention & Control of Pollution) Act, 1974	Effluents expected to be generated during construction and operation of ropeway project shall be treated as per standards prescribed by the Pollution Control Board prior to its disposal into any water bodies.
	Noise Pollution (Regulation and Control) Rules, 2000	One need to monitor the noise level due to operation of the various construction equipment during the implementation of the ropeway project and shall ensure that the ambient noise quality is maintained within the permissible limits in the project area as per the National Noise Standards.
	Municipal Solid Wastes (Management and Handling) Rules, 2000	The ropeway project will include provisions for proper disposal of solid wastes generated from various sources during the construction and operation of the Project.
	The Right to Fair Compensation and Transparency In Land Acquisition, Rehabilitation And Resettlement Act, 2013	Where acquisition of private land is required for the development of any ropeway project, the provision under this Act would be applicable. The Act provides compensation to families who are affected or whose land has been acquired, or livelihood has been affected, because of land acquisition. Provides adequate provision for rehabilitation and resettlement of the families affected
	Construction and Demolition Waste Management Rules, 2016	The ropeway project are likely to generate construction and demolition waste, which shall be disposed as per the applicable norms.
	Labour laws	All legislation governing the labour [legislation such as Child Labour (Prohibition and Regulation) Act, 1986, Contract Labour (Regulation and Abolition) Act, 1970, Minimum Wages Act, 1948 etc.] including child and women labour, wages and compensation, working condition and worker welfare will have a bearing on the ropeway project. Bid documents for the Contractor shall include adequate provisions to ensure strict compliance with applicable labour laws and regulations

Chapter -4

Annexure 4A: Impact of tariff, initial capacity and VGF on project IRR and equity IRR

The table below illustrates the impact on PIRR and EIRR at a tariff of Rs. 20 per passenger per trip, with varied initial occupancy level of the ropeway system and the corresponding VGF support required for the project viability.

Tariff (Rs.)	Initial Capacity (%)	VGF (%)	Project IRR (%)	Equity IRR (%)
20	30	0%	7.81%	7.29%
	30	20%	7.77%	9.97%
	30	25%	7.76%	10.76%
	30	30%	7.75%	11.69%
	30	35%	7.74%	12.74%
	30	40%	7.72%	13.92%
	40	0%	8.36%	8.01%
	40	20%	8.32%	10.99%
	40	25%	8.31%	11.88%
	40	30%	8.29%	12.93%
	40	35%	8.28%	14.12%
	40	40%	8.27%	15.48%
	50	0%	8.86%	8.69%
	50	20%	8.82%	11.98%
	50	25%	8.80%	12.97%
	50	30%	8.79%	14.15%
	50	35%	8.77%	15.50%
	50	40%	8.76%	17.05%
	60	0%	9.76%	9.98%
	60	20%	9.71%	13.64%
	60	25%	9.69%	14.74%
	60	30%	9.68%	16.07%
	60	35%	9.66%	17.61%
	60	40%	9.64%	19.36%
	70	0%	10.12%	10.52%
	70	20%	10.06%	14.48%
	70	25%	10.05%	15.66%
	70	30%	10.03%	17.12%
	70	35%	10.01%	18.82%
	70	40%	9.99%	20.75%

At a tariff of Rs.20 per trip, at different initial occupancy level, minimum VGF of 20% to 25% of the total project cost would be required.

The table below illustrates the impact on PIRR and EIRR at a tariff of Rs. 25 per passenger per trip, with varied initial occupancy level of the ropeway system and the corresponding VGF support required for the project viability.

Tariff (Rs.)	Initial Capacity (%)	VGF (%)	Project IRR (%)	Equity IRR (%)
25	30	0%	10.12%	10.45%
	30	20%	10.08%	13.35%
	30	25%	10.07%	14.45%
	30	30%	10.06%	15.53%
	30	35%	10.04%	16.76%
	30	40%	10.03%	18.14%
	40	0%	10.83%	11.49%
	40	20%	10.78%	15.01%
	40	25%	10.77%	16.03%
	40	30%	10.75%	17.27%
	40	35%	10.74%	18.07%
	40	40%	10.72%	20.31%
	50	0%	11.48%	12.52%
	50	20%	11.42%	16.47%
	50	25%	11.41%	17.62%
	50	30%	11.39%	19.04%
	50	35%	11.37%	20.67%
	50	40%	11.36%	22.53%
	60	0%	12.53%	14.21%
	60	20%	12.47%	18.66%
	60	25%	12.45%	19.94%
	60	30%	12.43%	21.55%
	60	35%	12.41%	23.41%
	60	40%	12.39%	25.51%
	70	0%	13.01%	15.08%
	70	20%	12.94%	19.95%
	70	25%	12.92%	21.33%
	70	30%	12.90%	23.01%
	70	35%	12.88%	25.17%
	70	40%	12.86%	27.49%

At a tariff of Rs.25 per trip the minimum VGF required ranges from 0% to 30% of the total project cost for an initial occupancy level of 70% and 30%.

The table below illustrates the impact on PIRR and EIRR at a tariff of Rs. 30 per passenger per trip, with varied initial occupancy level of the ropeway system and the corresponding VGF support required for the project viability.

Tariff (Rs.)	Initial Capacity (%)	VGF (%)	Project IRR (%)	Equity IRR (%)
30	30	0%	12.14%	13.35%
	30	20%	12.10%	16.84%
	30	25%	12.09%	17.83%
	30	30%	12.08%	19.06%
	30	35%	12.06%	20.46%
	30	40%	12.05%	22.03%
	40	0%	13.00%	14.76%
	40	20%	12.95%	18.78%
	40	25%	12.94%	19.91%
	40	30%	12.92%	21.33%
	40	35%	12.91%	22.97%
	40	40%	12.89%	24.82%
	50	0%	13.80%	16.17%
	50	20%	13.74%	20.75%
	50	25%	13.73%	22.02%
	50	30%	13.71%	23.65%
	50	35%	13.69%	25.54%
	50	40%	13.67%	27.66%
	60	0%	15.01%	18.32%
	60	20%	14.94%	23.49%
	60	25%	14.92%	24.88%
	60	30%	14.90%	26.71%
	60	35%	14.88%	28.84%
	60	40%	14.86%	31.22%
	70	0%	15.61%	19.75%
	70	20%	15.53%	25.25%
	70	25%	15.51%	26.75%
	70	30%	15.49%	28.76%
	70	35%	15.46%	31.01%
	70	40%	15.44%	33.07%

At a tariff of Rs.30 per trip the minimum VGF required ranges from 15% to 20% of the total project cost for an initial occupancy level of 30%.

The table below illustrates the impact on PIRR and EIRR at a tariff of Rs. 35 per passenger per trip, with varied initial occupancy level of the ropeway system and the corresponding VGF support required for the project viability.

Tariff (Rs.)	Initial Capacity (%)	VGF (%)	Project IRR (%)	Equity IRR (%)
35	30	0%	13.97%	16.08%
	30	20%	13.93%	19.95%
	30	25%	13.91%	21.02%
	30	30%	13.90%	22.37%
	30	35%	13.89%	23.92%
	30	40%	13.87%	25.66%
	40	0%	14.99%	17.90%
	40	20%	14.93%	22.39%
	40	25%	14.92%	23.60%
	40	30%	14.90%	25.18%
	40	35%	14.89%	27.00%
	40	40%	14.87%	29.05%
	50	0%	15.93%	19.73%
	50	20%	15.87%	24.87%
	50	25%	15.86%	26.22%
	50	30%	15.83%	28.03%
	50	35%	15.82%	30.12%
	50	40%	15.80%	32.45%
	60	0%	17.30%	22.36%
	60	20%	17.23%	28.13%
	60	25%	17.21%	29.58%
	60	30%	17.19%	31.60%
	60	35%	17.16%	33.93%
	60	40%	17.14%	36.52%
	70	0%	18.02%	24.01%
	70	20%	17.93%	30.31%
	70	25%	17.91%	31.85%
	70	30%	17.89%	34.06%
	70	35%	17.87%	36.63%
	70	40%	17.84%	39.46%

At a tariff of Rs.35 per trip no VGF would be required for an initial occupancy level of 30%.

Chapter 6

Annexure 6A: Ropeways as a feeder system to metro system (Optimistic scenario)

City	Potential demand for ropeways (peak hr)	Number of ropeway lines	Total kms	Total CAPEX (Cr.)
Delhi	165000	37	147	18333
Bangalore	60000	13	53	6667
Kolkata	45000	10	40	5000
Chennai	39000	9	35	4333
Hyderabad	122775	27	109	13642
Mumbai	18975	4	17	2108
Ahmedabad	45750	10	41	5083
Pune	28500	6	25	3167
Nagpur	17625	4	16	1958
Lucknow*	45750	10	41	5083
Kochi	30000	7	27	3333
Jaipur	18359	4	16	2040
Gurugram	11400	3	10	1267
Noida	11447	3	10	1272
Kanpur	10500	2	9	1167
Navi Mumbai	10350	2	9	1150
Agra	36000	8	32	4000
Total	716431	159	637	79603

Annexure 6B: Ropeways as a feeder system to metro system (Conservative scenario)

City	Potential demand for ropeways (peak hr)	Number of ropeway lines	Total kms	Total CAPEX (Cr.)
Delhi	66000	15	59	7333
Bangalore	24000	5	21	2667
Kolkata	18000	4	16	2000
Chennai	15600	3	14	1733
Hyderabad	49110	11	44	5457
Mumbai	7590	2	7	843
Ahmedabad	18300	4	16	2033
Pune	11400	3	10	1267
Nagpur	7050	2	6	783
Lucknow*	18300	4	16	2033
Kochi	12000	3	11	1333
Jaipur	7344	2	7	816

City	Potential demand for ropeways (peak hr)	Number of ropeway lines	Total kms	Total CAPEX (Cr.)
Gurugram	4560	1	4	507
Noida	4579	1	4	509
Kanpur	4200	1	4	467
Navi Mumbai	4140	1	4	460
Agra	14400	3	13	1600
Total	286572	64	255	31841

Annexure 6C: Ropeways as a main public transit system in hill cities with a population of over 2 lakhs (Optimistic scenario)

City	Potential demand for ropeways (peak hr)	Number of ropeway lines	Total kms	Total CAPEX (Cr.)
Srinagar	23456	5	21	2606
Dehradun	40681	9	36	4520
Shillong	18284	4	16	2032
Imphal	36744	8	33	4083
Aizawl	17928	4	16	1992
Agartala	28166	6	25	3130
Total	165260	37	147	18362

Annexure 6D: Ropeways as a main public transit system in hill cities with a population of over 2 lakhs (Conservative scenario)

City	Potential demand for ropeways (peak hr)	Number of ropeway lines	Total kms	Total CAPEX (Cr.)
Srinagar	11728	3	10	1303
Dehradun	20340	5	18	2260
Shillong	9142	2	8	1016
Imphal	18372	4	16	2041
Aizawl	8964	2	8	996
Agartala	14083	3	13	1565
Total	82630	18	73	9181