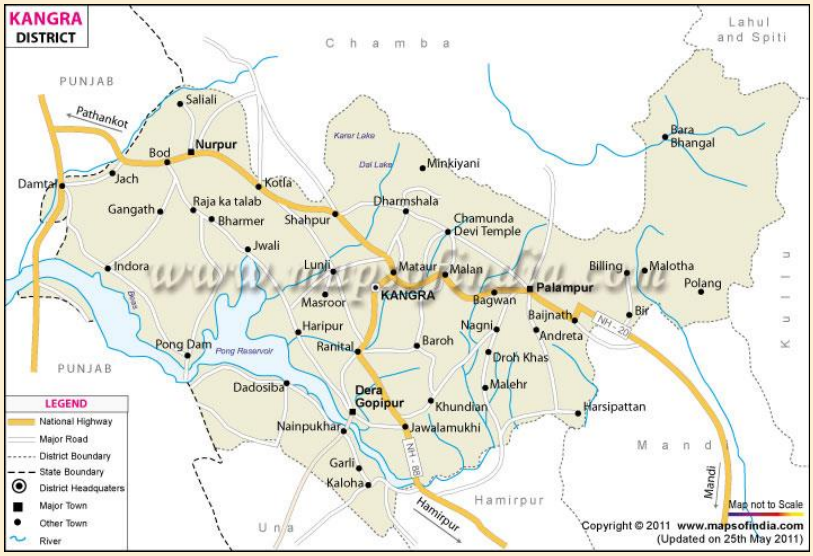
ROPEWAY AND RAPID TRANSPORT SYSTEM DEVELOPMENT CORPORATION H.P. LTD (RTDC)



Technical-Financial Feasibility Report

Passenger Ropeway from Bhatarka to Thathri to Chunja Glacier, Distt. Kangra in Himachal Pradesh

सत्यमेव जयते
हिमाचल प्रदेश सरकार

RTDC
(A Government of Himachal Pradesh Undertaking)
Ropeways and Rapid Transport System Development Corporation HP Ltd.
प्रदूषण मुक्त यातायात के लिए हिमाचल की पहल

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June 01, 2023


Cable

Table of Contents

1. Introduction 8

1.1 Background 8

1.2 Objective of the Project 8

1.3 Structure of the report 9

1.4 Stages to establish a touristic destination 10

1.5 Promotion for a natural tourist destination 11

2. Study Area Description 12

2.1 General Information 12

By Road 14

By Train 15

By Air 15

2.2 Geographical Location 16

3. Scope of Assignment 21

3.1 Objective 21

3.2 Technical Feasibility 21

3.3 Financial Feasibility 21

4. Traffic Analysis 22

4.1 Traffic Surveys and Studies 22

4.2 Total visitors 23

4.3 Growth of Tourists 25

4.4 Ticket Price (including GST) – Tentative and Proposed 28

5. System Requirements 29

5.1 Design Parameters 29

5.2 Regulations 29

6. Proposed ropeway systems 31

6.1 Jig-back System/ Aerial Tramway System 31

6.2 Circulating "2S" ropeway (detachable) 32

6.3 Circulating monocable ropeway (detachable) – "MDG" 33

6.4 Circulating "3 S "ropeway (detachable) 34
7. Recommended Ropeway System 36
7.1 Stations 36
7.2 Parking Bay 37
7.3 Line towers 37
7.4 Cabins/Carriers 38
7.5 Grip 39
7.6 Haul Rope 40
7.7 Sheave Assemblies 40
7.8 Cabin 42
7.9 Drive Terminal 42
7.10 Terminals/Stations 43
7.11 Hauling Rope 43
7.12 Track Rope 43
7.13 Grip System 43
7.14 Support Towers 43
7.15 Control and Safety Systems 43
8. Project Overview and Technical Data 44
8.1 Study of Ropeway Alignments 44
9. Financial Analysis and Structuring of Project 54
9.1 Introduction 54
9.2 Project Capital Cost 55
9.3 Key aspects of financial evaluation 56
9.4 Assumptions for the Total Project Cost (TPC) 57
9.5 Other Major Assumptions 57
9.6 Minimum return criteria for the Project 59
9.7 Straight forward PPP Model 59
9.8 Financial Analysis (Estimated profit and loss statement) 60
9.10 Economic Analysis (Estimated profit and loss statement) 68
10. Conclusion 72
11. Abbreviations 73

Table of Figures

Figure 1:Palampur on a winter afternoon 14
Figure 2: Map of Distt Kangra 16
Figure 3: Temperature – Palampur, Himachal Pradesh 17
Figure 4: Tourist Attractions near Palampur 17
Figure 5: View from Tira Sujanpur 18
Figure 6: Toy Train 18
Figure 7: Saurabh Van Vihar 19
Figure 8: Tea Gardens in Palampur 19
Figure 9: Neugal Khad – Scenic Beauty 20
Figure 10: "Jigback Monocable System" Ropeway 31
Figure 11:"2S" Ropeway 32
Figure 12: Mono-cable (MDG) 33
Figure 13: "3 S" Ropeway 35
Figure 14: Line Towers 37
Figure 15: Typical Cabin 38
Figure 16: Detachable Grip 39
Figure 17: Rope 40
Figure 18: Sheave assembly 41
Figure 19: Tower 41
Figure 20: Sheaves 41
Figure 21: 3S / Tricable Ropeway Sysyem/Aerial Tramway 42
Figure 22: Alignment 46
Figure 23: Proposed LTP 47
Figure 24: Proposed ITP 47
Figure 25: Proposed UTP 48
Figure 26: Tentative Tower Locations 53

Table of Tables

Table 1: General Data of Himachal Pradesh 13
Table 2: Distance of Palampur by Car 15
Table 3: Climate Data 16
Table 4: Monthly Visitors in 2019 and 2018 23
Table 5: Growth of Tourists 25
Table 6: Traffic Expectation in the Year 2026 26
Table 7: Projected Traffic and expected Ropeway Ridership 26
Table 8: Projected forecast for the Traffic Analysis 28
Table 9: Ticket Price 28
Table 10: Passenger Usage 45
Table 11: Environmental Impact 45
Table 12: Contribution to the Local Economy 45
Table 13: Brief description of the technical details for the alignment 48
Table 14: Tentative Area Required for LTP Development 49
Table 15: Tentative Area Required for UTP Development 51
Table 16: Project Cost with Item Description 55
Table 17: Key Assumptions for the Capital Cost 57
Table 18: Key Assumptions for the Revenue from Fare 58
Table 19: Financials for Base PPP Model 59
Table 20:Estimated Profit and Loss Statement (during concession period) – Phase-I 60
Table 21:Estimated Profit and Loss Statement (during concession period) – Phase-I & II 61
Table 22: Benefits components due to Ropeway 63
Table 23: Estimation of Benefits from using Ropeway to Transport Passengers 64
Table 24: Estimation of Carbon Credits from using Ropeway Instead of Travelling by Car 65
Table 25: Percentage of Benefit Components 67
Table 26:Estimated Profit and Loss Statement (during concession period) – Phase- I 68
Table 27:Estimated Profit and Loss Statement (during concession period) – Phase – I & II 69

DISCLAIMER

The objective of this report is to provide information to Ropeway and Rapid Transport System Development Corporation H.P. Ltd (RTDC) required for taking a decision for development of the proposed Passenger Ropeway Project in Himachal Pradesh. The information and data contained and used in this report is based on secondary data, market practices, trends and assumptions and existing survey reports.

The report covers statements, assumptions, forecast, assessments, analysis and recommendation provided by Nivesa Advisors LLP concerning the Project, which shall not amount to any form of guarantee that we have determined or predicted future events or circumstances. The report is based on the present situation, data and information available and has no bearing on any future conditions which cannot be envisaged currently.

This report has been prepared with the specific objectives of RTDC and Nivesa Advisors LLP, its employees or partners or advisors shall have no liability to any person, under any law, statute, rules or regulations or tort, principles of restitution or unjust enrichment or otherwise for any loss, claims, damages, liabilities or cost or expense which may arise from or be incurred or suffered on account of anything contained in this report or otherwise, including the accuracy, adequacy, correctness, completeness or reliability of the report and any assessment, assumption, statement or information contained therein or deemed to form part of this report.

Information provided in this report is on a wide range of matters, some of which depends upon appropriate laws, regulations and current situations. The information given is not an exhaustive account of statutory requirements and should not be regarded as a complete or authoritative statement of law.

Further, the report has been prepared for specific use by RTDC and should be treated as strictly confidential. No content of the report shall be replicated or used by any other person/agency without the consent and approval from RTDC.

1. Introduction

1.1 Background

The site lies in the Kangra district which is one of the most renowned districts for having the oldest serving Royal Dynasty in the world. The district is situated on the southern escarpment of the Himalayas. The altitude of the district varies from 500 meters above mean sea level to around 5000 meters above mean sea level. It is encapsulated in the north by the district of Chamba and Lahul and Spiti, in the south by Hamirpur and Una, in the east by Mandi and in the west by Gurdaspur, District of Punjab. The Kangra district consist of a number of ancient temples such as Masoor Rock cut temple, Jawalaji, Chamunda Devi temple, Chintapurni temple, baba baroh and Baijnath temple. The total area of the district is 5,739 km2 with a population of 15 lakh approx. and highest number of 3,869 villages among all districts. Mcleodganj in Dharamsala is a seal of the Dalai Lama has become a placeof international fame since 1966.

Gopalpur Natura park situated in Gopalpur village has tea gardens that not only make the area beautiful but also is a great source of revenue for the people of district. Kangra district is also connected through narrow gauge railway line that runs from Pathankot, Punjab to Joginder Nagar.

1.2 Objective of the Project

RTDC has appointed Nivesa Advisors LLP to conduct a Techno-Economic Feasibility Study (TEFR) for development of Aerial Passenger Ropeway from Bhatarka to Thathri to Chinja Glacier in Kangra, in Himachal Pradesh on PPP Mode with VGF (hereinafter referred to as "Report" or "Ropeway Project"). The aim of the study is to find the potential for enhancement of tourism to Palampur and local infrastructure by way of alternate transport.

The site analysis will be done to ascertain the feasibility and potential of the region towards installation of a Ropeway System. There would be a recommendation for the final alignment after studying various options.

This study should be taken as a guide a detailed project report and design of a Ropeway System.

1.3 Structure of the report

This innovative mobility solution is targeted to provide an efficient alternate public Transport System for tourists in the Distt. Kangra, between Bhatarka to Thathri to gunja Glacier, Himachal Pradesh.

The report is structured in the following manner, as explained below:

i. Description of Study Area

   a. An assessment of Kangra has been done based on the connectivity network, linkages and the major locations of the area.

   b. This report also contains the population, the mobility trends and the quality of transportation infrastructure in the city.

   c. The objective of the report is to give a macro view of the city as well as comprehensively analyse the target population of the proposed mobility solution.

ii. Vision and Methodology

   a. Formulation of a vision for the implementation of sustainable mobility transport between Bhatarka to Thathri to gunja Glacier in Kangra.

   b. A description of methodology and structure has been explained on the process followed to arrive at the proposal.

   c. The framework provided incorporates the population increase, and consequent projected rise in the demand of infrastructure and facilities.

iii. Planning and Conceptualization

   a. It deliberates various alternative mobility options between Bhatarka to Thathri to gunja Glacier in Kangra and the final selection methodology adopted.

   b. This report has clearly explained the proposed mobility option as part of the feasibility plan.

iv. Traffic Movement Assessment

   a. The assessment of the demand of the proposed mobility solution by traffic movement has been explained in this report.

   b. It consists of the movement pattern of the tourists.

v. Ropeway Ridership Estimation

   a. This report presents details about the expected usage of the proposed mobility solution in each corridor.

vi. Ropeway Alignment Lines

   a. Google Earth based alignment gives the idea of the route and tentative location of the stations.

vii. Cableway System Selection

   a. This report provides the information of the proposed mobility design and explains the kind of possible technologies viable for the project and their details, along with the alignment where they have been proposed.

viii. Cost Estimates

   a. An assessment has been done for the possible costing and expenditures for executing this Project in the stipulated time.

   b. Assumptions made for potential revenue sources and expenses.

   c. Costs are duly worked out in terms of fixed cost and variable costs.

   d. Financing mode of the Projects.

ix. Recommendation

Based on the reconnaissance survey and analysis of the available data, this report provides for the way forward with optimum solutions.

1.4 Stages to establish a touristic destination

On the way to establish a touristic area various steps had to be created as part of a recommended overall tourism development for Kangra:

1.5 Promotion for a natural tourist destination

Tourism should be promoted to boost visitors in places of stay with adequate natural surroundings. It is of utmost importance that all the stakeholders respect the environment and undertake to protect not only the natural habitat but also the social and cultural values thus enhancing the local economy.

The combination of social, environmental and economic sustainability is considered the cornerstone of a long-term success.

The visitors should have the feeling that they are in a protected environment.

2. Study Area Description

2.1 General Information

Kangra

Kangra district lies between 31° 21′ to 32° 59′ N latitude and 75° 47′ 55″ to 77° 45′ E longitude. It is situated on the southern escarpment of the Himalayas. The entire area of the district is traversed by the varying altitude of the Shivaliks, Dhauladhar and the Himalayas from north-west to south-east. The altitude varies from 500 metres above mean sea level (amsl) to around 5000 metres amsl. It is encapsulated in the north by the districts of Chamba and Lahaul and Spiti, in the south by Hamirpur and Una, in the east by Mandi and in the west by Gurdaspur district of Punjab. The present Kangra district came into existence on the 1st September, 1972 consequent upon the re-organisation of districts by the Government of Himachal Pradesh. It was the largest district of the composite Punjab in terms of area till it was transferred to Himachal Pradesh on the 1st November, 1966 and had six tehsils namely Nurpur, Kangra, Palampur, Dehragopipur, Hamirpur and Una.

About Palampur

Palampur is a hill station and a municipal corporation situated in the Kangra District in the Indian state of Himachal Pradesh. It is surrounded by pine forests and flanked by the Dhauladhar ranges. There are numerous streams flowing from the mountains to the plains, from Palampur. The combination of greenery, snowclad mountains and water gives Palampur a distinctive look.

About Bhatarka

According to Census 2011 information the location code or village code of Bhatarka village is 011848. Bhatarka village is located in Palampur tehsil of Kangra district in Himachal Pradesh, India. It is situated 38km away from district headquarter Palampur. Palampur is the sub-district headquarter of Bhatarka village. As per 2009 stats, Bandla is the gram panchayat of Bhatarka village.

About Thathri

According to Census 2011 information the location code or village code of Thathri village is 009547. Thathri village is located in Dharmsala tehsil of Kangra district in Himachal Pradesh, India. It is situated 9km away from Dharmsala, which is both district & sub-district headquarter of Thathri village. As per 2009 stats, Sounkni Da Kot is the gram panchayat of Thathri village.

Table 1: General Data of Himachal Pradesh

Country	India
City	Himachal Pradesh
Longitude	76.5213092
Latitude	31.6861745
Attitude/Elevation	774.74m (2541.8ft)
Local time	Wednesday 07:17
Annual high temperature	27.9ºC (82.22ºF)
Annual low temperature	17.96ºC (64.33ºF)
Average annual precip.	42.86mm (1.69in)
Warmest month	June (37.93ºC / 100.27ºF)
Coldest Month	January (8.31ºC / 46.96ºF)
Wettest Month	August (158.64mm / 6.25in)
Driest Month	October (2.01mm / 0.08in)
Number of days with rainfall (≥ 1.0 mm)	35.54 days (9.74%)
Days with no rain	329.46 days (90.26%)
Humidity	46.80%

Best time to visit

Nestled amidst mountains and verdant trees, Palampur experiences pleasant weather throughout the year. With the temperature rising to just 30 degrees, Summers are agreeable. While the monsoons receive mild rainfall, winters are at times frigid with temperatures falling to sub-zero levels. Hence, **the best time to take a trip to Palampur is at the onset of the summer season between March and June.** Early winters from September to November are also a pleasant time of the year. Winters are freezing in Palampur, but if you're looking for an adventure then this time is ideal for a visit.

Climate

In Palampur, the average annual temperature is 16.8 °C | 62.2 °F. The rainfall here is around 1578 mm | 62.1 inch per year. The location Palampur is in the northern hemisphere. Summer begins in September and ends at the end of June. The months of summer are: June, July, August, September.

Figure 1:Palampur on a winter afternoon

Accessibility

Below a list of some large cities showing distance and travel time by using different means of transport.

By Road

The idyllic town of Palampur is a must sought after tourist destination in Himachal and is easily accessible by road. There are regular state owned and private buses from Dharmshala, Chandigarh and Delhi to reach Palampur.

Some of the important stations/routes from where regular buses service is available to & from Palampur:

- Delhi, Panipat, Kurukshetra, Ambala, Chandigarh, Roopnagar, Una

- Amritsar, Jalandhar, Ludhiana, Hoshiarpur, Una
- Jammu, Pathankot, Kangra, Jawala Ji, Nadaun
- Dehradoon, Haridwar, Ambala, Chandigarh, Roopnagar, Una
- Keylong, Manali, Mandi, Sundernagar
- Kalpa, Rampur, Shimla, Bilaspur
- Chamba, Nurpur, Kangra, Jawala Ji, Nadaun

The State Transport (HRTC – Himachal Road Transport Corporation) operates its well-maintained fleet of Super Luxury, Luxury, Super-Fast and Ordinary buses to all the major destinations. Privately operated bus service is also available within the state. Hired Taxi service is also available at most of the places.

By Train

Owing no railway junction in Palampur, the closest one is at Maranda which is just 2 km away. The hill town is also connected to the narrow-gauge line of Pathankot located at 120 km from it. It is linked with frequent trains passing across major destination in the country. From the station, the travelers can continue by road to reach the town.

By Air

The nearest airport to Palampur is the Gaggal Airport at Dharamshala at a distance of 40 km. It is connected to the major airports like Delhi and Mumbai. The tourists can easily hire a taxi from the airport to reach Palampur.

Table 2: Distance of Palampur by Car

S.No.	Place	Distance	Timing
1	Delhi	456 km	9 hrs 11 min
2	Haryana	453 km	8 hrs 54 min
3	Ludhiana	207.8 km	5 hrs 34 min
4	Chandigarh	225 km	5 hrs 27 min

2.2 Geographical Location

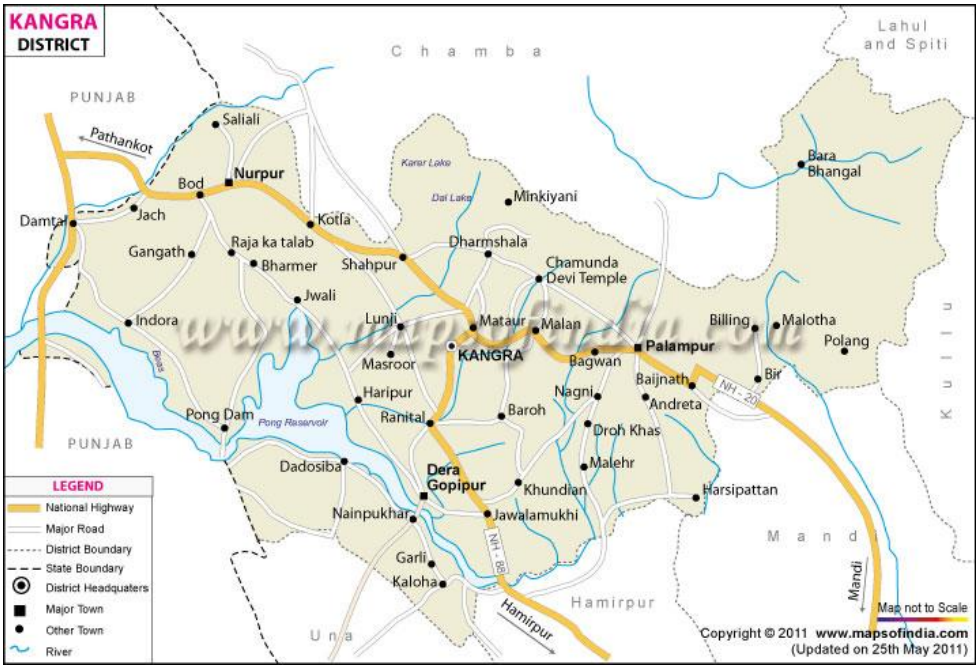


Figure 2: Map of Distt Kangra

The climate

Located at an elevation of 774.74 meters (2541.8 feet) above sea level, Kangra has a Humid subtropical, dry winter climate (Classification: Cwa). The district's yearly temperature is 24.46ºC (76.03ºF) and it is -1.51% lower than India's averages. Kangra typically receives about 42.86 millimeters (1.69 inches) of precipitation and has 35.54 rainy days (9.74% of the time) annually.

Table 3: Climate Data[1]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	12.8 (55.0)	14.7 (58.5)	18.1 (64.6)	24.1 (75.4)	25.7 (78.3)	25.9 (78.6)	25.2 (77.4)	24.1 (75.4)	23.3 (73.9)	23.4 (74.1)	20.6 (69.1)	14.8 (58.6)	21.1 (69.9)
Average low °C (°F)	1.8 (35.2)	3.6 (38.5)	8.8 (47.8)	10.8 (51.4)	14.5 (58.1)	16.3 (61.3)	16.7 (62.1)	20 (68)	15.9 (60.6)	15.3 (59.5)	10.7 (51.3)	4.8 (40.6)	11.6 (52.9)
Average precipitation mm (inches)	119 (4.7)	94 (3.7)	112 (4.4)	54 (2.1)	56 (2.2)	136 (5.4)	710 (28.0)	738 (29.1)	324 (12.8)	72 (2.8)	23 (0.9)	55 (2.2)	2,493 (98.3)

[1]https://en.wikipedia.org/wiki/Palampur,_Himachal_Pradesh#:~:text=Palampur%20has%20a%20monsoonal%2Dinfluenced,massive%20amount%20of%20monsoonal%20rain.

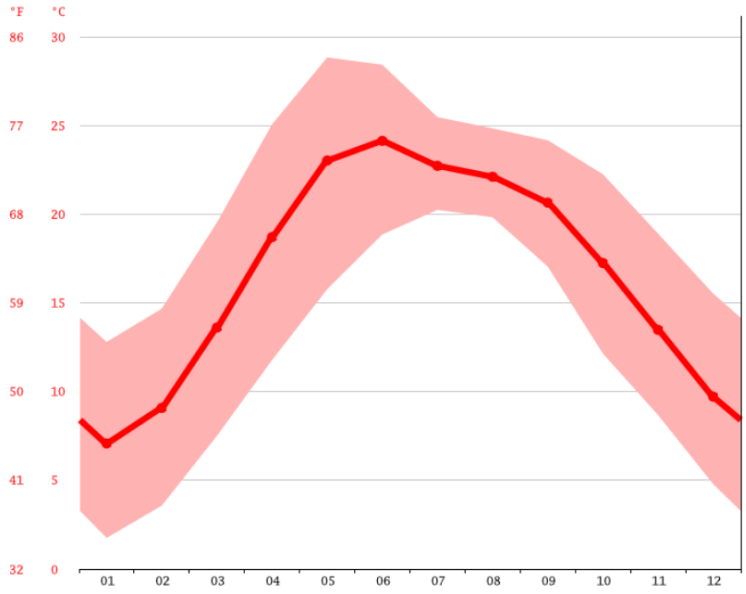


Figure 3: Temperature – Palampur, Himachal Pradesh[2]

Some Major Tourist Attractions in Palampur

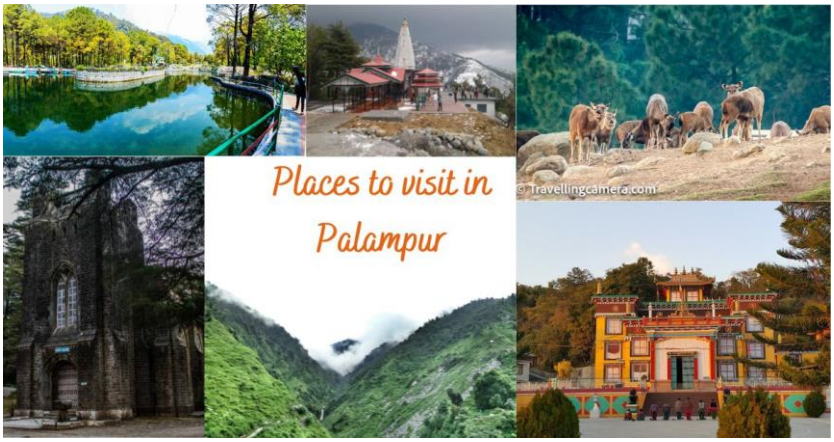


Figure 4: Tourist Attractions near Palampur

The list of heritage buildings in Palampur is as follows: -

- **Tashi Jong Monastery:**

The Tashi Jong Monastery is not just a centre for worship for Buddhists but is also the homely abode of various Tibetan refugees. The complex has a college for freshers and a Tibetan restaurant beside the main shrine. This place has been inhabited by Tibetan for

[2]https://en.climate-data.org/asia/india/himachal-pradesh/palampur-49025/

many years now and has a quaint serenity about it. Tibetan artefacts are also sold in the crafts emporium which are ideal for tourists to buy as souvenirs. Almost everyone who travels to Palampur visits this monastery.

Figure 5: View from Tira Sujanpur

- **Toy Train:**

One of the most popular attractions in Palampur is experiencing a toy train ride which is also designated as the UNESCO World Heritage Site. The train commutes between Palampur and Pathankot and takes you on a hilly ride amidst lush green forests, shimmering waterfalls and across meandering rivers. While you will definitely enjoy the picturesque vistas enroute, you will also cross rural villages and can witness the rural way of living in the hills.

Figure 6: Toy Train

- **Saurabh Van Vihar**

The Saurabh Van Vihar is a nature park that has been built in dedication of the brave and valiant soldier Saurabh Kalia, who was a martyr in the Kargil War. This beautiful and scenic tourist attraction is located on the banks of the snow-fed Neugel Khad in the village of Kwat and is spread over a total area of 13 kilometres. Saurabh Van Vihar is located

just 4 kilometres away from Palampur and is an ideal place to visit for a quiet getaway over the weekend. The nature park offers a panoramic view of the Dhauladhar Range and is home to a wide variety of plants, trees and birds, which add to the beauty of the park and attract nature lovers from all across.

Figure 7: Saurabh Van Vihar

- **Tea Gardens in Palampur**

Nadaun fort is better known as Amter-Nadaun fort, which was once the royal residence of Raja Sansar Chand. Perched atop a hill, this edifice attracts visitors by its impeccably done wall paintings and frescoes. Unfortunately, the fort is in a dilapidated condition but it still manages to put visitors in awe with its exquisite architecture. It is an ideal place that reflects the rich history of Raja Sansar Chand and the Katoch dynasty.

Figure 8: Tea Gardens in Palampur

- **Neugal Khad – Scenic Beauty**

  Settled just 2 kms from the main town, Neugal Khad is a popular tourist destination in Palampur. The place is blessed with clear streams flowing down with a beautiful backdrop of the snowcapped Dhauladhar mountains. This place is a perfect picnic spot and turns into a scenic destination during monsoon season.

Figure 9: Neugal Khad – Scenic Beauty

3. Scope of Assignment

3.1 Objective

To carry out a detailed technical, commercial, and financial feasibility analysis of the Ropeway Project involving elaborate study of the existing situation and covering all the important aspects like demographics, economy, physical characteristics, environmental and social issues.

3.2 Technical Feasibility

1. Selection of the optimum route for the proposed alignments keeping in view its feasibility/suitability with regard to construction, operation and maintenance.
2. Tentative locations of terminal stations and assessment of available area/options.
3. Consideration of any geological, traffic and other survey data relevant to the development of concept of passenger ropeway system.
4. Indication of staffing requirements for operation and maintenance for smooth and efficient functioning.
5. Broad assessment of traffic based on the information collected from concerned agency/survey for assessing system capacity, a key factor in selection of appropriate passenger ropeway Technology/ System. Provide inputs with regard to associated Power, safety, electrical and telecommunication requirements of the selected system.

3.3 Financial Feasibility

1. Assessment of the cost of Total capital investment required for Ropeway System Equipment & Components and Civil works.
2. Assessment of cost of operation and maintenance.
3. Based on the investments for the most appropriate and suitable system, financial appraisal of the project including periodic expenditure and estimated pricing of the passenger tickets will be made (financial model for 40 years will be made).
4. Structuring of Project under various options

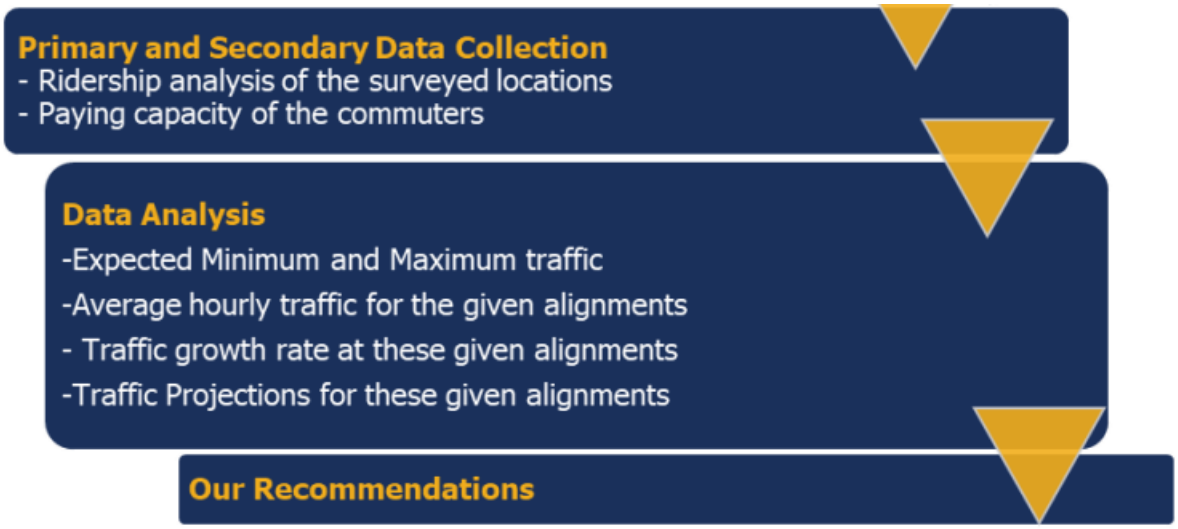
4. Traffic Analysis

This chapter deals with various traffic studies carried out and the analysis of the data obtained from these studies. In the planning and design of a Ropeway, an appreciation of the existing traffic and traffic forecast is important. This is to assess the capacity requirements, identify present and likely future traffic conditions and to have provisions for future improvements. As part of this study, a systematic methodology has been followed to assess ridership for the ropeway project.

4.1 Traffic Surveys and Studies

Data has been collected from various departments/Organizations/agencies/institutions and sources related to the Traffic census. Physical visits to the sites were made to assess the traffic data.

The following methodology was used to collect the primary and secondary data and to assess the traffic on the suggested alignments.

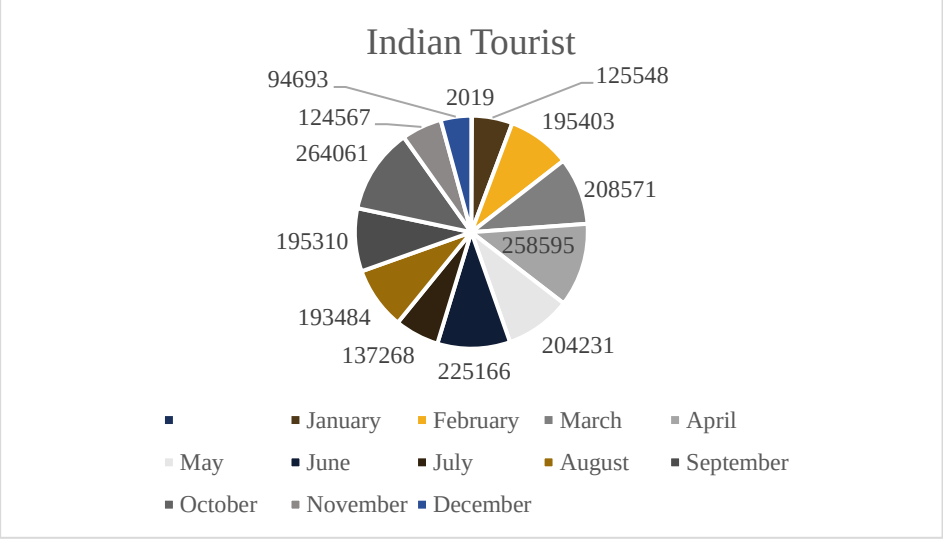


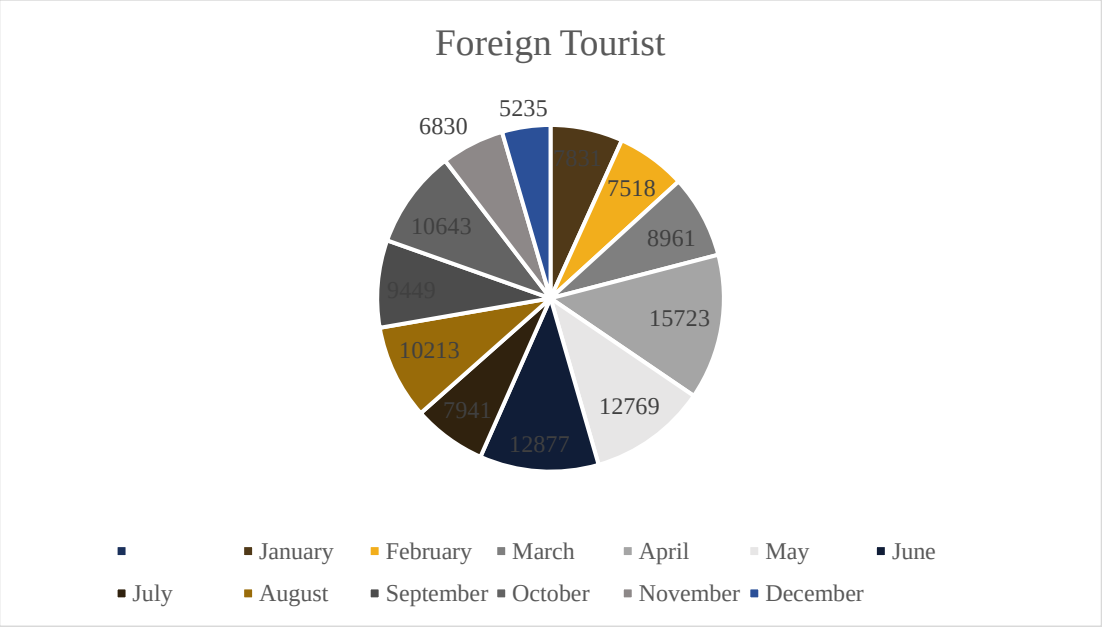
4.2 Total visitors

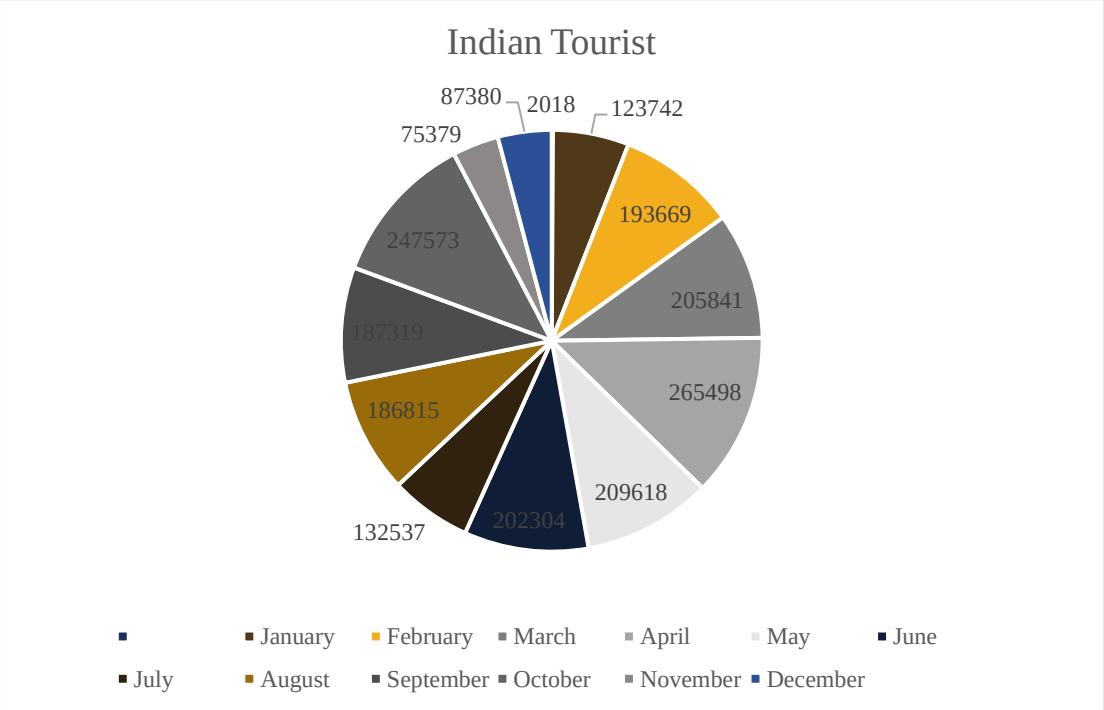
Table 4: Monthly Visitors in 2019 and 2018

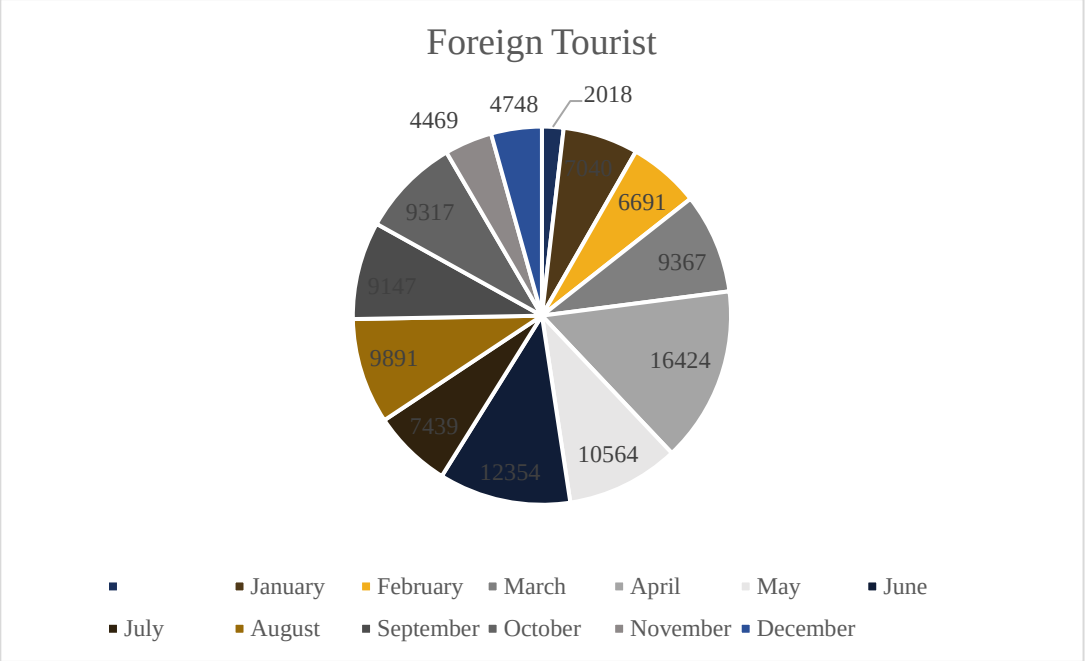
Month	Indian Tourists	Foreign Tourists	Indian Tourists	Foreign Tourists
	2019		2018	
January	1,25,548	7,831	1,23,742	7,040
February	1,95,403	7,518	1,93,669	6,691
March	2,08,571	8,961	2,05,841	9,367
April	2,58,595	15,723	2,65,498	16,424
May	2,04,231	12,769	2,09,618	10,564
June	2,25,166	12,877	2,02,304	12,354
July	1,37,268	7,941	1,32,537	7,439
August	1,93,484	10,213	1,86,815	9,891
September	1,95,310	9,449	1,87,319	9,147
October	2,64,061	10,643	2,47,573	9,317
November	1,24,567	6,830	75,379	4,469
December	94,693	5,235	87,380	4,748
Total	22,26,897	1,15,990	21,17,675	1,07,451

Source: District Tourism Development Office (DTDO), Kangra, Himachal Pradesh




Foreign Tourist
5235
6830
7831
7518
8961
10643
9449
15723
10213
7941
12769
12877
January
February
March
April
May
June
July
August
September
October
November
December


Indian Tourist
87380
2018
123742
75379
193669
247573
205841
187319
265498
186815
209618
132537
202304
January
February
March
April
May
June
July
August
September
October
November
December



4.3 Growth of Tourists

Table 5: Growth of Tourists

S.No	Year	No of Tourists Visiting Kangra	Variation in Growth	Growth Rate (%)
1	2008	13,45,974	-	-
2	2009	14,79,512	133,538	9.92
3	2010	17,22,941	243,429	16.45
4	2011	19,12,648	189,707	11.01
5	2012	23,05,411	392,763	20.54
6	2013	22,00,623	-104,788	-4.55
7	2014	23,33,367	132,744	6.03
8	2015	25,09,813	176,446	7.56
9	2016	26,52,732	142,919	5.69
10	2017	28,23,289	170,557	6.43
11	2018	22,25,126	-598,163	-21.19
12	2019	23,42,887	117,761	5.29

Source: District Tourism Development Office (DTDO), Kangra, Himachal Pradesh

It has been observed that Ropeway system is an attraction in itself and it pulls its own traffic.

Table 6: Traffic Expectation in the Year 2023

S.No	Year	No of Visitors	Total No. of Tourist Visitors	Total No. of Local Visitors
Total Ropeway Visitors in Palampur				
1	2023	12,00,000	800,000	400,000

* ~50% of tourist data in Kangra in 2019

Ropeway system is an attraction in itself and it pulls its own traffic. It has been observed from case studies done on various urban and touristic ropeways around the world that the expected growth of traffic has beaten the estimations for the traffic. Hence one can assume on a conservative side that the annual growth of this ropeway would be more than 5%. For calculation purposes we have assumed that the ropeway traffic will grow at an annual rate of 5% after coming into operation.

Growth Projection for the next 46 years for Phase I and 40 years for Phase II based on annual growth rate of 5%

Table 7: Projected Traffic and expected Ropeway Ridership

S.No.	Year	Expected Annual Tourist Ridership		Expected Annual Local Ridership		Annual Total Ridership	
		Phase-I	Phase II (90% of Phase-I)	Phase-I	Phase II (90% of Phase-I)	Phase-I	Phase II (90% of Phase-I)
		5% growth	5% growth	5% growth	5% growth	5% growth	5% growth
1	2028	510513	-	255256	-	765769	-
2	2029	536039	-	268019	-	804057	-
3	2030	562841	-	281420	-	844260	-
4	2031	590983	-	295491	-	886473	-
5	2032	620532	-	310265	-	930797	-
6	2033	651558	-	325779	-	977337	-
7	2034	684136	615722	342067	307861	1026204	923583
8	2035	718343	646508	359171	323254	1077514	969762
9	2036	754260	678834	377129	339417	1131390	1018251
10	2037	791973	712775	395986	356388	1187959	1069163

11	2038	831572	748414	415785	374207	1247357	1122621
12	2039	873150	785835	436574	392917	1309725	1178752
13	2040	916808	825127	458403	412563	1375211	1237690
14	2041	962648	866383	481323	433191	1443972	1299574
15	2042	1010781	909702	505389	454851	1516170	1364553
16	2043	1061320	955187	530659	477594	1591979	1432781
17	2044	1114386	1002947	557192	501473	1671578	1504120
18	2045	1170105	1053094	585051	526547	1755157	1579641
19	2046	1228610	1105749	614304	552874	1842914	1658623
20	2047	1290041	1161036	645019	530518	1935060	1741554
21	2048	1354543	1219088	677270	609544	2031813	1828632
22	2049	1422270	1280042	711134	640021	2133404	1920063
23	2050	1493384	1344044	746690	672022	2240074	2016066
24	2051	1568053	1411246	784025	705623	2352078	2116870
25	2052	1646455	181809	823226	740904	2469682	2222713
26	2053	1728778	1555899	864387	777950	2593166	2333849
27	2054	1815217	1633694	907607	816847	2722824	2450541
28	2055	1905978	1715379	952987	857689	2858965	2573068
29	2056	2001277	1801148	1000636	900574	3001913	2701722
30	2057	2101341	1891205	1050668	945603	3152009	2836808
31	2058	2206408	1985766	1103202	992883	3309609	2978648
32	2059	2316728	2085054	1158362	1042527	3475090	3127581
33	2060	2432565	2189306	1216280	1094653	3648844	3283960
34	2061	2554193	2298772	1277094	1149386	3831287	3448158
35	2062	2681902	2413710	1340949	1206855	4022851	3620566
36	2063	2815998	2534396	1407996	1267198	4223994	3801594
37	2064	2956797	2661116	1478396	1330558	4435193	3991674
38	2065	3104637	2794172	1552316	1397086	4656953	4191257
39	2066	3259869	2933880	1629931	1466940	4889801	4400820
40	2067	3422863	3080574	1711428	1540287	5134291	4620861
41	2068	3594006	3234603	1796999	1617301	5391005	4851904
42	2069	3773706	3396333	1886849	1698166	5660555	5094499
43	2070	3962391	3566150	1981192	1783075	5943583	5349224
44	2071	4160511	3744457	2080251	1872229	6240762	5616686
45	2072	4368536	3931680	2184264	1965840	6552800	5897520
46	2073	4586963	4128264	2293477	2064132	6880440	6192396

Table 8: Projected forecast for the Traffic Analysis

Traffic	Phase I	Phase II
Approx. no of visitors annually (2022-23)	12,00,000	12,00,000
Expected annual growth YoY	5 %	5 %
Expected ropeway ridership in 2028 for Phase I and in 2034 for Phase II	765,769	923,583
Expected ropeway ridership in 2073	68,80,440	61,92,396
Expected Avg. Monthly Traffic (2073)	68,80,440/12 = 5,73,370	61,92,396/12 = 5,16,033
Expected Max. Daily Traffic (2073)	68,80,440/350 =19658	61,92,396/350 =17693
Expected Hourly Traffic (2073) (PPH)	19658/10 = 1966	17693/9 = 1966
Expected Hourly Traffic (2073) (PPH) + 20% increase at peak time	1966+393 = 2359	1966+393 = 2359

Considering 10 hours of operation for the Ropeway at Phase I and 9 hours of operation at Phase II.

Based on the above assessment it is proposed that the designed capacity for the proposed ropeway at Palampur Ropeway Project shall be 1200 PPHPD, however for the initial years the system can have a lower capacity with lesser number of cabins on the line.

4.4 Ticket Price (including GST) – Tentative and Proposed

Table 9: Ticket Price

Trip	Ticket Price in Rs/-	
	Phase I	Phase-I + Phase-II
Round Trip Rates	1000	1800

5. System Requirements

5.1 Design Parameters

- Capacity of the cable car system: 1200 pphpd (People per hour per direction)
- Continuously moving cable car system
- Provide the highest passenger safety system for transportation.
- Simple Operation
- Least maintenance
- Easy Boarding and de-boarding in the stations
- Wind stable system – high winds up to 70 kmph

5.2 Regulations

To reach the highest possible safety on the cable cars, the engineering and execution must be done according to the following regulations (The harmonized CEN Standard **guideline 2000/9/EC** and as of 21st April 2018 according to **directive 2016/424** offers the highest safety in terms of manufacturing, installation, operation and maintenance of a ropeway and is globally accepted as a benchmark for passenger safety):

- European Ropeway Regulation EU 2016/424
- EN 12929-1: Requirements for all installations
- EN 12929-2: Additional requirements for reversible bicable aerial ropeways without carrier truck brakes
- EN 12930: Calculations
- EN 13223: Drive system and other mechanical equipment
- EN 13107: Civil Engineering Works
- EN 13243: Electrical equipment other than drive system

- EN 13796-1 to 3: Grips, Carriers, Cabins
- EN 12927: Ropes
- EN 1709: Pre-commissioning, inspection, maintenance, operational inspections and checks
- EN 1908: Tensioning Devices
- EN 1909: Recovery and Evacuation
- EN 12397: Operation
- Eurocode 1 to 3
- Relevant BIS standards shall be applicable

6. Proposed ropeway systems

The following 4 systems are technically feasible for the different sections:

6.1 Jig-back System/ Aerial Tramway System

Figure 10: "Jigback Monocable System" Ropeway

An Aerial Tramway (also called Reversible Ropeway or Jig-back Ropeway) is a type of aerial lift in which two passenger cabins (vehicles) are suspended from one or more fixed cables (called "track cables") and are pulled by another cable (called a "haulage rope"). The fixed cables provide the support for the cabins, while the haulage rope, through a grip, is solidly connected to the truck (the wheelset that rolls on the track cables). The haulage rope is usually driven by an electric motor and is connected to the cabins, moves the cabins from one end to the other.

They are called Jig Back because the power source and electric engine at the bottom of the line effectively pulls one carrier down using the weight to push the other carrier up. A similar concept is used in funicular railways. The two-passenger cabins are situated at opposite ends of the loops of cable. Thus, while one is coming up, the other is going down the mountain, and they pass each other midway on the cable span. Aerial tramways usually have big cabins that can carry from 20 to 200 people at speeds of up to 12 meters per second (43.2 km/h) and will pass each other mid-span each time due to the reversible operation of the ropeway. Depending on the size of the car, line speed, and line length, transport capacities vary between 500 and 2,000 persons per hour.

Advantages

- Simple system
- Low operation and Maintenance cost.
- Comfortable boarding / deboarding and ride.
- Low ground clearance not required.

Disadvantages

- Low transport capacity.
- Limitation in capacity expansion

6.2 Circulating "2S" ropeway (detachable)

Figure 11:"2S" Ropeway

Continuous moving system with gondola capacity for up to 16 persons. The gondolas are attached to a hauling rope by a detachable grip and running on the track rope. In the stations, the gondolas are detached from the hauling rope to have boarding/deboarding at significantly reduced speed. The system is comparatively not as wind stable and suitable for medium rope spans.

Advantages

- Large single spans are possible
- Comfortable boarding/de-boarding operation
- High transport capacity and speed

Disadvantages

- Relatively higher capital investment
- Higher operation and maintenance cost as compared to mono cable detachable gondola system
- Wind stability of the system is not good as compared to mono-cable and tri-cable detachable systems

6.3 Circulating monocable ropeway (detachable) – "MDG"

Figure 12: Mono-cable (MDG)

Continuous moving system with gondolas for 6-15 persons are attached to the carrying-hauling rope by detachable grips. In the stations, the gondolas are detached from the

carrying-hauling rope, which allows for boarding/deboarding at significantly reduced speed. Only one rope is needed for the transportation. This ropeway has high wind stability up to 70 kmph. System is suitable for installation in cities, as towers can be smaller (tubular structure) minimizing footprint and space requirement.

Advantages

- It maintains top ride comfort even in extreme weather conditions
- Higher wind stability, lower energy consumption and flexible operations to meet the traffic demands makes it the most widely used cable car system for urban applications
- Guaranteed seat availability for systems with cabins up to 10 passengers
- It has lower CAPEX and OPEX cost as compared to bi-cable and tri-cable systems

Disadvantages

- Unlike Bi-cable and Tri-cable detachable systems it cannot have very long spans (more than 1 km) between towers
- System can be operated in wind speeds up to 70 kmph

6.4 Circulating "3 S "ropeway (detachable)

Figure 13: "3 S" Ropeway

Continuous moving system with gondolas for up to 38 persons, which are attached to a hauling rope by detachable grips and running on two track ropes. In the stations, the gondolas are detached from the hauling rope, which allows for boarding/deboarding at significantly reduced speed. The two, fixed tracks make the system very wind stable (up to 100 kmph) and it is possible to have long spans between the towers.

Advantages

- High transport capacity. (The max. provided by any ropeway system)
- Comfortable boarding/de-boarding operation
- Flexible capacity and variable speed as per demand
- Comfortable ride
- Long spans between towers are possible. Ideal for tourism and urban areas where long span is a necessity

Disadvantages

- Higher CAPEX cost as compared to other cable car systems
- Higher footprint of towers and stations as compared to other cable car systems

7. Recommended Ropeway System

Based on the above assessment of all the 2 systems, circulating monocable ropeway (detachable) – MDG System for Phase- I and 3 "S" System for Phase – II are proposed for between Bhatarka to Thathri to gunja Glacier in Kangra, Himachal Pradesh.

Monocable Detachable Gondolas (MDG) is the most common Cable Propelled system used in both tourist and Urban installation where there is a continuous stream of people. This technology utilizes a single cable which provides both propulsion and support. Since the cable line circulates continuously around two end terminals, MDGs are classified as continuously circulating systems. MDG's detachable grip enables cabins to detach from the cable upon entering a station and reattaching when exiting. MDG cabins typically seat 8 passengers but can have capacities ranging from 6-15 passengers. They are increasingly popular forms of public transportation due to their high reliability, relatively high capacities, low cost, and quick implementation times.

MDG systems are well-suited and easily adapted to the urban environment whether it is built on challenging topography or flat land. In large cities they typically complement rapid transit trunk lines by functioning as feeder systems. However, in smaller cities with lower transport demands, they can operate as a primary transportation line.

Description of the components of MDG system is as follows:

7.1 Stations

There are various configurations possible: individual ropeway system between 2 stations with an interconnecting rail; one system between 3 stations with the mid station as drive station; one system between 4 stations. In short, this is a very versatile and adaptable system.

The typical area required for a station is between 450-800m. The construction can also be flexible, like across the road, cantilever, one sided, double sided, etc. The station platform size is relatively small as there is no waiting time for the passengers due to the continuously moving cabins.

7.2 Parking Bay

The flexibility of the system also extends to the parking of vehicles of detachable mono-cable ropeways, with two main types of garaging systems (with solutions for various space and/or financial requirements):

- The loop line garaging system
- The rail storage garaging system

The garaging system is not restricted to a particular type of installation. All parking systems can be realized as fully automatic, semi-automatic or manual system.

7.3 Line towers

The line between stations would be supported by vertical towers. These towers would act as supporting structures for haul rope and carriers between the stations. The towers would be designed as such to maintain the minimum clearance from roads, power lines, buildings etc. The towers are planned as central tubular tower shaft, equipped with tower yoke, working platforms and sheaves. The towers would be built of varying heights from 10m to 45m and would be built locally in India with IS grade conforming to International Standards. The line gauge will be around 6.4m and the required ropeway axis is totally appr. 15.0 m. The tower spacing generally varies from 20m to 300m. However longer spans can be achieved with the help of higher towers or using the slope of the profile. The towers are equipped with maintenance platforms, ladders for quick accessibility. It could also house lighting and ITES services.

Figure 14: Line Towers

7.4 Cabins/Carriers

Carriers consist of galvanized steel frames with an aluminum outer shell, detachable grip, automatic doors and top and bottom ventilators. These would have a capacity to comfortably seat 10 passengers with a provision of keeping small luggage under the seat. The level walk-in feature facilitates ease of boarding and de-boarding. The cabins can also be equipped with air conditioning, wi-fi, GPS, music system, advertising screen etc. to enhance the overall experience of the passengers. This system will guarantee a seat to every passenger.

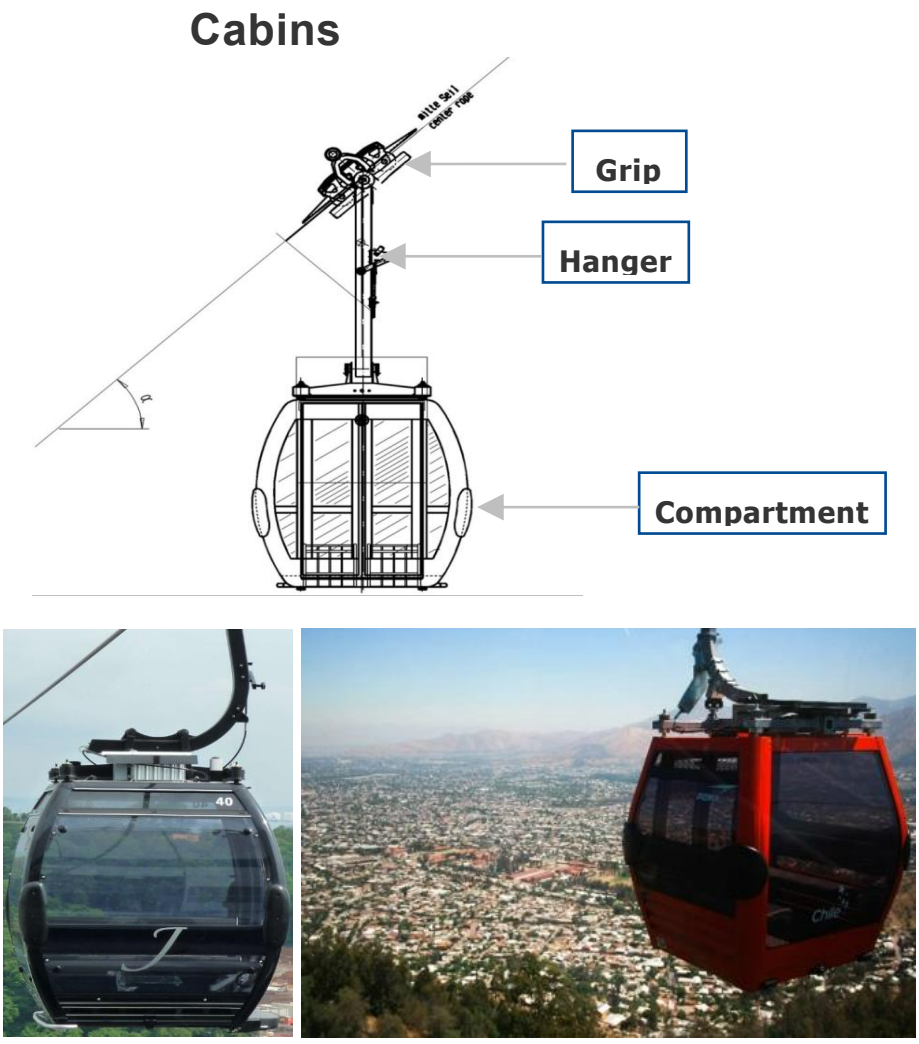


Figure 15: Typical Cabin

7.5 Grip

Detachable Grip

The grip works like pincers which are held by two coil springs. The opening and closing of the grips are activated by an opening - closing rail in the accelerator- and decelerator unit. The grip is very compact and resistant to adverse weather conditions. All forged pieces (movable and fix clamp plates) are with dichromat finish the bolts are protected against corrosion by an appropriate coating.

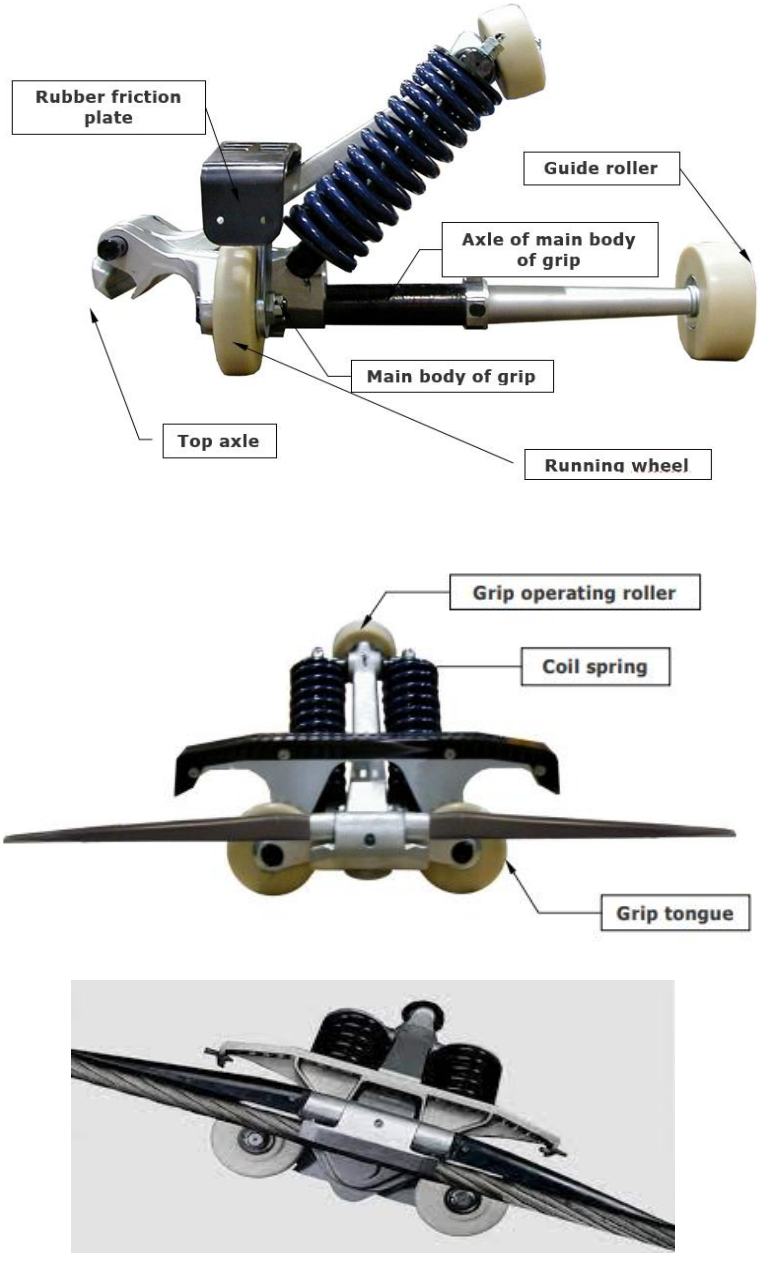


Figure 16: Detachable Grip

7.6 Haul Rope

- Galvanized steel wire rope, with plastic core capable of carrying data cables
- Core optimized for this application (compact core – low stretch), therefore minimal permanent elongation, high compressive stability, and excellent setting properties due to optimum internal lubrication of the rope

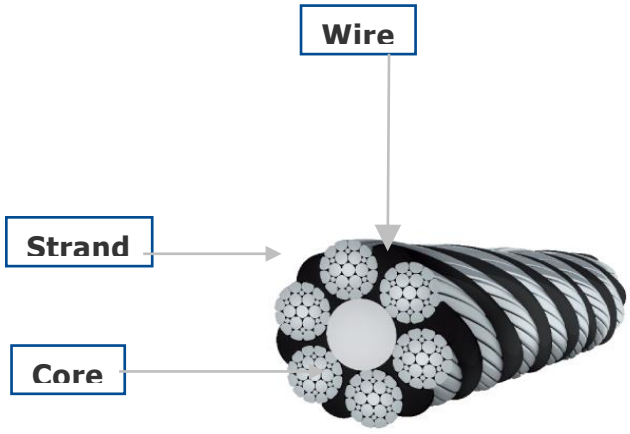


Figure 17: Rope

7.7 Sheave Assemblies

CEN compliant sheave assemblies (CEN = Latest European Code as per directive 2016/424 with adjusting facility to ensure proper rope tracking

- Use of latest generation of sheave liners, reduction of energy cost of up to 20% due to less friction
- Boltless sheaves with conductive rubber liners
- Rope catching shoes
- Frames and suspension galvanized
- Nitrated main axles for higher corrosion resistance
- Designed for easy disassembling for replacement of sheave liners (only one hydraulic sheave liner mounting tool required for different sheaves).
- Maintenance free sheave bearings, no lubrication of sheave bearings required
- Number of sheave assemblies according to profile

- Spare sheave assemblies (for every type one) for service during yearly shutdown

Figure 18: Sheave assembly

Figure 19: Tower

Structures supporting and keeping the rope in the normal operating position

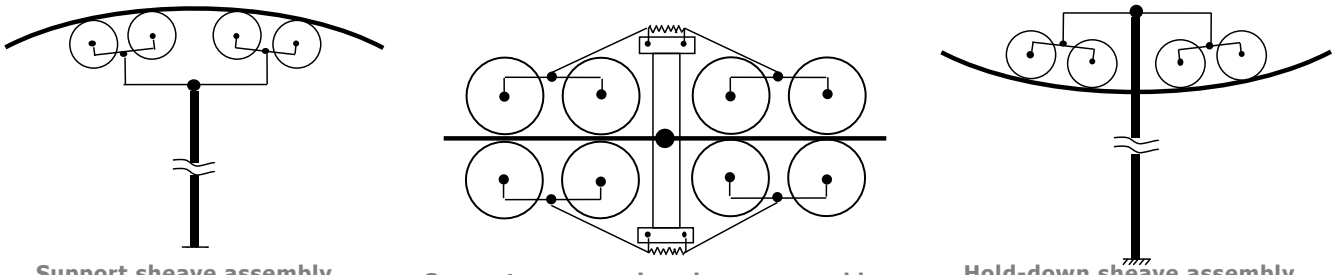


Figure 20: Sheaves

Description of the components of 3S/Tricable

A tricable gondola, also known as a 3S gondola, is a type of aerial lift system that features three cables for support and propulsion. The components of a tricable gondola system include:

Figure 21: 3S / Tricable Ropeway Sysyem/Aerial Tramway

7.8 Cabin

The cabins are the passenger carrying units in the tricable gondola system. They are suspended from the track ropes and travel along the ropes guided by the grip systems. The cabins are typically enclosed and designed to provide comfort and safety to the passengers. They may have seating or standing areas, windows, and ventilation systems.

7.9 Drive Terminal

The drive terminal is the starting point of the gondola system. It houses the main drive machinery, including electric motors or engines, gearbox, and control systems. The drive terminal provides the initial power to move the gondola cabins and carries out the necessary operations for the system's functioning.

7.10 Terminals/Stations

Stations are the designated points along the tricable gondola system where passengers can board or disembark from the cabins. Stations may vary in size and amenities depending on the system's purpose and location. They typically include platforms, control room, waiting areas, ticketing facilities, and passenger services.

7.11 Hauling Rope

The haul ropes are responsible for the propulsion of the gondola cabins. There are typically two hauling ropes, one for each direction of travel. These ropes are driven by the drive terminal and connected to the cabins through the grip systems. The hauling ropes are in constant motion and provide the necessary power to move the cabins along the track ropes.

7.12 Track Rope

Tricable gondolas have two track ropes that run continuously throughout the system. These track ropes are stationary and provide support and alignment for the cabins. The cabins are attached to these track ropes by means of detachable grip systems.

7.13 Grip System

The grip systems are mechanical devices that connect the cabins to the hauling ropes. These grips allow the cabins to be securely attached to the moving ropes while maintaining the ability to detach and reattach at stations or maintenance areas. The grip systems enable the cabins to be propelled along the track ropes by the hauling ropes.

7.14 Support Towers

Support towers are erected at various intervals along the gondola system to support the track ropes and provide stability. These towers are typically made of steel or concrete and vary in height depending on the terrain and elevation changes. The track ropes pass over the support towers, which help maintain the required clearance and alignment.

7.15 Control and Safety Systems

The tri-cable gondola system incorporates control and safety systems to ensure smooth and safe operation. These systems include motor controls, emergency stop mechanisms, safety brakes, overload sensors, and monitoring devices. Communication systems are also installed to facilitate coordination between the drive terminal, stations, and other key points along the system.

8. Project Overview and Technical Data

8.1 Study of Ropeway Alignments

A team of experts from Nivesa Advisors made site visits and studied the area in detail to arrive at the possible alignment options from Bhatarka to Thathri to Chunja Glacier in Kangra via a Ropeway System.

The following approach was kept in mind while selecting the possible alignments:

- The proposed alignment should be technically feasible for a ropeway system, keeping in mind the traffic data, slope, local environment etc.
- Approach and connectivity to the proposed station locations
- Availability to adequate land for the proposed stations
- Ease of land acquisition
- Minimum disturbance to the local environment
- Least rehabilitation required.

Several criteria were evaluated for selection of these alignments and a quantitative assessment was done for the following parameters:

- Passenger Usage
- Environmental Impact
- Contribution to the Local Economy
- Improvement in the connectivity

Table 10: Passenger Usage

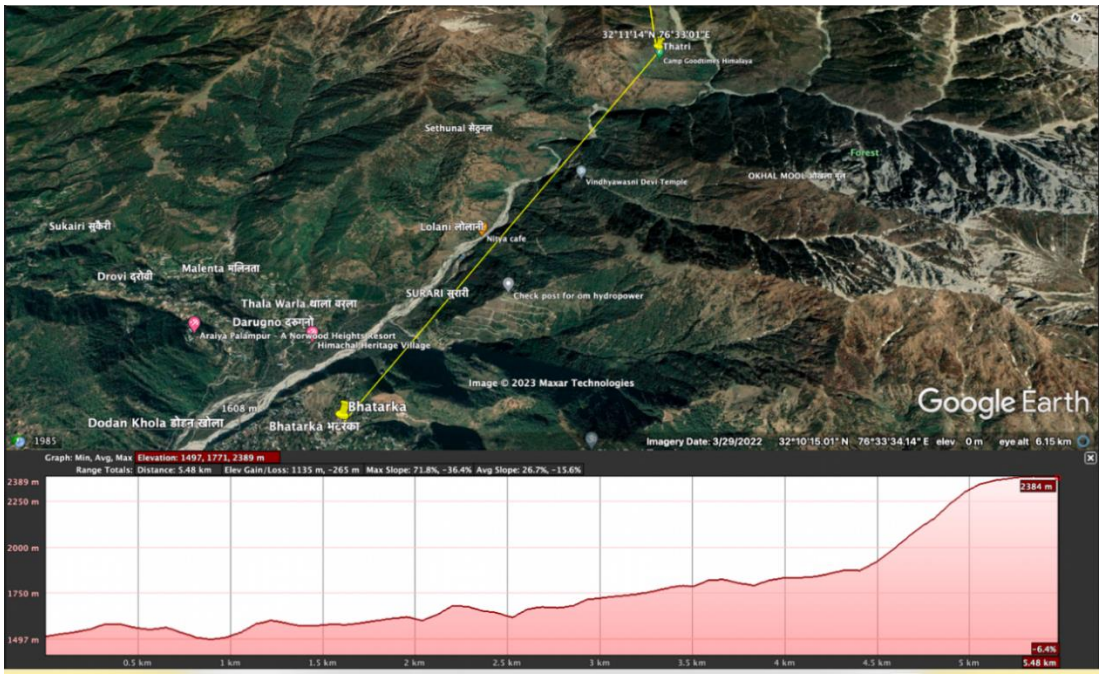
Criteria for Evaluation	Remark
Benefits to the Tourists	✓
Benefits to the Local Population	✓
Meets Traffic Demands	✓
Positive feedback of Public for the proposed system	✓

Table 11: Environmental Impact

Criteria for Evaluation	Remark
No Major Topographical Hindrances (Like River Crossing, Rock Fall Zone, Dense Urban Population etc.)	✓
Land Availability for Stations	✓
Least Impact on Flora and Fauna	✓

Table 12: Contribution to the Local Economy

Criteria for Evaluation	Remark
Improvement of Infrastructure	✓
Enhancement of Tourism Potential of Kangra Area	✓
Improvement of Livelihoods of the local people	✓
Benefit to the local and state economy	✓



Phase – I: include construction of Ropeway between Bhatarka to Thathri of approx. 5156 m
Phase – II: include construction of Ropeway between Thathri to Chunja Glacier of approx. 3573 m.

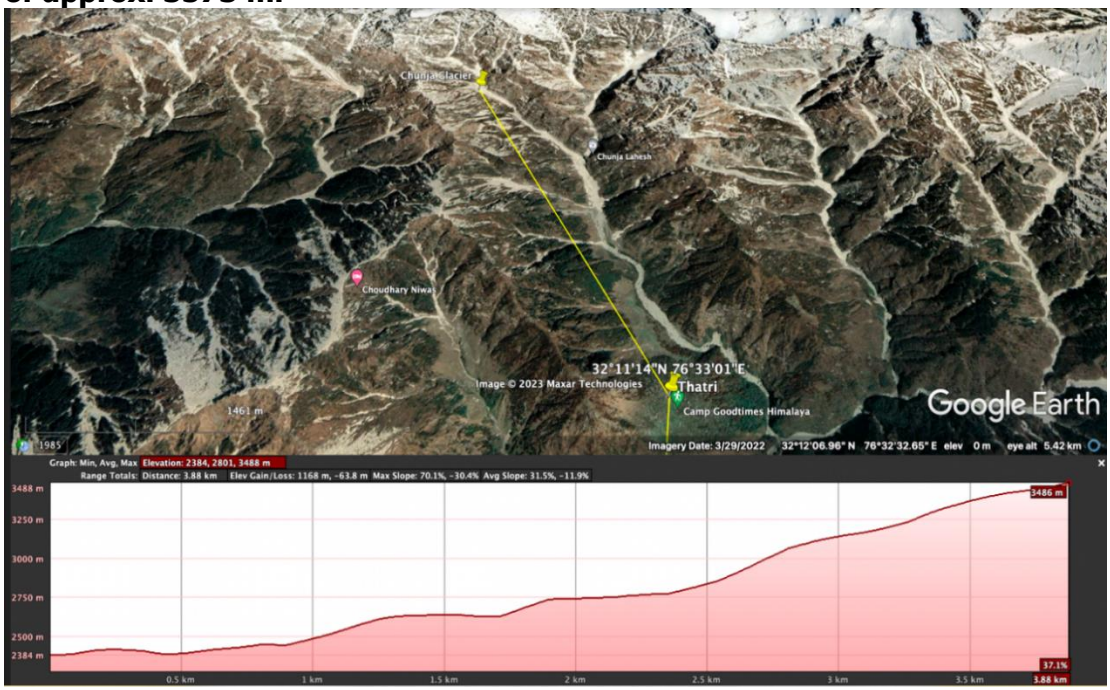


Figure 22: Alignment

Proposed LTP : At Bhartarka
Coordinates:
Latitude - 32°08’28‟N
Longitude - 76°32'36‟E

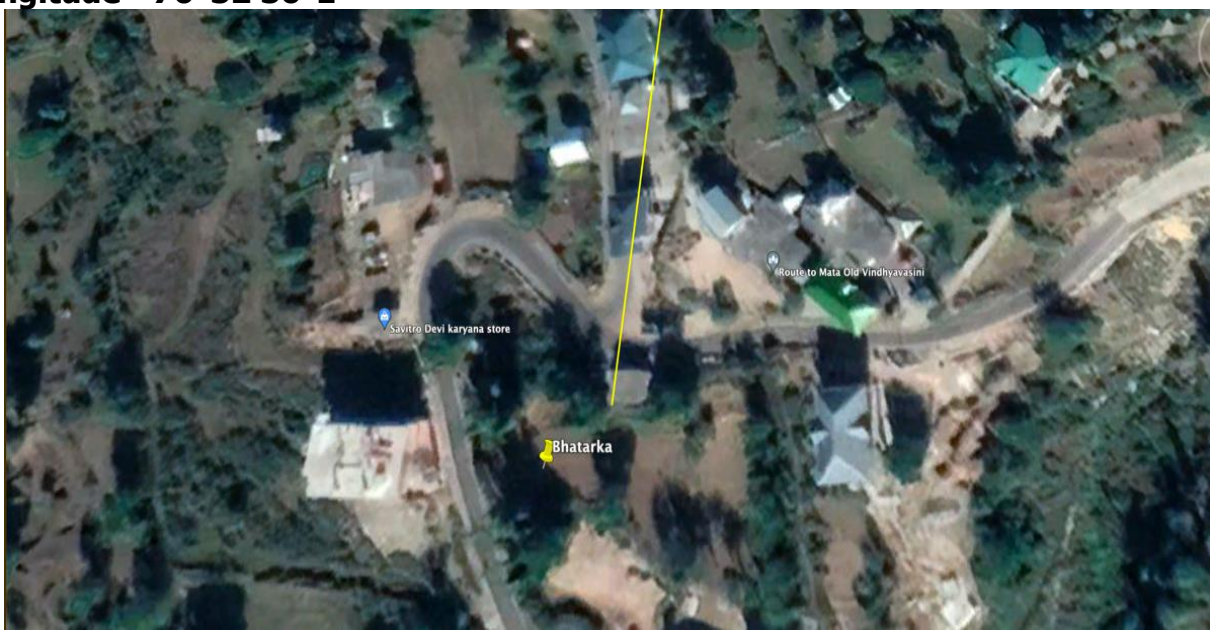


Figure 23: Proposed LTP

Proposed LTP : At Thathri
Coordinates: Latitude - 32° 11‘14‟N
Longitude - 76°33'01‟E

Figure 24: Proposed ITP

Proposed UTP: At Chunja Glacier

Coordinates:
Latitude - 32°12'59"N
Longitude - 76°32'04" E

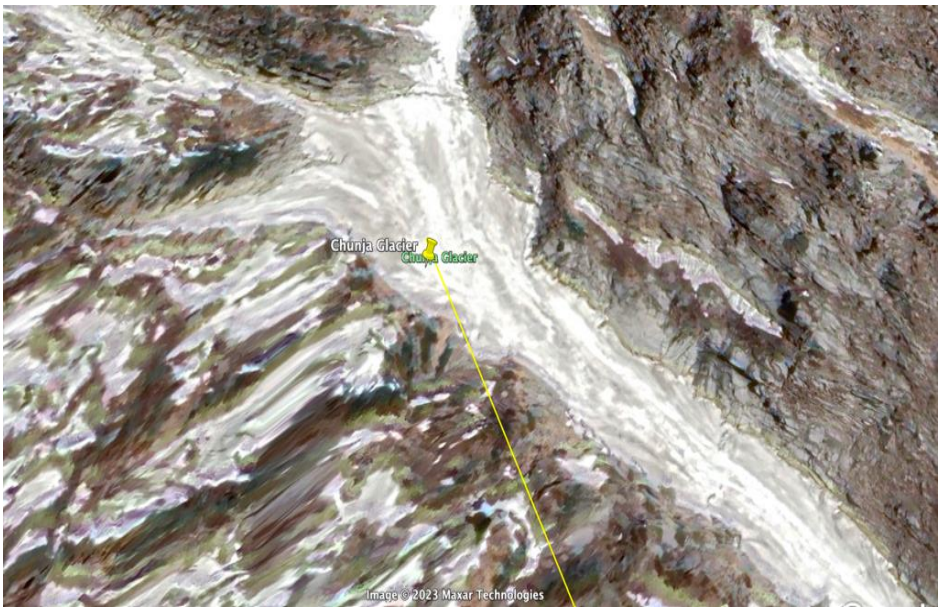


Figure 25: Proposed UTP

Table 13: Brief description of the technical details for the alignment

Particular	Phase - I	Phase II
From Station	Bhatarka	Thatri
To Station	Thathri	Chunja Glacier
Particular	MDG	3S
Geometrical data		
Height of Bottom station	1528 m	2412 m
Height of Top station	2412 m	3389 m
Horizontal Length	884 m	977 m
Height difference	5156 m	3753 m
Developed Length	5156 m	3573 m
Ropeway General Data		
Drive Station	Bhatarka	Thatri
Tension Station	Thathri	Chunja Glacier
Return Station	Thathri	Chunja Glacier
Capacity	1200 Pphpd	1200 Pphpd
Travel Speed	7 m/s	7 m/s
Cabin Capacity	8	28

Rope Diameter	52 mm	56 mm (T) / 52 mm (H)
Drive Group		
Power		
Continuous In Operation	800 kW	1100 kW
Starting Mode	1040 kW	1700 kW
Braking	780 kW	950 kW
Distance		
Distance between Cabins on line	168 m	588 m
Travel time	~12.3 minutes	~8.5 minutes
Quantity of Cabins and Towers		
Number of Cabins	69 (8-seater)	15 (28-seater)
Number of Towers	28	8
Estimated Cost		
Ropeway Equipment	~Rs. 139.32 Crores (including custom duty)	~Rs. 185.76 Crores (including custom duty)
Civil works and Assembly including material Ropeway	~Rs. 47.79 Crores (including GST)	~Rs. 74.34 Crores (including GST)
Other Costs including finance cost	~Rs. 42.48 Crores	~Rs. 95.58 Crores
Total Costs	~Rs. 229.59 Crores	~Rs. 355.68 Crores

Tentative Requirement of Land

Nature of land :

Land owned by Government of Himachal Pradesh

Tentative Area Required for LTP Development

Table 14: Tentative Area Required for LTP Development

S. No	Heads	Dimensions in Meters		Area (m^2)
1	Ropeway Station	30	15	450
2	Cabin parking	30	20	600
3	Store	5	6	30
4	Workshop	8	6	48
5	Office	5	6	30
6	Ticket Counter	3	5	15

7	Account and staff room	5	5	25
8	Toilets	6	6	36
9	Queue Area	15	15	225
10	Generator Room	5	10	50
11	Open Store	10	20	200
12	Panel Room and Control Room	6	10	60
Total		**1769**		
13	Multiple shops/commercial	30	40	1200
14	Multi-Level Car Parking	50	40	2000
Total		**3200**		
Total		**4969**		

Additional area for Setback: 131

Total Area Requirement (Tentative): ~ 1900 + 3200 sqm

Nature of land: Central Government Land under Cantonment Area

Tentative Area Required for ITP Development

S. No	Heads	Dimensions		Area (m^2)
1	Ropeway Station (MGD + 3 S)	30 + 40	15 + 30	450 + 1200
2	Toilet Space	10	10	40
3	Ticket Counter and Guard Room	5	5	15
4	Store	10	6	60
5	Electrical Panel and Control Room	5 + 8	6 + 10	30 + 80
6	Small Maintenance Area	5	5	25
7	Generator Room	5	10	50
8	Cabin parking	30	20	600
9	Office	5	6	30
10	Queue Area	15	15	225
Total				**1525 + 1280**

Additional area for Setback: 135

Total Area Requirement (Tentative): ~ 1660 + 1280 sqm

Nature of land: Central Government Land under Cantonment Area

Tentative Area Required for UTP Development

Table 15: Tentative Area Required for UTP Development

S. No	Heads	Dimensions		Area (m^2)
1	Ropeway Station	40	30	1200
2	Toilet	10	10	40
3	Security Room	5	5	15
4	Store	10	6	60
5	Electrical Panel and Control Room	8	10	80
6	Small Maintenance Area	5	5	25
Total				**1420**

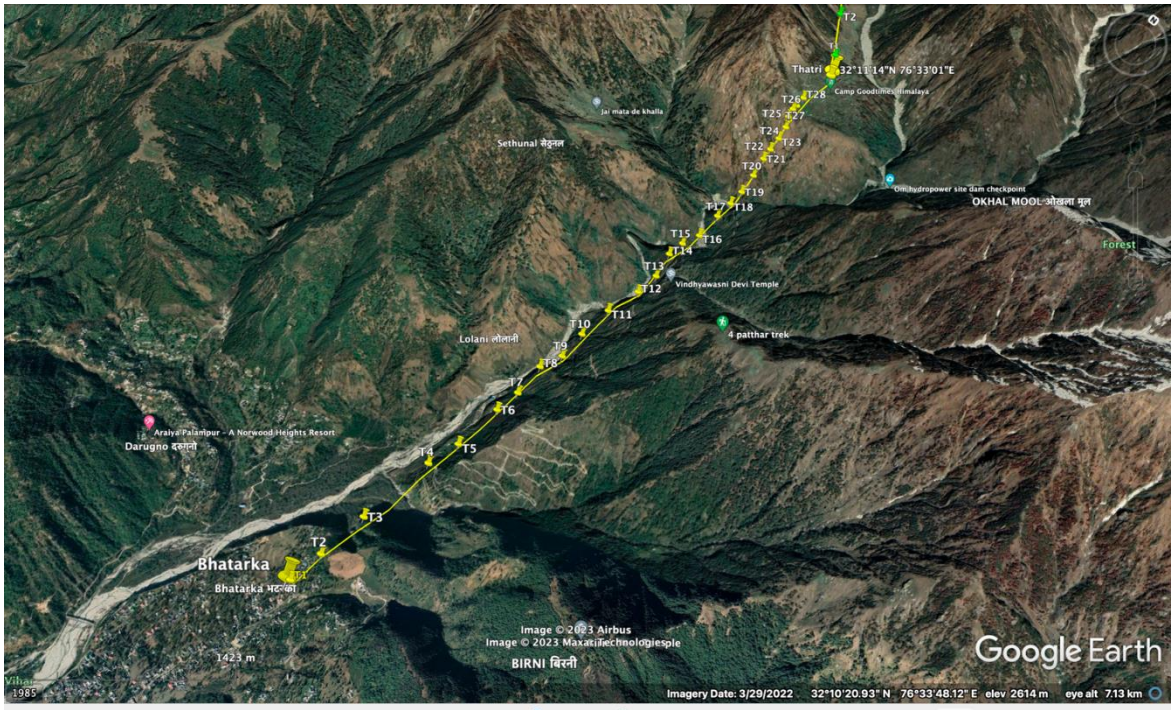
- **Additional area for Setback :** 80
- **Total Area Requirement (Tentative):** ~ 1500 sqm

TENTATIVE DETAILS OF TOWER LOCATIONS -

S. No	Tower Number	Tentative Co-ordinates Phase-I	Tentative Co-ordinates Phase-II
1	T1	32°08′30‟N 76°32′36.7‟E	32°11′21.8‟N 76°32′57.5‟E
2	T2	32°08′38‟N 76°32′37.9‟E	32°11′36.1‟N 76°32′49.5‟E
3	T3	32°08′47.5‟N 76°32′39.4‟E	32°11′48.1‟N 76°32′42.9‟E
4	T4	32°09′3.7‟N 76°32′41.8‟E	32°12′6.1‟N 76°32′33.1‟E
5	T5	32°09′11.2‟N 76°32′42.9‟E	32°12′28.5‟N 76°32′20.9‟E
6	T6	32°09′22.5‟N 76°32′44.5‟E	32°12′43.1‟N 76°32′12.9‟E
7	T7	32°09′28.3‟N 76°32′45.5‟E	32°12′49.3‟N 76°32′9.6‟E
8	T8	32°09′35.6‟N 76°32′46.5‟E	32°12′54.6‟N 76°32′6.7‟E
9	T9	32°09′42.4‟N 76°32′47.6‟E	
10	T10	32°09′48.4‟N 76°32′48.5‟E	
11	T11	32°09′56.5‟N 76°32′49.7‟E	
12	T12	32°10′6.7‟N 76°32′51.2‟E	
13	T13	32°10′12.2‟N 76°32′52‟E	
14	T14	32°10′17.2‟N 76°32′52.8‟E	
15	T15	32°10′21.8‟N 76°32′53.5‟E	

16	T16	32°10′27.6‟N 76°32′54.3‟E	
17	T17	32°10′33.4‟N 76°32′55.2‟E	
18	T18	32°10′38.9‟N 76°32′56‟E	
19	T19	32°10′43.1‟N 76°32′56.6‟E	
20	T20	32°10′46.5‟N 76°32′57.1‟E	
21	T21	32°10′49.7‟N 76°32′57.6‟E	
22	T22	32°10′51.9‟N 76°32′57.9‟E	
23	T23	32°10′54.5‟N 76°32′58.3‟E	
24	T24	32°10′56.8‟N 76°32′58.7‟E	
25	T25	32°10′59.3‟N 76°32′59.1‟E	
26	T26	32°11′0.3‟N 76°32′59.2‟E	
27	T27	32°11′0.1.5‟N 76°32′59.4‟E	
28	T28	32°11′4.3‟N 76°32′59.8‟E	

Phase - I



Phase -II

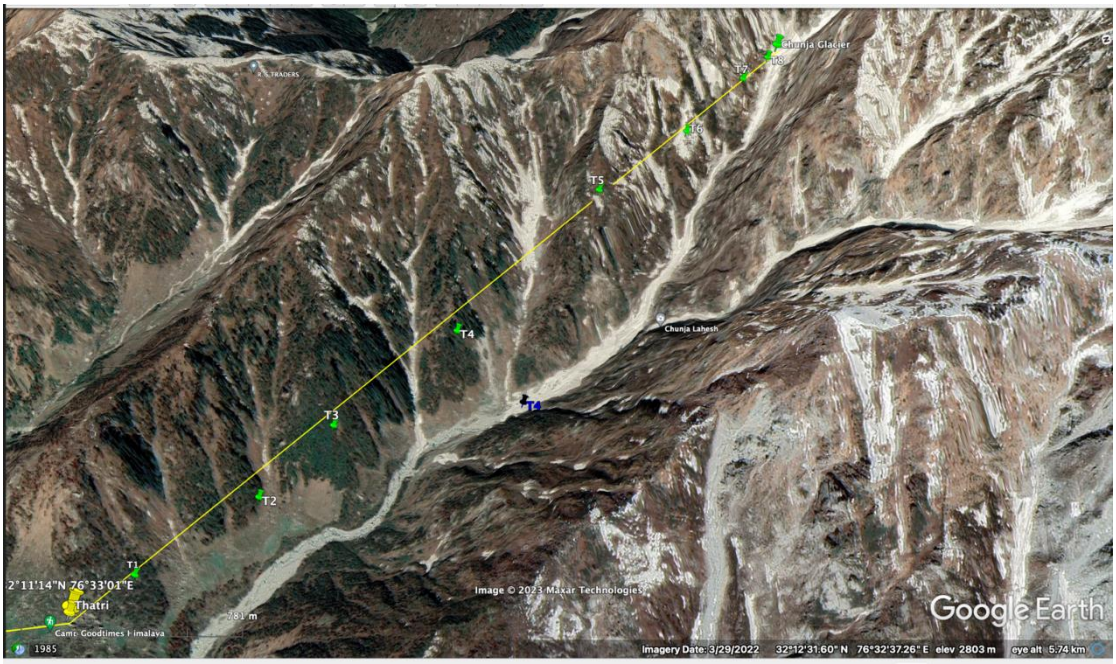


Figure 26: Tentative Tower Locations

Approx. Area requirewd for each tower foundation is 5 to 15 sqm

9. Financial Analysis and Structuring of Project

9.1 Introduction

The cable car is the safest mode of public transportation within a city and seamlessly provides overhead connection between stations. It is able to overcome barrier to provide the shortest commute distance. It does not encroach upon the road space and is virtually soundless.

The selection of such a transport system depends on criteria such as topography and terrains, length (horizontal & vertical), capacity (both cabin & whole system), line speed, operation system (uni-directional/bi-directional), purpose (passengers/tourists/materials), economic viability, operation & maintenance costs, safety of passengers, etc.

RTDC has primarily given the option of evaluating the financial feasibility of the development of Passenger Ropeway in the Distt. Kangra between Bhatarka to Thathri to gunja Glacier Himachal Pradesh under PPP Mode. RTDC is the Authority and shall provide this Project to the Concessionaire (Developer) for undertaking this project under PPP Mode.

The developer will raise the funds in the form of debt and equity. The concessionaire will Design, Finance, Build, Operate and Transfer (DBFOT) project at zero cost to Government/Government Authority during the post concession period.

In this chapter, we have considered base PPP Model of DBFOT.

The whole Ropeway system has two components, broadly: civil works, and the second is installation of plant and machinery to provide mechanical and electrical support in running of cable car vehicles.

The costs involved in the Project and revenue sources for the project have been discussed in this chapter in detail. The chapter also covers recommendation for financial model implementation of the project.

Capital Cost/Project costing

The capital costs involved in the Ropeway Project consists of the following:

- Electro-mechanical Cost (EM Cost) including supervision of erection
- Civil and structure Cost

- Other Costs
- Finance Costs (for landed project cost)

EM Cost includes the installation of the electro-mechanical equipment, like Station equipment including Bullwheel, Drive system, tensioning system, etc., It also includes erection of towers, sheave assemblies, rope pulling, etc. and finally installation of the gondolas, testing and commissioning. The cost is inclusive of sea freight, port and custom clearance and local transportation to the warehouse.

Civil and Structure cost covers foundations of the towers and the building and the station structure.

Other costs include supervision of erection, project management, architect cost, etc. The cost would also take into account pre-operative expenses.

Finance Cost includes the financing cost which is a percentage of the Debt component in the entire project and interest on loan.

9.2 Project Capital Cost

The capital cost for the Alignment of Phase I and Phase – I are provided herein below. The length of the Ropeway for this route is 8700 m.

Table 16: Project Cost with Item Description

S. No.	Item Description	Amount (in Rs. Cr.) Phase - I	Amount (in Rs. Cr.) Phase -II
1	Ropeway System (Electro-Mechanical Portion)	108.00	144.00
2	Custom Duty	31.32	41.76
3	Civil Works including material ropeway	40.50	63.00
4	GST on Civil works @ 18%	7.29	11.34
5	Other costs- Transportation, Design Charges, Escalation, Contingencies, QA/QC, PMC	42.48	95.58
Total		**229.59**	**355.68**

9.3 Key aspects of financial evaluation

We have considered following assumptions/analysis for the proposed Ropeway Project between Bhatarka to Thathri to gunja Glacier in Kangra:

a) The construction period of the Project is 48 months for each Phase;

b) The Project is considered to be awarded by 1st August 2023;

c) Commencement Date, 1st August 2024 for Phase I and 1st August 2034 for Phase II, i.e. start of construction activities shall be the Financial Closure date, considering all the Conditions Precedents as per the Concession Agreement are achieved;

d) Construction of the Project starts from 1st August 2024 for Phase I and 1st August 2034 for Phase II;

e) Scheduled Project Completion Date (48 months from the commencement date)- (31st July 2028 for Phase I and 31st July 2034 for Phase II);

f) Start date of Commercial Operations is 1st August 2028 for Phase I and 1st August 2034;

g) The concession period for Phase I is of 51 years and for Phase II is of 45 years (each period including an estimated construction period of 48 months);

h) Concession Period end date is 31st July 2073 (46 years from Commencement Date of commercial operations for Phase 1 and 40 years from Commencement date of commercial operations for Phase II;

i) The commercials of the proposed ropeway between Bhatarka to Thatri and Thatri to Chunja Glacier is based on riders taking the Phase-I ropeway upto Thatri or taking the ropeway for the combined Phase- I and II. There is no provision of only utilizing Phase-II as Thatri to be accessible by Phase-I ropeway only;

j) For the other revenue, we have considered four star reasonable 100 rooms hotel at Bhatarka, commercial and recreational activity, on an allocated land of 30,000 sqm at LTP and an activity centre like rides etc at Thathri; on a land of 20,000 sqm at ITP (Thathri);

k) Operation and Maintenance and manpower expenses include Ropeway related staff, Account & Administrative Staff, Other Manpower/Labour Expenses. The growth rate of expenses @5% every year;

l) Other Expenses includes Machine & Equipment's maintenance charges, power station and Generator Maintenance Expenses, Electricity & Water Expenses, Energy charges, Insurance and Other Administrative Expenses every year. The expenses growth rate has been assumed as 5% every year;

m) Financials and Rate of Return for Project along with projections of the project over 45 years Concession Period have been analyzed.

9.4 Assumptions for the Total Project Cost (TPC)

- Cost of Ropeway equipment is assumed as per global CEN standards for ropeway;
- Ropeway structural components including Towers, Support Structure, embedded parts, etc. are assumed to be procured indigenously;
- Other costs cover project development costs such as ROW, Utility Shifting, land diversion etc., project management consultancy, logistics, installation cost, administrative costs, contingency cost and pre-operation cost.
- Interest during the Construction Period has been assumed at 10%.
- Land shall be provided by the Concessioning Authority (RTDC) on a long-term basis. The Concessionaire will bear the cost of EIA clearance and cost for tree cutting. RTDC will facilitate clearance.
- The design and construction of parking facility at both LTP and UTP has not been considered in the capital cost.

9.5 Other Major Assumptions

The key assumptions are provided herein below.

Table 17: Key Assumptions for the Capital Cost

1	**Base Year for Civil construction**	2024-2028
2	**Base Year for Ropeway Installation**	2024-2028
3	**Land Clearances**	2023-2024
4	**Debt Equity Ratio**	80%:20%
5	**Expected Start date of Construction**	01.08.2024
6	**Estimated Construction Period**	48 months
7	**Completion of Construction**	31.07.2028
8	**Number of Days of Operation of Ropeway**	350 Days

Table 18: A. Key Assumptions for the Revenue from Fare for Phase I

1	Ropeway working hours per day (Phase-I)	10 Hrs.
2	Ropeway Operating Days per year	350 Days
3	Ropeway Capacity: Passenger Traffic per Hour per Direction (PPHPD)	1200 PPHPD
4	Increase in Traffic Per year from 2023 to 2028	5%
5	Annual Traffic in Year 2028 (5% growth over 2025)	15,31,538
6	Ridership in Year 2028 (50% of Annual Traffic in Year 2028)	7,65,769
7	Total Tourist Ridership in Year 2028	5,10,513
8	Total Local Ridership in Year 2028	2,55,256
9	Ridership in Year 2073 (50% of Annual Traffic in Year 2073)	68,80,440
10	Total Tourist Ridership in Year 2073	45,86,960
11	Total Local Ridership in Year 2073	22,93,480
12	Expected start of Revenue from operations	01.08.2028

Table 19: B. Key Assumptions for the Revenue from Fare for Phase II

1	Ropeway working hours per day (Phase-II)	9 Hrs.
2	Ropeway Operating Days per year	350 Days
3	Ropeway Capacity: Passenger Traffic per Hour per Direction (PPHPD)	1200 PPHPD
4	Increase in Traffic Per year from 2023 to 2034	5%
5	Annual Traffic in Year 2034 (5% growth over 2023)	20,52,407
6	Ridership in Year 2034 (50% of Annual Traffic in Year 2034)	9,23,583
7	Total Tourist Ridership in Year 2034	6,15,722
8	Total Local Ridership in Year 2034	3,07,861
9	Ridership in Year 2073 (50% of Annual Traffic in Year 2073)	61,92,396
10	Total Tourist Ridership in Year 2073	41,28,264
11	Total Local Ridership in Year 2073	20,64,132
12	Expected start of Revenue from operations	01.08.2034

Other proposed Revenue Streams

Hotel revenue
Revenue is considered at Rs. 15.3 Crores per annum with an increase of 5% every 4th Year.

Commercial space for rent
Rent is considered at Rs. 10 Crores per annum with an increase of 5% every 4th Year.

Activity Revenue
Revenue from activities like rides etc is considered at Rs. 25 Crores per annum with an increase of 5% every 4th Year.

9.6 Minimum return criteria for the Project

For any project to be viable under PPP or any of its variant, the minimum return criteria for the project is assumed based on experience and present trends in Ropeway Projects. This is to ensure the attractiveness of the project and to ensure returns to the concessionaire in the range of about 13-15% Financial Modelling for Passenger Ropeway Project

9.7 Straight forward PPP Model

We are herein below providing results of financial analysis of the base scenario of straight forward PPP Model.

Table 20: Financials for Base PPP Model

	S. No.	Particulars	Phase-I	Phase I & II
I	1	Total Capital Cost (approx.)	Rs 188 Crores	Rs 447 Crores
	2	Other costs including contingency	Rs 42 Crores	Rs 138 Crores
	3	Total Project Cost	Rs 230 Crores	Rs 585 Crores
	4	Construction Period	48 months	48 months
	Project Income Summary (40 years)		**Rs.**	
II	1	Total Consolidated Revenue	Rs 17,980 Crores	Rs 21,744 Crores
	2	Total O&M and Administrative Cost	Rs 8,438 Crores	Rs 11,342 Crores
	3	Net profit after tax	Rs 6,481 Crores	Rs 6,599 Crores

	Project Economics		Phase-I	Phase-I & Phase-II
	1	Project IRR (Financial)	16.6%	14.65%
	2	Project IRR (Economic)	22.9%	21.4%

9.8 Financial Analysis (Estimated profit and loss statement)

We are providing estimated profit and loss statements for the concession period which has been used to arrive at Project financial Internal rate of return based on the above assumptions.

Table 21:Estimated Profit and Loss Statement (during concession period) – Phase-I

(Figures in Rs. Cr.)

S.No.	Year	Revenue from Ridership	Revenue from Other source (rental revenue and advertisement)	Operational Cost (O&M, Administrative Expenses, Concession Fee	Earning before Interest, Depreciation and Tax
1	2028	65	50	32	83
2	2029	72	50	34	88
3	2030	79	50	36	93
4	2031	87	53	38	102
5	2032	94	53	39	107
6	2033	100	53	41	112
7	2034	107	53	43	117
8	2035	115	55	47	123
9	2036	123	55	51	127
10	2037	131	55	56	131
11	2038	141	55	61	135
12	2039	151	58	66	143
13	2040	160	58	71	147
14	2041	168	58	77	150
15	2042	177	58	83	152
16	2043	186	61	90	157
17	2044	195	61	96	160
18	2045	205	61	104	162
19	2046	215	61	111	165

20	2047	226	64	120	170
21	2048	237	64	128	173
22	2049	249	64	137	176
23	2050	261	64	147	179
24	2051	274	67	158	184
25	2052	288	67	169	187
26	2053	303	67	180	190
27	2054	318	67	192	193
28	2055	334	71	202	202
29	2056	350	71	211	210
30	2057	368	71	221	217
31	2058	386	71	232	225
32	2059	405	74	243	237
33	2060	426	74	254	246
34	2061	447	74	266	255
35	2062	469	74	279	265
36	2063	493	78	293	278
37	2064	517	78	307	289
38	2065	543	78	321	300
39	2066	570	78	337	312
40	2067	599	82	354	327
41	2068	629	82	370	341
42	2069	660	82	388	354
43	2070	693	82	407	369
44	2071	728	86	427	387
45	2072	764	86	448	403
46	2073	803	86	469	420

Table 22:Estimated Profit and Loss Statement (during concession period) – Phase-I & II

(Figures in Rs. Cr.)

S.No.	Year	Total Revenue	Operational Cost (O&M, Administrative Expenses, Concession Fee	Earning before Interest, Depreciation and Tax
1	2028	115	32	83
2	2029	122	34	88

3	2030	129	36	93
4	2031	140	38	102
5	2032	147	39	107
6	2033	153	41	112
7	2034	204	65	140
8	2035	212	69	144
9	2036	220	73	148
10	2037	229	77	152
11	2038	238	82	156
12	2039	250	86	164
13	2040	260	91	169
14	2041	270	98	172
15	2042	281	106	175
16	2043	295	114	181
17	2044	306	123	184
18	2045	319	132	187
19	2046	331	141	190
20	2047	348	152	196
21	2048	362	163	200
22	2049	377	174	207
23	2050	393	186	213
24	2051	412	200	216
25	2052	430	213	220
26	2053	448	228	224
27	2054	467	243	231
28	2055	490	259	236
29	2056	511	276	240
30	2057	533	293	245
31	2058	556	311	253
32	2059	584	332	257
33	2060	610	352	267
34	2061	636	369	278
35	2062	664	387	278
36	2063	698	406	291
37	2064	729	426	303
38	2065	761	446	315

39	2066	795	468	327
40	2067	835	491	344
41	2068	873	515	358
42	2069	912	540	372
43	2070	954	566	388
44	2071	1001	594	407
45	2072	1047	623	424
46	2073	1095	653	442

9 Economical Appraisal

The financial and economical analyses including the determination of the EIRR and FIRR are based on streams of benefits and costs resulting from the construction, installation and operation of the project components over their economic lives. The benefits and costs and the FIRR and EIRR are determined separately for all components.

Economical benefits are social and environmental benefits which are quantified and then converted into money cost and discounted against the cost of construction and maintenance for deriving Economic Internal Rate of Return (EIRR). When actual revenue earned from fare collection, advertisement and property development are discounted against construction and maintenance cost, interest and depreciation cost, Financial Internal Rate of Return (FIRR) is obtained. Therefore, EIRR is viewed from socio-economic angle while FIRR is an indicator of financial profitability and viability of any project.

The sources of economic savings are first identified which are quantified These components are quantified by linking with the number of passengers shifted and the passenger km saved by the trips which are shifted from road / rail based modes to metro. It may be observed that first four benefit components are given in Table below are direct benefits due to shifting of tips to metro, but other benefit components are due to decongestion effect on the road.

Benefit components were first estimated applying market values then were converted into respective Economic values by using economic factors which are also given in the Table below.

Table 23: Benefits components due to Ropeway

Sl. No.	Benefit Components
1	Emission Saving Cost
2	Annual Time Cost Saved by Ropeway Riders
3	Annual Fuel Cost saved by Ropeway Passengers
4	Annual Vehicle Operating Cost saved by Ropeway Passengers
5	Accident Cost
6	Annual Infrastructure Maintenance cost

For Phase-I

Table 24: Estimation of Benefits from using Ropeway to Transport Passengers

Estimation of Benefits from Using Ropeway to Transport Passengers		
S. No	**Particulars**	**Details**
A	Basic Data to Estimate Benefits from Using Ropeway	
1	Time Cost for Riders	2 Rs/Minute
2	Fuel Cost (Current Market Rate)	100 Rs/Liter
3	Vehicle Operating Cost	6 Rs/Km
4	Accident Cost	1.50 Rs/Crore Vehicle Km
5	Infrastructure Maintenance Cost	1.00 Rs/Vehicle Km
B	Annual Time Cost Saved by Ropeway Riders	
Total of B	**Annual Time Cost Saved by Ropeway Riders**	**Rs 5.3 Crore/Year**
C	Annual Fuel Cost Saved by Ropeway Riders	
Total of C	**Annual Fuel Cost Saved by Ropeway Riders**	**Rs 0.72 Crore/Year**
D	Annual Vehicle Operating Cost Saved by Ropeway Riders	
Total of D	**Annual Car Operating Cost Saved by Ropeway Riders**	**Rs 0.43 Crore/Year**
E	Annual Accident Cost Saved by Ropeway Riders	
Total of E	**Annual Accident Cost Saved by Ropeway Riders**	**Rs 1.72 Crore/Year**
F	Annual Infrastructure Maintenance Cost Saved by Using Ropeway Instead of Roads	
Total of F	**Annual Infrastructure Maintenance Cost Saved**	**Rs 1.15 Crore/Year**
B+C+D+E+F	**Potential Total Benefits from Using Ropeway to Transport Passengers**	**Rs 9.30 Crore/Year**

For Phase-II

Estimation of Benefits from Using Ropeway to Transport Passengers		
S. No	**Particulars**	**Details**
A	Basic Data to Estimate Benefits from Using Ropeway	
1	Time Cost for Riders	2 Rs/Minute
2	Fuel Cost (Current Market Rate)	100 Rs/Liter

3	Vehicle Operating Cost	6 Rs/Km
4	Accident Cost	1.50 Rs/Crore Vehicle Km
5	Infrastructure Maintenance Cost	1.00 Rs/Vehicle Km
B	Annual Time Cost Saved by Ropeway Riders	
Total of B	**Annual Time Cost Saved by Ropeway Riders**	**Rs 11.7 Crore/Year**
C	Annual Fuel Cost Saved by Ropeway Riders	
Total of C	**Annual Fuel Cost Saved by Ropeway Riders**	**Rs 1.58 Crore/Year**
D	Annual Vehicle Operating Cost Saved by Ropeway Riders	
Total of D	**Annual Car Operating Cost Saved by Ropeway Riders**	**Rs 0.95 Crore/Year**
E	Annual Accident Cost Saved by Ropeway Riders	
Total of E	**Annual Accident Cost Saved by Ropeway Riders**	**Rs 3.80 Crore/Year**
F	Annual Infrastructure Maintenance Cost Saved by Using Ropeway Instead of Roads	
Total of F	**Annual Infrastructure Maintenance Cost Saved**	**Rs 2.53 Crore/Year**
B+C+D+E+F	**Potential Total Benefits from Using Ropeway to Transport Passengers**	**Rs 20.5 Crore/Year**

For Phase-I

Table 25: Estimation of Carbon Credits from using Ropeway Instead of Travelling by Car

Estimation of Carbon Credits from Using Ropeway Instead of Travelling by Car		
S. No	**Particulars**	**Details**
A	Basic Data to Estimate Carbon-di-oxide Emissions from a Passenger Car and Power Generation	
1	A typical passenger vehicle emits about 4.6 metric tons of carbon dioxide per year.	4.6 Metric Tons CO2/Year
2	1,021.6 lbs CO2 per megawatt-hour for delivered electricity (assuming transmission and distribution losses of 7.3%) (EPA 2020; EIA 2020b)	0.000463 Metric Tons CO2/KWh

B	Carbon-di-oxide (CO2) Emitted if Using Car to Transport Instead of Ropeway	
1	Total Ropeway Ridership in Year 2028	765,769 Ropeway Ridership/Year
2	Equivalent Number of Cars to transport assuming 4 passengers per car	191,442 Equivalent Cars/Year
3	Assuming only 5% Riders Using Cars to Travel, and Rest Walk the Distance	5%
4	Estimated Equivalent Number of Cars Resulting in CO2 Emission for Travelling in Car	47,861 Equivalent Cars/Year
	Total Carbon-di-oxide Emitted if Travelling by Car Instead of Ropeway	**220,159 Metric Tons CO2/Year**
C	Carbon-di-oxide (CO2) Emitted if Using Ropeway to Transport Instead of Car	
1	Average Power Consumed in Ropeway: Start-in-Mode, Continuous-in-Operation	303 KW
2	Ropeway Operating Hours per Year: 8 Hours/Day for 360 Days/Year	3,500 Hours/Year
3	Total Power Consumed in Ropeway per Year	10,61,667 KWh/Year
	Total Carbon-di-oxide Emitted if Travelling by Ropeway Instead of Car	**0,492 Metric Tons CO2/Year**
D	Reduction in Carbon-di-oxide Emission if Using Ropeway to Transport Instead of Car	
1	CO2 Emitted from Using Ropeway - CO2 Emitted from Driving Car	219,667 Metric Tons CO2/Year
E	Estimated Carbon Tax in India	
1	Equivalent Carbon Tax in India = Coal Cess at Rs 400/tonne	400 Rs/Ton
A+B+C+D+E	**Potential Carbon Credit from CO2 Emission Reductions Using Ropeway instead of Car**	**Rs 8.8 Crore/Year**

For Phase-II

Estimation of Carbon Credits from Using Ropeway Instead of Travelling by Car		
S. No	**Particulars**	**Details**
A	Basic Data to Estimate Carbon-di-oxide Emissions from a Passenger Car and Power Generation	
1	A typical passenger vehicle emits about 4.6 metric tons of carbon dioxide per year.	4.6 Metric Tons CO2/Year

2	1,021.6 lbs CO2 per megawatt-hour for delivered electricity (assuming transmission and distribution losses of 7.3%) (EPA 2020; EIA 2020b)	0.000463 Metric Tons CO2/KWh
B	Carbon-di-oxide (CO2) Emitted if Using Car to Transport Instead of Ropeway	
1	Total Ropeway Ridership in Year 2034	1,689,352 Ropeway Ridership/Year
2	Equivalent Number of Cars to transport assuming 4 passengers per car	422,338 Equivalent Cars/Year
3	Assuming only 5% Riders Using Cars to Travel, and Rest Walk the Distance	5%
4	Estimated Equivalent Number of Cars Resulting in CO2 Emission for Travelling in Car	21117 Equivalent Cars/Year
	Total Carbon-di-oxide Emitted if Travelling by Car Instead of Ropeway	**97138 Metric Tons CO2/Year**
C	Carbon-di-oxide (CO2) Emitted if Using Ropeway to Transport Instead of Car	
1	Average Power Consumed in Ropeway: Start-in-Mode, Continuous-in-Operation	303 KW
2	Ropeway Operating Hours per Year: 10 Hours/Day for 350 Days/Year	3,500 Hours/Year
3	Total Power Consumed in Ropeway per Year	1,061,667 KWh/Year
	Total Carbon-di-oxide Emitted if Travelling by Ropeway Instead of Car	**0,492 Metric Tons CO2/Year**
D	Reduction in Carbon-di-oxide Emission if Using Ropeway to Transport Instead of Car	
1	CO2 Emitted from Using Ropeway - CO2 Emitted from Driving Car	96,646 Metric Tons CO2/Year
E	Estimated Carbon Tax in India	
1	Equivalent Carbon Tax in India = Coal Cess at Rs 400/tonne	400 Rs/Ton
A+B+C+D+E	**Potential Carbon Credit from CO2 Emission Reductions Using Ropeway instead of Car**	**Rs 3.9 Crore/Year**

Economic Benefits

The benefits in terms of money value are estimated directly from the projected passenger km saved for the horizon years and value for other years are interpolated on the basis of projected traffic. Accrued Benefit Components are shown in Table below.

Table 26: Percentage of Benefit Components

Ropeway Benefit Component	% of Benefit
Annual Time Cost Saved	57%
Annual Fuel Cost Saved	8%
Annual Car Operating Cost Saved	5%
Annual Accident Cost Saved	19%
Annual Infrastructure Cost Saved	12%
Total	**100%**

9.10 Economic Analysis (Estimated profit and loss statement)

We are providing estimated profit and loss statements for the concession period which has been used to arrive at Project Economic Internal rate of return (EIRR) based on the above assumptions.

Table 27:Estimated Profit and Loss Statement (during concession period) – Phase- I

(Figures in Rs. Cr.)

	Year	Revenue from Ridership	Revenue from Other source (rental revenue and advertisement)	Operational Cost (O&M, Administrative Expenses, Concession Fee	Earning before Interest, Depreciation and Tax
1	2028	65	68	27	106
2	2029	72	68	28	112
3	2030	79	68	30	118
4	2031	87	72	31	128
5	2032	94	72	33	133
6	2033	100	72	34	138
7	2034	107	72	36	143
8	2035	115	75	40	150
9	2036	123	75	44	154
10	2037	131	75	48	159
11	2038	141	75	53	163

12	2039	151	79	58	172
13	2040	160	79	63	177
14	2041	168	79	68	179
15	2042	177	79	74	182
16	2043	186	83	80	189
17	2044	195	83	87	191
18	2045	205	83	94	194
19	2046	215	83	101	197
20	2047	226	87	109	204
21	2048	237	87	117	207
22	2049	249	87	126	211
23	2050	261	87	135	214
24	2051	274	92	145	221
25	2052	288	92	156	224
26	2053	303	92	166	228
27	2054	318	92	178	231
28	2055	334	96	187	243
29	2056	350	96	195	251
30	2057	368	96	204	260
31	2058	386	96	213	269
32	2059	405	101	224	283
33	2060	426	101	234	293
34	2061	447	101	245	303
35	2062	469	101	256	314
36	2063	493	106	269	330
37	2064	517	106	281	342
38	2065	543	106	294	355
39	2066	570	106	308	369
40	2067	599	111	323	387
41	2068	629	111	338	402
42	2069	660	111	354	418
43	2070	693	111	371	434
44	2071	728	117	389	456
45	2072	764	117	408	474
46	2073	803	117	427	493

Table 28:Estimated Profit and Loss Statement (during concession period) – Phase – I & II

(Figures in Rs. Cr.)

S.No.	Year	Total Revenue	Operational Cost (O&M, Administrative Expenses, Concession Fee	Earning before Interest, Depreciation and Tax
1	2028	140	27	113
2	2029	146	28	118
3	2030	154	30	124
4	2031	165	31	134
5	2032	172	33	140
6	2033	179	34	144
7	2034	230	53	177
8	2035	239	57	182
9	2036	247	61	187
10	2037	256	65	191
11	2038	265	69	196
12	2039	278	73	205
13	2040	288	78	210
14	2041	298	84	214
15	2042	309	91	217
16	2043	324	99	225
17	2044	336	107	229
18	2045	348	116	233
19	2046	361	124	237
20	2047	379	134	245
21	2048	393	145	249
22	2049	408	155	253
23	2050	424	166	257
24	2051	445	179	266
25	2052	462	192	270
26	2053	480	205	275
27	2054	499	220	280
28	2055	524	235	290
29	2056	545	249	296

30	2057	567	265	302
31	2058	591	282	309
32	2059	620	300	320
33	2060	646	319	326
34	2061	672	334	338
35	2062	700	350	351
36	2063	735	367	368
37	2064	766	384	382
38	2065	799	403	396
39	2066	833	422	412
40	2067	875	443	432
41	2068	912	463	449
42	2069	952	485	466
43	2070	993	509	485
44	2071	1043	534	509
45	2072	1089	559	530
46	2073	1137	586	551

10. Conclusion

The broad study of the Route in terms of location, ridership and ease of execution leads us to the following conclusion:

Based on techno-economic analysis, Palampur Ropeway would not only provide easy access for tourists to the hill station but also would be beneficial for the environment as the vehicle traffic between Bhatarka to Thathri to Cunja Glacier in Kangra, Himachal Pradesh would reduce substantially. It would also give a boost to tourism in the region which will enhance the service industry also.

Since it is working out to be a profitable project, it has the potential to attract private partnership.

11. Abbreviations

Abbrevation	Term	Abbrevation	Term
2S	Bi-cable	**K.M.**	Kilometer
3S	Tri-cable	**Kmph**	Kilometer per hour
Approx.	Approximately	**kW**	Kilowatt
ATW	Aerial Tram-Way	**kWH**	Kilowatt Hour
BDG	Bi-Cable Detachable Gondola	**O&M**	Operation and Maintenance
BIS	Bureau of Indian Standards	**LLP**	Limited Liability Partnership
BOT	Built Operate Transfer	**LRT**	Light Rail Transit
CAPEX	Capital Expenditure	**MRT**	Mass Rapid Transit
CEN	Comité Européen De Normalization	**MRTS**	Mass Rapid Transit System
CMP	Comprehensive Mobility Plan	**m.s.l**	Mean sea level
CPCB	The Central Pollution Control Board	**MDG**	Mono-Cable Detachable Gondola
Cr	Crore	**Min**	Minutes
CRRI	Central Road Research Institute	**NCR**	National Capital Region
DBFOR	Design, Build, Finance, Operate and Transfer	**NH**	National Highway Sq. – Square
D.G.	Diesel Generator	**NR**	Number
DMRC	Delhi Metro Rail Corporation	**O&M**	Operation and Maintenance
DPR	Detailed Project Report	**OPEX**	Operational Expenses
EPC	Engineering, Procurement and Construction	**ITDP**	Institute of Transport and Development Policy

Abbrevation	Term	Abbrevation	Term
EC	European code	**PPHPD**	Passengers per hour per direction
EM	Electro-Mechanical Cost	**PPP**	Public- Private Partnership
EN	European Standards	**PWD**	Public Works Department
EU	European Union	**ROW**	Right of Way
HP	Himachal Pradesh	**RTDC**	Ropeway and Rapid Transport System Development Corporation H.P. Ltd
INR	Indian Rupee	**Sec**	Second
IRR	Internal Rate of Return	**TEFR**	Techno-Economic Feasibility Study
ISBT	Inter State Bus Terminal	**TPC**	Total Project Cost
IETS	Information Technology Enabled Services	**USA**	United States of America
IETS	Information Technology Enabled Services	**WTS**	Willingness to Shift