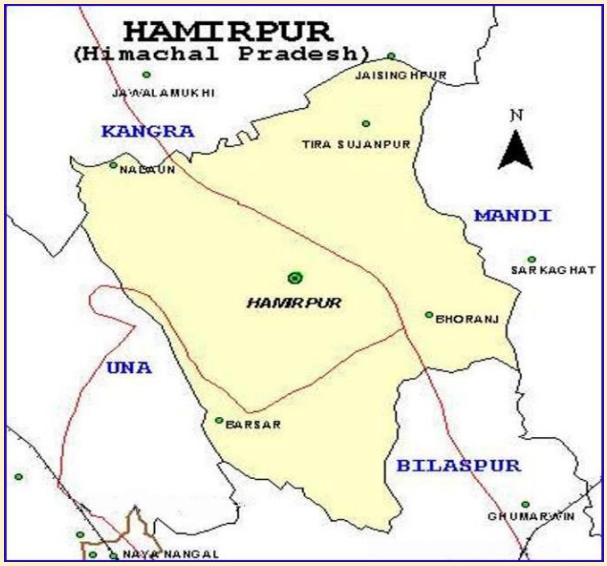
ROPEWAY AND RAPID TRANSPORT SYSTEM DEVELOPMENT CORPORATION H.P. LTD (RTDC)



Technical-Financial Feasibility Report

Passenger Ropeway from Taxi Parking to Baba Balak Nath Temple Distt. Hamirpur in Himachal Pradesh

Shimla – 171001 (H.P)
Telephone No (01772811001)
Email: cgmrtdchp@gmail.com

Prepared by: Nivesa Advisors LLP

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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.

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1. Introduction

1.1 Background

The history of Hamirpur is closely associated with the Katoch dynasty which ruled the area between the Ravi and Satluj rivers in the olden days. It is evident from the "Puranas" and Panini's "Ashtadhyai" that during the Mahabharta period, Hamirpur was a part of the old Jallandhar-Trigarta empire. Panini referred to the people of this kingdom as great warriors and fighters. The tradition of those people seems to have continued till today, as is evident from the large number of people from the region in Indian Defence Forces. It is believed that in the ancient period, the rulers of Gupta dynasty had set up their sovereignty over this part of the land. During the middle ages, presumably the area fell under the control of Mohammed Gazani, Timurlang and later Sultans. But with the passage of time, all the aforesaid rulers went away and at the time of Hamir Chand, a Katoch ruler, the area was under the control of 'Ranas' (Feudal Hill Chiefs). Some of the prominent Ranas were, Ranas of Mewa, Ranas of Mehalta and Dhatwal. There was no time when these feudal chiefs were not in quarrel against each other. It was only the Katoch dynasty which put these Ranas under its control, to ensure an orderly society. The Katoch dynasty became predominant during the period of Hamir Chand who ruled from 1700 A.D. to 1740 A.D.

Sidh Baba Balak Nath is a Hindu deity worshiped prominently in the Northern Indian states of Himachal Pradesh, Punjab, Haryana, Chandigarh, J&K etc. His shrine is known as "Deothsidh". It is situated 45 KMs. away from "Hamirpur" on the border of Hamirpur and Bilaspur districts of Himachal Pradesh, India. The Baba Balak Nath Temple is situated at the village of "Chakmoh" in the district Hamirpur on hilltop, in a natural cave. An Idol of Baba is placed in the cave.

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 between Taxi Parking to Baba Balak Nath Temple in Hamirpur, 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 Baba Balak Nath Temple 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. Hamirpur, between Taxi Parking to Baba Balak Nath Temple, Himachal Pradesh.

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

i. Description of Study Area

   a. An assessment of Hamirpur 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 Taxi Parking to Baba Balak Nath Temple in Hamirpur.

   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 Taxi Parking to Baba Balak Nath Temple 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 Hamirpur:

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

Hamirpur

Hamirpur is a Municipal Council and the headquarters of Hamirpur district in the Indian state of Himachal Pradesh. It is covered by Shivalik Ranges. Hamirpur is located in the Lower West Central Outer Himalayas at an average elevation of 790 M above sea level . Far northern High Altitude Dhauladhar Ranges overlook the city. It is also a major junction on National Highway 3 While National Highway 103 starts at Here . Hamirpur is Famous for its High literacy rate, Educational Institutions and Traditional Festival Of Hamir Utsav . Hamirpur City is spread from Jhaniari to Bhota along NH 3 and NH 103 and is a prominent commercial centre for the district. It is Connected to the National Capital with regular HRTC Volvo and ordinary Buses. The nearest Airport is Kangra Airport and Mohali International Airport While the nearest Railway is in Una at 79 km. Hamirpur City is surrounded by Pine tree forests and has a good city infrastructure ranging from Quality Educational Institutions, NIT, State Universities and Skill Learning centres. The highest point in Hamirpur is 1250m Awah Devi peak . .Hamirpur experiences Short Warm summers from late April to June when temperature may go up to 40 °C, and cool winters from mid October to April having as low as 7 °C . Monsoon season starts in late June and lasts till early September with fair amount of rainfall. It snowed in some parts of the district in January 2012 and February 2019 respectively. It lies beneath the irregular pattern hills Of Lower Western Himalayas and southern Shivalik Ranges. It has a fair amount of pine forests.

It is is situated 429 K/M north from Indian capital Delhi and 143 KM north-west side from the Shimla, the capital of Himachal Pradesh and around 82 kilometre south-east side from the Gaggal Airport airport of Dharamshala. In 2011, Hamirpur had population of 454,768 of which male and female were 217,070 and 237,698 respectively. In 2001 census, Hamirpur had a population of 412,700 of which males were 196,593 and remaining 216,107 were females. Hamirpur District population constituted 6.62 percent of total Maharashtra population. In 2001 census, this figure for Hamirpur District was at 6.79 percent of Maharashtra population. Hindi and Punjabi are the main spoken languages.

Baba Balak Nath

Baba Balak Nath is a Hindu deity, which is worshiped with great reverence in the North-Indian state of Himachal Pradesh and Punjab. His main place of worship is known as Deotsidh, this temple is situated in the high peak of the hill of Chakmoh village. Baba Balak Nath was born to Vishnu and Lakshmi (in a Brahmin family) in Kathiawad, Gujarat. There are two famous legends behind his birth and life. According to one tale, he was named Dev and meditated with Lord Shiva in his mind. He was not married and left home to attain Parma Sidhi. On getting Parma Sidhi, Dev became popular and came to be known as Baba Balak Nath.

As per locals, there is another story regarding Baba Balak Nath. As a child he was named Bal Shiva by his parents Vishnu and Lakshmi. He was not an ordinary child. Once when he was five years old, his parents slapped him. After this incident, Bal Shiva decided to go to his original parents Lord Shiva and Parvati. On seeing their son so sad, Lord Shiva and Goddess Parvati appeared before him and gave him a blessing that he will be a twelve year old boy for the rest of his life and never grow old. Lord Shiva also gave him a Singhi (Lord Shiva's dumroo). After this incident Bal Shiva came to be known as Baba Balak (child). His devotees refer to him as Baba.

Table 1: General Data of Baba Balak Nath

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	27.9°C (82.22°F)
Annual low temperature	17.96°C (64.33°F)
Average annual precip.	42.86mm (1.69in)
Warmest month	June (37.93°C / 100.27°F)
Coldest Month	January (8.31°C / 46.96°F)
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

This holy shirine can be visited any time throughout the year. Sunday is treated as the auspicious day of Baba Ji, therefore usually huge rush flows here on weekends and particularly on Sundays. Month long *Chaitr Malas* are celebrated here every year from 14th March to 13th April every year.

Climate

Located at an elevation of 774.74 meters (2541.8 feet) above sea level, Hamirpur 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. Hamirpur typically receives about 42.86 millimeters (1.69 inches) of precipitation and has 35.54 rainy days (9.74% of the time) annually.

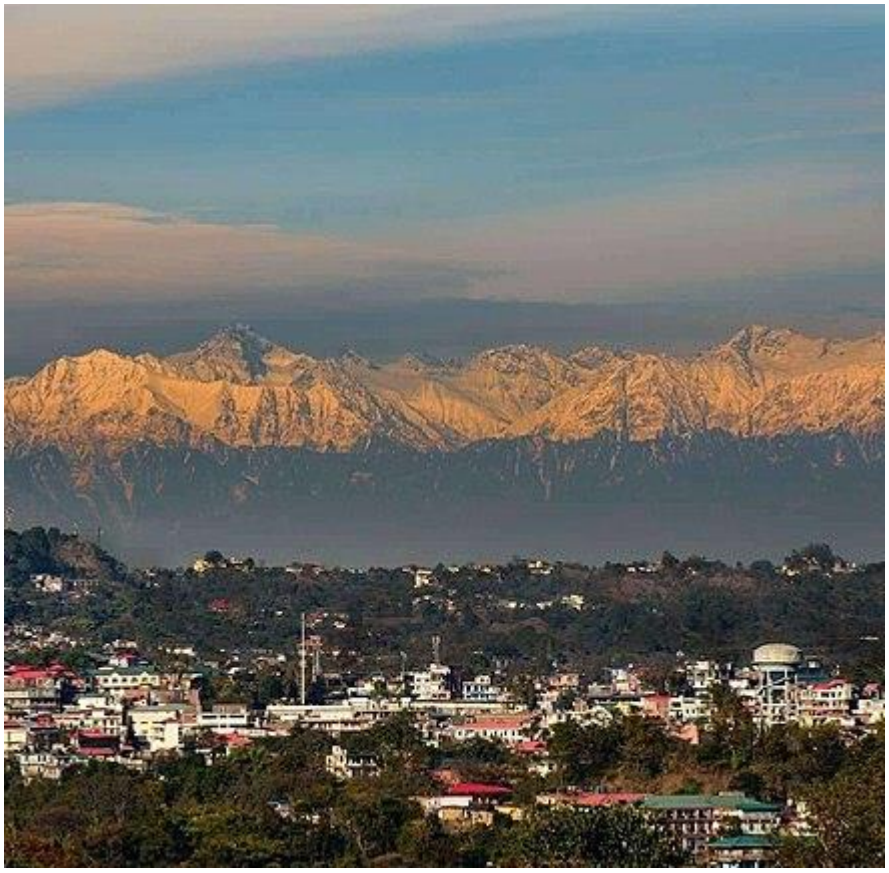


Figure 1:Hamirpur on a winter afternoon

Accessibility

The district Head Quarter is situated in a small but beautiful town Hamirpur which lies in almost centre of the district. Hamirpur is well connected by Roads with all the major cities / towns of Himachal Pradesh as well as with the neighboring states. Hamirpur is accessible throughout the year and major mode of transportation is by road. Hamirpur can be easily visited by Road, Train or by Air.

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

By Road

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

- 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

There is no direct Train service to this town. The nearest railway stations from Hamirpur is Una (Broad Gauge Railway line), Amb (Broad Gauge Railway line) and Jawalamukhi Road (Narrow Gauge Railway line). Una railway station is about 80 KMs far from Hamirpur. Amb railway station is approximately 70 KMs away from Hamirpur town.

To enjoy the beauty of the hilly serpentine track, one can visit Hamirpur via Pathankot Jawalamukhi Road, a narrow gauge link whic is about 58 KMs away from the town. Frequent Bus / Taxi service is available to and from all the Railway Stations.

By Air

There is no Airport in district Hamirpur, thus no direct Air Service / Flight is available to this town. The nearest Airport to Hamirpur is Gaggal (Kangra) near Dharamshala. Gaggal Airport is about 83 KMs far from Hamirpur and frequent Bus / Taxi service is available to and from the Gaggal. Presently Air India and SpiceJet are operating to Gaggal (Dharamshala DHM).

Table 2: Distance of Hamirpur by Car

S.No.	Place	Distance	Timing
1	Delhi	390.2 km	7hrs 30min
2	Haryana	387.6km	6hrs 54min
3	Ludhiana	190km	4hrs
4	Chandigarh	159.1km	3hrs 30min

2.2 Geographical Location

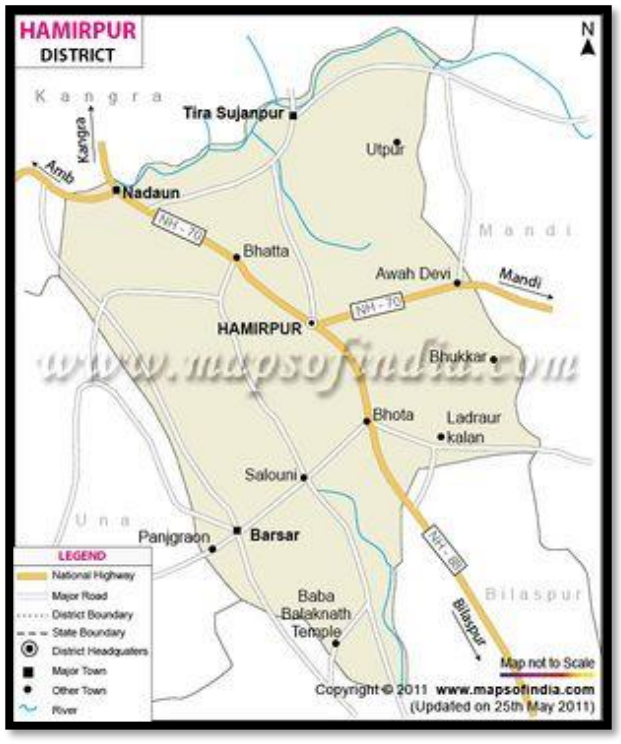


Figure 2: Map of Distt Hamirpur[1]

[1]https://hpgeneralstudies.com/brief-geography-of-district-hamirpur-himachal-pradesh/district-hamirpur-map/

The climate

Located at an elevation of 774.74 meters (2541.8 feet) above sea level, Hamirpur 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. Hamirpur 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[2]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Oct	Dec	Year
Record high °C (°F)	24.0 (75.2)	26.0 (78.8)	33.0 (91.4)	38.0 (100.4)	42.0 (107.6)	43.0 (109.4)	43.0 (109.4)	38.0 (100.4)	34.0 (93.2)	35.0 (95.0)	28.0 (82.4)	26.0 (78.8)	43.0 (109.4)
Average high °C (°F)	17.33 (63.19)	20.31 (68.56)	24.65 (76.37)	31.82 (89.28)	35.94 (96.69)	37.93 (100.27)	33.78 (92.8)	30.72 (87.3)	30.14 (86.25)	28.85 (83.93)	24.01 (75.22)	19.37 (66.87)	27.9 (82.22)
Daily mean °C (°F)	13.54 (56.37)	16.53 (61.75)	21.01 (69.82)	28.03 (82.45)	32.22 (90.0)	34.78 (94.6)	31.34 (88.41)	28.61 (83.5)	27.53 (81.55)	24.85 (76.73)	19.91 (67.84)	15.22 (59.4)	24.46 (76.03)
Average low °C (°F)	8.31 (46.96)	10.53 (50.95)	13.8 (56.84)	19.59 (67.26)	22.77 (72.99)	26.63 (79.93)	25.82 (78.48)	24.03 (75.25)	22.13 (71.83)	17.82 (64.08)	14.07 (57.33)	10.04 (50.07)	17.96 (64.33)
Record low °C (°F)	3.0 (37.4)	5.0 (41.0)	7.0 (44.6)	15.0 (59.0)	15.0 (59.0)	20.0 (68.0)	22.0 (71.6)	20.0 (68.0)	18.0 (64.4)	14.0 (57.2)	10.0 (50.0)	5.0 (41.0)	3.0 (37.4)
Average precipitation mm (inches)	21.45 (0.84)	22.94 (0.9)	22.7(0.89)	13.04 (0.51)	20.81 (0.82)	34.82 (1.37)	142.03 (5.59)	158.64 (6.25)	61.05 (2.4)	2.01 (0.08)	7.72 (0.3)	7.16 (0.28)	42.86 (1.69)
Average precipitation days (≥ 1.0 mm)	1.73	1.82	2.09	2.45	3.09	3.09	6.45	7.82	4.55	0.45	1.18	0.82	2.96
Average relative humidity (%)	48.05	51.61	45.6	31.99	24.94	32.41	59.8	76.71	67.72	41.78	40.71	40.31	46.8
Mean monthly sunshine hours	7.73	10.4	10.85	12.47	13.67	13.83	13.2	12.18	11.16	9.46	8.44	8.3	10.97

[2] https://tcktcktck.org/india/himachal-pradesh/hamirpur#:~:text=Hamirpur%20Climate%20Summary&text=The%20district's%20yearly%20temperature%20is,%25%20of%20the%20time)%20annually.

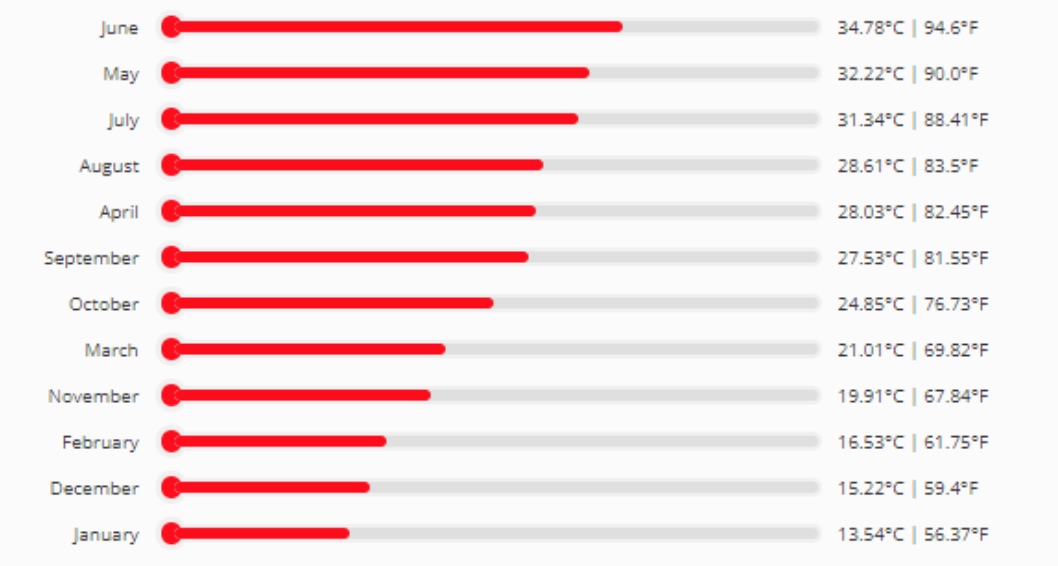


Figure 3: Temperature – Hamirpur, Himachal Pradesh[3]

Some Major Tourist Attractions in Hamripur

Figure 4: Tourist Attractions near Hamirpur

[3]https://tcktcktck.org/india/himachal-pradesh/hamirpur#:~:text=Hamirpur%20Climate%20Summary&text=The%20district's%20yearly%20temperature%20is,%25%20of%20the%20time)%20annually. =img&ei=08EoYbq7AZGtrAGjwbmADQ&bih=655&biw=1366&hl=en-GB#imgrc=wNQrzR2MgjZ1oM

The list of heritage buildings in Hamirpur town is as follows: -

- **Tira Sujanpur:**

  Tira Sujanpur, also known as **Sujanpur Tira** or **Sujanpur Tihra,** is a town and municipal council in the Hamirpur district of Himachal Pradesh. Founded in the 18th-century by the Katoch dynasty, the town is located midst the Himalayan foothills on the southern bank of the Beas River. It was one of the centers of Kangra-style miniature paintings (a *chitrakala* school) and Hindu temples built in an unusual blend of conventional Nagara architecture shrines with Mughal architecture palace, the latter decorated with floral murals of legends from the *Ramayana* and the *Mahabharata*

 [4]

Figure 5: View from Tira Sujanpur

- **Tauni Devi Temple:**

  Dedicated to Goddess Tauni, who is believed to be the sister of Goddess Durga, Tauni Devi Temple is situated on Hamirpur-Awa Devi Road. The temple is at a distance of 12kms from Hamirpur. It is a 200 years old temple and revered highly by the local people of the district. An annual fair takes place in the temple during the month of Ashran (June-July), which is attended by a large number of devotees from all over the state.

[4] https://en.wikipedia.org/wiki/Tira_Sujanpur

 [5]

Figure 6: Tauni Devi Temple

- **Awah Devi Temple (Jalpa Devi)**

  A 250-year-old shrine, Awah Devi Temple is situated 24kms from Hamirpur town. This sacred temple is perched upon a hill that is considered the highest point of Hamirpur. The spectacular backdrop further enhances the beauty of this place. Jalpa Devi is worshipped by a few locals as Kul Devi (Clan's Deity). Also, a large number of Hindu devotees throng the temple in order to seek the blessing of the goddess and to get their wishes fulfilled.

 [6]

Figure 7: Awah Devi Temple (Jalpa Devi)

[5] https://www.tourmyindia.com/states/himachal/tauni-devi-temple-hamirpur.html

[6] https://www.tourmyindia.com/states/himachal/awah-devi-temple-hamirpur.html

- **Nadaun Fort**

  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.

 [7]

Figure 8: Nadaun Fort

- **Narbadeshwar Temple**

  Narbadeshwar Temple is situated in Sujanpur town and was built by Maharani Prasanni Devi, the wife of Raja Sansar Chand. The temple is famed for its rich wall paintings that enhance the beauty of its walls. It is a 200 year-old temple that is built in the Bhitti style of architecture. The arches and niches catch the eyes of many visitors in the temple. There are other temples built around the Narbadeshwar, which are dedicated to Durga, Ganesh, Laxmi Naryana and Mahisasur Mardini.

 [8]

Figure 9: Narbadeshwar Temple

[7] https://www.tourmyindia.com/states/himachal/nadaun-fort-hamirpur.html

[8] https://www.tourmyindia.com/states/himachal/narbadeshwar-temple-hamirpur.html

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

3.4 Vision and Methodology

Mobility Vision of the City

Sitting near the banks of River Beas, Hamirpur is one of the lesser explored destinations in Himachal. The place is named after the famous ruler of Katoch Dynasty, Raja Hamir Chand who reigned the region between 1700 and 1740 AD. Dotted with serene spots and captivating vistas of enchanting scenery, no wonder, the quaint little hill resort is rightly christened as a nature lover's paradise. Majestic mountains, utmost serenity, tranquil aura and an endless adventure is what makes Hamirpur a delight for every traveler.

Hamirpur holds the reputation of being a prominent religious centre in Himachal. The town is peppered with a number of temples and shrines. The Deotsidh Shrine, also called the Cave Temple of Balak Nath in Hamirpur is its most sought after religious attraction. The famous Jwala Devi Temple, one of the sacred 51 Shaktipeeths of Goddess Sati, also lies in the close vicinity and makes for a must-visit destination for devotees and tourists alike.

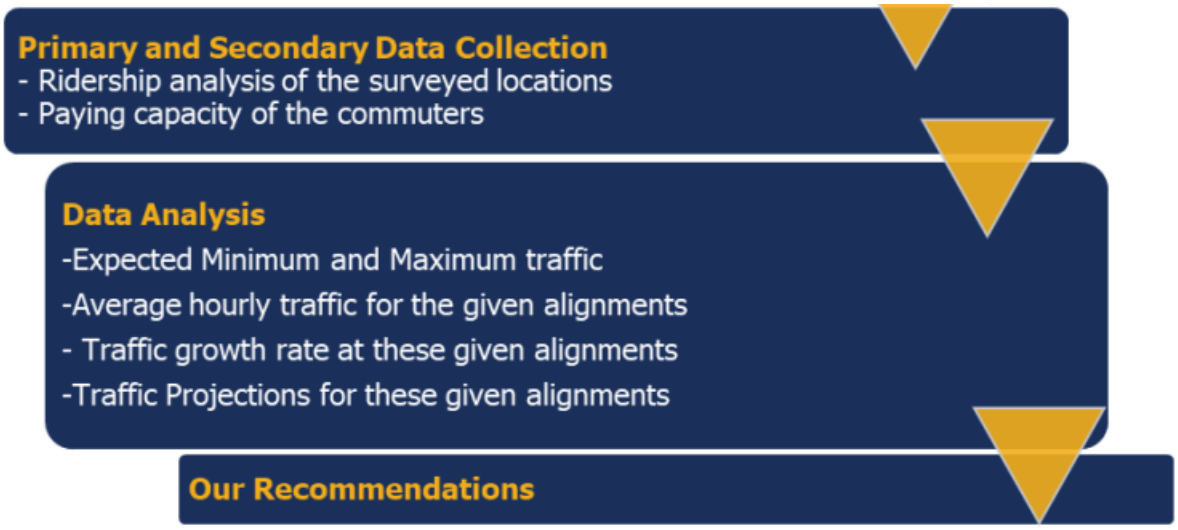
4. Traffic Analysis

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 number of visitors

Table 4: Visitors

S. No	Year	No of Tourists* Visiting Hamirpur
1	2008	279798
2	2009	432467
3	2010	554982
4	2011	630112
5	2012	683205
6	2013	729182
7	2014	753193
8	2015	855267
9	2016	906926
10	2017	980613
11	**2018**	**856111**
12	2019	901740

*Source - https://himachaltourism.gov.in/wp-content/uploads/2023/03/Tourist-Statistics.pdf

4.3 Growth of Tourists

Table 5: Growth of Tourists

S.No.	Year	Annual Total Visitors
		4% growth
1	2022	856111
2	2023	890355
3	2024	925970
4	2025	963008
5	2026	1001529
7	2027	1041590

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

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 4 %.

Growth Projection for the next 40 years based on annual growth rate of 4%

Table 6: Projected Traffic and expected Ropeway Ridership

S.No.	Year	Annual Total Traffic	Total Ropeway Ridership (65% of Annual Traffic)
		4% growth	4% growth
1	2027	1041590	677034
2	2028	1083254	704115
3	2029	1126584	732279
4	2030	1171647	761571
5	2031	1218513	792033
6	2032	1267253	823715
7	2033	1317944	856663
8	2034	1370661	890930
9	2035	1425488	926567
10	2036	1482507	963630
11	2037	1541808	1002175
12	2038	1603480	1042262
13	2039	1667619	1083952
14	2040	1734324	1127311
15	2041	1803697	1172403
16	2042	1875845	1219299
17	2043	1950879	1268071
18	2044	2028914	1318794
19	2045	2110070	1371546
20	2046	2194473	1426407
21	2047	2282252	1483464
22	2048	2373542	1542802
23	2049	2468484	1604514

24	2050	2567223	1668695
25	2051	2669912	1735443
26	2052	2776708	1804861
27	2053	2887777	1877055
28	2054	3003288	1952137
29	2055	3123419	2030223
30	2056	3248356	2111432
31	2057	3378290	2195889
32	2058	3513422	2283724
33	2059	3653959	2375073
34	2060	3800117	2470076
35	2061	3952122	2568879
36	2062	4110207	2671634
37	2063	4274615	2778500
38	2064	4445600	2889640
39	2065	4623424	3005225
40	2066	4808361	3125434

Based on the preliminary ridership at site it is estimated that initially about 65% of the total tourist traffic visiting Hamirpur will take the ropeway from the base year 2022

Table 7: Projected forecast for the Traffic Analysis

Approx. no of visitors annually (2027)	10,41,590
Expected annual growth YoY	4 %
Expected ropeway ridership in 2027	677,033 (65% of total)
Expected Avg. Monthly Traffic (2027)	677,033/12 = 516,419
Approx. no of visitors annually (2066)	3,125,434
Expected ropeway ridership in 2066	3,125,434 (65% of total)
Expected Avg. Monthly Traffic (2066)	3,125,434/12 = 2,60,453
Expected Max. Daily Traffic (2066)	3,125,434/350 = 8,930
Expected Hourly Traffic (2066)	8,930/10 = 893
Expected Hourly Traffic (2066) + 10% for the peak hour traffic	893*110% = 982

Considering 10 hours of operation for the Ropeway.

Based on the above assessment it is proposed that the designed capacity for the proposed ropeway at Baba Balak Nath Temple shall be 500 PPHPD for revenue and 650 PPHPD for design capacity, 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)

Table 8: Ticket Price

Trip	Ticket Price in Rs/-
Round Trip Rates	150
Single Trip Rates	100

5. System Requirements

5.1 Design Parameters

- Capacity of the cable car system: 650 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 3 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

7. Recommended Ropeway System

Based on the above assessment of all the 2 systems, circulating monocable ropeway (detachable) – MDG and Aerial Tramway/Jigback Systems are proposed for Baba Balak Nath Ropeway System in Distt Hamirpur, 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 13: 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.

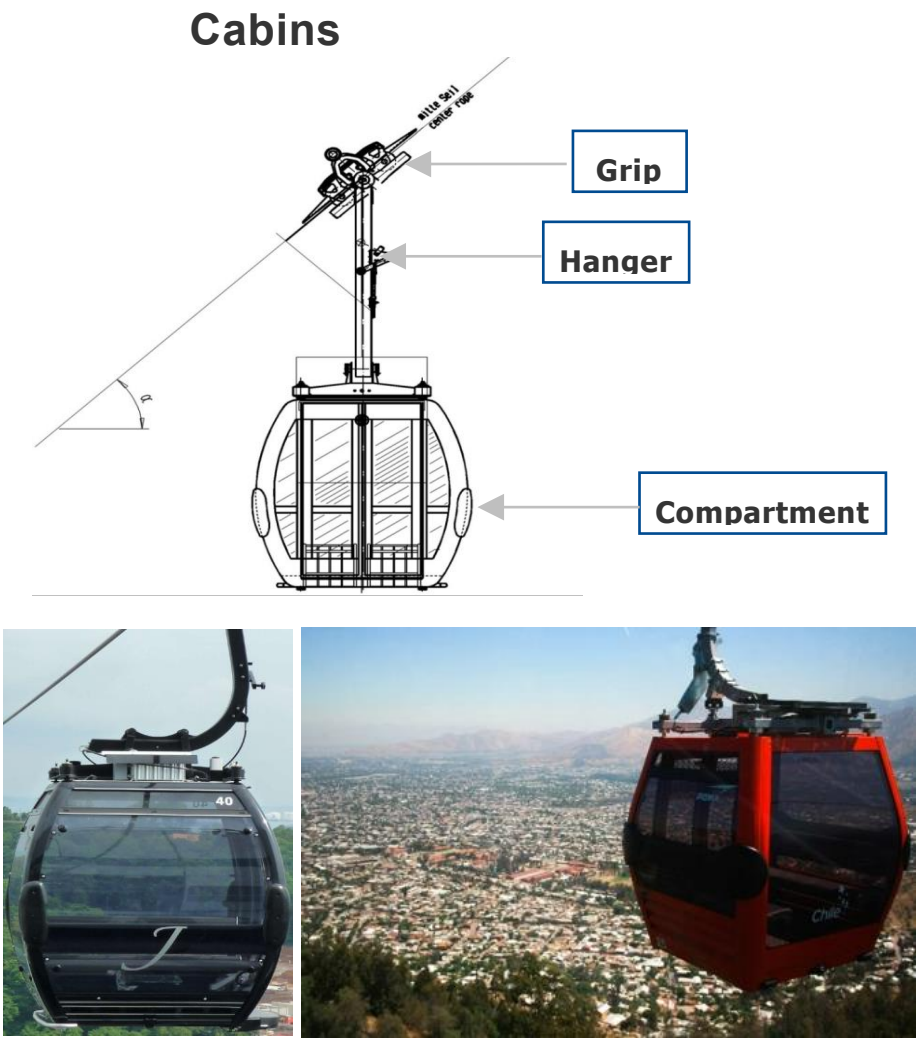


Figure 14: Typical Cabin

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.

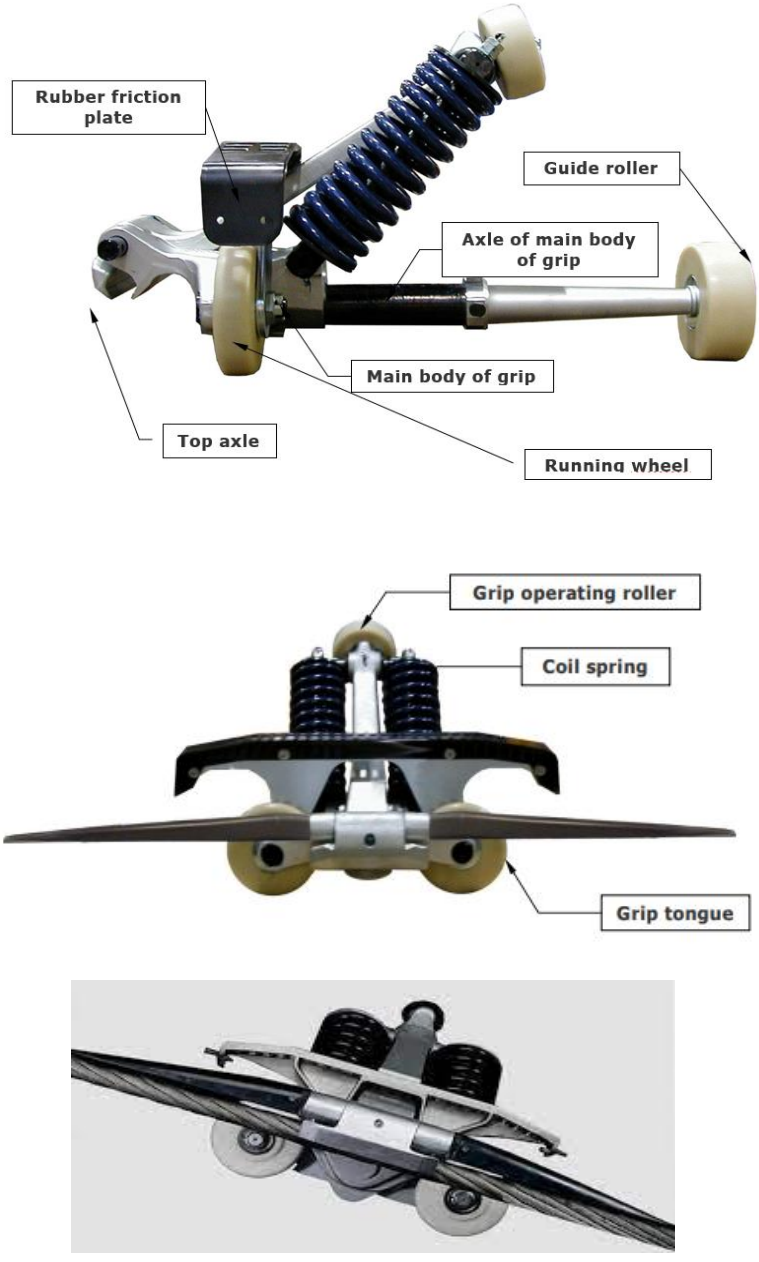


Figure 15: Detachable Grip

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

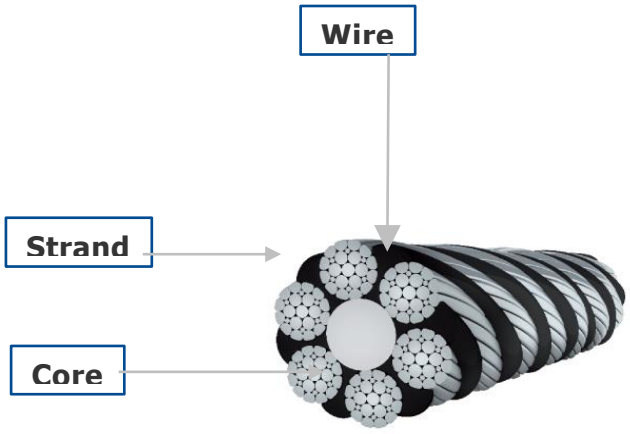


Figure 16: Rope

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 17: Sheave assembly

Figure 18: Tower

Structures supporting and keeping the rope in the normal operating position

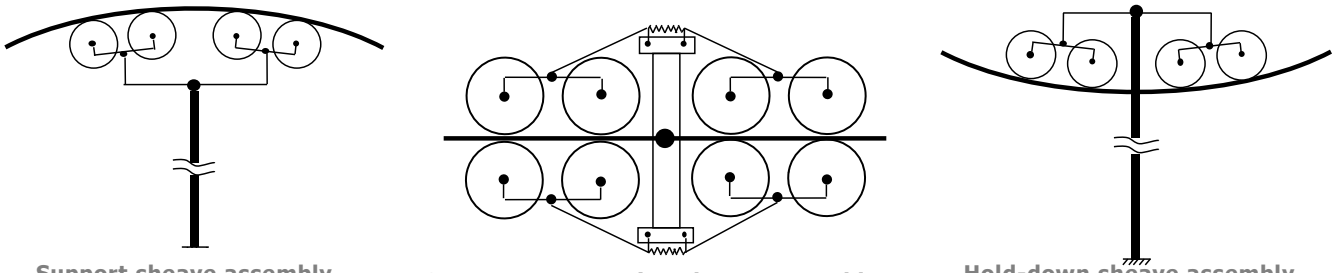


Figure 19: Sheaves

Description of the components of Jig-back System/Aerial Tramway

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.

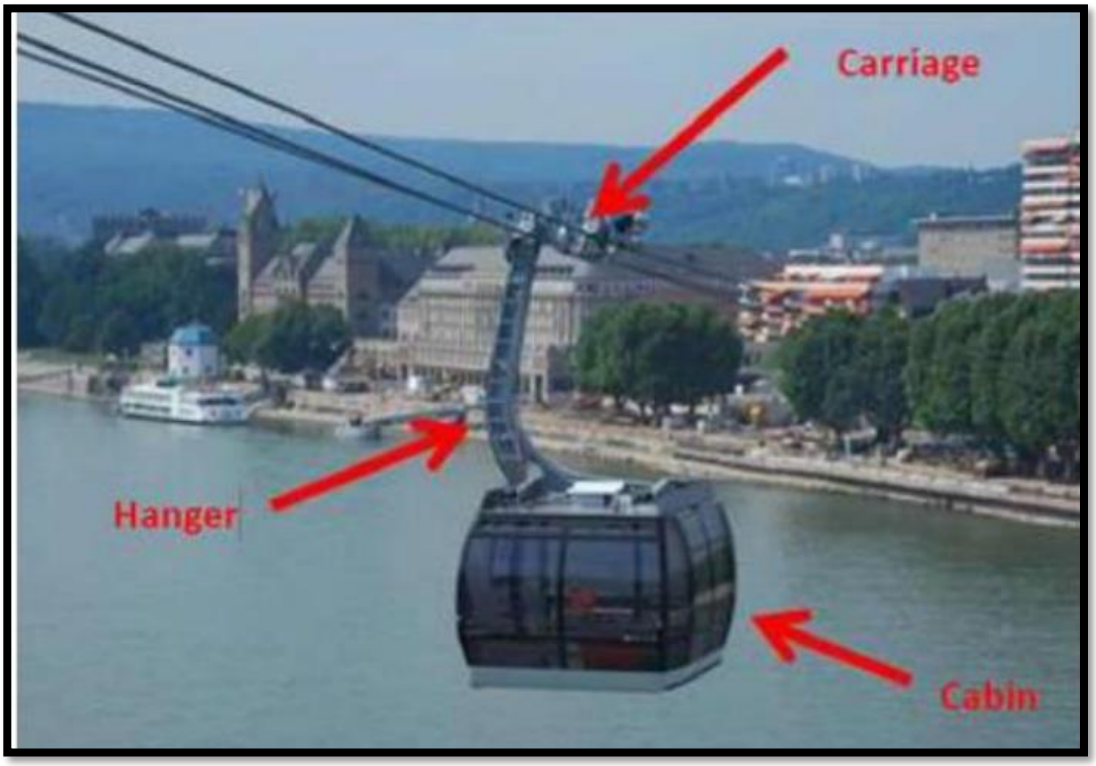


Figure 20: Jigback Ropeway Sysyem/Aerial Tramway

7.8 Cabin

Cabins are the structural and mechanical assemblage in which the passenger(s) of a ropeway system are transported. The cabin includes the carriage/ grip, hanger, and the passenger cabin. The cabin will consist of medium cabins which can seat 6-8 people. The cabins will be totally enclosed and have a standing room to reach full capacity.

7.9 Terminals/Stations

The system will have two terminals: Upper and Lower terminals. The drive machinery may be installed overhead or in an underground vault, based on developer's design and land allocated at upper and lower terminals at the project site.

7.10 Drive Terminal

The drive terminal is the starting point of the ropeway 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 ropes and carries out the necessary operations for the system's functioning.

7.11 Bullwheel and Deflection Sheaves

The bullwheel is a large wheel located at the drive terminal, around which the haul ropes are wound. It provides the necessary traction to move the ropeway system. Deflection sheaves, situated at various points along the system, guide the ropes and ensure proper alignment and tension.

7.12 Carriage

The carriages are the cabins or carriers that transport passengers or cargo along the ropeway. In a Jig-back system, there are typically two carriages that move in opposite directions, passing each other at a designated midpoint station. The carriages are suspended from the ropes and can be open or enclosed, depending on the system's requirements.

7.13 Ropes

The rope (cable) is the heart of any Aerial Ropeway Transit system. It is formed by intertwining individual wires to form a strand and then the strands to form a rope. There are

many variations of the processes used in manufacturing ropes and in choosing the appropriate rope for any given application.

There are two main types of ropes used: haul ropes and haulback ropes. Haul ropes are driven by the bullwheel and support the carriages, while haulback ropes are used to pull the empty carriage back to the starting point. These ropes are made of high-strength steel and are subjected to rigorous safety checks and maintenance.

7.14 Towers and Support Structures

Towers are intermediate structures that support the track and haulage ropes between terminals. They are often steel framed, and are sometimes pylon shaped. The tower's primary function is to support track ropes and haul ropes on line sheaves respectively. Towers must also have guides to keep carriages from hitting them for safety. Towers might not always be necessary depending on the length of the system. For long systems, intermediate towers are necessary to provide support to the system and therefore eliminating the need for long spans. A minimum of two towers will be required for the aerial ropeway

Towers are erected along the ropeway system to support and guide the ropes. These towers are typically made of steel or concrete and are strategically placed to ensure the required clearance and alignment. The number and height of the towers depend on factors such as distance, terrain, and elevation changes along the ropeway route.

7.15 Midpoint Station

The midpoint station serves as the transfer point for the carriages in a jig-back system. Here, the carriages traveling in opposite directions pass each other, allowing passengers to transfer between the two carriages. The intermediate station may also include waiting areas, ticket counters, and other passenger amenities.

7.16 Control and Safety Systems

The ropeway 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. Additionally, communication systems are installed to facilitate coordination between the drive terminal, intermediate station, and other key points along the system.

7.17 Plant and Machinery

The minimum components of the Plant and Machinery will be a main drive, an auxiliary drive, main gear box, tension trolley, counter-weight trolley, grip system, etc. The developer needs to ensure adherence to the minimum service obligations.

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 for connecting Taxi Parking to Baba Balak Nath Temple 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 9: 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 10: 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 11: Contribution to the Local Economy

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

Possible Alignment Options for Connecting Taxi Parking to Baba Balak Nath Temple in Hamirpur via Ropeway System

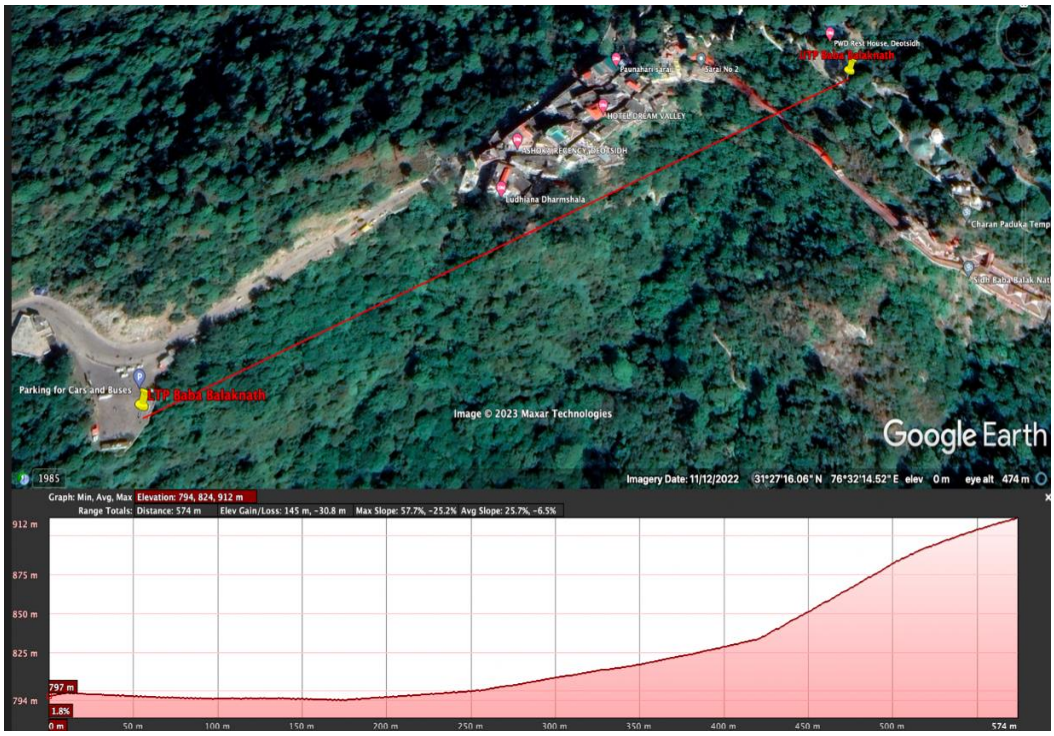


Figure 21: Alignment

The Proposed alignment from Taxi Parking to Baba Balak Nath Temple in Hamirpur, Himachal Pradesh is 520m, with 2 Stations

Proposed LTP : Baba Balak Nath Temple is situated at a Height of 940 m from sea level. The proposed Lower Terminal Point (LTP) is in the **Taxi Parking**. Normally Local from adjoining area and Tourists from Punjab and Himachal Pradesh visit the temple. Construction

of Ropeway will further increase the footfall as a good number of tourists travelling to Baba Balak Nath will possibly pay visits to the temple using Ropeway. Overhead station will be proposed at Parking area so that space can be utilized for parking. III Phase, 11 kv Power supply is available at proposed LTP

Coordinates:
Latitude - 31°27'12.0996"N
Longitude - 76°32'17.4696"E

Figure 22: LTP

The proposed station would be a bridge type ropeway station and would built above the existing road and the NHAI bridge with high columns. There shall be sufficient clearance maintained below the station for ease of movement of the vehicles.

Proposed UTP: The Upper Terminal Point (UTP) is near PWD Rest House and at a entry point of Charan Paduka. If Any privately owned land is required then NOC should also be obtained from such land owner. Double phase power supply is available at proposed UTP.

Coordinates:

Latitude - 31°27’19.5768“N
Longitude - 76°32’34.836“E

Figure 23: Proposed UTP

Table 12: Brief description of the technical details for the alignment

From Station	Taxi Parking
To Station	Baba balak Nath Temple
Particular	MDG/Jig-back
Geometrical data	
Height of Bottom station	803 m
Height of Top station	932 m
Horizontal Length	520 m
Height difference	129 m
Developed Length	520 m
Ropeway General Data	
Drive Station	Taxi Parking
Tension Station	Baba Balak Nath Temple
Return Station	Baba Balak Nath Temple
Capacity	650 Pphpd
Travel Speed	7 m/s
Cabin Capacity	12 (8 seaters) // 2 (40 persons each)
Rope Diameter in MGD	43 mm
Rope Diameter in Jigback	36mm and 20mm
Drive Group	
Power	
Continuous In Operation	55 kW/75kW
Starting Mode	85 kW/98kW
Braking	67 KW/86kW
Distance	
Elevation Difference	118 m
Distance between Cabins	4 m (MDG)
Travel time	~1.25 minutes
Quantity of Cabins and Towers	
Number of Cabins	12 (8 seaters) // 2 (40 persons each)
Number of Towers	4 (Indicative) // 2 (indicative)
Estimated Cost	
Ropeway Equipment	~Rs. 43 Crores (including custom duty)
Civil works and Assembly including material Ropeway	~Rs. 17 Crores (including GST)
Other Costs including finance cost	~Rs. 6 Crores
Total Costs	~Rs. 65 Crores

Tentative Requirement of Land

Nature of land :

Land owned by Government of Himachal Pradesh

Tentative Area Required for LTP Development

Table 13: 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 UTP Development

Table 14: Tentative Area Required for UTP Development

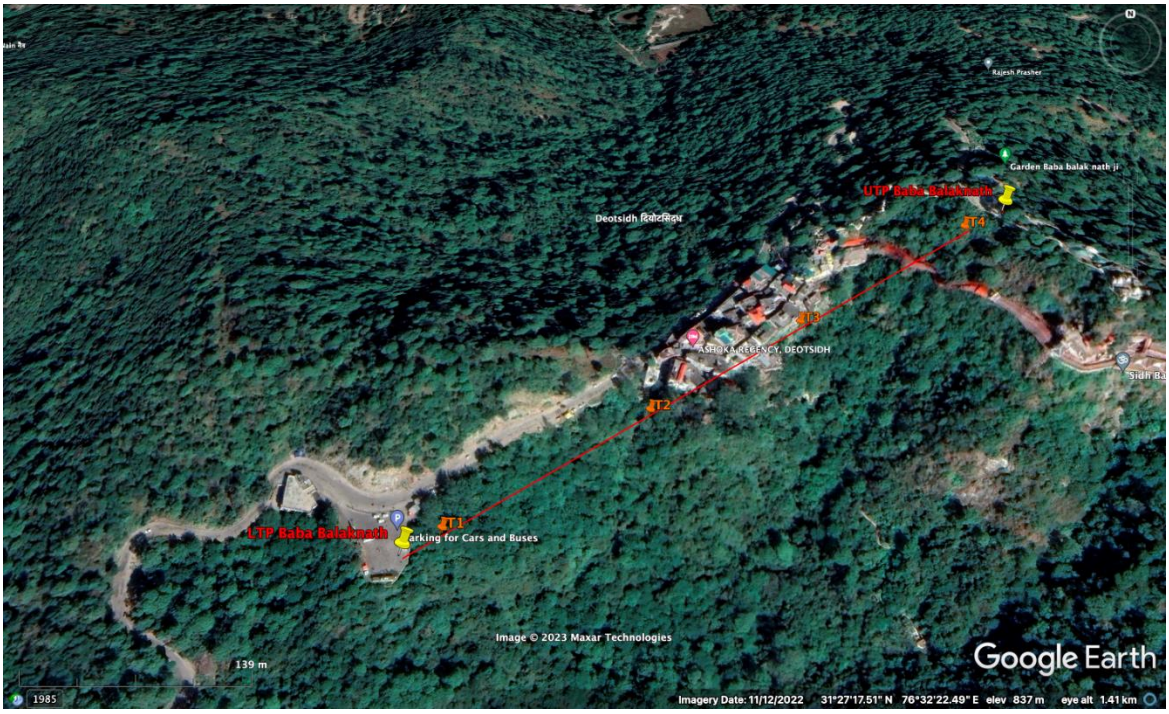
S. No	Heads	Dimensions		Area (m^2)
1	Ropeway Station	30	15	450
2	Toilet	10	10	40
3	Ticket Counter and Guard Room	5	5	15
4	Store	10	6	60
5	Electrical Panel and Control Room	5	6	30
6	Small Maintenance Area	5	5	25
Total				**620**

-

- **Additional area for Setback :** 80
- **Total Area Requirement (Tentative):** ~ 700 sqm

TENTATIVE DETAILS OF TOWER LOCATIONS -

S.No	Tower Number	Tentative Co-ordinates
For MGD System		
1	T1	31°27'12"N 76°32'19"E
2	T2	31°27'16"N 76°32'25"E
3	T3	31°27'19"N 76°32'29"E
4	T4	31°27'18"N 76°32'33"E
For Jigback System		
1	T1	31°27'12"N 76°32'18"E
2	T2	31°27'19"N 76°32'34"E



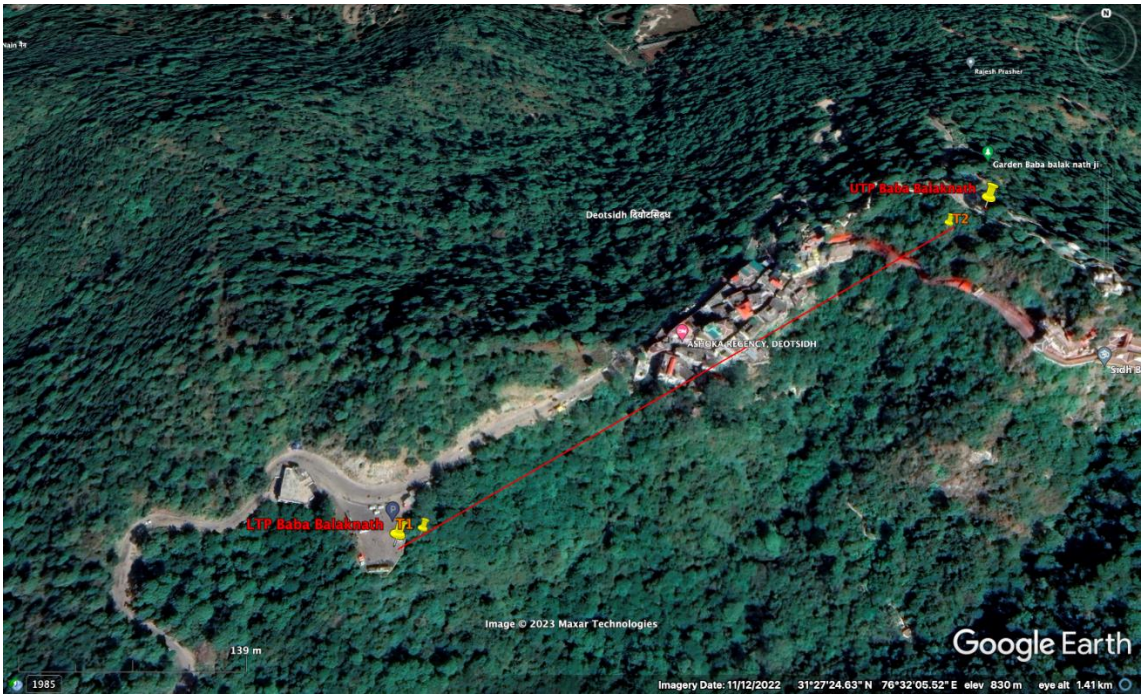


Figure 24: Tentative Tower Locations

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. Kamirpur at Baba Balak Nath Temple, Himachal Pradesh under PPP Mode with VGF. RTDC is the Authority and shall provide this Project to the Concessionaire (Developer) for undertaking this project under PPP Mode with VGF.

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 Baba Balak Nath is provided herein below. The length of the Ropeway for this route is 520 Km.

Table 15: Project Cost with Item Description

S. No.	Item Description	Amount (in Rs. Cr.)
1	Ropeway System (Electro-Mechanical Portion)	33
2	Custom Duty	9.57
3	Civil Works including material ropeway	14
4	GST on Civil works @ 18%	2.5
5	Project Development Cost (ROW, Utility Shifting, Land Diversion etc.)	1.65
6	Project Management Consultancy fee	1.25
7	Misc. Costs (Logistics, Installation cost, admin costs, etc.)	1.70
8	Project Contingency Cost	1.40
Total		**65.00**

9.3 Key aspects of financial evaluation

We have considered following assumptions/analysis for the proposed Ropeway Project at Baba Balak Nath Temple:

a) The construction period of the Project is 36 months;

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

c) Commencement Date, 1st August 2024, 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;

e) Scheduled Project Completion Date (36 months from the commencement date)- 31st July 2027);

f) Start date of Commercial Operations is 1st August 2027;

g) The concession period is of 44 years including an estimated construction period of 36 months;

h) Concession Period end date is 31st July 2066 (40 years from Commencement Date of commercial operations);

i) 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;

j) 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;

k) Financials and Rate of Return for Project along with projections of the project over 44 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 16: Key Assumptions for the Capital Cost

1	**Base Year for Civil construction**	2024-2027
2	**Base Year for Ropeway Installation**	2024-2027
3	**Land Clearances**	2023-2024
4	**Debt Equity Ratio**	80%:20%
5	**Expected Start date of Construction**	01.08.2024
6	**Estimated Construction Period**	36 months
7	**Completion of Construction**	31.07.2027
8	**Number of Days of Operation of Ropeway**	350 Days

Table 17: Key Assumptions for the Revenue from Fare

1	**Ropeway working hours per day**	10 Hrs.
2	**Ropeway Operating Days per year**	350 Days
3	**Ropeway Capacity: Passenger Traffic per Hour per Direction (PPHPD) for revenue purpose**	500 PPHPD
4	**Increase in Traffic Per year from 2022 to 2027**	4%
5	**Annual Traffic in Year 2027 (4% growth over 2022)**	10,41,590
6	**Ridership in Year 2027 (65% of Annual Traffic in Year 2027)**	6,77,033
7	**Ridership in Year 2066 (65% of Annual Traffic in Year 2066)**	31,25,434
8	**Expected start of Revenue from operations**	01.08.2027

Other proposed Revenue Streams

Commercial space for rent

Rent is considered at Rs. 30 Lakhs per annum with an increase of 5% every 4th Year.

Advertisement

Revenue from advertisement is considered at Rs. 50 Lakhs 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 15% Financial Modelling for Passenger Ropeway Project

9.7 Straight forward PPP Model (with VGF)

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

Table 18: Financials for Base PPP Model

	S. No.	Particulars	Base PPP Model
I	1	Total Capital Cost (approx.)	Rs 59 Crores
	2	Other costs including contingency	Rs 6 Crores
	3	Total Project Cost	Rs 65 Crores
	4	Construction Period	36 months
	Project Income Summary (40 years)		**Rs.**
II	1	Total Consolidated Revenue	Rs 2,392 Crores
	2	Total O&M and Administrative Cost	Rs 806 Crores
	3	Net profit after tax	Rs 1,106 Crores
	Project Economics		
III	1	Project IRR (Financial)	14.5%
	2	Project IRR (Economic)	23.9%

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 19:Estimated Profit and Loss Statement (during concession period)

(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	2027	7	1	3	4
2	2028	7	1	3	5
3	2029	8	1	4	5
4	2030	9	1	4	6
5	2031	9	1	4	6
6	2032	10	1	4	7
7	2033	11	1	4	8
8	2034	12	1	5	8
9	2035	13	1	5	9
10	2036	15	1	5	10
11	2037	16	1	6	11
12	2038	17	1	6	12
13	2039	19	1	7	13
14	2040	21	1	8	14
15	2041	23	1	8	15
16	2042	25	1	9	17
17	2043	27	1	10	18
18	2044	29	1	11	20
19	2045	32	1	12	22
20	2046	35	1	13	23
21	2047	38	1	14	25
22	2048	42	1	15	28
23	2049	46	1	17	30
24	2050	50	1	18	33
25	2051	55	1	20	35
26	2052	60	1	22	38
27	2053	65	1	24	42

28	2054	71	1	26	46
29	2055	78	1	28	51
30	2056	85	1	30	56
31	2057	92	1	32	61
32	2058	101	1	35	67
33	2059	110	1	37	74
34	2060	120	1	40	81
35	2061	132	1	43	89
36	2062	144	1	47	98
37	2063	157	1	50	108
38	2064	171	1	54	118
39	2065	187	1	58	130
40	2066	204	1	63	143

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 20: 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

Table 21: 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	1 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 1.8 Crore/Year**
C	Annual Fuel Cost Saved by Ropeway Riders	
Total of C	**Annual Fuel Cost Saved by Ropeway Riders**	**Rs 0.08 Crore/Year**
D	Annual Vehicle Operating Cost Saved by Ropeway Riders	
Total of D	**Annual Car Operating Cost Saved by Ropeway Riders**	**Rs 0.05 Crore/Year**
E	Annual Accident Cost Saved by Ropeway Riders	
Total of E	**Annual Accident Cost Saved by Ropeway Riders**	**Rs 1.02 Crore/Year**
F	Annual Infrastructure Maintenance Cost Saved by Using Ropeway Instead of Roads	
Total of F	**Annual Infrastructure Maintenance Cost Saved**	**Rs 0.68 Crore/Year**
B+C+D+E+F	**Potential Total Benefits from Using Ropeway to Transport Passengers**	**Rs 3.60 Crore/Year**

Table 22: 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 2027	677,033 Ropeway Ridership/Year
2	Equivalent Number of Cars to transport assuming 4 passengers per car	169,258 Equivalent Cars/Year
3	Assuming only 50% 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	8,463 Equivalent Cars/Year
	Total Carbon-di-oxide Emitted if Travelling by Car Instead of Ropeway	**38,929 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	38,437 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 1.5 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 23: Percentage of Benefit Components

Ropeway Benefit Component	% of Benefit
Annual Time Cost Saved	49%
Annual Fuel Cost Saved	2%
Annual Car Operating Cost Saved	1%
Annual Accident Cost Saved	28%
Annual Infrastructure Cost Saved	19%
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 24:Estimated Profit and Loss Statement (during concession period)

(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	2027	7	6	3	10
2	2028	7	6	3	10
3	2029	8	6	3	11
4	2030	9	6	3	12
5	2031	9	6	3	13
6	2032	10	6	3	13
7	2033	11	6	3	14
8	2034	12	7	4	15
9	2035	13	7	4	16
10	2036	15	7	4	17

11	2037	16	7	5	18
12	2038	17	7	5	19
13	2039	19	7	6	20
14	2040	21	7	6	21
15	2041	23	7	7	23
16	2042	25	7	8	24
17	2043	27	7	8	26
18	2044	29	7	9	28
19	2045	32	7	10	29
20	2046	35	8	11	32
21	2047	38	8	12	34
22	2048	42	8	13	36
23	2049	46	8	15	39
24	2050	50	8	16	42
25	2051	55	8	18	44
26	2052	60	8	20	48
27	2053	65	8	22	51
28	2054	71	8	24	56
29	2055	78	8	26	60
30	2056	85	8	28	66
31	2057	92	8	30	71
32	2058	101	8	32	78
33	2059	110	8	34	84
34	2060	120	8	37	92
35	2061	132	8	40	100
36	2062	144	8	43	109
37	2063	157	8	46	119
38	2064	171	8	50	130
39	2065	187	8	54	142
40	2066	204	8	58	155

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, Baba Balak Nath 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 to Baba Balak Nath Temple 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