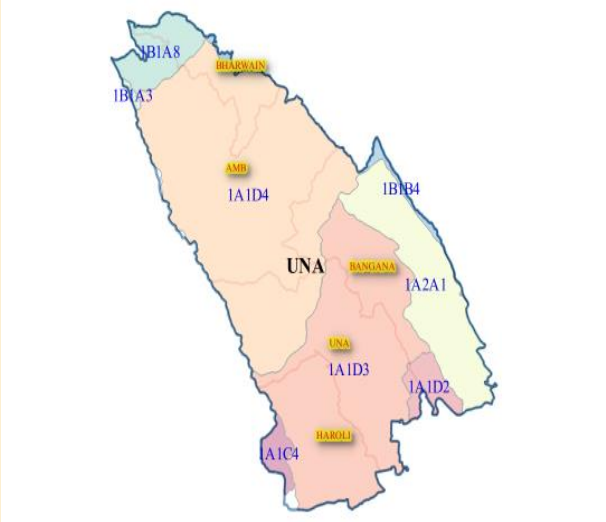
ROPEWAY AND RAPID TRANSPORT SYSTEM DEVELOPMENT CORPORATION H.P. LTD (RTDC)



Technical-Financial Feasibility Report

Passenger Ropeway from Chintpurni Baba Maya Dass Bhawan Parking to Chintpurni Temple Distt. Una in Himachal Pradesh

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June 01, 2023


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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 present Una district until 1st November, 1966 was one of the tehsil of the Hoshiarpur district of Punjab. Consequent upon reorganization of Punjab, all the hill areas including Una tehsil was transferred to Himachal Pradesh. Eversince, until September, 1972 it continued to remain as tehsil of the then Kangra district. On the 1st September,1972 the Himachal Pradesh Govt. reorganised the then Kangra district into three districts namely Una, Hamirpur and Kangra. Una district consists of five Sub-Divisions (Una, Amb, Haroli, Bangana & Gagret), five Tehsils (Una, Amb, Bangana, Haroli and Ghanari) and seven Sub-Tehsils (Bharwain, Ispur, Jol, Bihru Kalan, Dulehar, Gagret at Kaloh, Mehatpur Basdehra) and is having five Development Blocks (Una, Bangana, Gagret, Amb and Haroli).

During the first Sikh War, Raja Narain Pal succeeded in expelling the Sikhs from Kotwalbah and later in consideration of his services, he was awarded a life grant of Rs. 10000 in addition to the jagir of like value which was afterwards confirmed to his heirs in perpetuity, subject to a nazrana of Rs. 1188. He was also allowed three-fourths of the forest income within his jagir. Later on one of the head of the family Raja Brij Mohal Pal was the fifth Viceregal Darbari in Kangra District.

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 Chintpurni Baba Maya Dass Bhawan parking to Chintpurni Temple in Una, Himachal Pradesh on PPP Mode with VGF Mode (hereinafter referred to as "Report" or "Ropeway Project"). The aim of the study is to find the potential for enhancement of tourism to Chintpurni Baba Maya Dass Bhawan parking to Chintpurni 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. Una, between Chintpurni Baba Maya Dass Bhawan parking to Chintpurni Temple, Himachal Pradesh.

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

i. Description of Study Area

   a. An assessment of Una 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 Chintpurni Baba Maya Dass Bhawan parking to Chintpurni Temple

   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 Chintpurni Baba Maya Dass Bhawan parking to Chintpurni 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 Una:

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

Una

Una district is a district in the Indian state of Himachal Pradesh. Una shares its border with the Hoshiarpur and Rupnagar district of Punjab and Kangra, Hamirpur,and Bilaspur districts of Himachal Pradesh. The terrain is generally plain with semi hills.

Una has five tehsils, namely Ghanari, Haroli, Amb, Bangana and Una itself. It was a tehsil of Hoshiarpur district until the Punjab Reorganisation Act, 1966 and Kangra district until 1972, after which it became a district of Himachal Pradesh.

Una lies in the western part of Himachal Pradesh, with the Sivalik Hills of the Himalayas rolling on the western side and Solah Singhi range on the eastern side. The Satluj river alongside Shahtalai, known for the shrine of Baba Balak Nath passes through south of district near Nangal Dam and Beas passes at the north of district near Pong Dam, Talwara.

The altitude varies from more than 409 meters in plains to over 1000 meters in hills. Swan River which is basically seasonal river and also known as soul of district Una flows 65 km right across the Jaswan Valley towards south until it submerges in the Sutlej river near Anandpur.

Chintpurni

Chintpurni is a small town in the Una district of Himachal Pradesh about 40 km (25 miles) north of Una, not far from the border with the Indian state of Punjab. The elevation is about 977 meters (about 3,200 feet). It is home to the Maa Chintpurni Temple which is a major pilgrimage site as one of the Shakti Peethas in India. The Hindu genealogy registers at Chintpurni, Himachal Pradesh are kept here. North of Chintpurni are the western Himalayas. Chintpurni lies within the much lower Shiwalik (or Shivalik) range.

The temple houses the Chintpurni shakti peeth (Chhinnamastika shakti peeth).

The legend behind the Shakti Peetha is part of the Shaktism tradition which tells the story of the self-immolation of the goddess Sati. Vishnu had to cut her body into 51 body parts, which fell on Earth and became sacred sites.

The legend of Chhinnamasta Devi is apparently also part of the Shaktism tradition in Chintpurni. Here, Chhinnamasta is interpreted as the severed-headed one as well as the foreheaded-one.

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

The temple can be visited throughout the year, but the best time to visit is during the Navratri festival, which falls in the months of September or October. The weather during this time is pleasant, and visitors can witness the temple's grand celebrations. However, the temple is crowded during this time, and visitors should plan accordingly.

The temple is open throughout the year, so one can visit any time. But in winter, the temperature around this temple falls below the minimum zero degree, which is harmful for the health of tourists. During the rainy season, rainfall is comparatively higher than other places. The best place to visit the temple is in the mid of April to September.

Climate

Located at an elevation of None meters (0 feet) above sea level, Una has a Humid subtropical, dry winter climate (Classification: Cwa). The district's yearly temperature is 27.4ºC (81.32ºF)

and it is 1.43% higher than India's averages. Una typically receives about 27.03 millimeters (1.06 inches) of precipitation and has 26.1 rainy days (7.15% of the time) annually

Figure 1:Una on a winter afternoon

Accessibility

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

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

By Road

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

- Delhi – Panipat – Kurukshetra – Ambala – Chandigarh – Roopnagar – Kiratpur – Nangal
- Amritsar – Jalandhar – Ludhiana – Hoshiarpur – Jhalera
- Baijnath – Plalampur – Dharamshala – Kangra – Ranital – Dehra – Bharwain – Amb
- Katra – Jammu – Pathankot – Hoshiarpur – Jhalera
- Dehradoon – Haridwar – Ambala – Chandigarh – Roopnagar
- Shimla – Solan – Baddi – Nalagarh – Kiratpur – Nangal – Mehatpur

- Chamba – Nurpur – Talwara – Gagret – Amb
- Manali – Kullu – Mandi – Bhota – Barsar – Lathiani – Bangana – Thanakalan
- Hamirpur – Rangas – Kangoo – Dhaneta – Piploo – Bangana – Thanakalan

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

Una is only district of Himachal Pradesh which is connected through broad gauge connectivity to Una town. Railway Station is known as UNA HIMACHAL. It is about 1.5 kms from the Una town bus stand. There are direct trains from Delhi / Chandigarh.

By Air

There is no Airport in the district. The nearest Airport to Una are:

1. Chandigarh International Airport, which is around 125 kms form Una town. Frequent Bus / Taxi service is available to and from the Chandigarh.
2. Gaggal Airport near Dharamshala (Kangra). Gaggal Airport is about 115 KMs far from Una town. There is frequent Bus / Taxi service available to and from Kangra.

Table 2: Distance of Una by Car

S.No.	Place	Distance	Timing
1	Delhi	301 km	6 hr 40 min
2	Haryana	349.1 km	5 hr 59 min
3	Ludhiana	116.6 km	2 hr 32 min
4	Chandigarh	120.6 km	2 hr 35 min

2.2 Geographical Location

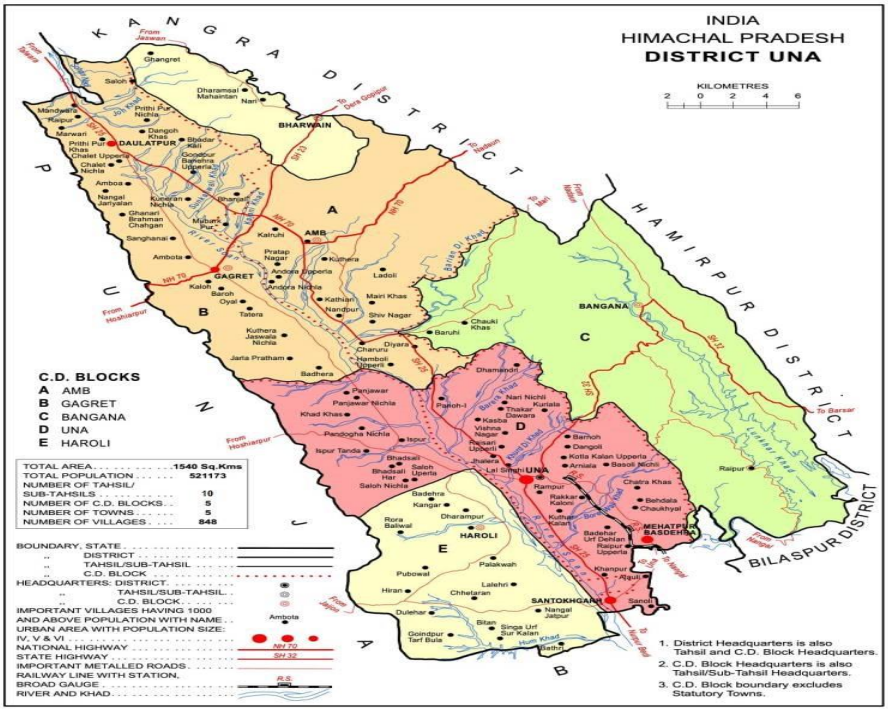


Figure 2: Map of Distt. Una

The climate

Located at an elevation of None meters (0 feet) above sea level, Una has a Humid subtropical, dry winter climate (Classification: Cwa). The district's yearly temperature is 27.4ºC (81.32ºF) and it is 1.43% higher than India's averages. Una typically receives about 27.03 millimeters (1.06 inches) of precipitation and has 26.1 rainy days (7.15% of the time) annually.

Table 3: Climate Data[1]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Oct	Dec	Year
Record high °C (°F)	26.0 (78.8)	29.0 (84.2)	37.0 (98.6)	42.0 (107.6)	45.0 (113.0)	46.0 (114.8)	47.0 (116.6)	42.0 (107.6)	38.0 (100.4)	37.0 (98.6)	31.0 (87.8)	27.0 (80.6)	47.0 (116.6)
Average high °C (°F)	18.96 (66.13)	22.08 (71.74)	27.31 (81.16)	35.31 (95.56)	39.59 (103.26)	41.87 (107.37)	37.84 (100.11)	34.25 (93.65)	33.91 (93.04)	32.59 (90.66)	26.54 (79.77)	20.98 (69.76)	30.94 (87.69)

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

Daily mean °C (°F)	15.1 (59.18)	18.2 (64.76)	23.44 (74.19)	31.46 (88.63)	36.08 (96.94)	38.57 (101.43)	34.85 (94.73)	31.78 (89.2)	30.99 (87.78)	28.56 (83.41)	22.6 (72.68)	17.12 (62.82)	27.4 (81.32)
Average low °C (°F)	10.03 (50.05)	12.15 (53.87)	15.85 (60.53)	23.01 (73.42)	27.33 (81.19)	30.69 (87.24)	28.86 (83.95)	26.52 (79.74)	25.36 (77.65)	21.47 (70.65)	16.77 (62.19)	12.16 (53.89)	20.85 (69.53)
Record low °C (°F)	4.0 (39.2)	8.0 (46.4)	8.0 (46.4)	16.0 (60.8)	21.0 (69.8)	24.0 (75.2)	24.0 (75.2)	22.0 (71.6)	20.0 (68.0)	19.0 (66.2)	12.0 (53.6)	7.0 (44.6)	4.0 (39.2)
Average precipitation mm (inches)	16.85 (0.66)	22.54 (0.89)	15.33 (0.6)	8.77 (0.35)	11.9 (0.47)	17.16 (0.68)	68.58 (2.7)	105.63 (4.16)	38.51 (1.52)	0.92 (0.04)	7.65 (0.3)	10.47 (0.41)	27.03 (1.06)
Average precipitation days (≥ 1.0 mm)	1.55	1.73	1.82	1.09	2	2	4.64	5.91	3.18	0.27	1.18	0.73	2.18
Average relative humidity (%)	52.99	56.21	45.75	27.64	20.24	27.01	52.17	69.94	61.28	34.16	37.38	42.7	43.96
Mean monthly sunshine hours	7.64	10.48	10.82	12.46	13.74	13.96	13.58	12.35	11.24	9.46	8.44	8.35	11.04

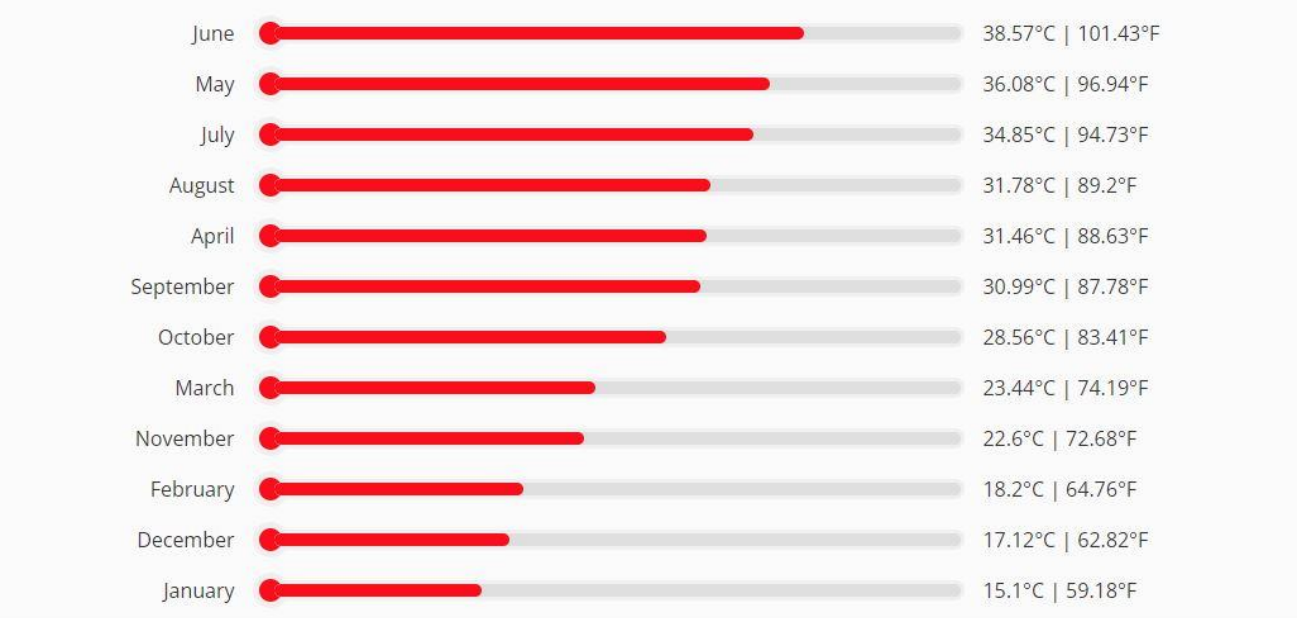


Figure 3: Temperature – Una, Himachal Pradesh[2]

[2]https://tcktcktck.org/india/himachal-

Some Major Tourist Attractions in Una

Figure 4: Tourist Attractions near Una

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

- **Kaleshwar Temple**

  Kaleshwar Temple is a temple of Lord Shiva and it is estimated to be 400 years old temple. The temple is also popularly called Shri Kalinath Kaleshwar Mahadev Temple. The temple was originally built by the Pandavas and was redeveloped by the kings of the Katoch dynasty. Temple is on the banks of River Beas. Kaleshwar Temple is a highly revered temple and thousands of devotees flock to this temple to seek spiritual bliss. Mahashivratri is celebrated with great festivities at this temple. There is a water tank or kund near the temple where devotees take a holy bath before visiting the temple. The temple is also mentioned in Hindu scriptures and is one of the most sacred and holy temples of Lord Shiva in Himachal Pradesh.

pradesh/Una#:~:text=Una20Climate%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

Figure 5: Kaleshwar Temple

- **Drona Shiva Temple:**

  There is an old Shiva temple at Ambota, which is close to Una. The temple is around 5000 years old temple of Lord Shiva and the shiva linga was established by Guru Dronacharya, who was the great teacher who trained the Kaurava and Pandava brothers in the art of warfare. There is a mythological legend associated with this temple. It is said that the daughter of Dronacharya used to play with Lord Shiva at this place. It is for this reason that the temple is called Drona Shiv Bari. The temple is located amid dense forest and the peace here is best to feel relaxed.

Figure 6: Drona Shiv Temple

- **Gobind Sagar Lake**

  Gobind Sagar Lake is close to Una, and this lake is the best site in Himachal Pradesh to spot exciting birds. It is a reservoir that was formed due to the construction of the Bhakra Dam on River Sutlej. Gobind Sagar Lake is a very beautiful and scenic lake with a lot of greenery and forested areas. You can do boating, kayaking, fishing, water skiing, and many other adventurous activities in Gobind Sagar Lake. If you are interested in wildlife, you can go deep into the jungles and spot many animals and birds.

Figure 7: Govind Sagar Lake

- **Thaneek Pura**

  Thaneek Pura is a small hill station that is very close to Maa Chintpurni Temple in Una. The hill station has fascinating natural beauty. The hills are covered with forests and there are many temples in this place. The famous temples are Radha Krishna Temple, Baba Balak Nath Temple, Guga Zahar Veer Temple, and many smaller ones. A wrestling competition and religious festival are organized in the temples which is a big draw for tourists. Thaneek Pura is best for nature walks, forest camping, and trekking trips. Shivratri, Krishna Janmashtami, Guga Navami, and other religious festivals are celebrated here with great festivities, festive events, and competitions.

Figure 8: Thaneek Pura

- **Gurudwara Dera Baba Bharbhag Singh**

  Una has so many religious places such as Gurudwara Dera Baba Bharbhag Singh. This Sikh gurudwara is a religious place of worship for thousands of Sikhs who live in Punjab and Himachal Pradesh. A Sikh saint called Baba Bharbhag Singh founded the gurudwara. The gurudwara is on top of a small hill. Devotees have a deep sense of devotion to this gurudwara. They come here to treat themselves with mental illnesses and emotional problems. A big fair is held here called Hola Mohalla during February.

Figure 9: Gurudwara Dera Baba Bharbhag Singh

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

The town of Una which happens to be the district headquarter is situated by the side of Swan river which is the tributary of the Sutlej river. As per a belief prevalent in the area the great rishi Balmiki had named this river as "Som Bhadra" in Ramayana while Rig Veda had mentioned it is "Swastu". Una had been mentioned as a state of Jalandhar Doab in "Aainey Akbari" a historical treatise of Mughal period having in its fold eight revenue mohals out of the 60 recorded in the said book.

Una besides being the district headquarter, owes its importance to being the residence of a branch of the Bedi family whose ancestor Baba Kaladhari, a descendant of Guru Nanak, during the time of tenth Sikh Guru Gobind Singh after wondering about the Jalandhar Doab for some years, finally settled down here as he attracted a crowd of followers who flocked to hear his eloquent discourse on the holy Guru Granth Sahib. Even today the descendants of Baba Kaladhari are putting up in the fort of Una. The golden dome of the mausoleum of Bedi Sahib Singh situated on a high terrace overlooks the valley.

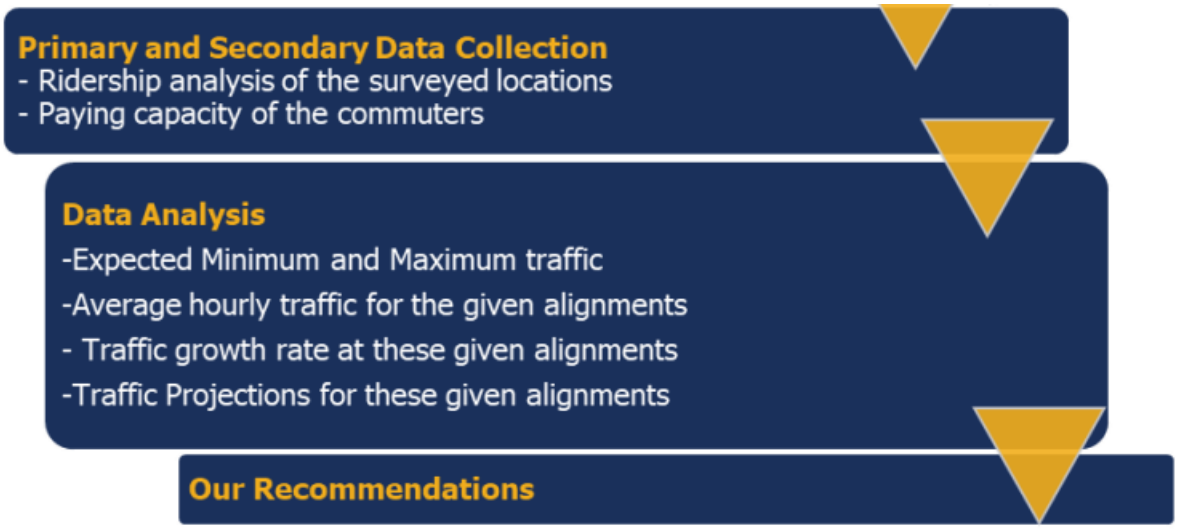
4. Traffic Analysis

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 no. of visitors in Chintpurni Temple

Table 4: Visitors in 2022

S.No	Month	No of Tourists
1	January	107222
2	February	177404
3	March	387595
4	April	287095
5	May	256585
6	June	400975
7	July	448923
8	August	626315
9	September	313385
10	October	274668
11	November	100000
12	December	100000
Total		**3480167**

*Source - RTDC

4.3 Growth of Tourists

Table 5: Growth of Vistors in Chintpurni Temple

Year	Expected Annual Tourist Ridership
	3.5% growth
2022	3480167
2023	3601973
2024	3728042
2025	3858523
2026	3993572
2027	4133347

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. For calculation purposes we have assumed that the ropeway traffic will grow at an annual rate of 3.5 % after coming into operation.

Growth Projection for the next 40 years based on annual growth rate of 3.5%

Table 6: Projected Traffic and expected Ropeway Ridership

S. No.	Year	Expected Annual Tourist Ridership	Expected Annual Local Ridership	Annual Total Ridership
		5% growth	5% growth	5% growth
1	2027	527086	303444	830530
2	2028	553441	318616	872056
3	2029	581113	334547	915659
4	2030	610168	351274	961442
5	2031	640677	368838	1009514
6	2032	672710	387279	1059990
7	2033	706346	406643	1112989
8	2034	741663	426976	1168639
9	2035	778746	448324	1227071
10	2036	817684	470741	1288424
11	2037	858568	494278	1352846
12	2038	901496	518992	1420488
13	2039	946571	544941	1491512
14	2040	993900	572188	1566088
15	2041	1043595	600798	1644392
16	2042	1095774	630837	1726612
17	2043	1150563	662379	1812942
18	2044	1208091	695498	1903590
19	2045	1268496	730273	1998769
20	2046	1331921	766787	2098707
21	2047	1398517	805126	2203643
22	2048	1468442	845383	2313825

23	2049	1541865	887652	2429516
24	2050	1618958	932034	2550992
25	2051	1699906	978636	2678542
26	2052	1784901	1027568	2812469
27	2053	1874146	1078946	2953092
28	2054	1967853	1132893	3100747
29	2055	2066246	1189538	3255784
30	2056	2169558	1249015	3418573
31	2057	2278036	1311466	3589502
32	2058	2278036	1311466	3589502
33	2059	2278036	1311466	3589502
34	2060	2278036	1311466	3589502
35	2061	2278036	1311466	3589502
36	2062	2278036	1311466	3589502
37	2063	2278036	1311466	3589502
38	2064	2278036	1311466	3589502
39	2065	2278036	1311466	3589502
40	2066	2278036	1311466	3589502

Based on the preliminary ridership surveys carried out at site it is estimated that initially about 20% of the total visitors in Chintpurni Temple will take the ropeway for the base year 2026.

Table 7: Projected forecast for the Traffic Analysis

Approx. no of visitors annually (2027)	4,133,347
Expected annual growth YoY	3.5%
Expected ropeway ridership in 2027	826669 (20% of total)
Expected Avg. Monthly Traffic (2027)	826669/12 = 68,890
Approx. no of visitors annually (2066)	1,58,11,589
Expected ropeway ridership in 2066	3,162,318 (20% of total)
Expected Avg. Monthly Traffic (2066)	3,162,318/12 = 2,63,526
Expected Max. Daily Traffic (2066)	3,162,318/350 = 9,035
Expected Hourly Traffic (2066)	9035/10 = 904

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 Chintpurni Temple shall be 700 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)

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: 700 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 Jigback 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 gondolas 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 is proposed for Chintpurni Baba Maya Dass Bhawan parking to Chintpurni Temple.

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 aluminium 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.

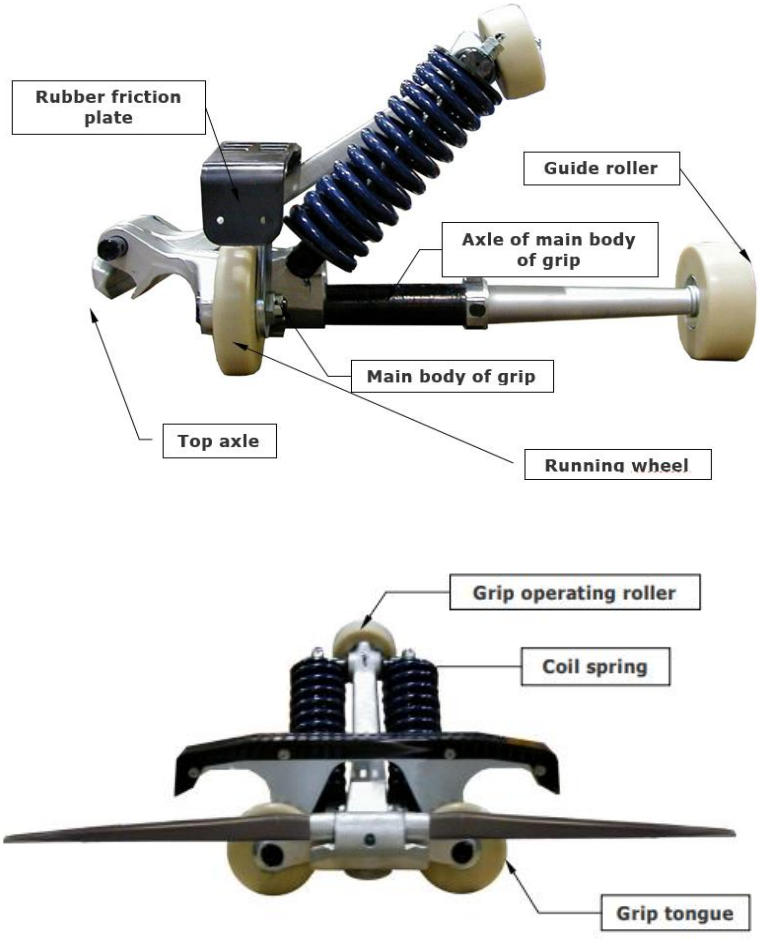


Figure 15: Detachable Grip

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

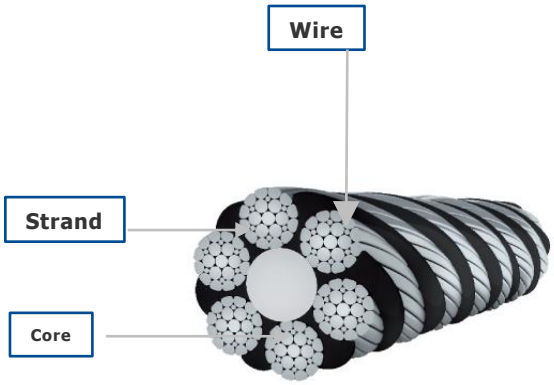


Figure 16: Rope

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

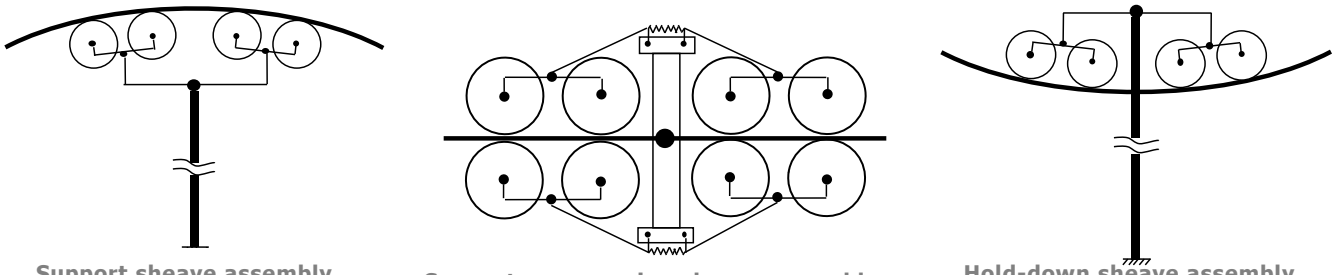


Figure 19: Sheaves

8. Project Overview and Technical Data

8.1 Study of Ropeway Alignments

A team of experts from Nivesa Advisors made frequent site visits and studied the area in detail to arrive at the possible alignment options for connecting Chintpurni Baba Maya Dass Bhawan parking to Chintpurni 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 Una Area	✓
Improvement of Livelihoods of the local people	✓
Benefit to the local and state economy	✓

Possible Alignment Options for Chintpurni Baba Maya Dass Bhawan parking to Chintpurni Temple via Ropeway System is Approx. 1.1 Km, with 2 stations

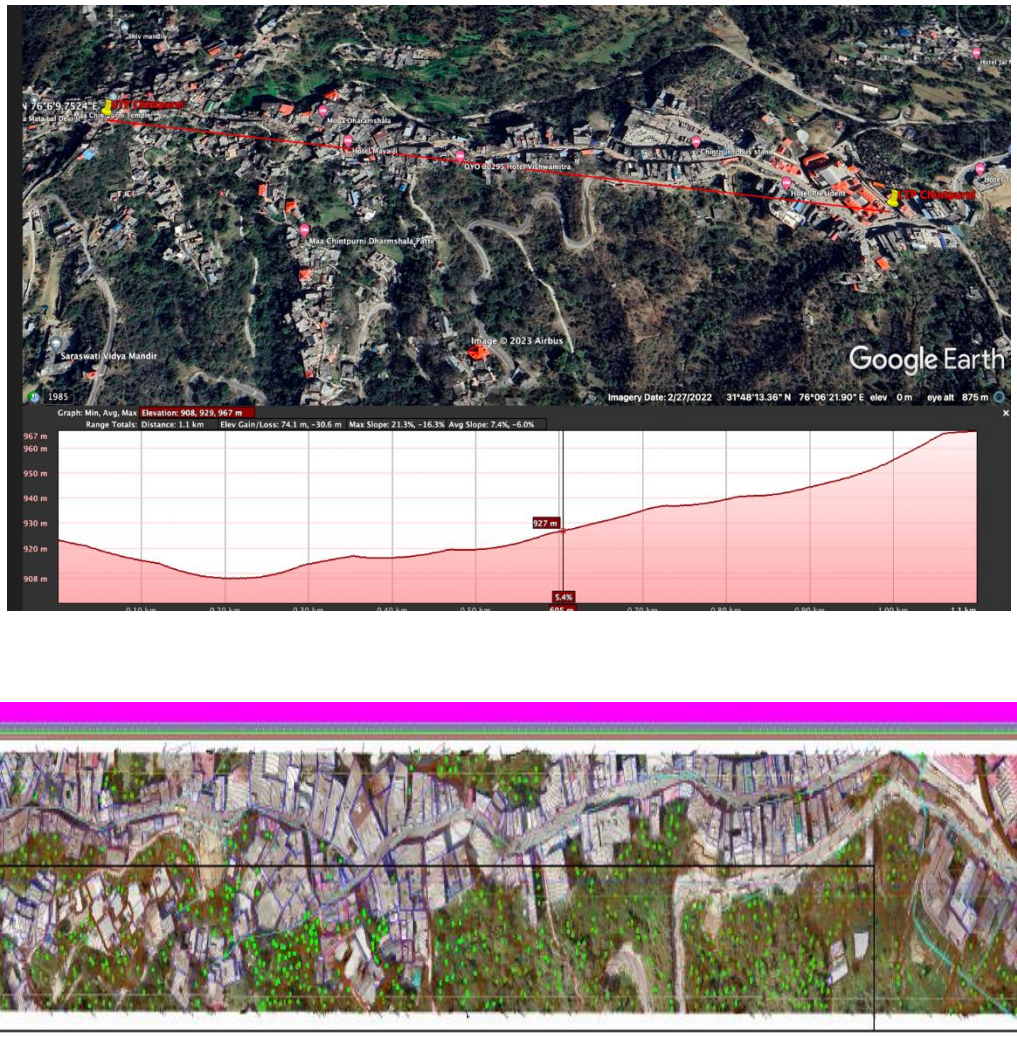


Figure 20: Alignment

Proposed LTP : The proposed Lower Terminal Point (LTP) is in the **premises of Baba Mai Dass Bhawan Parking**. 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 Chintpurni will possibly pay visits to the temple using Ropeway. III Phase, 11 kv Power supply is available at proposed LTP.

Coordinates:
Latitude - 31°48’07.1604“N
Longitude - 76°06’41.292“E

Figure 21: LTP

Proposed UTP: The Upper Terminal Point (UTP) is near entry point of Chintpurni Temple near Mundan Hall. 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°48’30.2688“N
Longitude - 76°06’09.7524“E

Figure 22: Proposed UTP

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

From Station	Chintpurni Baba Maya Dass Bhawan Parking
To Station	Chintpurni Temple
Particular	MDG
Geometrical data	
Height of Bottom station	803 m
Height of Top station	932 m
Horizontal Length	1100 m
Height difference	129 m
Developed Length	1100 m
Ropeway General Data	
Drive Station	Chintpurni Baba Maya Dass Bhawan Parking
Tension Station	Chintpurni Temple
Return Station	Chintpurni Temple
Capacity	700 Pphpd
Travel Speed	7 m/s
Cabin Capacity	18 (8 seaters)
Rope Diameter in MGD	43 mm
Drive Group	
Power	
Continuous In Operation	85 kW
Starting Mode	130 kW
Braking	105 KW
Distance	
Elevation Difference	42 m
Travel time	~2.62 minutes
Quantity of Cabins and Towers	
Number of Cabins	18 (8 seaters)
Number of Towers	6 (Indicative)
Estimated Cost	
Ropeway Equipment	~Rs. 46.44 Crores (including custom duty)
Civil works and Assembly including material Ropeway	~Rs. 18.94 Crores (including GST)
Other Costs including finance cost	~Rs. 11.12 Crores
Total Costs	~Rs. 76.50 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°48'9.3"N 76°06'38.5"E
2	T2	31°48'14.4"N 76°06'31.5"E
3	T3	31°48'19.2"N 76°06'25.1"E
4	T4	31°48'22.5"N 76°06'20.5"E
5	T5	31°48'26.4"N 76°06'15.2"E
6	T6	31°48'28.8"N 76°06'11.9"E

Figure 23: Tentative Tower Locations

Approx. Area required 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.

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 Chintpurni Temple is provided herein below. The length of the Ropeway for this route is 1100 m.

Table 15: Project Cost with Item Description

S. No.	Item Description	Amount (in Rs. Cr.)
1	Ropeway System (Electro-Mechanical Portion)	36.00
2	Custom Duty	10.44
3	Civil Works including material ropeway	16.05
4	GST on Civil works @ 18%	2.89
5	Project Development Cost (ROW, Utility Shifting, Land Diversion etc.)	2.00
6	Project Management Consultancy fee	2.00
7	Misc. Costs (Logistics, Installation cost, admin costs, etc.)	3.12
8	Project Contingency Cost	4.00
Total		**76.50**

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**	3.5%
5	**Annual Traffic in Year 2026 (5% growth over 2027)**	41,33,347
6	**Ridership in Year 2027 (20% of Annual Traffic in Year 2027)**	826,669
9	**Ridership in Year 2066**	3,162,318
12	**Expected start of Revenue from operations**	01.08.2027

Other proposed Revenue Streams

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 50% 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 65.38 Crores
	2	Other costs including contingency	Rs 11.12 Crores
	3	Total Project Cost	Rs 76.50 Crores
	4	Construction Period	36 months
	Project Income Summary (40 years)		**Rs.**
II	1	Total Consolidated Revenue	Rs 2,738 Crores
	2	Total O&M and Administrative Cost	Rs 1,031 Crores
	3	Net profit after tax	Rs 1,181 Crores
	Project Economics		
III	1	Project IRR (Financial)	14.1%
	2	Project IRR (Economic)	25.0%

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	9	1	5	5
2	2028	10	1	5	5
3	2029	10	1	5	6
4	2030	11	1	5	6
5	2031	12	1	6	7
6	2032	13	1	6	8
7	2033	14	1	6	9
8	2034	16	1	7	10
9	2035	17	1	7	10
10	2036	19	1	8	11
11	2037	20	1	8	12
12	2038	22	1	9	13
13	2039	24	1	10	15
14	2040	26	1	11	16
15	2041	28	1	11	17
16	2042	31	1	12	19
17	2043	33	1	13	20
18	2044	36	1	15	22
19	2045	39	1	16	24
20	2046	43	1	17	26
21	2047	46	1	19	28
22	2048	50	1	20	30
23	2049	55	1	22	33
24	2050	59	1	24	36
25	2051	64	1	27	38
26	2052	70	1	29	42
27	2053	76	1	32	45
28	2054	83	1	34	49
29	2055	90	1	36	54
30	2056	98	1	39	60
31	2057	106	1	41	66
32	2058	115	1	44	72

33	2059	125	1	47	79
34	2060	136	1	50	86
35	2061	148	1	54	95
36	2062	161	1	58	104
37	2063	175	1	62	114
38	2064	190	1	66	125
39	2065	207	1	71	136
40	2066	225	1	76	149

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	Infrastruture 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 2.2 Crore/Year**
C	Annual Fuel Cost Saved by Ropeway Riders	
Total of C	**Annual Fuel Cost Saved by Ropeway Riders**	**Rs 0.16 Crore/Year**
D	Annual Vehicle Operating Cost Saved by Ropeway Riders	
Total of D	**Annual Car Operating Cost Saved by Ropeway Riders**	**Rs 0.09 Crore/Year**
E	Annual Accident Cost Saved by Ropeway Riders	
Total of E	**Annual Accident Cost Saved by Ropeway Riders**	**Rs 1.86 Crore/Year**
F	Annual Infrastructure Maintenance Cost Saved by Using Ropeway Instead of Roads	
Total of F	**Annual Infrastructure Maintenance Cost Saved**	**Rs 1.24 Crore/Year**
B+C+D+E+F	**Potential Total Benefits from Using Ropeway to Transport Passengers**	**Rs 5.50 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	826,669 Ropeway Ridership/Year
2	Equivalent Number of Cars to transport assuming 4 passengers per car	206,667 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	10,333 Equivalent Cars/Year
	Total Carbon-di-oxide Emitted if Travelling by Car Instead of Ropeway	**47,533 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	47,042 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 1.9 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 23: Percentage of Benefit Components

Ropeway Benefit Component	% of Benefit
Annual Time Cost Saved	39%
Annual Fuel Cost Saved	3%
Annual Car Operating Cost Saved	2%
Annual Accident Cost Saved	34%
Annual Infrastructure Cost Saved	22%
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	9	8	4	13
2	2028	10	8	4	14
3	2029	10	8	4	14
4	2030	11	8	4	15
5	2031	12	8	4	16
6	2032	13	8	5	16
7	2033	14	8	5	17
8	2034	16	8	5	19
9	2035	17	9	6	20
10	2036	19	9	6	22
11	2037	20	9	7	22
12	2038	22	9	7	24
13	2039	24	9	8	25
14	2040	26	9	9	26

15	2041	28	9	9	28
16	2042	31	10	10	31
17	2043	33	10	11	32
18	2044	36	10	12	34
19	2045	39	10	13	36
20	2046	43	10	15	38
21	2047	46	10	16	40
22	2048	50	10	18	42
23	2049	55	10	19	46
24	2050	59	11	21	49
25	2051	64	11	23	52
26	2052	70	11	26	55
27	2053	76	11	28	59
28	2054	83	11	30	64
29	2055	90	11	32	69
30	2056	98	11	35	74
31	2057	106	11	37	80
32	2058	115	12	40	87
33	2059	125	12	42	95
34	2060	136	12	46	102
35	2061	148	12	49	111
36	2062	161	12	52	121
37	2063	175	12	56	131
38	2064	190	12	60	142
39	2065	207	12	65	154
40	2066	225	13	69	168

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, Bir Billing 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

Abbrevation	Term	Abbrevation	Term
EPC	Engineering, Procurement and Construction	**ITDP**	Institute of Transport and Development Policy
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