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

Technical-Financial Feasibility Report

Passenger Ropeway from Jabli Village to Kasauli, Distt. Solan in Himachal Pradesh

सत्यमेव जयते
हिमाचल प्रदेश सरकार

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(A Government of Himachal Pradesh Undertaking)
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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.

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

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

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

1. Introduction

1.1 Background

Solan District came into existence at the time of the reorganisation of the districts of the State on 1st September, 1972. The district was carved out of Solan and Arki tehsils of the then Mahasu district and tehsils of Kandaghat and Nalagarh of the then Shimla District. Administratively, the district is divided into four Sub-division viz. Solan comprising of Solan and Kasauli tehsils, Nalagarh covers the jurisdiction of Arki and Kandaghat Sub-divisions covers their respective tehsils. The total geographical area of the district according to the Surveyour General of India is 1,936 sq. km. which constitutes 3.49 percent of the total area of the State and ranks 9th amongst the district.

The district is surrounded by Shimla district in the North and by Ropar District of Punjab and Ambala district of Haryana in the south, by Sirmaur District in the east and by Bilaspur district in the west. Mandi District touches the boundary of Solan district in north-east. The shape of the district is rectangular with slight bulge on the northern side intruding towards Mandi district. It is located between the longitudes 76.42 and 77.20 degree and latitudes 30.05 and 31.15 degree north. the elevation of the district ranges from 300 to 3,000 metres above sea level. The mountain ranges lie in the outer Himalayas and are a part of Shivalik ranges. The mountains of lower elevation are found in western-southern parts of the distict comprising of Nalagarh and Arki tehsils while higher ranges start from central region and extend upto north-eastern corner of the District comprising Solan tehsil and parts of Arki tehsil, Kasauli tehsil and Kandaghat tehsil which are located in north-eastern direction of the district and are having the highest ranges of the District.

The district in its present form comprises of the erstwhile princely states of Bhagal, Bhagat, Kunihar, Kuthar, Mangal, Beja, Mahlog, Nalagarh and parts of Keonthal and Kothi and hilly areas of composite Punjab State which were merged in Himachal Pradesh on the Ist November, 1966 on the reorganisation of composite Punjab on the linguistic basis. Most of these princely state as per history were subjected to the onslaught of Gorkha invasion from the year 1803 to 1805. it was in the year 1815 that after th gorkhas lost to the Britishers, these states were freed and restored to the respective rulers. Most of the states were small in area and population and were under the control of the superintendent of Shimla Hill States before Independence. Himachal Pradesh appeared on the administrative map of the country on the 15th April, 1948 and the states of Bhagat, Baghal, Kunihar, Kuthar, Mangal, Beja, Keonthal and Koti formed a part of the then Mahasu District. Nalagarh state which was merged after Independence in Patiala and East Punjab State Union later on formed a part of

Punjab when the reorganisation of the states took place in 1956 and remained a tehsil of Ambala District, Kandaghat and Shimla tehsils of Shimla district like other hilly areas of Kullu, Lahul and Spiti and Kangra districts become part of Himachal Pradesh on the Ist November, 1972 and Solan District sprang up on the administrative map of the state. Solan District derives its name from Solan town which came into existence after the construction of the Cantonment at that place around the last quarter of the 19th century[1] Solan's history is entwined with that of the erstwhile princely state of Baghat. A cantonment was built here in the late 19th century by the British. Solan cantonment is still the best and the most well-planned part of this area hence buildings are made in a planned manner. The church in Solan cantonment is a heritage building with wooden and stone carvings. It has sloping roofs and arches reminiscent of British architecture.

1.2 Objective of the Project

RTDC has appointed Nivesa Advisors LLP through a tender process to conduct a Techno-Economic Feasibility Study (TEFR) for development of Aerial Passenger Ropeway from Jabli Village to Kasauli, Distt. Solan, in Himachal Pradesh on PPP Mode (hereinafter referred to as "Report" or "Ropeway Project"). The aim of the study is to find the potential for enhancement of tourism to Kasauli 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. Solan, from Jabli Village to Kasauli, Himachal Pradesh.

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

i. Description of Study Area

   a. An assessment of Solan 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

[1] https://hpsolan.nic.in/history/

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 for Jabli to Kasauli.

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 for Jabli to Kasauli 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 Solan:

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

Solan

Solan is a town in the Indian state of Himachal Pradesh and the district headquarters of Solan district. The 3rd largest Municipal Corporation of Himachal Pradesh after Shimla and Dharamshala, it is located 45.5 kilometres (28 mi) south of the state capital, Shimla, at an average elevation of 1,550 venerating the goddess is held, featuring a 3-day mela at the central Thodo ground. Solan was the capital of the erstwhile princely state, Baghat.

It is known for the production of quality mushrooms because of the vast mushroom farming in the area as well as the Directorate of Mushroom Research (DMR) situated at Chambaghat.

Solan is also called the "City of Red Gold", due to the bulk production of tomatoes in the area. The city is situated between Chandigarh (joint capital of Punjab and Haryana) and Shimla (state capital) on the Kalka-Shimla National Highway-5. The narrow-gauge Kalka-Shimla railway passes through Solan. Located on the Punjab-Himachal Border, Solan is nestled in the Shivalik hills of the Himalayas.

Solan has ancient temples and monasteries, and the city has one of the oldest breweries in the country. This city also has a 300-year-old fort located at the top of a hill. The Shoolini Mata Temple and Jatoli Shiv Temple are popular places for tourists. One of the most famous monasteries in this region is the Yundung Monastery.

Jabli

Jabli is a character in the ancient Indian epic Ramayana. A learned Brahmin priest and an advisor of King Dasharatha, he unsuccessfully tries to persuade Rama to give up his exile, using rational arguments.

In Ramayana, Rama abandons his claim to the royal throne and goes on a 14-year exile, in order to fulfill his father's promise. Rama considers his decision as his dharma (righteous duty), necessary for his father's honour. In Ayodhya Khanda, Jabali accompanies Bharata to the forest, as part of a group that tries to convince Rama to give up his exile.

Jabli uses nihilist and atheistic reasoning to dissuade Rama from continuing the exile. He states that those give up artha (material pleasures) for the sake of dharma suffer in this life

and meet extinction after their death. Showing further disbelief in the concept of afterlife, he criticizes the shraddha ritual, in which people offer food to their dead ancestors. He calls it a wastage of food, and sarcastically suggests that if food eaten by one person at a given place could nourish another person at another place, shraddha should be conducted for those going on long journeys, so they would not need to eat anything. However, even after listening to the arguments of Jabli and others, Rama refuses to give up his exile and extols the virtues of following the dharma.

Kasauli Hill Stations

Amongst the various Indian Hill stations is Kasauli. During the 17th century, driven by unsettled political conditions, some Rajput families from Rewari (in present day Haryana) fled their homes. They took refuge in the lower Himalayas, finally settling down at a village called Kasul where there was a perennial spring of fresh water. Today, some three centuries later, the spring is the site of a water reservoir and Kasaul has grown into the delightful little hill station of Kasauli. But some locals would believe that Kasauli comes from Kausalya, a mountain stream that flows between Kasauli and Jabli. The name might even have been derived from Kusmawali or Kusmali, meaning flower maiden. Given the abundance with which the hills of Kasauli bloom from spring to autumn, this could well be the truth.

The highest point at Kasauli, known as Monkey Point, is now with the IAF and the site of new family apartment blocks for IAF personnel. Monkey Point commands a panoramic view of the hills, valleys and plains below, with the meandering Sutlej and, far away, the city of Chandigarh.

Lawrence School at Sanawar, six kilometers away, rich in tradition and a world in itself, also attracts tourists. The temple of Nahari Devi, which overlooks a waterfall, is also worth a visit. Nothing has so far affected the fall, not the severest drought or driest summer.

Around town, one can look for the graves of the two Chinese POWs who died here. Or try to find out the names of the two brothers who perished fighting the forest fire that ravaged Kasauli at the turn of the century. Or find the old time mailbox with a cast iron crown on top, a relic of the British Postal Service.

The two main walks around Kasauli, the Upper and Lower Mall are beautiful. The residents of Kasauli walk a lot, for Kasauli was always short on city attractions and meant for getting about on your own two feet, in communion with nature or if you are lucky, a walking partner. The somewhat steep Upper Mall takes you past an important landmark, the Kasauli Club. Founded in 1880 as the 'Kasauli Reading and Assembly Rooms', it was later converted into Kasauli Club. Initially the club provided accommodation to men only, women not being permitted unless it was very cold or if accommodation was going a-begging. Famous for its six tennis courts, its lavish 'tennis teas' and gala Saturday Nights, the club suddenly found itself posed for dissolution in 1947. But saved by the breadth of a hair, it survived to celebrate its centenary in 1980.

Delhi is connected to Chandigarh by air. From Chandigarh it is a little more than an hour by road to Kasauli. Buses connect Kasauli to many major cities of north India. Private taxis are also available between; to Kalka and proceed by bus to Kasauli, less than an hour away.

Best time to visit

The tiny hill town of Kasauli in Himachal Pradesh has been blessed with lush surroundings. The pleasant weather makes it a destination that can be visited all- year around. The summer season stays here from March to June when the temperature ranges between 28°Celsius and 14°C. The morning and the nights are cool. One can enjoy adventure activities and sightseeing at this time. Rains drench the place completely during the monsoon season, making the place green and beautiful. If you love rains, be here between July and September. The winter season stays in Kasauli from October to February. The temperature ranges between 5°Celcius to 14°Celcius, and the place experiences occasional snowfall too. Indulge in the activities of your interest during these months.

Climate

Figure 1: Kasauli on a winter afternoon

Kasauli has a moderate climate. Winter temperature is approximately 2 degrees Celsius, the summer temperatures rarely exceeds 32 degrees Celsius or more. The general wind direction is south-west to north-east. Total rainfall for the year is 1020 millimetres, with humidity at 90% in September and 28% in April. Sometimes snowfall is also there during early January and in winters are chilly, there are a couple of frosty nights. Minimum temperature recorded in Kasuli was -6° Celsius.

Accessibility

The National Highway No. 22 is a prominent road passing through Solan town. It is an important road from many points of view. Firstly, it is a defence road connecting Delhi, Dehradun, Ambala, and Chandigarh to the China Border. Next, it is the lifeline of the State as it is the main road for all imports and exports in the state. It is on account of its significance that there are 2 bypasses within Solan Planning Area. These are:

- Solan bypass linking Saproon and Chambaghat.
- Barog bypass linking Saproon and Kumarhatti via Anji & Rabon. The NHAI has undertaken the 4-laning of this road. Work is under progress.

Besides N.H.-22, Solan has many other important roads connecting Solan to its nearby areas, towns, or settlements. These are: –

- Solan – Rajgarh road.
- Solan – Subathu – Arki Road.
- Solan – Kandaghat road via Basal and Salumana.
- Solan – Jaunaji road.
- Solan – Damrog – Jatoli road.
- Solan – Ashwani Khad road. It connects Solan to Hart Village, the site of Mohan Shakti National Heritage Park. It will connect Chail ultimately.

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

Car

S.No.	Place	Distance	Timing
1	Delhi	301 km	4hrs 38min
2	Haryana	277km	5hrs 25min
3	Ludhiana	148km	2hrs 30min
4	Chandigarh	62km	1hrs 5min

Train

S.No	Place	Timing
1	Delhi	4hrs 19min
2	Haryana	5hrs 25min

2.2 Geographical Location

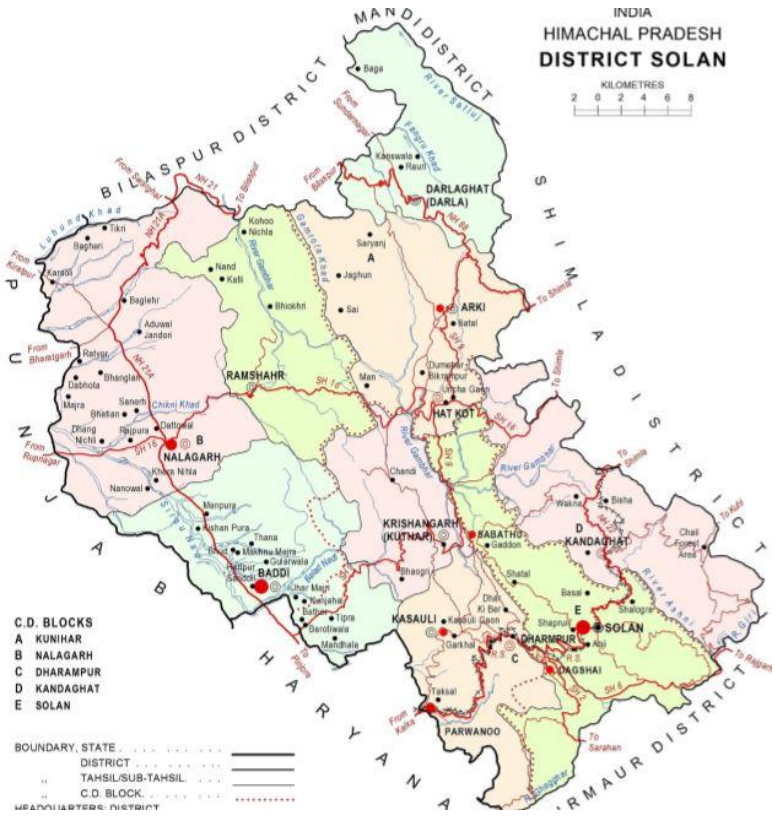

Figure 2: Map of Distt Solan[2]

[2]https://www.google.co.in/search?q=himachal+pradesh+district+solan+map&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiP98fogNHyAhURO isKHW9JBUIQ_AUoA3oECAEQBQ&biw=1366&bih=655#imgrc=JVGSfqEFHzUIHM

The climate

Situated at an altitude of 1600 metres on an average, Solan can be called as a cool Hill station. Solan city is neither so cold as Shimla, nor too hot as Kalka as the temperature hardly rise more than 35 °C (95 °F) That is why it is considered as an ideal station from residential point of view. During winters Solan experience little snowfall. Temperatures typically range from −4 °C (25 °F) to 34 °C (93 °F) over the course of a year, with record high temperature of 37 °C.

Table 1: Climate Data[3]

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	27.5 (81.5)	29.2 (84.6)	32.5 (90.5)	35.8 (96.4)	38.0 (100.4)	39.0 (102.2)	35.1 (95.2)	33.0 (91.4)	32.0 (89.6)	31.5 (88.7)	30.2 (86.4)	27.0 (80.6)	39.0 (102.2)
Average high °C (°F)	18.4 (65.1)	19.9 (67.8)	23.8 (74.8)	29.0 (84.2)	31.6 (88.9)	31.2 (88.2)	28.9 (84.0)	28.2 (82.8)	28.0 (82.4)	27.0 (80.6)	23.8 (74.8)	20.7 (69.3)	25.9 (78.6)
Average low °C (°F)	2.5 (36.5)	4.5 (40.1)	8.3 (46.9)	12.6 (54.7)	16.2 (61.2)	18.7 (65.7)	20.2 (68.4)	19.8 (67.6)	16.9 (62.4)	10.5 (50.9)	5.9 (42.6)	3.0 (37.4)	11.6 (52.9)
Record low °C (°F)	−3.6 (25.5)	−2.8 (27.0)	1.0 (33.8)	4.6 (40.3)	8.5 (47.3)	12.5 (54.5)	16.0 (60.8)	15.0 (59.0)	10.5 (50.9)	5.0 (41.0)	1.0 (33.8)	−2.5 (27.5)	−3.6 (25.5)
Average rainfall mm (inches)	61.8 (2.43)	69.9 (2.75)	74.3 (2.93)	46.0 (1.81)	61.5 (2.42)	118.0 (4.65)	218.5 (8.60)	218.9 (8.62)	138.4 (5.45)	22.3 (0.88)	14.9 (0.59)	47.6 (1.87)	1,092 (42.99)
Average rainy days	3.4	4.3	4.7	3.3	4.7	6.7	11.9	10.8	5.7	1.6	1.0	2.1	60.2
Average relative humidity (%) (at 17:30 IST)	52	49	45	38	37	52	73	78	70	52	49	51	54

[3] https://en.wikipedia.org/wiki/Solan

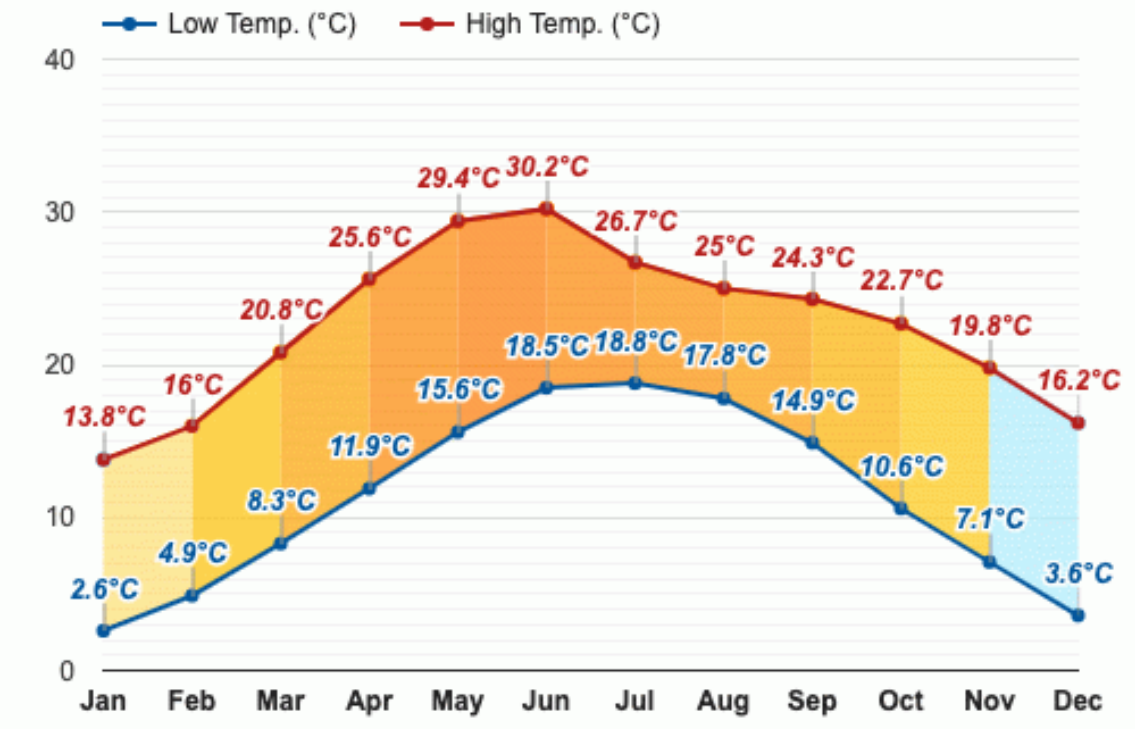

Figure 3: Temperature – Solan, Himachal Pradesh[4]

Kasauli has a moderate climate. Winter temperature is approximately 2 degrees Celsius, the summer temperatures rarely exceed 32 degrees Celsius or more. The general wind direction is south-west to north-east. Total rainfall for the year is 1020 millimetres, with humidity at 90% in September and 28% in April. Sometimes snowfall is also there during early January and in winters are chilly, there are a couple of frosty nights. Minimum temperature recorded in Kasauli was -6° Celsius.

[4] ://www.google.co.in/search?q=solan+climate+&tbm=isch&ved=2ahUKEwj68Ji8gtHyAhWRFisKHaNgDtAQ2-cCegQIABAA&oq=solan+climate+&gs_lcp=CgNpbWcQAzIECAAQGDoECAAQQzoICAAQgAQQsQM6BQgAEIAEOgcIABCxAxBDOgYIABAIEB46BggAEAoQGFC_T1jsdmCZeWgAcAB4AoABpgmIAaMnkgEOMC4xMC4zLjAuMS43LTKYAQCgAQGqAQtnd3Mtd2l6LWltZ7ABAMABAQ&sclient=img&ei=08EoYbq7AZGtrAGjwbmADQ&bih=655&biw=1366&hl=en-GB#imgrc=wNQrzR2MgjZ1oM

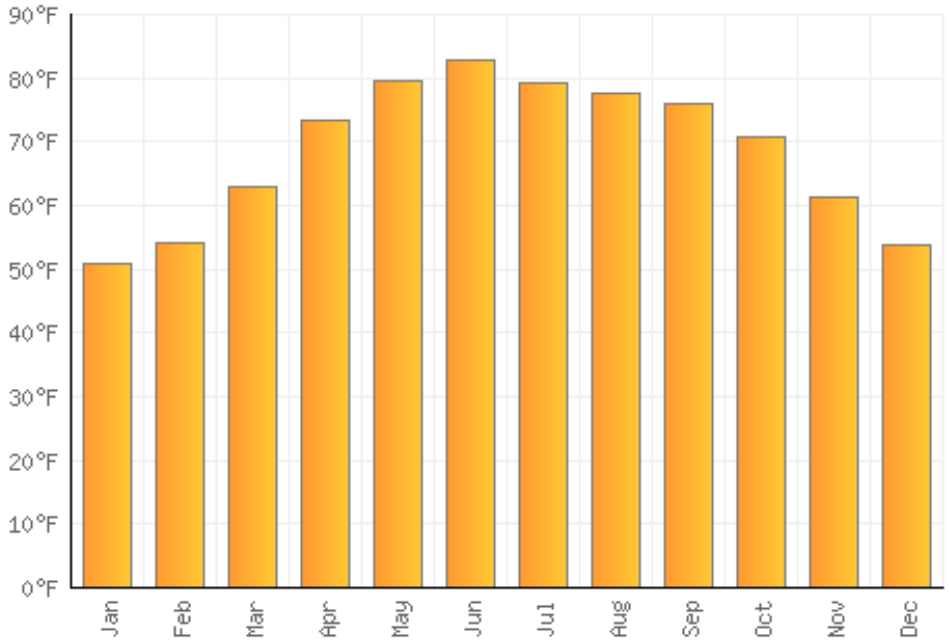

Figure 4: Average Monthly temperatures in Kasauli[5]

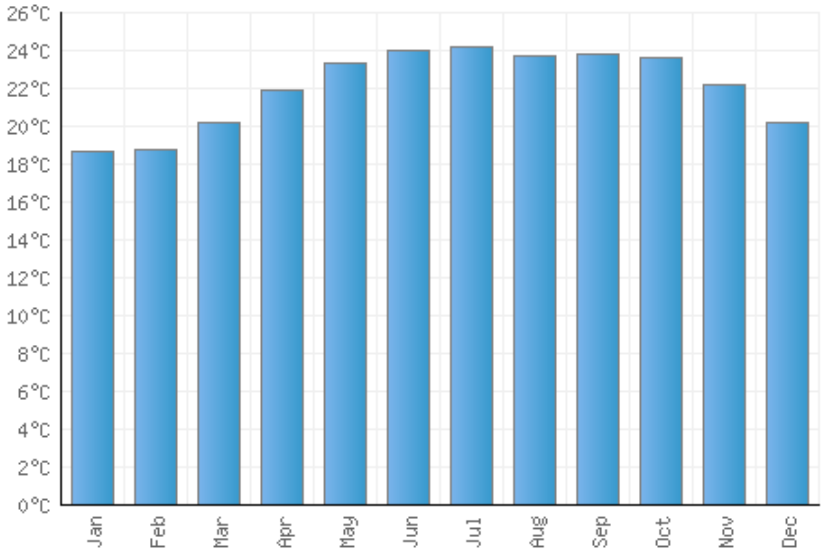

Figure 5: Average monthly sea temperature in Kasauli[6]

[5]//www.google.co.in/search?q=climate+chart+of+kausli+&tbm=isch&ved=2ahUKEwi0uPrkgtHyAhVUcSsKHd92CBoQ2-cCegQIABAA&oq=climate+chart+of+kausli+&gs_lcp=CgNpbWcQAzIFCAAQgAQyBQgAEIAEMgUIABCABDIFCAAQgAQ6BwgAELEDEEM6BAgAEEM6CAgAEIAEELEDOgsIABCABBCxAxCDAToECAAQHjoGCAAQBRAeOgYIABAIEB5Q9foCWMLIA2CNywNoAHAAeAKAAc4OiAHrS5IBDzAuNy42LjEuMS43LTEuM5gBAKABAaoBC2d3cy13aXotaW1nsAEAwAEB&sclient=img&ei=KMIoYbSEH9TirQHf7aHQAQ&bih=655&biw=1366&hl=en-GB#imgrc=-8U4yWO0EduwYM

[6] https://www.weather2visit.com/asia/india/kasauli.html

Some Major Tourist Attractions Near Kasauli

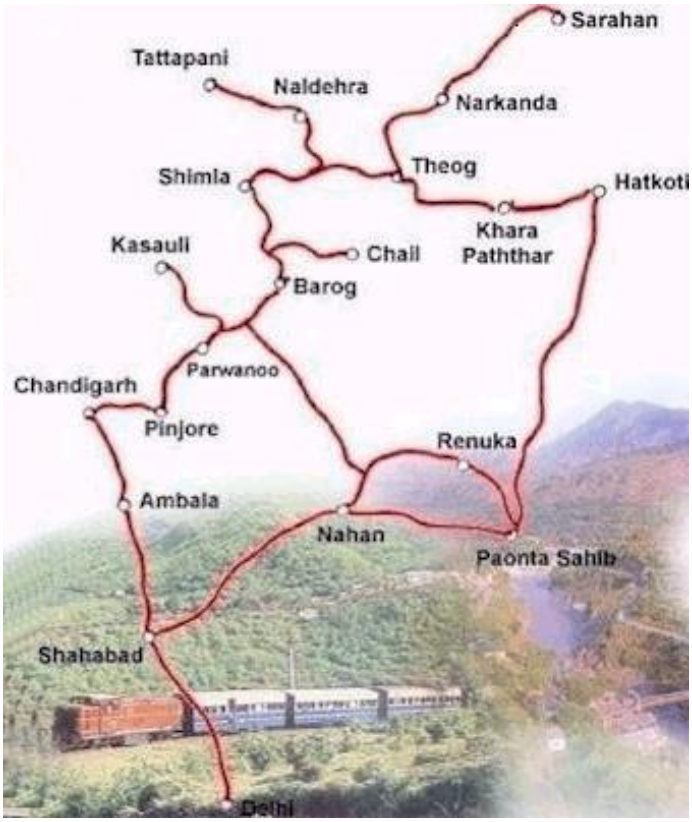

Figure 6: Tourist Attractions near Kasauli

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

Figure 7: Shoolini Devi Temple

- Christ Church, Kasauli
- The Church in Solan cantonment
- The Solan railway station
- The Barog railway station
- Hari Mandir a famous Lord Krishna temple
- The railway station and the railway rest house at Salogra
- The DC residence on Shilly road
- Anees villa, ancestral home of Salman Rushdie Shilly road near DC residence
- S.E., PWD office which used to be a durbar hall of Baghat State
- Old guest house in the palace of Baghat state
- Khalifa lodge (now the JBT college running in it)
- Kishan Niwas and Hill View on circular road
- St. Luke's Sen Sec School, Solan the school built in hill architecture
- Jatoli Temple (5 km. far from Solan on Rajgarh Road)

Figure 8: Jatoli Temple, Solan

- Mohan Shakti National Heritage Park (in Hart, 12 km from Solan)
- Mohan Meakin Limited – Mohan Meakin is a large group of companies which started with Asia's first brewery incorporated in 1855
- Dolanji Bon Monastery, Solan.
- Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni-Solan Worlds famous one of the Horticulture and Forestry University
- The Palace near Palace Road.
- Pandavas cave at Mount Karol, Chambaghat, Solan

Figure 9: Panaromic View of Solan City

Figure 10: Solan railway station

Figure 11: Bon Monastery Dholanji,Solan

Figure 12: View of Solan at night

2.3 Transportation – Road

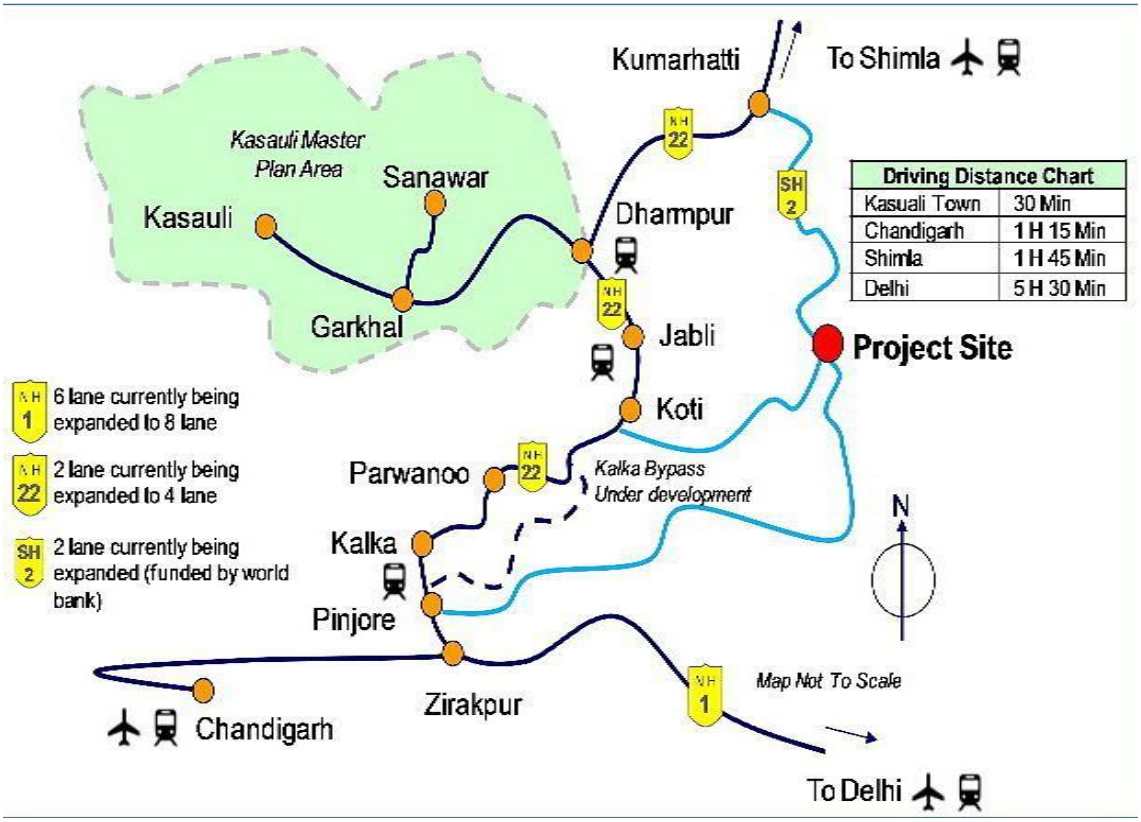

Figure 13: Transportation – Road

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. Field reconnaissance survey for the proposed alignments
2. Selection of the optimum route for the proposed alignments keeping in view its feasibility/suitability with regard to construction, operation and maintenance.
3. Tentative locations of terminal stations and assessment of available area/options.
4. Consideration of any geological, traffic and other survey data relevant to the development of concept of passenger ropeway system.
5. Indication of staffing requirements for operation and maintenance for smooth and efficient functioning.
6. 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

Solan is fast developing into a tourist spot. It is also known as a reference station for tourists visiting nearby places. Included in that category are Chail, Kasauli, Dagshai, Sabathu, Kandaghat, Churdhar Peak etc. Many visitors going to Shimla, Kinnaur and other areas of the state use this town as a halting station. The tourism infrastructure includes dozens of hotels catering to the needs of budget and luxury tourists.

The Solan Hills stand on the water – parting between the Sutlej and the Giri, a tributary of the Yamuna. The town of Kasauli is a hill-station for spending holidays and is a honeymoon destination with the temple devoted to the Lord Shiva. It is also home to Army and Air Force base. At Monkey Point there is a temple of Hanuman. This is one of the small towns developed by the British during the 'heyday' of the empire. It can be reached by a branch road on the Kalka-Shimla Road, near Dharampur.

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 2: Visitors

Month	Indian Tourist	Foreign Tourist
	2022	
January	74821	30
February	86792	44
March	108490	62
April	128500	55
May	133659	97
June	151034	84
July	157075	125
August	164928	104
September	173174	143
October	178369	154
November	187287	171
December	210425	190

*The above data is collected form Himachal Tourism Official site and after discussing with RTDC 1,50,000/- (data of visitors using taxes) visitors are added in the above for calculating ridership of Jabli to Kasauli Ropeway.

4.3 Growth of Tourists

Table 3: Growth of Tourists

S.No	Year	No of Tourists in Solan	Variation in Growth	Growth Rate (%)
1	2014	919498		
2	2015	1079178	159680	15
3	2016	1124810	45632	4
4	2017	1225750	100940	8
5	2018	1149082	-76668	-7
6	2019	1201211	52129	4
Avg. Growth Rate				8

Growth Projection for the next 5 years based on annual growth rate of 5.5 %

Table 4: Growth projection for next 6 years

S.No.	Year	Annual Total Ridership	Annual Total Ridership
		5.5% growth	5.5% growth
1	2022	1905813	952907
2	2023	2010633	1005316
3	2024	2121218	1060609
4	2025	2237884	1118942
5	2026	2360968	1180484
6	2027	2490821	1245411

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 5.5 % after coming into operation

Growth Projection for the next 40 years based on annual growth rate of 5.5%

Table 5: Projected Traffic and expected Ropeway Ridership

S.No.	Year	Annual Total Tourist in Solan	Annual Total Tourist in Jabli and Kasauli (50% of Solan Tourist)	Total Ridership (70 % of total Tourist in Jabli to Kasauli
		5.5% growth	5.5% growth	5.5% growth
1	2027	2490821	1245411	871788
2	2028	2627816	1313909	919736
3	2029	2772346	1386174	970322
4	2030	2924825	1462413	1023689
5	2031	3085690	1542846	1079992
6	2032	3255403	1627702	1139392
7	2033	3434451	1717226	1202058
8	2034	3623345	1811673	1268171

9	2035	3822629	1911315	1337921
10	2036	4032874	2016438	1411506
11	2037	4254682	2127342	1489139
12	2038	4488690	2244346	1571042
13	2039	4735568	2367785	1657449
14	2040	4996024	2498013	1748609
15	2041	5270805	2635404	1844783
16	2042	5560699	2780351	1946246
17	2043	5866538	2933270	2053289
18	2044	6189197	3094600	2166220
19	2045	6529603	3264803	2285362
20	2046	6888731	3444367	2411057
21	2047	7267612	3633807	2543665
22	2048	7667330	3833667	2683567
23	2049	8089033	4044518	2831163
24	2050	8533930	4266967	2986877
25	2051	9003296	4501650	3151155
26	2052	9498478	4749241	3324469
27	2053	10020894	5010449	3507314
28	2054	10572043	5286024	3700217
29	2055	11153506	5576755	3903729
30	2056	11766948	5883477	4118434
31	2057	12414131	6207068	4344947
32	2058	13096908	6548456	4583920
33	2059	13817238	6908622	4836035
34	2060	14577186	7288596	5102017
35	2061	15378931	7689469	5382628
36	2062	16224772	8112389	5678673
37	2063	17117135	8558571	5991000
38	2064	18058577	9029292	6320504
39	2065	19051799	9525903	6668132
40	2066	20099648	10049828	7034880

Based on the preliminary ridership surveys carried out at site it is estimated that initially about 70% of the total tourist traffic visiting Kasauli will take the ropeway for the base year 2027

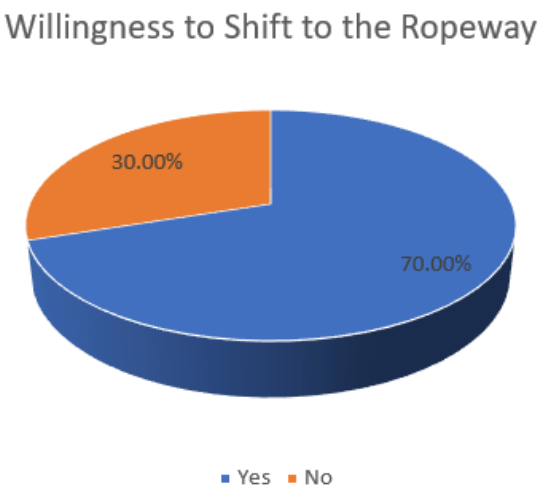

Table 6: Projected forecast for the Traffic Analysis

Approx. no. of visitors annually (2027)	1,245,411
Expected annual growth YoY	5.5%
Approx. no of visitors annually (2027)	6,05,818
Expected ropeway ridership in 2027	871,787 (70% of total)
Expected Avg. Monthly Traffic (2027)	871,787/12 = 871,787
Approx. no of visitors annually (2066)	10,049,825
Expected ropeway ridership in 2066	7,034,878(70% of total)
Expected Avg. Monthly Traffic (2066)	7,034,878/12 = 586,240
Expected Avg. Daily Traffic (2066)	7,034,878/350 = 20,100
Expected Avg. Hour Traffic (2066)	20,100/10= 2010

Considering 10 hours of operation for the Ropeway.

Based on the above assessment it is proposed that the designed capacity for the proposed ropeway between Jabli and Kasauli shall be 1100 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 7: Ticket Price

Trip	Ticket Price in Rs/-
Round Trip Rates	350
Single Trip Rates	600

5. System Requirements

5.1 Design Parameters

- Capacity of the cable car system: 1100 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 Circulating "3 S "ropeway (detachable)

Figure 14: "3 S" Ropeway

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

Advantages

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

Disadvantages

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

6.2 Circulating "2S" ropeway (detachable)

Figure 15: "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 16: 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) minimising 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 is sensitive to wind speeds more than 70 kmph

7. Recommended Ropeway System

Based on the above assessment of all the 3 systems, circulating monocable ropeway (detachable) – MDG is proposed for Jabli to Kasauli route in Distt Solan, Himachal Pradesh.

Monocable Detachable Gondolas (MDG) is the most basic and common Cable Propelled system used for urban transit installations. 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 propulsion cable upon entering a station and reattaching when exiting. MDG cabins typically seat 8 passengers but can have capacities ranging from 6-15passengers. 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. 1000-1500m. 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 system

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 would also house lighting and ITES services.

Figure 17: 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.

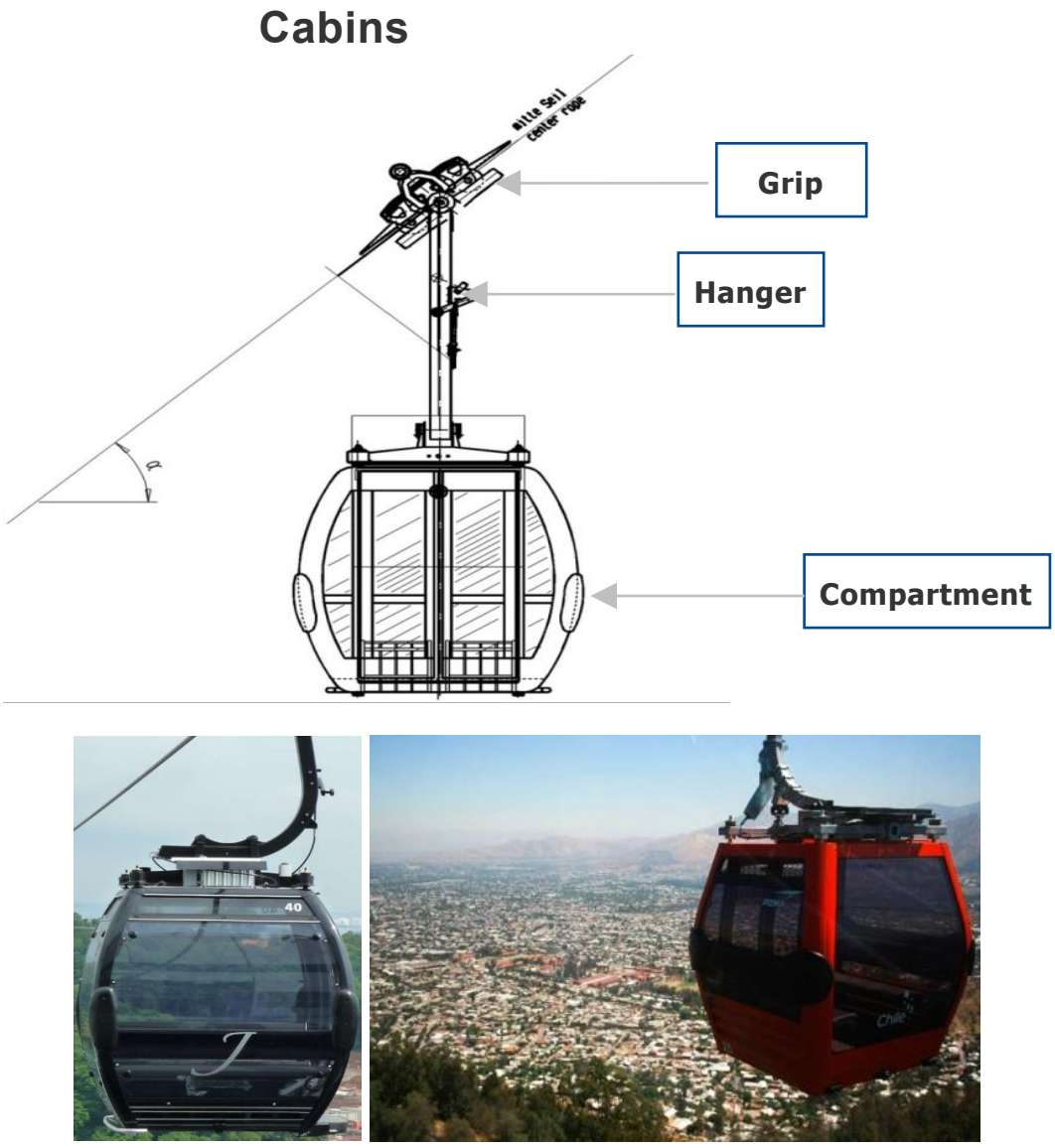

Figure 18: Typical Cabin

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.

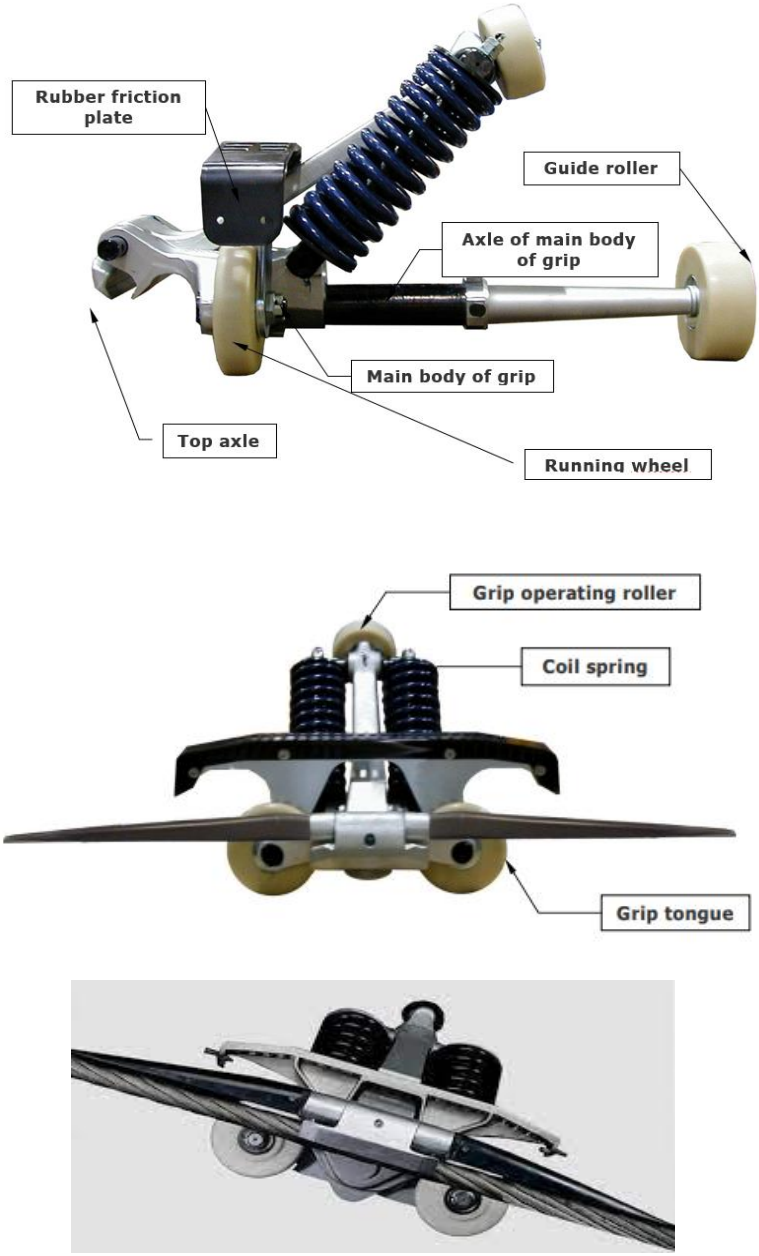

Figure 19: Detachable Grip

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

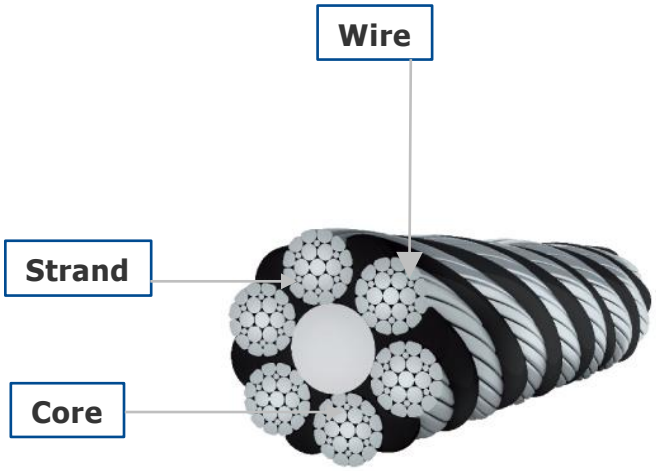

Figure 20: Rope

7.6 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 21: Sheave assembly

Figure 22: Tower

Structures supporting and keeping the rope in the normal operating position

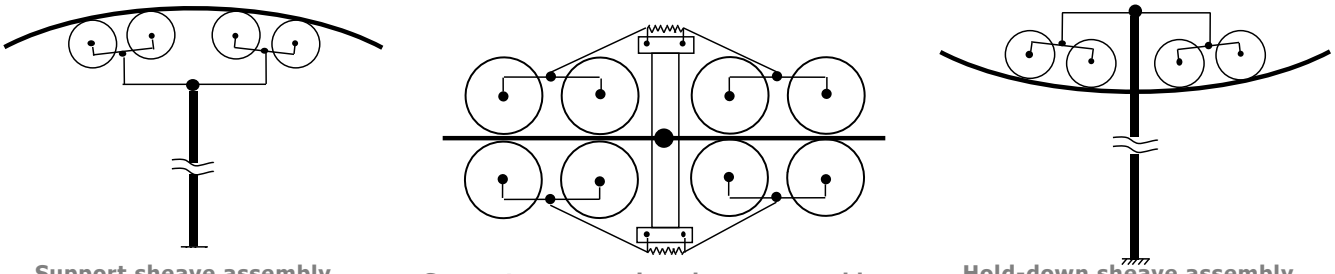

Figure 23: Sheaves

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 Jabli to Kasauli via a Ropeway System. A joint site visit was also conducted along with experts from RTDC for the selection of the best possible alignment.

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 8: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 9: 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 10: Contribution to the Local Economy

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

Possible Alignment Options for Connecting Jabli to Kasauli via Ropeway System

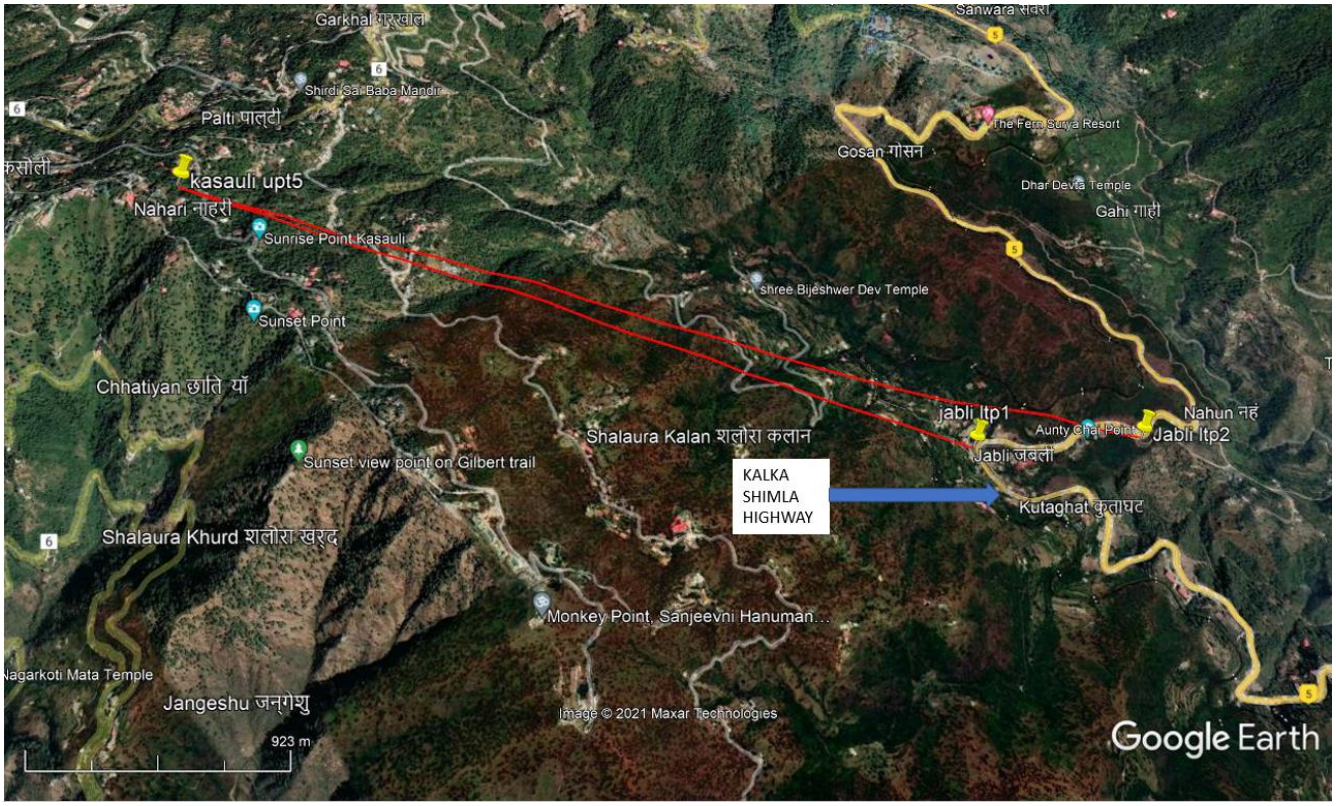

Figure 24: Alignment Options

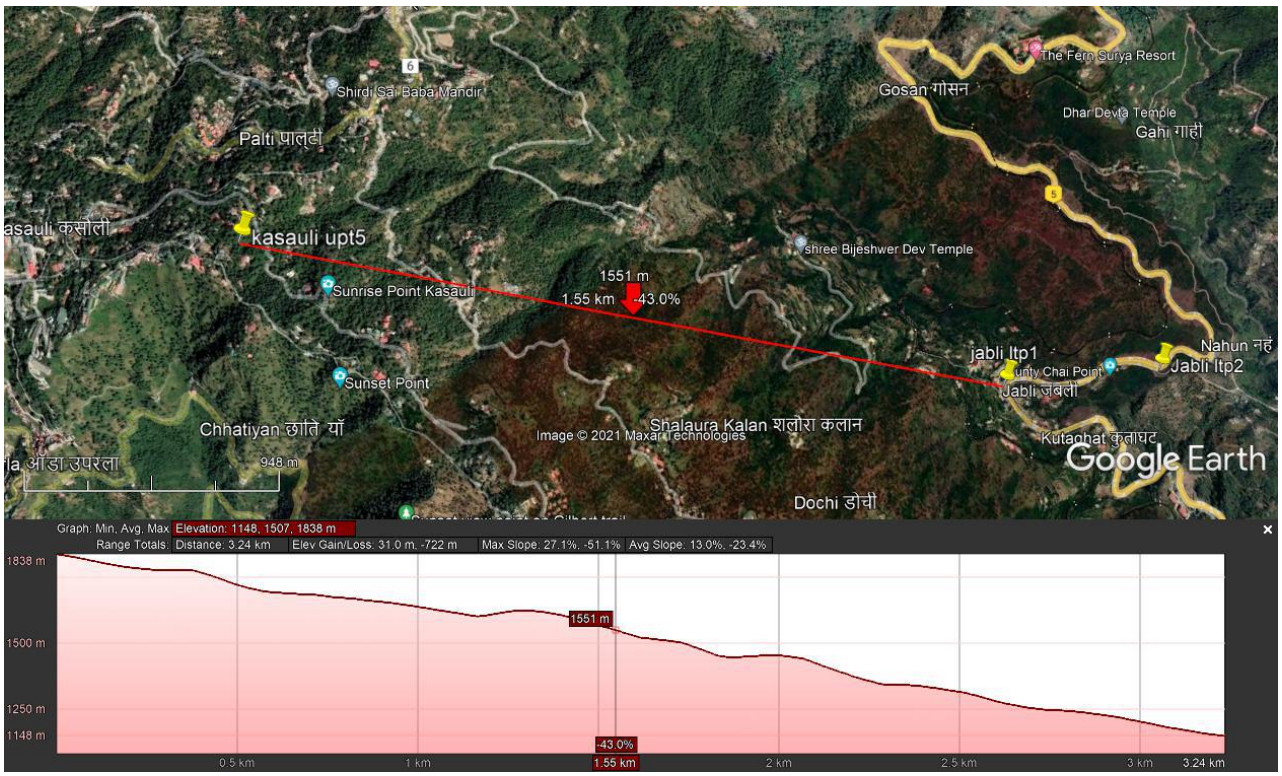

Figure 25: Alignment option 1

Proposed LTP Option 1: The proposed Lower Terminal Point (LTP) for this alignment option is at the Kalka Shimla highway near the Savoy Greens and Kenwood resort. The tourists coming from Delhi, Haryana and Punjab generally stop over at these points for taking meals while making enroute to Shimla, there is an existing private ropeway inside the premises of Savoy Greens which connects the resort to the shaura kalan area. The proposed suitable land proposed for LTP belongs to PWD department and some portion falls under the forest land.

Coordinates:

Latitude - 30° 52.648'N

Longitude - 76° 59.644'E

Figure 26: LTP Option 1

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 proposed Upper Terminal Point is located near the circuit house in Kasauli, the land for the UTP station falls under the Central Government and shall be transferred to the SPV for the construction of the ropeway.

Coordinates:

Latitude - 30° 53.837'N

Longitude - 76° 58.253'E

Figure 27: Proposed UTP

Advantages of Alignment Option 1:

- The alignment is well connected to the Kalka Shimla Highway
- The LTP is near Savoy Greens and Kendwood resorts where a lot of food courts are located and people make a stopover at this place while making an enroute to Shimla from Delhi, Haryana or Punjab.

Disadvantages of the Alignment Option 1:

- The construction cost of the station would be high as the columns would have to raised to maintain sufficient clearance from the road.
- There would infringement to the existing road to the resorts in the vicinity.

- The pillars would be constructed in the ridge and special geological measures would have to be taken care while constructing the station.
- There is limited land available for making a car parking for vehicles.

Alignment Option 2:

Figure 28: Alignment option 2

Proposed LTP Option 2 : The proposed LTP option 2 is located on the Kalka Shimla highway near the intersection point of Kalka Shimla Highway and the connecting road to Gayatri Shakti Peeth Shiv Temple. The proposed location is generally flat in nature with ample space available for construction of ropeway station. The proposed land is reserved with the Forest Department.

Coordinates:

Latitude - 30° 52.482'N

Longitude - 77° 0.017'E

Figure 29: LTP Option 2

The land for the station would have to be cleared from the existing bushes and vegetation and a small approach road shall be provided for providing smooth connectivity to the Kalka Shimla Highway.

Proposed UTP: The proposed Upper Terminal Point is located near the circuit house in Kasauli, the land for the UTP station falls under the Central Government and shall be transferred to the SPV for the construction of the ropeway.

Coordinates:

Latitude - 30° 53.837'N

Longitude - 76° 58.253'E

Figure 30: Proposed UTP

Advantages of Alignment Option 2:

- The alignment is well connected to the Kalka Shimla Highway
- The LTP station is generally flat in nature and easily accessible from the Kalka Shimla Highway
- Car parking can be easily made on the LTP for ease of commuters.

Disadvantages of the Alignment Option 2:

- The overall length of the alignment is approximately 700 meters longer as compared to the former alignment
- There are no existing food courts in the vicinity.

Based on the above assessment the alignment option 2 has been selected as preferred alignment for the Jabli- Kasauli ropeway system.

Table 11: Brief description of the technical details for this alignment option 2

From Station	**Jabli Village**
To Station	**Kasauli Town**
Geometrical data	
Height of Bottom station	1159 m.a.s.l
Height of Top station	1838 m.a.s.l
Horizontal Length	3816 m
Height difference	679 m
Developed Length	3876 m
Ropeway General Data	
Drive Station	**Jabli**
Tension Station	**Jabli**
Return Station	**Kasauli**
Capacity	1100 Pphpd
Travel Speed	6 m/s
Cabin Capacity	8 persons
Rope Diameter	50 mm
Drive Group	
Power	
Continuous In Operation	573 kW
Starting Mode	969 kW
Braking	-708 KW
Travel Time (with two intermediate Stations)	
Distance between Cabins	26.18 S
Distance between Cabins	157.09 M
Travel time	~13 minutes
Quantity of Cabins and Towers	
Number of Cabins	56
Number of Towers	~14 nr
Estimated Cost	
Ropeway Equipment	~Rs. 119 Crores (including custom duty)
Civil works and Assembly including material Ropeway	~Rs. 62 Crores (including GST)

Other Costs including finance cost	~Rs. 25 Crores
Total Costs	~Rs. 206 Crores

Tentative Requirement of Land

Location of LTP:

Coordinates:

Latitude - 30° 52.482'N

Longitude - 77° 0.017'E

Nature of land :

- Land owned by Government of Himachal Pradesh

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	Toilet	6	6	36
9	Multiple shops/commercial	30	40	1200
10	Multi-Level Car Parking	50	40	2000
11	Queue Area	15	15	225
12	Generator Room	10	15	150
13	Open Store	10	20	200
14	Panel Room and Control Room	6	10	60
Total		**5069**		

Additional area for Setback (10%): 506

Total Area Requirement (Tentative): ~ 5500 sqm

Figure 31: Lower Terminal Point

Location of UTP:

Coordinates:

Latitude - 30° 53.837'N

Longitude - 76° 58.253'E

Nature of land: Central Government Land under Cantonment Area

Tentative Area Required for UTP Development

S. No	Heads	Dimensions		Area (m^2)
1	Ropeway Station	30	15	450
2	Toilet	10	10	100
3	Ticket Counter and Guard Room	5	5	25
4	Multiple shops/commercial	50	20	1000
5	Generator Room	8	10	80
6	Store	10	6	60
7	Electrical Panel and Control Room	5	6	30
8	Small Maintenance Area	5	5	25

Total	1770

Additional area for Setback (10%): 177

Total Area Requirement (Tentative): ~ 2000 sqm

Figure 32: Upper Terminal Point

TENTATIVE DETAILS OF TOWER LOCATIONS

S.No	Tower Number	Tentative Co-ordinates
1	T1	30° 52.494'N, 77° 0.003'E
2	T2	30° 52.575'N, 76° 59.894'E
3	T3	30° 52.624'N, 76° 59.837'E
4	T4	30° 52.835'N, 76° 59.557'E
5	T5	30° 52.914'N, 76° 59.455'E
6	T6	30° 53.022'N, 76° 59.313'E
7	T7	30° 53.113'N, 76° 59.193'E
8	T8	30° 53.275'N, 76° 58.985'E
9	T9	30° 53.371'N, 76° 58.860'E
10	T10	30° 53.512'N, 76° 58.678'E

11	T11	30° 53.700'N, 76° 58.432'E
12	T12	30° 53.791'N, 76° 58.312'E
13	T13	30° 53.810'N, 76° 58.287'E
14	T14	30° 53.824'N, 76° 58.270'E

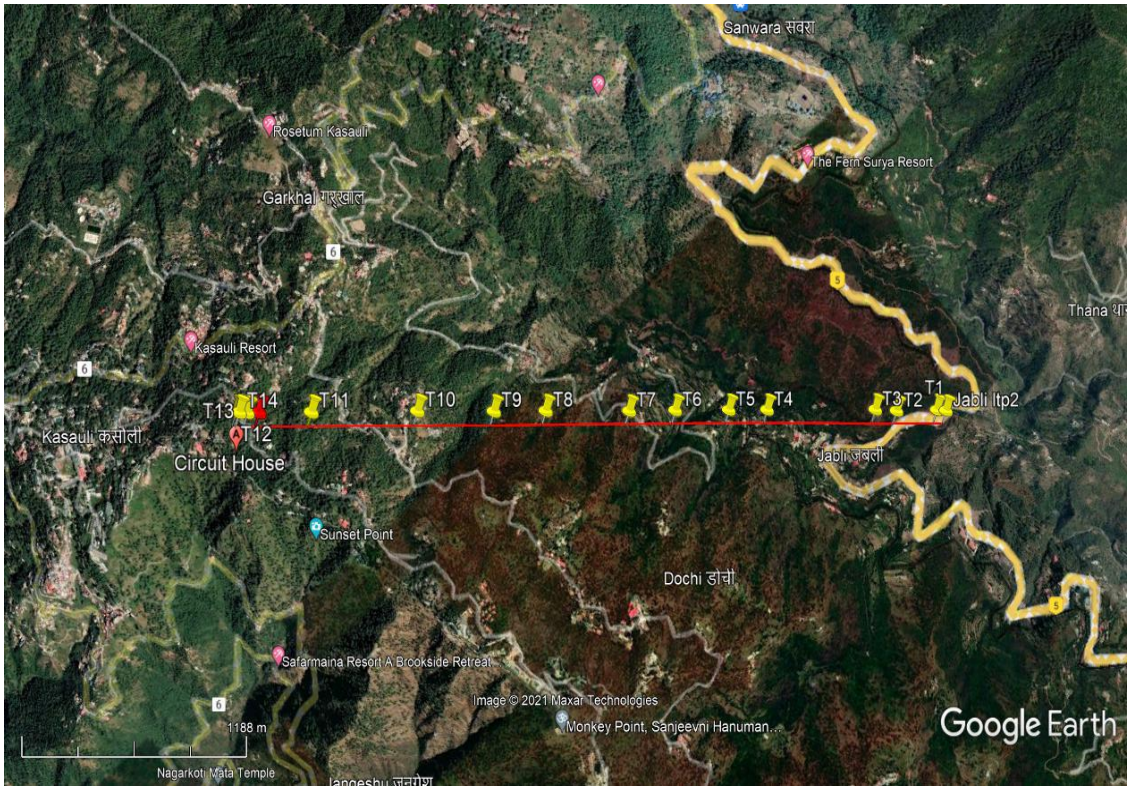

Figure 33: Tentative Tower Locations

Approx. area required for 14 towers (Considering 15m corridor): ~ 2100 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. Solan, Jabli to Kasauli, Himachal Pradesh under PPP Mode. RTDC is the Authority and shall provide this Project to the Concessionaire (Developer) for undertaking this project under PPP Mode.

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

In this chapter, we have considered base PPP Model with VGF 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 Jabli to Kasauli is provided herein below. The length of the Ropeway for this route is 3.88 Km.

Table 12: Project Cost with Item Description

S. No.	Item Description	Amount (in Rs. Cr.)
1	Ropeway System (Electro-Mechanical Portion)	117.00
2	Custom Duty (Ropeway to be imported under Project Imports scheme with basic custom duty of 5%) effective custom duty rate 25.73%	33.93
3	Civil Works including material ropeway	64.50
4	GST on Civil works @ 18%	11.61
5	Other Cost Project	26.00
Total		**253.00**

9.3 Key aspects of financial evaluation

We have considered following assumptions/analysis for the proposed Ropeway Project connecting Jabli Village to Kasauli:

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 13: 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 14: 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**	1100 PPHPD
4	**Increase in Traffic Per year**	5.5%
5	**Annual Traffic in Year 2027**	41,33,347
6	**Ridership in Year 2027 (70% of Annual Traffic in Year 2027)**	871,787
7	**Ridership in Year 2066**	7,034,878
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 30% 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 15: Financials for Base PPP with VGF Model

	S. No.	Particulars	Base PPP Model
I	1	Total Capital Cost (approx.)	Rs 76 Crores
	2	Other costs including contingency	Rs 151 Crores
	3	Total Project Cost	Rs 26 Crores
	4	Construction Period	36 months
	Project Income Summary (40 years)		**Rs.**
II	1	Total Consolidated Revenue	Rs 4,582 Crores
	2	Total O&M and Administrative Cost	Rs 1,444 Crores
	3	Net profit after tax	Rs 2,043 Crores
	Project Economics		
III	1	Project IRR (Financial)	14.66%
	2	Project IRR (Economic)	23.47%

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 16: 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	33	1	8	26
2	2028	35	1	8	28
3	2029	37	1	8	30
4	2030	39	1	9	31
5	2031	41	1	9	33
6	2032	43	1	9	35
7	2033	46	1	10	37
8	2034	48	1	10	39
9	2035	51	1	11	40
10	2036	54	1	12	42
11	2037	57	1	14	44
12	2038	60	1	15	46
13	2039	63	1	16	48
14	2040	67	1	17	50
15	2041	70	1	19	53
16	2042	74	1	20	55
17	2043	78	1	22	57
18	2044	83	1	24	60
19	2045	87	1	26	62
20	2046	92	1	28	65
21	2047	97	1	30	68
22	2048	102	1	33	71
23	2049	108	1	35	74
24	2050	114	1	38	77
25	2051	120	1	41	80
26	2052	127	1	44	84
27	2053	134	1	48	87
28	2054	141	1	50	92
29	2055	149	1	53	97
30	2056	157	1	55	103

31	2057	166	1	58	109
32	2058	175	1	61	115
33	2059	184	1	64	122
34	2060	195	1	67	129
35	2061	205	1	70	137
36	2062	217	1	73	145
37	2063	228	1	77	153
38	2064	241	1	81	162
39	2065	254	1	85	171
40	2066	268	1	89	181

9.9 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 17: 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 18: Estimation of Benefits from using Ropeway to Trnsport Passengers

Estimation of Benefits from Using Ropeway to Transport Passengers		
S. No	**Particulars**	**Details**
A	Basic Data to Estimate Benefits from Using Ropeway	
1	Time Cost for Riders	2 Rs/Minute
2	Fuel Cost (Current Market Rate)	100 Rs/Liter
3	Vehicle Operating Cost	6 Rs/Km
4	Accident Cost	1.50 Rs/Crore Vehicle Km
5	Infrastructure Maintenance Cost	1.00 Rs/Vehicle Km
B	Annual Time Cost Saved by Ropeway Riders	
Total of B	**Annual Time Cost Saved by Ropeway Riders**	**Rs 8.3 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 0.10 Crore/Year**
E	Annual Accident Cost Saved by Ropeway Riders	
Total of E	**Annual Accident Cost Saved by Ropeway Riders**	**Rs 1.87 Crore/Year**
F	Annual Infrastructure Maintenance Cost Saved by Using Ropeway Instead of Roads	
Total of F	**Annual Infrastructure Maintenance Cost Saved**	**Rs 1.31 Crore/Year**
B+C+D+E+F	**Potential Total Benefits from Using Ropeway to Transport Passengers**	**Rs 11.80 Crore/Year**

Table 19: 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	871,787 Ropeway Ridership/Year
2	Equivalent Number of Cars to transport assuming 4 passengers per car	217,947 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	10,897 Equivalent Cars/Year
	Total Carbon-di-oxide Emitted if Travelling by Car Instead of Ropeway	**50,128 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	771 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	2,698,500 KWh/Year
	Total Carbon-di-oxide Emitted if Travelling by Ropeway Instead of Car	**1,250 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	48,877 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 2.0 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 20: Percentage of Benefit Components

Ropeway Benefit Component	% of Benefit
Annual Time Cost Saved	70%
Annual Fuel Cost Saved	1%
Annual Car Operating Cost Saved	1%
Annual Accident Cost Saved	17%
Annual Infrastructure Cost Saved	11%
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 21: Estimated Economic 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	33	33	6	42
2	2028	35	33	6	43
3	2029	37	33	7	45
4	2030	39	34	7	47
5	2031	41	34	7	49
6	2032	43	34	8	51
7	2033	46	34	8	53
8	2034	48	36	9	56

9	2035	51	36	10	58
10	2036	54	36	10	59
11	2037	57	36	11	61
12	2038	60	38	13	64
13	2039	63	38	14	66
14	2040	67	38	15	69
15	2041	70	38	16	71
16	2042	74	40	18	74
17	2043	78	40	19	77
18	2044	83	40	21	79
19	2045	87	40	23	82
20	2046	92	42	25	86
21	2047	97	42	27	88
22	2048	102	42	29	91
23	2049	108	42	32	95
24	2050	114	44	35	99
25	2051	120	44	38	102
26	2052	127	44	41	106
27	2053	134	44	44	109
28	2054	141	46	46	115
29	2055	149	46	48	121
30	2056	157	46	51	127
31	2057	166	46	53	133
32	2058	175	48	56	140
33	2059	184	48	59	147
34	2060	195	48	62	155
35	2061	205	48	65	162
36	2062	217	51	68	171
37	2063	228	51	71	180
38	2064	241	51	75	189
39	2065	254	51	78	198
40	2066	268	53	82	210

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, Jabli to Kasauli 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 Kasauli 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	**PHPDT**	Peak Hour Peak Direction Traffic

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
ITDP	Institute of Transport and Development Policy		