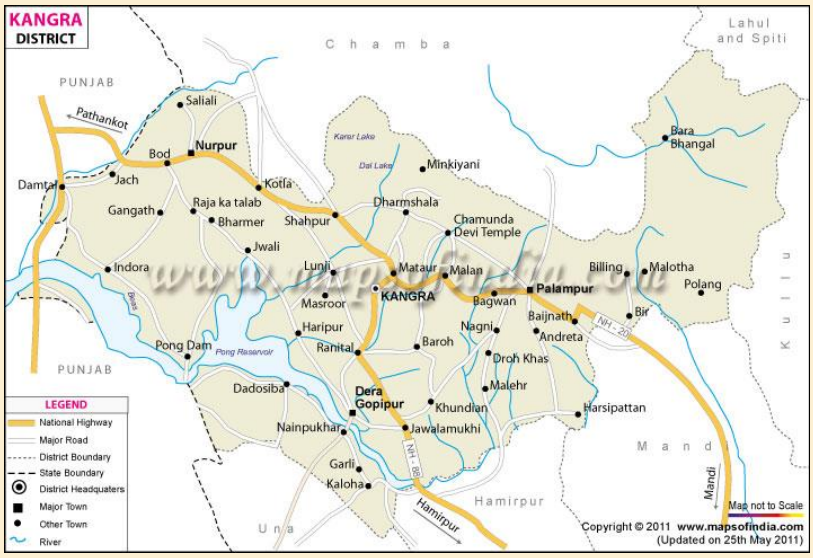
ROPEWAY AND RAPID TRANSPORT SYSTEM DEVELOPMENT CORPORATION H.P. LTD (RTDC)



Technical-Financial Feasibility Report

Passenger Ropeway at Bir Billing, Distt. Kangra, Himachal Pradesh

सत्यमेव जयते
हिमाचल प्रदेश सरकार

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

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Cable

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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

Himachal Pradesh is one of the most popular and easily accessible hill states in the northern part of India. People from different part of India visit the state seeking beauty, peace of mind and a comfortable atmosphere. The state is also known as The Land of Gods, provides a diverse range of flora and fauna, fairs and fests, culture and heritage, cuisine and adventurer destinations. There are several adventure destinations in the state that are famous in their way in which Bir-Billing is one of the adventure destination that is famous for its parasailing activities in the whole wide world.

The Bir and Billing are two small rural towns in the western part of Joginder Nagar valley that are situated in Distt. Kangra of Himachal Pradesh and is renowned for its state-of-the-art paragliding sports. In addition to this, the town is also famous for ecotourism, spiritual studies and medication activities along with several Tibetan Buddhist monasteries and supportive centres of the Nyingma school, the Karma Kagyu school and the Sakya School.

Bir billing is considered to be the best paragliding/ hang gliding sites in the whole Asia region due to its favourable flying conditions which resulted in various championships that have been held at this location in the past such as Hang-Gliding world cup in 1984 and Paragliding world cup in 2015. Thus, Bir billing is primarily famous for paragliding in which Billing is the village that is take-off site for paragliding and Bir has a landing site. This sport plays a major role in the attraction of the domestic as well as a foreign tourist in abundance throughout the year.

In addition to sky flying, the village is also famous for its 21.1 km Half marathon which is a part of Hell Race series, mountain biking over various biking route, Bir music festival 2.0 and trekking hiking.But to cater for a huge tourist population there are various issues related to road safety, environmental and society aspects that can be observed in the area. Such incident happened back in January, 2021 in which two people were killed and six others were injured when a jeep skidded over a snow-covered road in billing. Various fighting and small-scale accidents incidents were observed when due to over crowd single lane road. Landsides are another reason the area that were observed due to excessive rainfall during the rainy season.

1.2 Objective of the Project

RTDC has appointed Nivesa Advisors LLP through a tender process to conduct a Technical Financial Economic Feasibility Study (TEFR) for development of Aerial Passenger Ropeway for connecting lower terminal at landing site at Bir to upper terminal at take-off site at Billing is to be proposed, on Public Private Partnership (PPP) mode with VGF (hereinafter referred to as "Report" or "Ropeway Project"). Below are the aim of the study:-

1. To find the potential for enhancement of tourism to Bir Billing and local infrastructure by way of alternate transport.

2. The reduction in carbon footprints caused due to excessive movement of the vehicle back and forth at the hill and minimal alteration to environment due to human activities. Along with this, a huge reduction in accident and conflicts over single lane road from Bir to Billing can be achieved.

3. Enable job creation through direct employment to execute, operate, manage and maintain this state-of-the-art mobility solution as well as increase the town's productivity by adding various activities such as bike park, skate park, open air gym, bouldering section and many more.

4. A safe, comfortable, fast and reliable mode of transport to the tourists visiting Bir-Billing.

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

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

1.3 Structure of the report

This innovative mobility solution is targeted to provide an efficient alternate public Transport System for tourists in the Distt. Kangra, lower terminal at landing site at Bir Billing to upper terminal at take-off site at Bir Billing, Himachal Pradesh.

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

i. Description of Study Area

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

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

c. The objective of the report is to give a macro view of the city as well as comprehensively analyses 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 connecting lower terminal at landing site at Bir to upper terminal at take-off site at Billing .

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 connecting lower terminal at landing site at Bir to upper terminal at take-off site at Billing 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. Topographical survey data-based alignment as provided by Orbit Ropeway gives the idea of the route and tentative location of the stations.

vii. Cableway System Selection

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

viii. Cost Estimates

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

b. Assumptions made for potential revenue sources and expenses.

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

d. Financing mode of the Projects.

ix. Recommendation

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

1.4 Stages to establish a touristic destination

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

1.5 Promotion for a natural tourist destination

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

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

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

2. Study Area Description

2.1 General Information

Kangra

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

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

Bir Billing

Bir is a rural village located in the west of Joginder Nagar Valley in the state of Himachal Pradesh in northern India. It is also the location of the Bir Tibetan Colony, founded in the early 1960's as a settlement for Tibetan refugees after the 1959 Tibetan uprising. Mostly referred as "Paragliding Capital of India", the town is famous for its ecotourism, mountain biking, hand gliding and meditations. The summer season of Bir, starting from April to June, turn this beautiful land into heaven as the snow melts making the weather pleasant. This is considered the best time for paragliding bringing flocks of people all over the globe. Magnifying the elegance of Bir, the monsoon showers flourish the flora and fauna of the place turning the place into heaven. Moreover, the Bir-Billing is the gate way to the tribal part of Himachal Pradesh, which is known as Bada Bhangal. A sizable community of Tibetan refugee's lives in the Tibetan Colony located at Bir.

2.2 Best time to visit

There are two seasonal times to visit Bir - from March to May and from late September to November. These months are the best months if you're looking to do paragliding in Bir.

The summers during the months of April to June are pleasant. This is also the best time to visit Bir for the weather. The monsoons receive light to heavy rainfall and might be prone to landslides and winters are harsh with temperatures falling to sub-zero levels. At an altitude of 5000 feet, Bir Billing almost touches the clouds and is genuinely one of the most stunning places in the north**.**

Summer (March-June)

 [1]

Figure 1: Bir Billing at Summer (March to June)

The month of summer starting from March until June is the peak tourist season and is the most ideal time to visit Bir. Temperatures rise up to a high of 25°C and drop to a low of 11°C in the nighttime in summers. This is the season that appeals to adventurers looking to get an adrenaline rush from doing adventure sports. Bir is a haven for paragliding and sports enthusiasts from all over the country travel to this beautiful hamlet to participate in paragliding competitions or simply enjoy flying in the midst of tall mountains and fluffy clouds. This is a great time to go with your family and enjoy the pleasant weather. The climate is perfect to go hiking in the nearby villages where you can learn more about the culture and tradition of the region.

[1] https://www.tripcrafters.com/travel/bir-weather-and-best-time-to-visit-bir

Monsoon (July-September)

Figure 2: Bir Billing at Monsoon (July to September)

Monsoons in Bir that start from the month of July to September see a lot of rain. An average of 550 mm of rainfall has been recorded in the past seasons. Due to the ground being wet and slippery due to landslides, monsoons are the off season. Paragliding is not permitted during this time and hiking can be quite dangerous on the slippery slopes, if precautions aren't taken. Hence it is not the number one choice of season for people to visit. But, the monsoon does create an environment which is so serene that you might not mind the slippery slopes, as long as you can sip a hot chocolate and stare at the rains, the foggy mountains and the eye capturing greenery for hours on end.

Winter (October-February)

Figure 3: Bir Billing at Winter (October to February)

Winters in Bir are broken up into two segments; the months that don't see much snow and the months that have a lot of snowfall with temperatures dropping down rapidly. The months of October and November is season time, with paragliding being one of the top most sports that people usually go to enjoy. Temperatures range from a high of 18°C to a low of 8°C-10°C in the night and this is the perfect time to have a fun time with your family due to the beautiful weather.

The months from December to February are the coldest in Bir with temperatures dropping down to sub-zero levels. At this time, paragliding cannot be done, but you can try your hand at skiing. The picturesque view of the snow clad mountains along with the chilly breeze that runs through your face, makes it delightful to visit this lovely town in the winter time.

2.3 Climate

Table 1: Monthly Climate

Month	High/Low (°C)	Rain
January	11°/ 2°	13 days
February	15°/ 5°	7 days
March	16°/ 6°	17 days
April	22°/ 11°	17 days
May	25°/ 13°	9 days
June	28°/ 17°	12 days
July	25°/ 18°	29 days
August	24°/ 18°	28 days
September	25°/ 17°	23 days
October	23°/ 12°	7 days
November	19°/ 9°	12 days
December	14°/ 0°	5 days[2]

[2] https://www.holidify.com/places/bir/best-time-to-visit.html#:~:text=There%20are%20two%20seasonal%20times,April%20to%20June%20are%20pleasant.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	6.4 °C (43.5) °F	8.6 °C (47.4) °F	13.1 °C (55.5) °F	18.4 °C (65.1) °F	22.6 °C (72.7) °F	24 °C (75.1) °F	22.9 °C (73.2) °F	22.2 °C (72) °F	20.5 °C (69) °F	16.8 °C (62.2) °F	12.6 °C (54.6) °F	8.7 °C (47.6) °F
Min. Temperature °C (°F)	0.3 °C (32.5) °F	2.1 °C (35.8) °F	5.9 °C (42.7) °F	10.6 °C (51.1) °F	14.5 °C (58) °F	17.8 °C (64) °F	19.9 °C (67.8) °F	19.5 °C (67.1) °F	16.1 °C (61) °F	10.6 °C (51) °F	6.4 °C (43.5) °F	2.7 °C (36.8) °F
Max. Temperature °C (°F)	13.3 °C (55.9) °F	15.3 °C (59.5) °F	20 °C (68) °F	25.7 °C (78.2) °F	29.5 °C (85.1) °F	29.1 °C (84.4) °F	25.9 °C (78.6) °F	25.2 °C (77.4) °F	24.8 °C (76.6) °F	23.1 °C (73.6) °F	19.6 °C (67.2) °F	15.9 °C (60.7) °F
Precipitation / Rainfall mm (in)	105 (4.1)	147 (5.8)	117 (4.6)	84 (3.3)	103 (4.1)	199 (7.8)	512 (20.2)	464 (18.3)	146 (5.7)	34 (1.3)	24 (0.9)	45 (1.8)
Humidity(%)	63%	64%	58%	48%	47%	61%	86%	88%	79%	65%	57%	56%
Rainy days (d)	7	9	9	10	17	18	21	21	16	7	3	4
avg. Sun hours (hours)	8.3	8.5	9.8	10.7	10.9	9.8	6.9	6.4	8.4	9.3	9.0	8.6

Between the driest and wettest months, the difference in precipitation is 488 mm | 19 inch. The average temperatures vary during the year by 17.5 °C | 31.6 °F.

The month with the highest relative humidity is August (87.73 %). The month with the lowest relative humidity is May (46.68 %).

The month with the highest number of rainy days is July (28.60 days). The month with the lowest number of rainy days is November (4.27 days).

Bir are in the northern hemisphere.

Summer starts here at the end of June and ends in September. There are the months of summer: June, July, August, September.

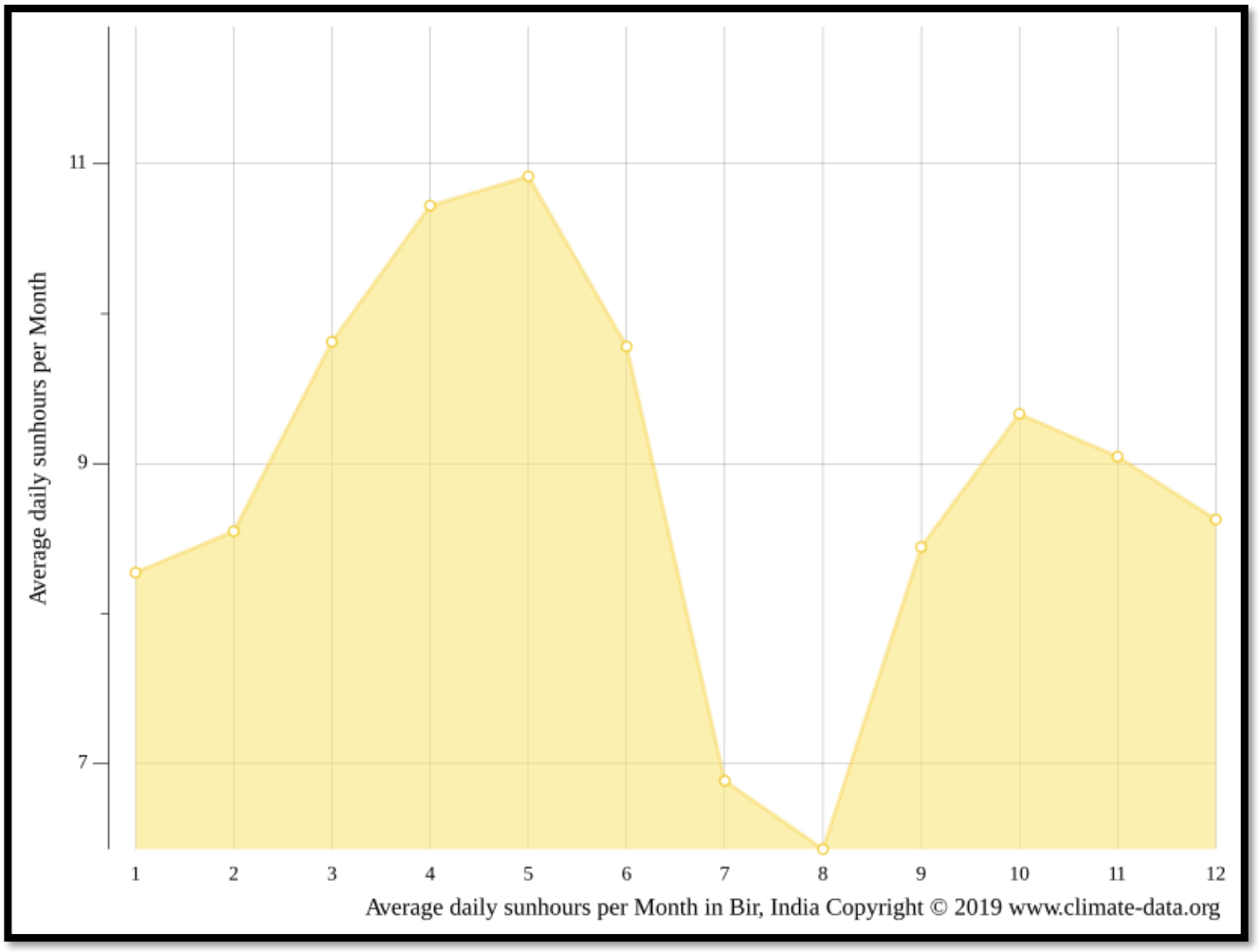


Figure 4: Average daily climate

2.4 Accessibility

By Air

Gaggal airport is the nearest airport from Bir Billing, located at a distance of only 68 km from nearby Palampur. This airport is connected to Delhi through frequent flights.

By Train

Baijnath has its own Railway Station named as Baijnath Paprola Railway Station which is connected to the major cities of Kangra. It is situated on the Pathankot- Jogindernagar Narrow gauge rail head and is linked with the cities like Pathankot, Kangra and Palampur. Station.

By Road

Bir Billing is 68Kms from Gaggal, 50Kms from Dharamshala, 180 Kms from Manali, 200Kms from Shimla, 280 Kms from Chandigarh, 500km from Delhi and is connected through Government HRTC buses or private services. HRTC Volvo Bus also available direct from Bir to Delhi Bus Stand.[3]

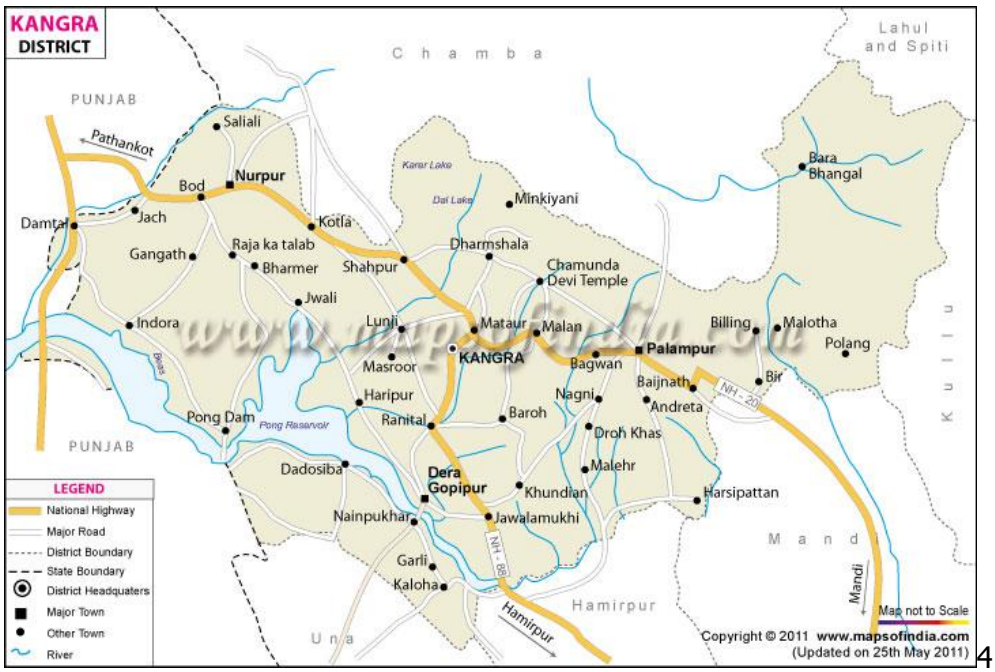
Below a list of some large cities showing distance and travel time by using different means of transport.

Car

Table 2: Distance by Car

S.No.	Place	Distance	Timing
1	Delhi	550 km	11hrs 13min
2	Haryana	495 km	10hrs 22min
3	Ludhiana	237.5 km	6hrs 27min
4	Chandigarh	256.4 km	6hrs 54min

2.5 Geographical Location



[4]

Figure 5: Bir Billing at Geographical Location

[3] https://hpkangra.nic.in/tourist-place/bir-billing/

2.6 Place to Visit

Chokling Monastery

Figure 6: Chockling Monastery

The Chokling Monastery tops the Bir Billing famous places list. Wonder why? Well, adorned with a stupa and the statue of Padmasambhava, the monastery is the perfect place for you to indulge in some peaceful meditation and overall have a good time. You can laze around the lush lawns, be captivated by the colourful flags hanging over you, and even steal a quick chat with the most humble of the monks! In the evening, the peace is immaculate as you bask in the holy vibe and enjoy the sunset view

Sunset point (Landing Site)

We all want to witness the sunset from the best place possible, right? Here at Bir Billing, the Sunset point is exactly that. The point is best known for the scintillating views it offers to tourists and locals during dusk. But there is more! How about a picnic under the setting sun? Well, the sunset point is quite a popular picnic spot. While enjoying the sunset, don't be taken aback when you see dots in the sky coming closer and increasing in size. That's just a group of paragliders that land there throughout the day, as the point is also known as Bir Landing site. The place is surrounded by many cafes and restaurants. So, you can grab a quick bite while enjoying the panoramic views the point offers. So if you travel Bir Billing, be sure to visit this spot for some indelible memories.

Deer Park Institute

Figure 7: Deer Park Institute

Heavy on Tibetan influences, Bir Billing is famous for its Deer Park Institute. It is a haven for all those seeking the tenets of Indian and Buddhist ideals. The structure has pagoda-style architecture, which reflects Tibet's culture. Apart from the painting-covered walls and the many learnings that you will take with you, the institute also organises various workshops on meditation, healing arts, and the culture of Buddhism. So if you want some time to disconnect from the outside world and connect with yourself, a visit to one of the gems of Bir Billing sightseeing will be worth it.

Chowgan Tea Garden

Figure 8: Chowgan Tea garden

The village of Bir is filled with a variety of tea gardens, and one of them happens to be the Chowgan Tea Garden. The verdant garden is the perfect place to take a stroll with your significant other or your family members. The weather of the village makes it conducive for the crop to grow in large numbers, and hence the abundance. The mesmerising fragrance of the tea crop will surely put you in a trance and you may even get to click a photo with the most friendly workers there! So the Chowgan Tea Garden is one of the best Bir Billing tourist spots.

Barot Valley

Figure 9: Barot Valley

Known for its magnificent Hydel project, the Barot valley is a hub of Bir Billing adventure. It is a treat for all trekking lovers! There are camping and other accommodation facilities available around here. But trekking isn't the only attraction here. Another activity you can indulge in is trout fishing at the Uhl river, organised by the Winch camp.

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 to be made).

4. Structuring of Project under various options.

4. Traffic Analysis

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

4.1 Traffic Surveys and Studies

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

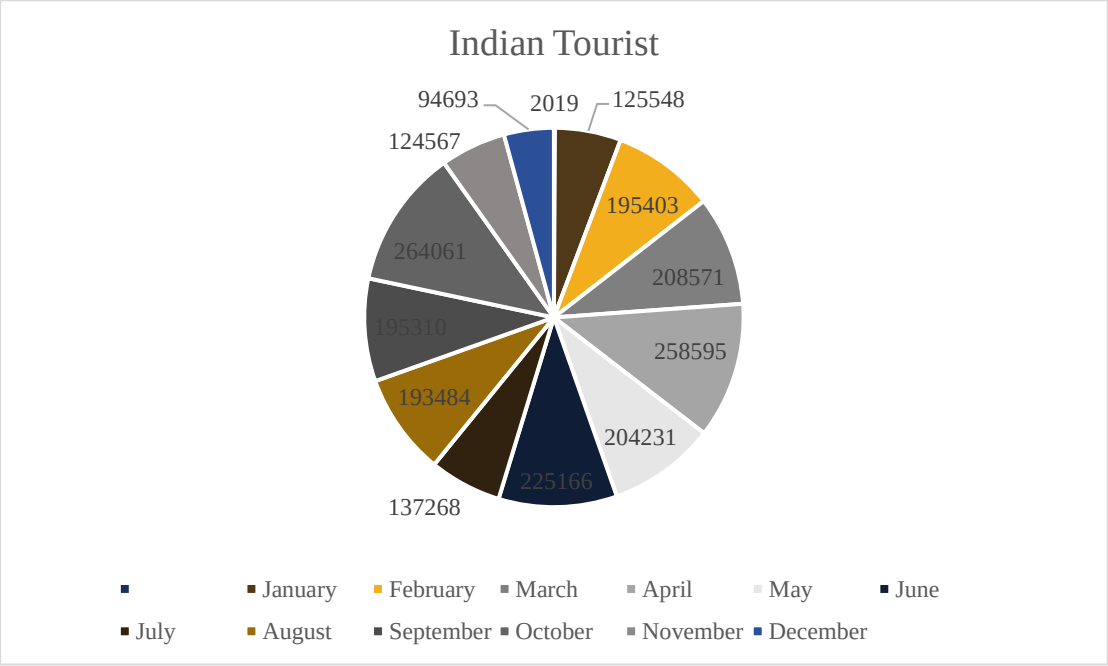
The following methodology was used to collect the primary and secondary data and to assess the traffic on the suggested alignments.

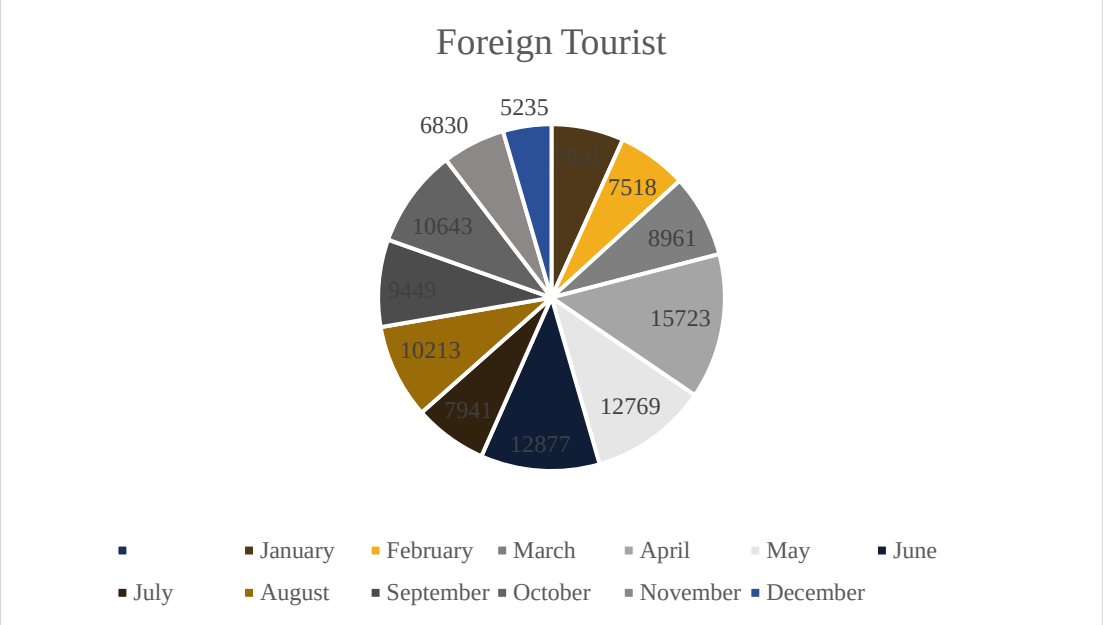
4.2 Total visitors in Kangra

Table 3: Monthly Visitors in 2019 and 2018

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

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




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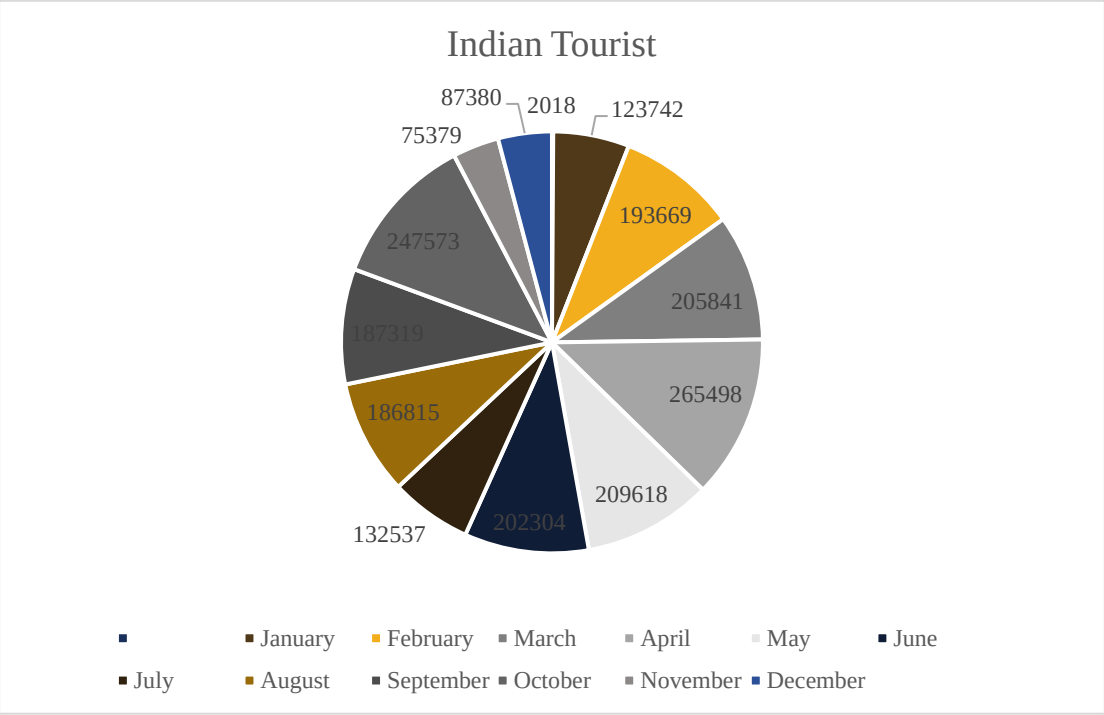
December


Indian Tourist
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2018
123742
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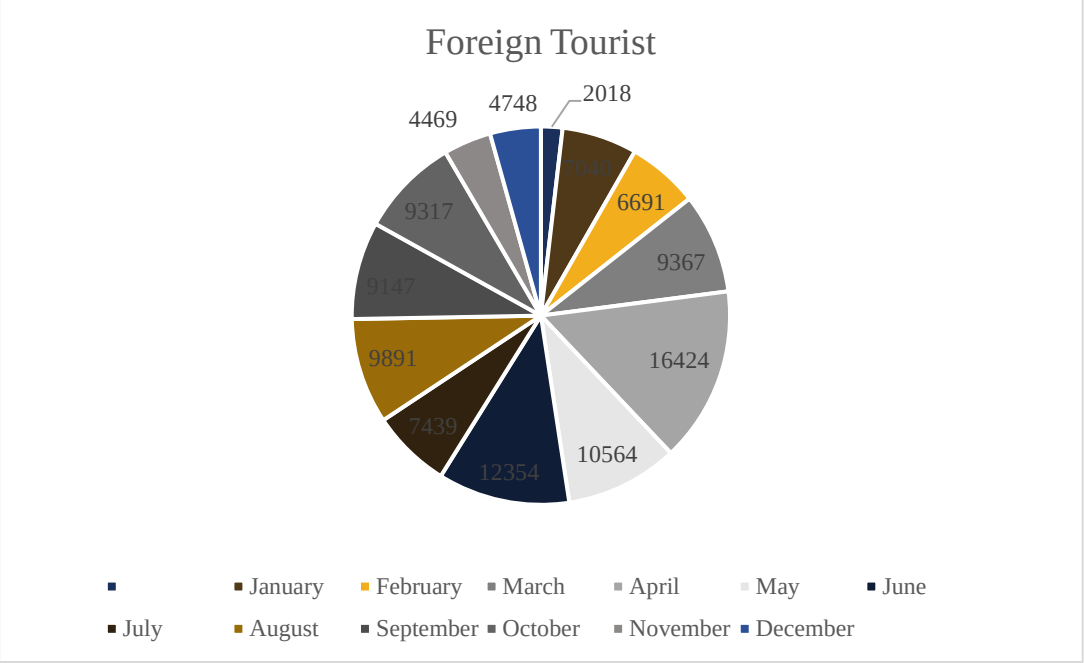

4.3 Growth of Tourists

Estimation 1: Based on tourist data of Kangra

Table 4: Growth of Tourists

S. No	Year	No of Tourists Visiting Kangra	Variation in Growth	Growth Rate (%)
1	2008	13,45,974	-	-
2	2009	14,79,512	1,33,538	9.92
3	2010	17,22,941	2,43,429	16.45
4	2011	19,12,648	1,89,707	11.01
5	2012	23,05,411	3,92,763	20.54
6	2013	22,00,623	-1,04,788	-4.55
7	2014	23,33,367	1,32,744	6.03
8	2015	25,09,813	1,76,446	7.56
9	2016	26,52,732	1,42,919	5.69
10	2017	28,23,289	1,70,557	6.43
11	2018	22,25,126	-5,98,163	-21.19
12	2019	23,42,887	1,17,761	5.29
			Avg. Growth Rate	5.75%

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

Growth Projection for the next 6 years based on annual growth rate of 5 %

Table 5: Growth projection for next 6 years of Kangra

S.No	Year	Projected Traffic Considering 5 % growth annually	Projected Traffic Considering 5 % growth annually (Domestic Visitors)	Projected Traffic Considering 5 % growth annually (Foreign Visitors)
1	2022	22,25,126	21,17,675	1,07,451
2	2023	23,36,382	22,23,559	1,12,824
3	2024	24,53,201	23,34,737	1,18,465
4	2025	25,75,861	24,51,474	1,24,388
5	2026	27,04,655	25,74,047	1,30,607
6	2027	28,39,887	27,02,750	1,37,138

Bir Billing : It is estimated that 40% of the total visitors of Kangra will visit Bir Billing.

Table 6: Growth projection for next 6 years of Bir billing

S.No	Year	Projected Traffic Considering 5% growth annually	Projected Traffic Considering 5% growth annually (Domestic Visitors)	Projected Traffic Considering 5% growth annually (Foreign Visitors)
1	2022	8,90,050	8,47,070	42,980
2	2023	9,34,553	8,89,424	45,129
3	2024	9,81,281	9,33,895	47,386
4	2025	10,30,345	9,80,589	49,755
5	2026	10,81,862	10,29,619	52,243
6	2027	11,35,955	10,81,100	54,855

Ropeway system is an attraction in itself and it pulls its own traffic. It has been observed from case studies done on various touristic ropeways around the world that the expected growth of traffic has beaten the estimations for the traffic.

Growth Projection for the next 40 years based on annual growth rate 5%

Table 7: Projected Traffic in Bir Billing

S.No.	Year	Projected Traffic Considering (Domestic Visitors)	Projected Traffic Considering (Foreign Visitors)	Total Projected Traffic
		5% growth	5% growth	5% growth
1	2027	1081100	54855	1135955
2	2028	1135155	57598	1192753
3	2029	1191913	60478	1252390
4	2030	1251508	63502	1315010
5	2031	1314084	66677	1380760
6	2032	1379788	70010	1449798
7	2033	1448777	73511	1522288
8	2034	1521216	77186	1598403
9	2035	1597277	81046	1678323
10	2036	1677141	85098	1762239
11	2037	1760998	89353	1850351
12	2038	1849048	93821	1942869
13	2039	1941500	98512	2040012
14	2040	2038575	103437	2142013
15	2041	2140504	108609	2249113
16	2042	2247529	114040	2361569
17	2043	2359906	119742	2479647
18	2044	2477901	125729	2603630
19	2045	2601796	132015	2733811
20	2046	2731886	138616	2870502
21	2047	2868480	145547	3014027
22	2048	3011904	152824	3164728
23	2049	3162499	160465	3322965
24	2050	3320624	168488	3489113
25	2051	3486656	176913	3663568
26	2052	3660988	185759	3846747
27	2053	3844038	195046	4039084
28	2054	4036240	204799	4241038
29	2055	4238052	215039	4453090
30	2056	4449954	225791	4675745
31	2057	4672452	237080	4909532
32	2058	4906074	248934	5155009
33	2059	5151378	261381	5412759
34	2060	5408947	274450	5683397

35	2061	5679394	288172	5967567
36	2062	5963364	302581	6265945
37	2063	6261532	317710	6579242
38	2064	6574609	333596	6908205
39	2065	6903339	350275	7253615
40	2066	7248506	367789	7616296

Based on the Projected Traffic in Bir Billing

Table 8: Projected Traffic in Bir Billing/ Expected Ropeway Ridership

S.No.	Year	Increase in Percentage of Ridership by domestic visitors in Bir Billing	Projected Ridership Considering (Domestic Visitors)	Projected Ridership Considering (Foreign Visitors) - 70% of total Foreign Visitors in Bir Billing	Total Projected Ridership
Growth			5%	5%	5%
1	2027	30% of total rider in Bir Billing	324330	38399	362729
2	2028		340547	40319	380865
3	2029		357574	42335	399909
4	2030		375453	44452	419904
5	2031		394225	46674	440899
6	2032		413936	49008	462944
7	2033		434633	51458	486092
8	2034		456365	54031	510396
9	2035		479183	56733	535916
10	2036		503142	59569	562712
11	2037		528299	62548	590847
12	2038		554714	65675	620390
13	2039		582450	68959	651409
14	2040		611573	72407	683980
15	2041		642151	76027	718179
16	2042	40% of total rider in Bir Billing	899012	79829	978841
17	2043		943963	83820	1027783
18	2044		991161	88011	1079172
19	2045		1040719	92412	1133131
20	2046		1092755	97032	1189787

21	2047		1147392	101884	1249276
22	2048		1204762	106978	1311740
23	2049		1265000	112327	1377327
24	2050		1328250	117943	1446194
25	2051		1394663	123841	1518503
26	2052		1464396	130033	1594428
27	2053		1537616	136534	1674150
28	2054		1614496	143361	1757857
29	2055		1695221	150529	1845750
30	2056		1779982	158055	1938038
31	2057	50% of total rider in Bir Billing	2336226	165958	2502184
32	2058		2453037	174256	2627293
33	2059		2575689	182969	2758658
34	2060		2704474	192117	2896591
35	2061		2839697	201723	3041421
36	2062		2981682	211809	3193492
37	2063		3130766	222400	3353166
38	2064		3287305	233520	3520825
39	2065		3451670	245196	3696866
40	2066		3624253	257456	3881709

Based on the preliminary ridership surveys carried out at site it is estimated that initially about 30% of the total domestic tourist visiting Bir Billing will take the ropeway for the base year 2027 to 2042, 40% from 2042 to 2056 and this number is expected to increase to 50% in the year 2057. The 70% of foreign tourist will take ropeway from initial year.

Table 9: Expected Traffic

Approx. no of visitors annually (2027)	362,729
Expected annual growth YoY	5%
Approx. no of visitors annually (2066)	3,881,705
Expected Max. Daily Traffic (2066)	3,881,705/350 = 11,090
Expected Hourly Traffic (2066)	11,090/10 = 1109

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 lower terminal at Bir to upper terminal at Bir Billing shall be 600 PPHPD, however for the initial years the system can have a lower capacity with lesser number of cabins on the line.

4.4 Ropeway Fare for visitors using Ropeway (including GST)

Domestic Visitors

Domestic Single Fare : Rs. 400

Domestic Return Fare: Rs. 700

Percentage of Domestic Visitors taking Return trip: 30%

Therefore, weighted Average Fare (includng GST): Rs. 490

Foreign Visitors

Single Fare for Foreign Visitors: Rs. 600

Return Fare for Foreign Visitors: Rs. 1,000

Percentage of Foreign Visitors taking Return trip: 50%

Therefore, weighted Average Fare (including GST): Rs. 800

5. System Requirements

5.1 Design Parameters

- Capacity of the cable car system: 600 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 10: "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 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) 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 connecting lower terminal at landing site at Bir to upper terminal at take-off site at Billing route in Distt Kangra, 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 approx. 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 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.

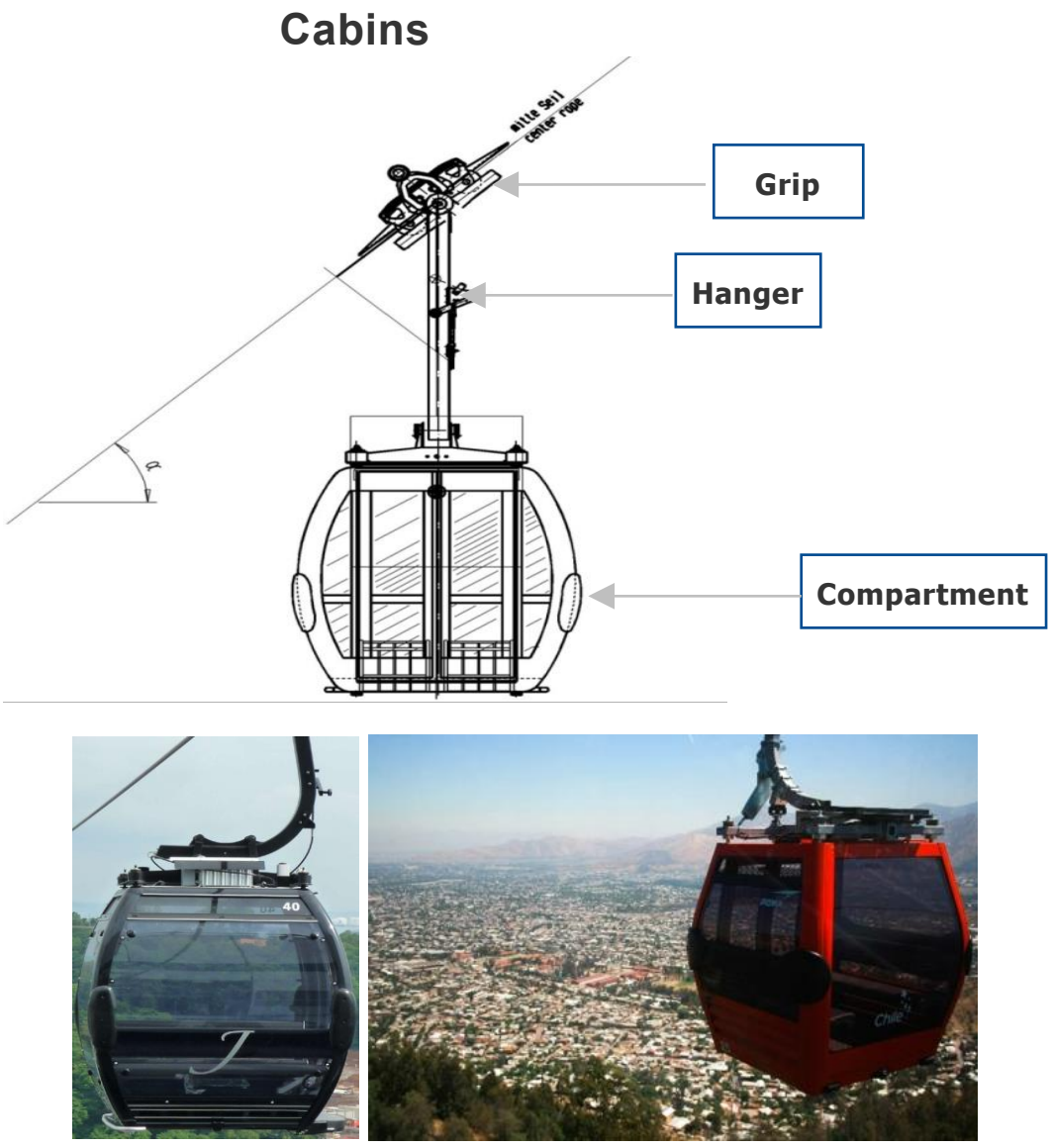

Figure 14: Typical Cabin

7.5 Grip

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.

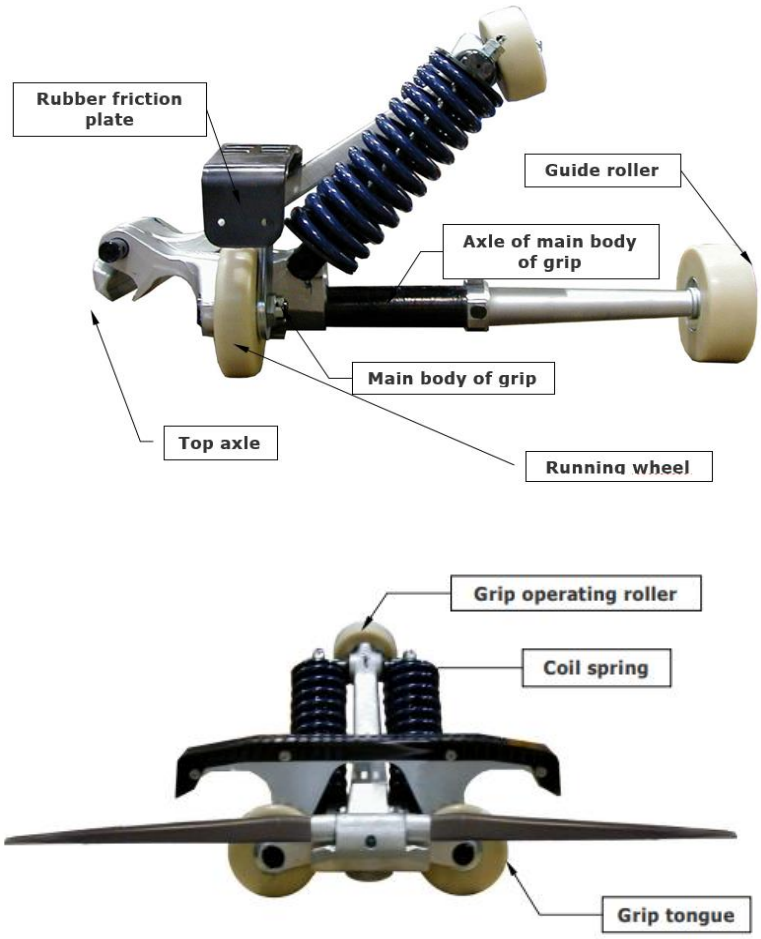

Figure 15: Detachable Grip

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

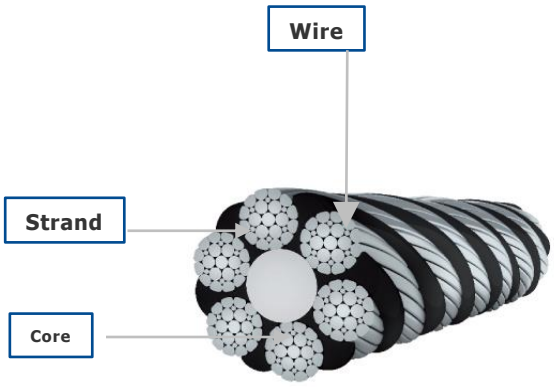

Figure 16: Rope

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

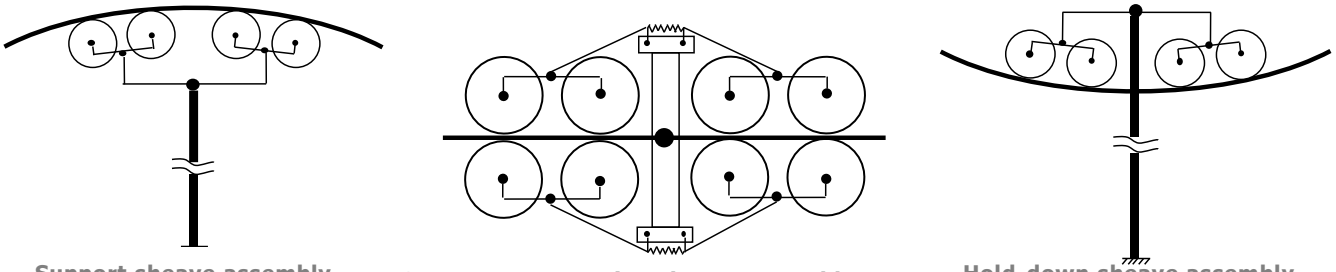

Figure 19: Sheaves

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 for connecting lower terminal at landing site at Bir to upper terminal at take-off site at Billing 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 10: Passenger Usage

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

Table 11: Environmental Impact

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

Table 12: Contribution to the Local Economy

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

Possible Alignment Options for Connecting lower terminal at landing site at Bir Billing to upper terminal at take-off site at Bir Billing via Ropeway System

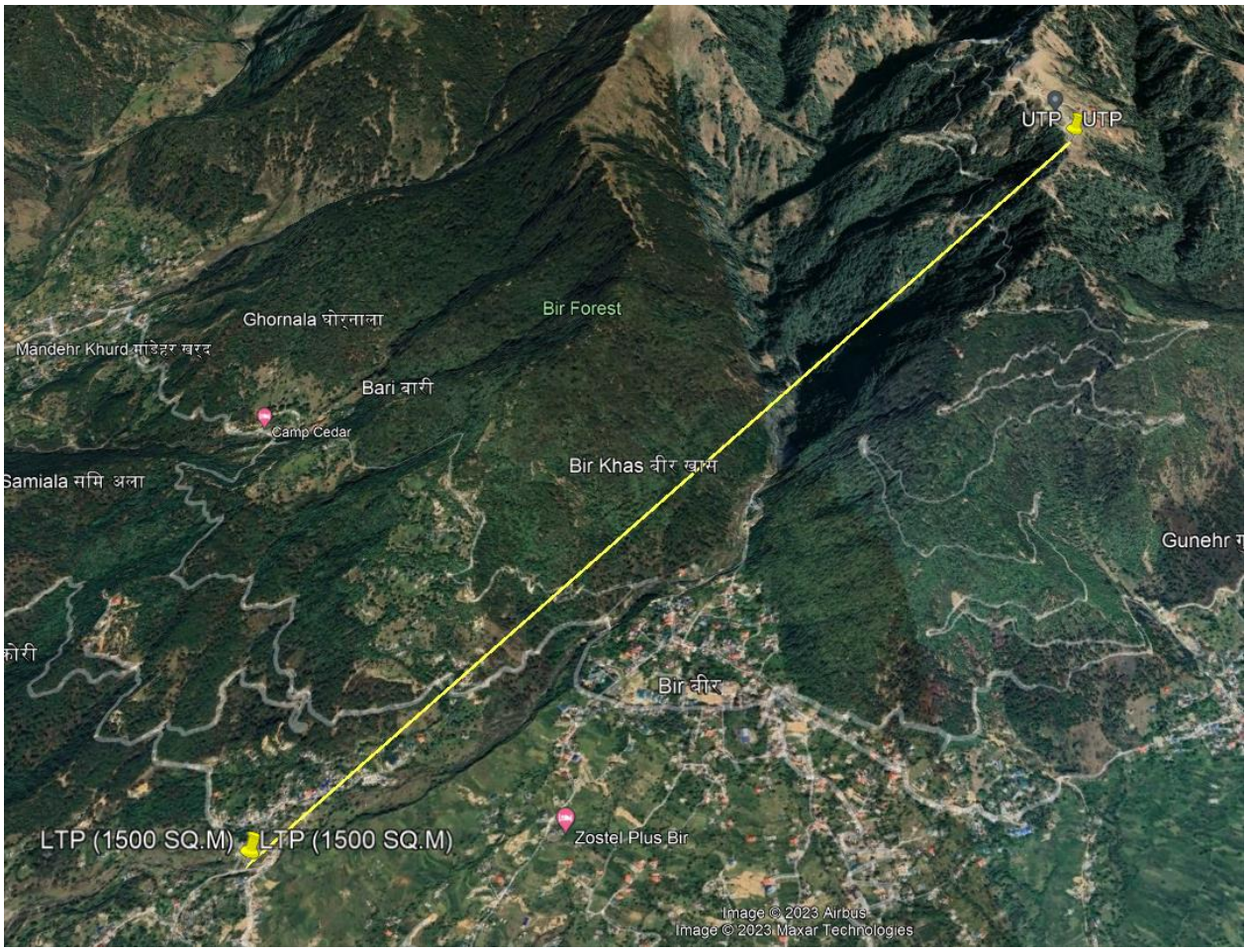

Figure 20: Propsed Alignment

Connectivity

Bir-Billing is one the preferable tourists place for paragliding sport in Himachal Pradesh and is well connected by road, rail and air. Bir lower terminal site is just at 3.50 km from NH-154 and this national highway stretch between Dharamshala to Mandi. The highway consists of two lanes that consist of government as well as private transportation bus services that are generally based on regular operation of transit buses.

Moreover, cabs can also be easily availed to reach Bir.

Along with this, rail is also an option to reach Bir billing. The closed railway station is situated in Ahuj at a distance of 3km from Bir. The railway line is narrow gauge due to which it has higher journey time as compare to roadway.

Airway is another option to reach Bir-billing. The nearest airport is situated at Gaggal which is 67.60 km from Bir that connect the Bir-Billing to whole world. Other closes

airports are in Chandigarh (290km), Amritsar airport (260 km) and New Delhi (520km).

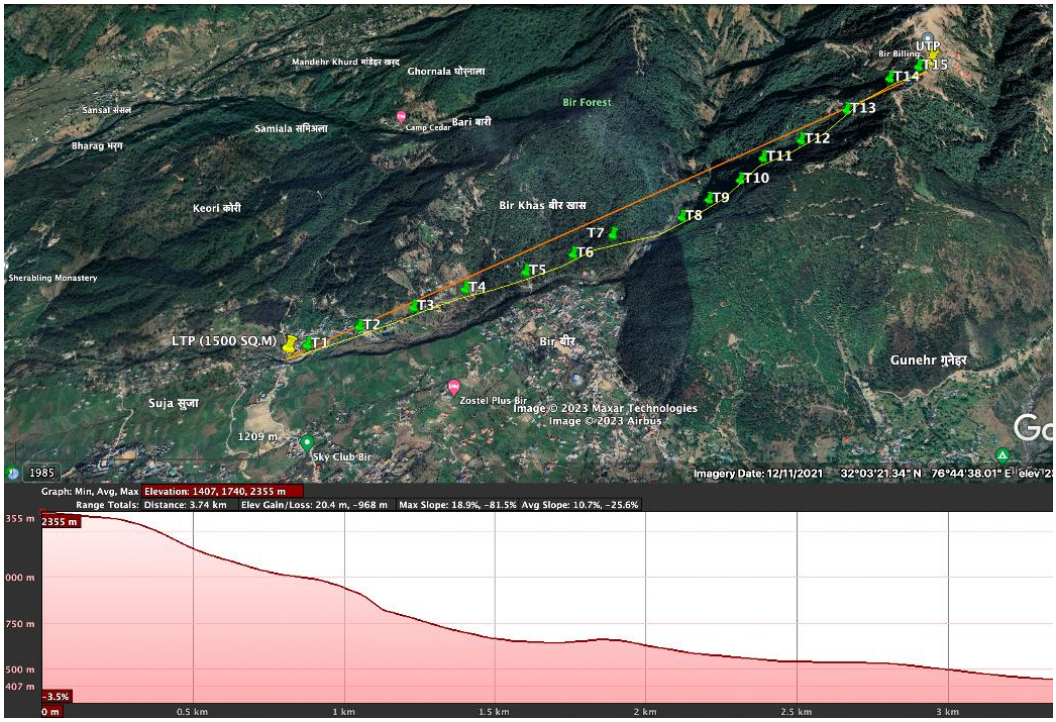

Figure 21: Propsed Alignment- LTP and UTP

Proposed LTP Option : The lower terminal point (LTP) for the proposed ropeway is situated at Bir village.

Coordinates:

Latitude - 32°02’44.28” N

Longitude - 76°42’31.64” E

Proposed UTP: The upper terminal point (UTP) for the proposed ropeway is situated at Billing.

Coordinates:

Latitude - 33° 03’02.77”N

Longitude - 76°43’34.83”E

Based on above topo-study and availability of land, the above alignment has been selected for Bir Billing ropeway system.

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

From Station	**Lower terminal at landing site at Bir**
To Station	**Upper terminal at take-off site at Bir Billing**
Geometrical data	
Height of Bottom station	1407 m.a.s.l
Height of Top station	2255 m.a.s.l
Horizontal Length	3512 m
Height difference	129 m
Developed Length	3641 m
Ropeway General Data	
Drive Station	**Lower terminal at at Bir**
Tension Station	**Lower terminal at Bir**
Return Station	**Upper terminal at Billing**
Capacity	600 Pphpd
Travel Speed	6 m/s
Cabin Capacity	8 persons
Rope Diameter	46 mm
Drive Group	
Power	
Continuous In Operation	710 kW
Starting Mode	800 kW
Braking	190 KW
Travel Time (with two intermediate Stations)	
Distance between Cabins	48 sec
Travel time	~8.36 minutes
Quantity of Cabins and Towers	
Number of Cabins	25
Number of Towers	~15 nr
Estimated Cost	
Ropeway Equipment	~Rs. 90 Crores (including custom duty)
Civil works and Assembly including material Ropeway	~Rs. 59 Crores (including GST)
Other Costs including finance cost	~Rs. 6 Crores
Total Costs	~Rs. 156 Crores

Tentative Requirement of Land

Tentative Area Required for LTP Development

Table 14: Tentative Area required for LTP development

S. No	Heads	Dimensions in Meters		Area (m^2)
1	Ropeway Station	30	15	450
2	Cabin parking	20	15	300
3	Store	5	6	30
4	Workshop	8	6	48
5	Office	5	6	30
6	Ticket Counter	3	3	9
7	Account and staff room	5	5	25
8	Toilet	5	5	25
9	Generator Room	10	15	150
10	Open Store	10	10	100
11	Panel Room and Control Room	6	8	48
Total		**1215**		

Additional area for Setback (10%): 120

Total Area Requirement (Tentative): ~ 1335 sqm

Tentative Area Required for UTP Development

Table 15: Tentative Area required for UTP development

S. No	Heads	Dimensions		Area (m^2)
1	Ropeway Station	30	15	450
2	Toilet	5	5	25
3	Ticket Counter and Guard Room	3	3	9
4	Co-working, Cafe	30	20	600
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				**1279**

Additional area for Setback (10%): 125

Total Area Requirement (Tentative): ~ 1404 sqm

TENTATIVE DETAILS OF TOWER LOCATIONS-

Table 16: Tentative Co-ordinates of Towers

S.No	Tower Number	Tentative Co-ordinates
For MGD System		
1	T1	32°02'45.13"N 76°42'34.55"E
2	T2	32°02'48.17"N 76°42'44.94"E
3	T3	32°02'51.26"N 76°42'55.45"E
4	T4	32°02'54.15"N 76°43'5.32"E
5	T5	32°02'57.68"N 76°43'17.35"E
6	T6	32°03'00.43"N 76°43'26.72"E
7	T7	32°03'02.84"N 76°43'34.95"E
8	T8	32°03'06.96"N 76°43'49.01"E
9	T9	32°03'08.63"N 76°43'54.71"E
10	T10	32°03'10.41"N 76°44'00.79"E
11	T11	32°03'11.67"N 76°44'05.09"E
12	T12	32°03'13.90"N 76°44'12.69"E
13	T13	32°03'16.49"N 76°44'21.56"E
14	T14	32°03'18.79"N 76°44'29.41"E
15	T15	32°03'20.69"N 76°44'35.87"E

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. Kangra, connecting lower terminal at landing site at Bir to upper terminal at take-off site at Billing, Himachal Pradesh under PPP Mode with VGF. RTDC is the Authority and shall provide this Project to the Concessionaire (Developer) for undertaking this project under PPP Mode with VGF.

The developer will raise the funds in the form of debt and equity. The concessionaire will Design, Build, Finance, 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 connecting lower terminal at landing site at Bir to upper terminal at Billing is provided herein below. The length of the Ropeway for this route is 3512 m.

Table 17: Project Cost with Item Description

S. No.	Item Description	Amount (in Rs. Cr.)
1	Ropeway System (Electro-Mechanical Portion)	70.00
2	Custom Duty	20.30
3	Civil Works including material ropeway	50.33
4	GST on Civil works @ 18%	9.06
5	Project Development Cost	1.30
6	Project Management Consultancy fee	2.00
7	Misc. Costs (Logistics, admin costs, etc.)	1.20
8	Project Contingency Cost	1.50
Total		**156**

9.3 Key aspects of financial evaluation

We have considered following assumptions/analysis for the proposed Ropeway Project connecting Lower terminal at landing site at Bir Billing to upper terminal at take-off site at Bir Billing:

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 18: 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 19: 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)**	600 PPHPD
4	**Increase in Traffic Per year from 2019 to 2026**	5 %
5	**Annual Traffic in the Year 2027 (5 % yearly growth over 2019)**	362,729
6	**Annual Ridership in Year 2055 (5 % growth over 2027) including return ridership**	3,881,705
7	**Expected start of Revenue from operations**	01.08.2027
8	**Increase in Fare in every year**	5%

Other proposed Revenue Streams

Commercial space for rent

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

Advertisement

Revenue from advertisement is considered at Rs. 50 Lakhs per annum with an increase of 5% every 4th Year.

9.6 Minimum return criteria for the Project

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

9.7 Straight forward PPP Model (with VGF)

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

Table 20: Financials for Base PPP Model with VGF

	S. No.	Particulars	Base PPP Model
I	1	Total Capital Cost (approx.)	Rs 150 Crores
	2	Other costs including contingency	Rs 6 Crores
	3	Total Project Cost	Rs 156 Crores
	4	Construction Period	36 months
	Project Income Summary (40 years)		**Rs.**
II	1	Total Consolidated Revenue	Rs 3,709 Crores
	2	Total O&M and Administrative Cost	Rs 710 Crores
	3	Net profit before depreciation, interest and tax	Rs 2,999 Crores
	Project Economics		
III	1	Project IRR (Financial)	14.66%
	2	Project IRR (Economic)	19.44%
	3	Equity IRR (Financial)	35%
	4	Equity IRR (Economic)	37%

9.8 Financial Analysis (Estimated profit and loss statement)

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

Table 21: Year Wise revenue and cost estimation

(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	16	1	4	13
2	2028	17	1	4	14
3	2029	18	1	4	14
4	2030	20	1	4	16
5	2031	21	1	5	17
6	2032	22	1	5	18
7	2033	23	1	5	19
8	2034	25	1	5	20
9	2035	26	1	6	21
10	2036	27	1	6	22
11	2037	29	1	7	23
12	2038	32	1	8	25
13	2039	33	1	8	26
14	2040	35	1	9	27
15	2041	37	1	10	28
16	2042	52	1	12	41
17	2043	55	1	13	43
18	2044	57	1	13	45
19	2045	60	1	14	47
20	2046	66	1	15	52
21	2047	70	1	15	55
22	2048	73	1	16	58
23	2049	77	1	17	61
24	2050	85	1	18	68
25	2051	89	1	19	71
26	2052	93	1	20	75
27	2053	98	1	21	78
28	2054	108	1	22	87
29	2055	113	1	23	92
30	2056	119	1	24	96

31	2057	152	1	28	126
32	2058	168	1	30	139
33	2059	176	1	31	146
34	2060	185	1	33	154
35	2061	194	1	34	161
36	2062	214	1	37	179
37	2063	225	1	38	188
38	2064	236	1	40	197
39	2065	248	1	42	207
40	2066	274	1	45	230

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 22: 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 23: 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 1.5 Crore/Year**
C	Annual Fuel Cost Saved by Ropeway Riders	
Total of C	**Annual Fuel Cost Saved by Ropeway Riders**	**Rs 0.41 Crore/Year**
D	Annual Vehicle Operating Cost Saved by Ropeway Riders	
Total of D	**Annual Car Operating Cost Saved by Ropeway Riders**	**Rs 0.24 Crore/Year**
E	Annual Accident Cost Saved by Ropeway Riders	
Total of E	**Annual Accident Cost Saved by Ropeway Riders**	**Rs 0.82 Crore/Year**
F	Annual Infrastructure Maintenance Cost Saved by Using Ropeway Instead of Roads	
Total of F	**Annual Infrastructure Maintenance Cost Saved**	**Rs 0.54 Crore/Year**
B+C+D+E+F	**Potential Total Benefits from Using Ropeway to Transport Passengers**	**Rs 3.60 Crore/Year**

Table 24: 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	362,729 Ropeway Ridership/Year
2	Equivalent Number of Cars to transport assuming 4 passengers per car	90,682 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	27,205 Equivalent Cars/Year
	Total Carbon-di-oxide Emitted if Travelling by Car Instead of Ropeway	**125,142 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	123,891 Metric Tons CO2/Year
E	Estimated Carbon Tax in India	
1	Equivalent Carbon Tax in India = Coal Cess at Rs 400/tonne	300 Rs/Ton
A+B+C+D+E	**Potential Carbon Credit from CO2 Emission Reductions Using Ropeway instead of Car**	**Rs 3.7 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 25: Percentage of Benefit Components

Ropeway Benefit Component	% of Benefit
Annual Time Cost Saved	43%
Annual Fuel Cost Saved	11%
Annual Car Operating Cost Saved	7%
Annual Accident Cost Saved	23%
Annual Infrastructure Cost Saved	15%
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 26: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	16	8	3	21
2	2028	17	8	3	22
3	2029	18	8	3	22
4	2030	20	8	4	24
5	2031	21	8	4	25
6	2032	22	8	4	26
7	2033	23	8	4	27
8	2034	25	9	4	29
9	2035	26	9	5	30
10	2036	27	9	5	31

11	2037	29	9	6	32
12	2038	32	9	6	35
13	2039	33	9	7	36
14	2040	35	9	8	37
15	2041	37	9	8	38
16	2042	52	10	10	51
17	2043	55	10	11	53
18	2044	57	10	12	55
19	2045	60	10	12	58
20	2046	66	10	13	63
21	2047	70	10	14	66
22	2048	73	10	14	69
23	2049	77	10	15	72
24	2050	85	11	16	79
25	2051	89	11	17	83
26	2052	93	11	18	86
27	2053	98	11	19	90
28	2054	108	11	20	99
29	2055	113	11	21	104
30	2056	119	11	22	109
31	2057	152	11	25	138
32	2058	168	12	27	152
33	2059	176	12	29	160
34	2060	185	12	30	167
35	2061	194	12	31	175
36	2062	214	13	34	193
37	2063	225	13	35	202
38	2064	236	13	37	212
39	2065	248	13	39	222
40	2066	274	13	42	245

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, for connecting lower terminal at Bir to upper terminal at 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 Bir Billing 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	**PHPDT**	Peak Hour Peak Direction Traffic
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		