TECHNO – FEASIBILITY STUDY REPORT

ON

INSTALLATION OF A PASSENGER ROPEWAY
AT HIRNI VILLAGE
BETWEEN
CHAMUNDA MATA TEMPLE & HIRNI MAHADEV TEMPLE

CLIENT: OFFICE OF THE MUNICIPAL COUNCIL, BHILWARA, RAJASTHAN

PREPARED & SUBMITTED BY

CONVEYOR & ROPEWAY SERVICES PVT. LTD.

75C, PARK STREET, 6TH FLOOR

KOLKATA – 700 016

YEAR 2016

PREAMBLE

The Office of the Municipal Council, Bhilwara, Rajasthan on 26.11.2015 under the tender no. 23/107 invited tenders for the Preparation of DPR for construction of a passenger Ropeway at Hirni Village between Chamunda Mata Temple and Hirni Mahadev Temple.

Accordingly, M/s Conveyor & Ropeway Services Pvt. Ltd. (CRSPL), a specialized engineering organization engaged in concept development, feasibility study, design, manufacture, supply, erection, commissioning, operation and maintenance of Aerial Ropeway System, for both Material and Passenger transportation, submitted their bid document to undertake a Techno - feasibility study.

After opening of bid document and negotiations with CRSPL, the Office of Municipal Council, Bhilwara, issued an order on CRSPL to undertake the Techno – Feasibility Study vide their letter no. MCB/NIRMAN/2016-17/7545 dt. 26.06.16.

Taking this opportunity, we would like to introduce our selves, as a pioneer engineering company in India, engaged in Design, Manufacture, Supply, Erection, Commissioning and Operation and Maintenance on Turnkey and BOOT Basis for Passenger as well as Material Ropeways, apart from other allied Engineering Projects. For the last 41 years, we have executed 95 Nos. of various Engineering Projects in India and Abroad.

We would like to inform you that we have successfully installing the maximum number of Passenger Ropeways in India. Till now, we have successfully installed 35 Nos. of Aerial Ropeway Projects out of which 13 Nos. are Passenger Ropeways. At present 7 Nos. Passenger Ropeways are under our Operation and Maintenance. We have 6 Nos. Passenger Ropeway Projects under BOOT Basis, 3 Nos. are in Madhya Pradesh, 2 Nos. in West Bengal and 1 No. in Andhra Pradesh.

Upcoming Passenger Ropeway Projects of CRSPL are:-

a. Tsomgo Passenger Ropeway : Sikkim on BOOT Basis
b. Gidda Pahar Passenger Ropeway : West Bengal on Turnkey Basis
c. Veer Hanumanji Passenger Ropeway : Rajasthan on BOOT Basis
d. Maa Bamaleswari Passenger Ropeway : Chhattisgarh on Turnkey Basis
e. Chamba Passenger Ropeway : Himachal Pradesh on Turnkey Basis

We are an ISO 9001:2008 certified company, which covers all the activities in Design, Production, Inspection, Installation and Operation & Maintenance of Passenger Ropeway. Our distinct Strength in this field are In-house (i) Design facilities backed up with experienced Engineers and CAD Station, (ii) well equipped own Workshop under our control, and (iii) R&D Wing for keeping us acquainted with the latest development in the field of Ropeway technology, globally.

The broad parameters of the scope for undertaking Techno – Feasibility Study, as jointly decided upon were:-

(i) Selection of a suitable location.
(ii) Alignment Survey.
(iii) Collection of the requisite data.
(iv) Select most suitable Ropeway System.
(v) Preparation of tentative Ropeway Profile and station arrangement drawings.
(vi) Working out Capital Cost and Operation & Maintenance expenses.

In line with the above parameter, this report has been prepared by M/s Conveyor & Ropeway Services Pvt. Ltd. and presented to the OFFICE OF THE MUNICIPAL COUNCIL, BHILWARA, for their kind perusal and acceptance.

CHAPTER – I

EXECUTIVE SUMMARY

01. This report has been prepared in response to the order released by the Office of the Municipal Council, Bhilwara, to look into feasibility of providing Passenger Ropeway at Hirni VIllage, so that the pilgrims / visitors coming to the Hirni Mahadev Temple can easily go to the Chamunda Mata Temple located on the hill top, as well as to enjoy the enchanting beauty of the surrounding and the city during their ride in the Ropeway.

02. Based on the ground alignment and the system capacity, a Monocable Jig Back System (deboarding / boarding facility at both the Stations) has been envisaged as most suitable.

03. The Ropeway need to have an inbuilt capacity of 120 PPH each way at full speed.

04. Salient technical parameters of the Passenger Ropeway System are as follows:-

Horizontal Length (M)	: 800 (Approx.)
Level Difference (M)	: 35 (Approx.)
Capacity (PPH)	: 120 (Max.)
Motor Rating (KW)	: 55 (Approx.)
Speed (M/Sec)	: 0 – 3.5 (Max.)

05. Power, requirement for the Ropeway installation inclusive of station lighting shall be approximately 65 KW.

06. Land requirement for the Plant shall be

- Ropeway Route alignment including land for intermediate trestles: 800 M Long x 10 M wide.
- Upper Station Technical Area : 30 M x 15 M.
- Lower Station Technical Area : 30 M x 15 M

07. Estimated cost of the Ropeway Installation, exclusive of the cost of land and taxes will be in tune of Rs. 610.00 lakhs

08. Estimated Operation & Maintenance cost is Rs. 34.00 lakhs annually excluding the cost of capital item replacement and marketing expenses.

09. CRSPL is of the opinion that :-

a) The proposed plant is technically feasible.

b) Required technical expertise and all the plant and equipment for construction of the ropeway shall be indigenously available.

c) It shall be implemented with the basic objective that operation of the plant being pollution free, it shall save the local people and surrounding greeneries from fuming vehicles.

d) Ropeway ride indeed will be a unique experience, in the lap of mountains and greenery.

CHAPTER – II

FIELD SURVEY AND DATA COLLECTION

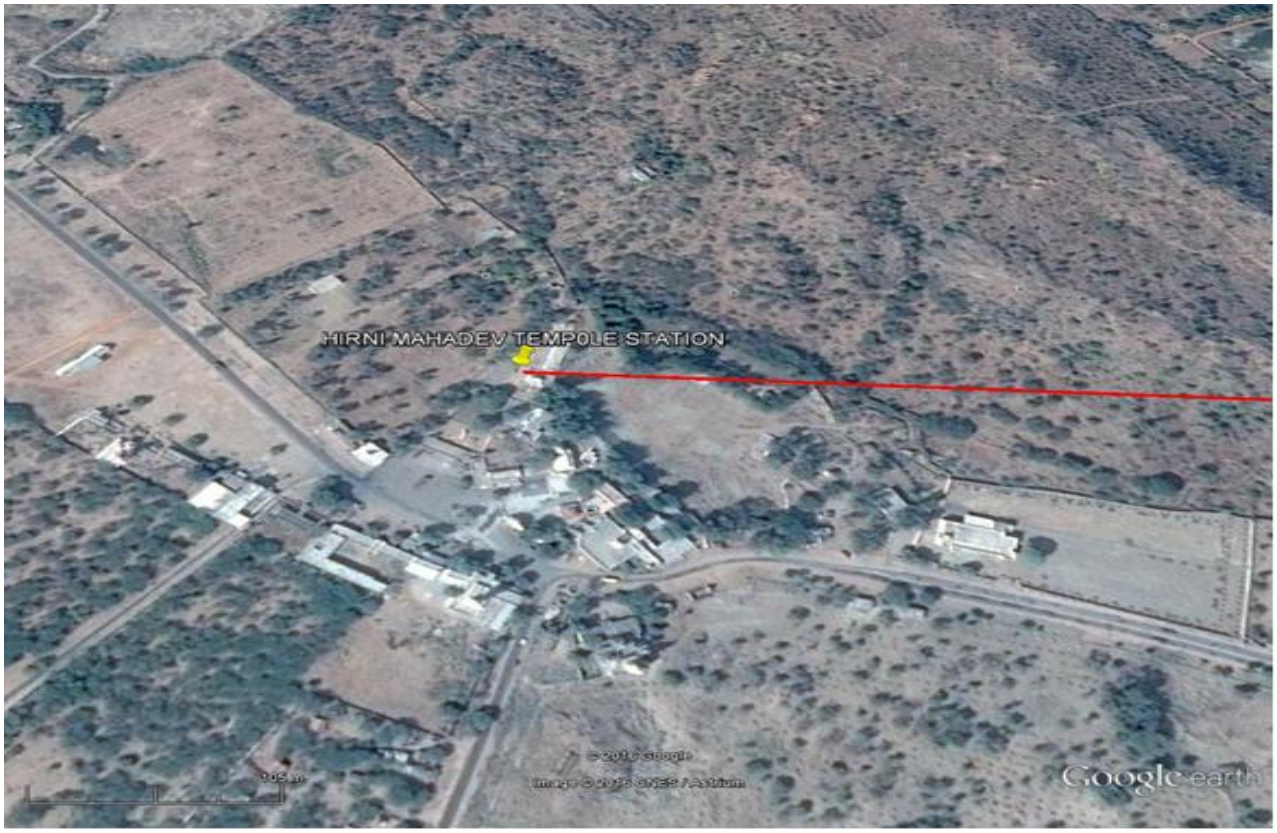
CRSPL representatives Messrs. Rajendra Sakre, along with surveyor Partho Protim Das visited the site on 17.08.16 and had interactions with Municipal Council executives in connection with the field study of the proposed Ropeway. A joint visit to the location was conducted for selection of the terminal stations. And, accordingly, the alignment survey was conducted and relevant data were collected by Conveyor & Ropeway Services Pvt. Ltd.

01. A reconssiance survey was first conducted starting from the Lower station identified near the Hirni Mahadev Temple to the Hill top near to the Chamunda Mataji Temple.

Harni Mahadev: Founded by the ancestors of the Darak family, a Shivling lies under the mountain, built into a Shiva temple is 8 km from the city. It got the name Harni on the name of village near it, a nice place for people from the city for outing as it has hills around. On the occasion of Shiv Ratri a three-day fair is held here. **Chamunda mata Mandir** : At place the Chamunda mata Mandir is also situated on the hill from where one can have a view of whole city. Near this place a very nice garden “Samriti Van” is situated.

01. A For the **Lower Station**, the area adjoining the motorable road was found to be most suitable for the following advantages:-

- Easy approach as close to the Main Road
- It is near to the Hirni Mahadev Temple.
- Ample vehicle parking area available
- The station housing can be constructed easily.



ROPEWAY LOWER STATION LOCATATION

01. B **Upper Station location**, was found to be most suitable for the following advantages :-

- Wide flattish land available for Ropeway Station
- Free of any encumbrances
- Ample space for development of amenities
- A good aerial view of the surrounding can be obtained
- It is near to the temple

ROPEWAY UPPER STATION LOCATION

02. The soil condition of both the stations are good.

After survey of the alignment the route was finalized, as follows :-

Horizontal Length (M) : 800 (Approx.)
Level Difference (M) : 35 (Approx.)

The alignment is free from any encumbrance, as no house is there in the alignment.

ROPEWAY ALIGNMENT

LOCATION & COMMUNICATION

History

Bhilwara is most pioneer clean and green city of the Rajasthan.

According to substantiation the present Bhilwara city had a mint where coins known as 'BHILADI' were minted and from this denomination was derived the name of the district. Over the years it has emerged out as the small CITY of Rajasthan. Nowadays, Bhilwara is better known as the textile city in the country.

The oldest part of this town was set up in the middle of the 11th century by building a Shiva temple that still exists today and is known as the Bada Mandir or Jataun Ka Mandir. The area that is now known as Purana Bhilwara or Bhilwara Gaon (Patwari Mohalla, Junawas). As per another legend, the city of Bhilwara had a mint that minted coins known as “bhiladi”. This is supposedly the origin of the district’s name. There is also reference to Arjuna having fought here during the Mahabharata period. Historical records show that a town named Mandal close to Bhilwara served as the military base of the Mughals when they had attacked Chittaurgarh. The ruins of their campsite can still be seen today. A watch tower that was built on a small mound in Mandal is now a Devi temple. Total diameter of bhilwara is nearly 70km.

Tourist places

- **Harni Mahadev:** Founded by the ancestors of the Darak family, a Shivling lies under the mountain, built into a Shiva temple is 8 km from the city. It got the name Harni on the name of village near it, a nice place for people from the city for outing as it has hills around. On the occasion of Shiv Ratri a three-day fair is held here. At place the **Chamunda mata Mandir** is also situated on the hill from where one can have a view of whole city. Near this place a very nice garden "Samriti Van" is situated. Dadi dham temple is also there on the way.
- Badnore Fort This fort is situated at Asind road and distance is 70 km from Bhilwara.

- Pur Udan Chatri is near by Bhilwara about 10 km from Bhilwara city. The "Adhar Sheela Mahadev" where a huge rock is resting on a small one.
- The "Adhar Sheela Mahadev" where a huge rock is resting on a small one. This visiting place is situated at Pur, Bhilwara.

The Chamunda mata Mandir is also situated on the hill of Harni Mahadev from where one can have a view of whole city. This nice place is far 5 km from Bhilwara.

"Samriti Van" is very nice natural visiting place far 5 km from Bhilwara

Ramniwas Dham The city has famous Ramdwara of Ramsnehi Sampraday. The founder Guru of the sampraday was Swami Ramcharanji Maharaj, who preached his followers here later, he moved to Shahpura, 50 km from Bhilwara, where the present headquarters of Ram Snehi Sampraday known as Ram Niwas Dham is located.

Tilesva Mahadev MandirThis famous shiv temple is situated in Bijauliya tehsil. At this place a huge tank of water is exist infront of temple. The people assume that a lots of skin deases cured after taking bath in this "Kund". The Ganga mata statue is also situated in the center of this "Kund". Mandakini Mandir Bijauliya: This famous temple is situated in Bijauliya tehsil far 90 km from district HQ. There are three temples and one pond. The "Lkulish" statue at the entrance of main gate of this temple. On the main gate there are two statue of Parvati and Ganesh are situated. The temples are "Hajareshwar Mahadev" and "Undeshwar" also situated here.

Swaibhoj Temple: This temple is situated in Asind tehsil far 55 km from Bhilwara. It most famous religious place of "Gurjar" society. The place where this place is situated is called "Gosth Dadawat". A small pond is exist with the name of "Rathora Talab" or "Prem Sagar". The fair is held on "Bhadrapad Chhath" in a year.

Other tourist places in Bhilwara District

- Dhanop Mataji: This famous temple of "Maa Durga" is approximately 85 km away from Bhilwara in Shahpura tehsil.
- Shri Beed ke Balaji: This place is completely around by the nature. It is situated kanechhan village in shahpura tehsil.
- Shri Charbhujanath temple: This temple is situated at kotri tehsil 30 km far from Bhilwara city.
- Bagore Sahib is Sh. Guru Govind Singh Ji stayed here when he was on journey to Punjab. This historical Gurdwara is situated at a distance of 20 km from town Mandal in Village Bagore of Tehsil Mandal, District Bhilwara, Rajasthan. This holy place has been blessed by the visit of the Tenth Sikh Guru, Shri Guru Gobind Singh Ji.
- Battis Khambon ki Chhatri. This place is situated in Mandal far 16 km from Bhilwara city. It has chhatri made of sandstone with 32 pillars.
- Hameergarh Eco-Park: This Eco-park is situated at Hills of Hameergarh far 18 km from Bhilwara. The park is famous for "Chinkara". You can see Blue Bulls, Jackles, Foxes, Vultures and many other wild animals. The "Mansha Mahadev" famous Shiv Temple is situated here. · Meja Dam: The Meja dam is one of the biggest dam of Bhilwara and famous for green mount park. It is far 20 km from Bhilwara.
- Kyara ke Balaji has a natural image of Lord Hanuman. It is said that the image spontaneously appeared on the rock. Patola Mahadev Temple,Ghata Rani Temple, Beeda ke Mataji Temple and Neelkanth Mahadev Temple are nearby attractions situated on the beautiful hills of the Aravali mountain range.
- The Bhilwara Municipal Corporation is developing a tourist place at Gata Rani Mandir.

- The Madhav Gou Vigyan Anusandhan Kendra (Madhav Cow Science Research Centre), Village Gaadarmala (Pur) is a very popular Gousala.
- Mandal is around 16 km from Bhilwara city; it has the Battis Khambon ki Chhatri. As the name implies, this is a handsome chhatri made of sandstone with 32 pillars. Some of them have beautiful carving at the base and the upper portion. Within this chatri a huge Shivling is situated.
- Gayatri shakti peeth near roadways bus stand.
- Dhanop Mataji: 3 km away from sangariya village in shahpura tehsil.
- Shri Beed ke Balaji: 3 km away from kanechhan village in shahpura tehsil.
- Shri Charbhujanath temple: situated at kotri tehsil.
- Pt. Deendayal Upadhyay Smriti Van : Built in about 465 bighas. It is situated near Harni Mahadev Panchavati.
- Shivaji Garden : Situated at R.C. Vyas Colony

According to the folk mythology, when Arjuna was going to Dwarika with all Gopis during Mahabharata period, he passed through Bhilwara region. There was a war with the Arjunai temple.

Bhilwara's cultural history can be traced back to the Nagar Brahmins mentioned in the Skanda Purana. The city has famous Ramdwara of Ramsnehi Sampraday. The sampraday runs Ram Snehi Multispeciality hospital. The founder Guru of the sampraday was Swami Ramcharanji Maharaj, who preached his followers here later, he moved to Shahpura, 50 km from Bhilwara, where the present headquarters of Ram Snehi Sampraday known as Ram Niwas Dham is located.

Bhilwara is famous as "the city of textiles & looms" & it is one of the Manchester of India.

Road

National Highway No. 79, part of the Golden Quardrilateral (four lane), and another National Highway No. 76 part of the East West Corridor (four lane) passes through the district. The total length is 120 km.

National Highway No. 758 (Kota-Ladpura-Bhilwara-Gangapur-Rajsamand-Udaipur) passes through the district. The length of this highway is 146 km. and other NH 148D (Bhim-Gulabpura-Uniara).

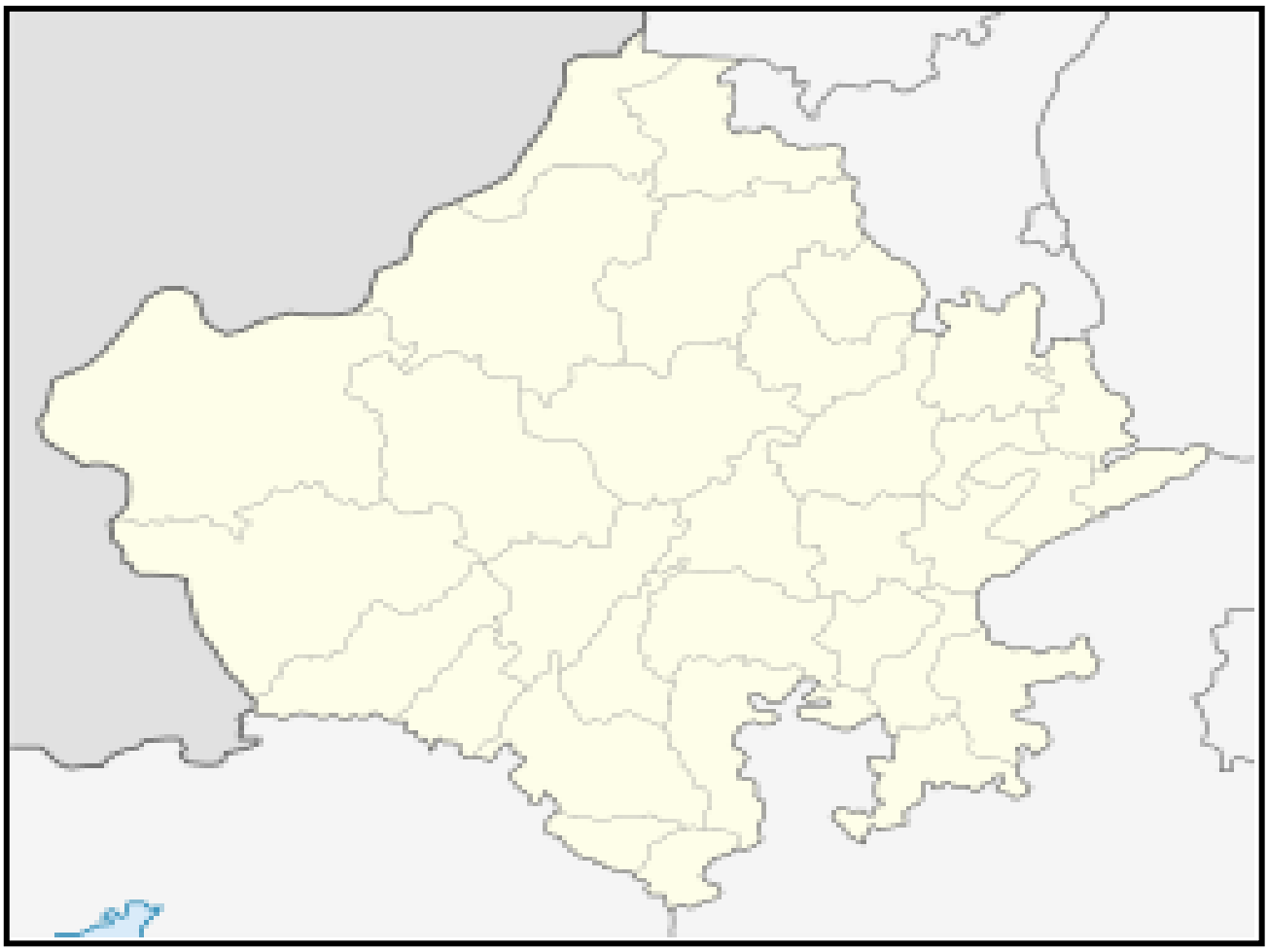
The total road length in the district was 3,883 km on 31 March 2000. With a government bus depot in the heart of the city, Bhilwara is connected to all the important cities of Rajasthan and other states. Many private service providers are available.

Rail

A broad gauge railway line connecting Ajmer, Jodhpur, Jaipur, Kota, Indore Junction, Ujjain, Delhi, Bharatpur, Agra, Gwalior, Lucknow, Kanpur, Allahabad, Patna, Kolkata, Chittorgarh, Udaipur City, Mavli Jn., Ratlam, Vadodara, Surat, Mumbai and Hyderabad passes through the district. Kota (160 km) is the convenient railway station to provide connectivity to the southern states of Karnataka, Andhra Pradesh, Tamil Nadu and Kerala.

Air

The nearest airport is at Udaipur (165 km) — approximately 2.5 hours, by road. The other nearest airport is at Jaipur (251 km) which takes about 4 hours by road. The nearest international airports are in Jaipur, New Delhi, Mumbai, and Ahmedabad.



BHILWARA CITY

CHAPTER – III
LAND DETAILS ALONG THE ALIGNMENT

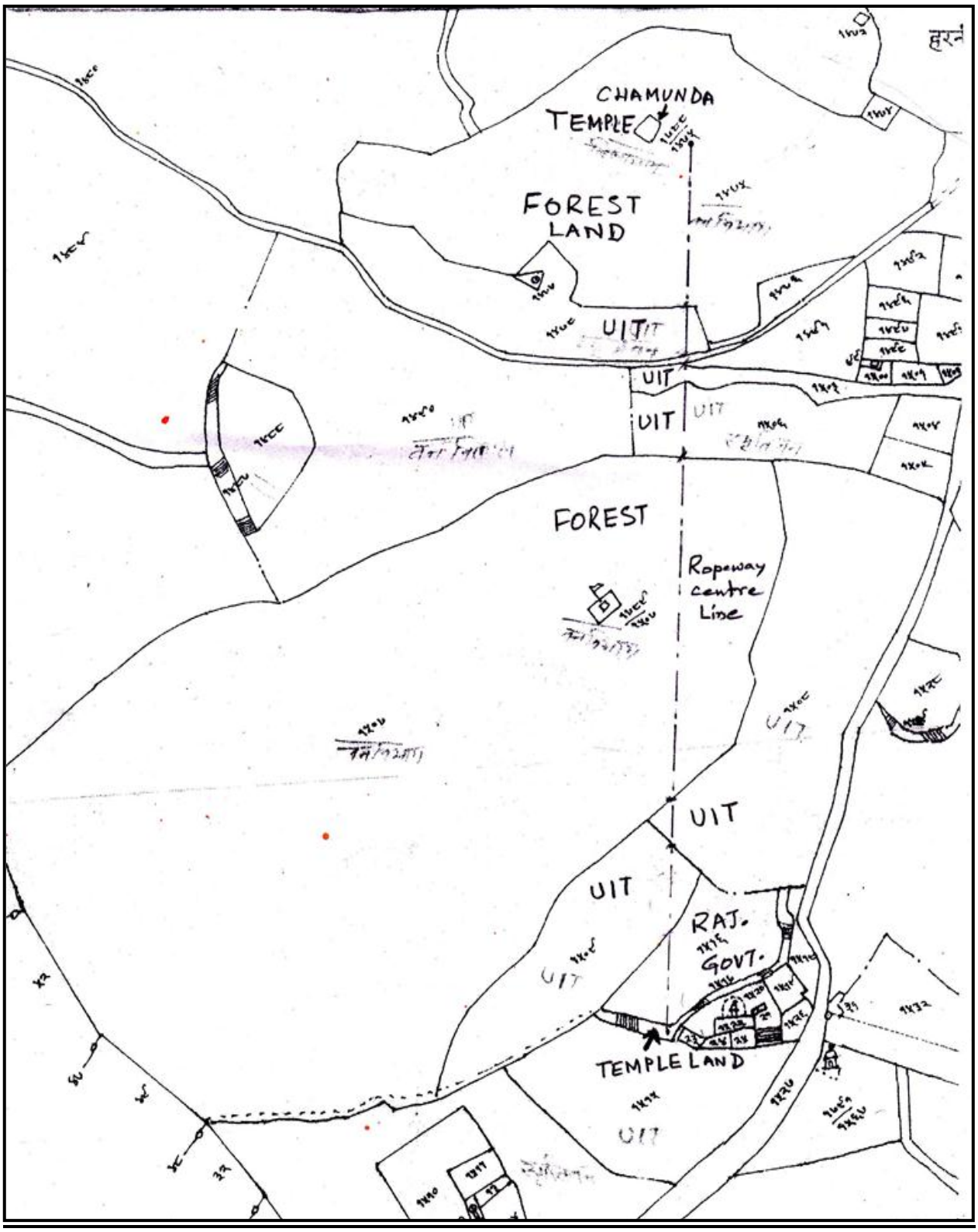
Location	Jurisdiction	Khasra No.	Area (l x B) (m^2)	Total area (m^2)
Chamunda Mata temple station	Forest	1475	30 x 15	450
Corridor	Forest	1475	139 x 10	1390
Corridor	UIT Bhilwara	1478	55 x 10	550
Corridor	UIT Bhilwara	1503, 1506	56 x 10	560
Corridor	Forest	1507	242 x 10	2420
Corridor	UIT Bhilwara	1508	96 x 10	960
Corridor	UIT Bhilwara	1509	47 x 10	470
Corridor / Hirni Mahadev Temple Station	Rajasthan Government	1516	92 x 10	920
Hirni Mahadev Temple Station	Hirni Mahadev Temple	1517	30 x 15	450
			Total	**8170**

AREA OF LAND REQUIRED FOR THE ROPEWAY PROJECT

Jurisdiction / Ownership	Khasra No.	(M^2)	Hect.
Forest Area	1475 & 1507	4260	0.430
UIT Area	1478,1503,1506,1508,1509	2540	0.254
Rajasthan Govt. Area	1516	920	0.092
Hirni Mahadev Temple Area	1517	450	0.045

NOTE : AREA FOR THE PASSENGER AMENITIES, VEHICLE PARKING, ETC TO BE CONSIDERED SEPERATELY.

ROPEWAY ALIGNMENT ON KHASRA MAP



CHAPTER – IV

OBJECTIVE & IMPORTANCE

01. Basic objective of the proposed installation is to provide a facility for the visitors / pilgrims to reach the Chamunda Mata Temple which is located on the hill top from the Hirni Mahadev Temple easily, safely and quickly.

02. To provide a means of entertainment to the visitors / pilgrims in enjoying bird's eye view of the surrounding greeneries.

03. Being an unusual means of transportation, the system shall have immense attraction, Firstly people generally love to be airborne. Secondly during travel, a panoramic view of the hill and surroundings can be enjoyed as well as an attractive mode for transiting from base to the hill top.

04. The Installation shall also serve as one of the glittering recreational facility, which can be enjoyed by kids and old alike.

05. The Ropeway project will facilitate the Municipal Corporation council for generating added revenue.

06. Being a new innovative technology, it will help in attracting a good amount of crowd to the Location.

CHAPTER V

SELECTION OF ROPEWAY SYSTEM

There are various types of Ropeway Systems as described below :-

CHAIR LIFT SYSTEM

This system is widely used in hilly areas. In the winter resorts, all over the world, one can find a number of them. Their capacity range between 50 to 1200 passengers per hour.

It is a monocable endless system. One continuously circulating rope serves the dual purpose of supporting as well as hauling the chairs clamped to the moving rope at specific intervals.
In between the terminals, the rope is supported on sheaves mounted on towers.

The most common on Chair Lift system are the Twin Seater Chair Cars. With more modern developments, Chair Lifts with cars for 3, 4, or 6 passengers have also come in use. They normally have detachable type Grip, whereas the ones with twin passenger chairs have mostly Fixed type Grips.

Advantages

- Continuous transportation of passengers.
- Low Capital Cost.
- Simple in construction.
- Low operation and maintenance cost.
- Flexibility in the system design, i.e. system can start with a low transport capacity vis-à-vis less investment and then expanding the capacity with growth of demand.

Disadvantages

- For Fixed Grip type system, boarding / deboarding operation is carried out while the carriers are on motion which calls for low speed and consequently long travel time. For detachable type Grip, although speed can be made faster, but cost would go up.
- Fixed Grip type carriers normally cannot negotiate any deviation en-route, i.e. Angle Station. For negotiating angles, Detachable type grip is required.
- Maintenance of large number of Towers and Carriers.
- Large Spans between the towers are prohibited.
- System is more sensitive to high wind.

MONOCABLE GONDOLA SYSTEM

For aerial passenger transportation, this system has the widest use in the world both in flat and hilly terrain.

One can see them in Disneyland, all over the Alpine Region and also other parts of world.

The maximum capacity achieved in this system is in the region of 2500 PPH. Its flexibility to adapt length, terrain conditions and capacity normally gives it preference while making a choice.

In this system, a single endless continuously moving rope supported on intermediate tower rollers carry the Gondola Cabins, spaced at equal intervals.

The cabins are fully enclosed as shown in the illustration, and because of this fact, the passengers inside, feel quite comfortable, even if the cabin travels at a considerable height from the ground profile.

The recent development have come up with 12 passenger Cabins, most suitable for high capacity. The Gondola Cabins have Detachable type Grips.

Although, the latest version of the cabins are very sophisticated type being completely enclosed, but the ones which were earlier in use had the upper half of the cabin exposed having only a canopy type of protection overhead.

Advantages

- High transport capacity.
- Comfortable boarding / deboarding operation.
- Adjusting speed and number of cabins as per demand.
- Comfortable ride. Passengers within cabin feel secured.
- Low ground clearance not required. Hence less number of towers and towers mechanicals.
- A moderately high speed possible.

Disadvantages

- High capital investment.
- High operation and maintenance cost.
- Maintenance of large number of cabins and towers.
- System more sensitive to high wind.
- Large span between Towers are prohibitive.

BICABLE GONDOLA SYSTEM

There are a number of Bicable Gondola system in operation for transportation of passenger all over the world. But like Monocable Gondola, their use is not that widespread. They only have an advantage over the Monocable Gondola System where the profile justify exceptionally large span, as in case of Monocable System for long span under maximum loaded condition, the sag becomes excessive.

In Bicable system, there are tensioned stationary Track Ropes both on the outward and inward journey sides, and a second endless rope attached to each cabin at equal intervals, when driven, carry the Gondola Cabins along the alignment in inward and out ward directions. The Bicable Gondola System, because of special locked coil type track ropes are more complicated carriages are always more expensive than the Monocable Gondola and Chair car System.

Advantages

- Large single spans are possible.
- Comfortable boarding / deboarding operation.
- High transport capacity and speed.
- Low operation and maintenance cost since less number of moving parts.
- System less sensitive to high wind.
- Rescue operation is easier.

Disadvantages

- Very high capital investment.
- Limited possibility of capacity expansion.
- System being sophisticated, requires qualified operation and maintenance staff.

JIG BACK TYPE BICABLE TRAMWAY

For Aerial passenger transportation in large capacity, this system also has a wide use in the world, particularly, in hilly terrain. Alpine Region is full of such type of Tramways. These Tramways can negotiate very high speed. The maximum achieved so far is 12M /sec and the most modern Tramway in the Jig back system has a capacity of 160 passengers, in a single cabin.

In hilly areas for negotiating large valleys, this is the ideal system as it can comfortably negotiate a span of more than 1.0 KM. There are a lot of installations, where, but this system, nothing would have been feasible.

In the Jig back system, 2 tensioned track ropes support the cars which are hauled by a separate rope fixed to the cabin.

Such installations in India could be seen in Mussourie, Nainital and Joshimath.

Advantages

- High Transport capacity.
- Very high speed compared to other system possible.
- Can negotiate extra large span.
- System not much sensitive to high wind.

Disadvantages

- High capital investment, highest of all systems.
- System very sophisticated and requires qualified personnel for operation and maintenance.
- Capacity limited and can not be expanded.

JIGBACK MONOCABLE SYSTEM

System is similar to Bicable Jig back but the difference is one endless haulage rope serves the dual purpose of carrying as well as hauling the cabin. Two or a group of Cabins are firmly attached to the rope, one at each terminal station but in opposite direction.

On driving, while the No. 1 shall proceed to the other station, No. 2 at the opposite end shall progress to the former station. Upon arrival at respective station, drive is reversed and the cabins change places.

Advantages

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

Disadvantages

- Low transport capacity.
- Limitation in capacity expansion.

FUNITEL / DMC (DOUBLE ROPE MONOCABLE) TYPE ROPEWAY

This is the latest system developed for aerial passenger transportation in large capacity (6000 PPH) and a number of such systems have already come up in Alpine region in Europe and also in Rocky Mountain in USA. In this system, large capacity carriers (25 passengers) are supported on 2 numbers ropes, which serve for the dual purpose of supporting and hauling. The carriers are attached to the twin rope by Detachable type grip.

Two endless continuously moving ropes supported on intermediate tower rollers carry the cabins spaced at equal intervals.

The Grips and cabins in this system are of real sophisticated type, and only serve for high capacities in hilly terrain.

Advantages

- Very high transport capacity.
- Flexibility of expanding capacity with the demand.
- Comfortable boarding / deboarding and ride.
- Low ground clearance not required.
- Cheaper than Bicable Tramway

Disadvantage

- High capital investment.
- High operation and maintenance cost.
- Sophisticated system – requires very skilled personnel for Operation and Maintenance

CHAPTER VI

THE PROPOSED ROPEWAY

For the proposed Ropeway between Hirni Mahadev Temple and Chamunda Mata Temple, a **MONOCABLE JIGBACK SYSTEM** is recommended.

The recommendation is based on the following factor:-

1. Length of the Ropeway is shortest.
2. Capacity requirement is easily met by a Jig back system.
3. The system is economic as compared to other systems.
4. Operating and Maintenance cost is less as compared to other systems.
5. Ground terrain is suitable for Monocable Jigback System.
6. Safe and secured travel. Passenger shall feel comfortable sitting in the cabins.
7. System is very flexible. Capacity enhancement / reduction can be done very easily.
8. As the cabins shall travel high above the ground, the passengers can have a good view around, which will make the ride enjoyable.
9. Jig – back System offers Comfortable boarding / deboarding operation. As the cabin will be brought to a halt at the terminals, it will be easier for the passengers, particularly aged people and kids, for boarding and deboarding.

CAPACITY DETERMINATION

It has been observed that in normal days about 500 pilgrims visit the temple in the whole day.

This was discussed with the client and as desired by the Client, it has been worked out that the Ropeway will be having maximum inbuilt capacity of **120 PPH (Passenger per Hour) per direction**, which will meet their requirement.

CHAPTER VII

SYSTEM DESCRIPTION

1.0 THE SYSTEM

1.1 Monocable Jig-back System as envisaged for the proposed Ropeway shall comprise of the following major items:-

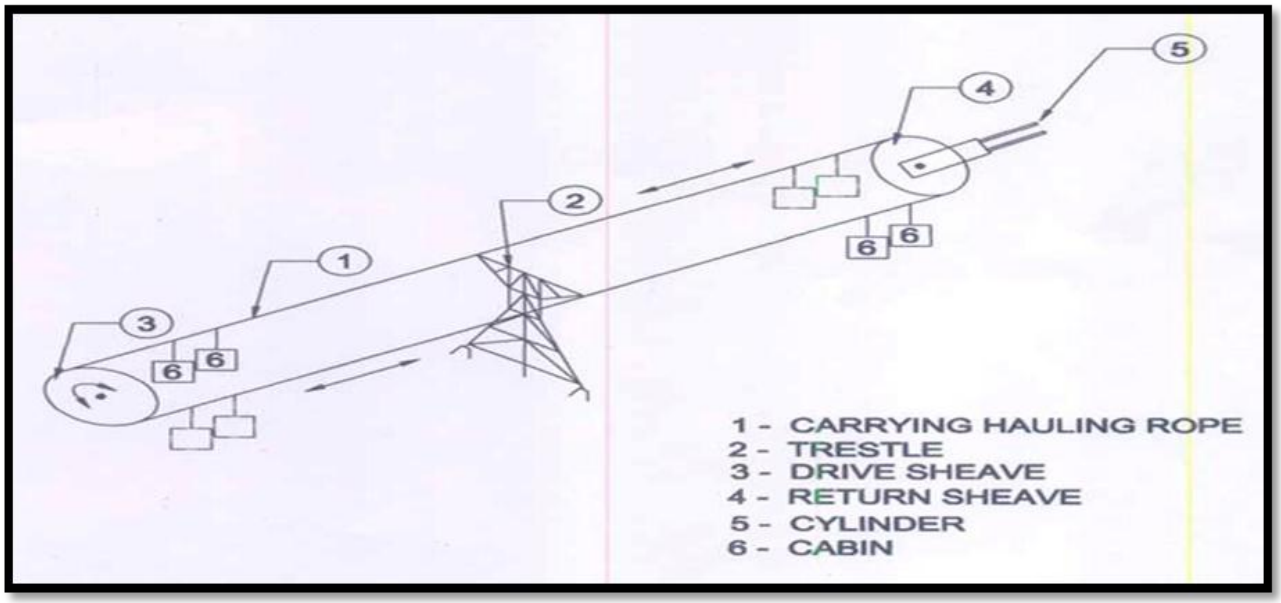
a. 1(one) no. endless haulage rope, driven by electric power through Sheaves at one end and tensioned at the other end by hydraulics.

b. Required quantity of Passenger Cabins complete with suspender and grip.

c. Ropeway drive arrangement located at lower station complete with Drive Sheave, Motor, Gearbox, Open gear & Pinion, Emergency and Service Brakes, Coupling etc.

d. Terminal stations complete with required Plant & Equipment and Structures.

e. Intermediate support tower complete with mechanicals.



1.2 OPERATION OF THE PROPOSED SYSTEM SHALL BE AS FOLLOWS:-

In this system, an endless rope, which serves the dual purpose of supporting and hauling the cabins, moves on intermediate towers equipped with mounts and line rollers.

While traveling along the line, the cabins remain firmly gripped to the moving rope and their passage being entirely automatic, requires no attention or operative labour on the line.

Along the alignment, under worst condition of sag and wind velocity, minimum clearance to the underside of the cabin and sufficient clearance to tower structures, respectively, will be maintained as per the provision of IS Code and Practice.

1.3 TRANSPORT CAPACITY

The Ropeway should be designed for a maximum capacity of 120 Passenger Per Hour.

1.4 CABIN & CARRIAGE

The proposed installation should have multiple Cabins each having a seating capacity of 6 passengers. The cabin shall be fully enclosed with transparent cover at the top portion for viewing. The maximum transport capacity to be 120 PPH at maximum travel speed.

The Cabins will be suspended from Rope by means of a carriage and hanger. Hanger should be attached to the carriage in such a way that whatever be the slope of the track, the cabin should always remain in plumb position.

1.5 LINE SPEED

A maximum speed of 3.5 M per second has been envisaged.

1.6 ROPEWAY DRIVE

For driving the Ropeway, Frequency controlled AC Motor is recommended. The unit to have a Micro Processor based VVVF controller for step less speed control.

1.7 STAND –BY DRIVE ARRANGEMENT

A suitably rated Diesel Engine coupled to the Main Drive through a clutch system shall be provided. The engine shall be operated at a slow speed to bring the cabins to the respective stations in the event of power failure. Operation to be also possible with the Diesel Engine Drive, but at a lower capacity. Normal operation shall be resumed after resumption of electric power.

1.8 SYSTEM CONTROL

The Ropeway shall be operated through variable voltage variable Frequency Controller. Acceleration, deceleration and stoppage shall be controlled. In the event of over speeding, Dynamic Braking shall automatically be energized to prevent the system speeding up.

1.9 ROPES

Haulage rope shall be stranded low elongation **STEEL WIRE ROPE WITH PP MAIN CORE.**

2.0 ROPEWAY CLEARANCE

The profile design of the Ropeway System should take into consideration minimum statutory clearance from the ground, permanent structures, roads, power / telephone line crossing as stipulated in Indian / International codes and standards.

2.1 TERMINAL STATIONS

LOWER TERMINAL STATION

The lower Terminal Station shall be a Ground Level Structure. Speed of an incoming cabins group on approaching the station, shall be automatically retarded and the cabins shall come to a dead halt at a pre-determined area. After deboarding of the passengers, who will arrive from Upper Terminal and boarding of new passengers waiting in the queue, the station attendant shall communicate to the Drive Operator. On receipt of similar communication from the Upper Terminal attendant, the drive operator shall start the drive. Cabins shall proceed to the Upper Terminal.

Ropeway tensioning devices shall be provided at this terminal to exert required tension to the Rope. However, it may be decided at the final stage of Design.

UPPER TERMINAL STATION

The Upper Terminal Station may be a ground level structure. Operation at this station shall be similar as described for Lower Terminal.

Ropeway drive shall be located at this Terminal. However, it may be decided at the final stage of Design.

2.2 ELECTRICALS

Power, requirement for the Ropeway installation inclusive of lighting should be kept at 100 KW approximately.

2.3 COMMUNICATION

Communication between terminal stations should be through telephone and public address system, as well.

2.4 LAND REQUIREMENT

Land requirement for the Plant shall be Ropeway Route alignment including land for intermediate trestles: 800 M Long x 10 M wide. Chamunda Temple Station Technical Area : 20 M x 15 M. Hirni Mahadev Station Technical Area : 20 M x 15 M

CHAPTER – VIII

DESIGN PARAMETERS AND SPECIFICATIONS

01. WORKING DATA

01.	Type of Ropeway	:	Monocable Jig Back System
02.	Length of Ropeway	:	800 meters approx.
03.	Level difference between terminals	:	35 meters approx.
04.	Cabin capacity	:	6 passengers
05.	No. of Cabin	:	2 + 2
06.	Capacity of Ropeway	:	120 Passenger Per Hour (PPH) (approx) each way at full speed
07.	Speed of Ropeway	:	0 - 3.5 meter / sec. Maximum
08.	Gauge of line	:	4.0 M
09.	Motor rating	:	55 KW
10.	Power supply	:	415V ± 10%, 3 Phase, 50 Hz.± 3%
11.	Number of towers	:	9
12.	Type of towers	:	Latticed construction
13.	Type of Grip	:	Fixed Grip.
14.	Rope	:	34 mm dia, 6 /19 or 17 S
NOTE:	**PARAMETERS PROVIDED ARE SUBJECT TO MINOR VARIATION AFTER FINAL DESIGN.**		

02. SPECIFICATION

01.	GENERAL	
	All design, manufacture, construction shall conform to the latest issue of National Codes & Standards and OITAF recommendation.	
02.	DRIVING GEAR	
	One set of driving unit to be of modern design and construction comprising of:-	
	a.	Heavy main drive sheave of approx. 4.0 M dia of MS fabricated construction with special aluminum liner.
	b.	Alloy steel driving sheave shaft provided with heavy roller bearing mountings.
	c.	Open ring gear with machine cut teeth and steel shafting, running in heavy ball or roller bearing mountings.
	d.	Special enclosed high speed Reduction Gear with machine cut teeth and steel shafting, running in heavy ball or roller bearings mounting.
	e.	One set Hydraulic Disc Brake mounted on drive sheave disc.
	f.	One set of Electro Hydraulic Thrustor Brake on Motor Coupling.
	g.	One set of jaw clutch with manually operated lever for engagement with Diesel Engine, coupled with manually operated Brake.
	h.	Main drive motor with power feed and control device.
	i.	Suitable rated Diesel Engine for auxiliary drive of the plant in the event of failure of the electrical systems.

03.	TENSION GEAR Hydraulically operated Tension Unit with Twin Cylinders complete with acceptable capacity Power pack.
04.	TRESTLE MOUNTS Necessary pair, quadruple, hexa or octa mounts consisting of special wheels with Synthetic rubber liners of suitable diameter fitted with grease packed ball bearings. The wheels shall be supported on built up steel beams which, in turn, shall be pivotally mounted on a special pedestal.
05.	STATION MOUNTINGS All necessary mounts and single wheels fitted with ball bearings for use on the stations, mounted with rubber / nylon tyres.
06.	CABIN Cabins shall be of moulded fibre glass construction. Cabins shall be fully covered and weather protected. Top portion of the cabin shall be fitted with transparent sheets for viewing.
07.	CABIN HANGER Cabin hanger shall be made of rolled steel sections carefully welded by jigs and fixtures to avoid distortion. The cabin shall be suspended from the hanger through hinged, rubber padded supports, so that it remain always in plumb position.
08.	GRIP Grip mechanism of cabin shall guarantee proper rope gripping under most unfavourable combinations of circumstances during Ropeway operations. Clamping pressure of grip onto rope shall resist sliding motion due to spring pressure and self-weight of cabin on maximum slope with factor of safety as per National / OITAF Code. Each grip shall be equipped with twin jaw for rope clamping.
09.	WIRE ROPE Rope selection is based on accepted norms of Ropeway

	engineering practice, available standards, manufacturer's code of practice and our experience in designing similar Passenger Ropeway. Rope shall be of 6 x 17 / 19 construction, Polypropylene core, 1770 N/Sq.mm tensile designation.	
10.	AUXILIARY DRIVE To operate the drive at slow speed in case of failure of the main power supply or any defect in the Drive motor, a Diesel Engine Drive Unit should be provided. The engine is envisaged to operate the system in condition like power failure etc. It will be adequately powered to operate the Ropeway under normal condition also. The engine shall be of reputed make and shall be fitted with gearbox, clutch, accelerator, brake mechanism, fuel tank , guages etc. as required.	
11.	STEEL WORK All steel work should be made of rolled steel section, bolted or welded. Fabrication shall be in accordance with latest Indian Standards. Structure shall include all support, bracing, service platform, ladders etc., wherever necessary. Steelwork, to be sand blasted and provided with 1 coat of Epoxy primer and a final coat of enamel painting. Tower steelwork will be galvanized.	
12.	ELECTRICALS The Purchaser will supply power at 415V to the Plant MCC. The total electrical system should comprise of:-	
	a.	Air circuit breakers of adequate rating complete with all protections for incoming supply.
	b.	Motor control centre at upper terminal station for drive and auxilliaries.
	c.	Control desk at the upper terminal station.
	d.	Necessary electric motors of adequate rating suitable for 415V, 3 phase, 50 Hz. power supply.

	e.	Frequency controller unit of reputed make for stepless speed control of the system fitted with digital display unit indicating amperage, frequency, motor rpm etc. Control is PC based and can be pre-programmed for the required operation.
	f.	Suitable rated diesel generating set of reputed make complete with fuel tank, gauges, power control unit and a change over switching..
	g.	Local push button stations for emergency stoppages.
	h.	PVC insulated, PVC seathed, armoured, aluminium conductor power cables and copper conductor multicore control cables.
	i.	Earthing equipments.
	j.	Safety Switches.
13.	CIVIL WORK Civil work should conform respective Indian Standards. Grade of concrete to be M15 or M20 nominal. Only HYSD bars should be used as reinforcement. Ingredients should be mixed by mechanical mixer in volumetric proportion only. Locally available sand and aggregates to be used	
14.	PAINTING All equipments and structures should be supplied with double coat of red oxide primar followed by a coat of Synthetic enamel paint.	
15.	TELECOMMUNICATION Suitable communication system between Upper and Lower Terminal to be provided.	

CHAPTER – IX

LIST OF PLANT & EQUIPMENT

Notwithstanding the equipment listed hereunder, all required Plant & Equipment for smooth and trouble-free operation of the plant. Specifications provided are tentative and subject to changes after final design on award of the work.

01.	Rope	:	34 mm dia 6X19 or 17 seale construction, 1770 N/mm^2 tensile strength with PP main core, - Length as required.
02.	Intermediate trestle complete with cathead and ladder of steelwork construction	:	As required
03.	Rope supporting trestle mounts comprising of rubber lined sheaves, their support beams and pedestals	:	2 sets per trestle
04.	Upper Terminal Station complete with required mechanical equipments and support structures of steelwork construction	:	1 set.
05.	Lower Terminal complete with required mechanical equipments and support structures of steelwork construction	:	1 set
06.	Rope Driving Gear comprising of aluminium lined Bull Wheel, Ring Gear & Pinion, enclosed Gear Unit, Couplings, Electro-Hydraulic Thrustor operated Service Brake, Emergency Brake etc., all mounted on a compact and robust steel base frame	:	1 set
07.	Diesel Engine driven Emergency Drive System complete with Engine, Gearbox, Clutch, Brake etc.	:	1 set

08.	Ropeway hydraulic tensioning equipment comprising of return sheave, hydraulic cylinders, power pack, counter weight and all piping work etc.	:	1 set
09.	Passenger Cabins complete with hanger and detachable grips	:	4 sets
10.	Tele-communication equipment comprising of telephone, and transmission wires	:	Lot as required
11.	Electricals and Control Unit with Cables, Safety Switches etc.	:	Lot

CHAPTER – X
SAFETY PROVISION

1. General safety provisions shall be in accordance with the stipulation laid in Indian Codes / International Standards.

2. Operational safety shall be ensured by providing protection against over speeding of Cabins and against reversal of rotation. Operational safety shall also be ensured against availability of service and emergency brake suitably interlocked. In case of Power failure, the emergency brake shall automatically be active and stop the Drive.

3. Line safety shall be ensured by providing suitable rope gauge with a view to having adequate clearance between Chairs while crossing each other during normal wind condition.

4. Line safety shall further be ensured by providing a “Rope Catcher” and “Rope Guard” which will arrest the rope in the event of any accidental occurrence of rope coming out of Line Rollers and at the same time trip the drive.

5. Electrical protection shall be provided by way of Thermal Overload Relay, Under Voltage Relay, Single Phasing Preventer, HRC Fuse, Earthing / Grounding of equipments etc.

6. Independent drive system is there through diesel engine, which can be operated at slow speed, once there is power failure / motor failure.

CHAPTER – XI

OPERATION AND MAINTENANCE COST

01. Manpower

a. The manpower requirement envisaged shall be for the purpose of supervision, operation, preventive and breakdown maintenance, ticketing and administrative services.

b. For satisfactory operation and maintenance of the Ropeway, the manpower placements are given below. The deployment is based on 8 (eight) hours working a day.

Administrative Staff

* Ropeway – in – charge	: 1
* Commercial Assistant – cum – Store Keeper	: 1
* Security Guard	: 2

At Lower Station

* Station Attendant	: 1
* Maintenance Supervisor	: 2

At Upper Station

* Station Attendant	: 1
* Drive Operator – cum – Electrician	: 1

Note : the above staff is base staff requirement and does not include leave reserve and rest givers for which separate provision included in the cost.

c. Total cost of the above Operation & maintenance Staff are given below:-

Heads		Salary/ Month/ person (Rs.)	No.	Total Salary (Rs.)
Ropeway – In – Charge	:	45,000.00	1	**45,000.00**
Commercial Asst.	:	10,000.00	1	**10,000.00**
Electrical Operator	:	12,000.00	1	**12,000.00**
Maintenance Supervisor	:	15,000.00	2	**30,000.00**
Station Attendant	:	6,000.00	2	**12,000.00**
Security Guard	:	3,500.00	2	**7,000.00**
		Sub Total		**116,000.00**
Add Benefit @ 33%				**39,000.00**
Add 15 % for leave and rest giver				**23,500.00**
Total Monthly Salary				**1,78,500.00 say 1,79,000.00**
Yearly, Salary				**21,48,000.00**

02. Spares and Consumables

It is assumed that annual cost of spares, replacement, lubricants, paintings, etc shall be Rs. 5.00 Lakhs. Per annum

03. Cost of Power

Power charges per unit of electrical energy consumed are estimated to be Rs. 5.00. Assuming daily average running of 8 (eight) hours and a utilization factor of 0.8, annual cost of power = 8 x 330 x .8 x 5 x 55 = 5.80 Lakhs. Add cost of Diesel fuel Rs.1.20 Lakhs.

04. Hence total annual cost of operation and maintenance shall be Rs. 21.48 + 5.00 + 5.80 + 1.20 = 33.48 Lakhs say 34.00 lakhs

Note : Capital Equipment, such as, rope, gearbox, etc replacement, has not been considered in above.

CHAPTER – XII

COST ESTIMATE

CAPITAL INVESTMENT COST

Basis of Estimate		
Estimates are based on the design and technical specification of the Plant described in this Report and also shown in relevant drawings annexed hereto.		
Prices of Standard items like Wire Ropes, Motors, Gearbox, Electrical and Cables, Telecommunication and Signaling items etc. have been based on the offers received from reputed manufacturers prevailing as on date. *No Excise Duty and Sales Tax have been considered in the prices.*		
Steel prices have been considered as per Steel Authority of India announcement prevailing as on date.		
Civil construction cost has been estimated on the basis of prevailing local rates as on date.		
Based on the considerations enumerated in estimated construction cost of the installation are :		
Ropeway Installation		
Total price for Design, Engineering, Manufacture, Supply, Erection, Testing and Commissioning of a 120 PPH capacity Jig back Passenger Ropeway system, explained in previous chapters. Excluding the cost of the land and Taxes and duties, levies etc.	**:**	**Rs. 6,10,00,000.00 (Rupees six crores ten lakhs only)**

Cost break up :-

Sl. No.	Particulars		Price (Rs.)
1.	Supply of Engineering Drawing & Design	:	50,00,000.00
2.	Supply of Plant & Equipment, Structural items & Electrical Items Comprising of a. Drive unit b. Rope c. Cabins with hanger and grip d. Tensioning unit e. Drive and Return sheaves f. Tower Mounts and mechanicals	:	3,81,00,000.00
2a.	Supply of Structural items Comprising of a. Station structurals b. Tower structure c. Housing		
2b.	Supply of Electrical Items Comprising of a. Cables b. Drive c. MCC & Control Desk d. Earthings e. LA		
5.	Execution of Civil Work Comprising of a. Drive foundation b. Station foundation c. Tower foundation d. Tensioning foundation e. Control room	:	1,15,00,000.00
6.	Erection & Commissioning	:	49,00,000.00
7.	Transportation, insurances, etc	:	15,00,000.00
	Total	**:**	**6,10,00,000.00**

Excluding the cost of the land and Taxes and duties, levies etc.

CHAPTER – XIII

CASH FLOW

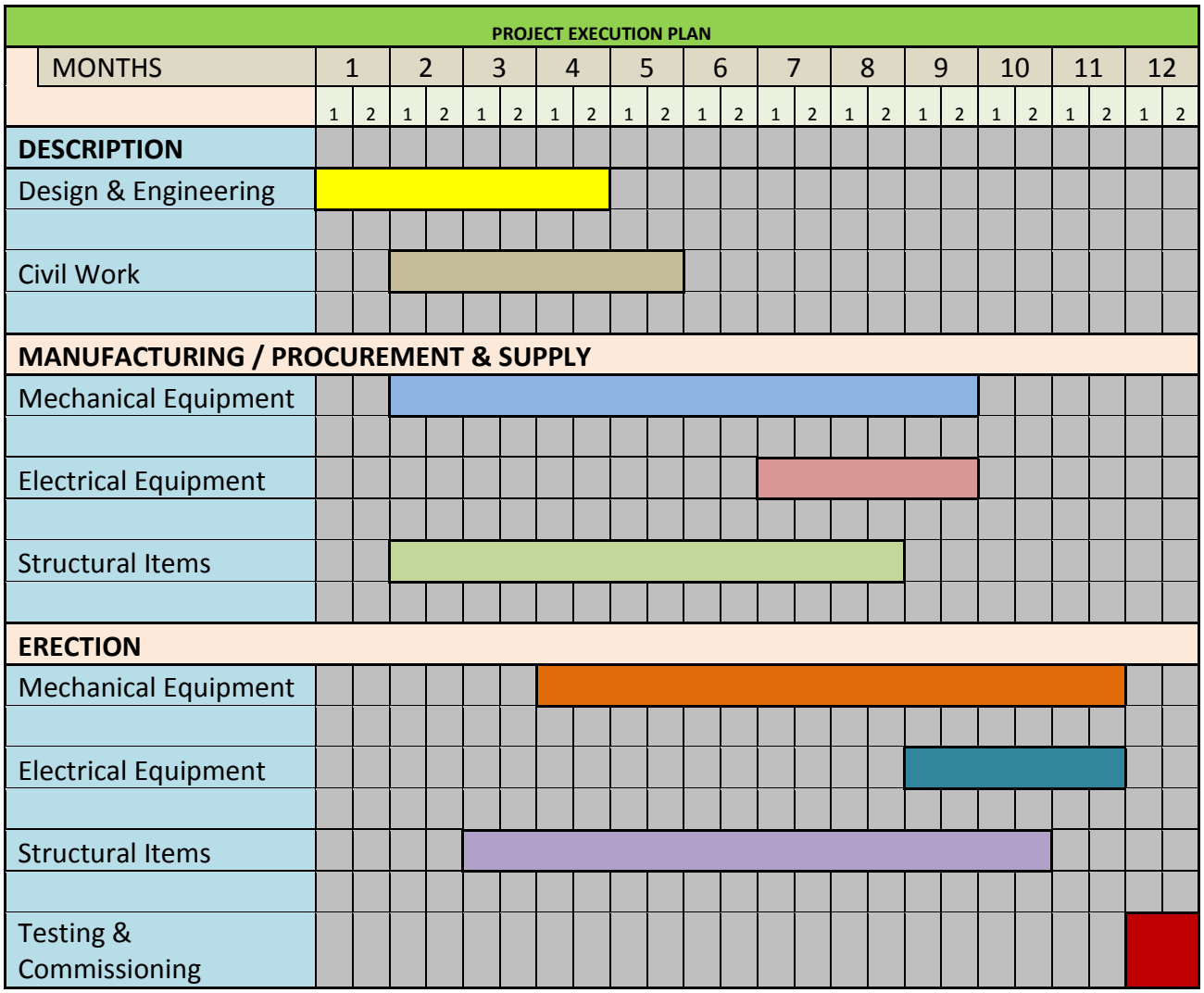
PROJECTED CASH FLOW FOR ROPEWAY PROJECT						
		1st Year	2nd Year	3rd Year	4th Year	5th Year
Annual Traffic		100,000.00	110,000.00	121,000.00	133,100.00	146,410.00
Tariff		60.00	65.00	70.00	75.00	80.00
Income from Operation		6,000,000.00	7,150,000.00	8,470,000.00	9,982,500.00	11,712,800.00
Total Income		**6,000,000.00**	**7,150,000.00**	**8,470,000.00**	**9,982,500.00**	**11,712,800.00**
EXPENDITURES						
Project Total Cost	61,000,000.00					
Power & fuel		700,000.00	770,000.00	847,000.00	931,700.00	1,024,870.00
Salaries at site.		2,148,000.00	2,309,100.00	2,482,282.50	2,668,453.69	2,868,587.71
Insurance		200,000.00	220,000.00	242,000.00	266,200.00	292,820.00
Repair & Maintenance		500,000.00	530,000.00	561,800.00	595,508.00	631,238.48
Site Expences		900,000.00	990,000.00	1,089,000.00	1,197,900.00	1,317,690.00
Miscellaneous Expences		300,000.00	357,500.00	423,500.00	499,125.00	585,640.00
Depreciation (SLM)		2,440,000.00	2,440,000.00	2,440,000.00	2,440,000.00	2,440,000.00
Annual Inspection		300,000.00	330,000.00	363,000.00	399,300.00	439,230.00
Capital / Rope replacement					1,600,000.00	
Sub Total	**61,000,000.00**	**7,488,000.00**	**7,946,600.00**	**8,448,582.50**	**10,598,186.69**	**9,600,076.19**
Profit before IT		(1,488,000.00)	(796,600.00)	21,417.50	(615,686.69)	2,112,723.81
Provision for IT		-	-	7,209.13	-	711,142.83
Net profit		**(1,488,000.00)**	**(796,600.00)**	**14,208.37**	**(615,686.69)**	**1,401,580.97**
Depreciation add. Back.		2,440,000.00	2,440,000.00	2,440,000.00	2,440,000.00	2,440,000.00
Cash accruals		952,000.00	1,643,400.00	2,461,417.50	1,824,313.31	3,841,580.97
Opening Balance		-	952,000.00	2,595,400.00	5,056,817.50	6,881,130.81
Net Amount		952,000.00	2,595,400.00	5,056,817.50	6,881,130.81	10,722,711.79
Closing Balance		**952,000.00**	**2,595,400.00**	**5,056,817.50**	**6,881,130.81**	**10,722,711.79**

Considerations :-

a. Entire project is funded by Government
b. 1st year total traffic flow : 1,00,000 increment @ 10 % every year
c. 1st year ticket fare : Rs. 60 per head increment @ 10 % every year
d. Royalty to the authority, not considered
e. Capital / Rope replacement cost considered after every 4 year
f. All Expenses increasing @ 10 % every year, except Repair & maintenance increasing @ 6% every year.

CHAPTER – XIV

PROJECT EXECUTION PLAN



NOTE : THE ROPEWAY INSTALLATION PROJECT SHALL BE COMPLETED WITHIN 12 WORKING MONTHS TO BE RECKONED FROM THE DATE OF RECEIPT OF ALL APPLICABLE PERMITS / NO OBJECTION CERTIFICATES ETC. AND PHYSICAL POSSESSION OF SITE, AND RECEIPT OF ADVANCE.

CHAPTER –XV

CONCLUSION & RECOMMENDATIONS

From the contents in previous Chapters, it may be concluded that:-

1.	The best suited proposed Passenger Ropeway installation is **"MONOCABLE JIGBACK SYSTEM."**
2.	The proposed Passenger Ropeway installation is **technically viable**.
3.	The proposed Passenger Ropeway installation is **commercially viable,** if government funded.
4.	The proposed Passenger Ropeway installation will **boost tourism** in the state.
5.	The proposed Passenger Ropeway installation shall help the promoters to enable the visitors / pilgrims to **reach from one temple to the other quickly, and safely**.
6.	The proposed Passenger Ropeway installation is **Eco friendly** means of transportation.
7.	The proposed Passenger Ropeway installation shall help in **generating direct and indirect employment.**
8.	The proposed Passenger Ropeway installation is **economic and easy to Operate and Maintain.**

CHAPTER –XII
LIST OF NOCs REQUIRED FOR THE PROJECT

1. FROM THE LOCAL ADMINISTRATION (DISTRICT COLLECTOR).
2. FROM THE STATE FOREST DEPARTMENT.
3. FROM UIT BHILWARA.
4. FROM HIRNI MAHADEV TEMPLE AUTHORITY.
5. FROM THE PWD DEPARTMENT.
6. FROM THE STATE ENVIRONMENT DEPARTMENT.

Annexure - 1
CODES & STANDARDS

All work shall generally conform to the requirements of the latest revisions and / or replacements of the following or any other relevant Indian Standard specifications and codes of practice.

IS : 210	:	Grey Iron Casting
IS : 226	:	Structural Steel (Standard Quality)
IS : 269	:	Ordinary and low heat Portland cement
IS : 277	:	Galvanized steel sheets (Plain and corrugated)
IS : 325	:	Three- phase induction motor
IS : 383	:	Coarse and fine aggregates from natural sources for concrete
IS : 432 (Part- I)	:	Mild Steel and medium tensile steel bars and hard – drawn steel wire for concrete reinforcement
IS : 456	:	Code of practice for plain and reinforced concrete
IS : 516	:	Methods of test for strength of concrete
IS : 692	:	Paper insulted lead- sheathed cables for electric supply
IS : 800	:	Code of Practice for use of structural steel in general building construction
IS : 802	:	Code of Practice for use of structural steel in overhead transmission line towers
IS : 802	:	Code of Practice for use of steel tubes in general building construction
IS : 808	:	Rolled steel beams, channels and angle sections
IS : 813	:	Scheme of symbols for welding
IS : 814	:	Covered electrodes for metal arc welding of structural steel
IS : 815	:	Classification and coding of covered electrodes for metal arc welding of mild steel and low alloy high tensile steel

IS : 816	:	Code of Practice for use of metal arc welding for general construction in mild steel
IS : 817	:	Code of Practice for training and testing metal arc welders
IS : 818	:	Code of Practice for safety and health requirements in electric and gas welding and cutting operation
IS : 822	:	Code of Practice for inspection of welds
IS : 919	:	Recommendations for limits and fits for Engineering
IS : 961	:	Structural Steel (High Tensile)
IS :1030	:	Carbon Steel castings
IS :1038	:	Steel doors, windows and ventilators
IS :1077	:	Common Burnt clay building bricks
IS :1139	:	Hot rolled mild steel, medium tensile steel and high yield strength steel deformed bars for concrete reinforcements
IS :1148	:	Rivet bars for structural purposes
IS :1149	:	High tensile rivet bars for structural purposes
IS :1161	:	Steel Tubes for structural purposes
IS :1199	:	Method of sampling and analysis of concrete
IS :1200	:	Method of measurement of steelwork and ironwork
IS :1239	:	Mild Steel Tubes
IS :1363	:	Black hexagon bolts, nuts and lock nuts (Dia. 6 to 30 mm) and black hexagon screws (Dia. 6 to 24 mm)
IS :1369	:	Precision and semi-precision hexagon bolts, screws, nuts, and locknuts (Dia. range 6 to 39 mm)
IS :1367	:	Technical supply conditions for treaded fasteners
IS :1442	:	Covered electrodes for the metal arc welding of high tensile structural steel
IS :1489	:	Portland- pozzolana Cement
IS :1554	:	PVC insulted cables for working voltages from (Part-I) 3.3KV up to and including 11KV

IS :1566	**:**	Hard- drawn steel wire fabric for concrete reinforcement
IS :1608	**:**	Method for tensile testing of steel products other than steel strip, wire and tube
IS :1730	**:**	Dimension for steel plate, sheet and strip for structural and general engineering purpose
IS :1731	**:**	Dimensions for steel flats for structural and general engineering purpose
IS :1786	**:**	Cold-worked steel high strength deformed bars for concrete reinforcement
IS :1804	**:**	Fibre main cores for steel wire ropes
IS :1852	**:**	Rolling and cutting tolerances for hot-rolled steel products
IS :1977	**:**	Structural Steel (Ordinary Quality) St-42-0
IS :2026	**:**	Power transformers
IS :2062	**:**	Structural Steel (fusion welding quality)
IS :2074	**:**	Ready mixed paints, red oxide zinc chromate priming
IS :2250	**:**	Code of Practice for preparation and tools and masonry mortars
IS :2315	**:**	Thimbles for wire ropes
IS :2363	**:**	Glossary of terms relating to wire ropes
IS :2516	**:**	Circuit Breakers
IS :2959	**:**	Contractors for voltages not exceeding 1000 A.C. or 1200 D.C.
IS :3757	**:**	High Tensile Friction Grip Bolts. 12-4
IS :3937	**:**	Recommendations for socketing of wire ropes
IS :3975	**:**	Mines steel wires, strips and tapes for armoring of cables
IS :4000	**:**	High strength bolts in steel structure
IS: 5228	**:**	Continuous Movement Monocable Ropeways with fixed grips intended for transportation of passengers.

IS: 5229	**:**	Aerial Ropeway for transportation of passengers - Continuous Movement Monocable with Automatic grips.
IS :5831	**:**	PVC insulation and sheath of electric cables
IS :7098 (Part – II)	**:**	Cross linked polyethylene insulated PVC sheathed cables
IS :7215	**:**	Tolerances for fabrication of steel structures
IS :8130	**:**	Conductors for insulated electric cables and flexible cords
IS :9413	**:**	Rope guide Rollers for Haulage Rope
IS :9595	**:**	Recommendations for metal arc welding of carbon and carbon manganese steels
IS :9706	**:**	Aerial Ropeways for transportation of material – code of practice for design & construction
IS :10891	**:**	Steel wire ropes for Aerial Ropeways

DRAWINGS AND PHOTGRAPHS

SOME PHOTOGRAPHS OF JIG BACK INSTALLATION FOR REFERENCE

DRIVE STATION

RETURN STATION

CABIN WITH HANGER

TOWER

CABINS

CABINS IN LINE

Recommended Make of Major Items

	Items		Make
01.	Rope	:	Usha Martin / Equivalent
02.	Structural Steel Sections	:	SAIL / TATA/ Equivalent
03.	Drive	:	ABB / Equivalent
04.	Gear Box	:	Primer Transmission /Elecon / Equivalent
05.	Motor	:	ABB/ Kirloskar / Equivalent
06.	D.G.Set	:	Cummins / Kirloskar / Equivalent
07.	Hydraulic System	:	EATON / Equivalent
08.	Electrical Items	:	Siemens / BCH / Equivalent
09.	Bearings	:	SKF / Equivalent