

RISK ASSESSMENT

Risk & Its Assessment

Risk: Probability or severity of occurrence of a harmful consequence due to hazards.

Hazard is a situation that poses a level of threat to life health or environment.

Disaster is a natural or man-made hazard resulting in an event of substantial extent causing significant physical damage or distraction loss of life or drastic change in environment.

Risk Assessment: Qualitative and quantitative measurement of the potential loss of life, personal injury, economic injury, and property damage resulting from hazards.

Risk assessment involves the following:

- Hazard Identification
- Vulnerability Analysis
- Risk Analysis
- Emergency Plan

The main objective of this Risk Assessment (RA) study for the proposed ropeway is to identify the disasters due to natural causes, human caused occurrences & technical failures and to provide risk mitigating measures to reduce associated hazards.

7.1 Hazard Identification

Aerial ropeway presents a number of hazards to the general public, operating and maintenance staff. Ropeways are liable to suffer from two types of threats, risks and hazards:

- ❖ **Natural Hazards-** Natural disasters include earthquakes, landslides, rock falls, floods, storms, avalanches, lightening etc. Risk Analysis due to Natural Hazards are discussed in section 7.3 of this chapter.
- ❖ **Human -caused occurrences-** Man made occurrences includes:
 - Fire
 - Electrical faults
 - Mechanical faults like drive / return sheave shaft failure / tension system failure, mount assembly parts failure, rollback, slippage / fall of cabin, entanglement of cabin, swinging of cabin resulting in fall of passengers outside cabin, cabin derailment at station etc.

- Technical faults like rope with broken wires in service over speeding of ropeway / brake failure security threat
- Accident

Hazard analysis for the Natural & Man made hazards is discussed in the table 7.1.

HAZARD ANALYSIS

Table 7.1

	Severity (1-5)	likelihood (1-5)	Severity x likelihood (1-25) (Hazards scoring 1-12 are less serious hazards & 13-25 are very serious hazards & need prior attention)
<u>HAZARD IDENTIFICATION</u>			
Natural hazard			
Earthquake	5	2	10
Landslides	5	4	20
Flood	5	1	5
Avalanche	3	2	6
Wind & cyclone	2	2	4
Cloud Burst	5	1	5
Man made hazard			
Fire & explosion	5	2	10
Electrical	3	5	15
Mechanical	4	4	16
Technical	4	5	20
Security	3	1	3

7.2 Vulnerability Analysis

As per the table 7.1, the vulnerable areas during construction phase are mainly the immediate areas under construction.

The vulnerability analysis during operation phase is given for natural as well as man made hazards are shown in Table 7.2 & table 7.3 respectively.

Vulnerable locations/ areas for natural hazards

Table 7.2

Hazard	Vulnerability
Earthquake	Damage to Towers, Termnal Stations, Cable Cars
Landslides	Damage to Towers if slope stability is not maintained.
Flooding	Govind Ghat (due to cloud burst or excess rain)
Avalanche	Ghangaria, Hemkund (due to noise & vibrations) This can cause damage or buriel of human and material.
Wind & cyclone	There are very moderate chances of wind & cyclone; this can cause damage to cable car.
Cloud Burst	Cloud burst can cause soil erosion, landslides and flooding in river. It can cause damage at towers and Terminal Stations at Govind Ghat.

vulnerable locations of different man made hazards

Table 7.3

Hazard	Vulnerable Locations
Fire	Cable car, Terminal Stations, Control Room
Electrical	Cable Car, Transformer, Control room
Mechanical	Cable car, Ropes, Terminal Stations, Ropeway Towers
Technical	Ropeway, Cable car, Terminal Stations
Accident	Cable car, Ropeway Towers, terminal stations
Security	Terminal Stations, Parking

7.3 Risk Analysis

ENVIRONMENTALLY INDUCED RISKS AND HAZARDS

- ❑ **Natural Calamity Hazard Profile** -Hazard profile map of India (published by Home Ministry of India as a part of document ‘Disaster Management Plan in India”) is depicted as per figure 7.1.

The region having project site is prone to following Hazards:

- Earth Quake
- Landslides
- Flooding
- Avalanche
- Wind & Cyclone
- Cloud Burst

Above findings are supported by profile map of India for earthquake, Landslides flooding and wind & cyclone as depicted in Fig. 7.1:

❑ Seismicity

As per fig. 7.2 & fig. 7.3 & the Geotech report attached as Annexure-VIII, the project site is located in seismic zone V which indicates high damage risk zone.



Fig 7.2 Earthquake zone Map of India (Source- UPDM)

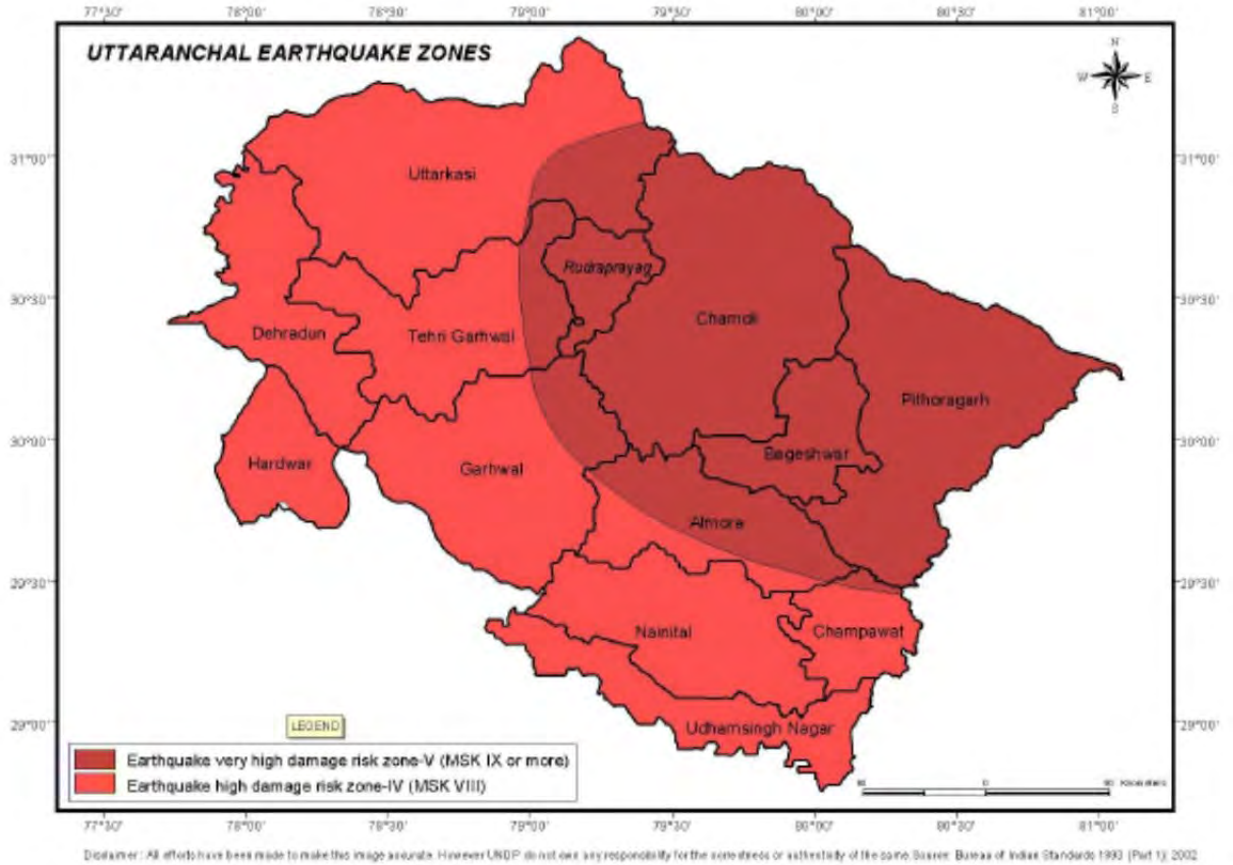


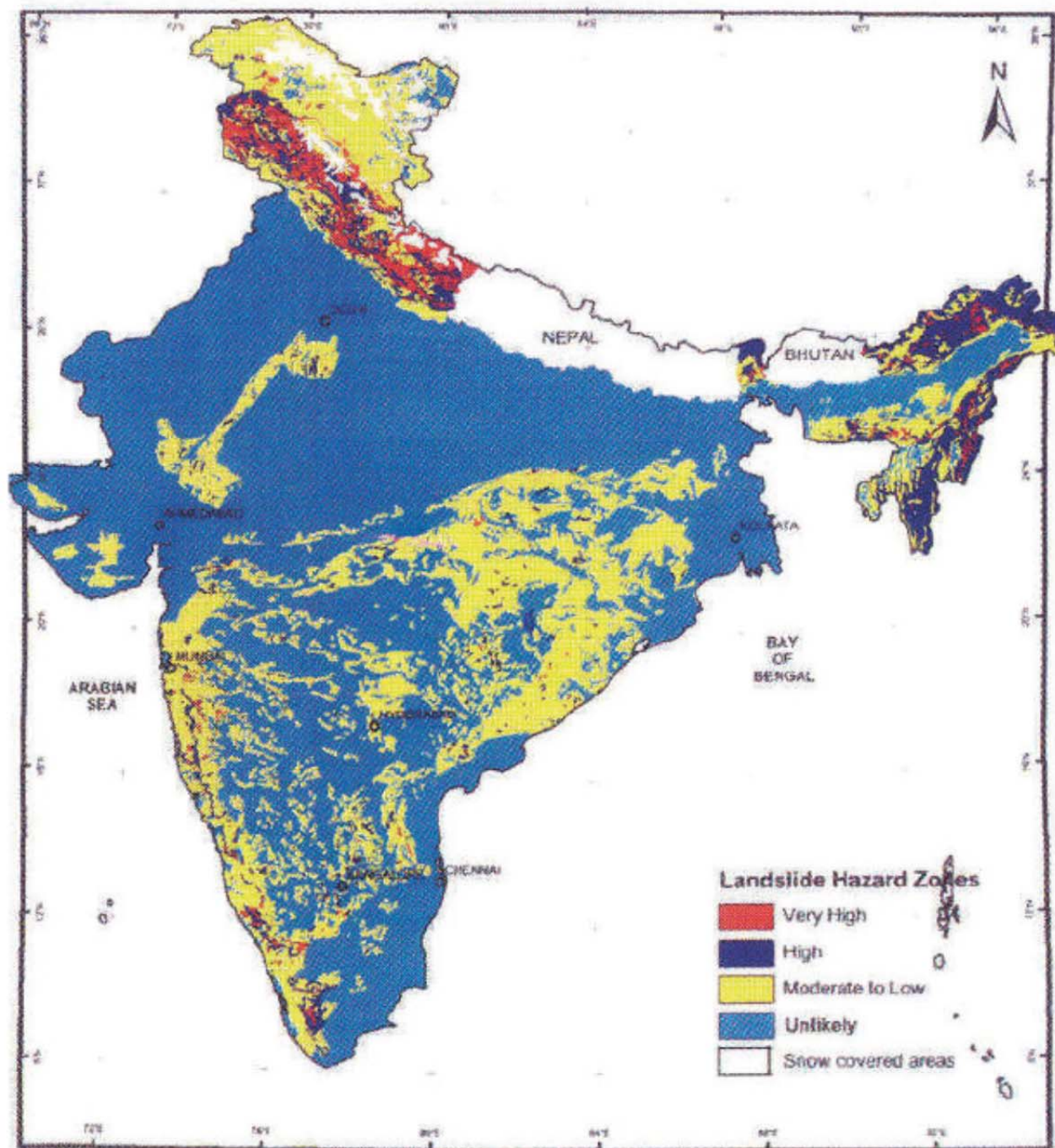
Fig 7.3: Seismic Map of Uttarakhand (Source: DMMC)

❑ Landslides

According to geological, topographical and climatic conditions of the area and human factors such as deforestation, unscientific road construction (blastings carried out for road cuttings), constructions of dams or reservoirs, housing schemes, roads, terracing and water intensive agricultural practices on steep slopes etc., implemented without proper environmental impact assessments have increased the intensity and frequency of landslides.

As per the Physiography, topography & terrain of the area (discussed in Ch-4) and the landslide hazard map of Uttarakhand shown in fig. 7.4, the area is highly prone to Landslides.

Landslides may occur at the project site, if, slope stability is not maintained.



Source: BMTPC

Fig 7.4 Landslides Hazard zone Map of India

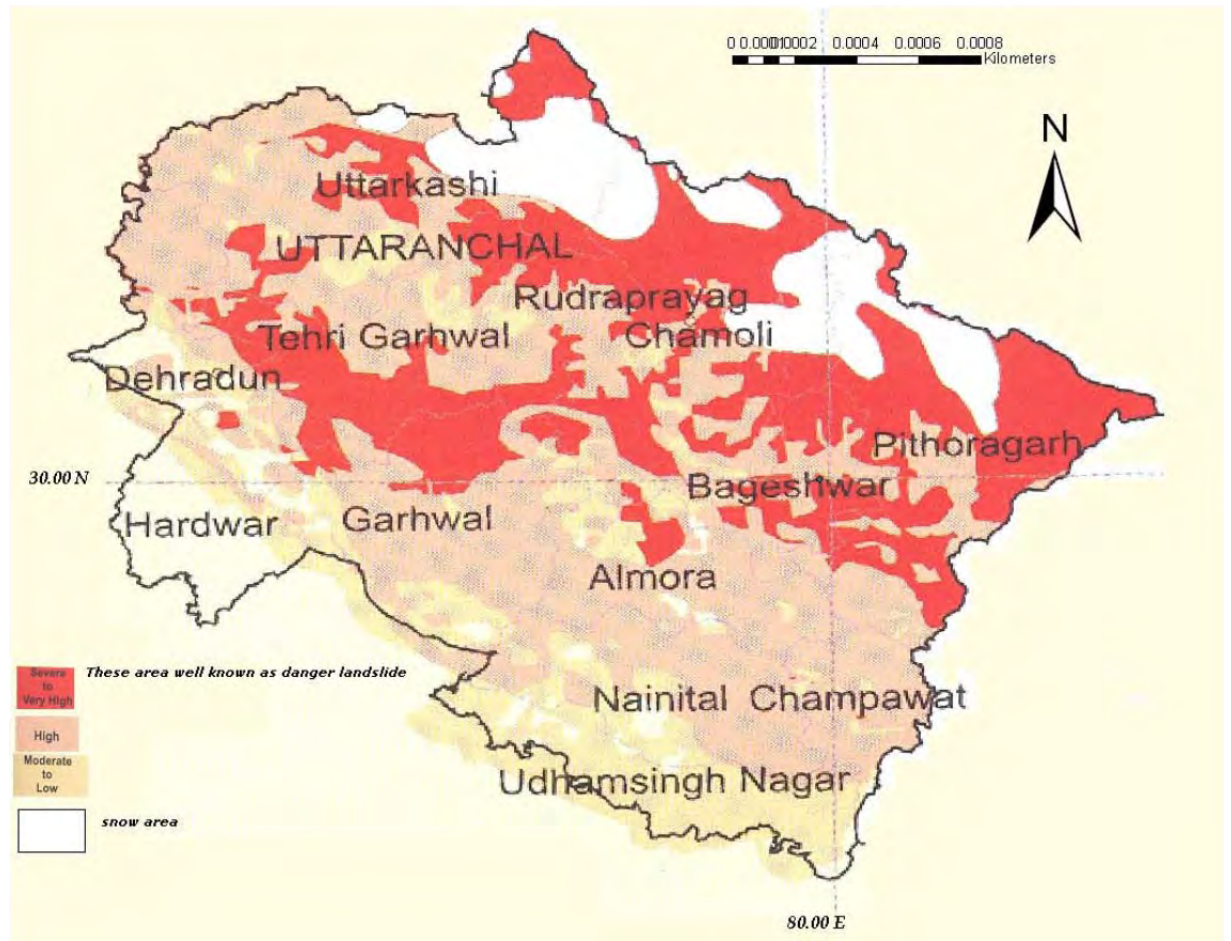


Fig. 7.5 Landslides map of Uttarakhand (Source- DMMC)

❑ Flooding

As discussed about the hydrology of the area in Section 4.10 of Chapter-4, the area is drained by tributaries of Laxman Ganga River. As per Indian flood zone map given in fig. 7.6 and Flood Hazard map of Uttarakhand given in fig. 7.7, the project site falls under no flood zone.

Whereas, devastating floods have occurred in June 2013 in the area due to cloudburst and glacier melting.



Fig. 7.6 Flood Map of India (Source- UNDP)

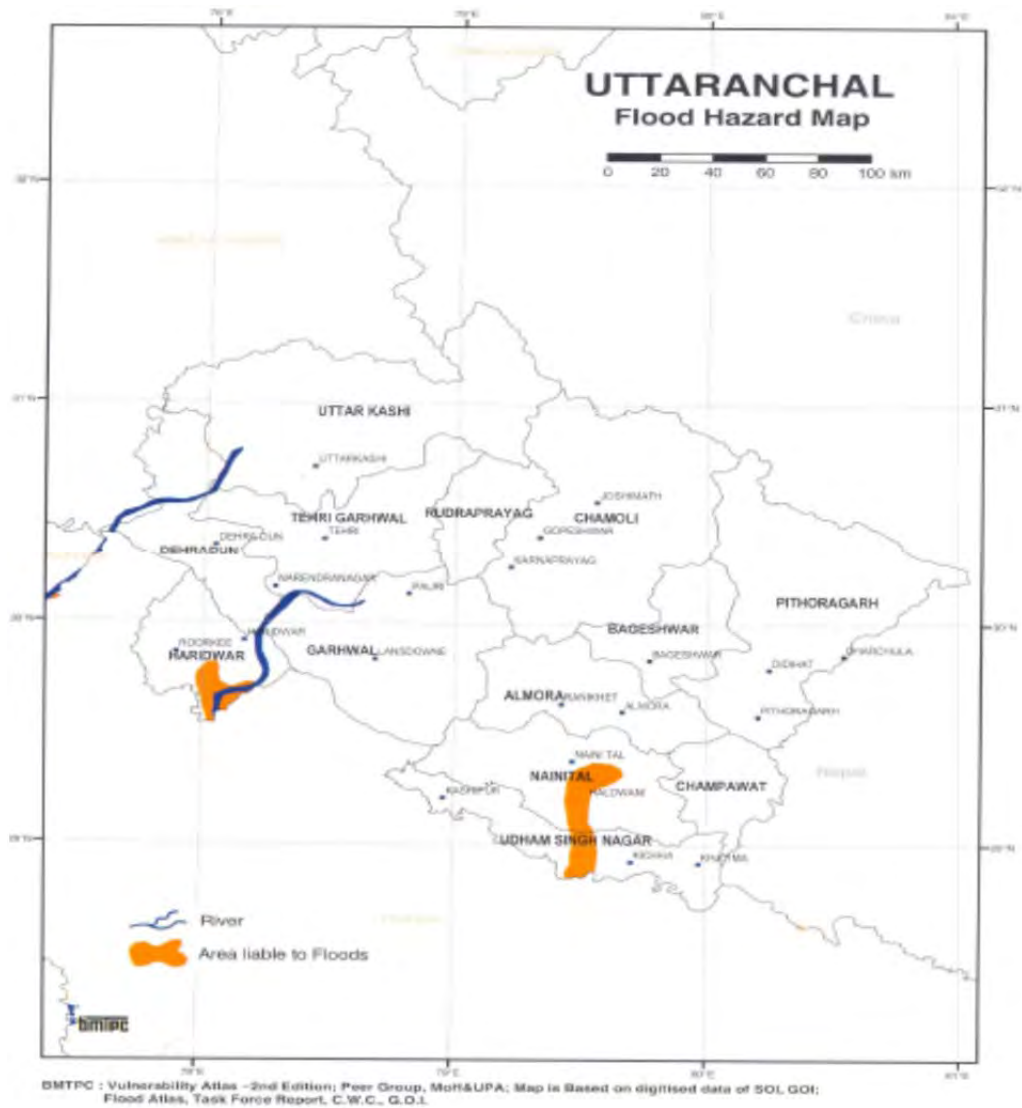


Fig. 7.7 Flood map of Uttarakhand

❑ Wind & Cyclone

The yearly distribution of tropical cyclones in the north Indian Ocean indicates large year to-year variations in the frequency of cyclonic disturbances and tropical cyclones, but no distinct periodicity. However, the trend indicates a slight decrease with time. The Cyclone hazard map of India as depicted in the Figure 7.8, gives the vulnerability map of hazard due to cyclone. As per this map, the project area falls under a zone where moderate wind & cyclone is seen.

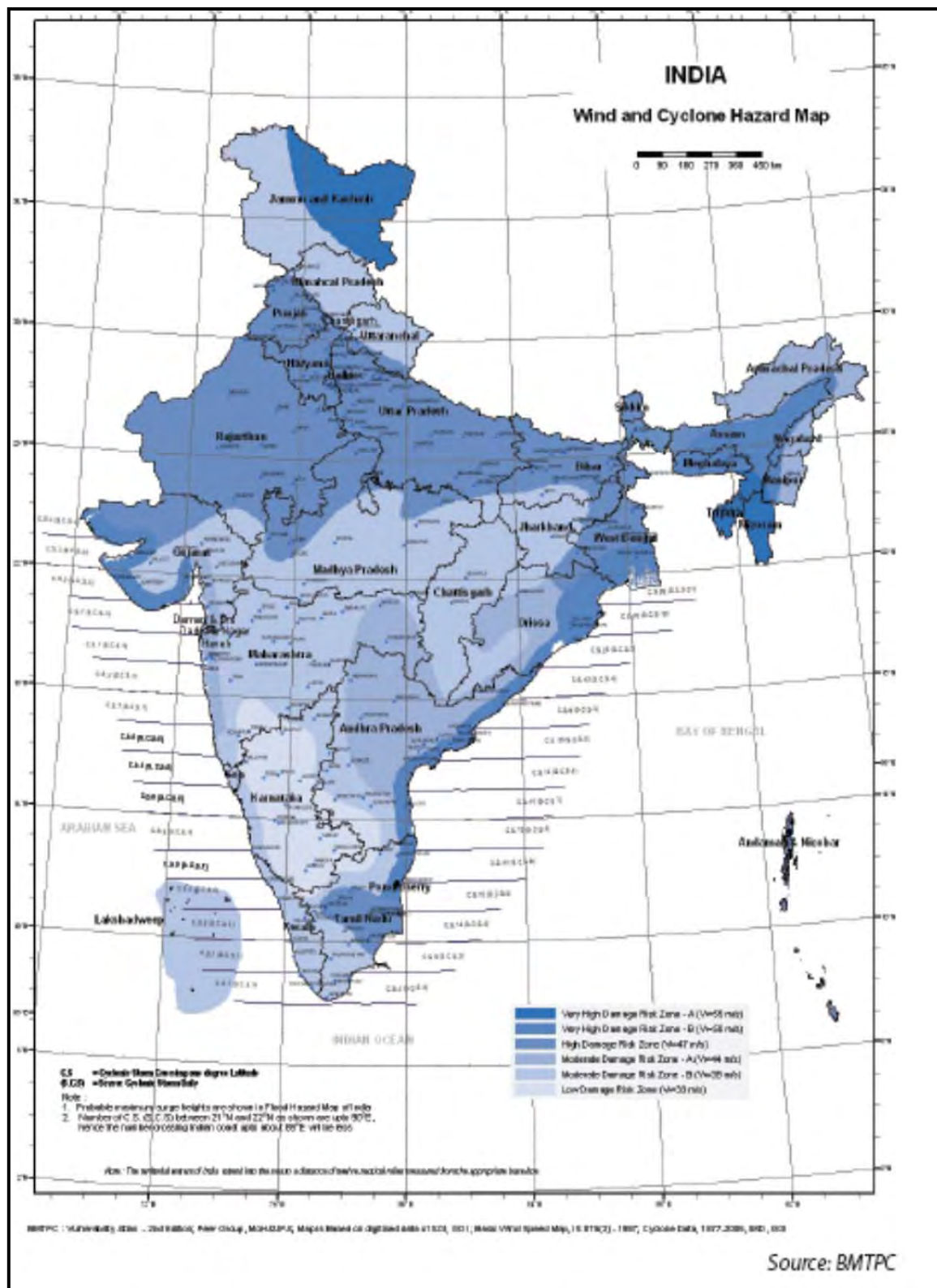


Fig. 7.8 wind & cyclone map of India

❑ Cloud Burst

Though not a regular phenomenon, cloudbursts lead to exceptionally heavy rainfall and sudden flash floods in the mountainous streams and rivers, leading to breaching of banks and overflowing of dams. It was the major reason for the tragedy happened in various parts of Uttarakhand in June 2013.

❑ Avalanches

Snow avalanches are the sudden slide of large mass of snow down a mountain. There are several factors, which can affect the occurrence of avalanche, including local weather, slope, atmospheric temperature, vegetation; terrain and general snow pack conditions. Different combinations of these factors can create low, moderate and extreme weather conditions. Most avalanches are very dangerous and cause huge loss of life and property. The temperature variation and wind speed are directly proportional to avalanches.

The preliminary avalanche study of the site from Govind Ghat to Hemkund Sahib was carried out by IIT Delhi in January 2008 to understand, conceptualize and assess the avalanche problems. The probable avalanche trajectories were identified based on the hydrological, terrain and meteorological data for the study area. The detailed study in this respect is enclosed as **Annexure IX**.

HUMAN INDUCED RISKS AND HAZARDS

Fire & Explosion:

Since it is a ropeway project, fire can mainly cause due to electric spark in electrical room, fire in the surrounding forest area, fire in fuel storage places, etc.

The Fire & explosion can cause suffocation due to harmful gases generation & panic in the minds of people.

Electrical:

The ropeway will run on electricity & hence electrical current can pass through cable cars & wires due to inadequate insulation or accidentally.

Mechanical:

As the ropeway consists of cable cars, ropes & big & heavy machineries, mechanical hazards can cause risks to people working in the area during construction phase & people who will travel through the ropeway in operation phase.

Mechanical hazards are like drive / return sheave shaft failure / tension system failure, mount assembly parts failure, rollback, slippage / fall of cabin, entanglement of cabin, swinging of cabin resulting in fall of passengers outside cabin, cabin derailment at station etc.

Technical faults:

As Ropeway is a technology based transportation method, Technical faults like rope with broken wires in service, over speeding of ropeway, brake failure may occur.

Accident:

Consequences of the discussed hazards may result into accident.

Security Threat:

War, crisis & terrorists can cause panic among public and staff.

7.4 EMERGENCY PLANS & SAFETY PLANNING**❖ Safety Measures For Design Stage****Information**

- a) Obtain from the manufacturer, supplier or assembly contractor any drawings, manuals, other data and design verification, inspection and test certificates that are necessary to establish that the passenger ropeway has been designed, manufactured and installed in accordance with the relevant IS codes ;
- b) Obtain from the manufacturer, supplier or assembly contractor catalogues, drawings, manuals, specifications or other information required to ensure that all relevant in-service activities can be carried out safely;

- c) Store this data at the place of work where the passenger ropeway is situated so that it is secure and readily available to all persons in that place of work and to any other person requiring access including equipment inspectors. This data shall be kept available for reference until disposal of the equipment.

Supervision

The ropeway operator will:

- a) Personally supervise the passenger ropeway and every specified activity or appoint a competent person to carry out this supervision;
- b) Ensure that persons appointed are competent to carry out duties allocated to them;
- c) Delegate to competent persons, appointed to supervise passenger ropeway, powers required to exercise supervision;
- d) Ensure that the names of persons appointed to supervise a passenger ropeway are made known to any persons who carry out a specified activity or any other significant activity associated with that passenger ropeway.

Erection and Commissioning Stage

Assembly contractors of a passenger ropeway will ensure that it is erected, commissioned, tested and inspected in accordance with information which is complete and appropriate for safe erection, testing, inspection and commissioning.

Assembly contractors of ropeway will record every critical safety stage in the erection and commissioning of passenger ropeways.

Inspection of Safety Related Components

- Where the failure of a component will directly result in serious risk to passengers, such components should be given particular consideration when drawing up maintenance and inspection schedules. Such components include wire ropes, fixed and detachable rope groups, pylon structures etc.
- In addition to the inspections detailed discussed above, thorough examination of the ropeway by a competent person, preferably an independent third party, is recommended on an annual basis. The examination should be based on a scheme prepared by the competent person along

with the ropeway controller and/or operator and take into account manufacturers' advice, past experience and all relevant standards and guidance material. Examinations cover all components and systems as discussed above and inspection of all structures and foundations for signs of movement or failure. All significant defects need to be reported immediately to the operator and a decision made on what action to take with a full written report provided within a reasonable time.

- Static ropes need examination particularly where they may be subject to bending stresses, at rope terminations and where environmental conditions could cause deterioration. Haul ropes need examination for wear, lubrication, broken wires, corrosion and localized damage.
- Monitoring the internal condition of the haul and suspension ropes is a specialist area and requires trained and competent people. Non-destructive (NDT) methods, such as magnetic induction, should be used if possible. In addition the competent person might consider it necessary to carry out an internal examination on some occasions. To monitor any deterioration in the rope and determine examination intervals, records of all examinations need to be kept. All ropes likely to be examined by NDT methods in service should be examined at the start of their service life to provide a datum for subsequent comparisons.
- It is not possible to have all safety related components examined each year, so a sampling strategy needs to be used so that all components are thoroughly examined over a set period which is determined by the competent person. The set period is recommended to be no greater than five years. Components examined in this way include:
 1. Clamping devices (including fixed and detachable grips) dismantled into their separate parts;
 2. Load bearing parts associated with chairs or cars;
 3. Bolts and other fasteners from the critical components such as anchor bolts and shear frame
 4. Pins found on support towers; and
 5. Foundations and structures concerning the ropeway.
- It is unlikely that one individual will be competent to carry out thorough examinations on all parts of the installation. For example, the examination of ropes is a specialized skill. It is up to the controller to establish that the competent person has the necessary skills and facilities to carry out the thorough examinations for which they are employed. It should be noted that thorough examination by a competent person is not a substitute for regular planned maintenance. Testing, inspection and thorough examination only form part of a maintenance scheme, which is covered in the next section.

Safety of Employees

- Operating procedures should ensure the safety of staff involved in operation, inspection, examination, testing, maintenance and repair work and in emergency procedures. Safe access should be provided. Permit-to-work schemes and power isolators which can be locked in the off position should be provided when necessary. Staffs need to be fully conversant with permit-to-work schemes or other similar systems.
- Operations involving the construction, structural alteration, demolition or repair of the structure of a ropeway may be subject to the Construction Regulations.

❖ Safety Measures For Operation Stage

General

The operator of the ropeway will ensure that:

- a) a display is placed in a conspicuous location for the operator at the main drive station stating the approved limiting conditions such as total number of cabins, capacity of each cabin , minimum spacing between cabins, maximum line speed and operating limiting wind velocities;
- b) The ropeway has a valid certificate of inspection.
- c) The ropeway is operated safely and within their design limits.
- d) All safety devices are in working condition.
- e) The operation is in accordance with relevant operating manuals/procedures.
- f) All operating procedures relating to ropeway are kept under regular review, improved and updated whenever possible, and implemented by competent persons.
- g) Security guard with hand held scanner and metal detector will be proposed at the entry of the LTP.

Further, the Government of Uttarakhand is in process of enacting Uttarakhand Ropeway Act & Rules which would lay down the constitution of Licensing Authority which would approve ropeway projects in the state of Uttarakhand, perform local hearing process, grant license and impose penalties and fines. For supervising the construction and operations of the ropeway projects in the state, Chief Ropeway Inspector has been proposed which would be assisted by District /

Divisional Inspectors. The Chief Ropeway Inspector shall be supervising and monitoring the ropeway projects especially on account of safety & standards, maintenance, traffic, etc.

Before making it for public use the ropeway project shall be thoroughly inspected by Chief Ropeway Inspector, Government of Uttarakhand to ensure the ropeway project is safe for public use. After getting clearance certificate, the commercial operation of the ropeway would be able to commence.

❖ Preventive Measures

Earthquake:

The project will be situated in Seismic zone-V area. Special attention shall be given to the structural design of foundation, elements of masonry, timber, plain concrete, reinforced concrete, pre-stressed concrete, and structural steel. All applicable guidelines will also be followed in this regard to ensure safety of the building.

Landslides:

The area where ropeway is proposed is highly prone to landslides. Structural stability & safety is must to prevent ropeway damage due to landslides. Slope stability in the area shall be maintained at 45°.

Flooding:

Proper designing of drainage system shall be done.

All the waste water shall be disposed off to soak pits.

Structures shall be built in such a way that no harm occurs to the people & structures due to flooding due to natural calamities.

Fire and Life Safety:

Safety Precautions

1. Smoking must be prohibited.
2. Electrical equipment must be explosion-proof to meet national electrical code requirements.
3. Dry chemical extinguishers should be accessible for small fires. An adequate supply of handheld and wheeled types should be available.
4. Hydrants should be strategically placed with adequate hoses.

5. Small spills should be remediated with sand, earth, or other non-combustible absorbent material, and the area then flushed with water.

Preventive measures for Technical & Mechanical Faults

- a. The cabins will be designed to be closed type with proper ventilation facility.
- b. Each station will have a first-aid medical facility and the upper station at Hemkund Sahib would also be equipped with oxygen cylinders in case of any emergency situations.
- c. The automatic lock system will be such that it cannot be opened by the passengers.
- d. Cabin shall be provided with dual fixed grip per cabin wherein each grip will be capable of taking the entire laden weight of the cabin with passengers.
- e. The ropeway system will be provided with minimum of two braking system; Emergency Brake and Service Brake. Both brakes should be capable of functioning automatically as per operational and program logic of control system OR manually, in case the need arises.
- f. The ropeway system machine configuration shall comply to following minimum requirement:
 - i. In event of main power supply failure, the system should have full rated Diesel Generator to carry on the commercial operation. The Diesel Generator should be de-rated by 30% or as recommended by the manufacturer to meet full load requirement of location altitude.
 - ii. In the event of main motor/ main gearbox failure, the emergency drive should be capable of bringing the stranded cabins on the line to Ropeway Terminals. The emergency drive can be in the form of gasoline/diesel engine or Hydraulic motor or Electric Motor. In case of Hydraulic or Electric Motor as emergency drive, the ropeway company is to ensure fitment of an additional Diesel Generator; over and above the Main Diesel Generator.
 - iii. Standard electrical safety and indicating devices shall be provided on ropeway. Special emphasis shall be paid to line de-ropement switches with independent control circuit to pin point the defect shall be used. As the ropeway terrain is difficult, each tower and sensitive location will be provided with pan/tilt/zoom type wired cameras to monitor the line status before starting the plant each day. As the plant is located in remoteness and nearest town is far away, enough stock of such small electrical and safety items

will be made by the ropeway company so as to resolve the defects to operate the plant without bypassing the safety circuit.

- iv. Rope catcher will be provided on mount beams on line trestle, P.F. and Stations to arrest/ support the hauling rope in case of de-ropement. Both drive and return bull wheel shall be provided with catcher device as well bull wheel arrestor device.
- v. Emergency push buttons will be provided at stations to stop the ropeway, if required. The ropeway shall also be provided with 50% station speed switches to reduce the speed of cabins in case of continuously circulating system.
- vi. The project shall be provided with 4 anemometers to monitor the wind speed. One at each station and two on the mid section towers. The anemometers shall be integrated with control panel to reduce operation speed to 50% in case wind velocity exceeds 50 km/h and stop the plant if the wind velocity exceeds 65-70 km/h.
- vii. Lightening arrestors shall be provided at all towers and stations to protect the plant and associated electronics. Adequate number of coal plus salt or chemical earth pits shall be provided at both stations and tower foundations.
- viii. All safety devices will be as per relevant Indian standard for passenger ropeway.

Security Threat Plan and Action Plan to Meet the Eventualities

An ISO 27001 and 27002, which are the international best practice information security management standards, defining and guiding Information Security Management System (ISMS) development shall be adopted. These will provide the necessary benchmarking for individual users to know the type of cover and the responsibilities that are defined and provided by that institution for its guests. Most importantly, training, to staff needs to be regularly imparted in dealing with such situations.

A **five tier security plan** has been designed for the project:

Tier 1 Protection against attack from Sky

Tier II Securing Building Externally and its periphery

Tier III Security of Building from Internal Threats

Tier IV Provision of

- a. proper Surveillance System
- b. Training and Security Drills (including Contingency plans)
- c. Security of Infrastructure Support Service System
- d. Making of Standard Operating Procedures

Tier V Emergency Response Team

Description of the Tiers:

Tier 1 Protection against attack from Sky

1. There can be a threat from Microlite suicide squads.
2. In case Terrorists are launched through Helicopters, then Mobile quick reaction team to move on terrace of stations with suitable arms and ammunitions which will be backed by reaction team.
3. Coordination of Security Control Room with Army Defence system through Central Control System of the city/Army/Air Force.

Tier II Securing Building Externally and its periphery

1. **Manual Checks:** At all terminals the visitors shall be manually checked and asked for ID's.
2. **CCTV:** At all important location with a remote viewing facility and record back up. With highest resolution and picture quality. DVR being the back bone, its recording and replaying capabilities must be considered.
3. **X-Ray Scanners:** This may be installed and the bell desk may ensure that all the baggage's while being shifted out or in goes through the machines. One scanner shall be installed at terminal stations entry.
4. **RFID** based access control and smart card applications can also control the movements of guest as well as staff.

6. **Zoning System:** Apart from these equipments there are agencies providing Zoning system. This system would be integrated with the BMS and in the even of terrorists strike it automatically will close the fire exit door and stairs door thus limiting the movement of the terrorist in one place.

Tier III Security of Building from Internal Threats

1. **Staff Profiling:** All the staff shall be required after proper verification of identity and residential proof. Smart card identification shall be given.
2. **Metal Detectors:** Every visitor will walk through metal detectors. There will be one metal detector at staff entry gate.
3. **Bomb Blankets:** This will reduce the impact of an explosion.
4. **Central Control Room:** This will control the security system from inside.
5. **Safety of weapons:** The weapons shall be kept in security.
6. **Communication Systems:** Proper communication system to security staff shall help them to coordinate better during emergencies.

Tier IV Provision of

a. proper Surveillance System

1. **Bio – Metric Access:** All the electronic locks be replaced as bio matrix access control in the rooms. It is suitable way to have finger prints in the name of a high end technology.
2. **Wireless Mobile Devices:** These can be installed at various locations to intercept people communications.
3. **Glass protection System:** This is a unique product combination of high security laminate films with chemicals which makes it blast resistant and thus protecting human life's and property from the damage caused by splinters.
4. **Explosive detectors:** With the help of this detector, the security personnel can check various zones for traces of explosive.

b. Training and Security Drills (including Surveillance System)

Disaster planning is the responsibility of all sections of the community. The police, fire brigade, civil defense, Home Guards, press, clergy, industrial groups, and community groups must participate in the pre-disaster planning. The community as a whole has the responsibility to teach first aid to groups in the community that could be utilized in disaster situations. The disaster may involve the normal communication network itself. Therefore, two-way radio systems and messenger systems must be included as backups in the event of a communication-system failure.

Proper training, security drill and evacuation drill shall be conducted in a defined time period, so as to train the management people, security personnel's, senior staff and all other working staff to take control of all odds what so ever come in the way. These trainings shall be conducted for use of weapons and Arms by some trained agencies for the said trainings. The training shall be done periodically.

c. Security of Infrastructure Support Service System

1. Hourly checking of building including Toilets and dust bins.
2. Random checking of visitors
3. Installation and Precautions of Public Addressing system.
4. Preventive measures for attack on D.G. Sets, Water Treatment System, Water Storages, Ventilation System.
7. Security against Chemical War & Anti hacking devices

d. Making of Standard Operating Procedures

A standard operating procedure manual shall be prepared, followed and maintained for all the eventualities due to attack by armed intruders.

Tier V Emergency Response Team

An emergency response team shall be formed, which has been already discussed ahead in this chapter.

❖ **Rescue Arrangement:**

- a. The Ropeway system would be provided with a rescue arrangement to enable the passengers being evacuated in case of an extreme emergency where cabin are stopped on line.
- b. *Ladder rescue* can generally be adopted for cabins which are stranded close to the ground. Here a light but strong aluminium ladder with a hook at the top is placed in position next to the cabin. An attendant stabilizes the ladder from below while another attendant goes up to open the door and help the passengers to come down.
- c. *Rope Rescue* System involves a winch and lowering rope. A small hand winch is clamped to the nearest tower, uphill from the stranded cabin. One attendant climbs the tower and then he “rolls” down to the cabin by means of a carriage which is restrained by a rope attached to the hand winch. Once the attendant reaches the cabin he views the restraining rope through a set of rollers pre-fitted to the cabin. A safety harness is now attached to the end of the rope and individual passengers are lowered to the ground by means of the harness, rope and winch.
- d. *Diesel engine* with independent drive, so that the ropeway system can be operated at reduced speed to bring stranded cabins to the terminal stations in case of failure of electrical power supply or main motor. A full capacity DG set to continue normal operation in case of main power supply disruption.
- e. As mentioned elsewhere the *Auxiliary Drive* with diesel engine enables the passengers to be evacuated in the event of power failure.

❖ **Remote Surveillance of Towers and Stations**

As the entire ropeway is set in difficult terrain with steep slope and high altitude, too many physical verification of plant machinery is comparatively difficult. The site location, its remoteness to urban area also poses constraints on availability of trained manpower. Most of the manpower will be residing at lower station, as living at 4400 meters of altitude may not be very comfortable for people other than from hills. Therefore, it is very essential that wire based video surveillance system must be incorporated along with ropeway system. Minimum of 2 cameras should be installed on each tower to see the line sheaves and position of the rope. Similarly minimum of 4 cameras should be located at each station to check the condition of critical machines, such as hydraulic tension cylinder position and pressure, station clearance, start up of critical machines as drive lorry and so on. This will ensure very safe start-up of the system under controlled condition,

which can then be followed by physical verification, daily maintenance routine as greasing, etc. with the help of maintenance cabin, before commencement of commercial operation.

❖ **Emergency Response Procedure**

Classification of Emergencies

Level of emergency should be declared as per criteria given hereunder:

➤ **Level 1 Emergency**

- No immediate danger to public or environment;
- Incident is confined to the lease or company property;
- Low potential for situation to escalate;
- Handled by company personnel; etc

➤ **Level 2 Emergency**

- Potential for risk to the public/environment; the emergency could extend beyond company property;
- Control of incident is still possible;
- May require the involvement of external emergency services, federal, provincial or local agencies; etc

➤ **Level 3 Emergency**

- There exists an immediate danger to the public or environment;
- Control of the situation has been lost;
- Extensive involvement of external emergency services, federal and/or provincial agencies;
- Emergency extends beyond company property;

Proposed ropeway shall involve Level-1 and Level-2 emergencies. However, in case of natural calamity such as earth quake, it may have Level-3 emergency.

A definite plan will be made for marshalling passengers for safe loading and unloading. The ropeway manager will establish and draw up any special instructions necessary to be observed by

staff to ensure the safety of children and elderly persons riding the ropeway, and shall ensure that such instructions are implemented and enforced by the staff.

Loading attendants are to ensure that passengers do not embark on chairs, or in cars or cabins, with equipment which will in any way be a hazard to the safety of themselves or other passengers.

Communication

Both an audible signal system and a two-way voice communication system shall be maintained between the drive station and all loading and unloading stations. If only one system fails to operate, the ropeway may continue to run, provided the remote attendant stop system is fully operational. In the event of the failure of both communication systems, the ropeway shall not be operated. In the latter event, provided that adequate special precautions are taken, the ropeway may be run for the purpose of evacuation only.

No ropeway shall be operated without a functioning dedicated communication system.

Indications for Extreme weather conditions

At the time of extreme weather conditions i.e when wind conditions are sufficiently severe (4.5km/hr or more as per IMD data), temperature is below a significant value (1 or below as per IMD data), heavy rainfall, etc that makes the operation hazardous to passengers or equipment, based on operational experience on a particular site, the ropeway shall be shut down. For this purpose, suitable gauges will be installed at appropriate locations to ascertain the prevailing weather conditions.

Disaster management

1. Establish direct contact with district administration and District Disaster Management Authority (DDMA) for any update on forecast (warning);
 - o Follow up agencies for forecast and keep records :
 - o Indian Metrological Department for cyclone and earthquake;
 - o Central water commission for flood forecast;
2. Establish an inhouse rescue team of volunteers from each unit and impart training as per DDMA;
3. Establish a first aid team of volunteers from each unit and impart training as per DDMA;

4. Organize mock drills in association with DDMA;
5. Establishment of Central Control Room for communication with Government agencies;
6. Updated contact details should be kept for the following:
 - o District Magistrate
 - o District Police Administration
 - o DDMA
 - o District Fire Service
 - o District Hospital
 - o District electricity Supply Agency
 - o District Water Supply Agency
7. Development of Standard Operating Procedures for role and responsibility of individual of response team.
8. Warning System
9. Inspection of design of buildings and towers with respect to severity of hazards presents;
10. Removal of encroachments and keeping basic infrastructure like roads, power & water supply, waste and storm water drainage system, parking etc in healthy conditions;
11. Demarcation of assembly points and evacuation routes for workers and general public in case of emergency;
12. Keep records of chemical inventORIZATION and associated hazards with each unit;
13. Planning for risk reduction measures due to chemical storage and traffic parking & movements;
14. Assessment of impacts and design & implementation of remedial measures; etc

Recovery Procedure

- The recovery procedure will depend on the type of emergency. Recovery procedure shall be followed by engineering section to restore the essential services.

Post Disaster Analysis and Evaluation

Audit

The in-house and third party audit shall be carried out on regular basis:

- To review the requirements to ensure that original design and installation conditions have not been altered to violate the requirements of the prescribed standards and guidelines;
- To ensure that all required signs are in place; and
- To ensure that only persons authorized shall start a ropeway.

The in-house safety team will also be responsible for monitoring of the ropeway.

Personnel Training

- Management and other personnel responsible for operation shall be familiar with the applicable provisions safety;
- Passenger ropeways shall be operated by trained and competent persons;
- The general training of operators and attendants shall include instructions on the observation of potentially dangerous operational or mechanical developments within view and the appropriate action to take in the event that a condition develops in which continued normal operation could endanger persons; and
- Operators and attendants shall be trained in the use of the manufacturer's operations manual for the installation on which they are to be working.

- **Personnel and Equipment**

1. During all operations, the equipment and trained personnel required shall be available.
2. Devices shall be capable of lowering passengers to the ground or rescuing passengers from the locations at which the devices are to be used.
3. The following shall be taken into account to determine the equipment required:
 - a) Probable operating and evacuation conditions;
 - b) Storage locations;

- c) Number of ropeways at a specific location; and
 - d) Periods of operation that can influence evacuation (day, night, or dusk).
4. The following shall apply to the equipment that is provided and maintained for emergency evacuations using non-metallic rope;
- a) When not in use, the equipment shall be carefully stored where it is readily available for use on a specific ropeway or ropeways.
 - b) Before each season's operation and after each completed ropeway evacuation or training session, each device and all ropes and attachments shall be thoroughly inspected, and any worn or damaged components shall be replaced or repaired in accordance with the manufacturer's instructions.
 - c) A logbook shall be maintained for all evacuation ropes and equipment. It shall contain details of all component specifications, the manufacturer's catalogue breaking strength, date of manufacture, service life, and replacement (and/or retirement) criteria. All periodic inspections shall be recorded.
 - d) Evacuation seats shall have an ultimate strength as required.
 - e) All non-metallic rope used for manual evacuation shall be made of synthetic polyester fibre, nylon, or both.
 - f) The equipment shall be designated for evacuation use only.
 - g) Evacuation rope shall be suitably protected against abrasion, sharp edges, and other destructive conditions.
 - h) Fibre rope and evacuation system components shall be clearly identified for inspection with permanent markings.
 - i) Evacuation equipment dedicated to specific locations along the ropeway shall be so marked and referenced in the evacuation plan.

❖ Other Actions to be taken for Risk Preparedness

Information to be displayed

- Enough suitable signs should be posted in prominent places to help and instruct the public. These signs are not an alternative to safe systems, but supplement to them.
- Where appropriate, notices should state the maximum number of people (with any age limitations) to be allowed in a car, emergency evacuation procedures and crowd control information. The information may need to be in other languages of the ropeway users. This applies especially to emergency evacuation instructions.

Termination of Daily Operations

Procedures shall be established for terminating daily operations to ensure that no passenger is left on a ropeway after it has been shut down.

Operation Log

- A daily operational log shall be maintained for each ropeway.
- The daily operational log shall include at least the following:
 - a) Date;
 - b) Names and duty stations of operating personnel;
 - c) Operating hours and purpose of operations;
 - d) Temperature, wind, and weather conditions and changes, with times of changes noted;
 - e) Record of compliance with daily operational inspection;
 - f) Position and condition of the tensioning carriage and of the counterweight or other tensioning devices;
 - g) Accidents, malfunctions, or abnormal occurrences during operation; and
 - h) Signature of the operator.

First Aid

- One or more persons trained to administer first aid shall be available at all times when a ropeway or conveyor is operating and transporting passengers;

- There shall be ready access to first aid equipment and supplies; and
- Provision for transporting an injured person to an enclosed and, if necessary, heated shelter shall be provided.

❖ **Emergency Management Cell (Off-site Emergency Planning)**

The actions necessary in an emergency depend upon the circumstances. It is imperative that required actions should be initiated and directed by a nominated team having specified responsibilities. An Emergency Management Cell will be formed, so that at the time of any Emergency, the team can work as a coordinator between all affected tourists and medical facilities/ requisite measures.

This avoids confusions arising out of panic situation. The details of proposed Incident Emergency Response Team are as per given hereunder:

1. Site Controller
2. Incident Controller
3. Safety & Security Coordinator
4. Information Officer
5. First aid coordinator
6. Medical Officer
7. Primary Controller

The role and responsibilities of individual are as per given below:

ROLES & RESPONSIBILITIES OF INCIDENT EMERGENCY RESPONSE TEAM

❑ Chief Incident Controller

He will be responsible:

- To assess the situation and analyze the possible impacts on account of the emergency;
- To declare emergency within project premises and specified danger zones;
- To inform Govt. agencies like District Collector, Police, Fire Brigade, hospitals etc.;

- To assess the magnitude, monitor/ review events in consultation with other controllers and take decision like as to whether and when people need to be evacuated from the danger zone; and
- To ensure that all events/ decisions taken/ directives given by outside agencies are recorded for future analysis.

☐ **Site Incident Controller**

- On hearing the alarm, he will rush to the spot and take overall charge and report to Chief Incident controller;
- Direct all operation within the affected area with priorities for safety of human life, minimum damage to the plant, properties and environment;
- Coordinate with Information Officer for outside help if required and report/review the situation with site controller;
- To evacuate non-essential staff to assembly points for utilization, if necessary by other co-coordinators; and
- To take all possible measures to protect evidences of further investigation.

☐ **Safety & Security Coordinator**

The safety & Security Manager/officer will be responsible for fighting the emergency. His role will be:

- On hearing the alarm, advice the Chief & Site Incident Controller about the nature of emergency and the spot;
- Organize manpower and other resources and give instructions to the plant staff to fight emergency; and
- Review the situation periodically and update the Chief and Site Incident Controller and seek for help if necessary from outside agencies like Fire Brigade, Police, hospital etc.

10.1 Information Officer

His role will be:

- On hearing the emergency alarm, in consultation with Chief/Site Incident Controller, advice outside agencies like police, Fire Services, Hospital about the emergency;
- To control traffics movements into & from the plant and ensures that alternate transport is available as and when need arises; and
- In liaison with Chief Controller/ Site Incident Controller/Medical officer call for ambulance/medical help, if necessary.

❑ First-Aid Coordinator

His role will be to:

- Ensure that casualties get adequate attention, arrange for additional help, if required and inform relatives;
- Arrange for relief of personal and organize refreshment/catering facilities, If emergency is prolonged;
- Arrange the stretcher and the First Aid Box at the assembly point and with the available facilities, organize a Make Shift Hospital in the Administrative Block;
- Keep company vehicle ready for any emergency shifting of casualties to hospital; and
- Apprise the Chief/Site Controller about the status of injured personnel and the arrangements.

❑ Medical Officer

On hearing the emergency siren/alarm or phone message, the medical officer along with first aid team will report to the Chief/site Incident Controller. His responsibility will be:

- To ensure that ambulance will be made available at the Emergency Control Center (ECC);
- If the ambulance leaves the ECC, it should be informed to Incident Controller;
- If the ambulance leaves with patient, the name and other particulars, hospital, destination etc. should be informed to the Incident Controller;

- To inform the Chief at the hospital about the causality reaching hospital for treatment;
- To keep necessary first aid medicines and artificial respiration equipment ready; and
- To inform doctors at other places to be ready, for attending serious injury and burns cases, if required.

☐ **Primary Controller (First Noticing Person)**

The primary controller is the employee who notices the incident/ accident. He will be responsible:

- To inform the security office (main gate) /safety manager/officer from the nearest available telephone about the location and the nature of incident;
- To assist fire brigade in their operation and in clearing any obstruction coming in way of fighting the emergency; and
- To carry out all instructions from Incident Controller.

☐ **Roll Call**

Record should also be maintained of the arrival and departure of visitors, together with the names.

The employees attending duty will be known through the punch cards and the records (on daily basis) of other employees (contractors and others) will be available at the security gate. At the time of emergency, attendance will be verified with the people assembled in the safe assembly and emergency assembly point.

In the immediately affected area, the Chief/Site Incident Controller should arrange for a search to be made for any casualty by fire brigade. Nominated work personnel should record the names and other details of casualties taken to respective reception areas and the location, e.g. hospital.

☐ **All Clear Siren / Alarm**

If the indication of the emergency is over and on hearing all clear signal, all employees will report back to their jobs excepting personnel who are instructed to stay back for necessary jobs at the scene of incident. The Chief Incident Controller is responsible for giving all clear signal after assessing the entire area conditions.

❑ Restarting

The Chief Incident Controller with his team of operation will inspect the area thoroughly and give instruction to start the ropeway as per restarting procedure in consultation with Site Controller and the Incident Controller.

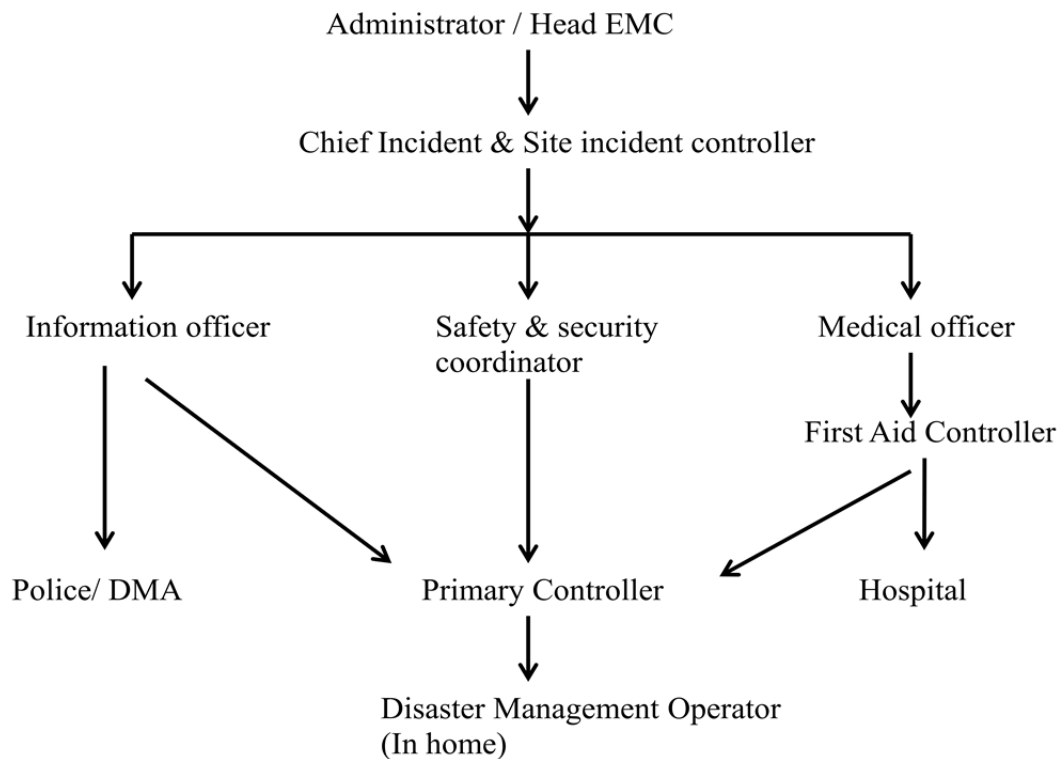


Fig. 7.9 Emergency Management Cell teams outline

Emergency Control Center (ECC)

In order to coordinate the emergency procedure during emergency, Administrative building should be made as ECC and should be equipped with the following:

- Layout plan of ropeway and surrounding area;
- At least two telephone lines. Out of two, one should be kept of receiving the calls and second one for making the calls in case of emergency;
- PPE, mask etc;
- Telephone numbers of administrative authorities, fire brigade, District medical officer, , Local police station and locally available private hospitals;

- Telephone numbers of all employees;
- Telephone directory of the city;
- List and MSDS of hazardous chemicals stored;etc

ROLE OF EXTERNAL AGENCIES DURING EMERGENCY

It is expected that the following roles shall be performed by various agencies:

Medical Facilities

Existing:

- *At Hemkund Sahib:* Emergency room with oxygen cylinder facility is available at Hemkund Sahib which is maintained by the Hemkund Gurudwara Committee
- *At Gangharia:* Dispensary maintained by Govinddham Gurudwara
- *At Govind Ghat:* Medical and Ambulance facility is maintained by Govind Ghat Gurudwara. Further, 108 Mobile Ambulance Facility is available at Govind Ghat – Joshimath highway.
- **Nearest Hospital: Joshimath**

Helicopter Facility

One Helipad is located at Ghangaria and there were two helipads at Govind Ghat which got washed-off in the June 2013 flash floods.

Civil Aviation Department, Govt. Of Uttarakhand is planning to create new helipads at Govind Ghat.

Helipad is also available at Joshimath which is maintained by **Indian Air Force**.

During yatra season, Helicopter facility is available from Govind Ghat to Ghangaria by private helicopter services provided by **Deccan, UTAir, Pawan Hans, etc.**

During June 2013 flash floods witnessed by Uttarakhand, Helipad at Joshimath was extensively used by Indian Air Force for emergency evacuation.

The Government of Uttarakhand plans to spend Rs 200 crore to strengthen the civil aviation sector in the state and to set up 40 chopper landing facilities in the hill state. The decision has been taken keeping in view the repeated natural disasters that frequently damage roads and bridges. The government has set up Uttarakhand Civil Aviation Development Authority (UCADA) and has

roped in the Airport Authority of India (AII), RITES, and Pawan Hans to develop new helipads, helidromes and heliports. At present, there are 12 helipads/helidromes in the state, most of which are undeveloped. In addition to this, the government intends to construct 28 more such facilities. These helidromes / heliports shall be equipped for Mi-17 category helicopter landing.

Airport Facility:

About 90 kms from Joshimath, is Gauchar airstrip which was used intensively for evacuation and supply of food during June 2013 disaster in the state. The Government of Uttarakhand is planning to strengthen the airport further to equip it for the operations of bigger aircrafts.

7.5 Safety Measures for Wildlife

From the safety point of view, the aerial ropeway seems to offer no danger of any kind to the Wild Life.

In the opinion of the Officer in-charge of the Nanda Devi National Park/ Sanctuary as submitted by him in the Part III of the documents submitted to the National Board for Wildlife (NBWL)

- Point No. 11-Due to preponderance of forest areas and scattered nature of habitats likely adverse affect on animal movement, connectivity and corridors are not anticipated.
- Point No. 12- The proposed project would not have any impact on the Wildlife in terms of Sections 29 and Section 35 (6) of the Wild Life (protection) Act 1972, as the case may be.

However all precautions and safety measures will be taken to ensure Maximum Safety of the Wild life during construction as well as Operational Phase, which are discussed as under:

During the construction phase

- Storage Yards for Construction Material, Tower Erection Steel Structures, Cable storage areas and other related Storage and working areas shall be properly made.
- The electro mechanical components of the ropeway would be designed to be of lighter weight and in parts to be joined and welded later at site; to ensure easy & harmless transportation by helicopter.
- The storage yards and construction areas will be barricaded with meshed wire fence of at least 3 m height. This would prevent the wild animals from accidentally entering into these work areas during the construction phase and thus ensure their safety.

During Operational Phase

- Minimum required area is being considered for the construction of Terminal Stations at maximum ground coverage of about 35% of the total plot area.
- As the Ropeway Towers, which shall be made up of steel, are to be erected over the ground, the base of the towers shall be of some danger to the Wild Life. Thus they would be closed in a mesh wire enclosure which shall be approximately 6 feet (2 m) high. This would prevent any animals from straying into these steel girder bases of the towers.
- The main stations of the Ropeway housing the pulleys with moving parts shall also be secured for bird hits by enclosing them with bird meshes.