

ANNEXURE 9

RISK ASSESSMENT AND DISASTER PREPAREDNESS PLAN

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1 Introduction

In order to ensure safety of life, to protect environment, to safeguard installation and rescue operations the Disaster Management Plan formulated. The purpose of the disaster management plan is to identify potential probable accidents/ emergency situations, establish and maintain procedures to address or prevent such situations, as well as to test the effectiveness/ review/ revise such procedures periodically. Generally the most of the accidents will be confined within the construction camp boundaries during construction phase and within the RoW of Highways during operation phase. This section of the EIA report presents an outline of disaster management plan in project districts of Uttarakhand.

1.1 Scope

An important element of mitigation is emergency planning, i.e. recognizing that accidents are possible, assessing the consequences of such accidents and deciding on the emergency procedures, both onsite and offsite, that would need to be implemented in the event of an emergency. Emergency plans are likely to be separate for on as well as off-site matters, but they must be consistent with each other, i.e. they must be related to the same assessed emergency conditions. While an on-site plan will always be the responsibility of the works management, different legislation may place the responsibility for the off-site plan elsewhere.

1.2 Objective

The overall objectives of the emergency plan will be:

- To localize the emergency and, if possible eliminate to; and
- To minimize the effects of the accidents on people and property.

Elimination will require prompt action by operators and works emergency staff using, for example, fire-fighting equipment, emergency due to collision and submergence etc.

Minimizing the effects may include rescue, first aid, evacuation, rehabilitation and giving information promptly to people living nearby.

1.3 Identification and Assessment of Hazards

This stage is very crucial to both on-site as well as off-site emergency planning and requires works management systematically to identify what emergencies could arise in their plant. These would range from small events, which can be dealt with by works personnel without Outside help to the largest event for which it is practical to have a plan.

The assessment of possible incidents should produce a report indicating:

- The worst events considered;
- The route to those worst events;
- The time scale to lesser events along the way;
- The size of lesser events if their development is halted;

- The relative likelihood of events;
- The consequences of such events.

1.4 Possible Type of Disaster

In roads & highways project, during construction and operation phases, disaster may occur due to the following types:

- Floods
- Earthquake
- Landslides
- Biological Disaster or Epidemic of Human/ livestock/ crops
- Fire
- Explosion
- Fuel Oil spillage
- Electrocution
- Hazardous materials releases
- Transportation accidents
- Terrorism / War
- Some of the hazards will be dealt with Government procedure for Natural hazards and calamities.

1.5 Earthquakes:

The details of the earthquakes of varying intensity since 1803 in the state and the nearby region are presented below

Earthquakes of Uttarakhand

S.No.	Date of occurrence	Magnitude	Affected area
1.	1 st September 1803	9.0	Badrinath
2.	1809	9.0	Garhwal
3.	26 May 1816	7.0	Gangotri
4.	25 July 1869	6.0	Nainital
5.	28 October 1916	7.5	Dharchula
6.	28 October 1937	8.0	Dehradun
7.	27 July 1966	6.3	Kapkot, Dharchula
8.	28 August 1968	7.0	Dharchula
9.	29 July 1980	6.5	Dharchula
10.	20 October 1991	6.6	Uttarkashi
11.	29 March 1999	6.8	Chamoli
12.	1 February /2006	5.2	Indo - China Border
13.	14 March 2006	5.0	Indo - China Border
14.	27 October 2006	3.8	Bageshwar
15.	31 March 2006	3.1	Chamoli
16.	5 August 2006	5.0	Indo - Nepal Border
17.	26 September 2006	4.1	Indo - Nepal Border
18.	27 October 2006	3.8	Bageshwar
19.	5 February 2007	3.5	Indo - Nepal Border
20.	27 March 2007	3.2	Uttarkashi

21.	22 July 2007	5.0	Uttarkashi
22.	7 August 2007	3.5	Uttarkashi
23.	3 November 2007	2.7	Uttarkashi
24.	25 January 2008	3.5	Rudraprayag
25.	13 August 2008	3.6	Bageshwar
26.	4 September 2008	5.1	Indo - Tibet Border
27.	25 February 2009	3.7	Uttarakhand
28.	18 March 2009	3.3	Uttarkashi
29.	15 May 2009	4.5	Chamoli
30.	27 August 2009	3.9	Uttarakhand
31.	18 September 2009	3.4	Uttarakhand
32.	21 September 2009	4.7	Uttarkashi
33.	3 October 2009	4.3	Bageshwar
34.	11 January 2010	3.9	Pithoragarh
35.	22 February 2010	4.7	Bageshwar
36.	3 May 2010	3.5	Uttarakhand
37.	31 May 2010	3.6	Almora
38.	22 June 2010	4.7	Pithoragarh
39.	10 July 2010	4.1	Almora
40.	14 March 2011	3.3	Chamoli
41.	20 June 2011	4.6	Chamoli
42.	24 June 2011	3.2	Indo - Nepal Border
43.	4 July 2011	3.4	Chamoli & Almora
44.	21 September 2011	3.1	Uttarkashi
45.	24 September 2011	3.0	Uttarkashi
46.	6 September 2011	3.8	Indo - China Border
47.	20 November 2011	3.2	Uttarkashi
48.	14 December 2011	3.2	Chamoli
49.	9 February 2012	5.0	Uttarkashi
50.	10 May 2012	3.9	Chamoli
51.	1 June 2012	3.7	Chamoli
52.	26 October 2012	3.5	Chamoli
53.	12 November 2012	2.5	Uttarkashi
54.	15 November 2012	3.0	Pithoragarh & Bageshwar
55.	26 November 2012	2.8	Bageshwar
56.	27 November 2012	4.8	Uttarkashi
57.	30 January 2013	2.6	Bageshwar
58.	11 February 2013	4.3	Uttarkashi
59.	17 February 2013	3.2	Uttarkashi
60.	25 February 2013	3.1	Uttarkashi
61.	6 March 2013	3.2	Indo - Nepal Border
62.	24 March 2013	2.9	Indo - Nepal Border
63.	6 April 2013	4.3	Rudraprayag
64.	5 September 2013	3.5	Uttarkashi

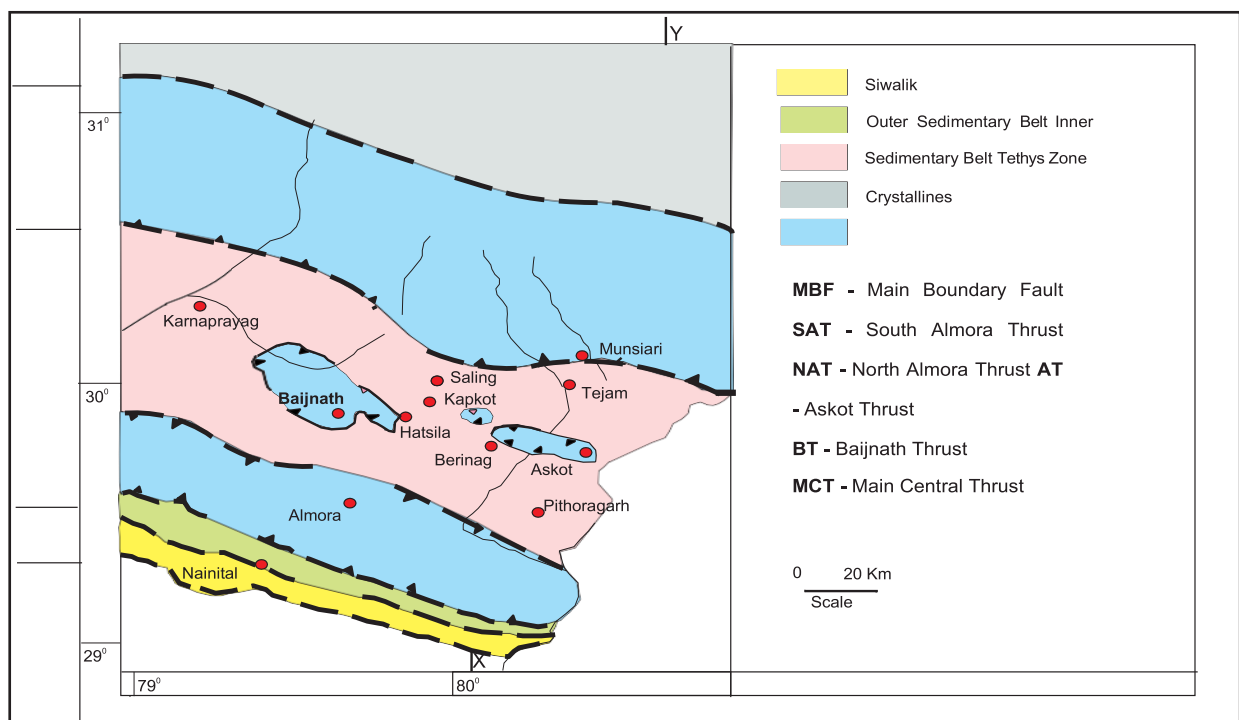
Source: National Institute of Disaster Management (Ministry of Home Affairs, Govt. of India)

1.6 Landslides:

During the periods of rainfall, landslides, slope failures or land subsidence is common in Uttarakhand hills. These are known to cause loss of human and animal lives, damage to

infrastructure like roads and buildings and destruction of agriculture and ecosystems. These are also known to aggravate, if environmental aspects of developmental activities are not adequately addressed. As per Central Water Commission, the possibilities of the landslides/slips can be avoided or considerably reduced by proper implementation of catchment area treatment plan including stabilizing of landslides/slips prone areas, reservoirs, rim treatment works, plantations etc.

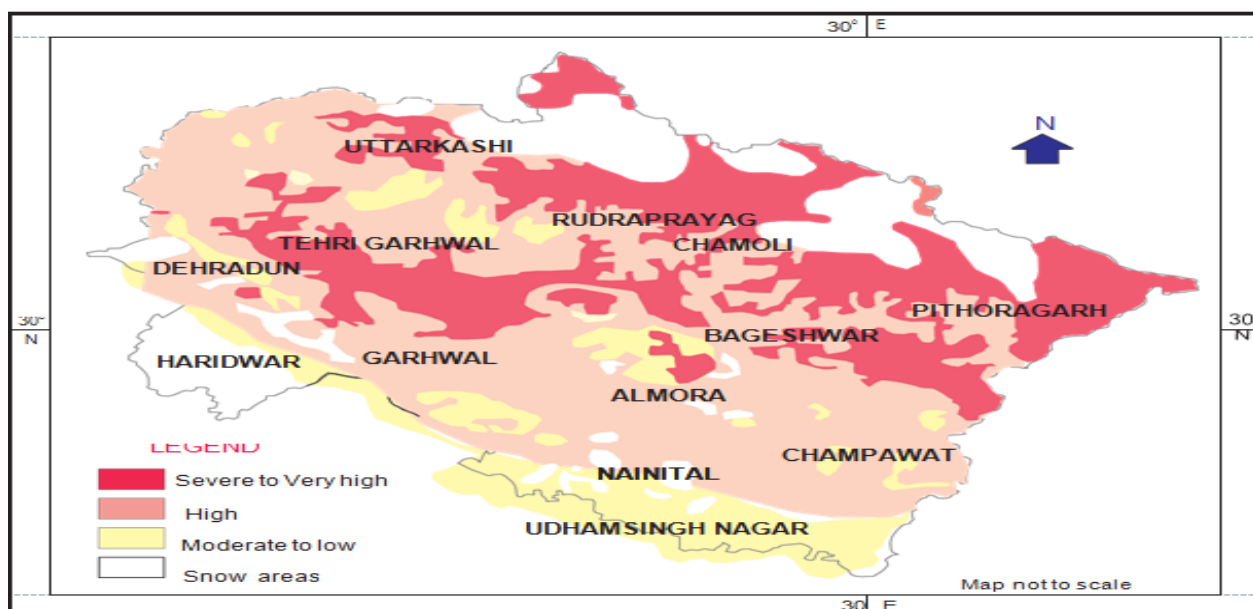
Landslides are particularly common in Uttarakhand along two zones lying in close proximity of two major tectonic discontinuities - Main Boundary Thrust (MBT) and Main Central Thrust (MCT). The sub divisions of Himalayas and associated thrust planes in Uttarakhand have been presented in **Figure below**.



Subdivisions of Himalayas and associated thrust planes in Uttarakhand

Source: National Institute of Disaster Management (Ministry of Home Affairs, Govt. of India)

Many landslides have occurred in Uttarakhand in the past. During August 1998, 103 people died in landslides which had struck in Madhmaheshwar and Kali Ganga valley". In 2001, approximately 20 people died in landslides in Phata and Gad area of Uttarakhand. About 16 people were killed in another landslide event on 5 July, 2004 that took place in Badrinath. Landslide hazard zonation map of the State showing vulnerable areas is given in Figure below.



Landslide zones of Uttarakhand

Source: National Institute of Disaster Management (Ministry of Home Affairs, Govt. of India)

Major landslides in Uttarakhand

Date/Year	Location	Remarks
1867 and 1880	Nainital	Two major landslides on the Sher-ka-Danda slope in Nainital. The 1880 landslide took place due to rainfall and an earth tremor, destroying buildings, and permanently filled a portion of the Naini lake.
1893	Alaknanda	Floods in the Birehi Ganga river near its confluence with the Alaknanda river triggered landslides causing major blockage of the river with a 10-13 m afflux. A girder bridge was bypassed and another one was destroyed.
1968	Rishi-Ganga	The Rishi Ganga river in Garhwal was blocked due to landslide at Reni village.
July 1970	Patal Ganga,	The Patal Ganga (a tributary of the Alaknanda river) was choked and a reservoir was created. The bursting of this choked reservoir resulted in flash floods in the Alaknanda river, triggering many landslides.
1971	Kanauldia gad	A major landslide on the bank of the Kanauldia Gad, a tributary of the Bhagirathi river upstream from Uttarkashi formed a debris cone that impounded water to a height of 30 m. Its breaching caused flash floods downstream.
August 1978	Uttarkashi	The Kanauldia Gad, a tributary joining the Bhagirathi river upstream from Uttarkashi in the Uttarakhand formed a debris cone across the main river, impounding the river to a height of 30 m, Its breaching caused flash floods, creating havoc. A 1.5 km long and 20 m deep lake was left behind because of the partial failure of the landslide dam.
1920, 1952, 1963, 1964, 1965, 1968, 1969, 1970 1971, 1972 and	Kaliasaur	Kaliasaur is one of the most persistent and regularly occurring landslides areas, located along the Rishikesh-Badrinath road. Landslides in this region result into frequent road blockage and land damage.

1985		
August 1998	Okhimath	Sixty-nine people were killed due to several landslides near Madhmaheshwar valley. The landslides caused huge devastation in villages.
18 August 1998	Malpa,Kali river	More than 210 people were killed. The heap of debris created was about 15 m high. The village was wiped out in the event.
24 September 2003	Varunavat Parvat, Uttarkashi	Incessant rains triggered massive landslide in the area, causing the 2003 Uttarkashi burial of numerous buildings, hotels, and government offices located at the foot of the hill slopes.
5 July 2004	Badrinath, Chamoli	Sixteen persons killed, 200 odd pilgrims stranded, 800 Chamoli shopkeepers and 2,300 villagers trapped as cloudburst triggered massive landslides washed away nearly 200 m of road on the Joshimath-Badrinath road cutting off Badrinath area.
29-30 June 2005	Govindghat, Chamoli	A cloudburst/landslide occurred in which huge quantities of debris and rock boulders were brought down along a seasonal nala. Eleven people were killed and property lost.
6 September 2007	Village Baram/Sialdhar, Dharchula, Pithoragarh	A landslide due to excessive rainfall resulted in 15 fatalities and loss of livestock.
2008	Amru Band	Total 17 people were killed, huge damages to roads and houses
8 August 2009	Berinag-Munsiyari road, Pithoragarh.	Forty three people died, due to landslide triggered by cloud burst.
18-21 September 2010.	Ganga-Alaknanda valley	Nearly 220 people died, 170 major and minor roads severely damaged.
14 September 2012	Okhimath, Rudraprayag	Sixty eight people killed in the landslides, which caused extensive damages to the buildings, agricultural lands, and roads at several places.

Source: National Institute of Disaster Management (Ministry of Home Affairs, Govt. of India)

Avalanches:

Generally, avalanches are common in Himalayan region with altitude more than 3500 m and slope more than 30 degrees. Convex slopes are generally more prone to avalanches. North facing slopes are known to have avalanches in winter, whereas south facing slopes usually get them during spring time. The holy shrines of Hemkund, Badrinath, Kedarnath, Yamunotri and Gangotri come under avalanche prone areas. Main avalanches occurred in Uttarakhand in the recent past are shown in **Table below**.

Major avalanches in Uttarakhand

Date/Year	Location	Remarks
June 2008	Gomukh Glacier near Gangotri, Uttarkashi	One person died and 9 injured.

June 2008	Hemkund Shahib, Chamoli	Six died and more than 12 people injured
September 2008	Kalindi-Badrinath track in the Garhwal Himalaya, Chamoli	Three persons were killed 37 persons were rescued.
21 September, 2010	Ghastoli, Chamoli	Two army officers were killed.
12 June 2013 and 1 July 2013	Kedarkharak, Uttarkashi Uttarkashi District	One person killed. Three Army personnel injured and 1 killed.

Source: National Institute of Disaster Management (Ministry of Home Affairs, Govt. of India)

Flash and Flash Floods:

With rainy season normally from late April to September the average rainfall of the Uttarakhand State is 1229 mm. Periods of high rainfall from July to September, result in flooding low lying areas and erosion of land. Increase of soil erosion in hilly areas has reduced the carrying capacity of rivers

Flash Floods are very common hydro-meteorological hazards which occur due to excessive or high rainfall combined with rapid snowmelt, bursting of natural or constructed dams, cloudburst, etc. These floods are devastating because of the high velocity of water with huge energetic capacity to carry away everything on its way. A list of major flash flood events from 1989 to 2011 along with damage is given in the **Table below**.

List of major flash flood events in the Uttarakhand

Date	Location	Damage
05-09-1989	Karanprayag, Chamoli	Three people died and 2 injured
26-12-1991	Uttarkashi	Three people died
30-07-1994	Chaukhutia , Almora	Four people died
02-08-1997	Near Neelkanth, Haridwar	Eighteen people died
17-07-2001	Near Meykunda, Rudraprayag	Twenty seven people died
20-07-2003	Didihat, Pithoragarh	Four people died
21-05-2004	Kapkot, Bageshwar	Three people died
09-06-2004	Kapkot, Bageshwar	Three people died
21-07-2005	Vijaynagar, Rudraprayag	Four people died
13-08-2007	Didihat, Pithoragarh	Four people died
25-07-2009	Joshimath, Chamoli	Three people died
2009	Munisyari, Pithoragarh	Forty Three lives lost due to massive cloudburst induced flash flood
19-07-2010	Kot, Pauri	Six people died
20-07-2010	Khatima, Rudrapur, Udham Singh Nagar	Three people died
31-07-2010	Dehradun	Five people died and 2 missing
18-08-2010	Dhari, Nainital	Thirteen people died and 3 injured
24-08-2010	Jaspur, Udham Singh Nagar	Four people died
08-09-2010	Karanprayag, Chamoli	Three people died
11-09-2010	Nyalgarh, Pauri	Three people died
18-09-2010	Belbandgoth, Champawat	Four people died
18-09-2010	Jwalapur Kasim, Haridwar	Five people died and 2 injured
20-09-2010	Dhari, Nainital	Five people died and 12 injured
22-09-2010	Kot, Pauri	Five people died

06-05-2011	Raipur, Dehradun	Three people died
15-08-2011	Tuneda, Bageshwar	Twenty one people died and 1 injured
03-08-2012	Asi Ganga Valley, Uttarkashi District	The worst affected areas were Gangotri, Sangam Chatti and Bhatwari. About 7,389 people from 1,159 families in 85 villages were affected. Nearly 28 people were killed in flash floods and landslides

Source: National Institute of Disaster Management (Ministry of Home Affairs, Govt. of India)

Cloud Bursts

Cloudburst is an extreme amount of precipitation, sometime with hail and thunder storm, which normally lasts for minutes but can also cause flash floods. Occasional cloudbursts in the region have resulted in flash floods and breaching of river banks, as listed in **Table below**.

List of major cloudbursts in Uttarakhand

Year	Location	Damages
2002	Khetgaon	Four person died
2004	Ranikhet	One person died
2007	Pithoragarh and Chamoli	Twenty three people died
2008	Pithoragarh	One person died
2009	Munsiyari Tehsil, Pithoragarh	Forty three people died
18 August 2010	Kapkot, Bageshwar	Eighteen school children were buried alive and 8 injured due to massive cloudburst
21 July 2010	Almora	Thirty six people died in cloud burst induced flash flood
13 September 2012	Chwanni, Mangoli and Kimana villages of Okhimath block in Rudraprayag	Completely inundated over Four villages and eroded two more villages

Source: National Institute of Disaster Management (Ministry of Home Affairs, Govt. of India)

1.7 Planning During Conceptual Stage

Proper planning of a DMP at the conceptual stage, although this is also responsibility of individual industry, helps in enhancing the safety of the equipment and worker. This eventually helps to minimize the loss of life and property, which are the direct consequences of accidents. In order to achieve this, following things need to be taken into account:

- Risk associated with the proposed facility
- Safety measures
- Siting of facility
- Layout of the facility
- Emergency preparedness and
- Compliance with the regulatory requirements
- Centralized control room
- LAN connecting to all safety concerns

1.8 Emergency planning and response procedures

Emergency rarely occurs. Therefore, activities during emergencies require coordination of higher order than for planned activities, carried out according to fixed time schedule or on a routine day to-day basis. To effectively coordinate emergency response activities, an organizational approach to planning is required. The important areas of emergency planning are Organization, Responsibilities, Procedures, Communication and Transport, Resource Requirements and Control Centre. Developer level emergency plan requires additional planning over and above those considered under above plans, which should be properly integrated to ensure better coordination. The emergency planning includes anticipatory action for emergency, maintenance and streamlining of emergency preparedness and ability for sudden mobilization of all forces to meet any calamity.

1.9 Disasters and Risks

The project consists of main area on which improvement of project road is proposed. In this scenario of vehicular movement, few risks and disasters are involved. This disaster could be natural as well as related to other sources. It is always important to chalk out strategies and planning to overcome these disasters at any given time.

Disasters (Events usually characterized by negative given impact and exceptional demands for intervention) are inevitable. Impact can be substantially reduced by adequate response, early warning and disaster responses. Disaster Management encompasses out aspects of planning for and responding to disasters and risks including hazard analysis vulnerability reduction (preparedness) prevention, mitigation, response, recovery and rehabilitation. Contingency planning relates to events, which major may not occur and potential responses put in place to prevent or respond to an emergency situation. It applies to management of both risks and consequences of disasters.

Mitigation is action to reduce the consequences of disasters while it may not be possible to prevent disasters, the effects can be modified or a reduced if appropriate steps are taken. Responses can be divided early and late phases. Early responses are rescuing a relief whereas later responses are Rehabilitation and Reconstruction. The first people respond to any disaster are communities/ institution themselves. Their resourcefulness is the key to disaster mitigation.

Thus there is inter- connection between Disaster Management and sustainable development while good Disaster planning minimizes interruption to development, poor responses can divert scarce resources, increase dependency and actually increase vulnerability to further disasters.

1.10 Risk analysis: Risk may be defined as the potential realization of unwanted consequences of an event (i.e. the product of the probability of an event and the consequences of the event). Both the probability of occurrence of an event and the magnitude of its consequences are thus involved. Acceptance criteria can be established either in the form of a predefined set of "Risk Acceptance Criteria" or in the form of "Optimum cost criteria". The Risk acceptance criteria are normally imposed by the authorities to reflect the willingness of people and society to accept risks. Optimum cost criteria are Acceptance Criteria based on cost effectiveness analysis comparing the cost of the bridge strengthening and protection measures against the benefits of risk reduction.

The analysis should take into account consequence of collision, such as:

- Damage to road
- Damage to the users of the road
- Inconvenience cost of society and business
- Social losses
- Damages to the environment.

1.11 Various Scenarios of Risks and Disaster in the Project

1.12 Head-On Collision/ Vehicle Accidents on the road

The major risk involved in this type of Disaster fatal or high degree of injury. Early response will be in terms of well-equipped ambulance with paramedical team reaching on the site. This will help in rescue of passengers from the accident site and will be taken to the nearest hospital. If need so arises the patient can be taken to one of the major and super specialty hospital in the area.

1.13 Important Features of the Disaster Management Plan

As mentioned above are the few important Disaster scenarios which could bring an emergency in system. The risks involved are of varied nature and requires an immediate attention. Rescue and Relief are two important and early parameters, which are responsive action to any disaster.

1.14 Traffic Surveillance Monitoring and Control System

Traffic surveillance shall be carried on the road. The project has built in sophisticated state of the art traffic management and control system. Signals will be used for controlling traffic on reversible lanes during emergency such as accidents, fire etc. lane use signals consisting of red, amber and green lights for permitting or prohibiting the use of specific lanes or to alert the impending prohibition of lane use will also be used. All road signs shall be of retro reflectories type and made of high intensity grade sheets with encapsulated lens type reflective sheets.

Mainly air pollution is contributed by vehicular emission. It is necessary to establish vehicular emission check center, in order to estimate contribution of vehicular pollution load and to identify the polluting vehicles.

1.15 Emergency Telephones

Emergency Telephones will be stand-alone; Central office and then to the control room. This approach was selected because of the long distances between the control room and the telephones. These wireless phones communicate on the 2.5 GHz band. The telephone directory of Civic Authorities has been presented in **Table** below:

Addresses and Telephone Directory of Civic Authorities

S.No.	Post name	Office No.	Mobile No.
1.	District Magistrate, Champawat	05965-230285	9412017838
2.	SDM, Champawat	-	7351512040
3.	Senior Superintendent of police Champawat	05965-230607	9411112984
5.	Chief Medical Officer, Champawat	05965-230312	9412975537

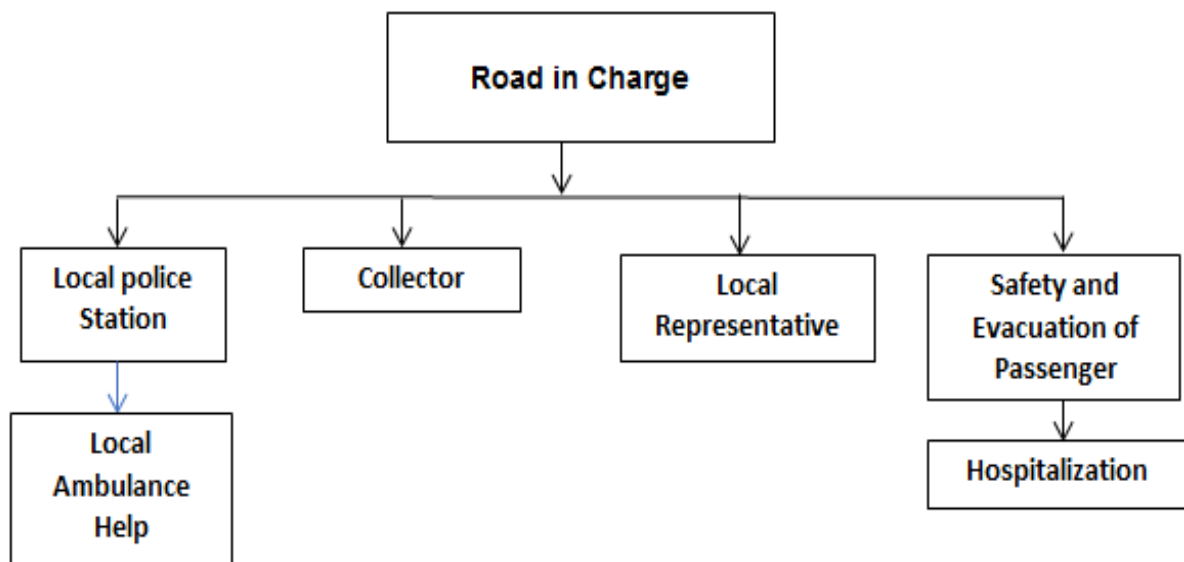
6.	District Magistrate Nainital	05942235684	9720070007
7.	Disaster Management Officer, Nainital	05942231178	9456523808
8.	Senior Superintendent of police Nainital	05942 -235730	9411112712
9.	District Magistrate Almora	+919456593401	+919456593401
10.	Safety Officer, Almora	9412306662	9412306662
11.	Senior Superintendent of police Almora	05962 -230007	9411112790
12.	Chief Medical Officer, Almora	9456362333	9456362333
13.	Police Control Room	100	-
14.	Fire	101	-
15.	Ambulance	102/108/	

1.16 Training and Operational Support

Adequate training will be given to staff for efficient of traffic surveillance, monitoring and control system. The training and operational support will be provided, the traveler information components, and system integration. Components are compatible with each other and are fully functional form the control center.

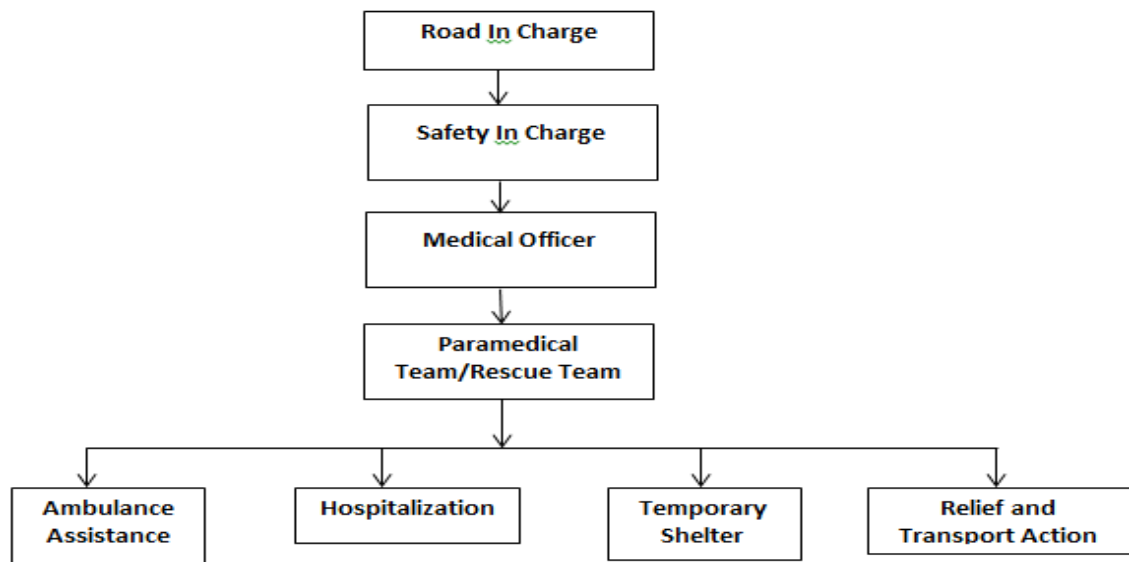
Enforcement is an essential ingredient to the successful operation of the traffic surveillance, monitoring and control system. Cooperation and coordination a with enforcement officials will be established to ensure that the integrity of the traffic surveillance, monitoring and control system that lawbreakers are dealt with in a satisfactory manner.

Figure below show the DMP for Accident Risk Scenario & Medical Safety Scenario respectively.



DMP for Accident Risk Scenario

Source: National Institute of Disaster Management (Ministry of Home Affairs, Govt. of India)



DMP for Medical Safety Scenario

Source: National Institute of Disaster Management (Ministry of Home Affairs, Govt. of India)

1.17 ROAD SIDE SAFETY MEASURES

Indian Road Congress (IRC) codes will be followed in proposing and designing road safety features. Pavement markings will be done for traffic lane line, edge lines and hatching. The marking will be with hot applied thermoplastics materials. The pavement markings will be reinforced with raised RR pavement markers and will be provided for median and shoulder edge longitudinal lines and hatch markings. Highway lightings including high masts will be provided at intersections in order to improve the night time visibility.

All the urban locations as well grade separated structure locations will be provided lighting arrangements