

# Etiquettes of Construction Management in Disaster-prone areas (*with special reference to Uttarakhand*)

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**Abstract**—*The infrastructure and construction industry is one of the most lucrative industries in the country and contributes substantially in the economic development of the nation as a whole. Construction industry is not only acknowledged as a way for the development of its infrastructure but to depict the present status of further development. The main objective of the research paper is to throw light that the newly established Himalayan state, Uttarakhand, has an incredible potential to invest in its infrastructural development, but not at the cost of its environment and the lives of the people. As in the present scenario, the infrastructural development of the state is flourishing more than an economic activity and has become a way towards its giant transformation. But its unplanned development led us to face June 2013 disaster, which was an alarm bell for the economic growth model being followed in the state. Being a disaster-prone state, a constant disaster preparedness at every level is immensely required and to be planned and integrated for sustainable development. The study will analyse the significance of following the etiquettes of construction management in hilly and plain areas of the state by scientifically identifying the problems and peculiarities of both the regions and scientifically solving them, so that we can materialize the sustainable development in the state without affecting its ecological balance while promoting its infrastructure.*

**Keywords:** *Infrastructure, Sustainable Development, Construction Management, Ecological imbalance, Disaster-prone areas.*

## 1. INTRODUCTION

Infrastructure acknowledged as a mirror of the economic development of any nation or state. The infrastructure and construction industry is one of the most lucrative industries of the country and contributes substantially in the economic development of the nation as a whole. Construction industry is not only acknowledged as a way for the development of its infrastructure but also to depicts its potential for further development. It generates wealth and growth in the country, but the development is neither equitable nor sustainable by carrying with blind motives. Uttarakhand, India's newest Himalayan state, has nine mountains and four plains' districts. Its inner mountain region is pristine, remote, rich in biodiversity and has fragile geographical features.

The entire state is disaster-prone, but successive state governments promoted an economic growth model that totally disregards Uttarakhand's disaster-prone characteristic. However, government put their faith in the conventional model of development with the single goal of increasing monetary wealth and revenue through industrialization, and resulted into haphazard construction activities carried out in the state. It is the same model that is followed throughout the country and does not recognize the special peculiarities of the mountain region. Massive floods and landslides in June 2013 was its worst disaster in history. A study by ASSOCHM Social Development Foundation (ASDF) said that there was a steep decline of 75% of tourist traffic post the June 2013 floods and the state tourism industry lost over Rs 1200 Crore (PHDCCI). The uncontrolled and unregulated massive construction was one of the most significant factors which added greatly to the number of lives and property lost in the disaster, and over the years the standard construction regulations were not followed in the state.

## 2. OBJECTIVES OF THE STUDY

- a) To discuss the challenges encountered with construction in disaster-prone areas of the hilly regions of the state.
- b) To study the significance of etiquettes of construction management in disaster-prone areas of the state by scientifically identifying the problems and peculiarities.
- c) To analyze the steps required to curb the losses of lives and property from frequent occurring disasters and provide sustainable infrastructure development.

## 3. RESEARCH METHODOLOGY

In the research study the researcher has made use of secondary sources of data in order to identify the challenges, problems in management of construction activities in disaster-prone areas of Uttarakhand. The study will analyse that the interest of local communities and ecology should be protected while

promoting infrastructure in the state. The study will also analyse the significance of following conventional methods of construction which is beneficial in disaster-prone areas. For the study researcher has used the data compiled and published by the *Department of Public Works Department (PWD) of Uttarakhand, National Disaster Management Authority (NDMA), Indian Meteorological Department* and also various official and non-official agencies have been used to draw relevant conclusion. Thus the data collected are compiled and analysed with the help of various statistical approaches.

#### 4. STATE PROFILE

As the state Uttarakhand came into existence on 09 Nov 2000. The newly formed state is known for not only for its varied natural resources but also for its rich scenic beauty and biodiversity. Its inner mountain region is remote, fragile, and prone to disasters. Its snow-capped peaks that surrounded this state make a profound impression on the people visited here and connects their soul to the aesthetic beauty of the nature. Rapid extension and construction of roads, new airports, helipads, bridges, dams and various modern buildings significantly added to its infrastructure. Nature has gifted Uttarakhand with abundant natural resources. It is blessed with bountiful rainfall, averaging about 1550 mm annually. Rain and snow feed thousands of rivers and streams flow in the state. Almost two-third of its area is covered with forest land although dense and moderately dense forest cover is limited to only 65 % of its area (Forest survey of India).

Since its formation the successive governments gave a special emphasis on its infrastructure development to bring socio-economic upliftment of untouched areas. As it is required for the development, but there is lack of proper planning and construction management in the hilly areas of the state. The rampant construction cause mishaps and consequence into serious natural disasters with immense loss of life and property. So it is very urgent to look into this matter very seriously so that we would not face such serious disaster in the near future.

#### 5. DISASTER-PRONE AREAS/HILLY AREAS AND ITS GEOGRAPHICAL HINDRANCES

Construction in disaster-prone areas/ Hilly areas is like a winning a war because of its various unfavourable factors. As the region is restricted with its climatic, geographical, hydrological and disaster-prone features, that makes construction a challenge in the area. Therefore one have to perform a lot of homework before pursue to construct any project. Following are some of the crucial factors that acts as a hindrance in the construction activities in the area:

- Extreme varied temperte and climate zones
- Sharp turns on highways

- Insufficient safety measures i.e landslides, frequent debris flow, deep gorges
- Risky slopes and river boundary beds
- Insubstantial construction waste deployment facilities
- Fragile inner land surface and seismic zones in the area

#### 6. CONSTRUCTION CHALLENGES IN DISASTER-PRONE AREAS

Uttarakhand has a total area of 53,483 km<sup>2</sup> of which 86% is mountainous and 65% is covered with forest. Since its formation in 2000 a massive construction of roads, dams, bridge, hotels, cottages/villas were carried out in the state. But the conventional models of construction activities are not fruitful for the state in the long run. Several factors like climatic conditions, geological and environmental features plays vital role in considering construction. The prominent deep gorges, river beds, high winds, low temperate zones, sharp turns on highways, debris flow requires greater attention while planning any construction activity. Following, are some of the challenges highlighted during construction in disaster-prone areas:-

##### Havocs of building roads

The expansion of hydropower projects and tourism in Uttarakhand created a need for more and wider roads for the big machines required at dam sites and the tourist traffic. To speed up the process corners are being cut. While the widening was earlier done by man power and machines, now we are using dynamite blasts to do it quickly. There are several roads that have become landslide prone because blasting leaves cracks inside the mountains," (Mazoomdar & Langer 2013). Earlier roads were built higher up the slopes on strong and firm rocks. Now a days these are built by the riversides on easily erodible slopes. Sustainable road building in Uttarakhand's sensitive and fragile mountain regions requires extra care and expenditure. But these requirements of the hills are generally ignored. Uttarakhand's most well-known Padma Shri geologist, Dr. K.S. Valdiya identified three major problems of road construction in the state. Firstly, active tectonic fault lines are usually ignored. "Micro seismic movements inactive fault lines make roads in these stretches susceptible to cave-ins and slides" Lack of adequate drainage also weakens the slopes. Finally, many roads are simply built over old landslides' debris to reduce costs. Hence the development works proving havocs for the state. Moreover timely completion of underconstructed roads also required in the state.

##### Illegal building construction on riverbeds

Habitations and hotel business are flourishing in a large number along riverside roads and become vulnerable to flash floods and other natural disasters. All along river front roads in Uttarakhand buildings have been built illegally right along river banks and sometimes in the middle of the river bed itself. Several times High Court ordered the state government to

demolish illegal structures built within 200 metres of river banks. But the state government's response was sleepy. It is serious that Vidhan Sabha building, the state's premier Doon University and several residential colonies are all at least partly located on the Rispana river bed in Dehradun. Unlike the state government, the rivers did not wait to act and led to disaster. Several times these buildings flashed with heavy rains but soon there appears a new structure on the same place. It is alarming that Unbridled and illegal construction taking place not only on the banks of large rivers but also along small streams. At every nook and corners, specially in hilly areas we may find such illegal constructions, without considering the construction patterns requirement of the land. In small towns where space is sometimes very limited, hotels, restaurants and shops are often illegally constructed in the middle of river beds in order to attract the tourists.

### III planned Hydroelectric projects (HEPs)

Various ill planned Hydropower projects are running in the state which was constructed without considering its adverse consequences of not only to damage the project structures but can cause acute loss of life in low-lying downstream areas in future. As per CAG performance audit of HEPs in Uttarakhand also highlighted that "No specific measures had been planned in any project to cope with the risk of flash floods" If we talk about the so called highly ambitious Tehri dam project erected with 1 billion US\$ and 1000 mw electricity production capacity. The project which not only highly displaced resident from their lands but also highly hazardous for the environment also. Government boost over its ultimate benefits not only for the state but also benefits other states. But as per cost benefit analysis commissioned by the Indian National Trust of Art and Cultural Heritage (INTACH) concluded that the construction cost of the dam is twice the projected benefits. Then again a mishap construction in the state at the cost of nature and human lives. Also it's a matter of concern that such big projects are highly unstable as they are located at the central Himalayan seismic zone.

### River-bed sand mining

A construction boom in Uttarakhand has led to large-scale sand mining from river beds. This unscientific sand mining increases the flow velocity and erosion of rivers with negative impact on the ecosystem of rivers. Local people in Uttarakhand have periodically protested that river bed mining leases are often exploited for profits, like construction of illegal commercial projects. Geologists say that sand mining should only be done without the use of heavy machinery and only in very small pockets of less fragile stretches in Himalayan rivers. But all the rules and regulations are going in vain. It is fearsome that river bed mining has often been allowed even in protected forest areas. A study on the impact of sand mining in Gaula river in Nainital district done by Wildlife Institute of India (WII) showed negative effects on the Flora, Fauna and the river ecology.

## 7. SUGGESTIVE CONSTRUCTION MEASURES IN DISASTER-PRONE AREAS

Visitors of Uttarakhand in the eighteenth century were amazed by the immensity of its forests (Guha, 1989), but in the last few decades there has been a large-scale deforestation – firstly due to the Britishers greed for timber and due to the construction of dams, roads and habitations, over-grazing and deforestation. Uttarakhand is highly disaster-prone and fall in seismic zone IV and V, the most earthquake-prone zone in India. Every year state witnessed frequent landslides, earthquakes, floods and forest fires. Following are some of the measures, so that construction would not affect the lives and ecological balance of the disaster prone areas.

### Sustainable hydropower projects and Dams

The following are some of the measures listed out so that dams prove boon and help in sustainable development in the state:.

- The requirement of environmental and social impact assessments or preparation of environmental and disaster management plans (DMPs) or monitoring of operations for projects with installed capacities of less than 25 MW;
- Many EIA reports must be prepared with honesty and DMPs are to be included which are presently inadequate;
- There should be cumulative impact assessments for river basins where a series of projects are to be planned on a river.
- Inadequate compliance monitoring systems to check the fulfillment of conditions imposed while approving projects;
- The main factors in deciding the size of a dam are the discharge and head available. Big dams are usually built on big rivers and small dams on smaller rivers or streams. All HEPs have the same kinds of environmental impacts. The only difference is that small projects have impacts that are more easily mitigated. Therefore instead of bigger dams, the strategy of smaller dams must be adopted in the state.
- Pro-dam biases of the appraisal, regulatory, monitoring agencies, environmentalist, Civil engineering department should investigate the projects so intensively so that dams utility would be materialised.
- Use of disaster-prone area specific hydro-projects must be formulated so that less affect to ecosystem with higher benefits may be reaped.
- Sanctions and approvals of projects must be in a transparent manner. An independent state commission should evaluate dams' proposals and monitor construction activities strictly and loyalty. At least some of the members of the monitoring committees must be from

affected communities. The approvals must ensure use of environment friendly construction practices and safer technologies like tunnel boring machines, insurance coverage, new dam designs and the use of the Precautionary Principle

### Environment friendly and Greener Roads

IIT geologists said that crucial parameters like geological safety factor, slopes and the characteristics of rocks should be considered before making a road in the Himalayan terrain. An analysis of the 2012 disasters by the Uttarakhand Disaster Management and Mitigation Centre (UDMMC) concludes, "It is therefore highly important to regulate developmental initiatives in close vicinity of rivers and stream. Use of explosives in the fragile Himalayan terrain for infrastructure developmental works introduces instability in the rocks and therefore use of explosives should necessarily be banned" (SANDRP 2013). GBPIHED has proposed the idea of greener roads and guidelines for building safer, green roads in the Himalayan region (GBPIHED). Therefore, there is a need to develop safe, multiple alternate routes, preferably trekking paths, specifically to the major shrines for safe and quick evacuation in the event of a disaster. Ropeways are useful alternatives to roads where the slopes are steep and distances are relatively short. Therefore, rope way would prove smart engineering and must be promoted so that less burden on roads occurs.

### Safer Habitation Buildings/cottages/Villas

Riverside construction may only be permitted at safe distances from the rivers on solid rock. The Uttarakhand High Court order banning construction within 200 m of all rivers in Uttarakhand needs to be strictly enforced, which is seen nowhere in the state. The state government must take strict action to demolish structures built in dry river-beds and strict guidelines for officials for the same. The Uttarakhand government must effectively promote low cost earthquake safe building construction in the rural areas. Experienced and Enthusiastic Village officers should be enlisted to raise the awareness of villagers about earthquake, safe construction features and to train masons to build such houses that have safety from earthquake, floods, rains etc. Specially by identifying the peculiarities of the kind of disaster occurrence in the area.

### Stability Analysis of slopes in disaster-prone areas

The stability Analysis of slopes is immensely required before starting any construction as the slopes are very fragile in some parts of the hilly areas, so that stability of the constructed building to be determined in the near future and other stability measures will be found out and suggested for the strong building. This will lead to firm construction and less chances of its collapse during heavy rains, floods and any other natural calamity etc.

### Analysis of weather interruptions

Besides geological conditions, weather conditions of the state are also varied and changeable frequently, therefore before planning any project firstly specify the weather vulnerability of the region and analyse its effect over its timely completion and the also has a significant impact over the firmness of the projects.

## 8. CONCLUSION

In a hurry to achieve the status of developed state and power state, the entire process of construction at every level is to be strengthened so that a safe construction, hydropower sustainability, environmental conservation and public acceptance can be achieved, besides curbing losses of lives and property during any natural disaster. Local communities must be included in the assessment process of the small-big projects of infrastructure, so that correct and actual cost-benefits assessment can be ascertained. The concept of Green, eco-friendly and conventional/traditional techniques of construction should be encouraged and supported so that safer infrastructure can be developed with sustainability. If the construction activities are being well planned, organized and managed in the state with considering its varied geographical and weather features, then we can achieve the completion of projects not only in time but also accumulate our capital asset with very strong infrastructure that can stand firm in occurrence of varied natural disasters in the "abode of gods" that is Uttarakhand.

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