International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

Environmental Impact of Road Construction in Nagaland State of India

Zulumanen[1], Sangyu Yaden[2]

[1, 2]Department of Geography, Nagaland University, Lumami
Email: *zulumanenjamir[at]gmail.com*

Abstract: ***Nagaland is a developing state of India with incessant strive towards better economic development and thus the massive road cutting across the state for better connectivity with the rest of the country in particular and the world in general. However, like any other northern hill region of India such as the Himalayas, it is characterised by steep and undulating hills with porous soil and rock formation coupled with incessant rainfall during the monsoon season. All these factors combined poses a serious threat to the environment and living population as the developmental activities continues to gain pace and momentum. Landslides, soil erosion, flash floods, floods and other geomorphic hazards are a common occurrence in the various parts of the state owing to its topographic complexity which has been enhanced with the increasing population and developmental activities. The increased rate of land sliding, rockfalls etc due to road construction has reversed the anticipated benefits from improved road access. This study brings to light the prospects behind the massive road construction that is underway along the National Highway 2 that connects the districts of Kohima (State Capital),Tseminyu, Zunheboto,Wokha and Mokokchung in Nagaland and the hazardous impacts it has on the natural environment and living population of the region.***

Keywords: Road construction; Environmental hazards; Rainfall; Nagaland

1. Introduction

Various relevant investigations on road induced hazards (Valdiya, 1985; Haigh, et al., 1988; Mosely, 1980) have illustrated that road construction have greatly altered and created severe environmental threats and imbalance in the ecosystem both in the physical and cultural landscapes. Moseley in 1980 in one of his studies near Nelson, New Zealand discovered that the road system contributed 750-800 cubic meter/kilometer/year debris to the local sediment budget. The construction of 44,000 km long roads in the Himalayan region have generated $2650x10^6$ m^3 of debris by landslides and rock fall, so that every year $24x10^6$ m^3 of sediment slide down the slopes-killing vegetation smothering springs and chocking mountain springs and streams (Valdiya, 1985). The annual rate of sediment generation as reported by Border Road Organization, is as high as 724 cubic metres/kilometer on Jammu-Srinagar Highway of Kashmir,591 cubic metres/kilometers on the Arunachal Pradesh highways, and 411 cubic metres/kilometer on the Tanakpur-Tawaghat road of Kumaun Himalaya (Haigh et al., 1986).At Mussoorie of central Himalaya, Haigh (1979 a) found that the road construction has contributed 5-10 percent increase in watershed sediment yield. However, it is important to mention that there exist variations in the above-mentioned rates. Satendra (2003) in his book Disaster Management in the Hills have mentioned that erosion from road sites is ten times more than from agriculture, 200 times more than from grass lands and 2000 times more than from forest cover. This figure in itself presents the severity of the present scenario of Nagaland state of India.

Nagaland, lying in the northeastern part of India is an extension of the Himalayan hill region at 25°6' N and 27°4' N latitudes and 93°20'E and 95°15'E longitudes covering an area of 16,579 sq.km (Figure 1). It is bounded by the Indian states of Manipur in the south, Arunachal Pradesh in the Northeast, Assam in the West and Northwest and the country of Myanmar in the East. Nagaland is a topographically complex region being an eastern extension of the Himalayas, it is characterised by high relief, steep slopes, rapid uplift and weathering, unconsolidated rocks and folded and fractured rocks in most parts of the state and undergoes several geologic processes out of which tectonic movements and land sliding are a common occurrence. In Nagaland, the period between June and September is marked by concentrated monsoon rainfall where almost 80% of the total annual rainfall is expected during this season. In such a setting that is prone to natural landslides, anthropogenic disturbances like road construction can further aggravate the occurrence of landslides (Hearn et al., 2003; Petley et al., 2007; Thapa, 2015). For a low- and middle-income state like Nagaland, it is dependent most entirely on road for its

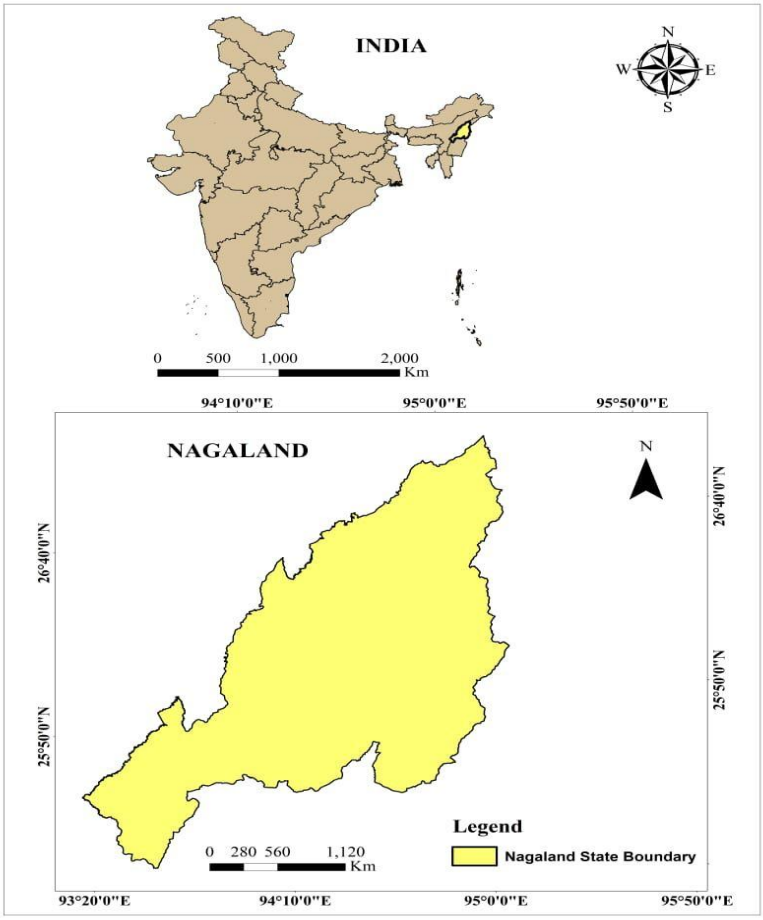

Figure 1: Location map of the study area, Nagaland state of India

Socio-economic development and socio-cultural benefits for those living in the rural areas which validates the extensive road construction due to the urgency for development while the vulnerability of the geographical aspect of the region proves to be a challenge. Owing to the Central government's initiative to construct more roads and highways and widening of already existing roads along the state since 2019, we have seen the aggravation of the environment to a larger extend and thus the need remains for better innovative and sustainable development strategies.

2. Methodology

The present study is at its preliminary stage and thus is a result of field survey which included an observation of the National Highway 2 and its environment, coupled with the study of the various road construction history and projects confined specifically to Nagaland state of India.

3. Discussion

National Highways in Nagaland: Nagaland has a total of 11 National Highways passing through, namely, NH 2, NH 29, NH 129, NH 129 A, NH 202, NH 202 K, NH 329 A, NH 702, NH 702 A, NH 702 B and NH 702 D (Figure 2a). The state's total length of road accounts at 14,377.50 km of both surfaced and unsurfaced roads covering a length of 7585.20km and 6785.30 km respectively according to the Road Statistics of Nagaland, 2013 and therefore the road density is estimated to be 86.68 km/100 sq. km. 1 km length of road construction requires removal of 60,000 m^3 of debris from the site (Satendra, 2003). If thus calculated for the entire surfaced or metalled road of Nagaland, the debris removal for metalled roads comes to 7585.20 x 60000 m^3 = 455,100,000 m^3. This figure gives an idea of the huge amount of erosion that takes place as a result of road construction.

The National Highway 2 (NH 2), that runs through the districts of Kohima, Tseminyu, Zunheboto, Wokha and Mokokchung is one of the widely travelled road in the state as it runs through the state capital along with the 2 fastest developing districts in the state and connects the state with that of Assam on the north and Manipur to the south (Figure 2b). The length of NH 2 within the vicinity of Nagaland state is estimated at 270.50 km where 200 km comprises of surface 2 lane road, 40 km is under construction and an approximate of 30.50 km has been sanctioned for construction based on interview with the office of Govt. of Nagaland PWD (R& B).

Physical geography and the NH 2 road network of the study area: Kohima, Tseminyu, Zunheboto, Wokha and Mokokchung are the 5 districts in Nagaland which are characterised by 85% of hilly and undulating slopes. The elevation of Kohima ranges between 255 to 3030 m.a.s.l, Tseminyu between 245 to 1730 m.a.s.l, Zunheboto between 315 to 2660 m.a.s.l,Wokha

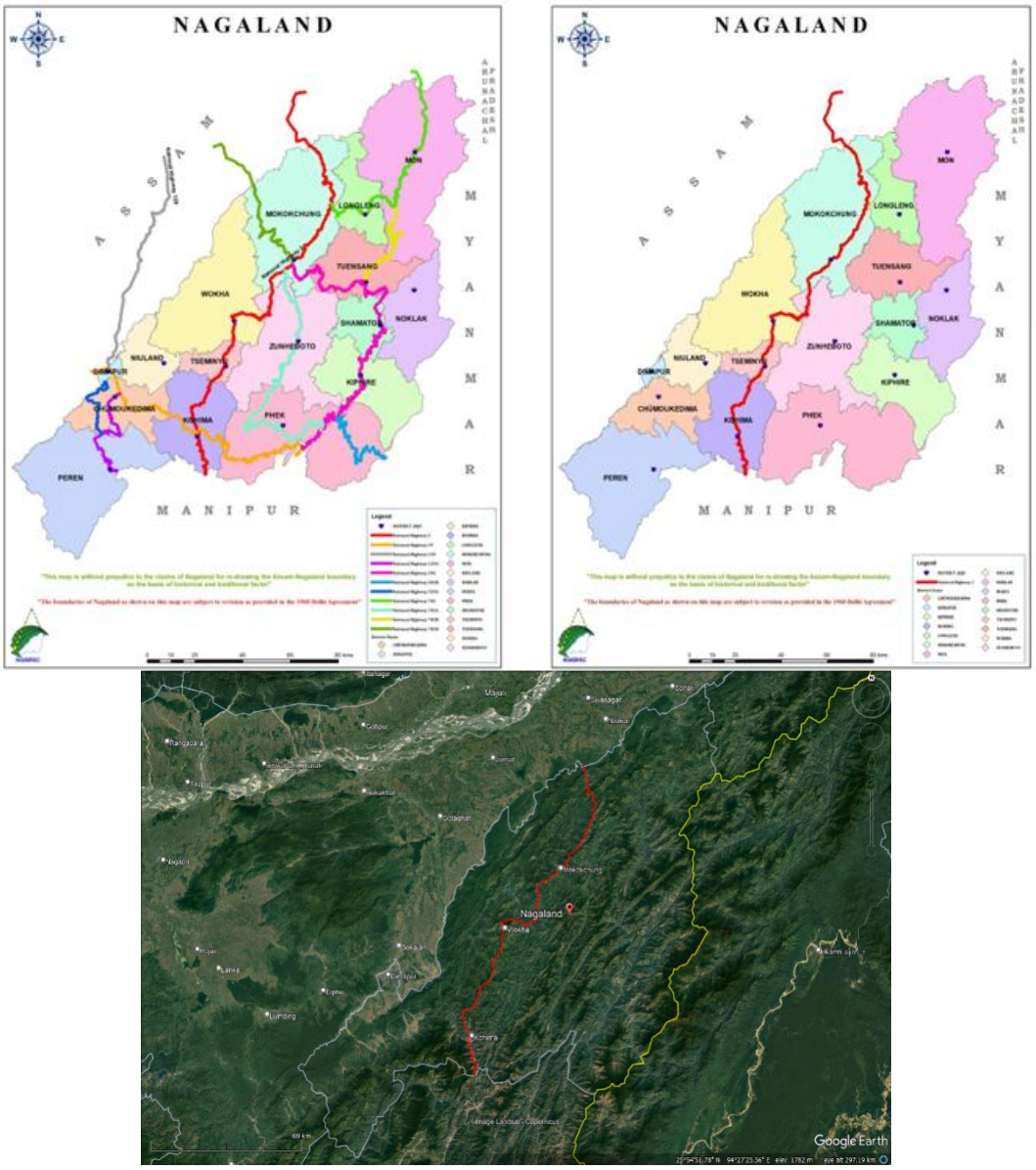

Figure 2: a) Nagaland state and its highways **b**) National Highway 2 in Nagaland state **c**) Google map view of NH 2 across Nagaland state (Figure 2 a and b: Source: NGISRSC)

between 105 to 1990 m.a.s.l and Mokokchung between 105 to 1995 m.a.s.l. As we can see from the Figures 2 a, 2 b and 2 c that the NH 2 road network has been constructed along the elevation range between 315 to 1995 in all the 5 districts combined which stands as the highest elevation range in the district of Tseminyu, Wokha and Mokokchung, while a moderate elevation range in Kohima district and that of lowest elevation range in Zunheboto district where only 1% of the National Highway 2 touches the respective district. Therefore, construction of the NH 2 for the most part of approximately 80% is seen on the highest elevation range of the collective region.

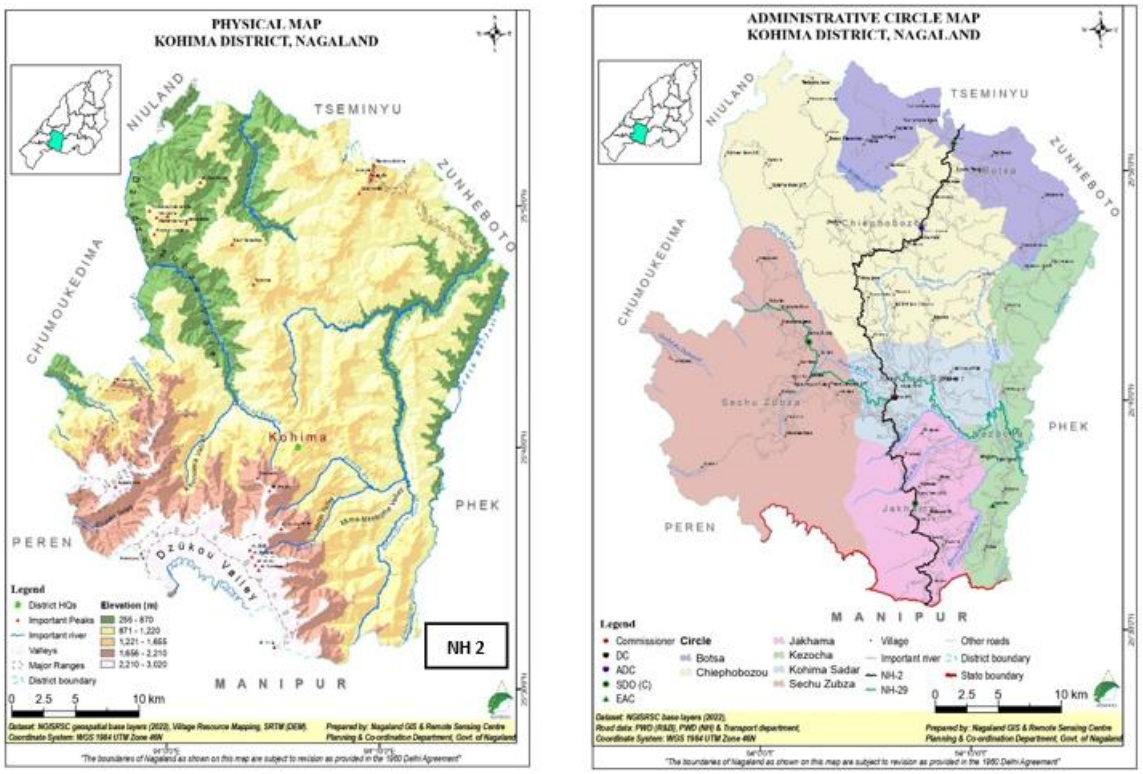

Figure 3: Comparative map of Physical map and Transportation map of Kohima district Nagaland with the NH 2 (Source: NGISRSC)

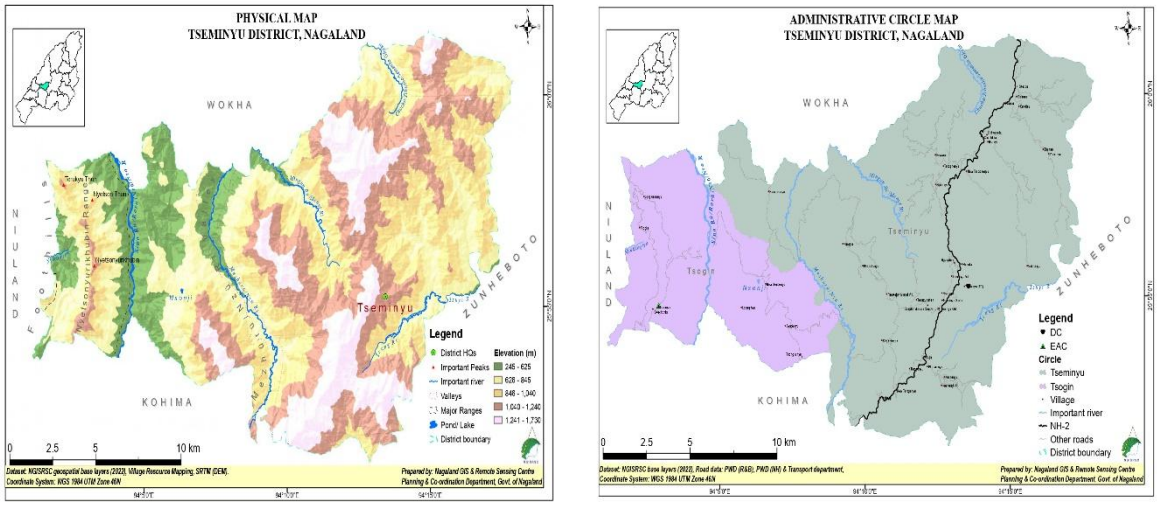

Figure 4: Comparative map of Physical map and Transportation map of Tseminyu district Nagaland with the NH 2 (Source: NGISRSC)

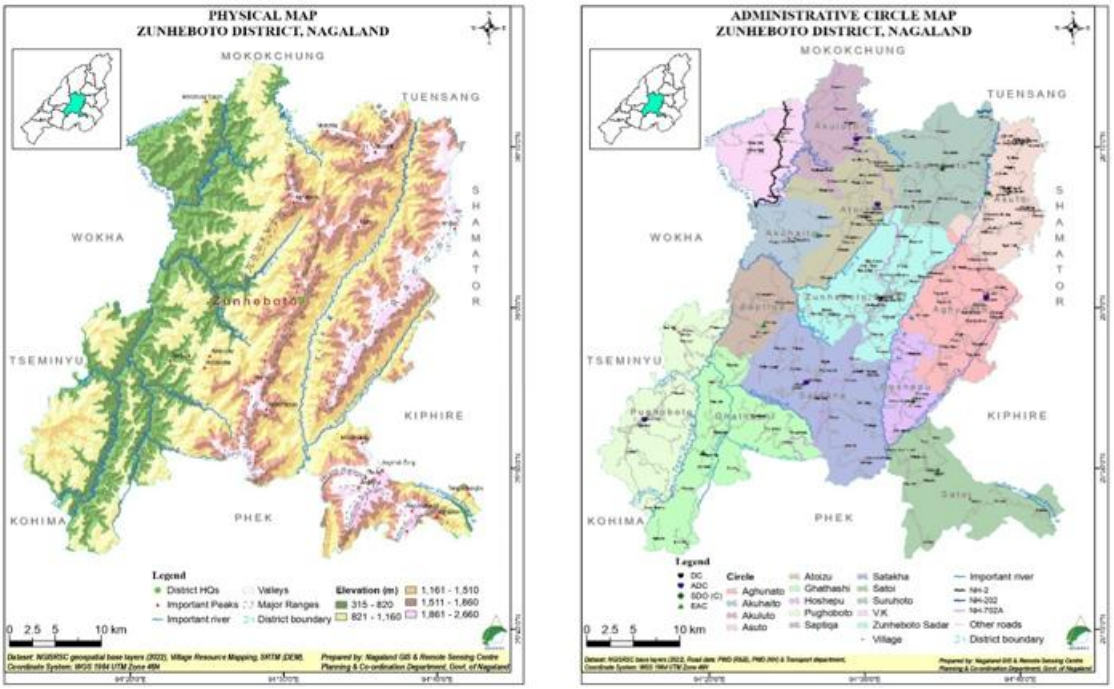

Figure 5: Comparative map of Physical map and Transportation map of Zunheboto district Nagaland with the NH 2 (Source: NGISRSC)

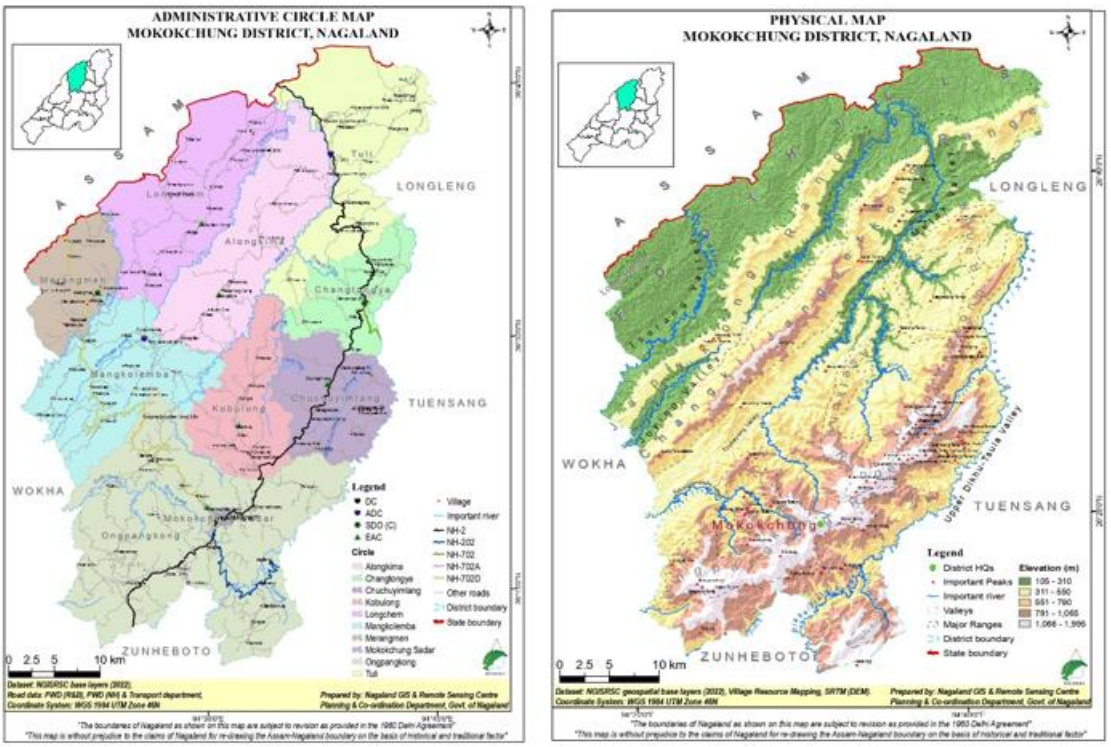

Figure 6: Comparative map of Physical map and Transportation map of Mokokchung district Nagaland with the NH 2 (Source: NGISRSC)

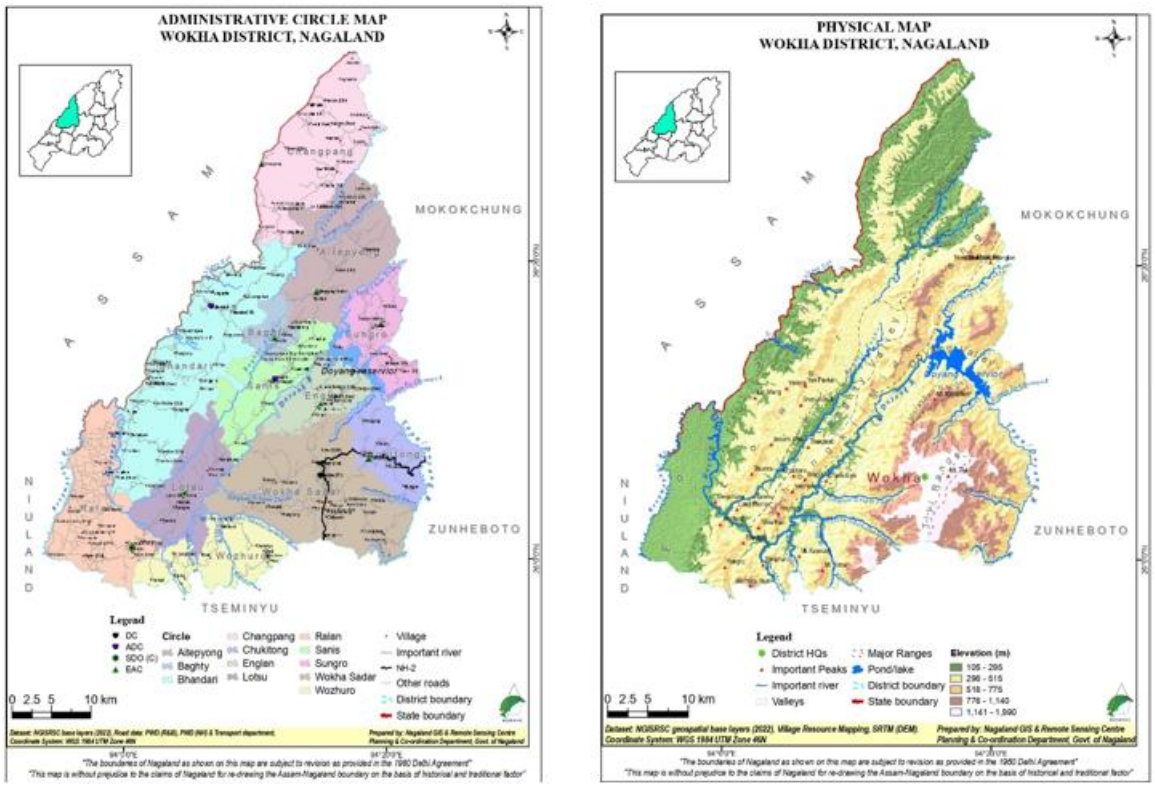

Figure 7: Comparative map of Physical map and Transportation map of Wokha district Nagaland with the NH 2 (Source: NGISRSC)

Although this may prove fatal for various hazardous consequences, it is important to note that roads constructed with the sole aim for economic connectivity. Building roads on higher elevation will – i) improve economic growth of the region as high altitudes may have important resources such as minerals, hydroelectric power which requires transportation as well as building roads in remote areas increases market, tourism and improves overall economy of the region. ii) Have military importance for strategic commuting of military personnels. iii) Improve social expansion as it can improve connectivity of remote villages and towns to various facilities and amenities and iv) for environmental concerns as it may help in conservation efforts for monitoring research and protection of endangered species and habitats.

However, it is vital to note that, road construction in Nagaland has led to an uprooting of the forests on a large scale. According to the report by Indian State of Forest Report, the total forest cover in Nagaland in 2011 was 13,318 sq. Km which drastically declined to 12,251 sq.km in 2021. This ultimately led to the loosening of soil the consequences of which is the failure of landscape. It is one of the five states where land is degrading is at an alarming rate, according to the Indian Space Research Organization's Space Applications Centre (SAC) atlas.

The region receives heavy rainfall during the monsoon months of June to September, while also the newspaper reports during these months are filled with reports of road mishaps, landslides, road blockades etc. The state is abounded with water bodies in the form of rivers and streams which are mostly rain fed and ponds and lakes which prove the idea of its insufficient intake capacity during heavy monsoon seasons which ultimately leads to flash floods and heavy erosion of surrounding areas resulting into landslides of various forms. This has become a serious environmental threat as there has been numerous reports of accidents, road blockages and severe economic blockades around the state.

4. Conclusion - Management and mitigation

While good and efficient road connectivity is very vital in today's fast-moving world, especially for a state like Nagaland which has been left neglected for a very long time owing to its far eastern geographical location from the rest of the country and various other cultural and social differences which has acted like a barrier between development and the state for a good period of time, it is also important to understand that, in desperate efforts to reach to the rest of the world, we have to be aware of the consequences it is causing to our land and the living population. For these, it is necessary to count, assess and strategize every step we take towards development without jeopardising the safety of the population and the land.

Nagaland in itself is topographically a challenging land and therefore requires special efforts and investigations before making any permanent changes. Road construction in Nagaland as of recent times is the highest rated activity that has been undergoing, however, with that, reports of landscape failure, forest loss, loss of settlements, and loss of lives have also become a frequent event. Therefore, it is extremely vital to take serious note of the issue. Everyone is aware of the hazardous impacts these road constructions are causing as we are living in the very core of the situation. However, not everyone is concerned about it unless it affects oneself personally. Therefore, greater efforts should be made by the government, NGOs, educational institutions and

various other social workers to not only spread awareness theoretically but practically as well. This can be done by reaching out to every ward of the respective administrations of every district in the form of a seminar or workshops. Greater efforts lie in the engineering section of the government where a penalty should be implemented in cases of unscientifically supervised activities before and after road construction.

Lastly, it is crucial to understand that we can only develop as much as we want, for if it does not fit into the natural context of the environment, it will ultimately backfire and cause greater loss than gained.

References

[1] Belho, K et al (2023): Response of Hydro-meteorological Hazards to Environmental Degradation in Kohima district of Nagaland. International Journal of Scientific Research in Science, Engineering and Technology, 10 (1): p.339-34
[2] Indian State Forest report (2021): Govt. of India.
[3] Kalwar, S.C. et.al., (2005): Geomorphology and Environmental Sustainability, Concept Publishing Company, New Delhi.
[4] Petley, D.N.et al (2007): Trends in landslide occurrence in Nepal. Nat Hazards 43, 23–44. https://doi.org/10.1007/s11069-006-9100-3
[5] Pirazizy, A.A. (1992): Environmental Geomorphology and Natural Hazards, Concept Publishing Company, New Delhi.
[6] Pradhan, Samprada (2021): Impacts of road construction on landsliding in Nepal, Durham theses, Durham University. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/14069.
[7] Rawat, M.S. (2011): Environmental Geomorphology and Watershed Management, Concept Publication Company pvt. LTD. New Delhi, p. 226.
[8] Road Statistics of Nagaland (2013): Public Works Department, R & B, Govt. of Nagaland.
[9] Satendra (2003): Disaster Management in the Hills, Concept Publishing Company, New Delhi-110059, p. 57-108
[10] Thapa et.al (2015): Potential of high-resolution ALOS–PALSAR mosaic texture for aboveground forest carbon tracking in tropical region. Remote Sensing Environment.