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Brief Communication: Vehicles for development or disaster? The new Silk Route, landslides and geopolitics in Nepal.

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Abstract

The “One Belt, One Road” (OBOR) policy launched in 2013, one of China’s most ambitious foreign investment and policy initiatives, portends significant changes in the social, cultural and critically, the physical landscape of Nepal, which became a signatory in May 2017. The small, mountainous nation is sandwiched between the massive Indian and Chinese economies and the roads that link these two signify vehicles of change. There are plans for expanding several major trunk roads to pass from Tibet to India along existing routes that are already being impacted by increased trade, and the recent landslide victory of the left alliance (Communist and Maoists Centre) auger greater openness toward China. Rural villages adjacent to these trunks will undoubtedly continue to tie into these roads via a network of poorly-constructed feeder (rural) roads which are likely to increase environmental, economic and human risks associated with roadside landslides. This commentary elaborates on the above issues based on research on the occurrence of roads and landslides in Nepal with recommendations for improved road governance.

Introduction

The “One Belt, One Road” (OBOR) policy launched in 2013, one of China’s most ambitious foreign investment and policy initiatives, portends significant changes in the social, cultural and critically, the physical landscape of Nepal, which became a signatory in May 2017. The small, mountainous nation is sandwiched between the massive Indian and Chinese economies and the roads that link these two signify vehicles of change. There are plans for expanding several major trunk roads to pass from Tibet to India along existing routes that are already being impacted by increased trade, and the recent landslide victory of the left alliance (Communist and Maoists Centre) auger greater openness toward China. Rural villages adjacent to these trunks will undoubtedly continue to tie into these roads via a network of poorly-constructed feeder (rural) roads which are likely to increase environmental, economic and human risks associated with roadside landslides.

As geopolitics between the two superpowers play out on Nepal’s soils, hills and rivers - who will win, who will lose? Does this new development link rural mountain communities to economic development opportunities, better health care and education options, and increased social networks? Or will the new roads through its fragile mountains create hazards such as landslides and damaged terraces while spurning unplanned satellite roads? Will Nepal rise to the challenge of establishing safeguards to ensure that promised benefits outweigh the losses as it transitions to the newly established decentralized federal governance system? This commentary elaborates on the above questions based on research on the occurrence of roads and landslides in Nepal with recommendations for improved road governance.

Background

Whether supporting the state strategy of “integration, or national unity” (i.e., the East-West Highway; **Figure 1**), by encouraging trade and population migration (i.e. movement of populations from the hills to the Terai in the 1950s), or as a geo-political play-off between Nepal’s megaliths China and India, road construction

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in Nepal has always been closely linked to nation-building and geopolitics (Rankin et al, 2017; The Economist, December 23, 2017). In other words, socio-politics impact road construction as much as roads impact socio-economics and environments (Murton, 2016). Dating back to the Rana period around the turn of the 20th century, the absence of roads linking Nepal and India was a strategy to hold the British at bay by deliberately controlling access, while the first roads around the Kathmandu valley constructed in the 1920s were considered key to ensuring supplies and consolidation of power for the elite (Rankin et al., 2017). Subsequent regimes, notably during King Mahendra's reign (1955-1972), leveraged cold war tensions to Nepal's advantage by playing off India/USA and China/U.S.S.R. poles to obtain development benefits from both sides (Rankin et al., 2017).

Until recently and with a few exceptions (notably the Arniko Highway linking China to Kathmandu), India has dominated most of Nepal's road infrastructure development, carefully guarding hydropower resources and its water tower upon which Northern Indians depend for irrigation and drinking water. Then came the devastating Gorkha earthquake [M 7.8] in April 2015, precipitating the signature of the long awaited National Constitution and a consequent Indian petrol blockade, (a complex combination of India's discontent with the new federal system and ethnic sympathies with India). The 5-month long petrol crisis opened a door for Nepal to look elsewhere for new trade routes, especially to its neighbor in the north (The Economist, December 23, 2017). China was also enjoying considerably good relations with Nepal after providing massive humanitarian assistance during the earthquake.

New trends paving the way for Nepal's roads

The One Belt, One Road (OBOR) initiative was launched in 2013 by the Government of China with the aim to connect major Eurasian economies through infrastructure, trade and investment. It is intended to revive the land and maritime Silk Road via a trade and infrastructure network spanning 60+ countries across East Asia, Western Europe and Africa. It consists of massive investments in roads, railways, ports and other infrastructure and provides significant opportunities for signatory countries to increase their economic development. The land-based part of the initiative passes through some extraordinarily mountainous terrain in countries such as China itself, Kyrgyzstan, Tajikistan, Iran, Armenia, Bulgaria, and Nepal and the hotly contested Kashmir region of Pakistan (The Economic Times, 2017). Infrastructure in such mountainous terrain warrants special attention to ensure that construction does not cause environmental harm or aggravate disaster risks such as landslides and flooding.

Although large national roads are generally constructed with proper engineering standards, many satellite roads that spring up in rural mountain areas of the Himalayas to feed into larger national roads lack proper design and cause significant environmental damage while straining local resources. Much of this expansion is due to weak planning and a lack of environmental management capacity. The question is whether the OBOR program will improve or worsen this outlook.

The Nepali road network has expanded from 4,740 km in 1998 to 12,494 km in 2014, of which 6,369 km were blacktop, 4,174 km were earthen and 1,924 km were gravel roads (DoR, 2015). This represents an 11% annual increase in rural earthen road construction alone (World Bank, 2016). Such rapid road construction throughout the country, but particularly in the high and mountain areas, is placing increasing pressure on extremely fragile ecosystems. This situation is worsening due to the intensifying rainfall during the monsoon, attributed to climate change (Bharti et al., 2016), which has led to a higher occurrence of landslides, especially in the middle and lower hills (*Siwaliks*).

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The Government of Nepal (GoN) is committed to supporting implementation of the OBOR Initiative (The Wire, July 11, 2017). This participation has opened up new opportunities in multiple fields including trade, connectivity, physical infrastructure development, tourism and investment. Subsequently, GoN has initiated opening borders with China through several improved strategic highways (The Economist, December 23, 2017) (**Figure 1**).

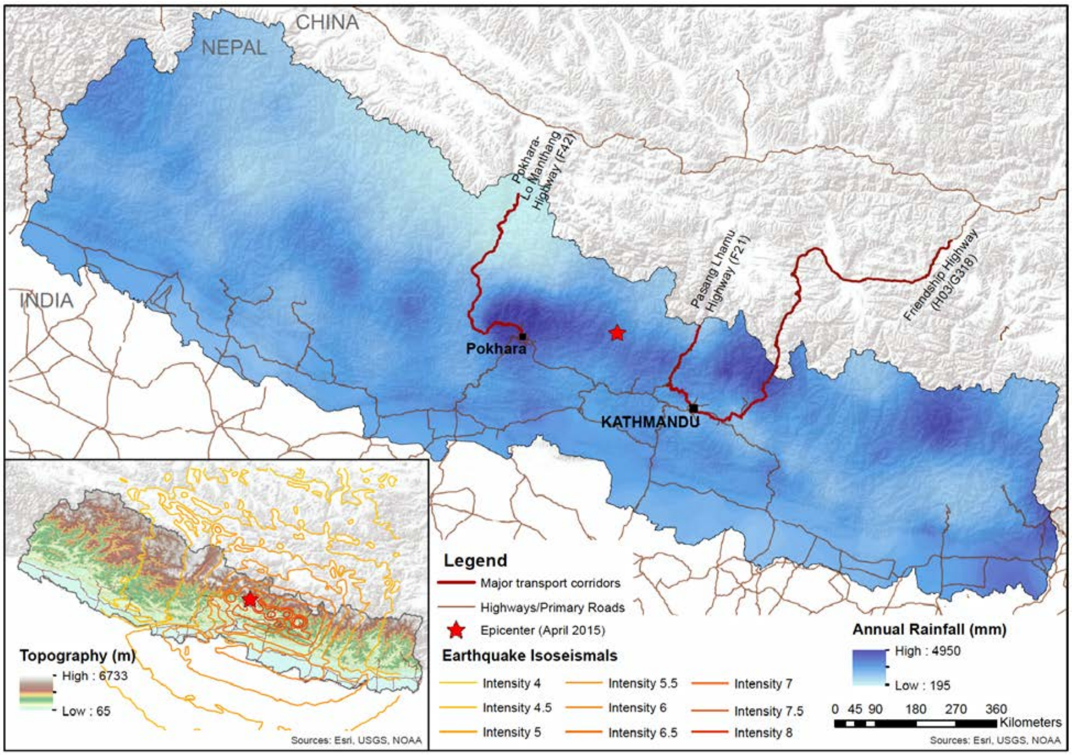

Figure 1. Hazards and Roads in Nepal. As Nepal and China negotiate the redevelopment of trans-Himalaya trade routes, the impact of monsoonal rainfall and earthquake hazards must be considered. While national strategic roads will be designed with these hazards in mind, poorly engineered rural feeder roads that seek to connect poor villages to the resources that will come with the road may increase the risk of economic loss and loss of life. Bioengineering provides a more sustainable solution that can reduce these losses .

These would link the country, with its northern neighbor through highly fragile mountain regions via several key frontier points. The three most heavily used routes currently are (Murton, 2016) :

i. Rasuwa region: Kerung – Dhunche - Galchi (50 km; Rasuwa District), with Rasuwagadhi becoming a major cross border entry point.
ii. Arniko Highway: Kodari - Dolalghat - Kathmandu (40 km; Sindhupalchowk District), an earlier border point, currently highly damaged due to the 2015 earthquakes.
iii. Mustang: Korala – Upper Mustang – Jomsom – Beni/Pokhara (158 km; Mustang District), in process of opening up to vehicular transportation.

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Discussions are ongoing with regards to which of these roads will be upgraded to handle more traffic and trade. There are early indications that the government will prioritize the Rasuwa road for connectivity to China, while the Mustang corridor road is also being upgraded for cross border trade due to its proximity to the road network that will be extended on the Tibet /China side. Thus these are the three road corridors and its satellite road sections, which are likely to be used as pilot sites in Nepal. China is obviously keen to expand its trade routes through Nepal to India, the question is what will be the consequences –both positive and negative – in Nepal?

Landslides and roads – what is the evidence?

In 1979, Peter Laban was commissioned by the United Nations Food and Agricultural Organisation (FAO) to document the number of landslides and their origin as either natural or human-induced. The study was part of the first comprehensive natural resource reconnaissance inventory for the whole country (1977 – 1979) by FAO and the Department of Soil and Water Conservation of the Ministry of Forests. It was triggered by increasing international attention and debate on the origin of flooding in India, with especially India pointing to Nepali farmers' inappropriate terracing practices and government neglect as the root causes of land degradation and landslides (Eckholm, 1975; Blaikie et al., 1980). The origin of landslides thus became a hot political issue.

The "Theory of Himalaya Degradation" (Eckholm, 1975) was subsequently discredited, backed by the Laban/FAO study which documented that 74% of all landslides were due to natural causes, such as river undercutting of steep mountain slopes and other natural mountain landscape building processes, with 26% being human-induced. However, the study also stated that while the overall density of landslides associated with roads was low (5%), roads represented at that time, a very small proportion of total land area. However, Laban warned that as the road network continued to expand, the number of landslides will, *"increase drastically in the near future, especially if more careful construction methods are not undertaken"* (Laban, 1979: iv) and that this increase will affect the nation's development.

In the quest for constructing roads quickly, the question is whether Laban's predictions have become a reality, and in an environment more complex than could have been imagined at the time. In the period between 1978 and 2005, there was a six-fold increase in landslide fatalities (from 20 to 120 on average per year, the average for the last five years is 152 deaths per year (DesInventar, 2017). According to several studies, drivers of this increased mortality is a deadly combination of an increase in poorly constructed roads with more intense monsoon rains, possibly linked to climate change (Petley et al, 2007).

Recent data further corroborate the link between roads and landslides in Nepal. Vuillez et al. (accepted) documented land use changes in Phewa Lake watershed (Kaski District, Western Nepal) between 1979-2016, resulting in an increase in roads from 23 km in 1979 to 340 km in 2016. The study was on-going when an intense rainfall event (315 mm) occurred over 24 hours on July 28-29, 2015, killing nine persons in the study area due to a landslide associated with a road. As a result of this event, 174 landslides were recorded (as compared to 14 landslides before the event), of which 39% (N=6) were situated either at the top or bottom of a road. A second study by McAdoo et al (submitted) correlates landslides mapped in Sindhupalchok District before the 2015 earthquake, of which nearly twice as many are located near roads than from a random distribution. These results from Nepal are corroborated by similar studies on landslides and roads from other mountainous areas worldwide (Haigh, 1988; Sidle and Ziegler, 2012; Sidle et al., 2014). Interestingly, earthquake generated landslides in the same district are less likely to occur near a road, and match a random distribution (McAdoo et al, submitted). This is due to ridge shaking effect of earthquake- versus monsoon-triggered landslides, which are more likely to be affected by anthropogenic causes such as road-induced slope fragilities (Collins and Jibson, 2015).

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Many of these losses are avoidable with concerted action. Good route selection, appropriate construction practices (which need not be expensive) and proper maintenance regimes, especially of drains and earthworks, can dramatically reduce landslide losses and be significantly more cost-effective while providing livelihoods benefits. A recent cost-benefit analysis compared grey or unplanned "bulldozer" roads with bioengineered mountainous roads, taking into account initial construction costs, yearly maintenance costs, economic losses due to monsoon damage and income associated to the harvesting of grasses used for road stabilization. Under the most conservative scenario, not accounting for above mentioned losses, bio-engineered roads are more cost effective after 12 years as maintenance costs are considerably lower (estimated at 5,600 USD/km for grey roads compared to 850 USD for bioengineered roads) (Vicarelli et al, in prep.). When taking both losses and benefits into account, bioengineered roads cost less from the outset (around 200,000 USD/km as compared to 1.2 million USD/km).

Conclusions

The OBOR investments will undoubtedly bring vast improvement to the quality, efficiency and safety of these main roads along with accompanying hydropower schemes, however the risk posed by the feeder roads must not be overlooked. On the surface, roads appear to be vital livelihood links for rural populations for improved access to markets, health care, education, employment and migration. Mobility is increased and rural populations have greater flexibility to adapt to harsh environmental conditions, either temporarily or permanently and offer the possibility of new economic opportunities, such as tourism, ultimately reducing their economic vulnerability. However, economic benefits of roads in mountainous areas are being questioned and present one of the greatest anthropogenic drivers of landslides (Jaboyedoff et al., 2016), presenting particular challenges of sustainability, risk and governance (Sidle and Ziegler, 2012). Since the turn of the 20^{h} century, development of the roads' sector has been one of the country's main priorities while becoming one of the greatest underlying anthropogenic causes of landslides and fatalities. And one whose impact could be significantly reduced. As the country moves toward greater decentralization of power through the new federal system, there is considerable opportunity for local and national government to turn the tide toward more safe and sustainable road development.

The issue of roads in Nepal is a political, not a technical issue: Nepal has some of the best bio-engineering manuals and knowledge in the world, with four decades of experience and well trained technicians alongside significant local knowledge of local species (of bamboo and grasses) with deep-roots for roadside slope stabilization. However, the environmental and high maintenance costs of haphazard "bulldozer roads" could be significantly reduced if government policies and well-established eco-engineering designs were enforced, including basic standards of road grading, alignment, drainage and bio-engineering.

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