

ECOROAD: A SUSTAINABLE INFRASTRUCTURE FOR ROAD DEVELOPMENT IN NATIONAL PARK

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ABSTRACT

Road infrastructure is acknowledged as supporting development for mobility in economic activities. Road infrastructure, in some point, will pass through national park. National park is conservation area for plants and animals. Their existence rely on the park itself. The road infrastructure could affect the animals habitat; fragment the habitat and endanger the existence of animals. Case study on 4 national park, based on World Wild Fund (WWF) collaborated work, are showing the urgency of mitigation of road infrastructure. In order to build a sustainable road infrastructure, ecology road (eco-road) is needed to be defined to minimize the effect of road development and preserve functionality of national park for conservation. Eco-road development must support human welfare and wildlife livelihood. Indonesia, as the largest tropical rainforest in the world, are developing regulations on road constructions. There are many factors considered in proposing ideas in eco-road. Every factor must address issues in human welfare and wildlife livelihood. A comprehensive approach on enrichment of fragmented habitat is due. Specific issues based on native animals behaviour is observed. Novel concept are proposed to adhere aspect eco-road. And, draft regulations according existing law and eco-road as Sustainability Infrastructure for Supporting Wildlife Livelihood.

Keywords: ecology road, sustainable infrastructure, sustainable development

1. INTRODUCTION

As development that were needed by human, road is one of infrastructure that has most significant role for human activities. Road infrastructure is acknowledged as supporting development for mobility in economic activities. Infrastructure enables trade, powers businesses, connects workers to their jobs, creates opportunities for struggling communities and protects the nation from an increasingly unpredictable natural environment.⁴ Doing the trade, there were movement of human, goods, and services. Though the transaction nowadays are also in digital, but the traditional movement of

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⁴ Brookings. Robert Puentes. January 20, 2015. *Why Infrastructure Matters: Rotten Roads, Bust Economy.* <https://www.brookings.edu/opinions/why-infrastructure-matters-rotten-roads-bust-economy/> accessed on 18 September 2017 19:11 WIB)



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human, goods, and services are still happening. Distribution of products as part of the operation management of business activity, the cost would affect the profit for companies or business entities. The longer the distance would harm the company. Even for human mobility, road condition would affect also the comfort.

By the capability of road for enabling the economic activities, government had the role to support the development. Calthrop and Proost (Calthrop and Proost. 1998) had measured the road transport externalities on congestion, accidents, and air pollution. The accident was only counted on human accident (by car and by foot). Rothengatter (Rothengatter, 1994) stressed out the benefits from road are basically consumer's or producer's surplus that induced by market interactions.

Regional cooperation, Association of Southeast Asian Nations (ASEAN), has planned ASEAN Connectivity to improve physical, institutional and people-to-people linkages. Indonesia as largest country in southeast Asia has 1.922.570 km² land area. Master Plan on ASEAN Connectivity identified priorities projects, there are two project immediate related with Indonesia, Melaka-Pekan Baru Interconnection (IMT-GT: Indonesia) and West Kalimantan-Sarawak Interconnection (BIMP-EAGA: Indonesia).

Based on Master Plan ASEAN Connectivity, ASEAN Connectivity Coordinating Committee will be established comprising Permanent Representatives to ASEAN or special representatives appointed by the ASEAN Member States. Accelerating ASEAN Community building by facilitating connectivity. As consequences, it could promote economic development sustained by infrastructure and communications networks as well as the mobility of people, goods and services within.

In some part, road development would cross through national park. A modern transportation system must be sustainable from an economic and social as well as an environmental viewpoint.⁵ It stressed that the road development in national park should be acknowledge the economic and social benefits, and also the environmentally friendly.

National park itself has objective to protect the biodiversity of flora and fauna. Biodiversity are needed to keep the sustainable of environment by supporting the

⁵ Karel A. Brookhuis, Marion Wiethoff, Evangelos Bekiaris, and Evangelia Gaitanidou. *From Accidents to Measures*. in Evangelos Bekiaris, Marion Wiethoff, Evangelia Gaitanidou (ed). *Infrastructure and Safety in a Collaborative World: Road Traffic Safety*. Springer: 2011. 20-21.



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ecosystem. Unbalanced ecosystem could damage the existence of species in food chain. Furthermore, it could danger the life of species.

2. METHODS AND PROBLEM

Our research were designed to give solution between human and animals activities in conservation area. Collecting data on existing road in national park (NP) were to give basic information and actual condition. Based on the data, we acknowledge the urgency of each NP. Information about species on animals and flora were also collected. Road development in conservation's area or NP could cause fragmented habitat. The risk of fragmentation is thus threefold: (1) demographic units may be destroyed outright, reduced in size, or subdivided (thus increasing their rate of extinction); (2) potential sources of immigrants may be lost (as a consequence of risk 1); and (3) immigration may be impeded by conversion of natural habitat between habitat patches.⁶ Fragmented habitat will cause the interior habitat and species decrease, edge habitat and species increase. Road that are crossing animal's habitat, can cause and facilitate poaching and logging. Poachings were not only for consumption but also for selling (economic transaction). Road infrastructure can make the transportation of illegal logging easier.

Arini and Prasetyo (2013) even stated about the need of corridor for big mammals and concern about reduced habitat could be causing decrease of population, low biodiversity that become endagered and distinct. It urged the plan on developing corridor for animals; mammals, reptile, insects, and othe affected animals.

⁶ Bruce A. Wilcox and Dennis D. Murphy. *Conservation Strategy: The Effects of Fragmentation on Extinction*. The American Naturalist 125, no. 6 (Jun., 1985): 882.



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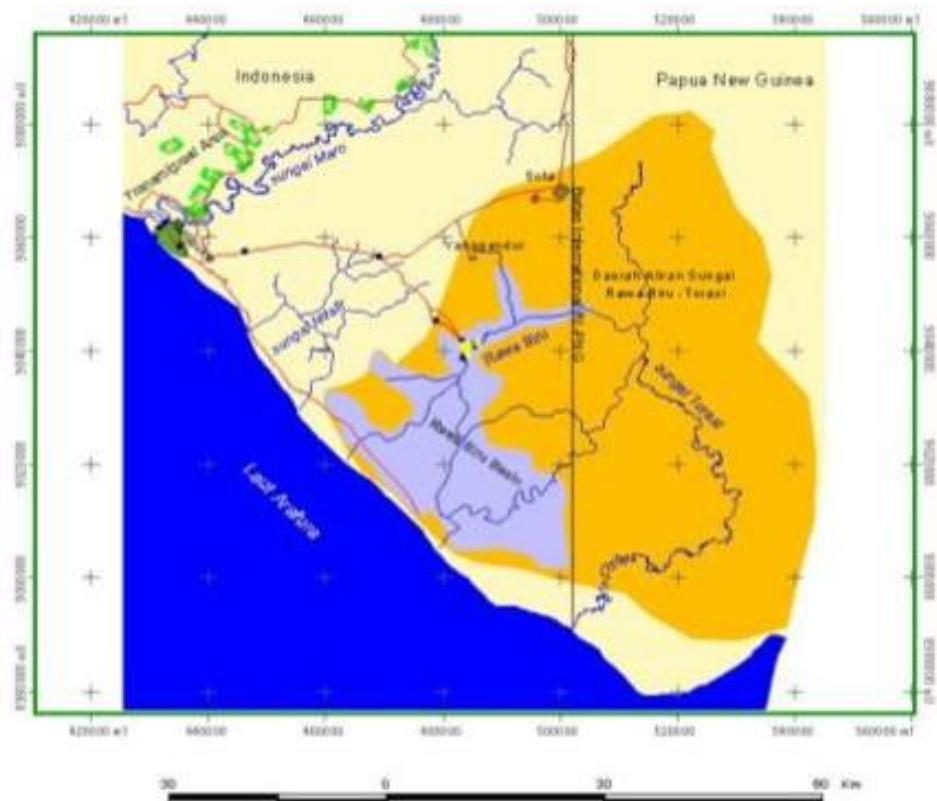


Fig. 1. Roads in Taman Nasional Wasur

The research were based on World Wide Fund's (WWF) works on road infrastructure within four national park in Indonesia. The national parks were Taman Nasional Wasur, Taman Nasional Sebangau, Taman Nasional Bukit Barisan Selatan, and Taman Nasional Kayan Mentarang. Each national park had different characteristic and problem on road infrastructure. Based on that, we identified the problem on road construction, ecology, and social impact.

Taman Nasional Wasur, West Papua, were the largest wetlands in Indonesia. In Wasur, there were 4 roads. Road in Rawa Biru was one of good practice on road construction in wetlands, the road had the same level with the surrounding. The others 3 roads were built by cut-and-fill technique. The implication by that technique were undesigned canal. During dry season, the canal provided water for animals and it jeopardize their position as a target poaching. In Fig. 1, red line show the road crossing Taman Nasional Wasur.

Taman Nasional Sebangau were established in 2004. This NP is peat area. There were 22 km road, built without standard. The road should be shut down because

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it didn't give any benefit. The road caused dry out the land and the technique made unstabilize road

Taman Nasional Bukit Barisan Selatan (TNBBS) were located in 2 province, Lampung and Bengkulu, most of the area were in Lampung. There are big mammals; elephant, sumatran tiger, and rhino. Before 2006, the road was still underconstruction, soil road, elephant and rhino could be seen from the road. Unofficial soil road were found. It was made by local people and giving access to people enter the NP.

Taman Nasional Kayan Mentarang are located in border between Indonesia-Malaysia. It has 1.300.000 ha. Needs of access through border to get basic needs (food).

3. CONSIDERATION

As the smaller of interior habitat decrease, government have to consider on developing zoning for mitigation anticipation of road development's impact. The development of spacial integration that include all aspects (broader stakeholders) should be concern. Furthermore, government and all NP stakeholders strongly consider habitat, animals, and flora as significant aspects and their existence are human responsibility.

Based on three main problems (Fig. 2), Unstandardized road infrastructure, fragmentation habitat, and poaching and logging, there's a need for balancing the ecosystem.

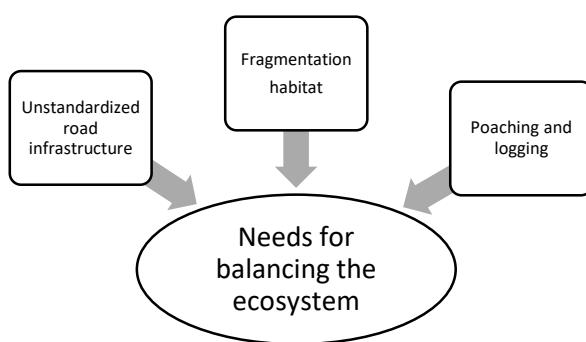


Fig. 2. Problems in Balancing Ecosystem

Emerging warning on mitigation as the habitat's needs, that include construction rehabilitation and road management to reduce the impact; existing road that were least significant for economic social impact, only for political benefit, should be shut down and let the NP's office do the management; initial and further comprehensive studies have to

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be conducted; and government have to develop standard for development and maintenance of road/bridge infrastructure through conservation area.

4. SOLUTIONS: ECOLOGY ROAD AS MITIGATION

Connectivity can help maintain genetic diversity, another variable that helps population persistence.⁷ Connectivity enable the animals to do their activities, that include finding food and mating (reproduction). It could minimize the impact of road infrastructure for human.

Solutions for 4 national parks are (1) mitigation for animal crossing; to minimize the impact of habitat loss, (2) the road infrastructure should be ecofriendly and low impact on wildlife livelihood, and (3) unstandardized and unofficial road should be shut down.

There are three types for animal crossing mitigation: (a) canopy crossing for arboreal animals (e.g. monkey, squirrel), (b) overpass; bridge, zebra cross, and road management, (c) underpass; tunnel, bridge for vehicles, flyover for vehicles.

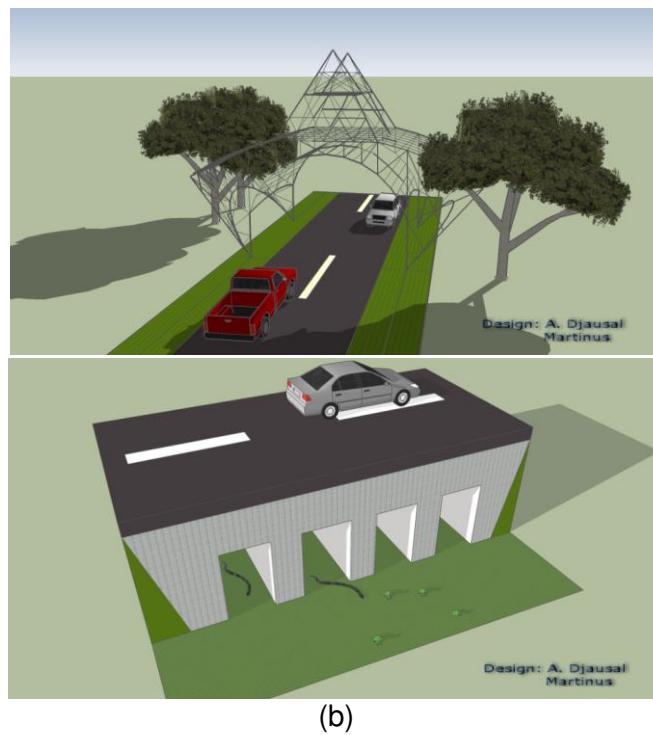


Fig. 3. Example of Ecology Road: (a) Canopy (b) Overpass

⁷ Jon P. Beckmann, Anthony P. Clevenger, Marcel P. Huijser, and Jodi A. Hilty (ed). *Safe Passages: Highways, Wildlife, and Habitat Connectivity*. Island Press: 2010.

5. CONCLUSION

Based on the problem stated above we can conclude there are three main problems that need ecosystem balancing unstandardized road and fragmentation habitat. Solutions are (1) mitigation for animal crossing; to minimize the impact of habitat loss, (2) the road infrastructure should be eco-friendly and low impact on wildlife livelihood, and (3) unstandardized and unofficial road should be shut down. It emphasized that government should concern on making guidelines on road development in conservation area or national park, in order to support the connectivity in general.

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