
TRANSPORTATION DISASTER RISK ANALYSIS ON THE ROAD SEGMENT TAPAN (SOUTH PESISIR, WEST SUMATERA) – SUNGAI PENUH (KERINCI, JAMBI)

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ABSTRACT

KEYWORDS

Risk, Disaster,
Transportation, Link and
National

Road segments ranging from local roads to national roads are the most urgent arteries in the mobilization of goods and people and determine the progress of economic development. Therefore the road must be constructed in accordance with the standards set out in the laws and regulations, including here the national road that has high economic value that connects the two regions of the two provinces namely Tapan Pesisir Selatan in the West Sumatra province and the Sungai Penuh Kerinci in Jambi province the two regions is closely related in economic and trade relations and the distance is only close to 64 km, but the terrain conditions have the potential to cause traffic accidents because natural factors penetrate row hills that have high geographical and national road standardization factors that do not have the attributes of road safety equipment complete. In this regard, it is necessary to examine how much the level of potential hazards caused by roads through disaster risk analysis in the transportation sector using the disaster risk analysis model. The results of the analysis using the disaster risk analysis model of the Tapan Sumbar - Sungai Penuh Kerinci Jambi road have a high hazard vulnerability level of 8.05 or above 5 means that this road needs to be improved both its construction and road safety equipment.

INTRODUCTION

One of the components of the transportation system that functions as the lifeblood of economic activity is the highway. According to Law no. 38/2004, concerning roads, "roads are land transportation infrastructure consisting of complementary buildings in the form of bridges, retaining walls, pontoons, culverts, drainage and equipment in the form of traffic signs and other safety equipment intended for traffic -public traffic". Among the national road sections that have the potential to support the growth of economic activity in the two provinces of West Sumatra and Jambi is the 65 Km long Tapan (South Pesisir District, West Sumatra Province) - Sungaipuh City, Jambi Province. The Tapan – Sungai Full road section has an important meaning in the movement of people and goods because apart from being quite close (only 65 Km) with an average travel time of 1.5 to 2 Km, it also provides high access between the two areas it connects to each other. supplying the necessities of life for the people of the two regions, namely from Tapan supplied with marine fishery products and coconut while on the other hand from Sungai Lilin agricultural products in the form of Vegetables and Rice which can ensure the stability of the availability of goods and prices in the market. If this road section is impassable, then there is no choice for road users to have to turn far enough with a longer distance and longer time, namely via South Solok Regency and Padang City as we can observe in the following map of figure 1.

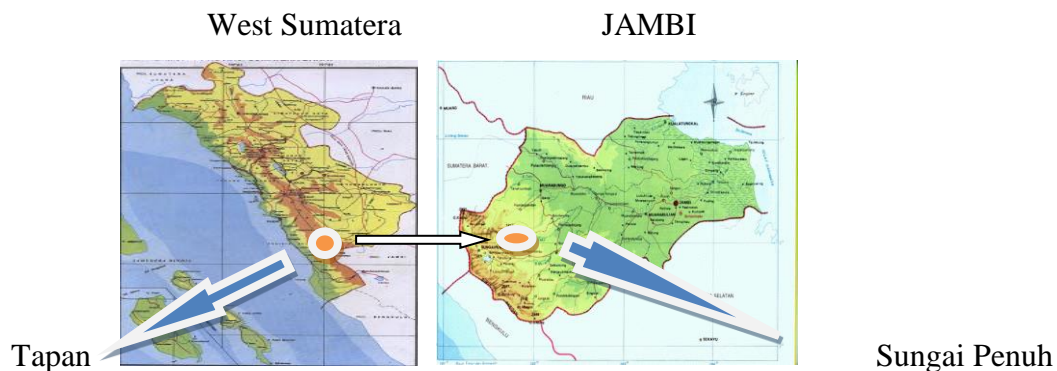


Figure 1: Map of the Regions of the Two Regions with the Segment Roads.
(Source : Documents of West Sumatera and Jambi Spatial, 2021).

The road section that connects Tapan (South Pesisir, West Sumatra) with Sungai Penuh City (Kerinci, Jambi), geographically penetrates the Bukit Barisan mountains with fairly steep topographical conditions through the TNKS Wilderness (Kerinci Seblat National Park) which is named Sako Forest, where on the left and right of the road there are hilly walls and quite deep ravines, without guardrails in accordance with the standard for inter-city roads according to Law 38/2004 with a pavement width of only 6 meters without shoulders, so the condition threatens the safety of road users, especially large trucks which transport logistics as can be seen in photo figure 2. Starting from the condition of the Tapan – Sungai Penuh road section, on the one hand, this is a route that has high economic value and on the other hand, has topographical and environmental conditions that endanger road users, so in this paper needs to be analyzed related to Disaster Risk, so that this road continues to play the role of as the economic backbone of the two linked regions, namely Tapan in West Sumatra and Sungai Penuh in Jambi.

RESEARCH METHOD

According to Law No. 24 of 2007, concerning Disaster Management, a disaster is defined as an event that threatens and disrupts people's lives and livelihoods. Disasters can be caused either by natural factors and/or non-natural factors as well as human factors resulting in human casualties, environmental damage, loss of property and psychological impacts.

In accordance with the definition of disaster mentioned above, there are 2 forms of potential disasters that influence each other in this transportation sector, namely natural disasters due to the natural geographical conditions of the steep Bukit Barisan mountains and high topography which threaten the emergence of disasters in the form of transportation accidents, namely transportation mode accidents that occur on land, sea and air.

If a transportation accident disaster occurs on land, namely on certain highway sections, then the component of the road transportation system in the form of road infrastructure must be handled immediately with a preventive or long-term approach to make road infrastructure an object that has resilience to potential disasters (resilience) because infrastructure roads are one of several critical infrastructures (Aitsi-Selmi & Murray, 2016; Carrington et al., 2021; Hebden, n.d.; Pearson & Pelling, 2015).

According to Moor (2015), the transportation sector has interdependence with other sectors outside of transportation, because transportation infrastructure is a complex system,

which in Indonesia always interacts with other infrastructure systems outside of transportation because of the nature of transportation supporting other sectors. outside of transportation such as power, communication, fuel, institutions, financing and other socio-economic (Santamaria-Ariza et al., 2023).

RESULTS AND DISCUSSION

According to Candy. PU No. 19-2011 about. Road Technical Planning Requirements & Criteria), among which are; Road Body Width (Pavement), Road Capacity, Road Auxiliary Buildings, Road Equipment, Road Shoulders (for Primary Arterial roads 2 meters. This requirement is a safety requirement for a Primary Arterial road section that must exist if a road section is Safe to use.

Observing the existing conditions on the Tapan – Sungai Penuh road section, we can describe the technical requirements for safe roads to use as follows;

>. Road Body Width Requirements for National Arterial highways are at least 7 meters (2 lanes), while conditions in the field are 6 meters as can be seen in Figure 2.



Figure 2. One of the Road Segments Tapan – Sungai Penuh with a Width of 5.5 m without Guardrails and Shoulders on the Left Right side is the Gorge and Cliff Wall
Source : Diunduh dari www.google.com Produy Hasted on Photo.

>. Road Auxiliary Buildings;

Referring to the standards for road complementary buildings according to Law no. 38 of 2004, one part of the road's complementary buildings other than bridges, including Pontoons or Land Retaining Walls either on cliffs or in ravines/valleys. While the existing condition of the Tapan – Sungai Full road section, there is no visible complementary section as seen in Figure 2 above and Figure 3 below.



Figure 3. Tapan Road Segment – Sungai Penuh Not equipped Earth Retaining Wall.
Source : Diunduh dari www.google.com Produy Hasted on Photo.

>. Road Equipment;

According to Law no. 38 of 2004 concerning roads, road equipment is in the form of traffic control signs in the form of signboards enforced by poles, traffic lights or in the form of road markings above the surface. Observing the condition of the existing road sections, they are also not equipped with warning signs and road markings as can be seen in Figure 4.



Figure 4. Road Section Bend Segments Tapan – Sungai Penuh without Equipped with
Warning Signs Bends and Road Markings.
Source : Diunduh dari www.google.com Produy Hasted on Photo.

Through the photo data described above, the Tapan – Sungai Penuh National road section can be analyzed for Disaster Risk using the following Disaster Risk Analysis model (United Nation, 2015) ;

$$R \text{ of } D = \frac{H \cdot V}{C} \quad (1)$$

where;

- R of D = Disaster Risk.
 H = Hazard (Potential/Threat Danger).
 V = Vulnerability.
 C = Capacity (Ability minimize risk).

1. Disaster Risk;

According to WHO (2002), disaster risk is the possibility of experiencing a damaging or negative impact on the community from a disaster which is a form of functional relationship between 2 variables, namely potential/threat of hazard) and vulnerability and ability to minimize risk.

For the case of the State road connecting Tapan – Sungai Penuh, the Disaster Risk can be categorized as High, Medium and Low with the interval scale as follows;

- a. Above 5 (>5) = High.
- b. 2 - 5 = Moderate
- c. 1 down (< 1 = Low).

2. Hazard Potential/Threat;

Hazards (dangers/threats) are the potential to experience a disaster which can result in loss of life, injury, or material loss/damage. Potential disasters are characterized by their location, intensity, frequency and likelihood that they will occur.

To find out the potential or threat of hazard on the Tapan – Sungai Penuh Country road section, use the characteristics of the location where the Tapan – Sungai Penuh road section is an Outer City (intercity) road. According to the MKJI standard (Indonesian Road Capacity Manual, 1997), inter-city roads are of the type; D (Flat), B (Hilly) and P (Mountain) where Type D (Flat) has no slope, B (Hill) has a medium slope and P (Mountain) has a high road surface slope. In this case, the higher the slope of the road surface, the greater the potential and threat of danger. Because the Tapan – Sungai Penuh road section crosses the Bukit Barisan mountains, this road type is P (Mountain) with a high road surface slope and a large potential threat of danger. For analysis purposes, these three types of roads can also be quantified as presented in table 1 below;

Table 1. Type, Degree of Slope and Section Hazard Potential Level Tapan-Sungai Penuh Section Street.

Road Type	Tilt Degree	Hazard Value
D (Flat)	Low	1
B (Hill)	Medium	2
P (Mountain)	High	3

Source: MKJI, 1997 and results quantification

3. Vulnerability;

Vulnerability according to WHO (2002), is a condition of vulnerability caused by physical, social, economic and environmental factors related to the effects of hazards. This vulnerability also describes the inability of individuals, communities or institutions, whether government or private, to prevent, face, or mitigate the effects of certain hazards. Quantitatively, this vulnerability can also be seen through the classification of institutional preventive actions related to road handling, in this case the Ministry and the PUPR Bina Marga Service, the Ministry and the Transportation Agency which must handle the procurement of

road sections in accordance with the Safety Adequacy Standards (SKK) that have been set by Laws and Ministerial Regulations and weighted as shown in table 2 below;

Table 2. Vulnerability Levels of Road Segments National Tapan – Sungai Penuh.

Road Attribute	Availability	Weight	Vulnerability Level
1. Building Complementary;	There isn't any.	1	3 (High)
Earth Retaining Wall	There is not Standard.	2	2 (Medium)
Road Shoulder, Road Width Design	There is, As Standard.	3	1 (Low)
2. Equipment	There isn't any.	1	3 (High)
Pole Signs,	There is not Standard.	2	2 (Medium)
Road Marking	There is, As Standard.	3	1 (Low)
Guard Rail	There isn't any.	1	3 (High)
Corner Mirror	There is not Standard.	2	2 (Medium)
Street Lighting Lamp	There isn't any.	1	3 (High)
3. Design geometric;			
Roadside,	There isn't any.	1	3 (High)
Lane Width,	There is not Standard.	2	2 (Medium)
Surface Coating.	There is, As Standard.	3	1 (Low)

Source; Observations and Methods Classification.

4. Capacity;

It is the ability of the community or related institutions to prevent it PREVENTIVELY (before a disaster occurs) and is seen with the responsibility of stakeholders (interested parties) in the procurement and handling of State roads. Capabilities here are also related to vulnerabilities as described in table 2 above.

From the results of observations on the environmental conditions of the roads, the community's ability to prevent before a disaster occurs is still low, it can be rated 1, because disasters cannot be predicted when they occur.

By applying the Disaster risk determination model above, and using the data observed at the location of the road section, the Disaster Risk at the location of the Negara Tapan – Sungai Penuh road section can be determined as follows;

- H ; Hazards; because the road section passes through the Mountain Topography (Type P), the potential hazard is 3.
- V ; vulnerabilities; vulnerability is determined by the condition of the road segment attribute;
 1. Complementary Building Attributes, all sub-attributes are missing, vulnerability 3
 2. Equipment attribute, there is, but not according to standard, vulnerability 2.
 3. Geometric Design Attributes, none, vulnerability 3

So that the average vulnerability value is $3 + 2 + 3 = 8$ divided by 3, with a value of 2.67 (close to high).

- C ; Capacity; the ability of the community and government institutions is low with value; 1. Then R of D (Disaster Risk) = $3 \times 2.67 = 8.01 (> 5)$, which means the road National Tapan – Sungai Penuh has a High Risk.

CONCLUSION

By entering qualitative observation data which is quantified using scale and weighting, it can be determined that the Tapan – Sungai Full National road section, which has high economic value in the agriculture, plantation, fishery, building and trade sectors, has a HIGH Disaster Risk with a value of 8.01.

To related institutions, in order to minimize disaster risk, because this road section has national status which has high economic value with a distance of only 65 km, with alternative sections having a distance of over 300 km and turning around to the city of Padang, it is hoped that the handling will be as follows; 1. Designing the road surface layer with Reinforced Concrete Cement construction. 2. Holding Road Shoulders. 3. Set up Guatd Rail 4. Make Pontoons (retaining walls) on the cliff walls of hills and ravines. 5. Procure and make all elements of road equipment.

REFERENCES

- Aitsi-Selmi, A., & Murray, V. (2016). Protecting the health and well-being of populations from disasters: health and health care in The Sendai Framework for Disaster Risk Reduction 2015-2030. *Prehospital and Disaster Medicine*, 31(1), 74–78.
- Carrington, M. A., Ranse, J., & Hammad, K. (2021). The impact of disasters on emergency department resources: review against the Sendai framework for disaster risk reduction 2015–2030. *Australasian Emergency Care*, 24(1), 55–60.
- Hebden, S. (n.d.). *Review of the 'Sendai Framework for Disaster Risk Reduction 2015-2013.'*
- Pearson, L., & Pelling, M. (2015). The UN Sendai framework for disaster risk reduction 2015–2030: Negotiation process and prospects for science and practice. *Journal of Extreme Events*, 2(01), 1571001.
- Santamaria-Ariza, M., Sousa, H. S., Matos, J. C., & Faber, M. H. (2023). An exploratory bibliometric analysis of risk, resilience, and sustainability management of transport infrastructure systems. *International Journal of Disaster Risk Reduction*, 104063
- (Director General of Highways, Ministry of PUPR (1997), Indonesian Road Capacity Manual (MKJI). Ministry of PUPR, Jakarta.
- Law No. 38, (2004), RI Law No. 38, 2004 concerning Roads. Director General Highway Ministry of PUPR, Jakarta.
- Law No. 24, (2007), RI Law No. 24, 2007 concerning Countermeasures Disaster. BNPB. Jakarta.
- Moor, R, et all (2015). Transport Infrastructure Systems in Disaster Risk Management in the Transport Sector A Review of Concepts and International Case Studies. The World Bank.
- United Nation (2015). Sendai Framework for Disaster Risk Reduction 2015-2030.
- WHO (2002). Disaster Management.

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