

Factors Causing Road Damage And Its Impact On The Environment Of Jorong Koto Kaciek Nagari Muaro Paneh Bukit Sundi District Solok District

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Abstract – Roads can connect regions and make it easier for people to travel to an area. Apart from that, roads have an important role in the social, economic and cultural fields, including the Muaro Paneh road. Muaro Paneh Road is a road that connects districts or cities. Apart from that, the road in Muaro Paneh experienced damage which had an impact on the environment and the surrounding community using the road. This research aims to identify factors of road damage that occur and analyze the impact of road damage on the environment in Nagari Muaro Paneh. This research uses a descriptive method with a qualitative approach. Samples were taken using purposive sampling as many as 8 people. The results of the research obtained are the factors that influence road damage in Jorong Koto Kaciek Nagari Muaro Paneh, namely changing weather conditions, the condition of building infrastructure that continues to increase, the increasing number of vehicles, and long-term blocked drainage channels that can affect the environment. around Jalan Muaro Paneh, especially Jorong Koto Kaciek. Meanwhile, the impact on the abiotic environment for dust and noise is still below the threshold of not endangering the environment, but in the future it could be threatening, while the impact on the biotic environment is disrupting community activities, increasing vehicle costs, and disrupting health.

Keywords – Dust, Noise, Road Damage, Environment, Community.

I. INTRODUCTION

According to Law of the Republic of Indonesia Number 38 of 2004 concerning Roads, it is explained that roads function as transportation infrastructure which has an important role in the economic, socio-cultural, environmental, political, defense and security fields, and is used for the greatest prosperity of the people. The aims of the road are, among other things, to facilitate traffic in developed areas, increase usability and usability, and improve distribution services for goods and services to support increased economic growth. Yudaningrum & Ikhwanudin (2007) added that roads are a locomotive in driving economic development, both in urban and rural areas. Therefore, roads greatly influence the socio-economic integration of people from one region to another.

Construction, especially roads, is currently increasing due to the needs and human population increasing over time, therefore, the increasing amount of development means that it is not followed by repairs, so roads can experience damage, whether on a small scale. It can be seen that according to the West Sumatra Central Statistics Agency (2020), West Sumatra Province experienced a lot of damage from 19 districts or cities, 3 districts experienced the most road damage, namely West Pasaman Regency with 32.40%, South Solok Regency with 41 .20%, and Solok Regency was the area that experienced the most damage at 46.20%.

The environment damaged by the road can affect the lives of those around it. According to Eko Priyono (2016), the first main cause of environmental damage is due to human activities such as excess vehicles, traffic volume and location conditions, while the second is due to nature, such as extreme weather, rainfall. However, human causes are very high and have a greater influence compared to natural events which do not happen every day

According to Nurhayati, (2018) Environmental damage has a multidimensional impact on human life. Human activities in the environment will cause a quite complicated cycle of environmental problems. This is in line with Julitra, Y., Siregar, RLV, & Afrita, D. (2022). Environmental impacts caused by roads are damaged, such as traffic roads becoming damaged due to vehicles passing on the roads, causing the roads to become damaged and have potholes. Damaged roads can have an impact on disrupting community activities and fatally, potholes can result in traffic accidents. Apart from that, due to damaged roads, more and more road dust is flying around.

In recent years, roads in Nagari Muaro Paneh have experienced damage, one of which is Jalan Tengah. Tengah Road is a district or city road that connects two districts or cities, namely Solok Regency and Solok City. On this road, there are various public facilities such as government offices, health centers, schools, and markets or economic centers. This was proven by special observations in Jorong Koto Kaciek Nagari Muaro Paneh itself, namely from the Nagari Muaro Paneh Mayor's Office to Simpang Ampek, which is the central center of community life in Nagari Muaro Paneh which has the impact of heavily damaged roads, disrupting community activities and the damaged roads themselves. approximately 1 km.

II. RESEARCH METHODS

This research was conducted in Jorong Koto Kaciek Nagari Muaro Paneh, Bukit Sund i K District, Solok Regency. carried out in January – April 2023. The method used is descriptive qualitative with a qualitative approach. Data collection was carried out using two types of data, namely primary data obtained through observation, pre-research, documentation, open interviews. Data sampling was carried out using *purposive sampling* . Secondary data was obtained from agencies, namely the Public Works and Public Housing Service of Solok Regency and the Wali Nagari Muaro Paneh Office. Respondents to this research were Wali Nagari Muaro Paneh, Head of Public Works and Public Housing for Solok Regency, Bukit Sundi Subdistrict Office, Secretary of Wali Nagari Muaro Paneh, Head of Jorong Koto Kaciek, and five residents of Jorong Koto Kaciek. According to Miles, Huberman, & Saldana (2014) Data analysis is carried out by collecting data, condensing data or sorting data, presenting data, and drawing data conclusions.

III. LITERATURE REVIEW

1. Road Damage

Damage to roads is caused by, among other things, excessive repetitive traffic loads (*overloaded*), heat or temperature of air, water, poor drainage. Therefore, besides being planned appropriately, roads must be well maintained so that they can serve the growth of traffic during the life of the plan. . Routine and periodic road maintenance needs to be carried out to maintain road safety and comfort for users and maintain its durability until its design life. (Putra, SA, & Abdillah, N. (2020).

2. Environmental damage

According to Caritra (2016), behavior that damages the environment falls into three categories: (1) human population growth; (2) excessive consumption of natural resources: forests, fisheries, rivers, and so on, and; (3) air, water and land pollution, (4) Transportation, (5) Waste .

3. Impact of Road Damage on the Environment

According to Krainyukov, A., & Kutev, V. (2014). That roads can have positive and negative influences on humans and the environment. On the positive side, roads provide mobility and transportation opportunities for people and goods. On the negative side roads occupy land resources and form barriers for humans and animals. The three most damaging impacts of road construction and management are noise, dust and vibration .

IV. RESULTS AND DISCUSSION

1. Factors of damage to the Jorong Koto Kaciek road, Bukit Sundi District, Solok Regency

a. Weather Conditions in Nagari Muaro Paneh

The weather conditions in Nagari Muaro Paneh which tend to change every year also affect the condition of existing roads. This can be seen in table 4 of the rainfall data in Nagari Muaro Paneh as follows:

Table 1. Rainfall data in Nagari Muaro Paneh

| No | Year | |
|----|------|---------|
| 1. | 2016 | 1538.00 |
| 2. | 2017 | 2002.00 |
| 3. | 2018 | 2068.00 |
| 4. | 2019 | 2780.00 |
| 5. | 2022 | 3010.60 |

Source: Bukit Sundi District Central Statistics Agency for 2016-2022

On the other hand, rainfall also affects road damage, according to Mulyatiyas (2020) that high rainfall every year can cause road damage to accelerate. This can be seen according to the Solok Regency Public Works and Housing Department in 2020 that the cause of road damage was not due to poor workmanship, but rather extreme weather factors and inadequate road maintenance.

b. Condition of Building Infrastructure

Apart from rainfall conditions, there is also infrastructure which from year to year increases in development, especially in Jorong Koto Kaciek Nagari Muaro Paneh, therefore it can be seen in table 2 as follows:

Table 2. Nagari Muaro Paneh Building Infrastructure in 2022

| No | The name is Jorong | House | Mosque/prayer room | School | Public health center | Office | Market |
|----|--------------------|-------|--------------------|--------|----------------------|--------|--------|
| 1. | Penang Hall | 120 | 4 | 3 | - | - | - |
| 2. | Galagah | 100 | 3 | 2 | - | 1 | |
| 3. | Koto Kaciek | 223 | 5 | | 1 | 4 | 1 |
| 4. | Long Koto | 180 | 4 | 3 | - | - | - |
| 5. | Ampang Rice Fields | 110 | 4 | 2 | - | - | - |
| | Amount | 733 | 20 | 10 | 1 | 5 | 1 |

Source: Data from Wali Nagari Muaro Paneh for 2022

The increase in infrastructure in Nagari Muaro Paneh, especially Jorong Koto Kaciek, could create an imbalance in the environment. According to Akhirul, A., Witra, Y., Umar, I., & Erianjoni, E. (2020) argue that with increasing population, infrastructure will increase so that the quality of the surrounding environment decreases. With increasingly rapid population

growth, this will have consequences for strong pressure on natural resources. Such as the increasing need for food, clean water, housing and so on, causing an imbalance between the supply of natural resources and human needs

c. Increase in the Number of Vehicles

Apart from building infrastructure, the cause of road damage in Jorong Koto Kaciek Nagari Muaro Paneh is vehicles. Jalan Nagari Muaro Paneh, based on researchers' observations, disrupts the comfort of drivers of both 2-wheeled and 4-wheeled vehicles and also increases the number of transportation vehicles, causing the road to be unable to withstand the load so that over time the road becomes more damaged. According to Lutfah (2015), the increase in traffic volume means that the road load becomes shorter and shorter, causing road damage to increase, which can be proven by table 3 taken from 2018-2022 as follows:

Table 3. Data on the number of vehicles in Nagari Muaro Paneh for 2018-2022

| No | Year | Transportation type | | | | Amount |
|----|--------|---------------------|----------------|-------|-----|--------|
| | | Private Motorcycle | Mobile Pribadi | Truck | Bus | |
| 1. | 2018 | 134 | 15 | 5 | 1 | 155 |
| 2. | 2019 | 160 | 23 | 8 | 2 | 193 |
| 3. | 2020 | - | - | - | - | |
| 4. | 2021 | 245 | 32 | 11 | 2 | 290 |
| 5. | 2022 | 301 | 40 | 15 | 5 | 500 |
| | Amount | 840 | 110 | 39 | 10 | |

Source: Muaro Paneh Nagari Mayor's Office 2018-2022

As the years increase, the number of transportation in Nagari Muaro Paneh also increases. It can be seen in table 3 that the highest ranking is private motorbikes which have increased from year to year with a total of 840, not only motorbikes but other transportation has increased from year to year such as 110 private cars, 39 trucks and finally 10 buses. Transportation is very necessary for residents when moving from one place to another or to their place of work or residence. On the other hand, noise also affects the conditions around the road itself, especially on Jalan Tengah itself. Therefore, data on the number of vehicles passing through Nagari Muaro Paneh, especially Jalan Tengah, can be seen in table 4 as follows:

Table 4. Data on the number of vehicles in Jorong Koto Kaciek Nagari Muaro Paneh per day

| Measure ment Location | Time | Transportation type | | | | Amount |
|--|---------------------------|-----------------------------------|------------------------------|------------------|----------------|--------|
| | | Private Motorcycle (90 Kg-150 Kg) | Private car (1,324-1,524 Kg) | Truck (1,628 Kg) | Bus (1,756 Kg) | |
| In front of the Muaro Paneh Mayor's Office | Wednesday 18 October 2023 | 200 | 60 | 15 | 2 | 277 |
| | Sunday, October 22 2023 | 100 | 30 | 7 | 1 | 138 |

Source: Research Data for 2023

According to the Department of Transportation (2020), there are different types of vehicles, one of which is a private motorbike with an average weight of 90-150 kg, a car 1,324-1524 kg, a truck 1,628 kg, and a bus 1,756 kg. Measurements were carried out over 2 days, namely on October 18 and October 22 2023 due to holidays and working days. Based on table 7, it can be seen that the number of vehicles passing through Jorong Koto Kaciek on Wednesday 18 October 2023 was 277 vehicles per day with 4 types of vehicles the highest being private motorbikes at 200 motorbikes per day while the least being 2 buses per day, cars 60 private motorbikes, and 15 trucks, while on Sunday 22 October 2023 there were 100 private motorbikes per day, while the minimum was 1 bus per day, 30 private cars, and 7 trucks. Therefore, it can be seen from table 7 that with the intensity of the number of vehicles in one day, the faster the roads become damaged, especially Jorong Koto Kaciek Nagari Muaro Paneh.

Apart from that, there are no maintenance costs, especially for roads in Nagari Muaro Paneh, from the government until now, so from day to day the roads become damaged and porous, making it difficult for people to travel from one area to another. This is similar to what was said by Mukhyar (2022) who found that increasing traffic volume causes an increase in traffic density which is not balanced with road capacity, this will cause problems such as congestion as well as traffic accidents and road damage which can disrupt the level of performance or service of that road.

d. Garbage and Drainage Channels

Apart from that, waste is a problem for the people of Muaro Paneh, especially Jorong Koto Kaciek, because many people still throw rubbish in irrigation canals. Muaro Paneh, especially Jorong Koto Kaciek, for irrigation channels on the side of the road shoulder

According to Yudhistira (2011) in his research, the impact of road damage on the environment, namely the high traffic factor, also has an impact on the physical nature of the road which is increasingly damaged. This is the same thing that happened in Nagari Muaro Paneh, where the intensity of road transportation is getting busier and busier over time. Apart from that, it is also in line with research conducted by Asrib, A (2018) . overflowing onto the road even though it is not during the rainy season. This is also due to the lack of direction of drainage water flow and drainage water catchment areas, therefore the capacity of drainage channels is not able to accommodate accumulated rainwater, people's habit of throwing rubbish into drainage channels causes drainage channels to become blocked and causes unpleasant odors, this can be seen that in Jorong Koto Kaciek Nagari Muaro Paneh this also happens, where people still throw rubbish carelessly and there is a lack of drainage channels, which causes water to overflow and result in flooding.



Figure 1: Garbage in the ditch

2. Impact of Road Damage on the Environment in Jorong Koto Kaciek, Bukit Sundi District, Solok Regency

a. Impact of Road Damage on the Environment (Abiotic)

1) Dust Due to Damaged Roads

According to Sholihah (2012), dust is the amount of dust that is filtered through the instrument filter during measurement ($\mu\text{g}/\text{m}^3$). During the change of seasons, during the dry season the roads will be dusty which can damage the surrounding environment, whereas during the rainy season the water will pool and floods will also occur, covering damaged roads, endangering the safety of road users, which can be seen in pictures 2 and 3.



Figures 2 and 3 . Road in the rainy season and dry season

According to government regulation number 41 of 1999, the national dust threshold value is $230 \text{ Ug}/\text{m}^3$ which is carried out over 2 days, namely on holidays and working days and carried out in one location because that location is the center of government, education and socio-economics. From the 2 days of measurements, it can be seen that on the first day, May 16 2023, the dust content is still classified as below the national threshold value, while on the second day, May 17 2023, it can be seen in the table above that it is still classified as below the national threshold value. From 2 days of dust measurements on Jalan Tengah in Jorong Koto Kaciek Nagari Muaro Paneh, vehicle dust levels in Nagari Muaro Paneh were still classified as being at the national limit limit of $230 \text{ ug}/\text{M}^3$. However, it needs to be seen that every hour the dust measurement is increasing over time due to the large number of vehicles passing, although it is still below the threshold, efforts need to be made to reduce ambient dust levels to a minimum while also reducing the risk of health and comfort problems for drivers or the public. around Tengah Road.

2) Noise on the Road in Jorong Koto Kaciek Nagari Muaro Paneh

According to Pristianto (2015), noise is usually defined as sound or sounds at a certain amplitude that can cause irritation or interfere with communication. Sound can be measured objectively while noise is a subjective phenomenon. Noise itself can come from 2 types, namely interior noise, the source of noise which is most often made by humans, household equipment or building machines, then there is outdoor noise, which comes from traffic, transportation, industry, *equipment*. mechanics visible in buildings, building construction sites, road repairs, sports activities and so on outside buildings. Transportation noise includes land transportation vehicles such as trucks, buses, cars and motorbikes. for Nagari Muaro Paneh itself, especially Jorong Koto Kaciek, namely noise due to damaged roads and the increasing number of vehicles in Jorong Koto Kaciek in general.

Look at the noise of vehicles, whether 2-wheeled or 4-wheeled, for noise in Zone B, namely the government zone, educational zone and others where measurements are carried out in front of the Muaro Paneh Nagari Mayor's Office. It can be seen that on the first day it is still below the threshold for the noise threshold itself 85 dbA and the highest on the first day, namely at 16.00-16.15, namely 42.5 dbA and the lowest at 07.00-07.15, namely 30.1 dbA. The second day is a working day where the highest is at 16.00-16.15, namely 64.2, at which time people go home from work and come home from the market, while the lowest is at 07.00-07.15.

Even though it is not yet at the threshold at least and has not yet had an impact on the community itself, that is why there is a need to repair roads, especially Jorong Koto Kaciek Nagari Muaro Paneh and because of that, there is also a need for socialization regarding this noise.

b. Impact of Road Damage on the Environment (Biotic)

1) The impact of damaged roads in Nagari Muaro Paneh on community activities

that is, when Monday is market day in Nagari Muaro Paneh, there is heavy vehicle traffic in Nagari Muaro Paneh, causing traffic jams and vehicle access to be disrupted, then people become uncomfortable with the damaged roads passing through Jalan Muaro Paneh, so from It could also cause potential conflict between the Nagari community and the local community. Apart from that, it also causes dust which creates discomfort for the community around Jalan Nagari Muaro Paneh. This is the same as the impact of road damage in Nagari Muaro Paneh, the same as research conducted by Prasetyo, AY (2017) which found that the impact on social aspects includes the quality of the environment felt by the community and the quality of interaction in social life which has an impact on community welfare in terms of The economy also has an impact on rising prices of daily necessities.

2) Impact of Road Damage on Transportation Costs

Various public complaints about damaged roads in Nagari Muaro Paneh include leaking tires for both motorbikes and cars ranging from Rp. 15,000 to Rp. 35,000 depending on the type of vehicle, damage to motorbike rims with a cost range of Rp. 500,000 to Rp. 1,000,000. This is also in accordance with what is said according to (Prasetyo, AY, 2017) that road damage also affects vehicle maintenance costs, because with poor road conditions the vehicle is forced to work beyond the vehicle's capabilities. Good road conditions certainly do not require frequent maintenance compared to damaged roads. In line with the opinion of Irawati (2023) that the costs incurred due to damaged roads are that damaged roads can make vehicles slow and waste fuel, making transportation costs more expensive. Apart from that, travel time can also increase because vehicle speeds become slower due to uneven roads. Apart from that, another impact that is no less important is reducing economic competitiveness

3) Health Impacts Due to Damaged Roads

that is, it can disturb a person's psychology and make people around the road become stressed. Apart from that, it also disturbs a person's hearing. This is in line with Cahyani R (2019) that damaged roads themselves can cause fatalities, stress, and disturb people's psychology due to the inconvenience of damaged roads. almost the same as the opinion of previous researchers that noise itself, even though it is classified as low intensity in Nagari Muaro Paneh, according to Nugroho (2018), the presence of noise can reduce work performance due to loss of concentration, which can lead to loss of work efficiency and productivity.

V. CONCLUSION

From the explanation above, the factors that cause road damage to roads in Jorong Koto Kaciek Nagari Muaro Paneh are caused by weather conditions, increasing building infrastructure, increasing the number of vehicles, and waste which will indirectly reduce the quality of the surrounding environment. The results of measuring dust and noise levels in Jorong Koto Kaciek Nagari Muaro Paneh are still below the threshold according to PP No. 41 of 1999 and Minister of Environment Decree 48/MENLH/II/1996, therefore the damage is not yet dangerous to the environment, although it is not yet dangerous to the environment, but in the long term it could threaten damage to the surrounding environment. The environmental impact of damage caused by roads in Jorong Koto Kaciek Nagari Muaro Paneh is a biotic , namely dust, noise and rubbish, although it is not yet at the threshold, but in the future it will disrupt people's lives and the ecosystem , while the biotic is disrupting people's comfort, increasing transportation costs, and health problems in man. Thus, road damage can threaten the balance of the ecosystem.

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