Development of Environmentally Friendly Transportation in the City of Probolinggo

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Abstract

Congestion brought on by the abundance of motorized vehicles in Probolinggo City, both private and public, is one of the issues with transportation. Because sustainable transportation exists, the current issues can be resolved. By utilizing environmentally friendly transportation to suit the community's transportation demands, sustainable transportation is realized. Because Probolinggo City only uses 16.4% of non-motorized transportation, which is still a low percentage, using sustainable, ecologically friendly transportation is another barrier to its achievement. As mentioned in the creation of the Probolinggo City Road Traffic and Transportation Network Master Plan Study, transportation development in the city is focused on sustainable transportation. According to the Probolinggo City Road Traffic and Transportation Network Master Plan Study, the development of transportation in the city is focused on sustainable transportation. As a result, the study of the development of green transportation can assess the state of the green transportation system in Probolinggo City and put into practice effective strategies in accordance with regional characteristics to ensure that green transportation is sustainable and that it is implemented to its fullest potential.

Keywords: *Transportation; Government Policy; Environmentally Friendly*

1. Introduction

Transportation has become a basic need in human life, such as to meet the needs of production, consumption and distribution activities. The need for transportation becomes a link that will create and

maintain stability and continuity of activities in society and government. This is supported by the notion of transportation according to Kamaludin (2003), transportation is transporting or carrying an item from one place to another or in other words, it is a movement of moving goods or people from one place to another. The sustainable development of mankind is a matter of concern to the whole world. Environmental pollution and haze diffusion have greatly affected the sustainable development of mankind. According to previous research, vehicle exhaust emissions are an important source of environmental pollution and haze diffusion (Peng et al., 2020).

Judging from the importance of transportation in life, this affects the number of motorized and non-motorized vehicles. Based on BPS data in 2019 shows that the number of motorized vehicles in Indonesia is more than 133 million units. The number of motorized vehicles in 2019 has increased by 5.3% from 2018. This is inversely proportional to the presence of non-motorized vehicles which are increasingly rare. Non-motorized vehicles or non-motorized transportation that are currently the most commonly encountered are bicycles. Cycling users themselves have increased every year. However, when compared to the increase in bicycle users with motorized vehicle users, it is very much different. The world is concerned about humanity's ability to progress sustainably. The sustainable progress of humans has been significantly impacted by environmental pollution and haze dispersal. In the modern world, environmental protection has emerged as one of the most important issues. In an effort to better people's lives and make the world a better place overall, more and more effort has been put into building smart cities (Visvizi et al., 2018).

The increase in the number of motorized vehicles will affect the increase in air pollutant substances released. This is supported by research from the Study on the Integrated Air Quality Management for Jakarta Area in 1997 and the Integrated Vehicle Emission Reduction Strategy for Greater Jakarta in 2002 which concluded that transportation has a major contribution to urban air pollution. Most motorized vehicles produce poor exhaust emissions which can be caused by inadequate maintenance or the use of fuel of poor quality. The existence of air pollution will cause the warming of the greenhouse effect (ERK) which will cause global warming (global warming) which will have an impact on life and the environment.

One of the cities in Indonesia that has transportation problems due to motorized vehicles is Probolinggo City. One of the transportation problems in Probolinggo City is congestion caused by the density of motorized vehicles, both private and public. These existing problems can be solved through the existence of sustainable transportation. Sustainable transportation according to the Organization for Economic Co-Operation & Development (OECD, 1994), is a transportation that does not cause harmful impacts on public health or ecosystems and can consistently meet existing mobility needs. The embodiment of this sustainable transportation by using environmentally friendly transportation to meet the transportation needs of the community. The use of environmentally friendly transportation can be realized by improving facilities for bicycle users, pedestrians, and public transportation such as electric trains.

The use of environmentally friendly sustainable transportation in Probolinggo City is also a problem in its realization, because the use of non-motorized transportation (NMT) is only 16.4% and this is still relatively low. In the Probolinggo City Medium-Term Development Plan (RPJMD), sustainability is one of the keywords in the Probolinggo City vision for 2019-2024 which is sharpened in the third mission, namely infrastructure and a sustainable environment, including transportation development. The development of transportation in Probolinggo City is directed at sustainable transportation as contained in the preparation of the Probolinggo City Road Traffic and Transportation Network Master Plan Study. Some of Probolinggo City's efforts in realizing sustainable transportation include:

a) Stipulation of Probolinggo Mayor Regulation Number 37 of 2013 concerning Regional Action Plans for Reducing Greenhouse Gas Emissions and Adapting to Climate Change Impacts of Probolinggo City.
b) Bike lane construction.
c) The implementation of the bike to work in the first week of the beginning of the month.
d) Submission of the Circular Letter of the Mayor of Probolinggo Number: 050/3824/425.201/2020 September 30, 2020 Regarding the Cycling Movement in the Probolinggo City Government.

Therefore, the Probolinggo City Government through Bappeda Litbang needs to compile a study on the development of environmentally friendly transportation in order to photograph the condition of the environmentally friendly transportation system in Probolinggo City and develop effective strategies according to local characteristics so that sustainable environmentally friendly transportation in Probolinggo City can be implemented optimally.

2. Material and Methods

2.1 Literature Review

Although there isn't a universally agreed-upon definition of sustainability, sustainable development, or sustainable transport (Beatley, 1995), it is generally acknowledged that these concepts imply striking a balance between (current and future) environmental, social, and economic qualities (Litman, 2003; WCED, 1987). Which environmental, social, and economic values ought to be guaranteed and balanced is less obvious. Although there have been several attempts to create sustainable transport indicators (see below), it has not yet been possible to identify a crucial set of indicators that accurately captures environmental, social, and economic attributes. The development of theory-based conceptions and operationalizations of sustainable transport indicators should ideally start with a definition of sustainable transport and lead to the identification of key performance indicators that help us quantify sustainable transport. Numerous performance indicators have been developed based on current procedures (such as those found in transportation plans and policies) and stakeholder perceptions of sustainable transportation. A clear concept or vision of sustainable transportation has not always been the foundation for indicator creation.

Examining the sustainability of the transportation system as a whole, with an emphasis on the current and foreseeable externalities and values of traffic and transportation, is one way to think about sustainable transportation. Governments have utilized these types of indicators (Gudmundsson, 2001) to set goals for sustainable transport and to check on the progress of the current transportation system. Future predictions are developed in some circumstances to predict advances in transportation and pertinent sustainability metrics. There have been numerous attempts to list such signs (Gudmundsson, 2001; Litman, 2003). Examples are energy use, CO_2 emissions, emissions of toxic and harmful substances, land use, disruption and fragmentation of natural areas, waste, traffic safety, noise pollution, health consequences of transport, crash costs, the contribution of the transport sector to economic welfare, and accessibility.

The underlying human urge to improve the planet and leave a lasting legacy is reflected in sustainability. Sustainability highlights how interconnected human endeavors are, necessitating the coordination of actions among many organizations, sectors, and governments. Planning for sustainability, also known as comprehensive planning, aims to make sure that local, immediate decisions are in line with societal strategic, regional, and long-term objectives. In contrast, reductionist planning assigns problems to a profession or organization with limited duties and objectives. This kind of planning could produce answers to one issue that make other issues in society worse (Litman, 2007).

Comfortable layouts, sophisticated ITS-based solutions to optimize operations, new engines designed to save fuel, and the improvement of the electric choices are key working areas. Most of these improvements are motivated by environmental concerns. Key Performance Indicators are used to evaluate the innovations' performance once they have been tested in actual urban settings. It was also possible to conduct a Transferability Exercise (TE) within EBSF to evaluate the innovations' theoretical exportability to more metropolitan situations (Corazza et al., 2016).

Land values will change as a result of changes in accessibility, and these changes will have an impact on how the land is used. The pace of trip awakening will change, leading to changes throughout the cycle, if a land-use change of travel requires to transport the value of land accessible facilities actually occurs. It should be highlighted that this cycle simplifies reality and does not depict market power. However, this cycle demonstrates the basic connection between land use and transportation (Khisty & Lall, 2005).

A city's land usage typically takes on a specific shape, and its growth pattern may be predicted. In urban development, choices are typically made freely but in conformity with land-use planning. With the establishment of major corporate centers, economic considerations have become the primary driver in the formation of a city's land use pattern. In addition to financial motivations, there are political motivations and factors related to the city's physical design, such as topography and drainage. Even though the city's layout appears haphazard, closer inspection reveals that certain patterns are regular. Internal zones of the city are made up of physical structures. The analysis of land use forms, which commonly include land use for housing, business, industry, agriculture, and services, is done utilizing existing urban structural theories (Koestoer, 2001).

The mobility system, the network system, the activity system, the institutional system, and the transport system for a number of microsystems. Each system was linked to the others. Transportation is a supporting element and an incentive for development (a sector for promoting economic development). Construction of a land area will increase traffic, which will reveal trends in land use. Regulation and policy-based interactions between land use and transportation. Long-term changes in the structure and pattern of land use will result from the creation of transportation facilities or the availability of modern transportation due to higher accessibility levels (Tamin, 2000).

Particularly in the urban sections of this complex that are developing, where the city has a range of consequences and elements that are more complex than the district/city The community's active involvement will promote unity even more, accelerating the advancement of just, prosperous, and prosperous welfare. This is due to the fact that development is an ongoing or continuous effort to achieve the goal of raising the standard of living, making it impossible for the local government to handle alone. The entire community must be involved, informed of the development, and given the chance to participate so that participation can then grow actively and dynamically.

2.2 Research Location

This study was carried out in the City of Probolinggo, with a particular emphasis on the downtown district, which serves as both the local government's administrative headquarters and a popular tourist destination. This location was picked because it is close to the heart of government administration, has a growth plan for non-motorized transportation, and is a popular tourist destination. The number of persons impacted by the change in land use is likewise considerable. Additionally, the location was chosen due to the area's accessibility as both a tourist and government administration hub. The following figure 1 shows the location of the research in Probolinggo City in terms of geography.

Figure 1. Map of Research Locations

3. Method

The descriptive qualitative research method is being used in this study. The goal of descriptive research is to characterize a thing in light of its surroundings or what it is. In this study, the authors gather data utilizing field research methods, namely direct data gathering, which entails observing the company closely, conducting interviews, and using questionnaires. Moreover, employing library research methods, such as gathering secondary data—that is, data gained from data that has already been recorded—both in the form of reports and discoveries from earlier studies. The analysis employed is Network System Analysis, which includes analyses of bike paths, non-motorized vehicle use, and pedestrian paths. The Activity Pattern of non-Motorized Transportation Modes is also analyzed using Movement System Analysis. Additionally, TOD (Transit Oriented Development) analysis is used, which includes Parking System Analysis, Analysis of Parking Space Provision (Park and Ride), Analysis of Bike Paths in Transit Areas, Analysis of Pedestrian Paths in the Transit Area, Analysis of Bike Sharing, and Environmental Analysis.

The research approach used in this research is by exploratory survey analysis. According to Nazir (2005), explains that explorative survey methods are often used to reveal facts and identify problems and justify ongoing implementation. The samples used in this study were obtained using Slovin formula (Setiawan, 2007). Respondents in the study also involved some supporting informants such as journalists Malang, NGOs, Vice Regent, District Officers, Entrepreneurs and village community leaders. Technics measurement of this research variable using questionnaires as an instrument in collecting data from respondents, because the method of data collection in this studies survey. The answers obtained with the research instrument were scored. The questionnaire in this study used five levels, ie Strongly Disagree (STS), Disagree (TS), Quite Agree (CS) or Neutral, Agree (S), and Strongly Agree (SS). Likert-scale usage can generate data categorized in interval scale (now, 2003). The score of answers to the questionnaire: Strongly Disagree (STS) = 1, Disagree (TS) = 2, Neutral (N) = 3, Agree (S) = 4, and Strongly Agree (SS) = 5.

4. Results and Discussion

The bicycle lane development plan, apart from being adjusted to the 2018 Probolinggo City Bike Path Study, is also adjusted to the function of the road network. In type A plans, bicycle lanes are physically separated from motorized traffic lanes. The physical separator referred to in the form of a kereb. It is planned that Jl Sukarno Hatta and Jl Panglima Sudirman are secondary arterial roads. In the type C plan, bicycle lanes are mixed with motorized vehicle lanes, there are no road markings or different colors, but are assisted by signs. It is planned that almost all roads in Probolinggo City will take advantage of the width of the road. Related to the convenience of bicycle users on the type C bicycle path with the presence of street vendors and parking, the bicycle lane plan utilizes a road body width of approximately 1 m so that the location of the bicycle lane remains on the road. The existence of street vendors generally takes advantage of the availability of pedestrian paths / sidewalks, while on-street parking takes advantage of the width of the road shoulders. So the efforts that can be made related to the comfort aspect of using bicycles on type C lanes include:

a) Providing clear signs on roads that are used as bicycle lanes.
b) Setting the location of street vendors, especially those that use the shoulder of the road on the road that is used as a bicycle lane.
c) Regulations and restrictions on the on-street parking system on roads that are used as bicycle lanes.

Parking for all secondary collector roads is allowed to park on street, taking into account traffic conditions and land use functions. The construction of pedestrian paths is carried out on roads which are connection points and centers of attraction generation in the form of non-motorized walking activities, namely on Jl Governor Suryo, Jl Hayam Wuruk, Jl Bengawan Solo, Jl Semeru, Jl Wahid Hasyim, and Jl Mastrip. Based on the concept of Development Law, the legal aspects related to the plan for the development of sustainable and environmentally friendly transportation. In environmental policy, the government makes policies that are oriented towards environmentally friendly and sustainable transportation that focus on the use of non-motorized vehicles as an effort to reduce greenhouse gas emissions in Indonesia. In the integration policy, the government makes policies that can integrate the transportation sector with other sectors, and also integrates land, sea and air transportation modes to improve transportation accessibility. In supporting policies, the government provides education and understanding and invites the public to use mass transportation or non-motorized vehicles.

a) Economic Aspect. The economic aspect is applied to reduce trips that are not too important, which is expected to be appropriate to reduce transportation problems in a balanced way.
b) Social Aspect. Based on the concept of developing social aspects, it can be seen from non-motorized, bicycle lanes, pedestrian paths and bus stops. The following is an environmentally friendly transportation development plan for each subject.

- Non-Motorized. Based on Probolinggo Mayor Regulation No. 37 of 2013 concerning Regional Action Plans for Reducing GHG Emissions and Adapting to Climate Change Impacts in Probolinggo City, there are several activities that can reduce air and noise pollution.
- Special Bicycle Tracks. The people of Probolinggo City feel that it is necessary to build a new special bicycle lane in order to have a new bicycle track that can increase the use of bicycles in the community. This can improve the safety and comfort of bicycle users in Probolinggo City
- Pedestrian Paths. It is necessary to build pedestrian paths on roads that do not yet have and it is necessary to widen pedestrian paths so that they are comprehensive on roads. Improving

the function of the pedestrian path is also needed by adding markers so that there are no street vendors and vehicle parking along the pedestrian path.

c) Environmental Aspects. The following is a plan for the development of environmentally friendly transportation from each subject viewed from the environmental aspect.

- Motorized Vehicles. Routine maintenance and maintenance of official vehicles by optimizing vehicle feasibility tests. It is also necessary to hold programs that can support the community to use renewable fuels.
- Pedestrian Paths. On the pedestrian path which is located on 13 roads, there are still side barriers in the form of trees around the pedestrian path. To overcome this, it is necessary to carry out routine arrangements on trees or other plants that are around the pedestrian path. This if left untreated can make pedestrians feel uncomfortable.

Development of the TOD (Transit Oriented Development) Area

After determining the connectivity points and supporting facilities for the movement of non-motorized transportation modes in the City of Probolinggo, then by using the criteria of the ATR BPN Regulation No. Transit Oriented Development for each mode change node. The Transit Oriented Development area is recommended at transportation nodes such as the Bayuangga terminal, Probolinggo train station, and Probolinggo Port. Passed by public transport routes that are connected to the train mode. Traversed by the bike path plan. Convenient walking paths are available. Located in the Central Business District area with mixed land use functions. And the allocation of parking space is sufficient (on street and off street).

Based on Permen ATR BPN No. 16 of 2017 concerning Guidelines for the Development of Transit Oriented Areas, Probolinggo City is very capable if it will be developed into a Transit Oriented Development Area because it has met the main criteria in determining the existence of a Transit Oriented Development area. The development of the area will later support the development of environmentally friendly transportation in the City of Probolinggo because it is expected to be able to integrate the modes of mass public transportation in the City of Probolinggo (trains, city public transportation, and sea transportation) with private vehicles (bikes) so that it will reduce the use of motorized vehicles. in Probolinggo City in the future. The following is a plan for an environmentally friendly sustainable transportation network:

a) Plans for Development of New Bicycle Paths. In addition to planning for the creation of bicycle lanes/lanes according to the route of the previous Cycle Path Study. It is recommended to add a type C bicycle lane/lane on several roads that have a high NMR mode activity with sports, shopping and work activities, including: Jl Gatot Subroto, Jl. Serma A, Jl Pahlawan, Jl Wahid Hayim, Jl Ikan Grouper, Jl Kihajar Dewantara.
b) Plans for making New Pedestrian Paths. To maximize non-motorized movement activities, it is necessary to plan new pedestrian networks, especially in areas dense with non-motorized activities but not yet served by pedestrian networks. Before determining which pedestrian path should be developed, it is carried out in accordance with the bicycle lane development plan. Where to connect the activities of the two modes must be on the same road network.
c) Public Transportation Performance Improvement Plan.

- Rejuvenation of public transportation modes. The prioritized public transportation mode is lyne that will pass through the Transit Oriented Development area, taking into account increasing interest in using public transportation modes, including lyne B, D, G, I H.

- Performance improvementof the reasons for the lack of interest in the use of public transportation is its poor operational performance, such as the long waiting time between public transports and the operation of routes that are not in accordance with the proper routes.
- Integration of public transportation payment systems. Through the integration of payment systems, it is hoped that it will make it easier for public transportation users to carry out their activities so as to increase interest in using public transportation among the general public. Integration can be done via prepaid electronic card payments.

One of the cities in Indonesia that has transportation problems due to motorized vehicles is Probolinggo City. One of the transportation problems in Probolinggo City is congestion caused by the density of motorized vehicles, both private and public. These existing problems can be solved through the existence of sustainable transportation. Sustainable transportation according to the Organization for Economic Co-Operation & Development (OECD, 1994), is a transportation that does not cause harmful impacts on public health or ecosystems and can consistently meet existing mobility needs. The embodiment of this sustainable transportation by using environmentally friendly transportation to meet the transportation needs of the community. The use of environmentally friendly transportation can be realized by improving facilities for bicycle users, pedestrians, and public transportation such as electric trains.

Conclusion

The use of environmentally friendly sustainable transportation in Probolinggo City is also a problem in its realization, as shown by the description of the data up front, some emphasis, as well as explanations at various points of the description. This is because the use of non-motorized transportation (NMT) is only 16.4%, which is still a very low percentage. Sustainability is one of the major phrases in the Probolinggo City vision for 2019–2024, which is emphasized in the third purpose, infrastructure and a sustainable environment, including transportation development, in the Probolinggo City Medium-Term Development Plan (RPJMD). According to the Probolinggo City Road Traffic and Transportation Network Master Plan Study, the development of transportation in the city is focused on sustainable transportation. The creation of Probolinggo Mayor Regulation Number 37 of 2013 concerning Regional Action Plans for Reducing Greenhouse Gas Emissions and Adapting to Climate Change Impacts of Probolinggo City, the implementation of bike to work in the first week of the month, the submission of the Circular Letter of the Mayor of Probolinggo Number: 050/3824/425.201/2020 September 30, 2 are some of the efforts made by Probolinggo City to achieve sustainable transportation. Therefore, the Probolinggo City Government, through Bappeda Litbang, has put together a study on the development of environmentally friendly transportation in order to document the state of the system in Probolinggo City and has developed effective strategies in line with regional characteristics so that sustainable environmentally friendly transportation in Probolinggo City can be implemented in an optimal manner.

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