

## **The Impact of Vegetation on the Arterial Road Median To the Convenience of the Road Users in Pangkep Regency South Sulawesi Province**

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**Abstract:** This research aims to analyze the median vegetation condition of the arterial road in terms of its function as a green channel, to analyze the median vegetation condition of the arterial road in terms of the convenience of the road users, and to formulate the concept of median arterial vegetation arrangement to the convenience of the road users. The research was conducted in Pangkep regency along the arterial road which has a median street. The research was conducted by survey technique and direct interview to the road user with descriptive method with quantitative and qualitative analysis, including vegetation condition in median artery road by measuring and observing directly height, width, distance, and type of plant and the result of questionnaire analyzed by using Likert scale. The result showed that the median of vegetated roads only reached 3.37% of the existing road length (41.21 km). Median road on the Hasanuddin Street segment can fulfill 3 green line function: reducing air pollution, noise, and showing environmental aesthetics. The function of the green line on the road median to the convenience of the road users has not been entirely good, most road users (49%) who cross the road median have the impression of arid, uncomfortable, not yet functioning as a shade, or other functions such as reducing vehicle noise, overcoming glare and has not given the impression of beauty. The concept of vegetation arrangement on the median of the road can be based on the five design principles of theme, rhythm, balance, scale and point of attention. Among others, by combining tree species such as trees, shrubs, and shrubs. On the ferry crossing, the road median can be applied the concept of lighting signs and stopan buttons and tree planting.

**Keywords:** median road, vegetation, green line, transportation

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### **I. INTRODUCTION**

The road supervision space a segment along the road outside belonging to the road that is determined based on the need for the driver's view, set by the road builder. In the road section can be done with planting green trees or plants. The area is called the green line [1]. Throughout the world, transportation generally consumes 30% of total commercial energy, of which 80% of the amount is consumed by land transportation. Motor vehicle gasoline burning will produce carbon dioxide, carbon monoxide, hydrocarbons, nitrogen oxides, particles and other compounds. Cars, motorcycles, buses and trucks are the kind of motor vehicles that produce such air pollutants. In addition to air pollution, noise pollution is also generated by transportation activities, especially experienced by urban centers in developing cities[2]. Some people still underestimate the importance of the existence of the green line, but if it has materialized not a few people realize the role of plants in creating freshness and eliminate fatigue. In fact, more in its function as green open space that can improve the quality of the environment. The existence of beautiful plants can not be separated from the presence Plants as a green path element. Indonesia as a tropical country has a very high diversity of plants. It is this potential that should be developed; the plants in Indonesia have a variety of shapes, textures, colors, sizes, and aromas. Placement and combination of good plant elements can also highlight the attraction the plant itself [3,4].

In accordance with the decision of Minister of Public Works and Public Housing No.248/KPTS/2015, artery road in Pangkep Regency is a national road that has a length of 41.20 km and is an arterial road with concrete and asphalt construction that can cause air heating because most of the absorbed heat is re-emitted to the surface, The median of the road is not well ordered but it is quite wide i.e., 1.00 m to 2.00 m, with diverse conditions i.e., concrete, grass, and vegetation. [5]trees can absorb carbon, microclimate modification with green concept is very significant to the control and reduction, the greening with the tree can serve as a sun protector. Therefore, this research aims to; 1) analyze the median vegetation condition of the arterial road in terms of its function as a green channel, 2) to analyze the median vegetation condition of the arterial road in terms of the convenience of the road users, and 3) to formulate the concept of median arterial vegetation arrangement to the user's convenience street.

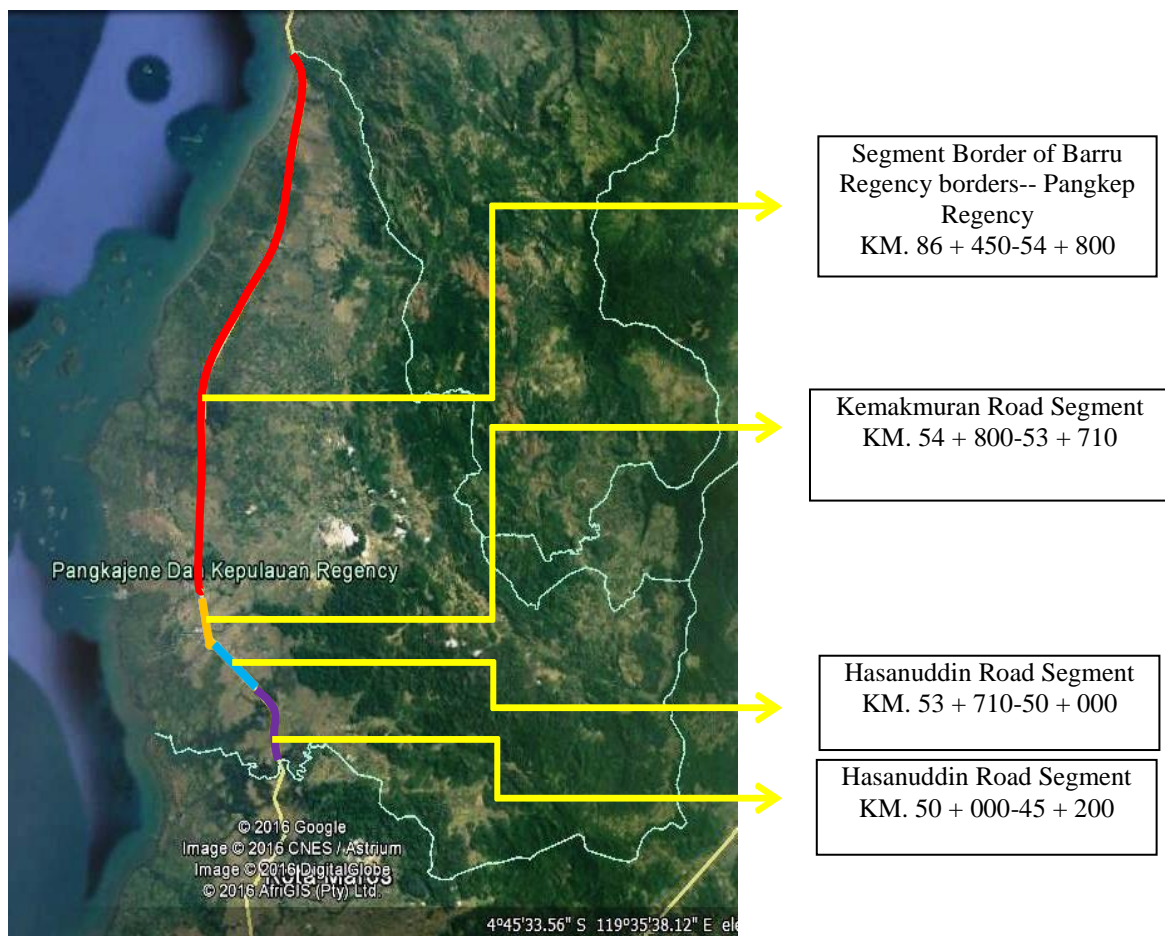
## II. MATERIALS AND METHODS

### Types of research

This research is descriptive to describe the median condition of the arterial path that will be compared against the literature review, theoretical or guideline standard that has been set. The method used is survey and direct interview to artery road user.

### Locus and Time of Research

This median artery road research was conducted in Pangkep Regency, South Sulawesi Province, on arterial road which is a national road segment, with very high traffic movement pattern with various types of vehicles ranging from two-wheeled vehicles, four wheelers to heavy vehicles with average speed 60 km/hour, also the pattern of pedestrian movement that often cross the road because there are some public facilities along the arterial road. The research location is divided into 3 segments namely boundary area of Barru Regency borders, Pangkep Regency KM 86 + 450-54 + 800, Kemakmuran Street KM.54 + 800-53 + 710, Hasanuddin Street KM. 53 + 710-50 + 000 and Hasanuddin Street is KM. 50 + 000-45 + 200 as in Figure 1.



**Figure 1.** Road Segment of Pangkep Regency

Source: Google Earth, 2017

The timing of the research is conducted from December 2016 until March 2017, in the hope that the data obtained during the time of the research is complete, so that it can be analyzed to provide answers to the formulation of research problems.

### Population and sample

The population in this research is all the road users passing through the observation segment in the artery road of Pangkep regency, with the heterogeneous population that is not the same nature so that sampling is needed in some point. For pedestrians a sample of people who crossed the road at 5 points of observation is a public facility that is in front of MTS Ma'rang School, Ar Ridwan Bungoro Mosque, Regional General Hospital, and Regent's Office. For users of four-wheels and two-wheeled vehicles taken samples that cross the arterit

road. Sampling using a Non Probability Sampling is a technique that does not give equal opportunity/opportunity for every element or member of population to be selected into sample[6], with technique in incidental sampling that is sample determination technique by chance, that is who accidental/incidental to meet with the researcher can be used the sample, when viewed by the person who happened to be met it is suitable as suber data [6], so the sample to be taken is any road users passing on this research segment, be it pedestrians, heavy vehicles, light vehicles, motorcycles.

**Data Collection**

Primary Data, is data obtained from respondents with questionnaires and/or interviews directly. Secondary Data, obtained from printed and electronic journals, books, regulations, related policies and planning guidelines that support the median arrangement of arterial roads.

**Data analysis**

Data analysis used is Likert scale to measure attitude, opinion, and perception of someone about social event or phenomenon.

The criteria scores determined in this paper are as follows

- 84,0% - 100% = Very Comfortable
- 67,9% - 83,9% = Comfortable
- 51,8% - 67,8% = Less Comfortable
- 35,7% - 51,7% = Quite Comfortable
- 19,6% - 35,6% = Uncomfortable

**III. RESULTS**

**Median Vegetation Condition of Arterial Roads as Functions as a Green Line**

Arterial road in Pangkep regency with road length 41,21 km has median condition of various road contained in Table 1. Grass is one of the ground cover plants that can protect the soil surface from the sun so it is not too dry and dusty [7], grass is one of the longest median road conditions at this research site but grows naturally or regularly Called weeds (66.49%). The surface of the soil by the concrete will absorb much of the sun's radiation, mostly absorbed and then released again into the air and surroundings, but the heat release will be much larger than that occurring in plants so that the temperature becomes higher[8], concrete conditions also present on the median of this road (28.97%). Characteristics of vegetation will give a natural impression of the environment, because plants can be a visual refreshment of hard and crude elements[9], but the least vegetation conditions (3.73%).

**Table 1.** Median condition of the arterial road in Pangkep Regency

No.	Roads	Long Road (km)	Median Condition of the Road			Road opening Length (km)
			Vegetation (km)	Grass (km)	Concrete (km)	
1.	Barru Regency borders- Pangkep Regency borders	31,60	-	18,60	11,07	1,93
2.	Kemakuran Street	1,10	0,27	0,37	-	0,46
3.	Hasanuddin Street	3,71	0,96	1,70	0,60	0,45
4.	Barru Regencu Borders – Maros Regencu borders	4,80	0,31	4,26	-	0,21
<b>Total</b>		<b>41,21</b>	<b>1,54</b>	<b>24,93</b>	<b>11,94</b>	<b>2,80</b>
<b>Percentage</b>		<b>100%</b>	<b>3,73%</b>	<b>60,49%</b>	<b>28,97%</b>	<b>6,80%</b>

Source: Results of the analysis, 2017

**Median Vegetation of Arterial Roads Reviewed on User Convenience of the Road**

For shade function, from the observation of the location there is no tree as a shelter on the road, especially the location around the crossing of the road, so pedestrian crossing is not convenient because there is no medium that becomes shade, as well as motorcyclists and 4 wheeled vehicles uncomfortable because it will be blocked by the glare of morning and afternoon sun light. For air pollution function, pedestrians, motorcycles, and 4 wheel vehicles visually feel air pollution by vehicle exhaust gas about 43% -50%, because users feel when passing this road there are 5-6 vehicles that emit exhaust.

For noise function, road users feel the noise caused by the sound of the motor vehicle is the highest users of motorcycles as much as 45% is noisy, because the feel when passing arterial road in Pangkep Regency is > 7 vehicles that sounded noisy. For the glare barrier function, the most road users who feel the glare by the light of the opposing vehicle's light is the user of the four wheel vehicle as much as 53%, due to the lack of retaining glare in the median of the road so that the vehicle that turns on the light and is in the opposite direction will feel so dazzling disturbing the view at night.

For the impact deterrent function, road users who always feel this road is accident-prone and can result in a clash of 13% of users of motor vehicles, meaning that the user of the impacted vehicle is still very small, although there is still very little but should be prevented since early. For the wind breaker function, road users who always feel shaken because of high winds are users of motorcycles as much as 5%, meaning that users of vehicles that experience shaking still very little, although still very little but should be given early prevention.

For pedestrians 53% less convenience with existing vegetation, the most significant is the function of reducing air pollution, because pedestrians feel that only 37% of vegetation can reduce air pollution because many vehicles emit vehicle air pollution, so do bicycle users 42% motor less comfortable and 40% wheelchair users less comfortable. To function as an environmental aesthetic almost all road users who claimed to need plants on the road median but the most are motorcycle users as much as 63%, meaning that road users feel the need for vegetation on the road median because now it does not feel the function of existing plants.

**Concept of Convenient Arterial Road Median Structuring for Road Users**

Some cornerstones so that the concept of structuring on median arterial road is very necessary, among others, i.e.: 1) The vegetation on the arterial road in Pangkep regency illustrates that of the seven functions of the green line only the most dominant aesthetic function on all median roads studied, and the road users also have not fully felt the current vegetation function. The green line functions that need attention are the shade function, the glare dispersion function, the impact breaking function and the wind breaking function because at four medians of the observed road segment, the function is completely unfulfilled, and 2) Pedestrians are still less safe when crossing over the median road because at every crossing, not equipped with markers and zebra cross signs are adequate. In addition, the median height of the road from the road surface makes pedestrian difficult for crossing, and the absence of shade trees at the crossing location.

**IV. DISCUSSION**

**Median Vegetation Condition of Arterial Roads as Functions as a Green Line**

There are seven functions and green line criteria summarized in Table 2, and adapted to vegetation located on the median artery path. The results show that vegetation at all points of observation fulfills the aesthetic function of the environment because each vegetation has various appeal, as for the function of reducing environmental pollution and noise absorbers are located on the Hasanuddin Street which is a city area of Pangkep Regency with a varied and still well maintained With other roads (see in Table 3).

**Table 2.** Vegetation functions and criteria as green lines

Function		Vegetation																		
		Type			Criteria															
		a	b	c	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Shade																			
2	Reduce Environmental Pollution																			
3	Noice absorber																			
4	Dazzled obstacle																			
5	Environmental aesthetics																			
6	Collision Barriers																			
7	Wind solver																			

Explanation:

Vegetation Types:

- a. Plant
- b. Clump
- c. Bushes

Vegetation criteria;

- |  |                                  |
|--|----------------------------------|
| 1. Placed minimal 1.5 m from the median edge | 9. The spacing of the huddle <3m |
| 2. Branching 2 m above ground                | 10. Forming Mass                 |
| 3. Branching rods do not duck                | 11. Height of 1.5 m              |
| 4. Solid dense leaves                        | 12. Flower                       |
| 5. Derived from seed propagation             | 13. Fruit                        |
| 6. planted line up                           | 14. Leaf color                   |
| 7. Not easy to topple                        | 15. form title                   |
| 8. It has the use of absorbing air           | 16. Rooted strong                |

**Table 3.** Function of the Green Line to Median Vegetation of Roads In Pangkep Regency

Roads	Function of the green line						
	Shade	Reduce Environmental Pollution	Noice absorber	Dazzled obstacle	Environment al aesthetics	Collision Barriers	Wind solver
Barru Regency borders-Pangkep Regency borders	x	x	x	x	x	X	x
Kemakmuran Street	x	x	x	x	0	x	x
Hasanuddin Street	x	0	0	x	0	x	0
Pangkep Regency borders-Maros Regencu borders	x	x	x	x	0	x	x

Explanation:

X: Not Compliance      O: Fulfill

**Median Vegetation of Arterial Roads Reviewed on Convenience of Road User**

Of the 7 functions of the green line are largely still not functioning properly in Table 4. For pedestrians 53% less comfortable with existing vegetation, the most significant is the function of reducing air pollution, because pedestrians feel that only 37% of vegetation can reduce contamination air because many vehicles that exhaust the vehicle that raises the risk of air pollution, so the users of motorcycles 42% less comfortable and 40% wheelchair users less comfortable.

**Table 4.** The effect of median road vegetation on the convenience of road users is viewed from each function

Road Users	7 vegetation functions on the road median							Effect of median road vegetation on road users convenience *)
	Shade	Reduce air pollution	Absorbent Noise	Hold Dazzled	Conflict Hold	Solver Wind	Aesthetics	
Pedestrian	-Uncomfortable -None (0%) vegetation serves as a shade	-Uncomfortable -37% vegetation that reduces air pollution	- Uncomfortable - 42% of the vegetation that absorbs noise	-Less comfortable 61% vegetation serves as a glare retarder	-	-	To obtain the vegetation comfort required 76% combination of plant species	43% Less Comfortable

Motorcycle	-Uncomfortable - None (0%) vegetation serves as shade	-Uncomfortable - 42% vegetation that reduces air pollution	- Uncomfortable - 44% of the vegetation that absorbs noise	-Uncomfortable - 49% vegetation serves as a glare barrier	-Comfortable - 5% had no accident due to impact	- omfortable - 6% did not experience shaking due to high winds	To obtain the necessary vegetation comfort 79% combination of plant species	52% Less Comfortable
Four-wheel vehicle	-Uncomfortable -None (0%) vegetation serves as a shade	-Uncomfortable - 40% vegetation that reduces air pollution	- Uncomfortable - 50% of the vegetation that absorbs noise	-Uncomfortable -47% of vegetation serves as a glare retarder	-Comfortable 80% had no accident due to impact	- Comfortable - 4% did not experience shaking due to high winds	To obtain the necessary vegetation comfort 80% combination of plant species	54% Less Comfortable

\*)Average of all functions

To produce vegetation that acts as aesthetic environment 76% of pedestrians suggest planting a combination of vegetation species i.e., trees, shrubs and bushes, as well as users of 79% comfortable motorcycles and 80% comfortable wheelchair users. Of the 7 green line functions to road users, 43% of pedestrians are feeling uncomfortable about existing vegetation, so motorcycle users are 52% less comfortable and users of four-wheel vehicles with 54% percentage less comfortable.

### Concept of Convenient Arterial Road Median Structuring for Road Users

Choosing the appropriate plant species, arranging the proper composition, and maintaining it according to the needs and character of the plant is a task that must be done to obtain the ideal vegetation[6]. The concept can be realized in a way, i.e.; 1) The arrangement of plants on the road median is based on the five design principles of theme, rhythm, balance, scale and point of attention. The theme used is linear formal, the rhythm used is repetition with heartbeat patterns derived from recurrent height differences, balance and scale obtained from plant height, plant color, and leaf texture. The point of attention is derived from the presence of plants that are more striking than the colors of plants on the left and right side. The point of attention can be placed every two to three row of plants, the intention of placing the point of attention that is not too short is not to interfere with the concentration of motorists, by combining 3 types of plants ie trees, shrubs and shrubs so that 7 lanes function Green can be fulfilled, and 2) General crop maintenance is post-plant maintenance and routine maintenance, with activities including watering, weeding, pruning, fertilizing, preventing and eradicating pests and diseases, and replacement of plants or embroidery. Maintenance in the form of watering should be more attention during the dry season due to the increase in very high temperatures, especially on the area around the road made of asphalt and concrete.

For pedestrians who will cross the road with the installation of crossings and the installation of buttons placed on traffic poles to be pressed when crossing the road, then wait until the red light will turn green, then the vehicle stops and the alarm sounds and then crossed carefully. This concept has been implemented in Surabaya city by planting shade trees at the crossing location

### V. CONCLUSION

The vegetation conditions on the road median only reached 3.37% of the existing road length (41.21 km). Median roads that fulfill the three functions of the green line are: reduce air pollution, noise and show the environmental aesthetics is located in Pangkep Regency of the Hasanuddin Street segment. Median on the road prosperity and road Pangkep Regency borders-Maros Regency borders only fulfills the green line function of aesthetic aspect. The median road form concrete pavement and grass is located on the border of Barru Regency, and the border of Pangkep Regency.

The median road vegetation condition on road users' convenience is not fully functioning properly, most road users (49%) who cross the median road have the impression of arid, uncomfortable, not yet functioning as shade, or other functions such as reducing vehicle noise, overcoming glare and has not given the impression of beauty. The concept of vegetation arrangement on the road median can be based on the five design principles of theme, rhythm, balance, scale and point of attention by combining tree species, shrubs, and shrubs. On the ferry

crossing, the road median can be applied the concept of lighting signs and stopan buttons and shade tree planting

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#### **REFERENCES**

- [1]. Zoer'aini 1997. Challenge of Environment and Urban Forest Landscape. CIDES Jakarta
- [2]. Hajar, 2011. Development of Green against Road User Convenience
- [3]. Lestari, et al., 2013. Analysis of Local Vegetation Compatibility for Green Open Space (GOS) Roadway in Kupang City Center. Brawiaya
- [4]. Lestari, et al. 2015. Ornamental Landscape Plant. Penebar Swadaya
- [5]. Watson, 2001. Global Warming Seminar. Hasanuddin University, 2008.
- [6]. Sugiyono, 2016. Research Methods, Quantitative, Qualitative, and R & D. Alfabeta.
- [7]. Frick and Suskiyatno, 2007. Fundamentals of ecological architecture, Canisius Publishers.
- [8]. Karyono, 2010. Introduction to Understanding of Green Architecture in Indonesia. Rajagrafindo Persada
- [9]. Judge, Rustam, 2006. Visual Design of Road Landscape, Aesthetic Wall Noise Barging Guide. Bumi Aksaradi Kota Makassar. Hasanuddin University.