Designing Friendly Environment for Pedestrian by Visual Perception

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Abstract. The purpose of this research is to design an environmentally friendly pedestrian facility by visual perception. One of the most important facilities is a road for pedestrians. We can see that the current expansion of roads has caused a reduction in green areas and many pedestrians are displaced, causing pedestrians are choosing to use private vehicles which results in traffic density. The method used in this research is analysis descriptive method. So far, most people do not pay attention to the pedestrian facilities such as for their safety, security, comfort, and beauty. Therefore to overcome them it is necessary to redesign road facilities, including improving service facilities. By redesigning pedestrian facility services, it is expected to improve the safety, security, and comfort.

1. Introduction
Pedestrian is defined as the movement or circulation of people from one place to another place as a destination using their own foot [1]. The pedestrian pathway in big cities has a function as one of the way to develop the city, including: (1) Pedestrian can foster healthy activities as to reduce the vulnerability of crime. (2) Pedestrian can stimulate various economic activities so that an attractive business area will develop. (3) Pedestrian is very beneficial for promotion activities, exhibitions, advertising, campaigns, and etc. (4) Pedestrian can be attractive to social activities, mental, and spiritual development. (5) Pedestrian is able to present a specific, unique, and dynamic atmosphere and the environment in the downtown environment. (6) Pedestrian also affects to reduce the level of air and sound pollution [2]. Comfort is a state of the environment that gives a sense and in accordance with the five senses and anthropometry along with facilities that are appropriate to its activities. Anthropometry is the proportions and dimensions of the human body and other physiological characteristics and is able to relate to a variety of different human activities. [3, 4]. The point of view of the three influences of the physical environment that is the sensational circle that connects all of it with cosmic rules.

This biological environment takes places in modern humans even where the physical environment has been developed constantly by technological control [5]. Comfort is influenced by distance. Factors that are affecting mileage are: (1) Time related to the purpose or importance of walking. (2) The comfort of pedestrian is influenced by the weather and type of activity [6]. The pattern of circulation regulation can influence a pedestrian to carry out a movement or activity in a place. Vehicle size also will affect parking facilities, namely capacity, access, and layout [7]. It is said that the pedestrian path must be considered as one of the most important designs of the city. The function of the pedestrian path is for pedestrian safety when moving from one place to another [8]. Therefore, pedestrian facilities should include safety, security, and comfort.

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expansion of roads has caused a reduction in green areas and many pedestrians are displaced, causing pedestrians are choosing to use private vehicles which results in traffic density. The method used in this research is analysis descriptive method. So far, most people do not pay attention to the pedestrian facilities such as for their safety, security, comfort, and beauty.

2. Method
The method of this study used analysis descriptive method, which describes and explains the factors needed in planning and designing, as well as supporting factors that will determine the concept of an environmentally friendly sidewalk or pedestrian design. Based on this, a data collection was carried out that elaborated and analyzed, and the results analysis would be used as the basis for planning and designing an environmentally friendly pedestrian. The data obtained comes from secondary data, namely the study of literature through books, journals, papers, references, standards for pedestrian ways, internet, and written sources.

3. Results and Discussion
Technological improvements in recent years have led to changes in the lifestyle of modern society. The lifestyle is also affecting people who used to walk into using private vehicles, resulting in traffic congestion [9]. The design of an eco-friendly sidewalk or pedestrian has the main function as a service for pedestrians to improve the smoothness, safety, and comfort of pedestrians. If the sidewalk is provided for the pedestrian, it will not disturb the traffic road that resulting in a traffic jam. Placing the sidewalk behind the bus stop is a good sidewalk requirement, as it can be seen in Figure 1.

![Figure 1. Example of placing a pavement at a bus stop](image)

1) Sidewalk are built in areas that have the potential to cause pedestrians such as housing, schools, office centers, shopping centers, bus terminals, and others.
2) Pedestrian paths can be measured or planned on roads with pedestrian volumes above 300 people per hour and traffic volumes above 1000 vehicles per hour.
3) Sidewalks are made parallel to the road but if the topography is not possible it can be made not parallel to the main road.
4) For bus stop areas (pedestrian stops) the pedestrian must be placed side by side or parallel to the bus lane and can be placed in front of or behind the bus stop.
5) As far as possible the sidewalk should be placed on the inside side of an open drainage channel.
In the planning and design of environmentally-friendly sidewalks for pedestrians, it is required to have the right dimensions. The sidewalk must have free space, that is, an area where there is no disturbance or obstruction [10]. With a dimension of the height of at least 2.5 meters, a depth of 1 meter, and minimum sidewalk freedom of 0.3 meters. In Table 1, can be seen the pedestrian path is suggested to have a width of at least 2 meters, in certain circumstances the width of the sidewalk can be planned according to the following minimum restrictions (see Table 1):

| Land use around it        | Minimum Width (m) |
|---------------------------|-------------------|
| Housing                   | 1.5 m             |
| Office space              | 2.0 m             |
| Industry                  | 2.0 m             |
| School                    | 2.0 m             |
| Bus stop / Terminal       | 2.0 m             |
| Shopping / Shopping area  | 2.0 m             |
| Bridge / Tunnel           | 1.0 m             |

Table 1. Sidewalk minimum Width

Minimum sidewalk width (pedestrian) based on surrounding land use (source: pu.go.id)

Figure 2 explained the structure and slope is in accordance with the function, the load, and the material used. The sidewalk for pedestrian must be hardened with concrete blocks, asphalt pavement, and plastering. The pavement surface must be flat and have a cross slope of 2-4%, while for the longitudinal slope of the road and a maximum of 10%. This slope aims to avoid puddles on the pavement (pedestrian) so that it gives a bad impact for the pavement users, it can be seen Figure 2:

![Figure 2. Example of a transverse slope on a sidewalk (pedestrian)](image)

The use of stairs is needed on a crossing bridge, crossings, and sidewalks which have a slope extending more than 10% [11]. The existence of stairs and ram will make it easier for pedestrians to go through the uphill area. A good sidewalk must be friendly for the disabled persons. The ease for the disabilities person must be considered in accessing public facilities such as the sidewalk as can be seen in Figure 3.
The pedestrian path needs to be fitted with a barrier so that motor vehicles cannot break through the sidewalk, besides that the sidewalk also needs to be planted with shady trees so pedestrians cannot feel the heat and comfortable. Trees also have a function as absorbents of vehicle passing traffic so that the air becomes cleaner. The sidewalk must be free from economic activities. Meanwhile, for pedestrian safety at night, street lights and the bright sidewalks must be installed to minimize crime. It can be seen in Figure 4.

A good sidewalk is important to use a manhole cover or drainage. Sidewalks built on drainage channels usually have a whole manhole to access the drainage channel. The pit must be closed so that pedestrian users do not fall or fall into the drainage canal. To close the drainage channel manhole cover or manhole cover is used. It can be seen in Figure 5.
4. Conclusion
Technology is increasing rapidly. Creating new innovations that can overcome problems, especially on the environment is needed. One of it is the effectiveness of the pedestrian path which depends on people's interest or desire to walk. Factors that influence the current community to walk from those who have a strong influence are variations in land use. It needs to be comfortable and safe. Then the running time factor is one of the most important factors for the pedestrian. If they do not have the time to walk, they will prefer to use private vehicles. Another factor is the distance traveled and people's interest to walk the feet. To increase the effectiveness, it is necessary to improve the quality and quantity of pedestrian paths. Activities in the pedestrian path must be permissible activities, namely walking, places of interaction, and so on. The pedestrian lane must be free of motor vehicle and street vendor activity.

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