Environmentally friendly photo road modeling in Tasikmalaya city to improve urban transportation framework

Indra Mahdi1,*, Nina Herlina1, Agi Nurhidayah2, Anto Purwanto3 and Andi Nur Rachman4

1Department of Civil Engineering, University Siliwangi, Indonesia
2Department of Informatics, University Siliwangi, Indonesia
3Department Public Health Faculty, University Siliwangi, Indonesia
4Department of Informatics University Siliwangi, Indonesia

*indramahdi@unsil.ac.id

Abstract. The development of a region can be seen from population growth and a high average growth rate, which has implications for socio-economic activities, infrastructure and other physical buildings that are increasingly complex. To accommodate all these activities, space is needed as a place of activity. The road infrastructure sector is one of the arteries in the region's economic growth, so the accuracy of its provision through the amount of investment is very important. This will not cause a bottleneck in the flow of goods/services and people at regional, national and even international levels which causes lower economic and social costs. Even so, in Tasikmalaya City, the road problems at this time have shown serious problems, especially on the main roads, traffic jams often occur, not only due to the increasing number of vehicles, but due to the non-functioning of the sidewalk as a place to walk because some sidewalks are used to sell street vendors, while walking is a tool for internal movement of the city, the only tool to meet the needs of face-to-face interactions that exist in commercial and cultural activities in urban life. This study will examine whether the sidewalk functions in accordance with existing regulations, and whether the sidewalk design has fulfilled the requirements of safety, fun, comfort, and has an appeal. This study uses a qualitative descriptive research method. Data obtained through direct observation in the field. Observations were made on the location of the main road that many pedestrians traversed such as Jl. Martadinata, Jl. Doctor Sukardjo, and Jl. H. Mustopa arrived at Padayungan intersection. The analytical method uses descriptive qualitative with the planning model. Stages of analysis are drainage channel analysis, analysis of the physical condition of the sidewalk, analysis of the quality of safety and comfort of the sidewalk as a pedestrian path. The results of the research are in the form of directional and environmentally friendly sidewalk designs in urban areas, which can be used to complement the shortcomings in variables and to correct variables that have not been fulfilled according to the perception and behavior of pedestrian users in the City of Tasikmalaya.

1. Introduction
The development of a region can be seen from population growth and a high average growth rate, which has implications for socio-economic activities, infrastructure and other physical buildings that are increasingly complex. To accommodate all these activities, space is needed as a place of activity. Especially with the dynamic nature of regional development that requires the provision of wider space
to accommodate it. The road infrastructure sector is one of the arteries in the region's economic growth, so the accuracy of its provision through the amount of investment is very important. With regard to economic development, road investment has a broad influence both for road users and for the region as a whole. For this reason, proper policies are needed in the implementation of roads so that they can support regional development and economic growth. One of the successes of city development is the availability of good transportation facilities and infrastructure in the area (Minister of Public Works 03/2014). In addition to playing a role in supporting the smooth socio-economic activities, it will also support physical development in the area concerned. Based on Law Number 38 of 2004 concerning Roads, that Regional Governments have an obligation to carry out road operations. Strategic issues faced in the implementation of roads, especially national roads and / or urban roads include the inadequacy of the primary road network system and / or collectors in serving continuous traffic flow and or urban traffic flow [1].

This has caused a bottleneck in the flow of goods / services and people at the regional, national and even international levels, which causes higher economic and social costs. Even so, in Tasikmalaya City, the road problems at this time have shown serious problems, especially on the main roads, traffic jams often occur, not only due to the increasing number of vehicles, but due to the non-functioning of the sidewalk as a place to walk because some sidewalks are used to sell street vendors, while walking is a tool for internal movement of the city, the only tool to meet the needs of face-to-face interactions that exist in commercial and cultural activities in urban life. Walking is a means of connecting between other modes of transportation. Judging from the speed, the walking mode has many advantages, namely low speed so it is advantageous because it can observe the surrounding environment [2]. Pedestrians are an important form of transportation in urban areas. Pedestrians are quite essential activities of the transport system and must get the right place. Traveling by public transport always begins and ends on foot, if pedestrian facilities are not provided properly, the community will be less interested in using public transportation [3], so that the existence of several sidewalks on the main road in Tasikmalaya City need to get attention, meaning whether the existence of the sidewalk has met the standards of its width, or still needs to be improved. Aside from being a pedestrian morning walkway, sidewalks can also be used as places / locations to put up billboards to promote goods / services products, so that they can be a source of Regional Original Income from advertisement taxes or advertising fees. According to Unterman, the sidewalk must fulfill several conditions, namely safety, pleasant conditions, comfort and attractiveness.

In the downtown area, a good and appropriate pedestrian pathway is needed so that people are more interested in choosing to walk compared to using a private vehicle. Perception and behavior of pedestrian path users is needed to be able to find out the needs of the community so that the pedestrian arrangement is in line with expectations and can attract the public to use pedestrian paths without neglecting the applicable pedestrian arrangement regulations. Therefore, research on the arrangement of lanes in the downtown area uses 4 variables. This is used to determine a design that is good and appropriate according to the perception and behavior of pedestrian path users. Directives and designs are used to complement the shortcomings in variables and to correct variables that have not been fulfilled according to the perception and behavior of pedestrian users at the research location.

2. Methodology

This study uses a qualitative descriptive research method. Data obtained through direct observation in the field. Observations were made on the location of the main road that many pedestrians traversed such as the Jl. Martadinata, Jl. Doctor Sukardjo, and Jl. H. Mustopa arrived at Padayungan intersection.

The analytical method uses descriptive qualitative with the planning model. Stages of analysis are drainage channel analysis, analysis of the physical condition of the sidewalk, analysis of the quality of safety and comfort of the sidewalk as a pedestrian path.

Broadly speaking, the implementation of the sidewalk masterplan work in Tasikmalaya City is carried out in 5 (five) stages of work. The five stages of the implementation of interrelated work are:
The first stage is more oriented to the preparation and preparation of the work program where after this stage a preliminary report has been made.

- The second stage is the stage of data collection and data compilation and initial identification of problems.
- The third stage is the identification stage of the basic concept of site selection planning the development of sidewalks in the City of Tasikmalaya. After this stage a product will be produced in the form of a report between.
- The fourth stage is the location selection stage where there will be an analysis based on the complete criteria for the selection of the location of the sidewalk development planning in the City of Tasikmalaya.
- The fifth stage is the last stage of the work of preparing this master plan is to provide conclusions on all the work that has been done and provide recommendations so that traditional market operations can run well. After this stage a product will be produced in the form of a final report.

### 3. Construction

3.1. **Construction of sidewalks to prioritize pedestrian interests in order to provide comfort and safety for user.**

- The use of sidewalks for other purposes that interfere with the sidewalk function needs to be disciplined by the application of strict sanctions.
- If the sidewalks built on the sewers must be guaranteed the smooth flow of water in the drains so as not to cause flooding.
- Construction of sidewalks to be adjusted to modern standards so that it is comfortable for users and road-use vehicles.
- Construction of sidewalks should not be cut off, especially to the edge of a sewer or river. If the disconnection must be given a warning sign.
- Construction of sidewalks to synchronize with the construction of sewers, roads, electricity networks, telephones, drinking water and reforestation trees.
- The height of the sidewalk height from the road surface is not too low but also not too high because it will reduce the road capacity. The height of the recommended road pavement is 150 mm.
- Aian Slackness on road access to allow disabled people who use wheelchairs to be able to use the sidewalk easily and easily.
- Trajectories that can be passed by blind disabled people.
- Width in accordance with the number of pedestrians who use sidewalks.

3.2. **Drainage Arrangement and Road Utility in the Research Area**

3.2.1. **Drainage.** Drainage structuring concepts and utilities on roads and the environment will be integrated with drainage channels and utilities. Based on SNI 03-1733-2004 Procedures for Urban Housing Planning in Urban Areas, road sections consist of the following.

![Figure 1. Road Parts](image)
Model of urban drainage channels using materials from precast holes with holes with the concept of Green Water, where drainage using this model is expected rainwater can seep into the soil.

The ZRO (Zero Run-Off) concept for drainage is the use of large capacity rainwater harvesting, supporting environmental-based drainage, and can reduce stagnant water in the settlements. The ZRO concept is the integration between the intensity of rain, storage, absorption, benefits or consumption, and the flow (ITRMA) of the remaining water runoff out of the area up to 0% (zero run off).

![Illustration of Closed Semi Drainage Design](image)

**Figure 2. Illustration of Closed Semi Drainage Design**

3.2.2. *Utility*. Urban utilities in the study area are based on observations in the field, not yet integrated such as PLN Cable Channels, Telephone Cables, PDAM Fiber and Pipe Fiber Cables, all of which are planted but are in their respective lanes.

For urban utility planning, there needs to be integration so as to facilitate monitoring of care and beauty of the road, then special routes must be made which together with drainage

![Utility System Details](image)

**Figure 3. Illustration of Utility System Details**

3.3. *Sidewalk Arrangement and Completeness*

3.3.1. *Sidewalk Material*. The sidewalks built as far as possible are placed on the inside of open drainage channels or above closed drainage channels by using the use of materials that are environmentally friendly, so that rainwater can seep into the soil, use materials with local equipment that is in place and easily found, so it does not need to bring material from outside the area except manufacturing materials that cannot be made in that location such as the examples and motives below
The use of materials for sidewalks is various but strong and environmentally friendly materials such as Pavingblock containing Titanium Dioxide (TiO2) are selected. Construction of sidewalks with pavingblock is done with 2 materials, namely pavingblock material with TiO2 content and without TiO2 content. The color and surface of paving blocks with and without TiO2 content is no different.

3.3.2. Sidewalk Motives and Design. In designing the sidewalk motif in the research area, it is necessary to consider and bring up a model with local wisdom, because Tasikamlaya City is a handicraft industry especially for webbing, so for planning sidewalk motifs and designs it should utilize attractive woven motifs and special materials for diffable.
3.3.3. Sidewalk lighting motifs and designs.

- Installation of lighting lamps Public roads aim to accommodate safe movements for pedestrians and vehicles. Where movement, road users can be helped by their orientation by providing the right hierarchy of lighting effects. The lighting hierarchy can be seen from the difference in distance, height and color of the light used. Lighting must also be functionally suitable and on a scale that is suitable for both pedestrians and vehicle lanes. For pedestrian lighting, lamps with relatively low altitudes can be used to provide a human scale and illuminate the lower canopy of roadside trees. The lighting properties for the pedestrian walk should not be uniform throughout the road, otherwise the vehicle path must be uniform overall. The average street lighting has a height of 6-15.2 meters, while for pedestrian paths, the vertical lighting distribution must reach 2 meters so that the vision towards other pedestrians remains clear. Street lighting facilities should meet the following requirements:
  
  - a. Placed on the left side of the traffic lane according to the direction of traffic or on the island of traffic;
  - b. Distance of street lighting poles is at least 0.60 meters from the edge of the traffic lane
  - c. The lowest part of the street lighting is at least 5.00 meters from the road surface
Pedestrian Information Facility

Pedestrian lighting is designed with the following components.

- Solar Cell, The use of solar cell as street light energy
- Lighting Lamps, Lampposts as street lighting lamps and road directors
- Digital Advertising Board, The existence of placement of advertising media and digital information on street lights as controlling billboards or advertising
- Digital Direction Board / Road, There are placement of digital road signposts at the bottom of digital billboards as a guide for pedestrians.
- Emergency Button, There are buttons, mic, and speakers that are directly connected to the nearest security to anticipate an emergency, such as an accident, crime, or fire.
- Wi-Fi Router and charger, There are internet facilities and charging power for pedestrians.

3.3.4. Street Furniture. Street furniture/Street furniture is a facility that is placed along the road as a complement or support for pedestrian paths. The placement is adjusted to the location of the area used by the pedestrian path. The material used must use materials that are easy to get around, strong against the weather, easy to maintain, easy to repair, strong and safe for road users and the environment around this road complement facilities must fulfill its functions such as:

1. The function of safety and comfort for pedestrians.
2. Complementary function as a seat,
3. Aesthetic functions can be seen from the shape, texture and color.

Some considerations that must be considered in planning road furniture such as:

1. Uniformity of shape and size of signs;
2. Sign design; colors, shape sizes, and material textures that meet the standards will attract the attention of road users.
3. The location of street furniture is placed in a location that is easily visible and not obstructed in front of it.
4. Maintenance of signs; needed to keep functioning properly.
3.3.5. Signage.

3.3.5.1 Signage
- Signage in the form of a building name can be installed on the facade / facade of the building, at an altitude between +2.20 to +5.00 (between the top of the ground floor to the middle of the second floor).
- The design of the marker must be integrated with the architecture of the building.
- Road Signage can refer to existing regulations

3.3.5.2 Advertising
The installation of billboards must pay attention to the safety and security factors, the aim to be achieved is to strive for a balance, linkage and integration of all types of information governance
elements and road faces in terms of function, aesthetics and social, both in the region and the surrounding region.

- The form of billboards and information boards must be integrated with the architect of the building.
- Advertising is only permitted in certain locations.
- Advertisements attached to buildings are allowed at certain locations.

The installation of billboards/billboards is an integral part of the development of the region. Because of that, it is necessary to match the planning of the billboard with the arrangement of the area. The billboard is no longer seen as an addition, but must be part of the arrangement of the area by taking into account applicable regional regulations. Included in the free area of billboards in the planning area are:

- Settlements and conservation areas on the banks of rivers
- The side of the plot facing the knot
- Utility paths and pedestrian lines
- The installation point of the billboard/billboard in the planning area can be placed in an open space formed on the road nodes

3.3.6. Waste management. Based on Government Regulation No. 81 of 2012, public facilities, especially sidewalks, are required to provide trash cans in the form of TPS 3R
3.3.7. Implementation of green road open space facilities.

- The minimum sidewalk width is 2 (two) meters so that the ecological functions that arise from the arrangement of pedestrian paths and green lanes can improve pedestrian comfort. Aesthetic functions between the sidewalks and greening of the road where the two elements need to be arranged on the sidewalk, on the side of the road, which is adjusted to the width of the land from the road shoulder to the channel threshold or Rumija boundary. The height and size of the plant must be adjusted so that the area has aesthetic value. Likewise, the color of the plant is adjusted and uniformed, but not flashy, not monotonous, giving an interesting impression.
- Aesthetic types of plants in urban areas that can be considered are:
  - a. Beautiful,
  - b. Titled easily formed,
  - c. Beautiful leafy,
  - d. Beautiful flowering, and
  - e. A distinctive scented or fragrant aroma

Figure 13. Pavement and Plant Pathways to Support Traffic Comfort and Smoothness

Figure 14. Models of Integrated Road and Sidewalk Development Plans [4]
3.3.8. Circulation and parking. Parking of motorized vehicles consists of parking inside the yard or inside the parcel (off-street) and parking inside the area owned by the road (on-street). For the parking area, the office is directed to develop Green Parking. Parking areas are built without dominant pavement so that rainwater can still be absorbed into the soil.

Figure 15. Illustration of environmentally friendly parking land [4]

References

[1] Haryadi B S 2010 Architecture, Environment and Behavior (Yogyakarta: Gajah Mada University Press)
[2] Anggriani N 2009 Pedestrian Ways in City Design (Klaten : Humanities Foundation)
[3] Guidelines for Planning Walkways on Public Roads No.032 / T / BM / 1999 1999 Attachment No.10 General Decree of Bina Marga No. 76 / KPTS / Db / 1999 Public Works Department
[4] Guidelines for Provision and Utilization of Urban Pedestrian Space and Infrastructure and Facilities 2000 Directorate General of National Spatial Planning Public Works Department.
[5] Asmoro D 1990 Sidewalk Planning Instructions (Jakarta: Directorate General of Highways)
[6] Public Works Department 1990 No.007 / T / BNKT / 1990 Guidelines for Sidewalk Planning Department of Public Works Directorate General of Highways and Directorate of Urban Road Development.
[7] Directorate of National Spatial Planning, Standardization Technical Committee for Construction Materials 2011 Guidelines for Provision and Utilization of Pedestrian Space Infrastructure and Facilities in Cities
[8] Tanan N 2011 Pedestrian facilities (Jakarta: Center for Research on Roads and Bridges)
[9] United States 2000 Highway Capacity Manual (HCM) (Washington D.C: Transportation Research Board)
[10] Unterman Richard K 1984 Accomodating the Pedestrian (Advent Towns and Neighborhoods for Walking and Bicycling) (New York: Van Nostrand Reinhold Company)
[11] Waldock R 2011 Planning and designing for Pedestrians: Guidelines. Perth (Western Australia: Department of Transport)
[12] Yang, Ching Chow 2005 The Refined Canoe's Model And It’s Application Journal Total Quality Management 16 (10):1127-1137