Accessibility and Connectivity Concept Between Motorcycles and Pedestrians at Education District

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Abstract. Land Transport Academy is one district of the education on Bekasi. Vehicle and pedestrian are the main traffic movement in the education district especially pedestrian and motorcycle. The condition of pedestrian facilities is not yet enough and not optimum, that be causing conflict between motorcycle and pedestrian. The conflict could to decrease level of road safety and to increase in road accident. Recently, the government has issued the Regulation of Safe and Safety Route for Schools (RASS) is focus for pedestrian safety at education district. This paper aims to propose the concept of accessibility and connectivity at education district, which could decrease road accident with develop safety routes for pedestrian. Basic concept of design was protected the pedestrian and decrease conflict between motorcycle and pedestrians.

Research methodology includes observation of pedestrian and motorcycles movement, traffic counting, land use inventory of education district and pedestrian facilities. Data is analyzed by using qualitative description. The result is used to show separate pathway of pedestrians with traffic lane will be increasing of pedestrian safety. The separate pathway of pedestrians with traffic lane is to decrease conflict. The concepts of a school safety zone (Zoss) and pedestrian safety are very important for students in the education district.

Keywords: education district, route safety regulation, pedestrian

1. Introduction

1.1. Background

Any person who travels by walking as part of his journey is pedestrian. Walking is a routine activity carried out by students in the land transportation academy. In addition to the ordinary form of walking, a pedestrian may use various modifications and aids to walk such as wheelchairs, motorized scooters, walkers, canes, skateboards, and rollerblades. The person is walking may carry items of varying quantities. A person is also considered a pedestrian when he or she is running, jogging, or hiking in the roadside.

The Land Transportation Academy is one of the education districts in Bekasi. This area consists of department buildings, library, rectorate, auditorium, sports building, dormitories, and other facilities. The routine activities of the learning process lead to the movement of people or pedestrians and two-wheeled vehicles (motorbikes). The pedestrian movement came from students who went to a class in the morning and returned to the dormitory in the afternoon after the learning process was finished.

There was a mix of movement between the vehicle and the traveler on certain points. The conflict between motorists and pedestrians will not happen if their adequate pedestrian facilities compared to the paths for vehicle movement.

Pedestrian facilities are still minimal causing pedestrians to use the road for movement. The use of traffic space between vehicles and pedestrians has the potential to cause conflicts
that trigger accidents. Currently, the government is intensively developing safe routes to be applied in the education area. The form of government support, by issuing Regulation of Safe and Safety Route for Schools (RASS) which regulate patterns of movement in educational areas that consider pedestrian safety, according to Regulation of the Ministry of Transportation of the Republic of Indonesia No. 16 in 2016 Regarding the Implementation Regulation of Safe and Safety Route for Schools (RASS).[1]

The purpose of this study is to reduce conflicts between pedestrians and vehicles to avoid accidents, the potential for accidents because pedestrian facilities are not yet available and the mixing of pedestrians with vehicles and to regulate pedestrian and vehicle circulation.

1.2. Research Problem
Pedestrians and motor vehicles use the roads together without any dividers, whilst the motorized vehicles are mostly motorcycles. The road segment that is used together has a width of 5 meters without the shoulder of the road.

The use of roads together will make the pedestrian feel uncomfortable because in the event of accident pedestrians are the most vulnerable road users. There is no clear separation between the rights of each road user, the lane for pedestrians and lane for motorized vehicles. The lack of facilities for pedestrians raises conflicts that have the potential for accidents.

1.3. Research limitations
This research area covers the area of the Land Transportation Academy specifically for accessibility and connectivity of pedestrian and motorcycle movements.

2. Literature Review
2.1. Pedestrians
Pedestrians are people who do their activities on foot and not a road user. Pedestrians must walk on the part of the road intended for him, on pedestrian sections, or on parts of roads that are intended for the pedestrian. According to the Ministry of Public Works [2], a pedestrian path is a path intended for walking that aims to provide services to pedestrians. Pedestrian paths can be in the form of sidewalks, level crossings (zebra crossings and pelican crossings), and non-level crossings.

In the traffic, pedestrians are in the weakest position if mixed with vehicles. Therefore, pedestrians are an important element in needs attention that the transportation system, according to Pignataro L. J. [3] in Traffic Engineering Theory and Practice. This is especially related to the magnitude of potential conflict between pedestrians and traffic flow, which can cause obstacles, congestion, endanger road users, and can even lead to accidents, one of which is a pedestrian crossing locations. There are pedestrian movements that go along the road and cross the road sections. The choice of lanes and conditions around the route traveled in accordance with the characteristics of pedestrians. This pedestrian characteristic is related to the desired distance and the trajectory was chosen when walking. While the land use characteristics describe the layout of the building that is in the education area. According to the guidelines set by the Ministry of Public Works [2], the minimum sidewalk width calculation is using Equation.

\[
W = \frac{v}{35} + N
\]

Where:
W is the minimum effective width of the sidewalk (m)
v is the planned pedestrian / bidirectional volume (person / meter / minute)
N is the additional width according to local conditions (meters), determined in Table 1.
Table 1. N Value

| N (meter) | Condition                                        |
|----------|--------------------------------------------------|
| 1,5      | Road in an area with high pedestrian volume      |
| 1,0      | Roads in areas with moderate pedestrian volume   |
| 0,5      | Road in an area with low pedestrian volume       |

The effective width of a pedestrian lane based on the needs of one person is 60 cm with an additional width of space of 15 cm to move without carrying goods so that the total lane requirement for two people walking hand in hand or two pedestrians crossing each other without contact is at least 150 cm.

According to Fred N. Ranck [4] in Design and Safety of Pedestrian Facilities states that properly planned sidewalks and walkways are essential in providing pedestrian mobility, safety, and accessibility, particularly for persons with disabilities, children, and older adults. Sidewalks reduce the incidence of pedestrian collisions, injuries, and deaths in residential areas and along two-lane roadways.

2.2. Motorcycle

The motorcycle is one of the option modes used for a movement that exceeds the desired distance for pedestrians. The use of motorcycles is more efficient, cheaper and faster when faced with congested road conditions. Data from the Central Statistics Agency (BPS) shows that every year the number of motorcycles in Indonesia has increased significantly. Based on BPS data, in 1990 the number of motorcycles in Indonesia was around 6 million units. Meanwhile, in 2017 the number has multiplied to more than 113 million units, compared with the number of passenger cars which in 2017 numbered around 15 million units.[5]

Most of the Land Transportation Academy employees use motorcycle for work trips in this educational area. Motorcycles are also used in the education area to move from one building to another and park in the parking area of the building. The peak of movements happens when working hours and study hours students are approaching.

2.3. Accessibility dan connectivity

Between buildings connected by roads for the movement of people both on foot and people using motorized vehicles. The more access in the form of a road the easier it is for people to reach the building in question. Accessibility is a description of how convenient land use are located in relation to each other, and how difficult it is to reach them via the transport network, according to Black J. in Urban Transport Planning Theory and Practice [6].

3. Research Methods

Data was collected to obtain pedestrian characteristics and land use characteristics. Pedestrian movement and characteristics must be studied to provide a design that minimized pedestrian-vehicle conflicts, increases pedestrian safety, and minimized vehicle delays, according to Pignataro L. J. in Traffic Engineering Theory and Practice.[3]

Analysis of accessibility and connectivity uses data on walking speed and pedestrian volume and land use in the education area. Accessibility is a concept that combines the geographical arrangement of land use and the transport that serves this land uses.

3.1. Research Area

The study was conducted in the education area of Land Transportation Academy at Bekasi, West Java, Indonesia. This location was chosen because of the many pedestrian concentrations, some of the student population reached 1,329 people. The students do the movement every day between buildings. The population that uses the education area reaches 1,670 people consisting of employees, students, and visitors. Motor vehicle users are mostly
employees and visitors in this area. The education system boarding school, so students are active on foot.

4. Research Analysis

4.1. Collecting Data
This research collects data from primary and secondary data. The secondary data are collected by using significant source such as books, internet sources, and Indonesian government standard. The secondary data that used in this research are site plan of Education District. The primary data are collected by traffic survey and pedestrian interview in Education District Area. The primary data that used in this research are road and land use inventory, pedestrians, traffic counting, and interview.

4.2. Method of Analysis
The research methodology includes observation of pedestrian and motorcycles movement and inventory of pedestrian facilities. Data is analyzed using qualitative description.

4.3. Data Analysis
The students at the Land Transportation Academy starts studying at 07.30 and ends at 12.30 the observations were done in two sessions, each session is two hours long, starting at 6:00 to 8:00 in the morning and from 12:00 to 14:00 at noon. The largest volume of pedestrians followed by pedestrian travel movement is towards the land transportation department, 797 pedestrians/hour, heading for The Traffic and Transportation Department, 665 pedestrians/hour and the lowest movement is toward The Railroad Department, 532 pedestrians/hour. This can be seen in Tables 2 and 3 below.

| Roads                              | Time Period (pedestrians/hour) |
|------------------------------------|--------------------------------|
|                                    | 06.00 - 07.00 | 07.00 - 08.00 | 08.00 - 09.00 |
| Department of Land Transportation   | 121            | 797            | 40            |
| Road Transport Traffic Department   | 133            | 665            | 14            |
| Railway Department                  | 105            | 532            | 10            |

| Roads                              | Time Period (pedestrians/hour) |
|------------------------------------|--------------------------------|
|                                    | 12.00 - 13.00 | 13.00 - 14.00 | 14.00 - 15.00 |
| Department of Land Transportation   | 156            | 526            | 140           |
| Road Transport Traffic Department   | 134            | 388            | 134           |
| Railway Department                  | 146            | 309            | 105           |

Employees come to work at 08:00 and went home at 16:00. Observation of the volume of vehicles in the morning was done employees before coming to work, starting from 06:00 to 09:00 and when employees got home from 15:00 to 17:00.

Motorcycle is the vehicle most widely used by the employees, up to 293 units. The use of is cars only 49 units, and bicycles are 3 units. This condition has an impact on the movement of large vehicles at certain locations.

5. Result and Discussion
The Land Transportation Academy is located on the main road linking Bekasi with Bogor Regency. This main road has a two-way lane type without borders (2/2 UD) which functions as an arterial road. The education area of the Land Transportation Academy has an area of 14.5
hectares, around 60% of the area is buildings and 40% is open space. There are three doors access to this area, two doors are routinely operated and one access door is only opened at certain times. Access from the main road used for road users who use motorized vehicles that will enter this education area for safety is made a school safety zone (Zoss) in accordance with applicable regulations, according to Regulation of the Ministry of Transportation of the Republic of Indonesia No. 16 in 2016 Regarding the Implementation Regulation of Safe and Safety Route for Schools (RASS).[1]

The road segment with the second-highest proportion of vehicle movement around the rectorate is 33 vehicles/hour (30%). Besides, the road movement to the building department, both buildings majoring inland transportation and road transport traffic and railroad, is the largest vehicle flow consist of 66 vehicles (38%). This is due to the many activities in the department building, especially during teaching and learning activities.

Interviews with 100 respondents found that 63% of respondents know that the distance between locations is 50 m, while 26% is 150 m. If the distance between buildings is less than 150 m, employees choose to walk, if more than 150 m employees prefer to use the motorcycle. The results of interviews with 100 student respondents said that the closest walking distance was 300 m (18%) and the farthest was 700 m (82%).

The condition of the road network area of the Land Transportation Academy is in the form of a grid. The main motorized vehicle movement lane is located in the north of this area, while the main pedestrian movement lane in the south and north. The lane in the southern part of this area is shared between pedestrians and motor vehicles. In this lane there is the highest conflict between pedestrians and motorized vehicles. Potential conflict points when pedestrians turn to the destination crossing with motorized vehicles. The final destination of the pedestrian journey is shown in Figure 1 in the yellow circle symbol. Pedestrian circulation (blue broken line) and vehicles (red line) can be seen in Figure 1 below.

![Figure 1 main road of vehicles and pedestrians](image)

On the road section used for the movement of motorized vehicles and pedestrians, with a volume of 14 pedestrians a pedestrian can be made a separate pedestrian path with a width of 1.00 meters (the calculation results are 0.9 rounded up to 1.00 meters). Limiting the lane between pedestrians and vehicles to avoid mixing the two movements. The pedestrian path in the southern part of the education area is not changed because it is specifically provided for pedestrian paths.
The main road section that is directly related to the education area is a point of conflict in the movement of vehicles and pedestrians who will enter or exit this area. This conflict can be reduced by installing a school safety zone (ZoSS). This is useful for directing pedestrians when crossing by following the traffic lights for road users (motorized vehicles) when crossing this zone to reduce speed and be careful of pedestrians. The form of ZoSS can be seen in Figure 2 above.

6. Conclusion
Roads that are shared for the movement of motorized vehicles and pedestrians need to be separated to reduce conflicts and increase pedestrian comfort to improve safety. Access to and from the education area to the main road needs to be equipped with facilities that are convenient for students when crossing. The meeting point of access to the education area with the main road is an intersection where a school safety zone (ZoSS) needs to be installed as a priority for pedestrians to cross into and from the education area.

Both approaches or concepts can be used in managing the movement of motorized vehicles with pedestrians in the education area. Accessibility and connectivity between locations are met and safety is maintained.

References
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