Transport Management for Sustainable Urban Development at Tambun Market Area

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Abstract. Tambun market is a commercial area located at T-Junction, an area with mixed land uses. Land use in this area consists of settlement, commuter line stations, offices, factories, and a historic building (Gedung Juang) which is a tourist destination. Trade activities, loading goods, unloading goods, public transport passengers, on-street parking, and traffic conflict between vehicles and pedestrian in this area influence the road traffic. It causes the bottleneck up to congestion at Tambun Market area. The level-crossing at the commuter line station become one of the causes of congestion. To solve from 2014 to 2017 that problem, the government of Bekasi districts built the underpasses to overcome congestion and improve road safety. In fact, the construction of underpasses does not solve the problems. The purpose of this research is to propose transportation management in the Tambun market area. The problem is analyzed based on the principles of traffic engineering. There are include some points such as accessibility planning, movement of people, goods and vehicles, pedestrian facilities, and parking areas. The analysis is using the principle of connectivity, accessibility, comfort, and safety. The results are the improvement of pedestrian facilities, design of public parking area, loading and unloading management, improvement road performance for Volume and Capacity Ratio (v/c ratio), traffic flow and accessibility planning, where it could be improvement of connectivity, accessibility, and traffic safety.

Keywords: Mix Land use, Sustainable Urban Development, Transport Management

1. Introduction
1.1. Background
Currently, more than 55% of Indonesians live in cities (based on UNDP data). This is caused by the increasing fulfillment of life’s needs in order to be better. As an impact of urbanization, the population of the city is increased. Furthermore, the people who commute cause many problems, start from a delay until congestion. In line with growth, urban environmental problems have also been increased. Unfortunately, there is not much time to modify past failures, improve the status quo and ensure environmental protection. Consequently, it’s important to pay attention to the development of sustainable urban planning and its role in urban management issues is an objective that requires a new approach to urban planning [1]. According to UNDP for sustainable urban development strategy in Indonesia, focus on enhancing the city’s government capacity to expand coverage of public service, improving the quality of public service, and improving public services on the ground. The Sustainable Urban Development Strategy prioritizes ten cities for the initial phase of engagement, based on quantitative and qualitative analysis. The cities were chosen after analyzing several factors, such as urbanization rates and poverty rates. Some of the cities are Banda Aceh, Medan, Pematang Siantar, Bandar Lampung, Bekasi, Bogor, and Semarang. Tambun Market is one of the traditional markets located in Bekasi. This market is right in the T-Junction commercial area, which is a mixed land-use area. Land use in this area consist of settlement, commuter

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line stations, offices, factories, and a historic building which is a tourist destination (Gedung Juang). The main road of the Tambun Market is only 2 kilometers away from Cikampek Toll road. Therefore, the road in the Tambun market area becomes alternative access if there is a traffic jam. This condition increases the road density in the Tambun market area. The purpose of this research is to propose transportation management in the Tambun market area, the problem is analyzed based on the principles of traffic engineering.

1.2 Research Problem
The location of Tambun Market on mixed land use create many problems. Trade activities, loading and unloading goods, public transport passengers, on-street parking, and traffic conflict between vehicles and pedestrians in this area influence the road traffic, these cause the bottleneck up to congestion. The level crossing at the commuter line station become one of the causes of congestion. To solve that problem, from 2014 to 2017 the government of Bekasi districts built the underpasses to overcome congestion and improve road safety. In fact, the construction of underpasses does not solve the problems. Currently, these problems increased in line with the population and the commuters.

1.3 Research Focus
This research focused on the analysis of connectivity, accessibility, comfort, and safety, by improvement road performance for v/c ratio, traffic flow and accessibility planning, where it could be an improvement of connectivity, accessibility and traffic safety. In this research, the area studied is 1.25 KM, where 700 meters to the west and 550 meters to the east, and for the north direction is about 300 meters.

2. Literature Review
2.1. Sustainable Urban Development
According to Larijani, the urban sustainability criteria are different at various levels and are not measurable in the same condition. Some of the topics under the investigation of the sustainable development are directly related to cities. These issues include: sustainable development through land use planning, reconstruction of the city, sustainable buildings, urban shape and energy, sustainable transportation, urban shape and pollution, density role in achieving sustainability, the vitality, and the meaning [2].

Cities around the world are now recognizing the need to pursue the sustainability agenda. To do so, they are seeking to define indicators of sustainability. Specific indicators are chosen based on being feasible and measurable each year to guide a city as it attempts to create livable communities, one of the examples of h indicators is transportation [3].

2.2. Accessibility and Connectivity
Based on movement and connectivity, the accessibility is necessary. It starts from pedestrian network and facilities, people and goods movement analysis, connected area and walkway strategy, public transportation, public utilities and facilities, universal accessibility, bicycle network and storage, and public car park area. The goals are to ensure their accessibility planning, for the movement of people, goods and vehicle, to make the pedestrian become the priority, to open access from the inside area to the outside area, to apply the principle of connectivity, accessibility, safety, comfort and attractive on a pedestrian path [4].

2.3. Traffic and Transport Management
Transportation plans delineate proposed improvement of the highway and public transportation systems and in the total future transportation networks. They are normally regional in scale and include intergovernmental coordination between local governments and the state of the Ministry of transportation. Traffic control planning seeks to reduce impacts on
residential streets and neighborhood. It may involve redesigning neighborhood streets and mitigating traffic impact on the collector or arterial streets in the residential area to protect them from through and high-speed traffic. A variety of methods can be used, including changes in paving, landscaping, stop sign, speed limits, pedestrian priority, and street narrowing and closing [5]. The amount of pollutant concentrations produced by vehicular exhaust emissions largely depends on the degree of pollutant contained in every vehicle, traffic volume and time. Optimizing the traffic and transport system is one measure that could be used to control air pollution resulting from vehicle exhaust emissions [6]. Through this scheme, we could at least reduce traffic congestion on the road network, which will eventually reduce pollutant concentration [6]. Movement management which is a result of mixed the activities system with the transportation system, referred to as traffic management is emphasized only on-road transportation [7].

3. Research Methodology
The research method used is as follows:

3.1. Collecting data
This research collects data from primary data and secondary data. The secondary data are collected by using significant sources such as books, journals, internet sources, the Indonesian government standard, and also from developing theoretical reviews and case studies. The secondary data used in this research are land use map and road classification. The primary data are collected by traffic surveys and observation in the field. The primary data that used in this research are road inventory, pedestrians, traffic counting, and spot speed.

3.2. Method of Analysis
The methods of analysis are by using the principle of connectivity, accessibility, comfort and safety based on the principles of traffic engineering for pedestrian facilities, design of public parking area, loading and unloading management, improvement road performance for v/c ratio, traffic flow and accessibility planning.

4. Research Analysis
4.1. Data Analysis
Data from the results of an inventory survey and traffic survey are shown in Table 1 and Table 2 below:

| Direction                  | Road Function   | Type   | Road Width (m) | Kerb Width (m) |
|----------------------------|-----------------|--------|----------------|----------------|
| Tambun Market to the West  | primary arterial| 2/2D   | 8              | 1              |
| Tambun Market to the East  | primary arterial| 2/2D   | 8              | 1.5            |
| Tambun Market to the North | secondary arterial| 2/2D | 8              | 0.8            |
| Tambun Market to the South | secondary arterial| 2/2D | 8              | 0.8            |

According to inventory data, road function on Tambun market area include primary arterial road and secondary arterial road, where the width of the roads are not appropriate to the standard.
Table 2 Vehicle Average Speed

| Direction                  | Average Speed (Kph) |   |   |
|----------------------------|---------------------|---|---|
|                            | MC  | LV | HV |
| Tambun Market to the West  | 37.87 | 27.42 | 25.17 |
| Tambun Market to the East  | 37.13 | 25   | 19.07 |
| Tambun Market to the North | 21.43 | 22.50 | 23   |
| Tambun Market to the South | 25.81 | 24.34 | 23.94 |

Base on spot speed survey, vehicle average speed divided into three vehicle categories: Motor Cycle (MC), Light Vehicle (LV), and Heavy Vehicle (HV), from data analysis maximum average speed for motorcycle is 37.87 Kph, light vehicle is 27.42 Kph, and heavy vehicle is 25.17 Kph.

4.2. Road Level of Service (Existing)

Based on traffic data could be calculated the road Level of Service on a study area, where the result shown in Table 3:

Table 3. Road Level of Service

| Direction                  | Volume (V) | Capacity (C) | V/C | LOS |
|----------------------------|------------|--------------|-----|-----|
| Tambun Market to the West  | 2064.4     | 3015.1       | 0.68| C   |
| Tambun Market to the East  | 2243.6     | 3015.1       | 0.74| C   |
| Tambun Market to the North | 1168.8     | 3015.1       | 0.39| B   |
| Tambun Market to the South | 636.3      | 3015.1       | 0.21| B   |

According to Table 3, the analysis of the Volume and Capacity Ratio (V/C ratio) could be concluded that Road level of service (LOS) are B and C, it’s mean for LOS B the traffic flow stable and for the LOS C the traffic flow stable but the speed is limited.

5. Result and Discussion

5.1. Accessibility and Connectivity

Based on the movement of people and vehicles in this area, the improvement of connectivity, accessibility and traffic safety, pedestrian facilities, the design of parking areas are required. As shown in Figure 1, the land use of Tambun market area in area study consists of 45% residential, 23% industrial, 17% commercial area, 7% open space area, 5% parking area and 3% others.

Based on existing land use the design of accessibility and connectivity can be proposed for the pedestrians to improve pedestrian safety and parking area. The design divided into two zone (zone A and zone B), where the zone A focus on pedestrians and motorcycle movement at Commuter line station. The zone B focus on trade activities, loading and unloading goods, public transport passengers, on-street parking, traffic conflict between vehicles and pedestrian on the major road (Figure. 2)
Figure 1. Existing Land Use at Tambun Market Area
(Source: www.maps.google.com with author analytical drawing add, 2019)

Figure 2. Zone connectivity, accessibility and traffic safety
To decrease traffic conflict between vehicles and Pedestrians the movement of motorcycles and pedestrians separated from the light vehicle and heavy vehicle movement (Figure 3). The road width for motorcycle access to the Tambun Commuter line station is 4 meters and it’s become one way system. The Improvement of pedestrian facilities, the curb (sidewalk) width requirements are calculated based on pedestrian volume [8], curb width can be calculated using the following equation:

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

Where:
- \( W \) = Kerb width
- \( V \) = Pedestrians volume/two way (person/meter/minute)
- \( N \) = Additional width according to local conditions (m). The value of \( N \) is specified in Table 4

| \( N \) (meter) | Condition                                      |
|-----------------|------------------------------------------------|
| 1.5             | Road in an area with high pedestrian generation |
| 1.0             | Road in an area with medium pedestrian generation |
| 0.5             | Road in an area with low pedestrian generation  |

Based on pedestrian observation, pedestrian volume/two way are 17 person/meter/minute. So in that area, the minimum effective width of the sidewalk that must be provided is 2 m.
To decrease traffic volume loading activities at Tambun Market area, designed at local roads one way system behind the market. Motorcycle parking capacity is 527 m² and the circulation of the motorcycle at the parking area separated for inflows and outflows (Figure. 4). To improve traffic safety facilities there are same points to design, among other design of pedestrian crossing with a traffic light, pedestrian bridge, bus stop/bus shelter and a traffic sign.

6. Conclusion
Public movement at Tambun market causes many problems, among others, are delay and congestion. Transport activity in this area influences urban development and has an impact on accessibility and connectivity. Proposed Results for transport management at Tambun market area, for zone A are the movement of motorcycles and pedestrians separated from the light vehicle and heavy vehicle movement. The road width for motorcycle access to the Tambun Commuter line station is 4 meters and it’s become one way system. The minimum effective width of the sidewalk that must be provided is 2 m. For zone B, to decrease traffic volume loading activities at Tambun Market area, designed at local roads one way system behind the market. Motorcycle parking capacity is 527 m² and the circulation of the motorcycle at the parking area separated for inflows and outflows. To improvement traffic safety facilities there are the same points to design, among other design of pedestrian crossing with a traffic light, pedestrian bridge, bus stop/bus shelter and a traffic sign.

The improvement of pedestrian facilities, design of public parking area, loading and unloading management, the improvement road performance for v/c ratio, traffic flow, and accessibility planning, where it could be the improvement of connectivity, accessibility, and traffic safety.
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