REFEREED ARTICLE

# Analyzing the Relation between Motorcycle Taxis as an Informal Transport and Land Use Factors: A Case Study of Urban Areas in Sukabumi Regency, Indonesia

Raga Perdana HADI, Tomohiko YOSHIDA

## Abstract

Motorcycle taxis as an alternative method for mobility in urban areas of Indonesia are still not controlled by proper operational regulations, although these taxis are considered to be a solution for the deficiency in the country's public transport service and unemployment problem by provide alternative job for people. They exist as an informal transportation option; there are no data about the number of motorcycle taxis, no standards about security and safety while operating them, and there are no standard service or fare guidelines for customers. Considering this fact, Sukabumi Regency, as the largest regency in West Java, has a specific plan related to the emergence of motorcycle taxis. The Local Government of Sukabumi Regency has a Transportation Masterplan that will regulate the use of motorcycle taxis in the regency beginning in 2016. This study aims to provide a better understanding of the role that motorcycle taxis play in urban transportation through the land use approach in the urban areas of Sukabumi Regency so it can help the government create a proper policy for this mode of transportation. The analysis showed that the existence of motorcycle taxis is unavoidable considering the automobile transport planning orientation and development of the sprawling urban areas in Sukabumi Regency, combined with the deficiency in the urban transport modes in that regency. The findings of this research have shown the correlation between motorcycle taxis and the built-up area, which is important information that can be used to formulate a policy related to the presence and use of motorcycle taxis in Sukabumi Regency.

Keywords: motorcycle taxis, informal transportation, urban areas, land use, policy

## 1. Introduction

Motorcycle taxis in Indonesia, called *ojek*, represent an informal transport system that is hardly avoidable, considering the country's high dependency on road transportation for mobility, the deficiency in its public transport service, and its unemployment problem. Beside provide alternative job for living, ojek has become the most common alternative transportation option in urban areas around Indonesia, and these motorcycle taxis complement the existing formal modes of transportation such as buses (Handayani, 2011). Ojek provide an informal paratransit service

offering a flexible door-to-door taxi service with no standard route (Cervero & Golub, 2007). As such, motorcycle taxis have become an alternative for residents who live in the areas that are not served by more formal modes of public transport. The term, informal, implies that an organization is very small scale or private and is not governed by any regulations (White, 1990). The same is true of the informal transport mode in Indonesia: there is no standard terminal and also fare. The service cost is usually based on a consensus, self-regulation forming gentlemen's between the motorcycle taxi operators, without being published, and, sometimes, the service tariff is negotiable (White, 1990) & (Dimitriou & Gakenheimer, 2011).

Although it is important not to make sweeping generalizations (Olvera, Plat, & Pochet, 2012), the existence of motorcycle taxis as a paratransit service can be advantageous for an urban area (Cervero & Golub, 2007). It provides mobility for poorer people and it connects areas that are not serviced by formal transport services (Cervero, 2000). Compared with other public transport modes, ojek offers faster transport service to users (Handayani, Mochtar, & Soemitro, 2009). Handayani et al (2009) also mentioned the convenience of ojek as a transport service, as the taxis can operate 24 hours a day in busy spots. In terms of financial incentives, becoming a motorcycle taxi operator is economically feasible, especially in urban areas, and, it is predicted that this employment option will be viable for a long time (Handayani, 2011).

Despite the advantages, motorcycle taxis also have disadvantages related to how the service operates and the safety and security issues associated with its use. Generally, a person can operate a motorcycle without a license, insurance, or any means of identification, including vehicle registration number (Olvera, Plat, & Pochet, 2012). Handayani (2011) emphasized that the absence of identification could endanger the safety of the customers who use the motorcycle taxi service. That study also mentioned that motorcycles, and the people who use them, are more vulnerable in vehicle accidents. Motorcycles, including motorcycle taxis, are the type of vehicles that are most likely to be involved in traffic accidents in Indonesia for last six years[1].

Due to its advantages and disadvantages, the existence of ojek can be a double-edge sword for governments. Motorcycle taxis have been used in Indonesia for many years without any regulations governing their existence and how they are operated. Although ojek can be a solution for tackling the gap between supply and demand in public transportation, there are no safety and security standards to protect users of this service. In terms of employment, ojek has become an option, especially for people living in an urban area. However, there is no exact data about the number of ojek drivers, whether on an Indonesian scale or a local scale. Ojek is still thought of as a second-class mode of transportation that does not need to be regulated, and the government pretends that there is nothing to worry about as long as this service remains under the radar.

Very few studies have examined ojek in Indonesia as a specific research topic, particularly related to land use as the key factors associated with transportation in urban development for developing countries. Considering this fact, this paper will analyze the data on ojek terminals and drivers in Indonesia's urban transportation system through the land use approach. This approach can provide a broader explanation for the existence of ojek and its relationship with the urban areas of Sukabumi Regency. Since the informal motorcycle taxi service can be part of the area's unemployment solution (Cervero, 2000), it is necessary to understand ojek through the land use approach given the importance of integrating transport policy and land use planning in order to alleviate poverty in developing countries (Cervero, 2013). Long before Cervero, Dimitriou (1995) has been underlined the necessity to understand the environment, policy and planning context of Indonesia urban transport to give better consideration to the policy directions. In particular, this paper focuses on some of the key factors in land use that are used to analyze the existence of ojek, such as population density, built-up area density, and the types of public transportation services available in those areas, to understand the ojek phenomenon. Furthermore, this paper discusses future plans based

on the study's findings with the hope that a meticulous understanding of ojek can help the Indonesian government create a policy to regulate this transportation mode.

The Indonesian national road segment 27 between the Cicurug–Cibadak–Cisaat corridors was selected as the subject area because of the importance of ojek as a transportation service in the urban areas of Sukabumi Regency. Ojek has become an integral part of transportation in those urban areas, connecting many residential and industrial sectors with public transport that operates on national roads. The selected road segment also plays an important role in the economic health of the region, as it relates to spatial planning in Sukabumi Regency. This road segment is the main access that connects Sukabumi Regency with Jakarta, the capital of Indonesia. Three out of the five districts that are traversed by this road have been established as an urban area in Sukabumi Regency.

## 2. Sukabumi Regency Spatial Planning

As the largest regency in West Java, Indonesia, Sukabumi Regency has an area of around 4.162 km2; it consists of 47 districts that are divided into 386 villages (Sukabumi, 2016). Surrounded by mountains on the north side (Mount Gede, Mount Halimun and Mount Salak) and a long coastline in the south[2] (117 km), Sukabumi Regency has become one of the West Java's richest regencies in terms of its emphasis on nature conservation and its reputation as a tourism spot near Jakarta.

Conforming to Regional Government Regulation No. 22, Year 2010 about Spatial Planning of the West Java province 2009–2029, Sukabumi Regency, along with the municipality of Sukabumi and part of Cianjur Regency, was established as a key border region of the West Java Province. The regulation divided the policies into two different policies that aimed to develop the western and the southern regions of Sukabumi Regency due to the nature conservation proposition. Article 12 of the West Java Spatial Planning policy stated that the southern part of the Sukabumi regional development had to be limited due to the need to address nature conservation, while the western part of became the region needed to be upgraded in connection with the strategic value of the location[3]. As a key

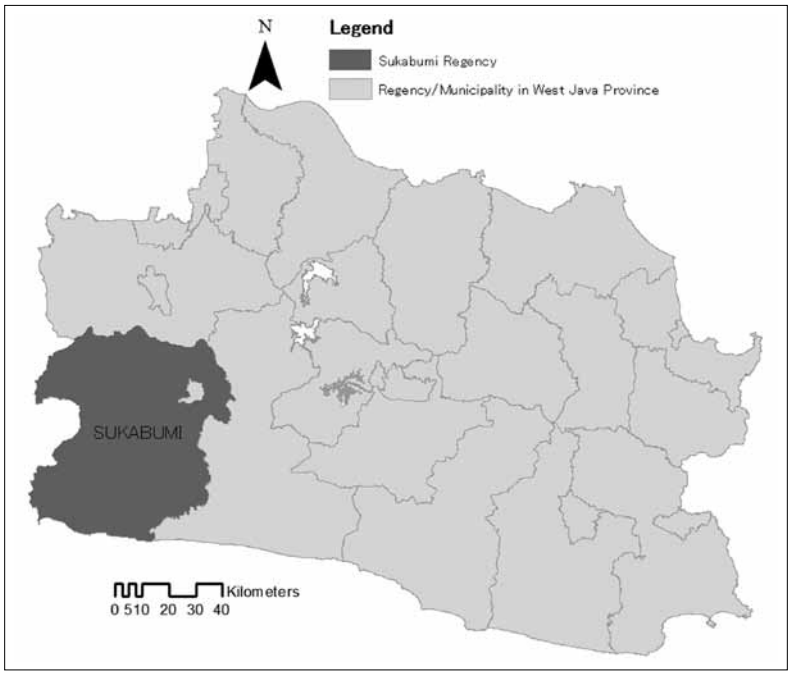


Figure 1. Sukabumi Regency in West Java Province

border region, and as the western and southern face of West Java, Sukabumi needed to accelerate its development, especially considering that Sukabumi Regency is one of the two poorest regencies in West Java.

More detailed regulation's about spatial planning in Sukabumi Regency are provided in the Regional Regulation No. 22, Year 2012 about Sukabumi Regency Spatial Planning. According to that document, Sukabumi is divided into eight different urban areas, four of which are linked to the national road on the northern section of the regency. In addition to the municipality of Sukabumi, those urban areas form a chain of cities that shape the sprawl pattern of the urban areas in Sukabumi Regency. The regulation also has established this chain of urban areas as one of the strategic areas in Sukabumi Regency.

Basically, the establishment of a strategic area in Sukabumi Regency is based on economic growth preference[4]. The strategic area is the area that has been given priority in spatial arrangements due to its economic, social, cultural, and environmental importance as well as its natural resources and technology[5]. In terms of economic importance, most of these strategic areas act as a single district or a single spot, except for the strategic area of the sustainable economies in the Sukabumi Regency, corridor Cicurug–Sukabumi–Sukalarang, which consists of 12 districts. The main goal of establishing this policy is to improve public service in that region so it can boost economic growth especially in the northern part of Sukabumi Regency. Several indicators are used to measure the implementation of this policy. Solving traffic congestion and arranging spatial use along the prime artery road and highway zone have become the main indicators of this policy.

## 3. Sukabumi Transportation

The West Java Province Spatial Planning documents contain several strategies for how to improve transport services in Sukabumi Regency in terms of land transportation. Those strategies include: improving the conditions and capacity of existing roads, building a new road network, increasing the service ability of angkot terminals, and revamping the public transport service that serves the regency. Based on data from the Statistical Bureau of Sukabumi Regency, total road length in Sukabumi is 2,185.7 km; divided into state roads (213km), provincial roads (242.4 km), and regency roads (1,730.3km) (Sukabumi, 2016). However, the total road length cannot meet the minimum road length needed to provide optimum service for the entire Sukabumi Regency area, which is about 13,745.0 km[6].

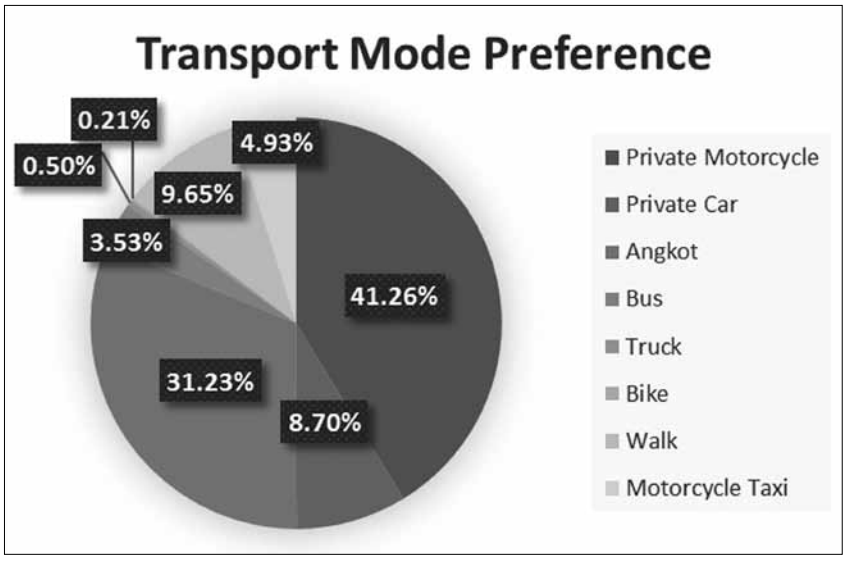


**Figure 2. Transport Mode Preference in Sukabumi Regency**

*Source: Sukabumi Regency Transportation Masterplan*

In addition to the lack of road length and networks, Sukabumi Regency as part of developing countries also has to solve the deficiency in public transport service (Dimitriou, 1990). In accordance with the data on 2012, buses are the main formal public transport in Sukabumi Regency. Small cars, called *angkot*, have a carrying capacity of approximately 10–12 persons; this mode of transportation represents about 31.23% of the mobility sector. Larger buses (capacity: 20–25 people) represent only 3.53% of all mobility sector in Sukabumi Regency. Most people (41.26 %) choose private motorcycles as their transport mode preference, and the people who prefer personal car sharing represent about 8.7% of all transport users. This is understandable considering the service area's formal public transport limitations. Meanwhile, as an informal transport mode in Sukabumi, ojek has about 4.9% of the total share of mobility options in the regency. The remainder of the population chooses to walk (9.65%), use a truck (0.5%), or use bicycles (0.21%)[7]. The use of the train as public transportation, which began at the end of 2013, is still insignificant because that service only operates one train every three hours, for a total of three runs each day.

In order to improve the transport sector, Sukabumi Transportation Masterplan is divided into two action phases every 10 years, and the improvement of public transportation performance is one of the priorities in the first phase (2014–2016). Three aspects of road transportation will be improved during the first stage of the plan. The first aspect is related to the network transportation system in Sukabumi. The main goal of this part of the Transportation Masterplan is to increase the capacity of the roads by optimizing the road network system, restructuring the road hierarchy, improving the level of service, and updating the roadways including marks, signs and other complementary buildings such as pedestrian bridge. The next aspect is related to transport infrastructures and facilities. It seeks to improve the service level of public transport in Sukabumi. Three strategies are used to achieve this goal: improving public transport service, establishing mass rapid transit (MRT), and increasing private vehicle performance. The last aspect is related to the development and construction of infrastructure. Developing the Cicurug terminal as a borderline terminal, building a cargo terminal in Cicurug, and improving road infrastructure are the strategies that is used to implement this improvement.

The plan to regulate ojek is also covered in the first phase of the Transportation Masterplan. Regulations about ojek have become one of the strategies to improve the service level of public transportation in Sukabumi. The regulation tends to manage such things as licensing, operational zones, operational taxes, and vehicle identity as motorcycle taxi[8]. Higher transportation costs, more competition among drivers, and competition with angkot have become the main issues fueling the need to regulate ojek in Sukabumi Regency. As comparison, angkot fare from Cisaat terminal to Cibadak terminal and *vice versa* set by local government is Rp. 5,000[9]. For the same service, ojek fare can be varied from Rp. 7.000 – Rp. 20.000, depend on the negotiation between driver and user. However, there is big obstacle to implement this policy, which is that there is no regulation imposed upon ojek as a public transportation mode that is acknowledged by the state of Indonesia.

In general, transport planning in Sukabumi Regency focuses on improving the capacity and network of roads as a manifestation of the policy's automobile transport orientation. This condition has had an impact on the poor design for other forms of transportation, including walking, cycling, and transit place design (Litman, 1995). It is unavoidable, considering that the development of urban areas in Sukabumi Regency tends to form a sprawl pattern with weak planning and coordination between stakeholders. According to the masterplan, for the next eight years, Sukabumi Regency public transport service improvement will focus on improving existing services and expanding the operation of a new service network.

## 4. Ojek and Land Use Factors

Before presenting an analysis of ojek, this chapter will describe its existence using possible land use factors to provide an overview of motorcycle taxis in the subject area. In accordance with the data that was obtained, two land use factors will be used to describe the presence of ojek in this paper: density and transport demand management (mobility management). As one of the most commonly evaluated land use factors, density is the first land use factor to illustrate the existence of ojek[10]. Density can affect geographic accessibility in an area by reducing the trip distance and promoting walking and cycling. This can provide more alternatives for mobility because the automobile option is not the only transportation choice. Reducing automobile dependency and promoting mobility alternatives will reduce automobile travel speed and travel friction, which can increase travel convenience (Litman T. A., 2016).

In this paper, two densities are used to explain the continuation of the use of ojek: population density and built-up area density. For population density, secondary data is used based on the latest census data for residents in the area in 2015, combined with digital West Java map to know the density rate. In this paper, the term, built-up area density, refers to all of the premises, including the parking areas that can be seen on Google Maps. Open spaces, such as gardens/lawns, ponds, and farms, are not included in this category.

Mobility management is the second land use factor addressed in this paper. The sub-section of this chapter will only highlight public transport routes around the subject area as a result of strategies in the existing transportation policy, which is part of the regency's mobility management. The term, public transport route, is used to understand ojek's role as an informal transportation option that is used to move people from place to place in urban areas. As such, the main public transpor's (angkot) route around the subject area will be described and compared to the ojek terminal location and the number of ojek drivers.

Ojek in Sukabumi regency has certain characteristic on their daily service. The first one is peak hour time. Operational peak hour of ojek is 05 a.m. – 08 a.m. in the morning and 04 p.m. – 07 p.m. on the afternoon in work day. The next one is related with their terminal. For terminal, there is no formal terminal for motorcycle taxis. Here, terminal means a place or spot where the ojek drivers establish themselves and wait for consumers. In some spots, such as a market or *angkot* terminal, these drivers tend to be scattered and they position themselves on the road or near gates to get their passengers. In this paper, the term, terminal, is used to represent the place where ojek drivers wait for potential customers, whether they are concentrated in specific spots or scattered and spread across a wide area.

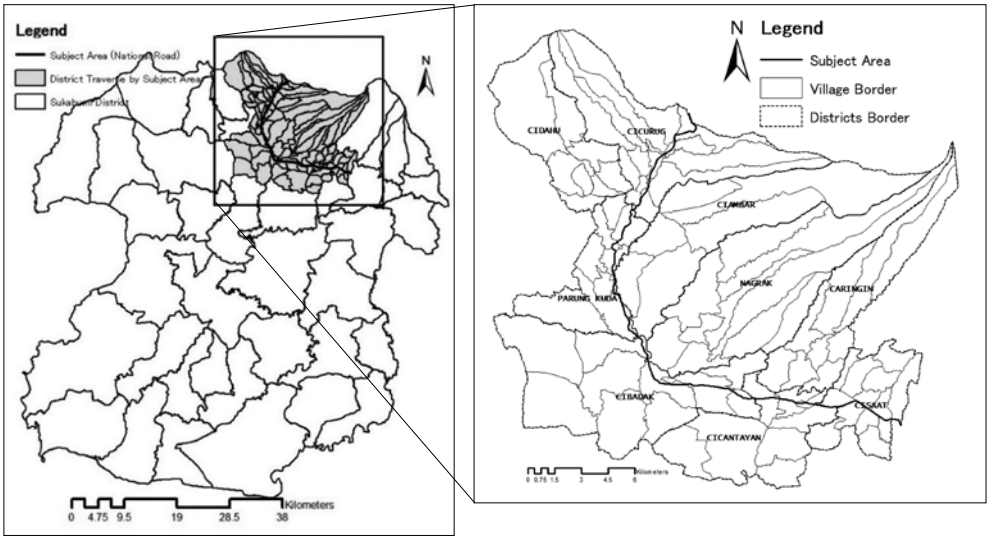


Figure 3. Subject Area of the Research

Since there are no available data about ojek, a field survey in subject area (Figure 3) was conducted in order to obtain information about the terminal (spot) location and the number of ojek drivers as primary data. Considering of ojek character related with operational time and terminal, the author believed counting the driver on the spot at certain time frame is the best method in this research to get representative data about the ojek driver number. Time frame in conducting survey is between 08 a.m. – 11 a.m. on work days, since during the time period, ojek driver usually wait the other passenger and take some rest after peak hours in their unofficial terminal. The ojek driver in the terminal then counted manually for each terminal, and documented in pictures so it can be recounted. Before it counted, usually the author conducted very short interview to confirm all of the waiting spots around the terminal so the survey can obtain more precise data. After it counted and documented, survey moved to the next terminal spot. The author also used google street view around the subject area as comparison especially in certain area such as market or transit place, considering it can cover all angle of the spot.

The analysis began by making a geospatial database related to the existence of ojek in order to explain the relationship between ojek terminals and the land use factors. The data (spot location and the number of drivers at that spot) that was gathered by field survey were plotted into ArcMap software using the My Maps feature from Google. Based on the data that was collected, three possible transport and land use factor combinations were identified to determine the best way to analyze the ojek terminal location and the number of drivers. These combinations are: population density, built-up area density, and public transport service availability.

### 4. 1. Population Density and Ojek Terminal Location

In this paper, population density is based on village population. In accordance with the West Java Digital Map, the basic characteristic of the villages and districts that are traversed by the national road segment 27 serviced by the subject area were collected. The data was then combined with the latest data about the number of village residents in Sukabumi, which was obtained from the Statistical Bureau of Sukabumi Regency, in order to obtain the village population density.

Figure 4 shows the relationship between the ojek terminal location and the population density of the villages in the subject area. The "●" symbol shows the ojek terminal location, and the symbol size shows the number of on-the-spot drivers when the field research was conducted. Its size increases from the "●" symbol, which shows 2–5 drivers at a spot, up to the "○" symbol, which represents 27–40 drivers. The population density of the villages in the district in the subject area is represented by a range of symbols. The symbols have a gradual transition, ranging from villages of 2–25 people/ha, represented by the "▭" symbol, to villages of up to 95–118 people/ha represented by the "■" symbol.

The ojek terminal location spread in the subject area was found to have an unequal distribution of ojek drivers. Starting from the west side of the region, Cisaat District has the highest number of ojek drivers in comparison to the other districts, although Cisaat is the smallest of all the districts. The total number of ojek drivers in Cisaat is 196, divided into 13 locations where the drivers wait for passengers. Cicantayan District has five different spots and 37 ojek drivers. As the second largest district in the subject area, Cibadak has 97 total drivers in eight spots. Parungkuda, which is located between Cibadak District and Cicurug District, has nine ojek terminals and a total of 107 drivers. Lastly, as the border district, Cicurug has 13 terminal locations and 150 ojek drivers.

As seen in Figure 4, most of the population is concentrated in the subject area, while the other areas have a very low population density. There are 43 villages in the subject area that have the lowest density rate with only 2–26 people/ha, while 28 other villages, which are located near the national road, are have a level 2 (27-49 people/

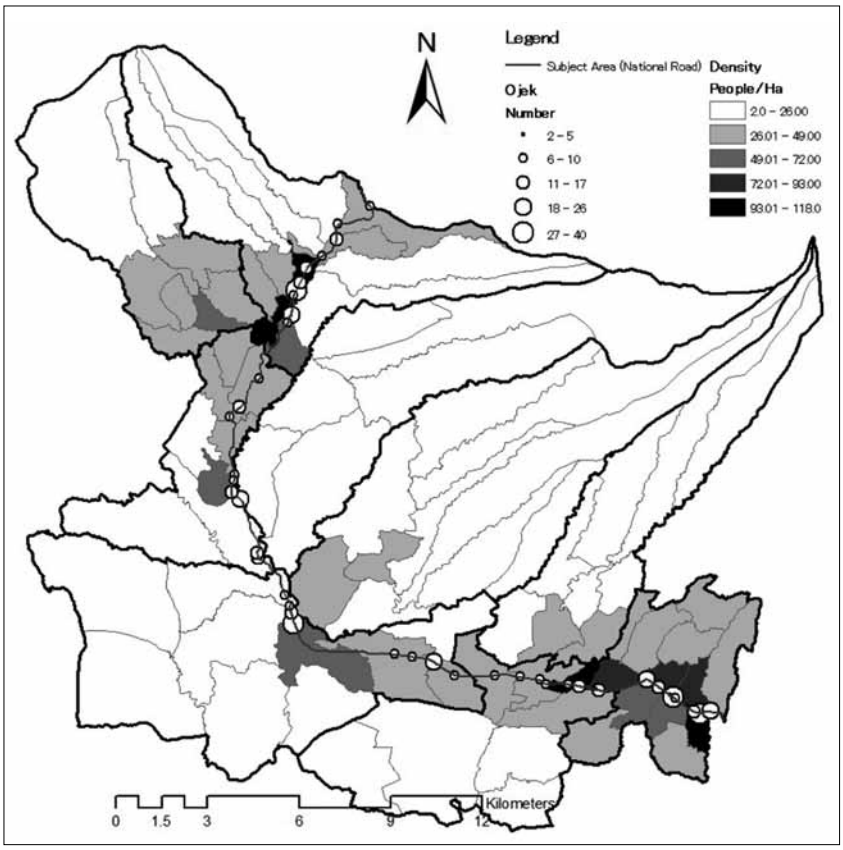


Figure 4. Village Population Density and Ojek Terminal Locations

ha) population density rate. The two districts with the highest population density are Cisaat, as a border district with the municipality of Sukabumi, and Cicurug, as the northern gate of Sukabumi Regency. Villages with the most concentrated population density in these districts form a chain of urban areas in Sukabumi. In addition to Cibadak District, which has been designated as the center of the Newly Autonomy Areas of North Sukabumi, Cisaat District and Cicurug District are regarded being part of urban areas in Sukabumi Regency. Based on correlation analysis, there are stong correlation between ojek driver number and district population density.

Table 1. District Base Population Density Compared with Ojek Terminal Locations and Drivers

| District | Area (ha) | Population (number of people) | Density (people/ha) | Terminal spot | Number of Drivers |
|---|---|---|---|---|---|
| Cisaat | 2,311.51 | 114,886 | 49.7 | 13 | 196 |
| Cicantayan | 3,490.37 | 52,877 | 15.1 | 5 | 37 |
| Cibadak | 6,303.22 | 106,791 | 16.9 | 8 | 97 |
| Parungkuda | 2,497.66 | 67,448 | 27.0 | 9 | 107 |
| Cicurug | 5,219.35 | 115,762 | 22.2 | 13 | 150 |

Table 2. Correlation Analysis Results Between Ojek Driver Number and District Population Density

| | | Density (people/ha) | Number of Drivers |
|---|---|---|---|
| Density (people/ha) | Pearson Correlation | 1 | .838 |
| | Sig. (1-tailed) | | .038 |
| | N | 5 | 5 |

### 4. 2. Ojek Terminals and the Built-up Area

This section provides an overview of the ojek terminals and drivers within the built-up area along the districts that are included in the subject area. In terms of the characteristics of the built-up area, because no data about the built-up area are available for Sukabumi Regency, the built-up area has to be drawn manually. We used Google Maps imagery and My Maps as tools to draw the built-up area before exporting it to ArcMap 10.3. From there, it was possible to analyze the results. Based on this, three types of built-up areas have been drawn: an industrial area, a commercial area, and a residential area. The three built-up areas were differentiated based on the characteristics of each area: the roof formation, the location, the accessibility, the availability of parking spaces, and the number of vehicles in the parking spaces. For the commercial built-up area, only commercial areas around the subject area (national road segment 27) were drawn due to the limitations of the data and the service area available from the Google street view. Due to the limitations of the data and the tools used in this study, the rest of the built-up area, including institutional buildings, such as schools and public offices, was defined as the residential area since these buildings are scattered around the residential area.

Figure 5 shows the built-up area combined with ojek terminal locations and the number of drivers. As seen, the built-up area is only drawn for the districts in the subject area that were traversed by national road segment 27. According to the Sukabumi Regency Spatial Planning document, those districts play a different role in the regency. Except for Parungkuda and Cicantayan District, which were designated as part of the rural area of Regency, the other three districts—Cicurug, Cibadak, and Cisaat—are designed as the urban areas of Sukabumi Regency[11].

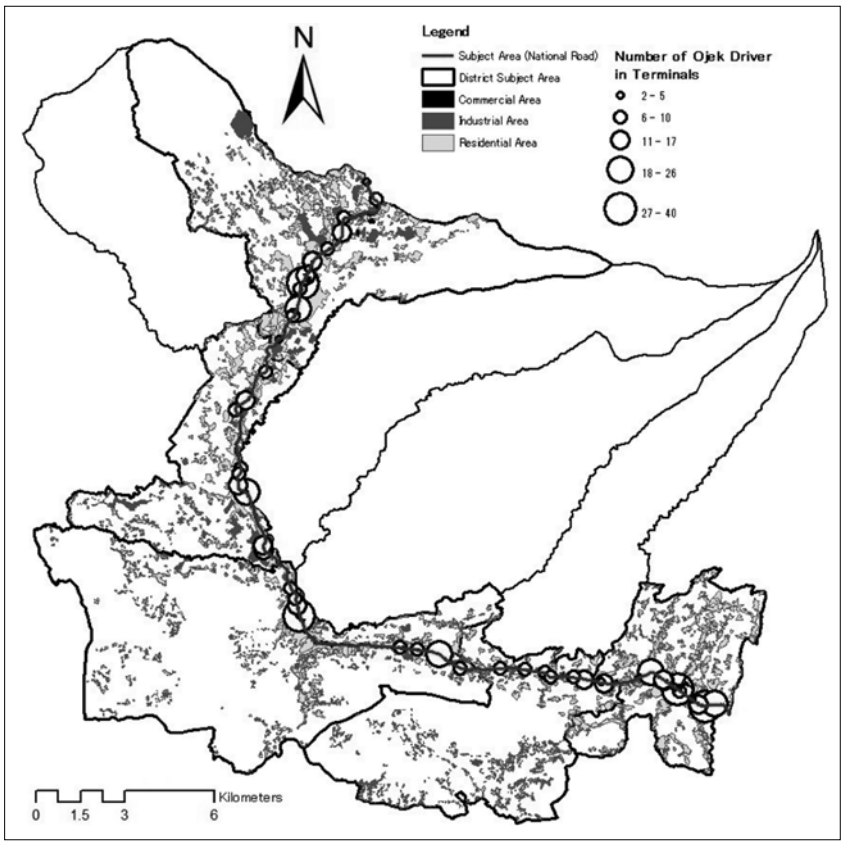


Figure 5. Built-up Areas by Category, Ojek Terminals and Drivers

As shown in Figure 5, the pattern of the Sukabumi built-up area is organically concentrated around the national road segment 27 as the prime artery. The ojek terminal with the most drivers tends to be concentrated in areas with a lot of urban core activity, such as a market; thus, the ojek terminal and the road intersect in these busy areas. Meanwhile, the rest of the areas have a lower number of drivers who are waiting for passengers at road intersections that connect residential or industrial built-up areas. These drivers transport passengers from the national road to the residential or industrial area, and vice versa.

Table 3. Built-up Area by District and the Number of Ojek Terminals and Drivers

| District | Area (ha) | Built-up Area (ha) | Built-up Area percentage | Terminal spots | Number of Drivers |
|---|---|---|---|---|---|
| Cisaat | 2,311.51 | 684.5 | 30% | 13 | 196 |
| Cicantayan | 3,490.37 | 349.5 | 10% | 5 | 37 |
| Cibadak | 6,303.22 | 729.1 | 12% | 8 | 97 |
| Parungkuda | 2,497.66 | 605.0 | 24% | 9 | 107 |
| Cicurug | 5,219.35 | 1,106.0 | 21% | 13 | 150 |

Table 4. Correlation Analysis Results Between Ojek Driver Number and District Built-Up Area Density

| | | Number of Drivers | Built-up Area percentage |
|---|---|---|---|
| Number of Drivers | Pearson Correlation | 1 | .875 |
| | Sig. (1-tailed) | | .026 |
| | N | 5 | 5 |

Table 5. Districts Categorized by Built-up Area, Number of OjekTerminals and Drivers

| District | Industrial (Ha) | Commercial (Ha) | Residential (Ha) | Terminal spots | Number of Drivers |
|---|---|---|---|---|---|
| Cisaat | 16.39 | 55.0 | 613.1 | 13 | 196 |
| Cicantayan | 29.39 | 16.2 | 304.0 | 5 | 37 |
| Cibadak | 57.45 | 41.0 | 630.7 | 8 | 97 |
| Parungkuda | 131.36 | 23.7 | 450.0 | 9 | 107 |
| Cicurug | 236.64 | 39.0 | 830.3 | 13 | 150 |

Table 6. Correlation Analysis Results Between Ojek Driver Number and District Categorical Built-Up Area

| | | Number of Drivers | Industrial (Ha) | Commercial (Ha) | Residential (Ha) |
|---|---|---|---|---|---|
| Number of Drivers | Pearson Correlation | 1 | .188 | .881 | .701 |
| | Sig. (1-tailed) | | .381 | .024 | .094 |
| | N | 5 | 5 | 5 | 5 |

**Table 7. District Categorized by Built-up Area Percentage and Number of Ojek Drivers and Terminals**

| District | Industrial (%) | Commercial (%) | Residential (%) | Terminal spots | Number of Drivers |
|---|---|---|---|---|---|
| Cisaat | 2% | 8% | 90% | 13 | 196 |
| Cicantayan | 8% | 5% | 87% | 5 | 37 |
| Cibadak | 8% | 6% | 86% | 8 | 97 |
| Parungkuda | 22% | 4% | 74% | 9 | 107 |
| Cicurug | 21% | 4% | 75% | 13 | 150 |

**Table 8. Correlation Analysis Results Between Ojek Driver Number and District Categorical Built-Up Area Density**

| | | Number of Drivers | Industrial (%) | Commercial (%) | Residential (%) |
|---|---|---|---|---|---|
| Number of Drivers | Pearson Correlation | 1 | -.092 | .484 | .000 |
| | Sig. (1-tailed) | | .442 | .204 | .500 |
| | N | 5 | 5 | 5 | 5 |

The information presented in Tables 3, 5 and 7 compares the built-up area share with the number of ojek drivers and terminals for each district. As the district with the greatest built-up area share, Cisaat has the most ojek drivers and terminals. Cisaat is also located near the municipality of Sukabumi, which is a center of activities in the region. Meanwhile, Cicurug and Parungkuda also have a large number of ojek drivers in comparison to Cibadak and Cicantayan, which also corresponds to the built-up area share in each of these districts. Based on correlation analysis, gross built-up area density of district has strong correlation with ojek driver number, while district categorical built-up area either based on area or density doesn't have significant correlation with the number of ojek driver.

### 4. 3. Ojek and Public Transport Routes

This section presents secondary data from the Sukabumi Regency Transport Agency about the public transport routes available. This information is compared with data about the number of Ojek terminals and drivers in the subject area. As mentioned above, the main public transport in Sukabumi is angkot, which has a capacity of approximately 10–12 people. The angkot routes and fares are set by the local government without a specific transit place and operational time. Some of angkot routes are traverse on the road which become main domain of ojek service, since the terminal located in the roads' intersection.

Figure 6 and Table 9 show the accessibility aspects related to the type of public transport available around the subject area. The 48 ojek terminals around national road segment 27 have a total of 587 ojek drivers. Meanwhile, 1,446 angkot vehicles operate around the subject area. From the 13 available angkot routes, 12 of those intersect with 14 ojek terminals that have 235 ojek drivers, and most of them are located in a transit place, such as the angkot terminal that are usually attached to a market. This condition providing alternatives public transport available for people, whether they choose angkot or ojek instead.

Based on district data, Cisaat District has 13 ojek terminals with a total of 196 drivers. Four of the terminals are located on angkot routes, and the largest ojek terminal is located in the central part of Cisaat District. There are 119 ojek drivers in Cisaat that provide transport services in an area that is not covered by angkot. Cicantayan has five ojek terminals with the total of 37 drivers. Only one angkot route shares a route with the ojek service in Cicantayan.

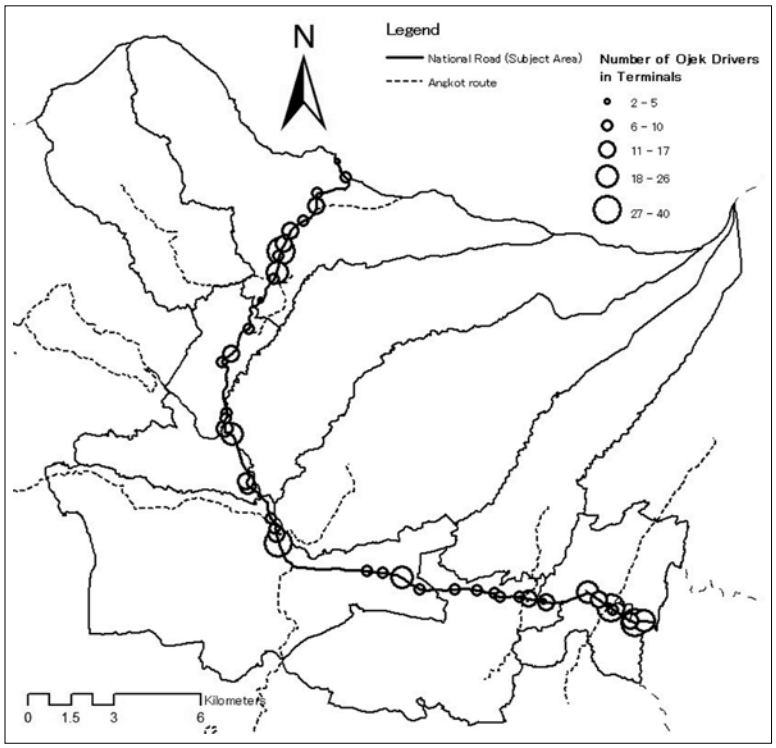


**Figure 6. Angkot Route, Ojek Terminals and Drivers**

Thirty of the 37 ojek drivers in Cicantayan use a route that is different from the angkot route. Cibadak District has a total of eight ojek terminals and 97 ojek drivers. Three of those ojek terminals are in the same location as the angkot route, and those terminals have a total of 51 ojek drivers. The remaining 46 drivers provide service in an area that does not offer angkot. Parungkuda District has nine ojek terminal spots and 107 ojek drivers. Two ojek terminals serve the same area as the angkot cars, and there are total of 37 ojek drivers at both terminals. Cicurug District has 13 ojek terminal spots with 150 drivers. Sixty-three of those drivers offer services that compete with three angkot routes, while the rest are provide services in areas that cannot be served by angkot.

**Table 9. Accessibility around the Subject Area**

| | |
|---|---|
| Number of ojek terminals in the subject area | 48 |
| Number of ojek drivers in the subject area | 587 |
| Number of angkot cars in the subject area | 1446 |
| Number of ojek terminals that share an angkot route | 14 |
| Number of ojek drivers that operate on the same route as an angkot car | 235 |
| Number of ojek drivers that serve a complementary role | 352 |

## 5. Analysis

Based on the three land use factors discussed above, the presence of ojek terminals and drivers was analyzed using the zoning built-up area density based on variations in the radii. Considering the data limitations, the built-up area was treated as an aggregate of the premises and no distinction was made between commercial, industrial, and residential areas, although those areas were drawn differently. Four different zoning radii were used to define the built-up area density in relation to the ojek terminals in the studied areas: 250 meters, 500 meters, 1,000 meters, and 1,500 meters.

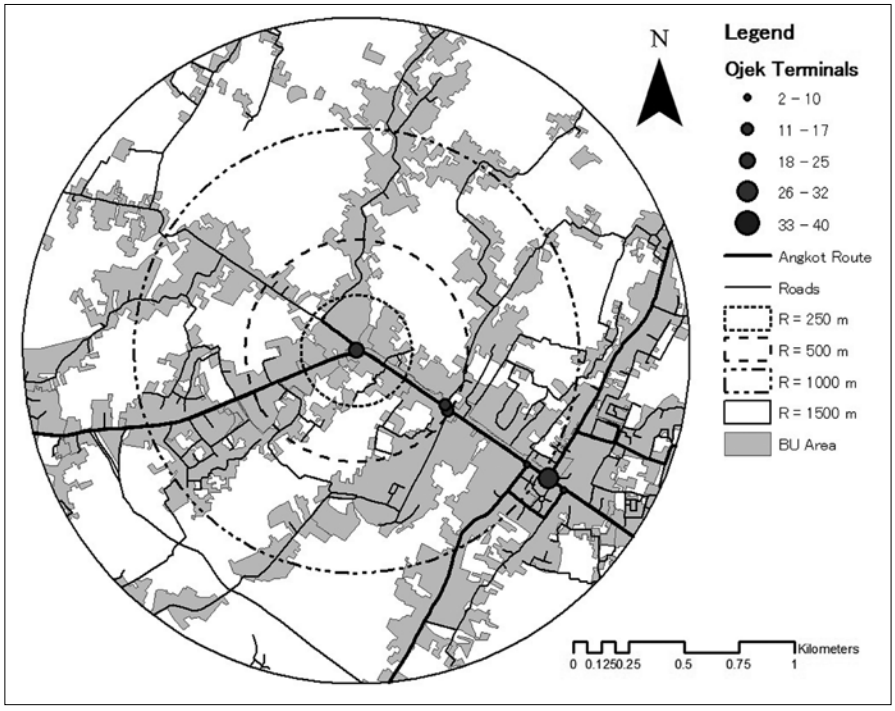


Figure 7. Example Built-up Area Zoning

The built-up area density based on the radii for four different zones was plotted into 48 different terminal spots along the subject area. Figure 7 shows the example of four different zones in one terminal spot (center of the circle) for calculating built-up area density. Each of the 48 terminal spots were analyze in the same way, and used to calculate the correlation coefficient between number of ojek terminal and built-up area density. The small dark grey circle symbolizes the ojek terminal location, while its size represents the number of ojek drivers. Four different built-up area zones are represented by the circle with different radii; the smallest zoning area has a radius of 250 meters and the largest zoning area has a radius of 1,500 meters. The thin black lines denote the local roads that can be used by cars, while the thicker lines denote the angkot routes that are available around the terminal.

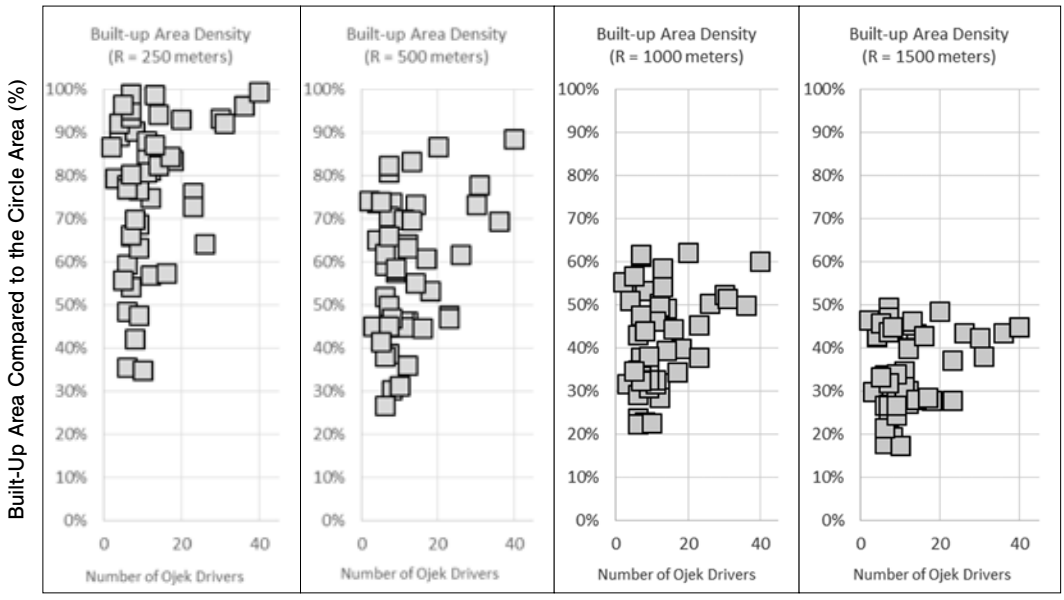


Figure 8. Built-up Area Density and Number of Ojek Drivers

Figure 8 shows the zoning built-up area (ha) data and the number of ojek drivers for each zoning radius. The range variation of the built-up area density, especially for zones with a low number of drivers (20 or less), is wider when the radius is set to 250 meters, and the range variation of built-up area density tends to become more narrow when the zoning radius is set to a greater distance. This phenomenon occurs due to the sprawl development in Sukabumi Regency, which to be concentrated on the main road as an urban periphery forming linear strip development pattern (Chin, 2002).

**Table 10. Correlation Analysis Results Between Ojek Driver Number and Zoning Built-Up Area in Varied Radius**

| | | R= 250 meters | R = 500 meters | R = 1000 meters | R = 1500 meters |
|---|---|---|---|---|---|
| Number of Drivers | Pearson Correlation | .298 | .306 | .330 | .263 |
| | Sig. (1-tailed) | .020 | .017 | .011 | .035 |
| | N | 48 | 48 | 48 | 48 |

According to the correlation analysis results, there is a weak correlation between the built-up area density zone for each radius and the number of ojek drivers. The Pearson correlation value increases when the zoning radius is set from 250 meter as starting point to a higher value, and it reaches its peak (Pearson Correlation = 0.330) when the zoning radius is 1,000 meters. When the radius is set to 1,500 meters, the Pearson correlation value decreases to 0.263. The main reason for the weak correlation in this study's finding is that the data analysis treated density as an isolated factor in land use; thus, it only has a minor impact on transportation in comparison to the aggregated impact from all of the land use factors (Litman, 2016).

## 6. Finding and Discussion

In accordance with the analysis, several findings are related to the presence of ojek terminals and drivers as determined through the land use approach. The first finding is related to the sprawl form of the Sukabumi urban areas that are affected by the transport policy which promoting automobile dependency in Sukabumi Regency. The built-up area scattered along the national road forming linear pattern development. The population and the built-up area are spread along the main road, which is the main access route for Sukabumi Regency. The commercial areas are dispersed throughout the cities in this urban chain (Cisaat, Cibadak, and Cicurug Districts), and no particular Business District Center (BDC) serves as the center of activities.

The next finding is that there are weak correlations between the zoning built-up areas and the number of ojek drivers. The maximum value of the correlation was reached when the zoning radius was set to 1,000 meters (Pearson correlation value of 0.330). Using the data for the same radius, the five highest number of ojek drivers are located in Cisaat District and Cicurug District, which, along with Cibadak District, are the three urban districts that comprise the subject area. The five largest built-up area spots are all located in Cicurug District. According to the Sukabumi Regency Transportation Masterplan, Cicurug District has become the area in Sukabumi that is most prone to traffic jams. In addition to the traffic in Cibadak District and Cisaat District, the traffic in Cicurug District forms a traffic jam chain that extends from the north of Sukabumi Regency up to the municipality of Sukabumi.

Based on the findings mentioned above, we can conclude that the service of ojek in Sukabumi urban area will still be available for years ahead. The sprawl urban form which poorly design for cycling and walking has maintain the status quo of ojek as part of Sukabumi urban transport entities. The willingness of local government to regulate ojek with the proper policy can improve ojek existence in the term of social and economic development, and also its

functions and performance as part of urban transport as well (Slack & Notteboom, 2006).

Findings in this research can give better considerations in formulating ojek policy in Sukabumi regency. Prioritizing the terminal management for ojek, especially in the urban areas of Sukabumi Regency, is one of the first items that must be addressed in order to regulate motorcycle taxis. Ojek terminal management will aid the normalization of road capacity in the subject area, since the ojek driver usually scattered around the side road or intersection. The other consideration based on the findings presented in this paper are related with the aspect of ojek fare which usually decided by negotiations. The problem arises when the negotiated fare sometimes is re-negotiated by driver as they felt the fare amount is insufficient after served the customer. This condition could give unsatisfied feeling either from driver or customer. Setting the ojek standard fare will improve trust ability between ojek and consumers.The local government in the Sukabumi Regency can set a minimum ojek fare based on the operational costs and rational margins for a service distance with an optimum radius of approximately 1,000 meters. The fare should also be determined based on the distance travelled (km). This will create more fair and reasonable conditions for both drivers and customers, in comparison to the current situation in which the ojek fare is determined by negotiation, at the ojek terminal location. Along with registration and enactment of a specific license for ojek drivers, the standard fare will increase the level of ojek service as a vital part of the Sukabumi Regency transportation system.

Although this paper can provide information for better consideration, there are limitation of this study as well. The study in this paper can only describe the relation between built-up area density and ojek driver number. Further research should be explain the relation between ojek and land use factors as an integral structure.

## Notes

[1] Indonesia Road Transportation in Figures 2014

[2] Regional Regulation No. 22 Year 2012 about Sukabumi Spatial Planning.

[3] Article 29 (a) Regional Regulation No. 22 Year 2010 about Spatial Planning in West Java Province.

[4] Article 109 Regional Regulation No. 22 Year 2012 about Sukabumi Regency Spatial Planning.

[5] Article 1 (77) Regional Regulation No. 22 Year 2012 about Sukabumi Regency Spatial Planning.

[6] Road standard minimum of service according to the Standard of Public Works Ministry.

[7] Masterplan of Sukabumi Regency Transportation, 2014.

[8] Ibid.

[9] Transport Agency of Sukabumi Regency, 2015

[10] Campoli and MacLean (2002); Kuzmyak and Pratt (2003); TRB 2009 in Land Use impact on Transportation (Litman).

[11] Regional Regulation No. 22 Year 2012 about Spatial Planning of Sukabumi Regency, article 6, points 3, 4, and 5 and article 7.

## References

Cervero, R. (2000). *Informal Transport. A Global Perspective.* Nairobi: UN Habitat.

Cervero, R. (2013). Linking Urban Transport and Land Use in Developing Countries. *The Journal of transport and Land Use Vol. 6 No. 1*, 7-24.

Cervero, R., & Golub, A. (2007). Informal Transport. A Global Perspective. *Transport Policy*, 445-457.

Chin, N. (2002). *Unearthing the Roots of Urban Sprawl: A Critical Analysis of Form, Function and Methodology.* London: UCL Center For Advance Spatial Analysis Working Paper Series.

Dimitriou, H. T. (1990). Transport Problems of Third World Cities. In H. T. Dimitriou, *Transport Planning for Third World Cities* (pp. 50-84). London: Routledge.

Dimitriou, H. T. (1995). *A Developmental Approach to Urban Transport Planning; Indonesian Illustration.* Aldershot: Avebury.

Dimitriou, H. T., & Gakenheimer, R. (2011). *Urban Transport in the Developing World: A Handbook of Policy and Practice.* Edward Elgar Pub.

Handayani, D. (2011). Financial Feasibility Analysis of Motorcycle Taxi (Ojek) Operational Service in Urban Area In Indonesia to Investigate The Prospect of Sustainability of Motorcycled Paratransit Service Into The Future (Case Study in The District of Surakarta-Central Java). *Dinamika Teknik Sipil*, 181-187.

Handayani, D., Mochtar, I. B., & Soemitro, R. A. (2009). *Characteristic of Motorcycle Taxi as Informal Urban Transport System. Case Study Surakarta Municipality.* Surabaya: ITS.

Litman, T. A. (1995). Land Use Impact Cost of Transportation. *World Transport Policy & Practice* , 9-16.

Litman, T. A. (2016). *Land Use Impacts on Transport : How land use factors affect travel behavior.* Victoria Transport Policy Institute.

Olvera, L. D., Plat, D., & Pochet, P. e. (2012, July 13). *http://echogeo.revues.org.* Retrieved from http://www.revues.org: http://echogeo.revues.org/13080

Slack, B., & Notteboom, T. (2006). The Nature of Transport Policy in Transport Planning and Policy. In J. P. Rodrigue, C. Comtois, & B. Slack, *The Geography of Transport System* (pp. 280-285). New York: Routledge.

Sukabumi. (2016). *Sukabumi in Figures 2015.* Sukabumi: Statistical Bureau of Sukabumi Regency.

White, P. R. (1990). Inadequacies of Urban Public Transport. In H. T. Dimitriou, *Transport Planning For Third World Cities* (pp. 85-116). London: Routledge.