Making the Connection between Transport Disadvantage and Motorcycle Usage of Low-Income People in Yogyakarta Urbanized Area, Indonesia

Yori HERWANGI^a, Pradono PRADONO^b, Ibnu SYABRI^c, Iwan KUSTIWAN^d

^aPh.D Candidate, School of Architecture, Planning, and Policy Development, Institut Teknologi Bandung, Indonesia
Lecturer, Urban and Regional Planning Program, Department of Architecture and Planning, Gadjah Mada University, Indonesia
E-mail: y.herwangi@gmail.com

^bProfessor, School of Architecture, Planning, and Policy Development, Institut Teknologi Bandung, Indonesia
E-mail: pradono@pl.itb.ac.id

^cAssociate Professor, School of Architecture, Planning, and Policy Development, Institut Teknologi Bandung, Indonesia
E-mail: syabri@pl.itb.ac.id

^dAssociate Professor, School of Architecture, Planning, and Policy Development, Institut Teknologi Bandung, Indonesia
E-mail: iwank@pl.itb.ac.id

Abstract: Low-income population is one of the groups that are vulnerable to transport disadvantage because of its limited resources, especially if they also live in areas which are not served by adequate public transportation. In such conditions, a motorcycle becomes an alternative solution to meet their mobility needs. Unfortunately, how motorcycle is used by low-income people and the influencing factors have not been fully understood. This study aims to understand the motorcycle usage in low-income people and identify the factors that contribute to the motorcycle usage in low-income people. Districts and household level of analysis were conducted in Yogyakarta Urbanized Area (YUA), Indonesia in 2014. Based on the results, the study suggests a more inclusive public transport planning in YUA by considering the need of low-income people so that efforts being made to reduce the use of motorcycles will not compromise the mobility of low-income people.

Keywords: Transport disadvantage, Low-income people, Motorcycle usage, Developing countries

1. INTRODUCTION

Yogyakarta, as other big cities in Indonesia, is experiencing urban sprawl. This resulted in the rapid development of the suburbs without spreading of job opportunities and public facilities from the city centre (Yunus, 2008; Kustiwan, 2010). As a result, the mobility pattern of the residents becomes inefficient. Public transport that should cater the mobility needs of population is not sufficiently available in suburbs. Low-income population is one of the most disadvantaged groups in this condition due to their inability to choose the housing location with decent public transport service. According to Glaeser and Kahn (2003), sprawling metropolitan area makes low-income residents be left behind because they cannot afford to have a car, which is essential to travel freely in such urban form. They are said to experience
transport disadvantage because of the difficulty to access the services, facilities and activities that are necessary for their life.

To overcome transport disadvantage caused by lacking of public transport supply, one of the strategies is to have private vehicles. In the case of developing countries it is a motorcycle. A motorcycle is relatively cheap compared to a car, making this mode more affordable for low-income population. This leads to the rapidly increasing number of motorcycle rapidly as happens in big cities such as Yogyakarta, Indonesia (BPS, 2012), and other countries such as in Hanoi City, Vietnam (Tuan and Simizu, 2005), and Taiwan (Chen et al., 2013; Hsu, Lin, and Tsai, 2007).

The increasing number of motorcycle in developing countries could lead to environmental problems. It brings the discourse to limit the number of motorcycles by increasing the market price of motorcycles and by prohibiting motorcycles in certain roads. It could reduce the mobility of low-income population that is highly dependent on the vehicle. Therefore, it is necessary to find a proper solution to reduce the dependency of low-income people to motorcycle, without compromising their right to a wide range of opportunities that can be obtained with the freedom of mobility offered by motorcycle. One way is to understand 1.) how transport disadvantage is experienced by low-income people, as well as 2.) how it affects the use of motorcycles in low-income communities, which are the goals of this study. This is in line with the principle of inclusive transport policy, where the social aspect of the policy should be considered in addition to the social and economic aspects.

Inclusive transport planning has started to become mainstreamed in transportation planning in Europe and America (Lucas, 2004; Stanley, and Stanley, 2007; Lucas, 2012). The social aspect is necessary to be considered because transportation planning that focus only on economic and environmental aspects can lead to the emergence of marginalized groups such as women, children, the disabled, the elderly, ethnic minorities, and low-income population. (Banister and Hall, 1981; Preston and Raje, 2007). While research on the transport disadvantage and its relation to the vehicle usage is now a major research in developed countries like the UK and US, Indonesia lacks a similar focus.

2. TRANSPORT DISADVANTAGE AND VEHICLE OWNERSHIP AND USAGE IN LOW-INCOME PEOPLE

Researches on public transport disadvantage in certain groups have become major researches in countries such as United States, England, and Australia. In these studies, transport disadvantage is described as the difficulty to access a variety of opportunities and activities caused by transportation. These conditions can lead to a person experiencing social exclusion. The themes in the study of transport disadvantage from the previous researches can be grouped into:

- Studies related to the marginalized people, such as: old people, woman, youngsters, ethnic minorities, and low-income people (Titheridge et al., 2009; Fobker and Grotz, 2006; Currie and Allen, 2007; Currie and Sendbergs, 2007b; Currie, 2007; Hurni, 2007)
- Studies related to the condition of a particular area, e.g. the downtown area, suburban, and rural area (Liddle et al., 2012; Farrington and Farrington, 2005; Currie and Sendbergs, 2007a; Currie and Delbosc, 2009; Miller, 2009)
- Studies related to the implementation of transport policy in general (Raje, 2003; Jones and Lucas, 2012; Bocarejo and Oviedo, 2012; Geurs et al., 2009)
Based on these studies, it is concluded that the conditions of transport disadvantage could be related to personal circumstances (socioeconomic status, age, race), and the characteristics of the settlement area (downtown, suburban, rural).

One of the efforts to address the transportation needs of low-income people is to improve access to private vehicles (Social Exclusion Unit, 2003; Clifton and Lucas, 2004). It is especially in areas without access to public transport as implemented in Hereford Shire and Suffolk Community Councils, UK, with a program named "Wheels to Work" (Department of Transport, UK, 1999). On the other hand, according to some studies, the link between vehicle ownership in low-income people and the benefits of the increased mobility is still uncertain. For example, the research conducted by Senbergs Currie (2007) in Metropolitan Melbourne, revealed that for the low-income families who live in the suburbs, not having a private vehicle (in this case a car) is an advantage. This is because families who do not own a car will adjust to living closely in the activity centre, while low-income families who own a car become very dependent on it. It was also revealed that those families tend to live in areas far from the activity centre and 50% of their revenues are spent on the vehicle cost. Further study revealed that the high vehicle ownership may increase the burden for the family.

2.1. Transport Disadvantage in Developing Countries

In developing countries, the studies on low-income people and transport disadvantage, have tended towards five issues: (Renny 2009, Astrop, 1997; Palmer et al., 1997; Tran and Schlyter, 2010; Ureta, 2008; McGrath, Hine and Gunay, 2007)
- The gap between the residential location and job and public facilities
- Poor public transport services
- Affordability of travel cost
- The high proportion of non-motorized travel
- Transport difficulties experienced by women and low-income people

In developing countries, public transport services are often not available at all (Lucas, 2011). Moreover, as is the case in Indonesia, the cost to travel by public transport is sometimes greater than the cost of using private vehicles such as motorcycles.

On the other hand, private vehicle ownership can also have symbolic and affective motives, such as a hobby, prestige, and socioeconomic status (Steg, 2005). This could lead to the policy to restrict motorcycles from certain roads, whereas the impact of the restriction may be fatal for low-income people by reducing their access to various facilities and opportunities.

2.2. Factors Affecting Vehicle Usage in Low-Income People

Factors that affect travel patterns including choice of mode have become topics of research for a long time. The effects of the built environment on vehicle ownership and usage have been investigated in several studies. In these studies, the built environment attributes that affect travel pattern are city size, density, diversity of land use, road design, and public transportation services. Meanwhile, another study stated that the effect of the built environment is very small or non-existent (Stead, 2001, Simma and Axhausen, 2003), in which socioeconomic factors and lifestyle (preference) are striving (Stead, 2001; Schwanen, 2002). In this case, socioeconomic factors that influence the travel pattern are type of household, age, gender, type and status of the job.

Several studies on the factors that influence the vehicle usage have been conducted in countries with high usage of motorcycles in Asian countries such as Japan (Yamamoto, 2009), Vietnam (Tuan and Simizu, 2005), and Taiwan (Hsu, Lin, and Tsai, 2007). From these studies,
it is revealed that the factors affecting the ownership and use of motorcycles are income (Yamamoto, 2009; Hsu 2007), and the number of household members who are working or entering university (Hsu, Lin, and Tsai, 2007; Senbil, Kitamura, and Mohammed, 2009). All these researches also state that location factors including residential location, accessibility to public transport and transport supply levels affect the ownership and use of motorcycles.

2.3 Transport Poverty and Forced Car Ownership in Low-Income People

Unlike other social groups, low-income people are often forced to own personal vehicle due to the condition of the built environment and the owned resources. This phenomenon is known as transport poverty or forced car ownership. Forced car ownership or transport poverty is defined as the condition of low-income people who are forced to bear the high cost of vehicle ownership due to the absence of other options (Banister 1994; Gleeson and Randolph, 2002 in Currie and Delbosc, 2009). From the above definition it is obvious that the reference used in deciding the forced condition is the cost. This is not surprising considering that this concept emerged from studies in developed countries where standards of comfort and safety of vehicles are already firm and no longer become a problem (Banister 1994; Gleeson and Randolph, 2002 in Currie and Delbosc, 2009). From the above definition it is obvious that the reference used in deciding the forced condition is the cost. This is not surprising considering that this concept emerged from studies in developed countries where standards of comfort and safety of vehicles are already firm and no longer become a problem (Banister 1994; Gleeson and Randolph, 2002 in Currie and Delbosc, 2009).

In Indonesia, there have not been many researches conducted on transport disadvantage experienced by low-income people and how it affects motorcycle ownership and usage. Such researches are necessary as a point of consideration in planning a more efficient public transportation. Inevitably, public transportation nowadays has to face a fierce competition with private vehicle. Therefore, understanding the use of private vehicle and its influencing factors would be very useful for planning public transportation which is suitable with the need of the communities, particularly the low-income community.

3. RESEARCH METHODOLOGY

3.1 Defining Low-Income People

There are no nationally accepted criteria regarding low-income population in Indonesia. The only ranking of socioeconomic population which has the same standard throughout Indonesia is the criteria developed by BKKBN (Badan Koordinasi Keluarga Berencana Nasional or National Agency for Demography and Family Planning). According to BKKBN family in Indonesia can be divided into 5 classes, namely pre-prosperous family, prosperous 1 family, prosperous 2 family, prosperous 3 family, and prosperous 3 plus family.

Based on the standard sets by BKKBN, in this study low-income people are defined as pre-prosperous family (keluarga sejahtera), prosperous 1 family (keluarga sejahtera 1), and prosperous 2 family (keluarga sejahtera 2). These three groups are families who have been able to fulfil their basic needs including social and psychological aspects (BKKBN, 2005), but have not been able to do personal development and to use the modes of transport in accordance with local conditions (BKKBN, 1994). The standard is used in this study to determine how big the population of low-income family in YUA on the analysis of the public transport service gap. According to the data from BKKBN, the proportion of low-income
people in this area is accounted for 13.28% from the total of 1,006,381 populations. Based on the data from the Yogyakarta Central Bureau of Statistics, low-income residents in YUA amounted to 110,186 households, or 28.36% of the total households.

Unfortunately, the list of families that belong to the pre-prosperous family, prosperous 1 family, and prosperous 2 family could not be obtained. Therefore, to select the respondents who will be given a questionnaire and interviewed the definition that is based on the standard of ADB (2010) about the middle class is used. According to the ADB, the middle class in developing countries is the people who consume more than $2 per day. Based on this standard, the low-income family in this study is defined as a family whose daily consumption per family member is less than $2 per day. ADB standard is used because it is in the form of single-scale figure, which can be easily verified, so that choosing which respondents are included in the low-income population groups and which ones are not is easier. In addition, this standard is more appropriate when compared to other income ranking standards that are often used in Indonesia such as the Regional Minimum Wage or Upah Minimum Regional (UMR). UMR is based on figures need for decent living which refers to the need for a single worker. Whereas, in this study, the unit of analysis is the household whose members are mostly more than one.

3.2 Study Area and Design of the Research

The study area of this research is Yogyakarta Urbanized Area (YUA). YUA consists of the City of Yogyakarta and nine districts in Sleman and Bantul Regency, which borders the city of Yogyakarta and has been characterized by urbanity. YUA is divided into the core urban area, the city of Yogyakarta, and the surrounding urban areas which cover some parts of Sleman and Bantul. The total area is 186.87 square km, which covers an area of 14 districts in Yogyakarta; 6 districts in Sleman; and 3 districts in Bantul. Distribution of the facilities in YUA is still much centralised in the core area of the city, the city of Yogyakarta. Similarly, the density of settlements is still concentrated in the area around the city centre.

In accordance with research questions of this study which are 1.) How transport disadvantage is experienced by low-income people, as well as 2.) How it affects the use of motorcycles in low-income communities then, the steps of this study are as follows:

1. Determining the areas included in the Transport Disadvantage Area (TDA) and the Non-Transport Disadvantaged Area (NTDA) by analyzing the public transport service gap in YUA.
   Based on the results of the analysis, 4 districts are then determined, where 2 districts represent areas with adequate public transport service TDA and 2 districts represent NTDA. Transport disadvantage in this study is defined as the difficulties in accessing the workplace, educational facilities, and health facilities caused by the transportation. Transportation disadvantage is assumed to occur in low-income communities living in areas with poor public transport services, which are referred to as the Transport Disadvantaged Area (TDA). The areas that are not included in the TDA in this study are referred to as Non-Transport Disadvantaged Area (NTDA)

2. Conducting a survey through questionnaires to a sample of the population in the four districts about the condition of the built environment, socioeconomic character, accessibility and public transport services, as well as the travel patterns using the motorcycle.

3. Analysing the relationship between the built environment and socioeconomic variables, and the variable of motorcycles usage to see which factors affecting the use of motorcycles in both areas (TDA and NTDA) and how strong the influence of these
factors by using the regression statistics method.
4. Analysing experiences and perceptions of respondents about the use of motorcycles through interviews.
5. Analysing the relationship between the results of regression models and interviews as well as formulating the implications of these results to the public transport planning policies for low-income people.

Figure 1. Framework of this study

3.1 Sampling and Interviewing Method

To conduct the second and third steps of the research, a number of samples from low-income population in the four districts (results from step 1) which are used as the case studies are taken. Having calculated the number of samples required using the Cochran formula (1977), and by using convenient sampling method, 503 questionnaires were distributed to potential respondents. Of the 503 questionnaires distributed, 437 are declared valid and are used as the data source in this study. Questionnaire aimed at obtaining information on the personal characteristics that include the number of family members, employment, income, and the use of motorcycles such as the number of motorcycles owned; time, distance, and the purpose of daily trips done with the motorcycle during weekdays; and incurred cost.

To supplement the data obtained from the questionnaire, interviews toward 40 people selected from respondents who had participated in the collection of data through questionnaires were also conducted. Selection of respondents to be interviewed is based on a variation of the data obtained from the questionnaire and the willingness of respondents to be interviewed. The interview is intended to obtain information on the perception of respondents with regard to the importance of motorcycle for daily activities as well as perceptions about the security and safety of riding.

4. RESULT

4.1 Determining Transport disadvantaged area in Greater Yogyakarta through Public Transport Service Gap

There are many ways to measure transport disadvantage (Dodson, 2004). In this research, access to public transport coverage is used as a proxy for transport disadvantage. With the help of GIS software, the data are then overlaid with the distribution of low-income residents to get the areas where transport disadvantage is likely to occur.

Transport disadvantage in this study is defined as areas with no or limited access to public transport. There are two kinds of public transport services in YUA, which are...
TransJogja BRT system and regular buses. TransJogja BRT has fixed bus stops while regular buses do not. Passenger of regular buses can stop everywhere along the road.

To assess which districts categorized as TDA, public transport service was measured in all the districts in YUA. These areas than were grouped into areas with good, medium, and low public transport services. The areas with low public transport service were categorized into TDA. The following approach was adopted:

1. Mapping of public transport route to determine which areas are covered by public transport service, including bus stop location for TransJogja.
2. Mapping of the services area for each public transport route based on the walking distance to public transport which is 400 meter from the bus stop of TransJogja BRT system and 400 meter area from the street that is covered by regular bus.
3. Calculating the index of public transport services with the following formula:

   \[ I_{PT} = \frac{L_{PT}}{L_A} x_{PT} \]  

   \( I_{PT} \): public transport supply index  
   \( L_{PT} \): area covered by public transport services  
   \( L_A \): districts area  
   \( x_{PT} \): service level measure (numbers of public transport route in the area)

4. The index is then grouped into very low, low, medium, high and very high, with the help of GIS software (see Figure 2).

![Figure 2. Public transport supply in YUA](image-url)
The gap between public transport services and needs in the context of this study, assessed by comparing the public transport supply index with the proportion of low-income residents in the districts. Figure 3 shows the areas where transport disadvantage most likely to occur due to the gap between the availability of public transport services and the need for public transport service of low-income people.

Based on the Figure 3, there are still many districts with high proportion of low-income people which are not served by public transport. The areas are mainly located in the western suburbs consisting of partially Bantul and Sleman, as well as the southern suburbs. In these areas, low-income residents living without access to public transport, where it is presumed to affect motorcycle ownership and usage in the area. There are 238,657 people live in 16 districts with zero or very low public transport supply and a high proportion of low-income people (Table 1). This area is classified as TDA. For the case study of this research, two districts, Sendangadi and Panggungharjo were chosen to represent the TDA, and two districts, Notoprajan and Ngampilan as case studies for NTDA (Figure 4).

Table 1. Public transport supply and proportion of low income people in YUA

<table>
<thead>
<tr>
<th>Public Transport Supply</th>
<th>Proportion of Low Income People</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Middle</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Districts</td>
<td>Population</td>
<td>Districts</td>
</tr>
<tr>
<td>Zero or very low</td>
<td>16</td>
<td>238,657</td>
<td>8</td>
</tr>
<tr>
<td>Low</td>
<td>5</td>
<td>50,760</td>
<td>3</td>
</tr>
<tr>
<td>Medium</td>
<td>3</td>
<td>21,459</td>
<td>5</td>
</tr>
<tr>
<td>High</td>
<td>9</td>
<td>148,406</td>
<td>7</td>
</tr>
<tr>
<td>Very High</td>
<td>2</td>
<td>20,972</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>480,254</td>
<td>28</td>
</tr>
</tbody>
</table>
4.2 Built Environment Characteristics of the Case Study Districts

In addition to representing the condition of different transport services, the four districts which were chosen as case studies also represent the different characteristics of the built environment. Ngampilan and Notoprajan represent the downtown areas with high level of public transport service, high population density, settlement patterns and the compact distribution of public facilities, and the grid pattern of the road network. Regions with such characteristics are defined as areas that are not likely to experience difficulties in transportation. On the other hand, two other districts, namely Panggungharjo and Sendangadi represent areas with characteristics: located at the suburb, a low level of transport services, low population density, settlement patterns and public facilities which are scattered, and curve-shaped pattern of the road network. The selection of the 4 districts representing different characteristics are intended to know the different patterns that may arise between these two characteristics of the built environment. The summary of the characteristics can be seen in Table 2.

For the purposes of regression modelling, measurements on household unit of analysis were also conducted. The built environment variables measured in the household unit of analysis are the closest distance from home to workplace, educational facility, health facility, shopping facility, and bus stop.
Table 2. Case study site characteristics summary

<table>
<thead>
<tr>
<th>Site Characteristic</th>
<th>Notoprajan and Ngampilan (Non-Transport Disadvantaged Area)</th>
<th>Panggungharjo and Sendangadi (Transport Disadvantaged Area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>High (23,740 persons/Km² for Notoprajan and 25,617 persons/Km² for Ngampilan)</td>
<td>Low (3,026 persons/Km² for Sendangadi and 5,880 persons/Km² for Panggungharjo)</td>
</tr>
<tr>
<td>Land Use</td>
<td>Mixed</td>
<td>Mixed in the main street only, mostly residential</td>
</tr>
<tr>
<td>Residential pattern</td>
<td>Compact</td>
<td>Scattered</td>
</tr>
<tr>
<td>Street pattern and condition</td>
<td>Grid, good condition, width 2.5-4m on main street and 1.7m on residential alley</td>
<td>Curved and grid, good condition, average width 2.5-5m in residential area</td>
</tr>
<tr>
<td>Public facilities</td>
<td>Accessible in less than 400 m from residential area</td>
<td>Some of the facilities are accessible in less than 400 m from residential area</td>
</tr>
<tr>
<td>Public Transport Access</td>
<td>More than 3 bus routes</td>
<td>1 bus route</td>
</tr>
<tr>
<td>Walking</td>
<td>Difficult because of the mixed traffic.</td>
<td>Common in local residential street, but hazardous in main street. No pedestrian way</td>
</tr>
</tbody>
</table>

4.3 Socioeconomic Characteristics of Respondents

In term of socioeconomic characteristics, the four districts have similar characteristics. From the 437 valid questionnaires, socioeconomic characteristics of the respondents are summarized in Table 3. Most of the respondents are productive families, which in this study is defined as families with children who are in school or working. The respondents mostly work full time in informal sectors. Employment in the informal sector includes street vendors, hawkers, household scale enterprises, construction workers, as well as housekeepers. Most of these jobs have irregular working hours.

Table 3. Social economic characteristics of respondents in TDA and NTDA

<table>
<thead>
<tr>
<th></th>
<th>TDA</th>
<th>NTDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of samples</td>
<td>219</td>
<td>218</td>
</tr>
<tr>
<td>Number of family members</td>
<td>3.61</td>
<td>3.61</td>
</tr>
<tr>
<td>Number of working family members</td>
<td>1.66</td>
<td>1.94</td>
</tr>
<tr>
<td>Monthly income (Rp)</td>
<td>1,251,803</td>
<td>1,299,862</td>
</tr>
<tr>
<td>Number of head of the households working in flexible job (in term of time and location)</td>
<td>86.7%</td>
<td>81.9%</td>
</tr>
</tbody>
</table>

4.4 Use of Motorcycle

The use of motorcycle in this study is measured by the total length of daily trips taken by using the motorcycle. The collection of the trip information is done through a questionnaire. The respondents were asked to fill the time and purpose of the trip done daily on weekdays. The data are then processed using ArcGIS software. Based on the information, data on the destination, time, frequency, and length of journey undertaken with the mode of motorcycle are obtained. Summary of the results of survey on the use of motorcycle in low-income residents in the study areas are presented in Table 4.
Table 4. Motorcycle usage of low-income households in the study area (in average)

<table>
<thead>
<tr>
<th></th>
<th>TDA</th>
<th>NTDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of HH Motorcycle (unit)</td>
<td>1.58</td>
<td>1.46</td>
</tr>
<tr>
<td>Motorcycle expenses (Rp/month)**</td>
<td>239,604.00</td>
<td>204,074.00</td>
</tr>
<tr>
<td>Percentage of MC expenses to total income</td>
<td>20.90</td>
<td>18.35</td>
</tr>
<tr>
<td>Daily travel distance to workplace (meter)**</td>
<td>7,005.34</td>
<td>5,715.87</td>
</tr>
<tr>
<td>Daily travel distance to education facilities (meter)</td>
<td>6,164.26</td>
<td>3,943.22</td>
</tr>
<tr>
<td>Daily travel distance to shopping facilities (meter)</td>
<td>1,609.33</td>
<td>1,864.19</td>
</tr>
<tr>
<td>Total daily travel distance (meter)**</td>
<td>9,547.10</td>
<td>7,173.94</td>
</tr>
<tr>
<td>Percentage of daily travel distance covered by public transport services</td>
<td>61.36</td>
<td>64.22</td>
</tr>
</tbody>
</table>

** One-way ANOVA between TDA and Non TDA is statistically significant at p<.05
* One-way ANOVA between TDA and Non TDA is statistically significant at p<.01
* US$ 1 is equal to Rp.12,900 as per February 2015

Table 4 shows the characteristics of motorcycle usage in low-income people who live in the TDA and NTDA. Based on the analysis by using one-way ANOVA statistical test, there is a significant difference in the length of the trip by motorcycle between low-income residents who live in the TDA and NTDA. The difference is especially significant in trip distance to workplace and education facilities, which affects the total length of the trips. Thus it can be inferred that there is a relationship between residential location (TDA or NTDA) with a long daily commuting trips using motorcycle.

The significant difference on the daily travel distance has affected the motorcycle expenditure among low income people who live in the TDA and NTDA. People who live in the TDA spent more for motorcycle cost compared with people living in NTDA. People who live in the TDA spent 2% more than people in NTDA. Aside from the difference in the trip distance, the greater the cost may also be associated with greater number of motorcycle ownership in the low income people who live in the TDA compared with people living in NTDA.

4.5 Built Environment and Socioeconomic Factors Affecting Motorcycles Usage in Low Income People

Based on the reviews from previous research on factors affecting motor vehicle usage, this study analyzes the relationship between socioeconomic, location, and transport services factors and motorcycle usage using household unit of analysis. Analysis of the factors was conducted to strengthen the results of the previous study which stated that built environment, i.e. whether the area is included in the TDA or NTDA, affect the motorcycle usage of the low-income people. Using linear regression analysis the correlation between socioeconomics, location, and public transport service factors and the use of motorcycle in low-income people are evaluated. Indicators of the variables measured in this correlation are presented in Table 5.

Socioeconomic variables that significantly contribute to the models are: number of family members, type of work (based on the flexibility of working hours), and family income. The greater the number of family members and the family income, the farther the trip that is taken by using motorcycle. Related to the type of work, it is found that the presence of family members who work with no fixed working hours also encourages the more frequent use of motorcycle. As for the built environment factors (location and public transport service) the only variable significantly contribute to the models is distance to workplace.
Table 5. Variables used in the regression models of factors affecting motorcycle usage in low income people

<table>
<thead>
<tr>
<th>Variables</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependant:</td>
<td></td>
</tr>
<tr>
<td>Motorcycle usage</td>
<td>total of daily trip distance by motorcycle</td>
</tr>
<tr>
<td>Predictors:</td>
<td></td>
</tr>
<tr>
<td>Socio-economics</td>
<td>number of family members</td>
</tr>
<tr>
<td></td>
<td>family income</td>
</tr>
<tr>
<td></td>
<td>type of employment (dummy- 0 for formal sector with fixed working hours, 1 for the formal sector with no fixed working hours and informal sector)</td>
</tr>
<tr>
<td>Built environment</td>
<td>distance to the workplace</td>
</tr>
<tr>
<td></td>
<td>distance to commercial facilities</td>
</tr>
<tr>
<td></td>
<td>distance to education facilities</td>
</tr>
<tr>
<td></td>
<td>distance to health facilities</td>
</tr>
<tr>
<td>Public transport service</td>
<td>distance from house to the nearest bus stop (for TransJogja BRT system)</td>
</tr>
<tr>
<td></td>
<td>or the road passed by public transport (for regular buses)</td>
</tr>
<tr>
<td></td>
<td>level of public transport service (dummy- 0 for residential area with zero or low level of public transport route, 1 for residential area with medium to high level of public transport route)</td>
</tr>
</tbody>
</table>

Based on these results (Table 6) we can conclude that the use of motorcycles in low income people is largely determined by socioeconomic factors and is not strongly associated with the built environment characteristics, except for the distance to the work place. The distance to the work place as the only factor that affects land use could indicate that for the low-income people motorcycle is an important mode for working. This is also consistent with the finding that the factor of the type of employment also affects the use of motorcycles. Here we can also see that the level of public transport service which is indicated by the many public transport routes that pass through the area where they live has no effect on the use of motorcycles. This could mean that the availability of public transportation routes do not necessarily correspond with the needs of low-income population, which keeps them using motorcycle even though their residence is passed by public transport. To verify the assumption obtained from these calculations, an analysis of the results of interviews with 70 respondents is carried out and will be discussed in the next section.

Table 6. Linear regression models of motorcycle usage in low income people

<table>
<thead>
<tr>
<th>Variable</th>
<th>Daily travel distance by motorcycle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parameter</td>
</tr>
<tr>
<td>Constant</td>
<td>-4282.397</td>
</tr>
<tr>
<td>Number of family members</td>
<td>1138.538</td>
</tr>
<tr>
<td>Type of work (dummy)</td>
<td>3074.835</td>
</tr>
<tr>
<td>Family income</td>
<td>0.002</td>
</tr>
<tr>
<td>Distance to workplace</td>
<td>1.889</td>
</tr>
<tr>
<td>Distance to the nearest health care facilities</td>
<td>N.S</td>
</tr>
<tr>
<td>Distance to the nearest education facilities</td>
<td>N.S</td>
</tr>
<tr>
<td>Distance to the nearest shopping facilities</td>
<td>N.S</td>
</tr>
<tr>
<td>Distance to the bus stop</td>
<td>N.S</td>
</tr>
<tr>
<td>Level of public transport service (dummy)</td>
<td>N.S</td>
</tr>
</tbody>
</table>

R²: 0.709
F: 204.993
Sig: 0.000

*N.S: non-significant variable based on parameter t-test result
4.6 Perception of Low Income People on Motorcycle Usage

The calculation in the previous section indicates that there is a specific need in low-income society relating to their work that affect the use of motorcycles, encouraging the conducted interviews on 40 respondents to verify the assumption. Interviews were conducted with regard to how important motorcycle for the fulfillment of their daily needs is, as how they feel when using the motorcycle pertaining to the comfort and safety of the motorcycle. Comparison of the results of the regression and interviews related to the factors that influence the use of motorcycles can be seen in Table 7.

Almost all respondents stated that the motorcycle is very important for their daily mobility. The importance of motorcycle is primarily to travel to place of work. In line with the findings of the regression model, it is mainly expressed by workers who do not have fixed working hours and high mobility such as salesmen, field technical personnel, construction workers, street vendors, and employees who work with the shift system such as a security guard or clerk; as mention by one of the respondents:

*Question:* If there is no motorcycle, do you think it will be difficult for your husband to travel to work?

*Answer:* Yes, sometimes it is difficult. If there is no motorcycle, he cannot work. He cannot ride bus to work. Working as a construction worker, the house he works on does not always located on the main street. What I mean is, there might be no public transport. That is the only constraint. So the constraint of his work is the transportation, hehe... (Yeni, 38 years)

For the purpose of the trip such as access to educational, health, sport, leisure and shopping facilities, respondents' perceptions of the importance of the motorcycle is not too high (see Figure 5).

![Figure 5. How important is motorcycle to do this activity?](image)

The difficulty to access public transport also reinforces the importance of motorcycles for the low-income people. As mentioned by most respondents, the distance that must be taken to reach the bus stop is far enough so they are reluctant to use public transport. In addition the condition of the built environment and the traffic also do not support them to walk.
The condition of the bus is probably common, but as I have mentioned earlier the walking distance is too far to ride TransJogja bus. Riding motorcycle enable me to go to even the remote parts of kampong comfortably (Ningrum, 26 years)

Question: How far is it from your house to your husband’s work place?
Answer: hmm... Gedung Agung. I have to walk there from my husband’s place. Get off the bus. Walking when there is no motorcycle.
Question: Is it far?
Answer: It is quite far. I often feel sorry when he is tired after working. Yes, hehe.. The calculation is about the same for either taking bus or riding motorcycle. I mean, how much do we have to pay for taking the bus now... 3,000 IDR right? The gasoline....actually is about the same but it is easier. How long will it take if taking the bus? (Ren, 26 years)

The importance of motorcycle for low-income people, leading them to various violations such as:
1. The use of motorcycles not only for transportation but also as a means for transporting merchandise for those who work as traders. Motorcycle is used to shop for goods which they will sell, as is done by Willy, 46 years.

   Question: Have you ever used your motorcycle to transport goods, Sir?
   Answer: Only for the merchandise, no other. When I shop for goods, I use motorcycle.
   Automatic motorcycle is convenient; I can put my goods in front or behind me.
   Question: What do you sell?
   Answer: I sell clothes.

2. The use of the motorcycle for more than two people on one motorcycle. The average number of family members in Yogyakarta is 3-4 people. This leads to three or more people riding on a single motorcycle for the families that have only one motorcycle.

   Question: Have you ever had to ride motorcycle for more than two people, maam? For example for three people?
   Answer: Very often.
   Questions: Because your children are still young?
   Answer: Yes, the younger one wants to come when I pick the older child from school, so there are three of us. Sometimes I also have my nephew. When he wants to join, I have no other option but to ride the motorcycle with four of us on it. Sometimes s/he also wants to come to play. This one and that one (my younger child and my nephew) in front and my older child behind, but I ride it slowly. When the street slopes upward, I ask them to get off the motorcycle, and when the street has levelled they get back on the motorcycle.(Wahyuni, 48)

The respondents realized that motorcycle is not an ideal choice of transportation mode, due to:
1. The high level of accidents
   The respondents realize that motorcycle is prone to accident compared with other modes.
2. The high level of vulnerability to crimes such as robbery and mugging compared with other modes

In this regard, it was revealed that many of them actually want to get out of the situation by moving to a location with more convenient access to public facilities and public transportation, if there is a chance

Question: If there is a chance, when you have the time and the money, will you consider looking for a new place to live which is closer to public transport?
Answer: Yes (Respondent answered it promptly) I will try to look for a house as close as possible to the public transport, and other facilities such as gas station, supermarket, or hospital. That is what I am looking for. (Ira, 34 years)

Question: Excuse me, Sir. If there is a chance, when you have the time and the money, will you consider looking for a new place to live which is closer to public transport?
Answer: Of course. Of course I will.

Question: Will you look for one which is closer to the transportation access?
Answer: At least the one with an easy access to it. Areas which are more advanced. I want to, this is just my aspiration. If I cannot fulfil it, well...it is OK to stay here. I already feel grateful. This one is actually a rented one! (Sunaryono, 44 years)

However, because of the opportunity resulting from the motorcycle is considered greater than the costs and losses that may be incurred, added with the spiritual belief that accident which may happen is inevitable destiny, safety standards are not their priority. These things cause violations of safety standards and the consequences that may be borne out of such behaviour are regarded as a normal thing for them. The existence of this phenomena may become obstacles that can discourage the use of public transport. Therefore attention in the planning of public transport, especially the one aimed to serve the low-income people, is required.

**Tabel 7. Comparison of Factors Affecting the Use of Motorcycle in Low-income Community Based on the Results of the Regression Analysis and Interview**

<table>
<thead>
<tr>
<th>Factors</th>
<th>Regression Analysis</th>
<th>Interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>Affecting</td>
<td>Affecting Costs incurred for motorcycle are cheaper than taking public transportation</td>
</tr>
<tr>
<td>Revenue/Cost for Motorcycle</td>
<td>Affecting</td>
<td>The number of family members which are not proportional to the capacity of the motorcycle owned forcing them to ride motorcycle exceeding its capacity (more than 2 people on 1 motorcycle)</td>
</tr>
<tr>
<td>Number of family members</td>
<td>Affecting</td>
<td>The work locations of most respondents are not served by public transit. Besides, the distance from the homes to the line of the public transport is considered quite far</td>
</tr>
<tr>
<td>Distance to the workplace</td>
<td>Affecting</td>
<td>The importance of motorcycle to do daily activities other than working is moderate. In order to do these activities, low-income people tend to use non-motorized transport modes such as: bicycle and walking</td>
</tr>
<tr>
<td>Distance to the shopping center, healthcare facilities, and education facilities</td>
<td>Not Affecting</td>
<td>Low-income people with motorcycle ownership tend to access all the activities by motorcycle</td>
</tr>
<tr>
<td>Distance to the bus stop and level of public transport service</td>
<td>Not Affecting</td>
<td></td>
</tr>
</tbody>
</table>

5. DISCUSSION

Based on the results of this study, motorcycle plays a very important role for the movement of low-income people in Yogyakarta, especially to make the trip to work. It is based on the following reasons:

1. The condition of land use and design of settlements in Yogyakarta in particular and major cities in Indonesia in general is still pushing a heavy reliance on private vehicles. In the case of low-income people in Yogyakarta Urbanized Area, dependency on motorcycle occurs because the urban sprawl causes the emergence of scattered
settlement areas on the outskirts of the city, also included in the TDA, and the work locations which are still focused in the city centre. In the city centre, included in the NTDA area, the public facilities are located nearby, yet high density of the built environment causes many areas can only be accessed by two-wheeled vehicles. These areas are typically the residential blocs inhabited by low-income people. These things lead to high dependency on a motorcycle, both in the city centre (NTDA) and in the suburbs (TDA) as indicated by this research. In this case Yogyakarta can be said as Motorcycle Dependent Cities (MDC) as some cities in Asia such as Hanoi (Vietnam), Hochiminh City (Vietnam), Bangkok (Thailand), Taipei (Taiwan), New Delhi (India), and Jakarta (Indonesia) (Hung, 2006).

2. The quality and quantity of public transportation in Yogyakarta and major cities in Indonesia in general, still cannot meet the needs of residents, including the low-income people. In the suburban, public transportation is available only in limited quantities and only operates on the main streets. Furthermore, the sprawled residential patterns and unavailability of transport feeder cause longer distances that must be taken by people who want to access the public transport available only on the main street. In the downtown area, public transport is available in a greater number, but it also has not been able to fully address the needs of low-income people's movement because of the personal characteristics that will be discussed at the next point.

3. Characteristics of employment in low-income people, who are mostly working in the informal sector with the hours and location of work which are not fixed, cannot be accommodated by the existing public transport. Thus, it results in high dependency on motorcycle.

In this study, workers in the informal sector reached 84.3% of the entire population. The similar facts existed in the bigger context of Indonesia (60.2%) and other developing countries, such as the Philippines (72.5%), India (67.5), and Pakistan (73%) (ILO Department of Statistics, 2012).

4. The absence of firm action against violations of safety standards, such as: the use of motorcycles of more than two people in one vehicle, and the use of motorcycles for transporting goods in large quantities.

With regard to the future of motorcycles in urban transport, as long as the things mentioned above are still not properly addressed, the high dependency on motorcycles will continue to occur. In this case the low-income people will experience the greatest loss because of the limitation of choices. From the conducted interviews, it was revealed that many of them are actually insecure and uncomfortable to use motorcycle. They also need a mode of transportation that can carry the whole family and bring the goods needed for their business purposes.

Despite increasing investment in mass public transport conducted in major cities in Indonesia, including Yogyakarta, transportation services will not be able to cope with the high dependency on motorcycle in low-income people for the policies that are made do not consider these conditions. Therefore, this study may suggests:

Long term strategies:
- Setting the land use which distributes employment centre not only in the city centre to shorten the travel distance.
- Setting and control over the design of residential areas are needed to avoid the emergence of residential blocks that can only be accessed by two-wheeled vehicles

Short term strategies:
- Provision of a feeder vehicles in the settlement leading to the main road that is passed by public transport, especially for the suburban area with scattered settlement patterns.
- Providing a more flexible public transport in terms of time and route, for example through community transport. This community transport can be operated in areas that become pockets for low-income people. The mode can use the passenger vehicle which route and time mutually agreed upon by the community that uses it.
- For areas that can only be passed by a two-wheel vehicle, motorcycle taxi provision can be considered by setting the number, area of operation and safety standards.
- Improvements on the pedestrian facilities both in terms of condition and connectedness with the settlements, activity centres, and public transportation stop points.
- Enforcement of the rules regarding driving safety standards needs to be done. As long as breaches of those standards are not dealt with firmly, even considered as common, they will open up the opportunity for people, especially low-income people to perform various improvisations (such as tricycles motor, motorcycles fitted with a basket carrier, using a motorcycle for more than 2 people) which may be harmful for them.

6. CONCLUSION

The current study adds to the limited research on inclusive transport by identifying the transport disadvantage experienced by low income people and its relation with motorcycle usage in Yogyakarta Urbanized Area, Indonesia. This study found that nearly 240,000 low-income people in YUA live in the area with no or very low public transport service or Transport Disadvantaged Area (TDA). Low income people living in TDA have to travel farther to the workplace and public facilities using motorcycle. As a result, they have to spend more than 20% of their monthly income for motorcycle expenses.

The empirical analysis in this study finds that the conditions of transport disadvantage affect the use of motorcycles in low-income people. The use of motorcycles is very important, especially as a means of transportation to work. Based on field observations, questionnaires and interviews, the condition of transport disadvantage experienced by the low-income people (with regard to the condition of the built environment, the employment centres, settlement patterns, and the designs of the road) lead to high dependency on a motorcycle. In terms of socioeconomic factors, there are factors that are very typical in Indonesia, which is the type of jobs in the informal sector. Working in the informal sector makes low-income people do not have fixed working hours and work location so that resulted in a higher dependency on private vehicles. With the cheaper price compared to a car, motorcycle becomes one of the solutions for them. The interesting thing was obtained from interviews that they did not fully feel safe and comfortable with their choice is. They realize that the level of safety of the motorcycle is more vulnerable than other modes. In addition there is also a need to transport more family members and the need to transport goods. So with no other choice they are often forced to violate safety standards.

With the high number of informal workers in developing countries (ILO Department of Statistics, 2012), the implications of this type of work on the use of motorcycles are in needs of further studies and worth studying for other urban areas in developing countries. Public transport planning must take this into account so as to serve low-income communities more effectively. Various long-term and short-term strategies can be used as input for land-use planning policy and transport based on the results of this study. Long-term strategies include the regulation of land use to distribute employment centres, as well as setting and controlling the settlement pattern and design of roads unto avoid areas that can only be accessed with
two-wheeled vehicles. Short-term strategies can be done by providing feeder in an area with scattered settlement patterns, providing a more flexible public transportation through community transport, improvement of pedestrian facilities, and enforcement of road safety on a motorcycle that can discourage the use of motorcycles and more to encourage the use of public transport.

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