# Housing Development and Building up Car-Oriented Community in Big Cities of Indonesia

Djoko SASONO[1], Yasunori MUROMACHI[2], Noboru HARATA[3], Katsutoshi OHTA[4]

## 1. INTRODUCTION

Large-scale housing developments have become a new trend of urban development in big cities in Indonesia since a couple decades. Most new housing estates have created inefficient and undesirable urban development patterns as also found in Jakarta Metropolitan Area (JMA), the biggest urban conurbation in Indonesia. Sprawled and scattered housing areas with poor support of transport system developments, particularly the lack of public transport services, are apparent. Increased car-oriented communities, in one side, are inevitable, whilst in the other side, public transport-only dependants face problem of mobility even for conducting the necessary trips. The situation is even worse accelerated by the disability of both local government and public transport operators to facilitate urban movements due to limited sources of fund for new investment. The number of passenger cars and motorcycles increases rapidly while public transport capacity slightly increases. All of those accelerate the domination of private transport on the roads directing to increased congestion and environmental issues such as air pollution.

This paper takes a look at the effects of new housing developments on the travel pattern of work trips in relation to investigate the indication of the increased car oriented communities. The paper presents a portrait of socio-economic and travel characteristics of main workers and to use them for estimating its modal share using discrete choice model. The data were collected via a household interview survey at 74 locations of new housing estates all around of study area.

## 2. JAKARTA METROPOLITAN AREA IN BRIEF

Jakarta Metropolitan Area (JMA), called JABOTABEK, is situated within three provinces and consists of the Jakarta Special Province and BOTABEK (Bogor and Bekasi regions in West Java Province and Tangerang region in Banten Province). JABOTABEK covers an area of 6,864 square kilometres where Jakarta only occupies about 665 square kilometres while Bogor, Tangerang, and Bekasi take about 3,433 square kilometres, 1,282 square kilometres, and 1,484 square kilometres respectively. JABOTABEK's population increased rapidly as the result of abrupt urbanization with the growth rate higher than national level since 1960s. In 1995, total population was more than 20 million people where more than 45% of them lived in Jakarta (see also Sasono *et al*, 2000, 2001A and 2001B). During the late 1960s up to the mid 1970s the migration pattern was dominated by in-migration to Jakarta from all over Indonesia, mainly from Java and Sumatra. From the mid 1970s, the pattern changes and the main stream of urbanization shifts from Jakarta to BOTABEK leading to an even more distinct increase of population in BOTABEK followed by building up commuting between Jakarta and BOTABEK mainly work trips to Jakarta. Following demographic changes, the conurbation continuously widens by filling up of Jakarta in terms of population density and low price land availability in fringes in which attract new housing development to BOTABEK. Although fringes develop as housing areas, low-income group tends to stay in Jakarta in order to avoid high commuting cost. Transport system development to new developing sites is poor and lack of a coherent hierarchy on road network. The existing road system throughout most urbanized JABOTABEK has evolved from dirt tracks and paths of agricultural uses (JICA, 2000).

Motorised vehicles and roads grew imbalanced. The vehicles increased far above the growth of road length. In 1995, total number of vehicles was over 3 million units (about double of 1990's number). Motorcycles occupied more than a half while passenger cars took nearly 30 percent. Goods vehicles and buses placed the rest with a slightly same amount. In Jakarta itself in 1995, road only occupies less than 6% of total area that is far from ideal situation. Motorcycles play an important role as transport mode due to some reasons such as flexible in highly trafficked/congested roads, longer distance between homes and workplaces (as the result of the shift in housing locations), cheaper operating cost than cars and even public transport. Meanwhile public transport vehicles also showed a significant increase annually, but in total, its capacity still needed an increase by 12% to 19% equal to 1,515 to 1,335 regular buses (MOC, 1996) in order to cope with 1995's demand.

Total households of JABOTABEK in 1995 were more than 4.5 million grouped into low income (34%), lower middle-income (37%), upper middle income (22%) and high income (7%). More than 60% of all income groups own no vehicle of which occurred nearly all of low-income, over a half of lower middle income, a quarter of upper middle income and one tenth of high income.

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1. Graduate Student, Univ. of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656. Ph. (03) 5841-6254. Fax (03) 5841-8527. E-mail: djokosas@ut.t.u-tokyo.ac.jp
2. Ass. Professor, Univ. of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656
3. Professor, Univ. of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656
4. Professor, Univ. of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656

Large scale housing developments in Indonesia started intensively in 1980s. In 1989, the total cumulative houses built nationwide were over 650 thousand units where JABOTABEK took share nearly a third. While in 1997, the cumulative number of houses built nationally was nearly 1.5 million units and JABOTABEK shared more than a quarter where mostly were built within BOTABEK within the distances less than 60 kilometers from Jakarta and mostly have poor public transport connections, more than 500 meters long to a bus stop. Most new housing areas in Jakarta are well away from a bus route and this figure is much even worse in BOTABEK (MOC, 1996).

It was reported that some roads connecting to new housing areas had average speed in a range of 15 km/hour in 1995 (MOC, 1996). Private vehicles dominated traffic composition at 6 cordons connecting the centre of Jakarta to fringes by more than 75% in 1993 and became nearly 90% in 1995 in average. The percentage of 4-wheel passenger cars in average was nearly 55% in 1993 and 51.4% in 1995, and both followed by motorcycles by more than 40%. In heavily trafficked cordons, motorcycle dominated the traffic by over 60%. It was estimated that congestion in Jakarta in 1999 valued about US$3 million/year comprising US$1.9 million imposed to cars' users, US$0.3 million subject to public transport users, and the rest related to vehicles' operation (KOMPAS Daily, Nov. 11, 1999). Of these have not yet covered costs of accidents and environment destruction. It was also reported that from 1990 to 1999, the car traffic from and to new housing complexes continuously rose as recorded at tollgates near new housing areas and the increase was considerably high, particularly during 1990 to 1995 (Sasono *et al*, 2001A and 2001B).

## 3. SURVEY RESULTS

### 3.1 Samples, Its Locations and Family Characteristics

Samples were heads of family taken via household interview conducted in July 2000 from 455 sampled households in 74 selected housing estates within 34 clusters throughout BOTABEK (427 of them travel for work daily). All locations were located out side Jakarta boundaries within the distances of 14 kilometres to 31 kilometres from the centre of Jakarta (most of them within distances of 20 km to 30 km). Most locations have poor access of public transport. More than 95% of locations are more than 500 meters away of regular bus services (45-seat bus) and nearly 60% are more than 500 meters away of mini bus routes (9-seat bus).

Samples with 3,4 and 5 family members take part of 83.07% while the rest are samples with family members of 1, 2, 6, 7, 8 and 9 with a small percentage of each. Based on family income, 59.12% of samples are lower middle income, and is followed by upper middle income (38.24%) and high income (2.64%). An interesting point noted here is lower income is not caught via the survey. A reason that could be raised up is as expressed by JICA (2000) that is although fringes dominantly developed as housing areas, the low-income group tends to stay in Jakarta in order to avoid high commuting cost.

Nearly one third of samples have no vehicle (32.97%) where mostly is lower middle income while samples with only one motorcycle account for 34.29% which mostly are lower middle income. Samples with one or more cars no motorcycle occupy 23.30% dominated by upper middle income; and samples with one or more cars and motorcycles position at 9.45% dominated by high income.

### 3.2 Characteristics of Travellers

**Socio-economic characteristics: age, education and occupation**

Ages between 30-40 and 40-50 dominate the travellers by more than 40% and nearly 40% respectively (see Figure 1). Based on education, university or college (UNIV) is the main background of travellers (nearly 60%) and followed by high school (HS) nearly 40% and junior high school or lower (<HS) at about 2%. According to occupation, more than a half of travellers work as private employees (PE) and followed by civil servant (CS), running own business (OB) and armed forces or police (AFP).

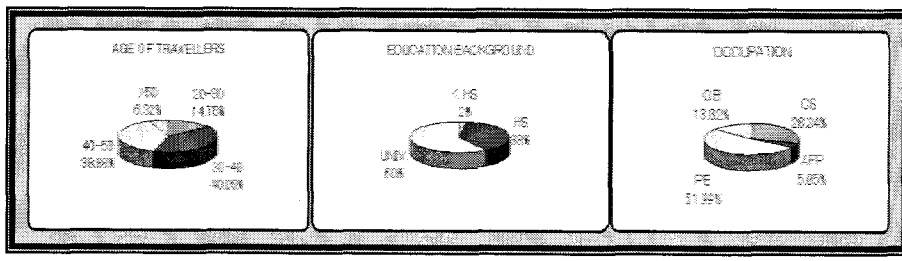


**Figure 1: Ages, Educations and Occupations of Travellers**

**Travel characteristics: workplace, modes used, travel distance, and travel time**

Nearly a half of travellers have workplace within the same area of their origins (LOCAL) as seen on Figure 2. Work trips to Jakarta (TO JKT) account for 46.60% while the rest travel within BOTABEK (WBTB) and out side JABOTABEK (OJBTB). Nearly 60% of travellers take private transport (CAR and M/C) for travel to work, while the rest is by public transport (PT). To the workplaces, nearly 40% of travellers must travel more than 30 kilometres one way and more than 20% must travel between 20-30 kilometres, while more than a quarter travel for a distance between 10-20 kilometres and more than 15% travel 10 kilometres or less. Average travel distance is 27.6 kilometres one way. According to time, more than 40% of travellers consumed one to two hours for one way, while travel time between a half to one hour is experienced by more than 30%. The percentages of traveller with travel time of a half hour or less and more than two hours are 18.74% and 8.20% respectively. The average travel time is 78.1 minutes one way.

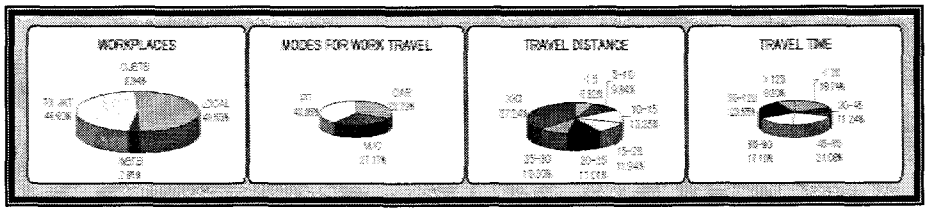


**Figure 2: Workplaces, Travel Distance, Modes Used and Travel Time**

## 4. MODE CHOICE ANALYSIS FOR WORK TRIPS

### 4.1 Model Estimation

The analysis for modal choice uses a multinomial logit model (MNL). The choice of MNL for modeling is based on some reasons, that is, not only suits to the data available, also can represent a wider range of policy variables, as well as can treat multimodal problems without difficulty (Ben-Akiva and Lerman, 1985).

The number of observations is 293 representing the number of samples that have two or more alternatively mode choices for their travel to work. The modes available are car, motorcycle and public transport. Motorcycle as a choice is a reality that many people use it as found on the survey with a significant percentage. Sample frequencies of the chosen mode are as follows Car (47.78%), motorcycle (M/C) (39.93%) and public transport (PT) (12.29%). Some variables have been tested and based on the t-statistic values obtained, some satisfied the statistical requirements and some others did not. The final variables used in the model are shown in Table 1 of the result of model estimation.

**Table 1: The Result of Analysis on Mode Choice Model for Work Trips**

| VARIABLES | ESTIMATE | t-statistic VALUE |
|---|---|---|
| Constant to Car | 3.1514 | 3.0837 |
| Constant to M/C | 0.0763 | 1.5813 |
| In Vehicle Time (mnt) | -0.0270 | -2.2313 |
| Out of Vehicle/Travel Distance (mnt/km) | -1.9048 | -3.0464 |
| Travel Cost/Household Income (Rp.000/Rp.000) | -244.1680 | -2.1794 |
| No. of Cars available in the Car Owning Household | 1.1712 | 3.2788 |
| Dummy, =1 if Working Place for Car and M/C Choices is in Jakarta; =0 otherwise | 3.0734 | 3.7337 |
| No. of Observations | | 293 |
| Initial Log Likelihood, L(0) | | -220.9300 |
| Log Likelihood-Constant Only, L(c) | | -111.4660 |
| Final Log Likelihood, L(β) | | -80.2822 |
| Likelihood Ratio, -2{L(0)-L(β)} | | 281.2956 |
| Likelihood Ratio, -2{L(c)-L(β)} | | 62.3676 |
| Likelihood Index, rho-squared ($\rho^2$) | | 0.6366 |
| Adjusted rho-squared ($\rho^{-2}$) | | 0.6049 |

### 4.2 Model Interpretation

**Statistical Performance**

All estimated parameters are significantly different to zero at 90 percents confidence level. The likelihood ratio of the model was also calculated against the log likelihood for constant only [L(c)]. This resulted a much higher value compared to the tabulated $\chi^2$ at the 99 percents confidence level ($\chi^2_{6.0.01}$ = 16.81) that means a good fit statistically.

The constants to car and motorcycle show positive values as predicted that mean people tend to drive to work or take motorcycle than public transport. The constant value of car that is much higher than motorcycle value gives a sign that car greatly more attractive than motorcycle as a mode for travel to work. There is a possible reason in which even though M/C is more flexible and cheaper than car, but car is more comfortable and safer compared to M/C in the trafficked roads where these service quality factors of road were not included in the model.

**Policy Variables**

Three main policy variables to be analysed in the model, that is, in-vehicle-time (IVT), out-of-vehicle-time (OVT) associated with travel distance, and travel cost associated with family income. IVT and OVT convince as important variables to mode choice model for work trip because work trip as a compulsory trip is more time considering related decision. Hence IVT and OVT take place as sensitive determinants in conducting work trip.

The model estimates a trade-off of 3.44 OVT minute that is equal to a minute of IVT. It is also estimated that the value of in-vehicle-time is equal to Rp. 180/minute or Rp. 10,800/hour (US$1.35; US$1= Rp.8000 in July 2000) and the value of out-of-vehicle-time is equal to Rp. 620/minute or Rp. 37,200/hour (US$4.65).

**Trip Characteristics and Socio-Economic Variables**

Four variables related to trip characteristics and socio-economic variables are travel distance (associated with OVT), family income (associated with travel cost), car availability and workplaces. The estimated value for car availability and workplace are as predicted. The positive sign of those two is supported by empirical evidence that increasing car ownership gives an increased preference for driving, while for workplace, a positive value means either car or motorcycle is the better mode choice compared to public transport due to insufficient capacity and poor service quality of public transport as well as congested road network. Further, people with good socio-economic level tend to use private transport to avoid undesired PT services such frequently changes, long stranded for a seat and even within congested roads etc., also public transport cannot be hoped as satisfactorily mode to work. People with better income would choose to spend more money in their own car, particularly for long distance working trip in order to minimize the disappointment to public transport services and severe traffic condition.

### 4.3 Modal Share Estimation

Via sample enumeration approach, the model estimates current modal share of the available modes is as follows: Car occupies 45.87%, motorcycle takes 35.62% and public transport shares 18.51%. This means that private transport will be the main mode choice for work trips from new housing areas as public transport remains unchanged and even worse in service quality and coverage. Hence car-oriented communities will no doubt build up significantly. Motorcycle could be a captive mode. Its users would switch to public transport if there is a significant improvement on its service quality and coverage, but inversely, they would move to car if public transport fails to improve its performance as family income goes up.

## 5. CONCLUSIONS

Large scale housing developments in JABOTABEK is as an example of implementation on current policy of housing development in Indonesia. Facts show that such developments have created inefficient and undesirable sprawled development patterns with poor support of transport system; and even have accelerated swiftly car-oriented communities. This is clearly proved by the evidence on the result of the estimated modal share of work travel by main workers from new housing areas.

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