Study on the Impact of Intercity Bus Terminal Relocation to Utilization Level of Bus Terminal A Case Study of Probolinggo City, Indonesia

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1. Introduction

In Indonesia, intercity bus terminal plays an important role to serve transfer passengers, especially between intercity and intracity modes. Recently, there has been a growing tendency for the city's local government to relocate the intercity bus terminal from city center to urban periphery (Dimitriou, 1993). Some objectives of intercity bus terminal relocation are to increase level of service of bus terminal by increasing capacity, reduce traffic congestion in the street nearby old bus terminal, stimulate urban development, and increase local government revenue. In East Java Province, statistical data show that among 45 bus terminal in operation, 19 of them have been relocated.

Earlier studies on the impact of bus terminal relocation on traffic congestion have been done by some researchers (Holik, 1990; Soenarman, 1995). However, the result shows that relocation only moving the traffic congestion place, from old bus terminal area to new one. The fact that bus terminal relocation caused more inconvenience to intercity passenger, leading to reduce the use of intercity bus terminal by utilizing informal transfer place, suggested the need to study the impact of bus terminal relocation to the changing on the utilization level of intercity bus terminal. This utilization level is consider to be important, because local government want to increase their revenue, since terminal fee is considered to be one of a potential new tax for local government (Kristiadi,1987). Second, as the construction cost for new bus terminal usually is a credit from central government, there is a need to pay back those credit. In addition, Minister of Transport stated that there is a need to evaluate the intercity bus terminal relocation policy (Bisnis Indonesia, 1995) because travel time and cost of intercity passenger are increased due to farther distance. There is no previous study about such an impact, therefore this study is the first attempt to get a better understanding about the reducing utilization level of bus terminal after relocation.

The objectives of this paper are: (1) to examine the impact of bus terminal relocation to utilization level of bus terminal; (2) to identify the important factors influencing intercity bus terminal usage, by developing a behavioral model of bus terminal usage; (3) to propose measures to solve the need of intercity bus terminal development due to an increase in travel demand. In March 1997, a revealed preference sample survey has been conducted in Probolinggo City, an intermediate size city with the population of about 180,000, which relocated the intercity bus terminal in 1992. This city was chosen as a study area because it represents the typical bus terminal relocation, has a relatively better performance than other cities, and it was assumed that 5-year period makes traveler have already adapted.

2. Data and Analysis

At present, there are three major intercity bus routes in Probolinggo City, namely for: Surabaya, Situbondo and Lumajang destinations. In addition to the new bus terminal, there are three major informal transfer places, one for each direction, those are Ketapang Junction for Surabaya direction, Randupangger Junction for Situbondo and Jorongan Junction for Lumajang. Revealed preference data have been collected in this study, and choice-based sampling was applied. Here, direct interview was conducted in the bus terminal and three informal transfer places. In Probolinggo City, there are two types of public transport that can be used: intracity minibus and becak (rickshaw). Other access mode are walk, bicycle, motorcycle or car. However, as the distance of bus terminal and two of informal transfer place from city center is about 5 kms, intracity minibus was dominantly used (75%).

For each passenger the following data were obtained: origin of trip, possible access modes and chosen access mode to bus terminal and respective informal transfer place, access distance, access time, access cost, transfer time, waiting time and transfer cost. Other trip information was also collected, such as: frequency of using existing bus terminal, trip purpose, number of accompanying person, number of luggage, etc. More importantly, the statements about their experience in using old bus terminal have been collected, these include: possible access modes and chosen access mode, and frequency of their usage. Socio-economic data were also collected for the analysis, such as: sex, age, education level, occupation, income level, car ownership and status of city resident.

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A binary choice logit model has been selected since there is a need to analyze the choice between using bus terminal and one of those three informal nearest transfer places respective to the intercity direction. As the information for respective trip to go to alternative transfer place was not collected directly from respondent, some calculation is needed to provide such a data for trip comparison between chosen and alternative transfer place. Here, it was assumed that the alternative trip is using intracity minibus, as this mode is dominantly used to reach bus terminal and those other three informal transfer places (junction). An a priori assumption is that the important variables affecting the choice of transfer place are access distance, access time, access cost, transfer time, waiting time and transfer cost. Access distance is the distance between the origin of trip to transfer place (bus terminal or junction). Access time is defined as in-vehicle travel time from the origin of that trip to transfer place. Transfer time is defined as the time required to walk after get off the access mode to the place the passenger will wait the intercity vehicle, this include the ticketing in the case of bus terminal. Waiting time is defined as the time which required for passenger to wait the intercity vehicle, it start from the time when they reach waiting place until they get on the intercity vehicle. Access cost is the amount of money that passenger should pay to reach transfer place, however due to flat fare system of intracity minibus (Rp.300), the difference between access cost to bus terminal and access cost to transfer place will be normally zero, therefore it may not affecting the passenger choice. Transfer cost is paid only by the person who transfer from intracity access mode to intercity mode in the bus terminal, however the amount is small (Rp.100), therefore it also may not affect the choice of transfer place.

3. Intercity Bus Terminal Usage Choice Model

There are 573 valid samples have been collected within 5 days of data collection. From the collected samples, 244 respondents are choice user, therefore for the purpose of model analysis only these data will be used, among them 32% are bus terminal user. In relation with the usage of old bus terminal, among 244 choice respondent it was found that 167 of respondent stated that they have such an experience. In term of frequency of using bus terminal before and after relocation, it can be concluded that there is a decreasing situation. Figure 1 shows that almost 20% of respondent was give up to use a new bus terminal anymore. If we assume that 50% of using bus terminal as a limit to measure the share between those who use bus terminal and those who was not, then it can be concluded that the share of passenger who use bus terminal before and after relocation was about 85% and 50%, respectively. This imply that the decrease of about 35% of bus terminal user, after relocation.

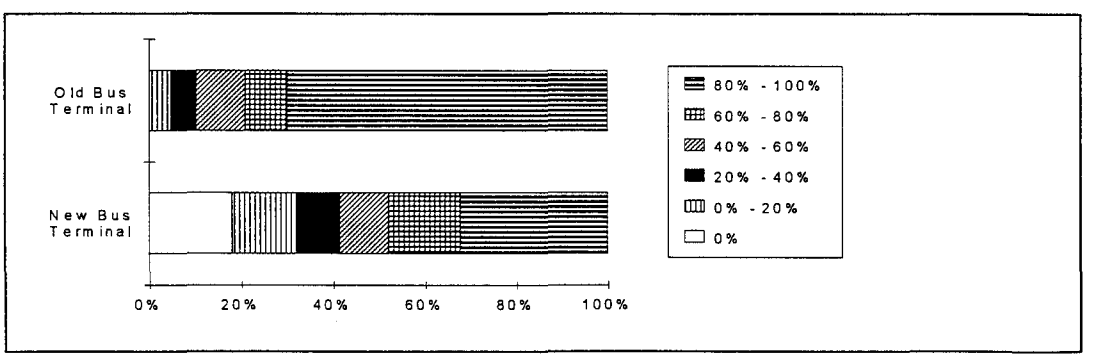

Figure 1. The Frequency of Using Intercity Bus Terminal (For choice user who have experienced in using old and present intercity bus terminal, $n = 167$)

The hypothetical assumption taken in developing the model is that intercity passenger are mostly concern with variable time. Moreover, as access distance and access time have a relatively high correlation (0.70), and access time was more significant than access distance, therefore in the next step of analysis, each of variable time and its combination was checked. As a priori assumption stated, access cost and transfer cost were not significantly affect the choice of usage bus terminal. Some socio-economic variables have also been tested to be included in the model. Variables such as education level, sex and status of city's resident was not influencing as the t-value was lower than 0.5. It is interesting to know that not only city's resident but also outsider were using informal transfer place, as relocation was done 5 years before.

Table 1. Definition of Variables for Intercity Bus Terminal Usage Choice Model

Name	Description
Bus Terminal (bt) Constant	= 1, if using bus terminal; 0 = otherwise
Access time, minutes	in vehicle travel time to reach bus terminal or alternative junction
Transfer time, minutes	transfer time in bus terminal or alternative junction
Waiting time, minutes	waiting time in bus terminal or alternative junction
Out-of-vehicle time, minutes	transfer time + waiting time in bus terminal or alternative junction
Total time, minutes	summation of access time, transfer time and waiting time in bus terminal or alternative junction
No of luggage	common variables, number of luggage bring by respondent
Age	common variables, age of respondent
Income level	common variables, monthly household income level of respondent, is: = 1, for income that less than 50,000 rupiah = 2, for income that lies between 50,000 and 100,000 rupiah = 3, for income that lies between 100,000 and 200,000 rupiah = 4, for income that lies between 200,000 and 300,000 rupiah = 5, for income that lies between 300,000 and 500,000 rupiah = 6, for income that more than 500,000 rupiah

Table 2 Parameter Estimation Result for Intercity Bus Terminal Usage Choice Model

Variables Name	Model 1	Model 2	Model 3	Model 4
Bus Terminal-Constant	- 0.78526 (0.960)	-0.98812 (1.229)	-1.01678 (1.259)	-1.18027 (1.556)
Access time	- 0.15811 (6.229)	-0.15173 (6.125)	-0.15135 (6.211)	
Transfer time	- 0.15087 (1.356)	-0.15383 (1.386)		
Waiting time	0.05260 (1.642)			
Out-of-Vehicle time			0.01517 (0.547)	
Total time				-0.09104 (5.068)
No of Luggage	0.72131 (3.351)	0.72527 (3.362)	0.65637 (3.216)	0.70765 (3.590)
Age	- 0.04639 (2.535)	-0.04845 (2.666)	-0.04842 (2.653)	-0.05149 (2.852)
Income Level	0.36606 (2.543)	0.38330 (2.677)	0.39212 (2.758)	0.33185 (2.350)
No. of Cases	244	244	244	244
Log Likelihood at B=0	-151.347	-151.347	-151.347	-151.347
Log Likelihood at conv.	-103.986	-105.409	-106.222	-117.796
Log Likelihood Ratio	94.723	91.876	90.251	67.103
Rho Squares	0.313	0.304	0.298	0.220
Percent right	0.766	0.745	0.760	0.705

Notes: ( ) is t-value

Table 1 presents the variables included in the specification of intercity bus terminal usage choice model, while Table 2 shows four model that have been tried among other alternatives that did not presented here. Model 1 shows that although rho-squares and percent right is high, but the estimate parameter of waiting time was wrongly sign. In model 2, transfer time was statistically found to be insignificant. Model 3 combine transfer time and waiting time as out-of vehicle time, however the sign of the estimate parameter of out-of-vehicle time was found to be wrong. Finally model 4 is chosen for this analysis since all estimated parameters have correct sign and are statistically significant (except the bus terminal-constant). The log-likelihood ratio is higher than the tabulated χ^2 at the 99 percent confidence level. The rho square is good enough and more than criteria suggested by Ortuzar & Willumsen (1990) for sample proportion selecting the one alternative 0.7 that is 0.12. However, the percent right shows that the predicting capability of model was not high enough, this suggest that there must be other factors that affecting the choice.

Total time which consist of access time, transfer time and waiting time was found to be significantly influencing intercity passenger on the usage of bus terminal, and the estimate is negative, since intercity passenger prefers shorter access time. The number of luggage brought by passenger is highly

influencing the usage of bus terminal, this can be explained that passenger who bring more luggage want to get the seat in intercity bus, therefore they will use bus terminal as the possibility to get the seat is greater than if they use informal transfer place. The model shows the significance of variable age and income of passenger, hence the sign shows that younger and higher income passenger tend to use bus terminal.

The capability of the model to predict the situation before relocation was not checked by the model developed here, because the availability of access mode, that is intracity minibus was small before relocation, therefore the influence of access mode choice should be analyzed, first. With regard to future policy, there are two possibilities that should be considered. First, the relocation of bus terminal policy should be evaluated carefully, since the relocation makes bus terminal farther from their demand, unless new bus terminal will be relocated to future city center. The importance of total time that influencing the usage of bus terminal shows that passenger wants to have a higher accessible bus terminal, and the most accessible location from all city area in most cases are the city center, therefore expansion of the former intercity bus terminal has to be taken into consideration. In order to reduce the congestion in city center, it is better to start by introducing traffic restraint measures to reduce the usage of private car. Second, in the case of bus terminal that has already been relocated, local government should reduce access time either by rearranging the intracity minibus routes or try to scheduling intracity minibus. Other effort should also be done by re-design the lay-out of existing bus terminal, in order to reduce transfer time. Unfortunately the effect of access cost and transfer cost are not able to be identified in the case study, and this makes the analysis on pricing measure was not possible. Local government may use such a transfer cost to be applied also to those who get on the intercity vehicle in the places other than bus terminal, this can be done by incorporating transfer cost into the intercity fare.

4. Conclusions

This paper reveals three main conclusions: (1) The impact of intercity bus terminal relocation on the changes in the level of bus terminal usage was existed, however the model is questionable to be used in explaining how much the difference of bus terminal users before and after relocation. The analysis of the model presented here is in a premature stage, however we found the influencing factor of decreasing utilization level of bus terminal; (2) Major policy variables affecting the use of intercity bus terminal is total time, which consist of access time, transfer time and waiting time, while other influencing variables are number of luggage brought by the passenger, their age and income; (3). Two future policies should be considered. Firstly, in the case of the city that have not yet relocated their bus terminal, relocation should be considered carefully. The relocation of intercity bus terminal can be done if some other specific reason justifying it, such as: capacity, congestion, etc. Secondly, in the case of the city that already relocate their bus terminal, to increase the usage level of bus terminal is by rearranging the intracity public transport route and scheduling it to minimize total time. The improvement may also be done by re-design the lay out of new bus terminal to reduce transfer time.

With respect to future planning on intercity bus terminal development, behavioral models of intercity bus terminal usage choice model provide an important tool for local government as a decision maker. Although conceptually this model development is more complicated than some of the simple approach that they applied now, however their advantages argue strongly for their adoption. The next problem is related with the need of increasing the revenue of local government as one of the factors motivating the bus terminal relocation, at the cost of increasing access time and cost of passenger, leads to decreasing number of bus terminal users. Further research is necessary to optimize the objective of increasing local government revenue and the intercity passenger's need to have a better accessibility and service level of bus terminal. As the amount of existing transfer cost does not have any basis for calculation, the analysis on deciding this transfer cost based on passenger's willingness is badly needed. This analysis will show the potential of privatization and other type of joint development of bus terminal operation.

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