Travel cost budget distributions among household life stages considering bus users in Banda Aceh

A Putri¹, S Sugiarto², S M Saleh² and D Basrin³

¹Civil Engineering Postgraduate Program, Department of Civil Engineering, Universitas Syiah Kuala, Banda Aceh, Indonesia
²Department of Civil Engineering, Universitas Syiah Kuala, Banda Aceh, Indonesia
³Department of Civil Engineering, Universitas Samudra, Langsa, Indonesia

Abstract. This study aims to investigate the average travel cost budget (TCB) distributions among household life stages (HLS) groups considering the bus users of Trans-Koetaradja in Banda Aceh, capital of Aceh province. This research was conducted within three corridors of Trans Koetaradja. The onboard survey is performed to collect bus users related information such as their monthly travel budget, socio-economic attributes, and travel/mobility characteristics. In this study, we only consider to analysis the distributions and characteristics obtained data sets by deeply investigating socio-demographics and travel attributes of bus users. The analysis result reveals that the group 3 (families with pre-school children) spent the highest average of TCB (0.442 million IDR/month) and group 1 (single person) spent the lowest TCB (0.280 million IDR/month). While group 2 (childless couple) has portion the lowest average of TCB about 10.2% from their monthly income, and group 3 (families with pre-school children) has shared the highest TCB accounting up to 14.4% from their monthly income compared to the remaining groups. This result depicts that an average TCB across HLS groups is considerably high, especially early household life stages development. It is may partially due to a limitation on their monthly income and lack of affordable transport mode for them.

1. Introduction

To days, promising economic development, together with rapid urbanization, leads to increase people travel to satisfy their daily routines. In order to do that, people need to allocate more time and money to their transportations. Consequently, the more trips they are made, the greater the time and money allocated for traveling. The allocation of money for travel refers to the so-called travel cost budget (TCB). The TCB defines as the maximum amount of money that households/individuals willing to allocate for their transportation within a month [1, 2]. Furthermore, an investigation by Sugiarto et al. [1] and Saleh et al. [2] approved that the variation of TCB is significantly influenced by the household’s monthly income as well as life stages development of the households. Sugiarto et al. [1] further revealed that changes in technology, incomes, attitudes, social demographics and travel behaviors could have a significant influence on travel cost expenditure.

In Banda Aceh, highly automobile ownership (i.e., car and motorcycle), which leads to private mode dependency, creates several transport-related problems such as increased travel time, additional fuel consumption and environmental deterioration [3-5]. This problem could be mitigated by reducing people’s dependence on private mode by shifting their mode to public transport mode, such as the urban...
bus system. Public transportation is believed able to reduce people's dependence on private vehicles in Banda Aceh [6-8]. Furthermore, the government aims to implement bus reform so-called “Trans Koetaradja” with a full charge by the years of 2020. The Trans Koetaradja now is under trial runs, a free of charge is applied within running corridors [6]. It is argued that the willingness and ability to pay are significantly influencing by the TCB in order to determine the appropriate tariff of the bus.

The policy, in applying the tariff, will cause problems, especially for low income and captive commuters. Affordable public transport is necessary to be provided by the government, especially for those who highly dependent on public mode. Moreover, the TCB highly depends on household life stages (HLS). The understanding of the distribution of TCB across HLS could be used as a reference in the establishment of this bus tariff efficiently. Therefore, this study was conducted to determine the average TCB across HLS as well as their socio-economic and mobility attributes prior to the implementation of the tariff of the bus. Furthermore, the TCB could be used to determine the ability to pay of people in Banda Aceh prior to the tariff establishment. It should be noted that the HLS is classified based on the previous work done by [1].

Figure 1. Banda Aceh city (map Data © 2019 Google).

Figure 2. Study area within Trans Koetaradja corridors 1, 2B and 3 [8].

According to Sugiarto et al. [1], the HLS is classified into six groups: (1) group 1 (single-person household); (2) group 2 (childless-couple household); (3) group 3 (families with pre-school children);
(4) group 4 (families with young school children); (5) group 5 (families with college/university children); and (6) group 6 (families only with adults).

The onboard survey was conducted to collect respondent’s socio-economic and travel attributes. This study was performed within Trans Koetardja corridors, namely corridor 1 (the City Center – Darussalam), corridor 2B (City Center – Ulee Lheue), and corridor 3 (City Center – Mata Ie), as illustrated in figure 2. Using onboard collected data, we investigate the average TCB distributions across HLS as well as their attributes of socio-economic and travel characteristics. The rest of this paper is systematized into several sections that describe the survey and data profiles, distribution data set, and discussion and conclusions of the study at the end of the paper.

2. Methodology
The survey was conducted in Banda Aceh (see figure 1) within three corridors of Trans Koetaradja. The target respondents were the householders who used the bus for their commuting. The survey was conducted by direct-interview to the householders. A total of 450 questionnaires with valid answers were collected and analyzed in this study. The summary of the questionnaire used can be seen in table 1 which consists of survey time, target area, distribution method, valid number of samples, and outline of the questionnaire. The questionnaire was designed to be able to gather information related to respondents’ socio-economic attributes and travel attributes, which can be seen in table 1.

Table 1. Summary of SP questionnaire.

| Description                  | Details                                                                 |
|------------------------------|-------------------------------------------------------------------------|
| Time of survey               | April 2019                                                             |
| Target location              | Banda Aceh, Aceh Province                                               |
| Distribution methods         | A paper-pencil based direct interviews and collected by the enumerator based on the onboard survey |
| Number of valid questionnaires | 450 samples                                                           |
| Questionnaire outline:       |                                                                        |
| Social-economic attributes   | Gender, age, education, occupation, income monthly, monthly travel expenditure, housing owned status, household member, motorcycle ownership, car ownership. |
| Travel attributes            | Mode use, public transportation use, frequency of public usage mode in daily life, willingness to use public transportation, travel destination. |

This questionnaire was designed to obtain information related to respondents. As mentioned in table 1, information pertaining to socio-demographic characteristics and travel behavior is obtained by direct interviews adopted from previous works done by [8-11]. In this study, surveyors used 450 samples of data that had been collected. When the interview data has been collected, the data is separated according to the respective HLS group. Then, the data were analyzed for revealing the distribution of the data, especially for TCB across HLS groups. Prior to the distribution analysis of the respondent’s attributes, we aggregated our datasets into several HLS.

3. Results and discussion
The aggregation result across HLS is described in figure 3. HLS group 4 (family with young school children) has larger portion of the sample (N=170) compared to the remaining HLS.
Figure 3. Aggregation of HLS group.

Table 2. Distributions of socio-demographic attributes.

| Item               | Category                  | Number of Samples | Share (%) |
|--------------------|---------------------------|-------------------|-----------|
| Gender             | Male                      | 138               | 30.7%     |
|                    | Female                    | 312               | 69.3%     |
| Age                | 30-49 years               | 291               | 64.7%     |
|                    | 50-59 years               | 95                | 21.1%     |
|                    | 60 years or more          | 64                | 14.2%     |
| Education          | Senior High School        | 249               | 55.3%     |
|                    | College                   | 74                | 16.4%     |
|                    | University / Bachelor     | 127               | 28.3%     |
| Occupation         | Government Employee       | 52                | 11.6%     |
|                    | Private Employee          | 132               | 29.3%     |
|                    | Retired                   | 27                | 6.0%      |
|                    | Trader                    | 66                | 14.7%     |
|                    | Housewife                 | 173               | 38.4%     |
| Housing Own Status | Owned                     | 280               | 62.2%     |
|                    | Family's Housing          | 66                | 14.7%     |
|                    | Renting                   | 101               | 22.4%     |
|                    | Others                    | 3                 | 0.7%      |
| Household Members  | 1-2 person                | 122               | 27.1%     |
|                    | 3-5 person                | 295               | 65.6%     |
|                    | 6-10 person               | 31                | 6.9%      |
|                    | 10 person or more         | 2                 | 0.4%      |
| Car Ownership      | None                      | 394               | 87.6%     |
|                    | 1-2 unit                  | 56                | 12.4%     |
| Motorcycle Ownership | None                     | 208               | 46.2%     |
|                    | 1-2 unit                  | 231               | 51.3%     |
|                    | 3 unit or more            | 11                | 2.4%      |
Table 2 contains data on the socio-demographic characteristics and travel attributes of targeted respondents. As for gender, female respondents (69.3%) have dominated our data sets, accounting for up to 69.3% compared to male respondents. Young respondents have larger proportion compared to older people in the data set, and they are between 30-49 years old or about 64.7%. Looking to education attribute, having high school education level and bachelor’s degree are predominant up to 83.6% of respondents.

Concerning occupation attributes, respondents with private employees (29.3%) and housewives (38.4%) have a more substantial share in data sets. Interestingly, most of the respondents have not owned cars. Therefore they are more likely to use the bus as their daily mode, as shown in table 2. In addition, the car ownership level is nearly 12.5% of respondents. Furthermore, our datasets reveal that respondents who have their own homes are accounting more than 60%, and the remaining households are renting and stay with their parents. Moreover, the household member attribute shows close to 65% of households having 3 to 5 members, only 7.3% of the households have household member larger than five members.

Table 3. Distributions of travel data attributes.

| Item                                      | Category                  | Number of Samples | Share (%) |
|-------------------------------------------|---------------------------|-------------------|-----------|
| Representative Mode Use                   | Motorcycle                | 66                | 14.7%     |
|                                          | Car                       | 15                | 3.3%      |
|                                          | Public Transportation     | 369               | 82.0%     |
| Public Transportation Use                 | Trans Koetaradja (Bus)    | 355               | 96.2%     |
|                                          | Online Public Transport   | 3                 | 0.8%      |
|                                          | Labi-Labi                 | 11                | 3.0%      |
| Frequency using public mode               | 1-2 days a week           | 27                | 7.3%      |
|                                          | 3-4 days a week           | 129               | 35.0%     |
|                                          | 5 days a week or more     | 213               | 57.7%     |
| If they used a car for representative     | 1 day a week              | 23                | 28.4%     |
| mode used, if they are asked to use a     | 2 days a week             | 28                | 34.6%     |
| bus how frequently they willing to use a  | 3 days a week             | 30                | 37.0%     |
| bus in a week                            |                           |                   |           |
| Travel Destination                        | Work                      | 166               | 36.9%     |
|                                          | Shopping                  | 196               | 43.6%     |
|                                          | Pick up & drop to school  | 5                 | 1.1%      |
|                                          | Social                    | 47                | 10.4%     |
|                                          | Entertainment             | 36                | 8.0%      |

Looking at the respondent's travel attributes, table 3 discloses that most of the respondents use public transport, mainly bus for their daily routines accounting close to 82%. Amongst them are frequently using the bus (more than three times a week) for more than 90% of respondents. As for the trip, going to work and shopping has dominated activities dataset (80.5%).

Figure 4 illustrates the distribution of monthly income across households. Figure 5 describes the monthly TCB corresponding HLS as well as their share of TCB. As for all data sets, we found that an average monthly income is 3.2 million (IDR), while the average TCB is 0.324 million (IDR). Looking at the highest average monthly income, the HLS of group 2 (childless-couple) is considered as the highest one, which is 3.7 million (IDR) per month, and the lowest average monthly income belongs to
HLS of group 1 (single-person) of about 2.7 million (IDR). For TCB, figure 5 reveals that the highest average TCB has corresponded to the HLS of group 3 (families with pre-school children) accounting up to 0.442 million (IDR) per month or 14.4% shared from their monthly income, and the lowest average TCB is the HLS of group 1 (single-person) for about 0.280 million (IDR) per month or 12.8% from their monthly income.

**Figure 4.** Distribution of monthly income.

**Figure 5.** Distributions of TCB.
Figure 6 indicates that 46% of group 1 (single-person) has the lowest income, with 1-2.9 million IDR, and the other life stages have 48% to 59% with 3-4.9 million IDR. Figure 5 indicates that 46% of group 3 (families with pre-school children) have the highest TCB with 0.250-725 million IDR and the other life stages have less 0.250 million IDR (52% to 76%). Figure 6 indicates that 43% of group 3 has the highest share of TCB with a share of 10-20%, and the other life stages have 47% to 65% with a percentage of 0-10%. It is presumed that several variables are affecting the variation of the TCB across HLS. For instance, table 3 depicts the number of family members and owned car characteristics corresponding to more disbursement for money expenditure on transport. The purpose of the trip for mandatory activities also results in more higher frequency in travel; as a consequence, it would like to add more money for traveling.

4. Conclusion
This study reveals that an average monthly income is 3.2 million (IDR), while the average TCB is 0.324 million (IDR). The highest average monthly income belongs to group 2 HLS (childless-couple) and the lowest average monthly income signs to group 1 (single-person) for 3.7 million (IDR) per month and 2.7 million (IDR) per month, respectively. This monthly income seems to be associated with the TCB, specifically for group 1 HLS. The distribution of the dataset further discloses that the highest average TCB has corresponded to the HLS of group 3 (families with pre-school children) and the lowest average TCB is the HLS of group 2 (childless-couple) accounting for 14.4% shared and 10.2% from their monthly incomes, respectively. This variation of share TCB may be affected by the limitation of their monthly income and their travel attributes such as owning a car, trip activity, and frequency. We hypotheses that the number of family members and owned car characteristic corresponds to more disbursement for money expenditure on transport; and, the purpose trip could result in higher frequency for traveling and consequently would like to add more money for traveling. However, further exploration is needed to confirm factors that effecting TCB across HLS, for example using the time-space prism diagram as it is applied by [1, 2] to explore money expenditure constraints in greater Jakarta.

Furthermore, the result shows that low-income HLS has a substantially higher share of TCB. It means that low-income HLS may have limited income or has limitations for spending the money on travel.
This evidence provides insight for the Government-related policymakers to consider monetary constraints when the government decides how much of the fare of the bus system must be applied. The government must consider to which income groups such policy will be imposed monetary, particularly for those who have the low-income bracket. The government policies must reflect the needs to be addressed for certain income groups in determining a more impartiality a full-charge implementation, thereby leading to more affordable public transport for citizens. A better understanding of travel behaviors is vital for successful transport planning to gain more efficient policies [10-12].

Acknowledgments
The authors would like to express their honest gratitude to Universitas Syiah Kuala for financially supported data collection of this study under Contract No. 522/UN11/SPK/PNBP/2019. Furthers thanks go to the staff and students of Transportation System Laboratory, Civil Engineering Department of Syiah Kuala University for their substantial help with the data collection.

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