SUROBOYO BUS FARES SUFFICIENCY WITH WILLINGNESS TO PAY ASPECTS

(CASE STUDY: PURABAYA BUS STATION – RAJAWALI SHELTER)

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Abstract
Suroboyo Bus is the one of public transportation based on Bus Rapid Transit as the implementations of Surabaya Municipality policy to fulfill needs of Surabaya citizens about proper public transportation according to security, safety and comfortable aspects. After it’s launching at April, 7th 2018, Suroboyo Bus has so many interests from Surabaya citizens who want to try for grand rides which it payments using plastic waste such as used drinking bottle or glass of mineral water. Payments method by using this plastic waste of drinking bottle in order to complying the objectives of Surabaya Municipality is reducing plastic wastes also citizens shouldn’t make a littering anywhere. This research is conducted to calculate how much Suroboyo Bus fares that sufficient with existing payments method due to Suroboyo Bus operations needs with using Willingness To Pay (WTP) analysis and Vehicle Operations Cost regulations. As the research results value of Willingness To Pay on weekday is IDR 4,784,12 and then on weekend is IDR 4,602,50. Value of Vehicle Operations Cost that Suroboyo Bus needed is IDR 13,500 according with regulation standard from Directorate General of Land Transportations. Reviewed on load factor value 70% that appropriate with standards from Department of Transportations, so government must subsidize Vehicle Operations Cost for Suroboyo Bus with value IDR 300/passengers-km.

Keywords: Suroboyo Bus, bus rapid transit, plastic waste, fares, Willingness To Pay, Vehicle Operations Cost

INTRODUCTION
Suroboyo Bus is the one of public transportations based on bus rapid transit that located on Surabaya City. Suroboyo Bus had officially launched by The Mayor of Surabaya at April 7th 2018. Capacity of Suroboyo Bus is able to carry 67 peoples.

Operation time of Suroboyo Bus start from 06.00 AM to 22.00 PM. This bus has width 2,40 meters and length dimension 12 meters. Suroboyo Bus also have state of art on passenger seat features which performed with various colors. Passenger seat with pink colors refers to female passengers and passenger seat with orange colors refers to male passengers which placed on backside. Passenger seat distinguishing is meant to minimize sexual harassment acts on bus. In order to supporting security assurance for bus passenger 12 CCTV units had installed inside of bus, and 3 CCTV units had installed outside of bus. Bus door also equipped with infrared sensors so that if there any passengers who stands near the door, it will not closed. The bus will not moving until the door bus is really closed. Suroboyo Bus also have emergency response system with using emergency buttons if there is a fire or accidents happened. Bus driver could press the emergency buttons and alarm will ring out and then the door bus opened automatically [1]. Payments method to get a ride on Suroboyo Bus is very unique, that is using a plastic waste such as used drinking bottle or glass of mineral water. This payment method is intended to reducing plastic waste that becoming a serious problem on environmental matters. Plastic waste that paid will be collected and then storage to Suroboyo Bus plastic waste management center. From this facility collected waste has been sold to recycling into useful materials [2]. Payments method by using this plastic waste of drinking bottle in order to complying the objectives of Surabaya Municipality is to reducing plastic waste also citizens shouldn’t make a littering [3]. Enthusiasm of Surabaya citizens to Suroboyo Bus existence proofed with the increasing of peoples interest to take a ride only on Saturday and Sunday at weekend but going on contrary at weekday. At weekday the number of Surabaya City peoples who using Suroboyo Bus the main part of public transportations are less. Considering with recent conditions somehow will affecting Suroboyo Bus Operations terms because it relying on plastic waste income.

This research is conducted to calculate how much Suroboyo Bus fares that sufficient with existing payments method due to Suroboyo Bus operations needs with using Willingness To Pay (WTP) analysis and Vehicle Operations Cost regulations.
Cost regulations.

**RESEARCH METHOD**

**A. Theory**

Public transportations which located on a big city have an important role to perform the functions as supporting people mobility to their daily activities. Factors that affected a willing of nominated passengers to choose public transportations for travelling and work trip are considerations of travel time efficiency, achievable cost of transportations, passenger safety and comfort during the trip, and efforts of nominated passengers to avoid traffic congestions [4]. Transportations need is not stand alone but it takes side by side with another needs. Transportation service demand just arise when there is another needs beside that. A lot of factor that affects determining of transportation service fares, such as people economics conditions, vehicle maintenance or spare parts cost, fuel cost and many more [5]. Transportation service fares that offered by all means of transportations for same objections will affects transportation modal choice which is bought by passengers. By increasing of people and goods mobility on its turn will claim transportation service with highly safety, security, fluency and comforts [6].

Some public transportations have a good services measurements that if complying safe, comfort, fast and achievable. Strongly considerable aspects is comfort which received by public transportations users. Assumed with passenger seat arrangements, easy of movements on bus, safe and easy embarking or alighting on bus shelter, comfort riding, and bus cleanliness conditions [7].

Basically mass public transportation means is held to reducing traffic load in transportation system, but actually this not working well as expected because of impact which generated. This impact commonly mention as traffic congested. Traffic congested happened when a number of people which expected to change their mindset from private vehicle into public transportations are not done right as possible. In contrary, a number of people who using private vehicle are increasing than public transportations users and using road together. The expectancy of public transportations existence can reducing volume of private vehicle. It concerns with characteristics of public transportations that transport fares can be added to more people or passengers. The more number of passengers giving occasion that fares per each passengers can be thrifty as low as possible [8].

Another important problems on public transportation operation system is about route and fares. Public transportation route generally adapted with the types of vehicle. Large bus have a far route, then a medium bus and last is a microbus. Else, designated routes couldn’t overlapping with another kind of public transportation, for some reason this will causing road performance decreasing such as traffic congestion and other negative effects like reducing of public transportation drivers income as consequence of inter-public transportations kind competitions. Public transportations fares could be flat fares or distance base fares. In order to establish the public transportations fares, three party must be involved, those are:

1. Public transportations provider, fares is the price from services that served;
2. Public transportations user, fares is the cost that spent whenever using public transportations;
3. Government, as an authorized corporate who legally determining official fares of public transportations [9]

Bus Rapid Transit (BRT) is a high quality, high capacity bus-based mass transit option for rapidly growing cities. Bus Rapid Transit delivers fast, reliable and cost-effective mobility through the provision of segregated lanes, enclosed stations, rapid and frequent operations. Bus Rapid Transit fares based on fares collection stationary entry rather than on buses and excellent passenger information systems. A Bus Rapid Transit system provides priority to public transport passengers, but can also greatly improve conditions for mixed traffic by solving the problem of bus stop congestion. Bus Rapid Transit infrastructure should be built in a corridor where many public transport users travel and suffer delays due to congestion. Compared to a regular bus, the journey on a Bus Rapid Transit is much quicker, because Bus Rapid Transit using bus-only lanes, passengers pay at the shelter, rather than on the bus, and the shelter floor which is the same level as the Bus Rapid Transit is easily accessible to individuals with limited mobility [10].

Willingness To Pay (WTP) usually defined as a willingness of consumers to purchase some money due to the services that provided. Willingness To Pay (WTP) is also defined as a maximum number that paid by consumers to take a benefit from service quality improvement. On Willingness To Pay (WTP) analysis calculated how far ability of each person to pay or spent a money for repairing the services process in desirable conditions. Willingness To Pay (WTP) is a value of potential utility from natural resources and services activity [11].

Factors that affecting Willingness To Pay (WTP) [12] :

1. Perceptions of consumers to the level of quality services
2. Consumer utility to public transportations which is used.
3. Facility that provided by services operators.
4. Consumers income

Willingness To Pay (WTP) value obtained by calculating average value from tariff perceptions that chosen for each kind of jobs as shown as formulations below:

**Willingness To Pay for each kind of jobs =**
Income of public transportation crew those are prime salary, social allowance, and official allowance.

Cost of transportation per day can be calculated with formulations expressed below:

\[
\text{Cost of transportation per day} = \frac{\text{cost of transportation crew}}{\text{bus production (km per year)}}
\]

4. Fuel consumption cost
Fuel consumption cost usually calculated according with amount kilometers per liters.

Fuel consumption cost can be calculated with formulations expressed below:

\[
\text{Fuel consumption cost} = \frac{\text{fuel consumption per bus (day)}}{\text{travelling distance per day (km)}}
\]

5. Tires replacement cost
Usually, within on periodic time tires replacement cost calculated according to vehicle travelled distance in kilometers.

Tires replacement cost can be calculated with formulations expressed below:

\[
\text{Tires replacement cost} = \frac{\text{number of tires usage x price of tires per each}}{\text{tires durability (km)}}
\]

6. Vehicle maintenance cost
Vehicle maintenance cost consist of cost that spent for maintenance, repairing and spare parts replacement. There are two basic of calculations to determining a value of vehicle maintenance cost, on travelling distance and periodic time (years).

Vehicle maintenance cost distinguished into two kind of maintenance:

a. Light maintenance cost:
Light maintenance cost can be calculated with formulations expressed below:

\[
\text{Light maintenance cost} = \frac{\text{light maintenance cost}}{\text{kilometers}}
\]

b. Hard maintenance cost:
Hard maintenance cost can be calculated with formulations expressed below:

\[
\text{Hard maintenance cost} = \frac{\text{hard maintenance cost}}{\text{kilometers}}
\]

7. Insurance cost
Insurance cost consist of vehicle insurance and transportation crew insurance.

Insurance cost per transportation can be calculated with formulations expressed:

\[
\text{Insurance cost} = \frac{\$ (insurance cost per year)}{\text{bus productions (km per year)}}
\]
8. Motor vehicle license and vehicle tax cost
   Motor vehicle license extension executed at once for every 5 years, but vehicle tax payment executed for every years adjustable with regulation requirements.
   Motor vehicle license cost can be calculated with formulations expressed:
   \[ \text{Motor vehicle license cost} = \frac{\text{motor vehicle license cost}}{\text{bus productions (km per year)}} \] (11)

9. Bus cleaning cost
   Bus cleaning cost can be calculated with formulations expressed:
   \[ \text{Bus cleaning cost} = \frac{\text{bus cleaning cost per month}}{\text{bus productions (km per month)}} \] (12)

10. Bus Station retribution fee
    Bus Station retribution fee calculated per day or per month. Bus Station retribution fee can be calculated with formulation expressed:
    \[ \text{Bus Station retribution fee} = \frac{\text{terminal retribution fee per day}}{\text{bus productions (km per day)}} \] (13)

11. Engine lubricants adding cost
    Engine lubricants adding cost can be calculated with formulation expressed:
    \[ \text{Machine lubricants adding cost} = \frac{\text{lubricants adding per days x lubricants price per lt}}{\text{bus productions (km per day)}} \] (14)

b. Standing cost
   Standing cost is a cost that spent when public transportations already operated. Standing cost often called as variable cost, because this cost is various depend on the result of services process.
   Cost components that included to standing cost are:
   1. Bus employee cost (besides bus crew)
   2. Management cost
      Standing cost of bus per year can be calculated with formulation expressed:
      \[ \text{Standing cost of bus per year} = \frac{\text{total of standing cost per year}}{\text{bus amount}} \] (15)

      Standing cost of bus per km can be calculated with formulation expressed:
      \[ \text{Standing cost of bus per km} = \frac{\text{standing cost of bus per year}}{\text{bus productions (km per year)}} \] (16)

Bus performance
   Bus performance can be determined by value of load factor and headway.

Load Factor
   Following with Directorate General of Land Transportations, Department of Transportations (2002), load factor is comparison between sold capacity and available capacity of transportation rolling stock for one trip that usually expressed on percent (%).
   Load factor calculations based on assumption as mentioned below:
   1. For a bus that allowed standing passengers, that is vehicle with height 1,70 meters from inside floor and minimum area 0,17 m² per passengers. Bus capacity calculated according to amount of passenger seat plus with 30%
   2. For a bus that not allowed standing passengers, bus capacity calculated equal to amount of passenger seat.
   Load factor value that appropriate with standards from Department of Transportations is 0,70 [14].

Headway
   Headway is a time interval between arrivals of two vehicle in a series on road segment. Headway can be expressed on a time or a distance. If headway expressed on a distance it called spacing [15].
   Headway value can be calculated with formulation expressed:
   \[ \text{Headway} = \frac{60 \times C \times LF}{AP} \] (17)
   with:
   \[ C = \text{vehicle capacity} \]
   \[ LF = \text{load factor} \]
   \[ AP = \text{amount of passengers per hour on observation periods} \]

B. Methodology

Problems Identifications
   Willingness To Pay (WTP) inspired by consumer behavior theory that assume a persons who choose goods and services alternatives with objective to maximize their whole satisfaction.
   Therefore, this research is head for:
   1. Calculating how much Surabaya citizen to pay Suroboyo Bus fares that sufficient with Willingness To Pay (WTP) analysis which equal with existing payments method
   2. Calculating Suroboyo Bus fares according with Vehicle Operations Cost
   3. Calculating existing prime cost that spent by government for Suroboyo Bus operation.

Data collecting
   Data collecting is carried out to obtaining several data that needed for research completion. Research data is consist of primary data and secondary data. Primary data is a data which obtained directly from locations of study by observers. Secondary data is a data which obtained from relevant office to support primary data analysis.

Primary Data
Primary data is a data which obtained directly from locations of study by observers. Primary data in this research are:

1. Amount of Suroboyo Bus passengers that embarking from Purabaya Bus Station as responders
   This data is for calculates Suroboyo Bus fares that sufficient with Willingness To Pay analysis

2. Amount of Suroboyo Bus passengers as main data for load factor calculations
   This data is used for calculates performance of Suroboyo Bus in load factor aspects

3. Existing headway time of Suroboyo Bus
   This data is used for calculates performance of Suroboyo Bus in headway time aspects

Primary data collecting procedures:

1. Responder data
   Responder data is obtained from total amount of Suroboyo Bus passengers that calculated with Slovin formulation [16]:
   \[ n = \frac{N}{N \cdot d^2 + 1} \] (18)

   with:
   n = amount of responder
   N = amount of populations
   d = number of precisions (taken = 10%)

2. Load factor calculations
   Load factor value obtained through dividing the averages of passengers amount per bus with seat capacity along trip routes. Registering amount of passengers executed with positioning surveyor at front and back door of the bus. Surveyor notes departure and arrival time of the bus and number of passengers that embark and alighting along one trips.

3. Determining headway time
   Headway time of bus obtained from registering license plate of vehicle and departing time which starts from bus station and check off arrival time when it ends on destinations. Difference of time that needed for bus to depart until arrived on Bus Station is a travel time. Travel speed is a division between travel distances with travel time.

Secondary Data

Secondary data is data which obtained from relevant office to support primary data analysis as mentioned below:

1. Amount of Suroboyo Bus rolling stock that operated from Transportation Office of Surabaya.
2. Amount of passengers records that have ride Suroboyo Bus for a last 2 years from Suroboyo Bus management office. This data is for calculating a number of responder.
3. Trip routes of Suroboyo Bus from south side (Purabaya Bus Station) to north side (Rajawali Shelter) from Suroboyo Bus management office.

RESULT AND DISCUSSION

Samples withdrawal is carried out to Suroboyo Bus passengers to observing perceptions about Willingness To Pay. A number of samples or responders are calculated from secondary data about amount of passengers that have ride Suroboyo Bus for a last 2 years from Suroboyo Bus management office. Calculations of a number of samples listed below:

\[ n = \frac{N}{N \cdot d^2 + 1} \]

\[ n = \frac{14500}{14500 \cdot (0.1)^2 + 1} \]

\[ n = 99,315 \]

\[ n \approx 100 \] responders

As the results of questionnaire distributions to 100 responders obtained that passengers income affecting Willingness To Pay aspects it shown at figures 1 as following:

![Fig.1 Percentages of Suroboyo Bus passenger income at weekday](image)

From figure 1 it is known that Suroboyo Bus passengers at weekday in low income shows that large percentage is 34% refers to IDR 500.000 – IDR 2.000.000 from total responders.

Another results of questionnaire distributions to 100 responders obtained that passengers jobs affecting Willingness To Pay aspects it shown at figures 2 as following:
Fig. 2 Percentages of Suroboyo Bus passenger jobs at weekday

From figure 2 it is known that Suroboyo Bus passengers jobs at weekday shows that large percentage is 26% refers to college or school students from total responders.

The results of questionnaire distributions to 100 responders obtained that passengers income on weekend affecting Willingness To Pay aspects it shown at figures 3 below:

Fig. 3 Percentages of Suroboyo Bus passenger income at weekend

From figure 3 it is known that Suroboyo Bus passengers income at weekend in low income shows that large percentage is 36% refers to IDR 500.000 – IDR 2.000.000 from total responders.

Another results of questionnaire distributions to 100 responders obtained that passengers jobs affecting Willingness To Pay aspects it shown at figures 4 as following:

Fig. 4 Percentages of Suroboyo Bus passenger jobs at weekend

From figure 4 it is known that Suroboyo Bus passengers jobs at weekend shows that large percentage is 30% refers to private employees from total responders.

Willingness To Pay analysis
Willingness To Pay analysis distinguished into 2 conditions:
1. Weekday conditions

On weekday conditions there are several alternatives of possible fares that offered to Suroboyo Bus as a responders: IDR 1500, IDR 4500, and IDR 5000. The results of primary data survey presented as table 1 following:

Table 1. Willingness To Pay of Suroboyo Bus passengers on weekday

From table 1 known that Suroboyo Bus passengers with jobs as college or school students get high percentages on proposed fares IDR 4500 at value 16% and 10% on proposed fares IDR 5000.

Willingness To Pay calculations for each jobs category listed as following:
1. Willingness To Pay calculations for public servant:
   \[
   = \frac{(6 \times 4500) + (10 \times 5000)}{16}
   = IDR 4812.50
   \]

2. Willingness To Pay calculations for private employees:
   \[
   = \frac{(8 \times 4500) + (10 \times 5000)}{18}
   = IDR 4777.70
   \]
3. Willingness To Pay calculations for college or school students:
\[ \frac{(16 \times 4500) + (10 \times 5000)}{26} = \text{IDR 4692.30} \]

4. Willingness To Pay calculations for housewife:
\[ \frac{(12 \times 4500) + (8 \times 5000)}{18} = \text{IDR 4722.2} \]

5. Willingness To Pay calculations for entrepreneurs:
\[ \frac{(10 \times 4500) + (8 \times 5000)}{6} = \text{IDR 4700} \]

6. Willingness To Pay calculations for others:
\[ \frac{2 \times 5000}{2} = \text{IDR 5000} \]

7. Willingness To Pay calculations for all categories of jobs:
\[ \frac{4812.50 + 4777.70 + 4692.30 + 4700 + 4722.2 + 5000}{6} = \text{IDR 4784.12} \]

2. Weekend conditions
On weekend conditions there are several alternatives of possible fares that offered to Suroboyo Bus as a responders: IDR 1500, IDR 4500, and IDR 5000. From the results of primary data survey presented as table 2 following:

<table>
<thead>
<tr>
<th>Jobs</th>
<th>Willingness To Pay</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IDR 1500</td>
</tr>
<tr>
<td>Public servant</td>
<td>Σ</td>
</tr>
<tr>
<td>%</td>
<td>-</td>
</tr>
<tr>
<td>Private employees</td>
<td>Σ</td>
</tr>
<tr>
<td>%</td>
<td>2%</td>
</tr>
<tr>
<td>College/school students</td>
<td>Σ</td>
</tr>
<tr>
<td>%</td>
<td>8%</td>
</tr>
<tr>
<td>Housewife</td>
<td>Σ</td>
</tr>
<tr>
<td>%</td>
<td>8%</td>
</tr>
<tr>
<td>Entrepreneurs</td>
<td>Σ</td>
</tr>
<tr>
<td>%</td>
<td>2%</td>
</tr>
<tr>
<td>Others</td>
<td>Σ</td>
</tr>
<tr>
<td>%</td>
<td>4%</td>
</tr>
<tr>
<td>Total</td>
<td>Σ</td>
</tr>
<tr>
<td>%</td>
<td>4%</td>
</tr>
</tbody>
</table>

= IDR 4692.30

Table 2. Willingness To Pay of Suroboyo Bus passengers on weekend

From table 2 known that Suroboyo Bus passengers with jobs as private employees get high percentages on
proposed fares IDR 5000 at value 18% and 14% on proposed fares IDR 4500.

Willingness To Pay calculations for each jobs category listed as following:
1. Willingness To Pay calculations for public servant:
   \[ \frac{10 \times 4500 + (6 \times 5000)}{16} \]
   = IDR 4687.50

2. Willingness To Pay calculations for private employees:
   \[ \frac{(2 \times 1500) + (14 \times 4500) + (18 \times 5000)}{34} \]
   = IDR 4588.24

3. Willingness To Pay calculations for college or school students:
   \[ \frac{8 \times 4500 + (6 \times 5000)}{14} \]
   = IDR 4714.29

4. Willingness To Pay calculations for housewife:
   \[ \frac{(8 \times 4500) + (8 \times 5000)}{16} \]
   = IDR 4750

5. Willingness To Pay calculations for entrepreneurs:
   \[ \frac{(2 \times 1500) + (6 \times 4500) + (8 \times 5000)}{16} \]
   = IDR 4375

6. Willingness To Pay calculations for others:
   \[ \frac{(4 \times 4500)}{4} \]
   = IDR 4500

7. Willingness To Pay calculations for all categories of jobs:
   \[ \frac{4687.50 + 4588.24 + 4714.29 + 4750 + 4375 + 4500}{6} \]
   = IDR 4602.50

From calculations of Willingness To Pay on weekday and weekend conditions noticed that Willingness To Pay on weekday value is most resolve with IDR 4784.12 or equal with IDR 4800.

Vehicle Operations Cost analysis
In order to supporting vehicle operations cost analysis, there are data about specifications of Suroboyo Bus and travelling distance productions as presented below:

1. Suroboyo Bus Specifications:
   a. Brands : Mercedes-Benz O500U 1726
   b. Service type : city bus
   c. Passengers capacity : 67 persons (on seat and standing)
   d. Fuel tank : 300 l
   e. Engine lubricants : 28 l
   f. Gearbox : 30 l
   g. Differential gear : 10 l

2. Productions per bus:
   a. Travel distance / trip : 19 km
   b. Travel frequency : 12 trips / day
   c. Travel distance / day : 19 x 12
      = 228 km / day
   d. Travel distance / month : 228 km x 30
      = 6840 km
   e. Travel distance / year : 6840 x 12
      = 82080 km
   f. Passengers / trip : 725 (weekday And weekend)

A. Fixed cost analysis
   1. Vehicle depreciation cost:
      a. Bus vehicle prices : IDR 2.170.000.000
      b. Depreciation time : 5 years
      c. Scrap value : 20% x bus vehicle prices
         = 20% x 2.170.000.000
         = IDR 434.000.000

   d. Vehicle depreciation cost:
      \[ \frac{bus \text{ vehicle prices} - \text{scrap value}}{\text{productions per bus} \times \text{reduction time}} \]
      \[ = \frac{2.170.000.000 - 434.000.000}{82080 \times 5} \]
      = IDR 4230,02 / bus - km

   2. Financial capital interest (secondary data): IDR 182.26 / bus – km

   3. Fuel consumption cost:
      a. Suroboyo Bus fuel consumption: 42,22 l
      b. Travel distance / day : 228 km / day
      c. Fuel prices (Suroboyo Bus using Solar DEX fuel) : IDR 11700
      d. Fuel consumption / bus / day:
         = 42,22 l / 11700
         = IDR 493.974
      e. Basic fuel consumption cost / km:
         \[ = \frac{bus \text{ fuel consumption} \times \text{day}}{\text{travel distance} \times \text{day}} \]
         \[ = \frac{493.974}{228} \]
         = IDR 2166,55 /bus – km

   4. Tires replacement cost:
      a. Prices of new tires : IDR 3.300.000
      b. Number of tires on bus : 6
      c. Tires durability : 24000 km
      d. Tires replacement cost:
5. Light maintenance cost:
Light maintenance for Suroboyo Bus carried out every 5000 km is important to avoid damage that might be happened on the bus engine.

Maintenance material cost:
I. Engine lubricants prices:
\[ = 28 \text{l} \times 273000 \]
\[ = \text{IDR 7644000} \]
II. Solar DEX fuel prices:
\[ = 1 \text{l} \times 11700 \]
\[ = \text{IDR 11700} \]
Total : IDR

Light maintenance cost:
\[ = \frac{\text{maintenance material cost}}{\text{km–distance}} \]
\[ = \frac{7655700}{5000} \]
\[ = \text{IDR 1531.14/km} \]

6. Hard maintenance cost:
Hard maintenance for Suroboyo Bus carried out every 10000 km is important to maximize performance of vehicle engine and electricity system

Maintenance material cost:
I. Engine lubricants prices:
\[ = 28 \text{l} \times 273000 \]
\[ = \text{IDR 7644000} \]
II. Differential gear lubricants prices:
\[ = 10 \text{l} \times 90000 \]
\[ = \text{IDR 900000} \]
III. Gearbox lubricants prices:
\[ = 30 \text{l} \times 160000 \]
\[ = \text{IDR 4800000} \]
IV. Solar DEX fuel prices:
\[ = 1 \text{l} \times 11700 \]
\[ = \text{IDR 11700} \]
V. Brake pad parts prices:
   Front brake (disc brake pad) prices:
   \[ = 2 \times \text{IDR 650.000} \]
   \[ = \text{IDR 1.300.000} \]
   Rear brake (brake pad) prices:
   \[ = 2 \times \text{IDR 575.000} \]
   \[ = \text{IDR 1.150.000} \]
VI. Oil and air Filter:
   Oil Filter prices:
   \[ \text{IDR 2.275.000} \]
   Air Filter prices:

   \[ = \text{IDR 1.200.000} \]

Total : IDR 19.280.700

Hard maintenance cost:
\[ = \frac{\text{maintenance material cost}}{\text{km–distance}} \]
\[ = \frac{19560700}{10000} \]
\[ = \text{IDR 1928.07/km} \]

7. General overhaul cost (secondary data):
IDR 143,40 / km

8. Engine lubricants adding cost:
Engine lubricants adding just in case when bus vehicle on emergency conditions.
Amount of engine lubricants that added: 1,5 l
Travel distance/ day: 228 km/day
Engine lubricants prices: IDR 273000

Engine lubricants cost:
\[ = 1.5 \times 273000 \]
\[ = \frac{228}{10000} \]
\[ = \text{IDR 1796.05 / bus – km} \]

9. Bus cleaning cost:
Bus cleaning cost per day: IDR 100000
Bus production (km per day) : 228 km
Bus cleaning cost:
\[ = \frac{\text{bus production}}{\text{km per day}} \]
\[ = \frac{3000000}{228} \]
\[ = \text{IDR 134,88 / bus – km} \]

10. Bus Station retribution fee:
Bus Station retribution fee per day: IDR 10000
Bus production (km per day) : 228 km
Bus Station retribution fee:
\[ = \frac{\text{bus station retribution fee per day}}{\text{bus productions (km per day)}} \]
\[ = \frac{10000}{228} \]
\[ = \text{IDR 43,86 / bus – km} \]

11. Vehicle tax cost
Bus vehicle tax cost (source from Region Revenue Commission of East Java): IDR 7.798.000
Bus production / year: 82080 km
Vehicle tax cost per bus-km:
Vehicle worthiness inspection cost

A vehicle that used for public transportations rolling stock must be checked periodically every 6 months. So, vehicle inspection arranged twice a year.

Vehicle worthiness inspection cost for bus: IDR 105.000 (source: Surabaya Transportation Service)

Vehicle worthiness inspection cost per bus-km:

\[
\text{vehicle worthiness inspection cost} \times \frac{1}{\text{bus production per year}}
\]

\[
= 210000 \times \frac{1}{82080}
\]

\[
= IDR 2.56 / \text{bus - km}
\]

Total: IDR 13472,6/ bus-km

B. Standing cost analysis

Standing cost data obtained from Suroboyo Bus management office (as secondary data) there are:

1. Bus employee cost (besides bus crew):
   IDR 15.840.000
2. Management cost:
   IDR 6.920.000
   Total of standing cost:
   \[
   = 15.840.000 + 6.920.000
   = IDR 22.760.000
   \]

And then calculate standing cost of bus per year:

\[
= \frac{\text{total of standing cost}}{\text{number of rolling stock}}
\]

\[
= \frac{22760000}{20}
= IDR 1.138.000
\]

Standing cost per bus-km:

\[
= \frac{\text{standing cost of bus per year}}{\text{bus production per year}}
\]

\[
= \frac{1138000}{82080}
= IDR 13,86 / \text{bus-km}
\]

Prime cost per bus-km:

\[
= \text{fixed cost} + \text{standing cost per bus-km}
\]

\[
= IDR 13472,6/ \text{bus-km} + IDR 13,86/ \text{bus-km}
\]

\[
= IDR 13500 / \text{bus-km}
\]

Prime cost per passenger – km:

\[
= \frac{\text{prime cost per bus-km}}{\text{total of passengers on bus}}
\]

\[
= \frac{13486,46}{67}
= IDR 201,29 / \text{passengers-km}
\]

≈ IDR 200 / passengers-km

By calculations which presented means that government must subsidize Vehicle Operations Cost for Suroboyo Bus as value IDR 300/passengers-km.

CONCLUSION

1. According the results of Willingness To Pay (WTP) analysis Surabaya citizen must pay Suroboyo Bus fares IDR 4784,12 or equal to IDR 4800
2. From Suroboyo Bus Vehicle Operations Cost calculations obtained that prime cost per bus-km is IDR 13500/ bus-km

An overview of Suroboyo Bus fixed cost per km:

1. Vehicle depreciation cost: IDR 4320,02 / bus-km
2. Financial capital interest: IDR 182,26 / bus-km
3. Fuel consumption cost: IDR 2166,55/ bus-km
4. Tires replacement cost: IDR 825/ bus-km
5. Light maintenance cost : IDR 1531,14 / bus-km
6. Hard maintenance cost: IDR 1928,07/ bus-km
7. General overhaul cost: IDR 143,40/ bus-km
8. Engine lubricants adding cost: IDR 1796,05/ bus-km
9. Bus cleaning cost: IDR 438,59/ bus-km
10. Bus station retribution fee: IDR 43,86/ bus
11. Vehicle tax cost : IDR 95,00/bus-km
12. Vehicle worthiness inspection cost : IDR 2,56/bus-km

Total: IDR 13472,6/ bus-km

It means that government must subsidize Vehicle Operations Cost for Suroboyo Bus as value IDR 200/passengers-km with load factor value 100% or bus in full passenger conditions.

Whenever it reviewed on load factor value 70% that appropriate with standards from Department of Transportations, so:

Prime cost per passenger – km:

\[
= \frac{\text{prime cost per bus-km}}{70 \% \times \text{total of passengers on bus}}
\]

\[
= \frac{13486,46}{70 \% \times 67}
= IDR 287,56/ \text{passengers-km}
\]

≈ IDR 300 / passengers-km
3. Reviewed on load factor value 70% that appropriate with standards from Department of Transportation, so government must subsidize Vehicle Operations Cost for Suroboyo Bus as value IDR 300/passengers-km.

REFERENCES


