CHAPTER III

BASIC THEORY

The good transportation, in case of safe, cheap, efficient and well-orginized, can be assumed as the good city. On the other hand the poor condition of transportation reflect the chaotics city. One of the key strategy to attract people to use public transportation is the financial, which is considered by operational cost, arrangment of fare, and the demand of transportation.

Standard that will be used is Public Transportation Design by the Ministry of Transportation or *Pedoman Teknis Penyelenggaraan Angkutan Umum di Wilayah Perkotaan Dalam Trayek Tetap dan Teratur*, released by *Direktorat Jenderal Perhubungan Darat Kementerian Perhubungan* in 2002. At the standard is explained the component of public transportation that are operational cost calculation and fare calculation. The detail of both elements is explained in this chapter.

3.1. Operational Cost

3.1.1. General Terms

In transportation field, specificaly for operational cost, the terms that are usually used are:

a. Production cost is the value for produce a service.

b. Fare is the multiplication of main fare and average distance (km) in one trip plus 10% profit of organization.

c. Load Factor is ratio between sold-capacity and avaible capacity on one trip (%).

d. Production coefficient is divider to total cost then the number per production coefficient is determined.

e. Production equipment is any equipment which is used to produce services of public transportation.

f. Additional facility: air conditioner (AC) and classes (economy and non-economy).

g. Cycle or *rit* is a one trip from the origin to the destination.

h. Travel time/cycle is the time in one cycle.

i. Travel distance/cycle is the distance (km) in one cycle.

j. Travel distance/day is the total distance in one day.

k. Frequency is the total cycle in certain time (per hour, per day).

l. Capacity is the maximum availible passengers in one vehicle.

m. Capacity-sold is the total of seat/ticket-sold multiply by frequency.

n. Operational day/month is the total operation day in one month.

o. Deadhead is the unproductive distance (km), depo – first station.

p. Effective kilometer is the productive distance (km).

q. Seat-km availible is the number of seat-km. Calculated from seat availible multiply by frequency and travel distance (km).

r. Seat-km sold is the number of sold production. Calculated from seat-sold multiply by travel distance and frequency.

3.1.2. Production Calculation

The production of public transportation can be reviewed from some elements, these are distance production, cycle /*rit* production, seat-passenger production, and seat-km-production. The equation of those elements are:

a. Production-kilometer

= *operational vehicle* × *frequency/day* × *operational day/month* × *operational month/year* × *distance/cycle)* + *deadhead* (3-1)

b. Cycle production

= *operational vehicle* × *frequency/day* × *operational day/month* × *operational month/year* (3-2)

c. Seat-passanger production

= *operational vehicle* × *frequency /day* × *operational day/month* × *operational month/year* × *seat-sold/cycle* (3-3)

d. Seat-km production

= *operational vehicle* × *frequency/day* × *operational day/month* × *operational month/year* × *seat-sold/cycle* × *travel distance/cycle* (3-4)

3.1.3. Cost

Cost analysis can be devided into three main parts as if reviewed from the activity, outcome for company management, vehicle operational and additional cost (retribution, contribution, donations, etc.). Whereas the cost based on the main activity can be devided as:

a. Production cost : all of the cost that related with production process

b. Organizational cost : administration and organization cost

c. Marketing cost : marketing of the services

Furthermore, group of cost that has the relation with services production can be devided as:

a. Direct-cost

1) Depreciation cost per bus-km

$$= \frac{\boldsymbol{Price - residu\ value}}{\boldsymbol{bus\ production - km/year \times depretiation\ time}} \quad (3\text{-}5)$$

2) Interest of vehicle per bus-km

$$= \frac{\boldsymbol{interest\ per\ year}}{\boldsymbol{bus\ production - km/year}} \quad (3\text{-}6)$$

3) Fee and allowance of driver and conductor per bus-km

$$= \frac{\boldsymbol{fee + allowance\ per\ year}}{\boldsymbol{bus\ production - km/year}} \quad (3\text{-}7)$$

4) Fuel cost per bus-km

$$= \frac{\boldsymbol{fuel\ per\ bus\ per\ day}}{\boldsymbol{km\ per\ day}} \quad (3\text{-}8)$$

5) Tires cost per bus-km

$$= \frac{\boldsymbol{number\ of\ tire(s) \times price}}{\boldsymbol{durability\ of\ tire}} \quad (3\text{-}9)$$

6) Minor service cost per bus-km

$$= \frac{\boldsymbol{Minor\ service\ cost}}{\boldsymbol{5{,}000\ km}} \quad (3\text{-}10)$$

7) Major service cost per bus-km

$$= \frac{\boldsymbol{Major\ service\ cost}}{\boldsymbol{10{,}000\ km}} \quad (3\text{-}11)$$

8) General overhaul cost per bus-km

$$= \frac{\boldsymbol{overhoul\ cost\ per\ year}}{\boldsymbol{bus\ production - km\ per\ year}} \quad (3\text{-}12)$$

9) Oil per bus-km

$$= \frac{\textbf{additional oil per day} \times \textbf{oil price per lt}}{\textbf{bus production} - \textbf{km per day}} \quad (3\text{-}13)$$

10) Washing cost

$$= \frac{\textbf{washing cost per month}}{\textbf{bus production} - \textbf{km per month}} \quad (3\text{-}14)$$

11) Bus station retribution

$$= \frac{\textbf{retribution per day}}{\textbf{bus production} - \textbf{km per day}} \quad (3\text{-}15)$$

12) STNK/tax

$$= \frac{\textbf{cost of STNK and tax}}{\textbf{bus production} - \textbf{km per year}} \quad (3\text{-}16)$$

13) Operational test / *Keur*

$$= \frac{\textbf{test per year}}{\textbf{bus production} - \textbf{km per year}} \quad (3\text{-}17)$$

14) Assurance (vehicle and employees)

$$= \frac{\textbf{assurance per year}}{\textbf{bus production} - \textbf{km per year}} \quad (3\text{-}18)$$

b. Indirect-cost

1) Non-crewman employee, the element consist of fee, overtime fee and allowance.

2) Management element, consist of depreciation of office building, depo, inventory, workshop, office administration cost, office operational cost, depo operational cost, electricity and water cost, telephone and telegram cost, employees travel fee, taxes, operational permit, business permit, marketing, etc.

3.1.4. Vehicle Coefficient

Vehicle coefficient is the value of specific part of vehicle that related to the maintanance of vehicle. The coefficient are depends on the type of vehicle and the quality of the items. Table 3.1 shows the data of vehicle coefficient.

Table 3.1 Variable Value of Vehicle Spare Parts

No	Variabel	Unit	Public Transportation				
			Big-Bus		Medium	Small-	Passenger
			DD-Bus	SD-Bus	-Bus	Bus	Car
1	Depreciation	year	5	5	5	5	5
2	Average distance	km/day	250	250	250	250	250
3	Fuel	km/lt	2	3.6-3	5	7.5-9	7.5-9
4	Tyre	km	24,000	21,000	20,000	25,000	25,000
5	Driver/bus ratio	person/vehicle	1.2	1.2	1.2	1.2	1.2
6	Conductor/bus ratio	person/vehicle	1.2	1.2	1.2	-	-
7	Minor-service	km	5,000	5,000	5,000	4,000	4,000
8	Major-service	km	10,000	10,000	10,000	12,000	12,000
9	Engine oil	km	4,000	4,000	4,000	3,500	3,500
10	Brake fluid	km	8,000	8,000	8,000	12,000	12,000
11	Grease lubricant	km	3,000	3,000	3,000	4,000	4,000
12	Transmission oil	km	12,000	12,000	12,000	12,000	12,000
13	Gear oil	km	12,000	12,000	12,000	12,000	12,000
14	Operational day	day/year	365	365	365	365	365
15	Operational:Non-operational	%	80	80	80	80	80
16	Residual value	%	20	20	20	-	-

3.2. Fare

Fare is calculated with considering the characteristics each type of vehicle. Fare of public transportation where there are not classification or grouping of type of passanger, the formula is:

$$\boldsymbol{Fare\ (Rp)} = \frac{\boldsymbol{Vehicle\ Operational\ Cost\ (Rp\ per\ year)}}{\boldsymbol{Passengers\ (per\ year)}} \quad (3\text{-}19)$$

While when there is a classification of the fare (general, student, children, etc), the formula of the fare is:

$$\boldsymbol{Fare\ (Rp)} = \frac{\boldsymbol{Vehicle\ Operational\ Cost\ (Rp\ per\ year)}}{\boldsymbol{Ordinary\ passanger\ (per\ year)+n\times specific\ passanger\ (per\ year)}} \quad (3\text{-}20)$$

Where n = ratio between ordinary fare and specific fare (%)

Furthermore, fare can be determined from the operational cost per bus-km. This calculation could determine the fare of passanger per km. It is used sometimes when the fare of a public transportation is related to the distance of passenger. The equation is:

$$\boldsymbol{Fare\ (Rp)} = \frac{\boldsymbol{Vehicle\ Operational\ Cost\ (Rp\ per\ bus-km)}}{\boldsymbol{Passenger\ (per\ trip)}} \quad (3\text{-}21)$$

3.3. Ability and Willingness to Pay

Ability to pay (ATP) (Tamin *et al*.,1999) is ability of someone to pay a service based on the ideal proportion of income salary. Some factors that influence ATP are: salary income, trasnportation needed, transportation cost, travel intensity, outcome, and activity. Then willingness to pay (WTP) is a willingness of someone

to pay for service which his/her is obtained. WTP is influenced by: transportation productivity, quantity and quality, utility and income salary. The decision-making has a strong impact if consider the WTP analysis (Quevedo *et al*.,2009).

There are three condition of fare rates related to ability to pay and willingness to pay, those are:

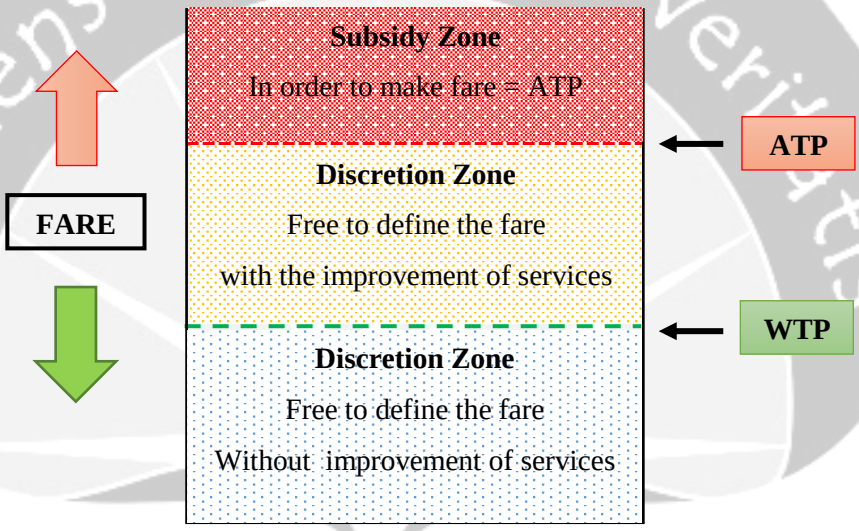

Fig 3.1 Illustration of Fare with ATP and WTP (Tamin *et al*., 1999)

1. ATP greater than WTP

   This condition shows that the salary income in high rate but the utility on the service is low, consument in this zone commonly called choiced riders. Consument are free to choose the transportation mode belongs to their ability.

2. ATP less than WTP

   The consument in this condition has low income salary but it has high utility to the service of transportation. The consument in this zone called as captive riders. The consument can not to use the transportation mode and using the available option based on their ability

3. ATP same with WTP

This is the equilibrium condition where the utility of transportation in the same rate with the ability. The consument choose the transportaion mode as the ability of using it.