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The Optimization of Microbus-Based Public Transportation Facilities in Jayapura City

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ABSTRACT

Public transport services will work well if there is a balance between supply and demand. The research aimed to analyze the performance and the needs for the number of public transportation facilities based on the microbuses in Jayapura City. The types of the public transports, which would be discussed, were the microbuses which operated in 12 routes of the total routes of 26 in Jayapura city; those were B1, B2, B3, B4, J1, J2, K, I1, E, G, IA and I. The analyses of the performance and the demand for number of public transports were analyzed based on the load factor and the break event in accordance with the value of the vehicles operating costs (BOK) in setting tariffs. The research results indicated that the standard performance value of the public transport route code of K, I1, G, IA were categorized as less, while the routes of B1, B2, B3, B4, J1, J2, E and IB were categorized as medium. The microbuses demand was only 50% of the total microbuses now operating in Jayapura city.

Keywords: load factor, performance, BOK, route, Jayapura

1. INTODUCTION

A transport basically is a mean to move people and goods from one place to another place. Mass public transport is a transportation service which has fixed routes and schedule. In terms of mass, public transport fares become a joint burden, so that the public transportation system becomes efficient because the fare is very cheap [1]. The role of public transportation is to serve the public mobility in doing their aktivities. The other aspects of the public transportation services are traffic control, energy austerity and area development. Since it involve many people, users must have similarity, in the end will cause the unbalance between stock and demand. The public transportation will run well if there is a balance between stock and demand [2].

Accoding to the guideline of the operation technique of public transportation (Directorate of Communication 2002), the network transportation line is the group of designated route giving transport to people and influenced by some factors in its determination, namely land use pattern, the pattern of some factors in its determination, namely land use pattern, the pattern of passenger movement of public transport and services area [3].

The characteristics of passenger transportation covers service level, and their operations referring to effectiveness and efficiency of the transports such as accessibility, capacity, rapidity and endure time, *headway* (pass period and waiting time).

Accessbility is a concept geographically combines the arrangement system of land with transportation network system. Accessibility is a measurement of convenience and ease about the method of the land use pattern location to interact one another and how difficult and easy to reach the location via transportation network system [4].

Capacity means how many vehicles operating on the streets (Transportation line) per certain route [5].

The speed is defined as a comparison between the covered distances and the time needed to get to the destination. While travel time is the time during traveling used to get to destination. Speed is the speed on the way said with formula [6].

Pass period is the time needed by passengers during waiting for transport until they get into the vehicles [7].

Headway (pass time), the time between the arrival of vehicle or the departure of the first vehicle and the arrival and the departure of the next vehicle measured on the certain point.

Operation Capacity (availability) is the percentage of the number of public transports averagely operates, compared with the number of public transports which have many routes [8]. The trip generation constitutes the trip leaves one zone to another zone [5].

The number of urban transport fleets needed by one route may be known by dividing the circulation time (*round trip time)* with the pass time [9].

Load factor is the comparison between the number of passengers according to seat capacity in vehicles in a particular period [10]. The purpose of the load factor is to be known later if each route of a transport is able to load passengers to maximal capacity. The level of the load factor has the best correlation between users and organizer. The research aims to determine the performance and the need of the number of public transport microbus-based.

2. STUDY METHOD

In this research, there are two steps of collecting data, primary data and secondary data. The secondary data were obtained from related instances such as Statistic Center Board in Jayapura City and Communication Services in Jayapura. Primary data were the measurement of segment length, the journey time of each segment, the number of vehicles operating, and the number of passegers getting on and getting out of each segment. The secondary data were the number of registered transports and the route of transports. The survey was conducted step by step. The first step was to perform survey on the number of passengers

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in 12 transportation lines, the second step was to conduct survey on the load factor (LF) of microbuses in the 12 routes and the third step was to survey and to know *the Transport Operational Cost* (TOC).

The data analysis commencing from analyzing the existing load factor analyzing the number of passengers and transport operational cost of microbuses, analyzed the fares based on the tariff based on the TOC, analyzed the income, analyzed the Load Factor Break Even Point (LF_{BE}) and analyzed the need of microbus fleet need based on LF_{BE}.

The determine of microbus fleet numbers with *Break Even* (LF_{BE}) method based on transport operation cost with the income of microbus vehicles operating in every route. The Load Factor in *Break Even*

(LF_{BE}) condition and the need of microbus fleet (KM).

3. RESULT

Table 1 The Quality Standard of public transport services either general or in particular route can be seen by using the indicator settled by Communication Department based on the parameter assessment such as the load factor in busy hours and load factor out of busy hours, the speed of travel, headway, travel time, service time, frequency, the number of operating vehicles, period of waiting, and starting and finishing the travel. From the survey of the static performance of public transports of the public transports of the 12 routes indicates the Performance Standard of Public Transportation service.

Table 1. The Standar of Public Transportation Service Performance

Code of Route	Grade Parameter	Indicator of Standard Parameter Grade of Public Transportation Performance
B1	Sufficient	18,00 – 24,00 (Good)
B2	Sufficient	12,00 – 17,99 (Sufficient)
B3	Sufficient	12 (insufficient)
B4	Sufficient	
J1	Sufficient	
J2	Sufficient	
K	insufficient	
I1	insufficient	
E	Sufficient	
G	insufficient	
IA	insufficient	
IB	Sufficient	

Source: Calculation Result

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Table 2 indicates the largest number of passengers on the Route B2 as many as 96 people and 72 people, 67 people for Route B1 consecutively. The smallest number of passengers in 21 people on J1 route. The biggest TOC per day is on the routes IB 167.510,03.- and the lowest is 79.136,71.- on J1 route. The value of TOC is very influenced by the distances of the vehicles jouney on the value of TOC is very influenced by the distance of the vehicles journey on the route especially in the analysis of the cost depreciation. The analysis result of microbus tariff based on TOC indicated the different value with existing tariff. The tariff of Rp. 16.766.- while the existing tariff only Rp. 2.800.- on the Route E. While the existing tariff only Rp. 2.953.- and existing tariff is bigger with value of Rp. 4.300.-

Table 2. TOC and the number of passengers

Route Codes	Number of Passengers (Person)	TOC Per day (Rp)
B1	67	112.306,61
B2	96	103.625,43
B3	24	108.552,58
B4	51	105.183,59
J1	32	79.136,71
J2	38	84.055,98
K	53	92.463,90
I1	21	96.279,81
E	72	150.889,65
G	66	89.156,79
IA	35	122.553,25
IB	35	167.510,03

Source: Calculation Result

Table 3 indicates the income of microbus operators as in the existing tariff at present. The most income of the operator was obtained on the route IA as much as Rp. 604.800.- and the least operator income in on the route B3 as much as Rp. 91.200.- The amount of operators' income depends very much on the number or passengers using the microbus transports.

Table 3. Tariff and income

Route Codes	Tariff of TOC (Rp/ Passenger)	Tariff (Rp.)	Income (Rp./day)
B1	8.022	3.800	254.600
B2	6.477	3.800	364.800
B3	7.335	3.800	91.200
B4	6.743	3.800	193.800
J1	2.953	4.300	137.600
J2	3.562	4.300	163.400
K	4.718	3.800	201.400
I1	5.290	4.800	100.800
E	16.766	2.800	201.600
G	4.246	4.300	283.800
IA	6.879	4.800	604.800
IB	10.203	4.200	281.400

Source: Calculation Result

Table 4 indicates that the largest number of microbuses needed in route J2 as many as 110 units with LF_{BE} as much as 1,91% while the numbers of microbuses operating is 214 units, so that the fleet units is excessive. It should be 74 units with LF_{BE} 1,84% of LF_{BE} J1 where the number of microbuses operating 128 units, while the number microbuses needed 8 units with the value of 0,96 LF_{BE} for route IA and the number of microbuses is 40 units, is quite a lot if it is compared with the need.

Table 4. The Amount of Microbus Needed

Route Codes (Unit)	LF Dynamic (%)	LF_{BE} (%)	Microbus Operating (Unit)	Number of Microbus Need (Unit)
B1	20	8,82	74	33
B2	18	5,11	72	20
B3	2	2,38	14	17
B4	15	8,14	69	37
J1	4	1,84	128	74
J2	2	1,91	214	110
K	6	1,88	30	14
I1	4	1,84	9	9
E	21	12,08	93	70
G	20	10,29	82	26
IA	5	0,96	40	8
IB	5	2,36	22	10

Source: Calculation Result

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4. EXPLANATION

In this research, it is found that the numbers of microbus fleet operating in Jayapura City indicate the misbalance between the quantities of the microbuses needed by the passengers based on the analysis of load factor break even. The quantities of microbuses needed by the 12 routes is only 50% with the load factor break even (LF_{BE}), is very low compared with and the number of the microbuses operating, so that the policy of related institution is needed to optimize the quantities of microbuses operating in Jayapura. This is meant to increase vehicles and the income of operators.

5. CONCLUSION AND SUGGESTION

It can be concluded that the public transportation in Jayapura City of the 12 routes with codes of B1, B2, B3, B4, J1, J2, K, I1, E, G, IA, IB are Ideal. This is indicated by parameter indicator 12 that constitute the middle range indicator that is 12, 00 – 17,99. Optimization of the quantity of microbuses needed 50% of the number of microbuses operating in Jayapura from the 12 routes. So that it is necessary to optimize the quantity of public transportation.

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