Characteristics and Performance of Angkutan Kota (*Angkot*) in Banyuwangi City Indonesia

Ahmad SODIQ
Officer of Banyuwangi Gov. & Student
Graduate School of Engineering,
Faculty of Engineering,
University of Miyazaki
1-1 Gakuenkibanadai Nishi, Miyazaki,
889-2192 Japan
Phone : + 81-985-587329
Fax : + 81-985-587344
E-mail : ah_shod@yahoo.co.id

Chikashi DEGUCHI
Associate Professor
Department of Civil and Environmental Eng.
Faculty of Engineering,
University of Miyazaki
1-1 Gakuenkibanadai Nishi, Miyazaki
889-2192 Japan
Phone : + 81-985-587329
Fax : + 81-985-587344
E-mail : deguchi@cc.miyazaki-u.ac.jp

Tetsunobu YOSHITAKE
Associate Professor
Department of Civil and Environmental Eng.
Faculty of Engineering
University of Miyazaki
1-1 Gakuenkibanadai Nishi, Miyazaki
889-2192 Japan
Phone : + 81-985-587331
Fax : + 81-985-587344
E-mail : t.yoshi@cc.miyazaki-u.ac.jp

Abstract : *Angkot* (the acronym of *Angkutan Kota*) is the main mode of urban public transport in Banyuwangi, as well as other local cities of Indonesia. However, *Angkot is* failing to provide the necessary service and is actually in decline in Banyuwangi. This paper intends to explore the characteristics of *Angkot* and analyze their performance in Banyuwangi. Analysis based on questionnaires and literature shows that 1) main users are relative poor people and students, 2) *Angkot* fleets are old, 3) service level becomes lower, and 4) a driver's gross income per day is in the range of Rp. 65,000 to Rp. 187,000. These results suggest that financial support is needed to renew *Angkot* vehicles and governments should formulate proper policies and carry them out in order to improve the *Angkot* transport system in Banyuwangi City.

Key words: *Angkot transport system, Local city, Questionnaire survey*

1. INTRODUCTION

Access to personal transport has enabled people more freedom to choose their home location. Increased private transport systems have enabled people to move around more easily. Most people perceive private vehicles (car and motorcycle) as a higher-quality mode of transport. This has encouraged everyone to own a private vehicle and discouraged them from using public transport. Mirroring the sudden and dramatic jump in vehicle ownership in Banyuwangi, public transport systems have lost many of their users. Public transport is

failing to provide the necessary service and is actually in decline in Banyuwangi. Recently, people have become reluctant to use public transportation because of service issues. They require reasonable services of public transport such as comfort and safety, with affordable fares and appropriate network coverage. Passenger volume is low, even though there is population growth and an increase of income.

The modal distribution of urban passenger travel shifted toward the private vehicle and away from public transport. The dramatic shift from public transport to the private vehicle generally reflects users' preference for the convenience, comfort, speed, flexibility, and independence. People prefer using their car not only because the public transport is unorganized and inefficient, but also because it is too easy for them to use their cars. Public transportation is more expensive than using private vehicles. The poor quality, inconvenience, and unattractiveness of public transport have encouraged travelers to shift to private vehicles once they could afford a motorcycle or private car. The increases in fuel price, maintenance and repair costs have put great pressure on public transport, despite a small increase in the fare.

This paper intends to explore the characteristics of *Angkots* and analyzes their performance in Banyuwangi for improving the *Angkot* system and developing a better public transport system. For this purpose, questionnaires and interviews have been carried out with *Angkot* users and drivers. In addition, field survey and direct observation were conducted.

2. OVERVIEW OF BANYUWANGI

2.1 Location of Banyuwangi City

As shown in Figure 1, Banyuwangi Regency is located at the easternmost end of the Indonesian island of Java, which covers a land area of 5,783 km^2. Administratively, Banyuwangi Regency is divided into 24 Sub-Districts (*kecamatan*), with 28 villages in urban areas (which are called *kelurahan)*, and 151 villages in rural areas (which are called *desa)* (BPS, 2006). Banyuwangi city is the capital of Banyuwangi Regency. The Banyuwangi city administration extends over 2,730 ha that covers 26 *Kelurahan* within four sub-districts. The topography of the Banyuwangi city area is gentle inclines from 0-8 % at a height of 6 to 125 m above Mean Sea Level.

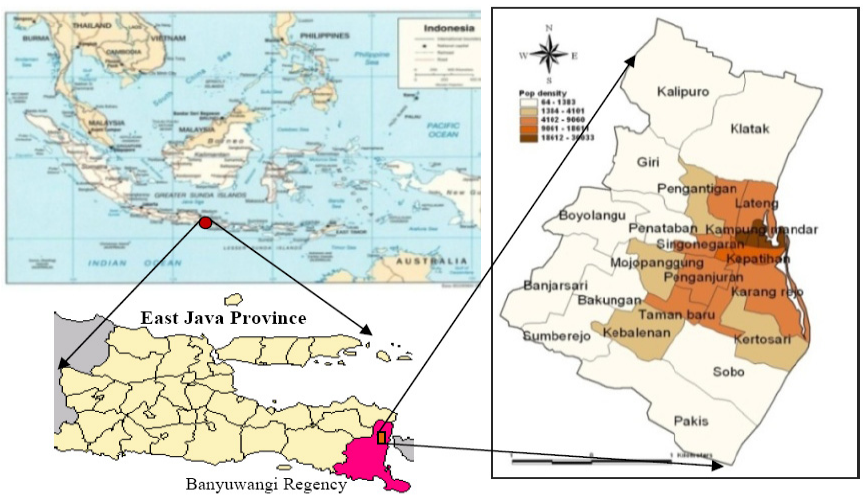

Figure 1 Location of Banyuwangi city

2.2 Social –Economics of Banyuwangi

Table 1 shows the social and economic situation of Banyuwangi. The population is one of the basic elements of a region and has a significant role in development. Based on the data from the population census, the total population of Banyuwangi in 2000 was 1,576,000 and in 2006 was recorded at 1,576,328. At that time the population of Banyuwangi city area was 163,037 (BPS, 2006). Statistically, the average growth of population in Banyuwangi during the last six years (year 2001-2006) is 0.24% per-year. Based on its total population, Banyuwangi city can be categorized as a medium sized city (100,000 – 500,000 people).

In 2006, per capita income at current prices has been estimated at Rp. 7,838,932. This is relatively low in comparison to Indonesia per capita income of Rp. 14,840,809 (BPS 2006). The average economic growth in 2006 was based on the constant market price in 2000 estimated at 5.0% per year.

Table 1 Social and economic situation of Banyuwangi

No.	Year	Banyuwangi City area		Banyuwangi Regency		Per Capita Income (Rp)
		Population (persons)	Density (persons/km^2)	Population (persons)	Density (persons/km^2)	
1	2001	157,782	692	1,470,577	254	3,656,545
2	2002	158,032	693	1,493,250	256	4,009,472
3	2003	154,672	678	1,531,026	264	4,283,818
4	2004	158,279	694	1,557,423	269	4,673,461
5	2005	162,221	712	1,575,089	272	7,049,340
6	2006	163,037	715	1,576,328	272	7,838,932

2.3 Overview of Motorization Trends in Banyuwangi

Table 2 shows the number of registered vehicles and their trends. In recent years, motor vehicle ownership has been growing faster. Figure 2 shows motor vehicle ownership in Banyuwangi versus per capita GRDP. It is seen that the motor vehicle ownership is directly proportional to the income level. With the intense desire for auto ownership and use, Banyuwangi has a rapid pace of motorization of around 10% per year, as shown in Table 2 and Figure 2.

From 1998 to 2006, car ownership increased approximately 1.5 times and motorcycle ownership three times. The number of registered motorcycles increased from 97,728 in 1998 to about 229,589 in 2006 at an annual growth rate of 11%. The BPS (*Badan Pusat Statistik*) data show that at a household level, the average number of cars owned per 100 households is 2.9 and the average number of motorcycles owned per household is 0.485.

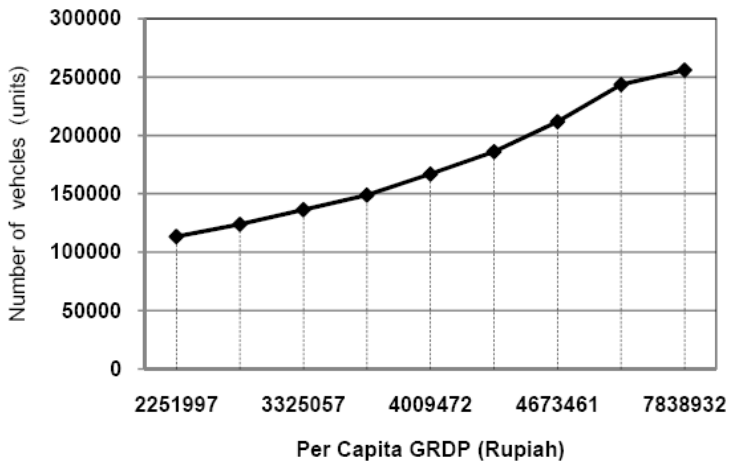

Figure 2 Number of vehicles versus per capita GRDP

Table 2 Registered vehicles and their trend in Banyuwangi

Year	Number of motorized-vehicle (units)					Increment (%)				
	Private Car	Motor Cycle	Goods Vehicle	Bus	Total	Private Car	Motor Cycle	Goods Vehicle	Bus	Total
1998	7,536 (6.6 %)	97,728 (86.2 %)	8,043 (7.1 %)	92 (0.1 %)	113,399 (100 %)	0.00	0.00	0.00	0.00	0.00
1999	8,900 (7.2 %)	105,965 (85.5 %)	8,897 (7.2 %)	94 (0.1 %)	123,856 (100 %)	18.10	8.43	10.62	2.17	9.22
2000	9,821 (7.2 %)	117,100 (85.8 %)	9,349 (6.9 %)	116 (0.1 %)	136,386 (100 %)	10.35	10.51	5.08	23.40	10.12
2001	10,741 (7.2 %)	128,235 (86.1 %)	9,801 (6.6 %)	131 (0.1 %)	148,908 (100 %)	9.37	9.51	4.83	12.93	9.18
2002	11,417 (6.8 %)	144,978 (86.8 %)	10,430 (6.2 %)	130 (0.1 %)	166,955 (100 %)	6.29	13.06	6.42	-0.76	12.12
2003	11,828 (6.4 %)	163,125 (87.7 %)	10,991 (5.9 %)	136 (0.1 %)	186,080 (100 %)	3.60	12.52	5.38	4.62	11.46
2004	12,405 (5.9 %)	187,636 (88.6 %)	11,621 (5.5 %)	142 (0.1 %)	211,804 (100 %)	4.88	15.03	5.73	4.41	13.82
2005	13,431 (5.5 %)	217,593 (89.4 %)	12,312 (5.1 %)	159 (0.1 %)	243,495 (100 %)	8.27	15.97	5.95	11.97	14.96
2006	13,801 (5.4 %)	229,589 (89.7 %)	12,449 (4.9 %)	161 (0.1 %)	256,000 (100 %)	2.75	5.51	1.11	1.26	5.14

2.4 Urban Public Transportation Services

In Banyuwangi city, local public transportation demands are met by several kinds of modes, either motorized or non-motorized vehicles, provided by a variety of operators. Within Banyuwangi city, there are multiple transportation service types, both fixed-route and unfixed-route, as shown in Table 3. Unfixed routes are served by taxi, public motorcycle (*ojek*), and rickshaw (*becak*), while fixed routes are served by hundreds of small city transporters called *Angkot*, which are the main urban public transport. They are the easiest and most popular means of transportation in Banyuwangi.

Table 3 Public transport modes in Banyuwangi

Type of services	Service features		Passenger capacity	Service niche	Market regime
	Routes	Schedules			
Angkot (*angkutan kota*)	Fixed	Variable	8 – 12	Feeder	Licensed
Taxi	Variable	Variable	3 – 6	Feeder	Licensed
Rickshaw (*becak)*	Variable	Variable	2 – 3	Short trips, feeder	Unregulated
Motorcycle taxi (*ojek*)	Variable	Variable	1 - 2	Feeder, some longer distances	Unregulated
Dokar (horse –drawn)	Variable	Variable	1 - 6	Short trips, feeder	Unregulated

2.5 Road Network and Transport Infrastructure

The road network is relatively limited, as are opportunities to increase road capacity in urban areas. Banyuwangi would face serious congestion problems if private auto ownership and use continues to grow in conjunction with currently forecast rates of economic growth. The share of roads in used land is about 7%. It was revealed that the share of roads in used land is far below standard, which is about 20 to 25%.

The total length of roads in Banyuwangi in 2006 was 1,829.03 km, which consists of National, Provincial, and Municipal roadways as shown in Table 4. In general, road conditions vary from "Good" to "Strongly damaged". Figure 3 shows the ratio of total road length to the number of registered vehicles. The ratio becomes smaller and road congestion may become more severe.

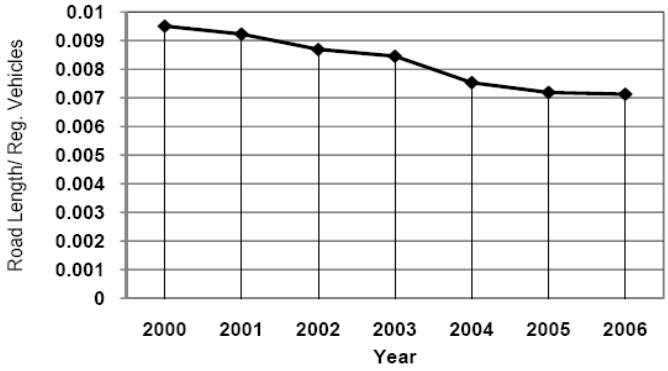

Figure 3 Ratio of total road length to registered vehicles in Banyuwangi

Table 4 Annual trend and condition of road in Banyuwangi (BPS, 2006)

		Road Status			Total (km)
		National (km)	Province (km)	Municipal (km)	
Annual trend (per year)	2001	100.53	114.35	1,164.51	1,379.39
	2002	100.53	114.35	1,241.84	1,456.72
	2003	100.53	114.35	1,363.44	1,578.32
	2004	100.53	114.35	1,385.05	1,599.93
	2005	100.53	114.35	1,540.15	1,755.03
	2006	100.53	114.35	1,614.15	1,829.03
Road condition	Good	23.08	75.91	1091.97	1,190.96
	Medium	75.35	36.54	346.24	458.12
	Lightly damaged	2,10	1.92	98.46	102.49
	Strongly damaged	-	-	77.32	77.32
	Total	100.53	114.35	1,614.15	1,829.03

3. ANGKOT SYSTEM IN BANYUWANGI

In Banyuwangi, *Angkot is* the main urban public transport. *Angkot is* a small van which has been re-designed to accommodate more passengers as shown in Figure 4. All back seats have been removed and replaced by two long dark-benches covered with foam. Normally, an *Angkot* can carry up to 12 passengers but sometimes drivers carry up to four more people. The fare of *Angkot* is Rp. 3,000 for non-student and Rp. 1500 for student for one boarding and does not depend on travel distance.

Angkots are operated and managed by individuals, cooperatives, and private owners usually as single-person enterprises. They operate without subsidy from the government. The *Angkot* crew (sometimes consisting of only the driver, but at other times the driver accompanied by a conductor) generally makes an informal agreement with the car owner to pay a daily rental fee, and earn a salary from the surplus. In general, the driver pays the fuel cost, but the maintenance cost is covered by the car owner.

Angkot provides public transportation services with no exclusive right-of-way, mixing with other road users. They follow a fixed route within the city's road network, with no fixed schedule (no particular time frame), stopping on demand. These factors mean that *Angkot* stops for passengers and passengers get on and off everywhere.

In *Angkot* operation, the role of government (performed by the municipal authorities) is to issue permission to operate on the selected designated route, and to decide the number of vehicles on each designated route. Recently, the large number of public transport vehicles has caused great competition. The number of small cars that serve within the city is diminishing due the fact that more and more people who live in Banyuwangi own motorbikes. The ease of buying motorbikes through leasing systems enables many people to own a motorbike.

Figure 4 *Angkot* in Banyuwangi

4. DATA AND ANALYSIS RESULTS

4.1 Data Used

Table 5 shows primary and secondary data used in this paper. Interviews and questionnaire were conducted from July 15–22, 2008. Interviews and questionairre surveys were carried out with drivers and users of *Angkot*. A total of 55 *Angkot* drivers and 440 *Angkot* users were used as samples repectively as shown in right column in Table 5.

Table 5 Data used for analyses

Type of Data	Data Collection Method	Sources of Data
A. Primary Data		
1. *Angkot* users' attributes (age, monthly income, occupation, travel purpose, private vehicle owned, walking distance)	- Questionnaire survey	- 440 passengers for 11 routes are used as samples (40 passengers for each route)
2. *Angkot* drivers' atributes (age, education, family size, status, number of work days per week, number of trips per day, gross income and rental fee per day)	- Questionnaire survey	- 55 drivers for 11 routes are used as samples (5 drivers for each route)
3. Transfer rate	- Interview	- *Angkot* users
4. Speed, load factor, and frequency	- Field survey /direct observation	- *Angkot* and user
B. Secondary Data		
1. Demographic	- Literature	- *Badan Pusat Statistik*
2. Socio-economic		- *Bappeda* (Municipal Planning Board Agency)
3. Number of vehicles		
4. Road network		- *Dinas Perhubungan* (Municipal Transportation Agency)
5. *Angkot* route network		
6. Number and age of angkot vehicle		- *Dinas Pekerjaan Umum* (Municipal Public Works Agency)

4.2 Route Characteristics

The public transport routes in Banyuwangi are as shown in Figure 5. Some routes operate across the city centre. Most of the routes are along the two main roads which run from north to south, concentrated in the central area. Currently, urban public transport caters 11 routes where the shortest route is 5.16 km (route 1) and the longest is 11.81 km (route 12) and most of the available routes are overlapping. Table 6 shows the characteristics of these routes

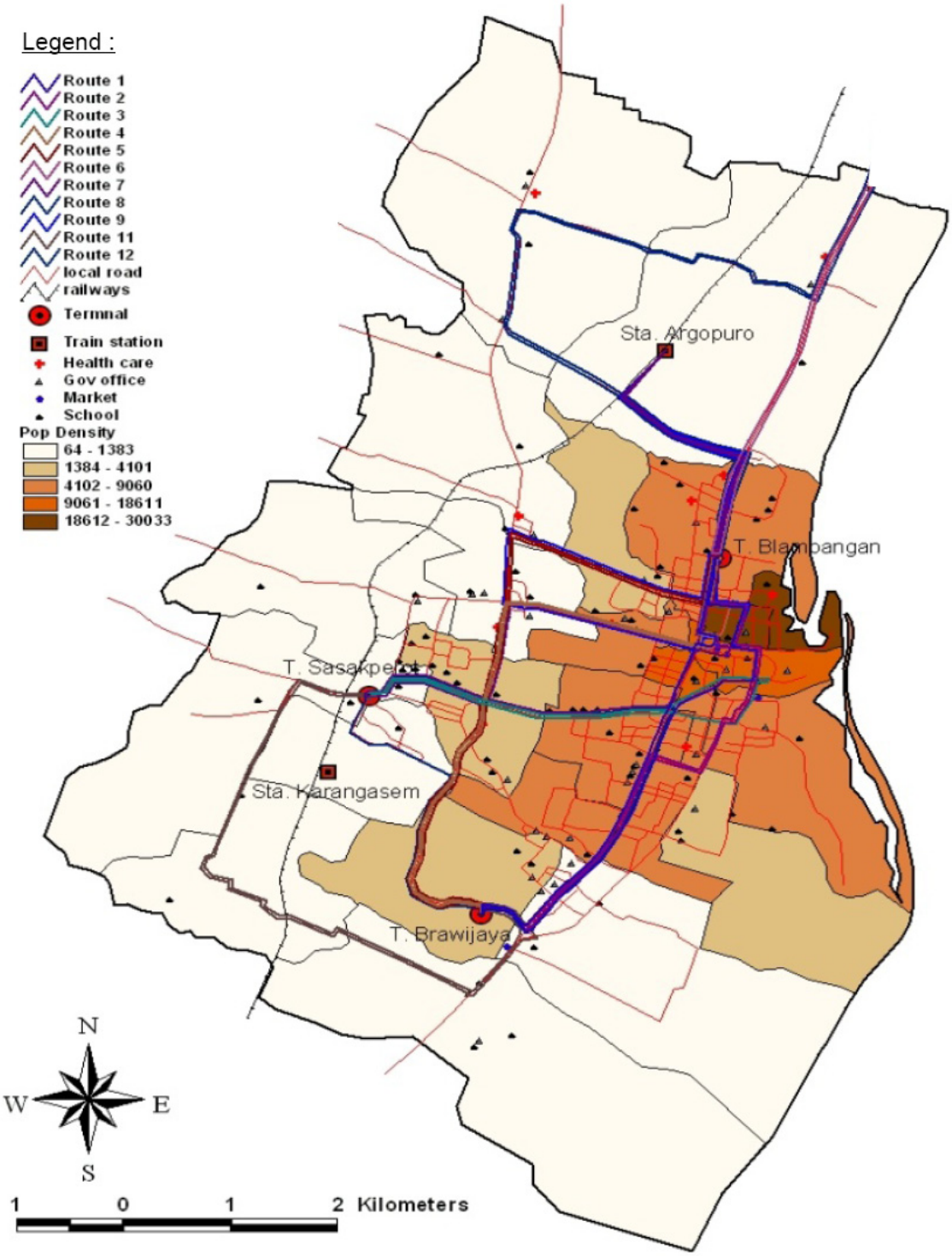

Figure 5 Routes of *Angkot* in Banyuwangi City

Table 6 Routes of *Angkot* in Banyuwangi City

No	Route	Length of route			Overlapping *)		Deviation **)	
		The shortest (km)	The longest (km)	Average (km)	Length (km)	Percent (%)	Length (km)	Percent (%)
1	Route 1	4.34	5.97	5.16	3.62	65.3	4.28	77.3
2	Route 2	7.04	7.28	7.16	4.46	59.8	5.51	73.8
3	Route 3	7.83	7.83	7.83	1.26	12.2	7.62	73.9
4	Route 4	5.40	6.35	5.88	3.54	57.6	4.36	71.0
5	Route 5	5.38	5.23	5.31	3.08	48.8	4.79	75.9
6	Route 6	4.53	5.98	5.26	0.52	6.9	5.70	74.5
7	Route 7	8.86	5.55	7.21	1.26	19.3	4.79	73.2
8	Route 8	6.50	6.50	6.50	3.54	48.1	5.39	73.3
9	Route 9	9.91	9.91	9.91	2.74	27.0	7.70	76.0
10	Route 11	7.74	8.44	8.09	0.54	7.2	2.99	39.9
11	Route 12	11.08	11.53	11.81	1.45	15.4	7.23	76.7

*) Overlapping level = ratio between the length of overlapping routes and the actual length of a route.
**) Deviation level = ratio between the difference of actual route length and route length based on the shortest path linking origin and destination

4.3 Spatial Coverage of Transport Service

A critical factor in measuring the performance of public transport is the spatial coverage of the service. Spatial coverage measures the ease with which the service can be reached at different locations. Spatial coverage also measures spatial equity. It determines the access time or walking time and walking distance to access the service. The higher the spatial coverage of the service, the shorter the walking distance will be to the service. In this situational analysis, the number of routes per road segment, route density, and proximity measures can be used to assess the spatial coverage.

The number of routes per road segment shows the number of overlapping routes on a segment. A higher number of routes per segment suggests more opportunities to access the service in different directions. As shown in Figure 5, most *Angkot* routes in Banyuwangi run along the major North-South axis in the central city.

The denser the distribution of the public transport line, the more people are expected to choose public transport because of greater opportunity for direct trips. In addition, the denser the route density the shorter the walking distance. As shown in Figure 5, the spatial distribution of the *Angkot* service in Banyuwangi is concentrated in the central area. The *Angkot* lines are denser in the central area than in peripheral areas. This shows that people in the peripheral area have to walk further to reach *Angkot* routes compared to those in the central area.

Table 7 Service level for walking

Service level	Walking time (minutes)	Walking distance (meters)
A	< 2	0 – 100
B	2.0 – 4.0	101 – 200
C	4.0 – 7.5	201 – 400
D	7.5 – 12.0	401 – 600
E	12.0 – 20.0	601 – 1,000
F	> 20.0	> 1000

Source: Alter, 1976 in Nasution 2003

Another parameter which demonstrates the spatial coverage of the service is proximity. Proximity measures the closeness of the service either to the origins or destinations of the people. Armstrong-Wright and Thiriez (1987) suggest that the walking distance should not exceed 300 to 500 m. Furthermore, Armstrong-Wright and Thiriez (1987) suggest that the maximum distance that passengers have to walk should not exceed 1,000 m. According to analysis, more than 90% of the *angkot* users in Banyuwangi are within a distance less than 500 m. The service level for walking, according to Alter (1976), is shown in Table 7.

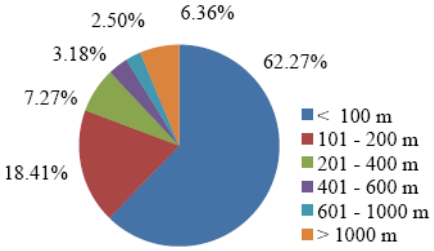

Figure 6 Walking distance before boarding *Angkot*

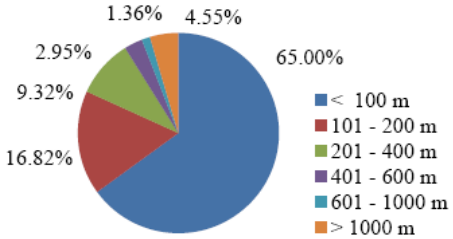

Figure 7 Walking distance after alighting *Angkot*

Figure 6 and Figure 7 show the walking distances before boarding and after alighting *Angkot.* Walking distances less than 100 m occupy about 62% and 65% before boarding and after alighting *Angkot,* respectively. These proportions increase to more than 80% for the distance less than 200 m. These results mean that the *Angkot* service is good enough to cover the urban area, and based on Alter's classification, the level of service can be categorized as Service level-A.

4.4 Spatial Coverage by Socio-Economic Group

The need to provide equitable service for all groups of society, particularly for disadvantaged groups, should be one of the objectives of public transport. The high income population group has the opportunity to use alternative modes, while the poor rely on public transport or walking. Spatial coverage by socio-economic group is analyzed to see whether public transport is giving equitable service to all groups of society.

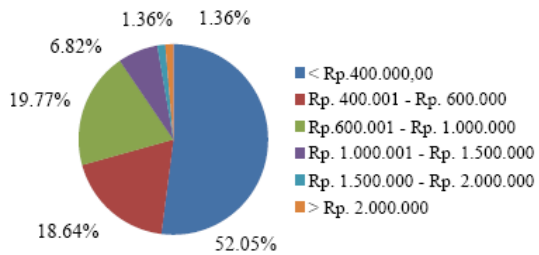

Figure 8 *Angkot* users based on monthly income

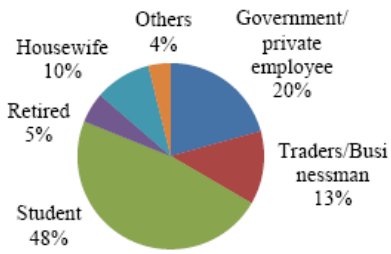

Figure 9 *Angkot* users based on occupation

Figure 8 shows the monthly income of *Angkot* users. About 50% earn less than Rp. 400,000. This is relatively lower than the average monthly income of Rp. 653,245 = 7,838,932 (Per Capita) /12 months. This result means that it would be difficult to raise the fare for the benefit of *Angkot* employees. Figure 9 breaks down the occupations of *Angkot* user. Students occupy about 50%. This result means that *Angkot* plays an important role as a mode of transport for students, and needs to operate at peak hours.

Another important measure of the performance of the public transport system is the extent to which it meets the needs and preferences of citizens. The main purpose of travel refers to the motive or main goal in undertaking a particular journey. In this case, journey purposes can be divided into some categories, namely: for travel to work, travel to school, travel to visit relatives, shopping or for recreation and other purposes.

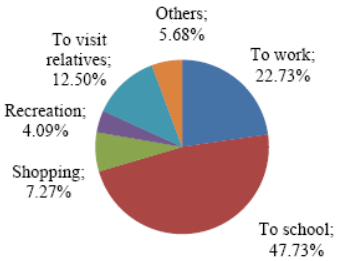

Figure 10 *Angkot* user's travel purpose

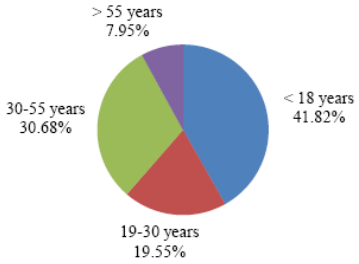

Figure 11 *Angkot* users based on age

Figures 10 and 11 show the travel purpose and age of *Angkot* users. The most common purpose and age are to travel to school, and persons under 18 years old, respectively. This corresponds with main users being students. Figure 12 shows the reasons of using *Angkot* where about 63% of the users cite "No private vehicle" as the reason for using *Angkot*. Figure 13 shows the private vehicles owned by *Angkot* users where 54% answer that they have no private vehicle. These results mean that *Angkot* is required to play a role of transportation for the poor.

By the way, 35% of *Angkot* users have a motorcycle. This suggests that *Angkot* and motorcycles compete with each other as modes of transport. However, it may be that the two modes complement each other because 35% is a fairly high ratio of *Angkot* users.

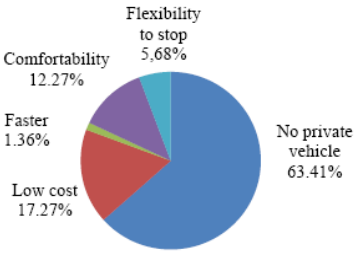

Figure 12 Reason using *Angkot*

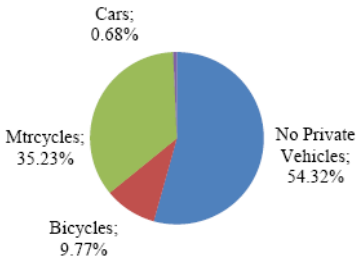

Figure 13 Private vehicle owned by *Angkot* users

4.5 Vehicle Operation

4.5.1 Number, Utilization Efficiency and Age of Vehicle

Table 8 shows the number of *Angkot,* their availability, and their average age on each route. 170 *Angkots* are in operation. The availability is defined as the ratio of operational vehicles to the total number vehicles licensed. The average availability is 92.8%. This value is above the range of 80–90% specified by Armstrong-Wright and Thiriez (1987) and shows a relatively high availability. The average age of the fleet means the condition of the fleet, and can be used as an indicator of service quality. It is a common performance measure that is calculated by averaging the ages of all vehicles in the fleet. New vehicles have several potential

advantages for passengers compared to old vehicles. New vehicles are likely to be more comfortable, more reliable, and safer, although the realization of these potential advantages depends upon several factors such as vehicle design and specification, quality of maintenance, driver behavior, etc. The average age of *Angkots* is 15.9 years, which is fairly old. As the old *Angkots* are not so comfortable, renewal is required.

Table 8 Fleet availability and average age of *Angkot*

Route	*Angkot* Fleet			Average Age (years)
	Licensed (units)	Operational (units)	Availability (%)	
Route 1	36	34	94.4	17.00
Route 2	16	16	100.0	16.63
Route 3	11	10	90.9	18.30
Route 4	10	9	90.0	16.67
Route 5	9	8	88.9	16.00
Route 6	41	38	92.7	15.45
Route 7	10	8	80.0	16.75
Route 8	12	12	100.0	14.75
Route 9	10	10	100.0	11.30
Route 11	6	5	83.3	17.80
Route 12	20	20	100.0	15.10
Total / Average	181	170	92.8	15.92

4.5.2 Vehicle Operating Speed

In Banyuwangi, *Angkots are* operated from about 5:00 a.m. to 9:00 p.m. though except for several routes, 6:00 a.m. to 5:00 p.m. and provide service for seven days a week. Actual speed achieved is influenced by vehicle and alignment speed, as well as stopping at passenger stops and general traffic conditions. During field survey, the speeds along many routes were recorded.

Table 9 Operating speed of *Angkot* in Banyuwangi

Route	Average length of route (km)	*Angkot* operating speed (km/hour)			
		Morning peak hours	Off peak hours	Evening peak hours	Average
Route 1	5.16	11.3	13.9	12.4	12.5
Route 2	7.16	25.1	22.4	23.7	23.7
Route 3	7.83	22.1	21.0	28.0	23.7
Route 4	5.88	19.1	15.4	18.1	17.5
Route 5	5.31	10.6	9.9	10.6	10.4
Route 6	5.26	9.6	10.5	10.3	10.2
Route 7	7.21	25.3	16.1	26.9	22.8
Route 8	6.50	17.6	23.8	17.8	19.7
Route 9	9.91	24.5	20.9	18.9	21.4
Route 11	8.09	19.7	16.6	19.4	18.6
Route 12	11.81	24.6	20.5	16.7	20.6

Based on field survey results, the average speed of angkot in Banyuwangi varies from 10.2 km/hour to 23.7 km/hour as shown in Table 9. Armstrong-Wright and Thiriez (1987) recommends that public bus systems should operate with a minimum of 10–12 km/h operating speed for dense areas with mixed traffic. On this basis, the operating speed of *Angkot* is good enough for public transport system.

4.5.3 Load Factor

Load factor is the ratio of passengers actually carried to the total passenger capacity of the vehicle. It shows the level of crowdedness and level of vehicle capacity utilization. Passengers prefer low load factors because this means there is always space for them and their journey is more comfortable. Analysis of load factor is intended to measure passenger capacity per trip, so load factor can indicate whether each *Angkot* for each route carries people efficiently. From the user's view point, a low load factor will give the opportunity to sit and improve the convenience. For operators, on the other hand, a low load factor means less financial benefits. The opposite is true for high load factors. Calculation of load factor can guide policy determination for government and operators.

Table 10 Load factor of *Angkot* in Banyuwangi

Route	Average of route Length (km)	Load Factor (%)			
		Morning peak hours	Off peak hours	Evening peak hours	Average
Route 1	5.16	66.7	33.3	75.0	58.3
Route 2	7.16	66.7	25.0	33.3	41.7
Route 3	7.83	50.0	41.7	58.3	50.0
Route 4	5.88	58.3	25.0	25.0	36.1
Route 5	5.31	100.0	33.3	50.0	61.1
Route 6	5.26	66.7	41.7	66.7	58.3
Route 7	7.21	100.0	33.3	50.0	61.1
Route 8	6.50	75.0	25.0	66.7	55.6
Route 9	9.91	58.3	33.3	33.3	41.7
Route 11	8.09	50.0	25.0	58.3	44.4
Route 12	11.81	91.7	50.0	75.0	72.2

Load factor calculations are the primary variable used to assess how *Angkot* can be effectively and efficiently allocated among different routes. Table 10 shows the load factor for 11 routes. The highest load factors of more than 90% occurred on Routes 5, 7 and 12 during morning peak hours. With the exception of Route 12, load factors at off peak hours are very low. Most of the routes have twice the load factor during peak hours than during off peak hours. This suggests relative inefficiency and oversupply in some routes. Because of excess in supply on some routes, many of the vehicles are vacant. In these cases, new fleet of *Angkot* are not needed.

4.5.4 Frequency and Headway

Analysis of the performance of a public transport service must consider the requirements of passengers and operators because the requirements of passengers are very different from the requirements of operators. Passengers are interested in the quality of service provided. Of course, the quality criteria needs to be considered, and can be measured in surveys.

Frequency affects average waiting time (assuming *Angkots* are not already full). In Indonesia, passengers in urban areas expect high frequency, especially during times of peak demand. Frequency analysis is intended to measure the performance of the service given to users. In general, users want to use *Angkots* for their travel purposes and to get to their destinations as soon as possible, so they do not want to wait a long time. Long waiting times will discourage people from using the service, and makes urban public transport less attractive compared to private cars and motor cycles despite public transport's affordability.

Headway is the time interval between two successive buses passing a fixed point on a route in the same direction (Vuchic, 2005). Short headways mean short waiting times for passengers.

Table 11 shows that the frequencies between peak and off peak periods are very different. Most of the routes in Banyuwangi are not optimal because *Angkot* availability is high in peak periods, but in off peak periods, many *Angkots* do not operate because there are less users. This indicates that *Angkot* management for all routes needs to be revised, because many routes are not efficient in terms of frequency. As a result, the demand and supply is unstable. Headway for all routes except Route 11 is good from passenger's point of view where it varies from 2.9 to 5.5 minutes. It means passengers do not wait for long time to get *Angkot*.

Table 11 Headway and frequency of *Angkot* in Banyuwangi

Route	Frequency (units/hour)				Headway (minutes)			
	Morning peak	Off peak	Evening peak	Average	Morning peak	Off peak	Evening peak	Average
Route 1	27	17	19	21	2.2	3.5	3.2	2.9
Route 2	17	10	18	15	3.5	6.0	3.3	4.0
Route 3	16	9	15	13	3.8	6.7	4.0	4.5
Route 4	15	12	14	14	4.0	5.0	4.3	4.4
Route 5	13	10	12	12	4.6	6.0	5.0	5.1
Route 6	20	12	10	14	3.0	5.0	6.0	4.3
Route 7	15	10	9	11	4.0	6.0	6.7	5.3
Route 8	12	9	12	11	5.0	6.7	5.0	5.5
Route 9	17	7	16	13	3.5	8.6	3.8	4.5
Route 11	3	2	2	2	20.0	30.0	30.0	25.7
Route 12	13	10	12	12	4.6	6.0	5.0	5.1

4.6 Transfer Rate

Users need to transfer *Angkot* to complete trips which do not have a direct route form origin to destination. A low percentage of passengers having to transfer would indicate that a route is well matched to demand. The transfer data of *Angkot* users were collected by interviews with passengers in *Angkots*.

Table 12 Transfer rate of *Angkot* users in Banyuwangi

Routes	Without Transfer (%)	With Transfer (%)
Route 1	62.1	37.9
Route 2	56.7	43.3
Route 3	60.0	40.0
Route 4	62.5	37.5
Route 5	73.3	26.7
Route 6	23.3	76.7
Route 7	83.3	16.7
Route 8	56.7	43.3
Route 9	76.7	23.3
Route 11	42.1	57.9
Route 12	86.7	13.3

From the passengers' point of view, a good service is one which allows them to make their journey without having to transfer between origin and destination. If they have to transfer along their journey, the travel time is longer and they have to pay more money.

Table 12 shows the percentage of *Angkot* users travelling without transfer and with transfer for each route. These results reveal that the transfer rates of all routes in Banyuwangi except route 7, 9 and 12 are more than 25 %. It means that the routes of *Angkot* in Banyuwangi are not well matched to users' demands and are not efficient.

4.7 Driver's Characteristics

Table 13 shows the attributes of 55 respondents of *Angkot* drivers in Banyuwangi. The size of their families are mostly three (32.7%), four (30.9%), and more than four (29.1%). Table 14 shows gross income and rental fee of *Angkot* drivers. The driver gross income per day ranges from Rp. 65,000 to Rp. 187,000, with the average about Rp. 115,300. The rental fee per day ranges from around Rp. 20,000 to Rp. 50,000. The average rental fee is about Rp. 36,500.

Table 13 General attributes of *Angkot* drivers in Banyuwangi

Attributes	Variable	Value (%)
Age range	20 – 25 years	1.8
	26 – 55 years	85.5
	More than 55 years	12.7
Education	Elementary	16.4
	Junior High school	34.6
	Senior High School	49.0
Family size	Two	7.3
	Three	32.7
	Four	30.9
	More than four	29.1
Status in *Angkot* operation	Driver only	92.7
	Driver and owner	7.3

Table 14 Gross income and rental fee per day of *Angkot* drivers in Banyuwangi

Routes	Average driver's gross income per day (Rp.)	Average rental fee per day (Rp.)
Route 1	100,000	30,000
Route 2	65,000	21,000
Route 3	150,000	58,000
Route 4	112,000	40,000
Route 5	128,000	30,000
Route 6	120,000	60,000
Route 7	118,000	30,000
Route 8	147,000	35,000
Route 9	187,000	50,000
Route 11	73,200	28,000
Route 12	68,000	20,000

Figure 14 reveals that 72.7 % of *Angkot* drivers work 7 days per week and 67.2 % of them operates less than eight trips per day. Assuming that all drivers work 5 days per week and 4 weeks per month, their income may be estimated as Rp. 36,500 x 5 days x 4 weeks = Rp. 730,000. This value is not much higher than the average Per Capita income of Rp. 653,245 per month. This is higher than minimum living needs of Rp. 580,054 but less than average montly wage worker of Rp. 845,520 in East Java Province (BPS 2006).

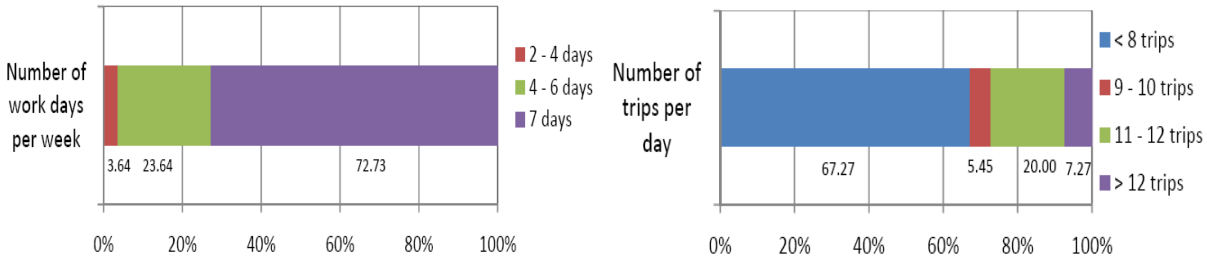

Figure 14 Trips characteristics by *Angkot* drivers

5. CONCLUSION

Angkot is a typical mode of public transport in medium sized local cities in Indonesia. This paper has explored the characteristics of *Angkot* and analyzed their performance in Banyuwangi based on observation, questionnaire, and interviews with *Angkot* users and drivers. The survey and analyses reveal the following:

1) The number of private cars and motorcycles has been increasing with the increase of Per Capita GRDP.
2) The ratio of road length to number of registered vehicles has been decreasing. This means that road congestion will become more severe in the future
3) The walking distances of passengers before boarding and after alighting *Angkot* less than 100m are about 62% and 65% of users, respectively. Moreover, these proportions are more than 80% for the distances less than 200 m. These results mean that *Angkot* routes and services need to be easily accessible by citizens.
4) Because the average age of *Angkot* is 15.9 years and may be not comfortable, renewal is required for the older *Angkot*.
5) About 50% of *Angkot* users' monthly income is less than Rp. 400,000. This is lower than the average monthly income of Rp. 653,245. Drivers' average monthly income is roughly estimated about Rp. 730,000. This value is not much higher than the average income of Rp. 653,245 per month.
6) The main users of *Angkot* are students, and 50-60% of users have no private vehicle. Therefore, *Angkot* plays an important role in public transport, especially for people on lower incomes. These results mean that it would be difficult to raise the fare for improvement or renewal of *Angkot* systems by *Angkot* owners.
7) Operation speeds are between 10 and 25 km/h in Banyuwangi, which is faster than the 10–12 km/h recommended for public transport systems in dense areas in mixed traffic. Transfer rates, which are the rates that passengers need to transfer to complete their travel, are high where the majority of routes has transfer rate more than 25%. These results reveal that *Angkot* system keeps a certain service level with room for improvement.

8) 35% of the *Angkot* users have motorcycles. In other words, *Angkot* and motorcycles compete with each other as modes of transport. The number of motorcycles is increasing correspondingly with economic growth in Indonesia. This means that there is a possibility that the users who have motorcycles will shift from *Angkot* in a near future.
9) From the above observation and analysis, effective and proper policy instruments are required to suppress rapid motorization, to improve the service level of the *Angkot* system, and to encourage the use of public transport.

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