COMPARATIVE STUDY OF PUBLIC BUS TRANSIT PERFORMANCE IN METROPOLITAN CITIES OF DEVELOPED AND DEVELOPING COUNTRIES: CASES OF JAPAN, LONDON, HANOI, BANGKOK, AND JAKARTA[*]

by Phyo Thet Thet Htun[**], Fumihiko Nakamura[***], Toshiyuki Okamura[****]

1. Introduction

Developing countries are characterized by relatively low level of income, low private car ownership, high population density in the cities, and rapid growth in urbanization coupled with limited financial resources available for investment in rail mass transit systems. Consequently, all of these conditions are favorable to a high level of bus transport ridership. On the other hand, the status of bus services are woefully influenced by substandard bus services quality that gives poor value for money, low standards of safety and efficiency making it uncomfortable, and unreliable. Although most of the bus transport problems experienced in developing countries are similar to those found everywhere in the world. However degree of problems tends to be much more critical in developing countries because the demand for transport is rising rapidly with population growth. The basic idea to overcome bus transport problems in developing countries is through enhancing the performance of existing bus transport system rather than trying to implement a new system that might need higher costs.

This study is therefore conducted to review public bus transit performance in metropolitan cities of developing countries as well as in developed countries. The main objectives of this study are
- ✧ To make comparison of operational and financial performance of urban bus operators, in order to get a better understanding of the nature of bus industry in developed and developing countries
- ✧ To find out the factors affecting on differences in public bus transit performance by comparison analysis to those in the developed countries

Case study technique was selected as the most appropriate form of methodology in order to make comparative study. Three metropolitan cities in developing countries such as Hanoi, Bangkok, and Jakarta were selected on the basis that they represent metropolitan cities with higher demand on bus transport services and they have similarities in demographic and socio-economy characters as developing countries in the Asia region. Additionally, two metropolitan cities in developed countries such as Yokohama and London were chosen to figure out the differences in operator performance between developed and developing countries from the perspective of Asian and Western concept of bus industry structure. The necessary information for this study was gathered through literature reviews and enquires from transport authorities and city bus operators holding relevant information in case study cities. Furthermore, each of 3 cities in developing countries was visited and several government officers/city transport authorities and city bus operators were interviewed in order to get information about current situation of their bus operation system.

This paper is organized as follows. The next section briefly summarizes the current state of bus transport industry structure in case study cities. Methodology approach for this study is explained in section 3. Comparative analysis of operational and financial performance of bus operators are presented in section 4. The main findings and conclusions are drawn in the final section of this paper.

2. Basic Characteristics of Case Study Cities

This section will briefly explain the demographic and socio-economic characteristics and the current situation of bus transport industry structure in case study cities.

(1) Demographic and socio-economic characteristics

It is essential to look on demographic and socio-economic background of a city because it provides one of the basic information that indicates the need of public bus transportation service. Table 1 shows the basic information of demographic and socio-economic background in the case study cities

---

[*] Keywords: Bus operators' performance, Comparison, Metropolitan cities, Developed and developing countries

[**] Student Member of JSCE, M.E., Department of Civil Engineering, Graduate School of Engineering, Yokohama National University
(79-5 Tokiwadai, Hodogaya-ku, Yokohama, 240-8501, Japan, Tel/Fax: +81-45-339-4039, email: phyotth@gmail.com)

[***] Member of JSCE, Dr. Eng., Department of Civil Engineering, Graduate School of Engineering, Yokohama National University
(79-5 Tokiwadai, Hodogaya-ku, Yokohama, 240-8501, Japan, Tel/Fax: +81-45-339-4032, email: f-naka@ynu.ac.jp)

[****] Member of JSCE, Dr. Eng., Department of Civil Engineering, Graduate School of Engineering, Yokohama National University
(79-5 Tokiwadai, Hodogaya-ku, Yokohama, 240-8501, Japan, Tel/Fax: +81-45-339-4033, email: tokamura@ynu.ac.jp)

Table 1: Demographic & Socioeconomic Characteristics of Case Study Cities

City	Country	Area of City (km²)	City Population (thousands) {2009}	Urban Population (thousands) {2010}	Urban Annual Growth Rate (%) {2005-2010}	National GDP Per Capita (US$) {2009 est.}
Hanoi	Vietnam	3,324.92	2,668	27,046	3.26	2,900
Bangkok	Thailand	1,568.74	6,902	23,142	1.66	8,100
Jakarta	Indonesia	661.52	9,121	102,960	1.74	4,000
Yokohama	Japan	437.38	3,680	84,875	0.19	32,600
London	U.K.	1,706.8	8,615	49,295	0.69	35,200

Source: United Nations, World Urbanization Prospects: 2009 Revision, World Population Prospects: 2009 Revision; CIA the world fact book; www.wikipedia.org

(2) Current state of bus transport industry in case study cities

The following section describes the summary of current bus transport industry structure in case study cities.

a) Hanoi, Vietnam

Bus operation in Hanoi is basically run by state-owned enterprise, called Transport and Service Corporation (Transerco) and three private operators. The private operators' entry to the bus market is controlled by the competitive tendering system newly introduced in 2005 to privatize bus services in Hanoi. In current operating arrangement all routes are operated under unit cost contracts which are defined as the operating cost per km. Transport Management and Operation Center (Tramoc) is a regulatory body under control of national government that has specific responsibilities for management and operation of bus transport in Hanoi such as planning of routes and making contracts to operators; management of bus service quality through inspection and supervision; management of bus-related infrastructures; management of revenues and determining the amount of subsidy. Bus operators need to follow in every operational aspect and moreover they are not allowed to decide fare level that is strictly controlled by the national government. This study mainly focuses on Transerco's performance since it is the largest bus operator and operating 48 out of a total of 56 routes.

b) Bangkok, Thailand

Bangkok Mass Transit Authority (BMTA) is a state-owned enterprise with the exclusive rights to operate fixed route bus services in Bangkok and surrounding areas under the supervision of Ministry of Transport through Department of Land Transport (DLT). Every route is governed by a route license which specifics every operational aspects and it is issued by the DLT. Since BMTA has a statutory monopoly right to issue licenses for large bus services, the other private bus operators have to get sub-license contracts from BMTA and it is called as BMTA joint service scheme. Private operators pay sub-license fee to BMTA and operate on routes determined by BMTA using their own buses at specified performance levels and fares, but retain fare revenue that must cover their operating costs. The selection process of private operators is ambiguous and is largely depending on the decision of Board of BMTA. BMTA was selected for this study because of its functions as bus operator as well as regulator of bus operation carried out under joint service licenses by private operators.

c) Jakarta, Indonesia

Since 2004, Jakarta's bus transport industry is divided into two types such as ordinary bus operation system and TransJakarta busway system. For ordinary bus services, the current regulation on bus operation is based on a route licensing. So far, new routes and new operating vehicles are proposed by the operator companies or cooperatives either individually or through ORGANDA, a professional organization in the field of land public transport. The licenses are awarded to individual buses. Therefore, it is not uncommon that one route is run by a number of individual bus owners. Undesirably, the award of a license to operate on a route is not accompanied by specified performance measures for both the service quality and physical standard of the bus. [1] In the field, the license holders (companies or cooperatives on the behalf of individual bus owners) hand over the actual management to bus crews who rent the buses on daily basis. The bus crews are obliged under specified revenue sharing system by paying a certain amount based on daily rental charge, number of bus trips or period of day of operation, or pre-determined commission as a percentage (about 10-17.5%) of bus passenger revenue while daily operational cost is covered by the bus crews. [2] Different from the ordinary bus operation system, TransJakarta busway is designed to provide the citizens of Jakarta with a fast and comfortable bus transportation system as buses are given median lanes. In the current regulation on bus operation, bus operators are selected through competitive tendering system using the service standards specified by the local government. The costs of bus operation are fully borne by local government budget. Busway system operation is managed by the BLU TransJakarta, i.e. a form of regulatory body and it has responsibility for administrative and financial matters such as making contract with operators, management of revenues, and maintaining busway-related infrastructure and facilities. Fare level is decided by the parliament at the local level. This study emphasizes on the performance of TransJakarta busway in order to compare it with the ordinary bus system of other case study cities.

d) Yokohama, Japan

Yokohama City Transportation Bureau is the administrative agency in charge of public transportation services in the city of Yokohama. Over half of Yokohama's buses routes are provided by Yokohama Municipal Transport Bureau (YMBT) with the remainder, serving mainly outer suburbs, run by private companies. All operators charge a common fare within the flat fare area which covers most of the city. For comparison of operators' performance, Yokohama municipal bus operator (YMBT) is selected from Yokohama city.

e) London, United Kingdom

Bus services in London are provided by private companies under tendered contracts with London buses, an arm of Transport for London (TfL) which manages bus services within Greater London and is responsible for delivering the Mayor of London's transport strategies. London buses manage bus services under TfL and have responsibility for planning bus routes, setting bus fares, management of revenues, specified service quality, managing and monitoring the performance of bus operators, and constructing and maintaining bus-related infrastructure. Current contract type is quality incentive contract in which TfL retains revenue but they incorporate incentive provisions in the form of performance payment bonuses and deductions. Tendered contracts are for up to 7 years extendable to 9 years in the event of achieving specified performance targets.

3. Methodological Approach

In order to get a better understanding of the nature of bus industry in developed and developing countries, the paper first makes comparative analysis of operational and financial performance of bus system among case study cities. Depending on the availability of detailed data, the performance of major bus operation system in each city has been selected and the general information of their systems is shown in Table 2. To assess the operational and financial performance of bus system, performance indicators are selected based on data availability. Table 3 shows detail explanation of these indicators. It then discusses factors affecting on differences in public bus transit performance by comparison analysis to those in the developed countries

Table 2: Basic Characteristics of Case Study Systems (2009 Data)

	Transerco, Hanoi	BMTA, Bangkok	TransJakarta, Jakarta	YMBT, Japan	TfL, London
Established year	2001	1976	2004	NA	2000
Size of bus operating system					
(a) bus fleets size	830	3506	426	786	8,200
(b) no. of staff	4,800	16,516	811	2412	NA
(c) no. of operated routes	48	108	8	129	700
(d) total operating length (km)	958.3	2,593.9	143.35	497.629	3,730
Average daily no. of passengers	1,018,758	1,112,329	225,692	336,450	6,156,164

Table 3: Evaluation Index for Bus Transit Performance

Evaluation Index	Definition	Measurement
% of total fleet	A proportion of total buses in service from the total fleet	Fleet utilization
Bus-km per operating buses	*Bus-km:* Total distance traveled by buses in service *Operating buses:* Total no. of operating bus	Vehicle utilization
Total passengers per bus-km	*Total passengers:* Total of all passengers *Bus-km:* Total distance traveled by buses in service	Service utilization
Operating cost per bus-km	*Operating cost:* Total of all expenses to operate bus system, except capital *Bus-km:* Total distance traveled by buses in service	Cost efficiency
Revenue per bus-km	*Revenue:* Total revenue earned from the bus system operation *Bus-km:* Total distance traveled by buses in service	Revenue generation

4. Analysis of Data

(1) Operational performance

Availability and utilization of the buses considerably influence on the productivity and efficiency of the bus system. Further, in order to sustain the level of financial viability, buses need to be well utilized throughout their period of operation. Hence, the assessment of the operational performance, in terms of fleet utilization in combination with vehicle utilization is deemed essentials as this can figure out an important input to productivity of the system. Figure 1 below shows a comparative operational performance of case study systems except London because of lack of data during 2004 to 2009 based on fleet utilization and vehicle utilization.
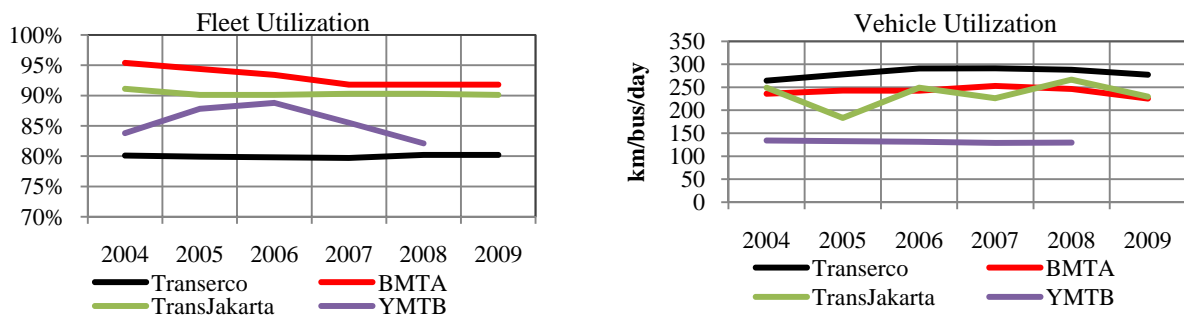
Figure 1: Fleet utilization and vehicle utilization of Transerco, BMTA, Transjakarta, & YMTB (2004~2009)

According to World Bank study of 1987 [3)], with adequate maintenance and staff management, fleet utilization between 80-90% is considered reasonable, though it can be achieved to 95%. On the other hand, vehicle utilization for developed and developing countries is 130 km/bus/day and 220km/bus/day respectively.

An analysis of the fleet utilization and vehicle utilization of case study systems shows that the fleet utilization for both developed and developing countries stand above 80% and vehicle utilization for developed and developing countries are about 130 km/bus/day and approximately 250 km/bus/day or more respectively. Thus, the operational performance of bus operators in terms of vehicle utilization can be said to be more than the World Bank standard for developing countries.

(2) Service utilization

Now this study will discuss the extent to which this capacity is utilized by the public and the quality of the bus service. An analysis of service utilization, shown in Figure 2, indicates that YMTB and TfL are significantly higher than TransJakarata and BMTA, indicating better service utilization because of provision of good bus services quality. In contrast, Transerco shows even higher service utilization compared to YMBT and TfL which if combined with findings of low fleet utilization and higher vehicle utilization can be regarded as overstressed rather than efficient system.
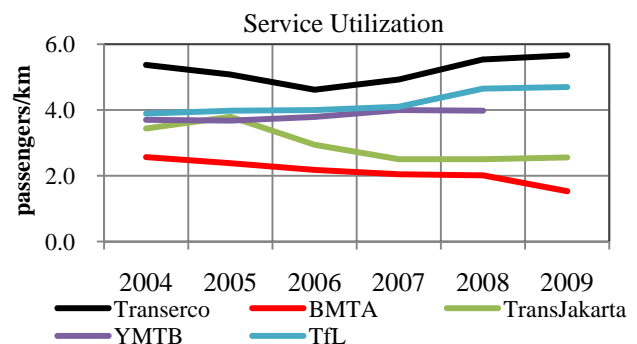

Figure 2: Service utilization of case study systems (2004~2009)

(3) Financial performance

Data of bus operations in case study systems show losses throughout the study period of 2004~2009 except YMBT that seem profitable in some period, see Table 4. The consistent losses suffered by the bus operations in case study systems obviously show that the total costs consistently exceeded total revenues; i.e. primarily generated from passenger fares.

Table 4: Key Financial Performance Statistics (2004~2009)   Unit: ($ millions)

Transerco	2004	2005	2006	2007	2008	2009
Total operating costs	17.03	21.11	24.61	31.43	32.98	37.41
Bus fare revenues	10.51	13.73	15.39	16.19	17.93	18.86
Profit/loss	**-6.52**	**-7.39**	**-9.22**	**-15.24**	**-15.05**	**-18.55**
BMTA	2004	2005	2006	2007	2008	2009
Total operating costs	330.37	359.16	412.36	404.62	435.06	362.46
Bus fare revenues	174.90	186.53	204.39	201.08	203.32	223.27
Profit/loss	**-155.47**	**-172.63**	**-208.02**	**-203.53**	**-231.73**	**-139.19**
TransJakarta	2004	2005	2006	2007	2008	2009
Total operating costs	5.1	7.32	33.82	39.92	52.09	62.02
Bus fare revenues	4.33	6.18	14.49	22.92	27.51	30.41
Profit/loss	**-0.77**	**-1.14**	**-19.33**	**-17.00**	**-24.58**	**-31.61**
YMBT	2004	2005	2006	2007	2008	2009
Total operating costs	NA	287.92	255.59	228.42	235.77	NA
Bus fare revenues	NA	272.48	257.45	233.34	224.61	NA
Profit/loss		**-15.44**	**+1.86**	**+4.92**	**-11.16**	
TfL	2004	2005	2006	2007	2008	2009
Total operating costs	2720	3079	3311	3527	3851	3911
Bus fare revenues	1531	1749	1952	2054	2291	2298
Profit/loss	**-1189**	**-1330**	**-1359**	**-1473**	**-1560**	**-1613**

Since bus-km is the main cost driver in operating cost of bus system, therefore in order to make proper comparison of financial performance, cost/revenue per bus-km for each city are computed. These calculations of per-unit operating costs and revenues are presented in Table 5. Additionally, financial position in terms of average revenue earnings and average cost of operation (in US$ per bus-km) of case study systems over the period of 2004~2009 is shown in Figure 3.

Table 5: Trends in Per-Unit Operating Costs & Revenues

Statistic/bus system	Absolute level						Change (%)				
	2004	2005	2006	2007	2008	2009	2004-05	2005-06	2006-07	2007-08	2008-09
Cost per bus-km ($)											
Transerco	0.32	0.36	0.38	0.48	0.50	0.55	+12.5	+5.56	+26.32	+4.17	+10
BMTA	1.13	1.20	1.39	1.35	1.50	1.37	+6.19	+15.83	-2.88	+11.11	-8.67
TransJakarta	1.11	1.34	2.57	1.63	1.75	1.93	+20.72	+91.79	-36.58	+7.36	+10.29
YMBT	NA	7.20	6.88	7.13	7.65	NA	NA	-4.44	+3.63	+7.29	NA
TfL	6.22	6.84	7.29	7.70	8.23	8.18	+9.97	+6.58	+5.62	+6.88	-0.61
Revenue per bus-km ($)											
Transerco	0.20	0.23	0.24	0.25	0.27	0.28	+15	+4.35	+4.17	+8	+3.70
BMTA	0.60	0.62	0.69	0.67	0.70	0.84	+3.33	+11.29	-2.89	+4.48	+20
TransJakarta	0.93	1.13	1.10	0.94	0.92	0.95	+21.51	-2.65	-14.55	-2.13	+3.26
YMBT	NA	6.82	6.93	7.29	7.29	NA	NA	+1.61	+5.19	0	NA
TfL	3.50	3.89	4.30	4.48	4.90	4.81	+11.14	+10.54	+4.19	+9.38	-1.84

Source:Transerco through Dr.Hung (Institute of Transport Planning & Management, Hanoi University of Transport & Communication); BMTA through Mr. Surawangse (Bangkok Metropolitan Administration) & Mr. Chana (Department of Land Transport); BLU TransJakarta; YMBT official website; TfL annual report 2009
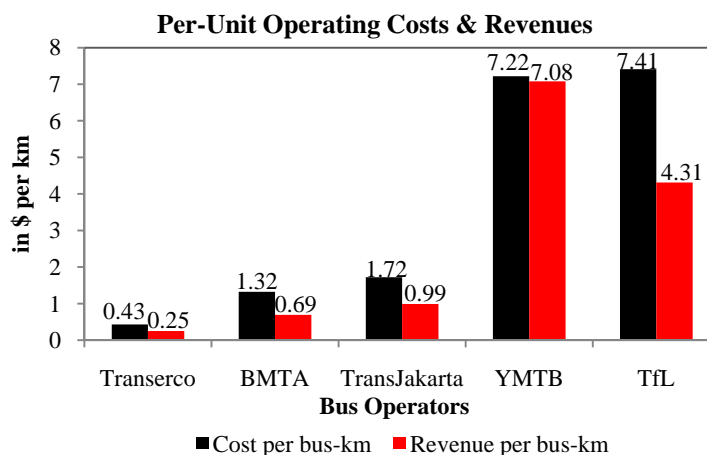

Figure 3: Average costs and revenues per km over the period 2004~2009 in case study systems

The analysis of costs and revenues per unit km shows that case study cities have similar trend of more operating costs compared to revenue generated. Cost per bus-km is considerably higher in developed countries due to their higher socio-economic background and provision of bus services by utilizing advanced technology.

Among case study systems of developing countries, operating cost of TransJakarta is considerably higher than the other two systems. The reason behind the higher costs is due to implementation of busway system, in contrast to ordinary bus system of Transerco and BMTA. It is more interesting to see that cost of providing bus services of BMTA is found to notably higher than Transerco even though both of them are similar ordinary bus systems.

Though there are several causes for BMTA's running in loss, the foremost one is deployment of excess manpower than required that creates high wage and salary overheads as it can be seen on every large corporate and organizational structure. Furthermore, one of the major problems of BMTA costing is bus maintenance cost as bus maintenance is performed by contracts with third parties. These contracts are not based on km of operation and are accounted for on a daily basis. Moreover, impact of ticketing policies and fare structure is also one of the adverse affect on BMTA revenues. BMTA is required to provide social concessions/free travel facility to certain category of passengers. BMTA has introduced advanced purchase ticket (time based) that offers unlimited bus trips within the time period indicated on the ticket with the purpose of getting greater patronage, however, in fact, that tickets are vulnerable to exploitation. The availability of unlimited trips has potential of using by other parties (not the purchaser) and of making extra free trips

and as a result, severe reduction in revenue of BMTA.

In case of Transerco, although it has higher service utilization, the system still incurs losses in operation. One of the reasons can be due to revenue leakages that come from inappropriate fare collection system since bus fares is collected by on-board conductors. Bus conductors are either tardy in the collection of fares in the case of large crowded buses or they cannot tackle fare evaders. Additionally, fares collected can be stolen by the conductors.

For developed countries, financial position of YMBT seems relatively better than compared to TfL as costs balance with revenues. In case of London buses, costs are rising faster than bus fare revenues over the period of 2004~2009. Higher operation costs are compounded by a growing scale of the network, both its size and frequency of services set out by the Mayor's transport strategy that needed additional resources to deliver the service. In addition, TfL pursued a Mayoral policy that ensured operational bus staff received a bonus since 2001; designed to increase attendance rates and in turn improve bus operating performance. [4] During this period, passenger demand has grown considerably from growth in the size of the network however; the growth in revenue has been less than the growth in passenger journeys. This is reflected due to the further increase in the range and validity of concessionary tickets, which now offer free travel to children under sixteen (under eighteen for those in full time education) and people over sixty at any time of the day. The other factor of cost rising is due to increased in TfL overhead costs such as the ticketing system and iBus passenger information that come from the impact of mayor policy decisions to introduce the new bus for London.

5. Conclusions

Even though it is widely believed that socio-economic factor is one of the important indices which affect on operation of bus transport services worldwide developing, yet a better quality of service can be provided through improved operation and management e.g., case study of Jakarta city, whose National GDP much lower than Bangkok city, shows better quality of service using TransJakarta busway system despite having similar financial performance to those in other case study cities except Yokohama.

In developing countries, government considers bus services as a welfare function provided to the people and thus fares are often regulated at lower levels for benefit of the community, in particular, the urban poor. As a result, generated revenue becomes considerably lower than operating costs that is later compensated by Government in the form of subsidy and if the subsidies do not keep up with demand due to shortage of funds then result is reduced standard of service.

Among developing countries, TransJakarta has higher costs of providing bus services that can be attributed to implementation of busway system in contrast to ordinary bus system of Transerco and BMTA. However, interestingly the costs of BMTA bus services are considerably higher than Transerco even though both have similar ordinary bus systems. The main reason of such high costs of BMTA is regarded as due to large organization structure that lead to high wage and salary overheads, and inappropriate maintenance system.

Furthermore, fares collection system, revenue controls system and driver salaries are different in each system and they are found to directly influencing the bus systems financial performance. Usual practices of such system among developed countries, if implement in developing countries with a varying degree of feasibility considering their socio-economic situation can help to improve their financial performance.

6. Acknowledgments

7. References

1) Indonesia National Development Planning Agency (BAPPENAS) and Japan International Cooperation Agency: The study on integrated transportation master plan for Jabotabek (Phase 2): Technical Report, Vol. 6, 2004

2) Ieda, H.: Sustainable Urban Transport in an Asian Context, Springer, 2010

3) Wright, A.A. and Thiriez, S.: Bus services: reducing costs, raising standards, World Bank Technical Paper Number 68: Urban Transport Series, 1987

4) KPMGLLP, London Bus Services Limited: Independent strategic review of the provision of bus services in London, Final report, July 16th, 2009