Proceedings of the Eastern Asia Society for Transportation Studies, Vol. 5, pp. 352 - 362, 2005

ANALYZING OF BUS SERVICE IN HANOI, VIETNAM

Trinh Tu ANH
Lecturer
Department of Transport and Economics
University of Transport and Communication
Hanoi- Vietnam
Fax: +84-8-827-9205
Email: tuanhxd@yahoo.com

Yordphol TANABORIBOON
Professor
Asian Institute of Technology
PO Box 4, Klong Luang, Pathumthani 12120
THAILAND
Fax: +66-2-524-5509
E-mail: yord@ait.ac.th

Bui Quang HUNG
Lecturer
Department of Accounting
University of Economics
Hochiminh City, Vietnam
Email: u_khung@yahoo.com

Abstract: This paper presents the systematic method to improve inefficient and ineffective bus operations through the performance analysis in Hanoi. Bus operations and characteristics were conducted and compared among bus routes. In addition, questionnaire surveys were employed on the bus users and their perceptions toward the bus service. Furthermore, the performance indicators through resource, service efficiency and effectiveness were analyzed on bus routes and their performances were compared among bus companies. Also, GIS package, Map Info, was employed as a tool to clearly identify the operating deficiencies and the causes of poor operations of these bus routes. It was found that 90 percent of bus routes were identified as deficient. The poor performance operational characteristics in this study were low service distance, insufficient bus operation, poor social effectiveness and low passenger trips. Therefore, to minimize these deficiencies, recommended measures were proposed improve the bus services in Hanoi.

Key Words: Bus Service, Public Transport, Performance Indicator

1. INTRODUCTION

The higher public income and the preeminence of private transportation mean also lead to the increase in owning private vehicles. Recently, Hanoi has been confronted with serious issues resulting from increased road traffic congestion. One of the most prominent methods to solve the traffic congestion problem is to improve the bus operation.

For the reason that the limitation of bus facilities, such as narrow road network, lacking of parking area, deficiency in road system, etc. impact directly to bus route network, bus system serves a limited area and number of roads covered by bus are limited. Furthermore, in some urban area does not serve any buses due to high concurrence of bus routes.

The main purpose of this paper is to examine the bus services in Hanoi through the application of Geographic Information System (GIS). The specific objectives of this study are to investigate the existing bus system in Hanoi; to examine the bus service characteristics and

user characteristics; to analyze the deficiencies of bus service by applying GIS concept as well as to compare efficiencies of bus service operation to each bus company.

2. BUS USERS CHARACTERISTICS ANALYSIS

The study of bus users characteristics were totally conducted through the questionnaire surveys. A thousand of bus users and people either traveling or living along all 41 bus routes in Hanoi were interviewed to study their characteristics and perceptions toward bus service.

Using cross-classification technique, the relationship between any two factors was accordingly analyzed to determine how one factor could affect upon the other. The analysis of the public transportation usage classified by income is presented in Table 1.

Table 1. Analysis the usage of public transportation in income

Income (VND)	**The frequency of people using bus service**			
	Seldom	Daily	1 time per week	Total
<200.000	11.10%	11.40%	2.10%	**24.60%**
200,000-700,000	18.70%	25.90%	7.20%	**51.80%**
800,000-1.5 mill	10.20%	7.00%	2.70%	**19.90%**
1.6-2.5 mill	2.10%	0.39%	1.20%	**3.69%**
Total	**42.10%**	**44.69%**	**13.20%**	**100.00%**

Considering the analysis of the respondent's frequency bus usage, it was known that this figure based on bus users' respective income. More than 75% of the people using bus service were low income level which was less than 700,000 VND. On the contrary, only 0.4% of high income people (1.6-2.5 VND Million) used public transportation daily while other 1.2% used once a week. In addition, 42% of bus users seldom used bus service, 45% of those used daily, and other 13% used once a week. This study also revealed that the first highest sharing user group (59%) was student, while the second highest (15%) was government officers. The labor group with 5.6% fell into the last bus user group.

Regarding the reasons why people choose bus service, mainly 45.5% and 33.5% used this mode because of safety and cheap price, respectively. While short walking, comfortable and short time walking was not the major motivation which totally occupied 20% of all users.

This study found that people would not use bus service when their trip times were short, particularly less than 19 minutes (63%). There are two main reasons why people did not choose bus mode. About 48 percents of them answered "Long walking distance" reason while other 22 percents of them did not use by means of "Work place near home". These people mainly occupied in the short trip time group (less than 19 minutes). It can be implied that people in Hanoi used bus service when their trips are quite long. The other main reasons, which are "Not on time", "Expensive price" and "Long waiting time" were not affected the uses of bus service in Hanoi as shown in Table 2.

Table 2. Analysis of trip time impact to the main reason that people do not use bus service

Trip time	The main reason that people do not use bus						
	Work place near house	Long waiting time	Not on time	Noisy & crowded	Long walking distance	Expensive price	Total
<9	5.30%	0.70%	0.70%	0.70%	14.60%	0.70%	**22.50%**
10-19	10.60%	4.60%	2.60%	6.00%	16.60%	0.70%	**41.10%**
20-29	3.30%	2.60%	0.70%	3.30%	6.00%	0.70%	**16.60%**
30-39	1.30%	0	0	1.30%	6.60%	0.70%	**9.90%**
40-49	1.30%	0.70%	0.70%	0.70%	2.60%	0.70%	**6.60%**
>60		0.70%	0.70%	0	2.00%	0	**3.30%**
Total	**21.90%**	**9.30%**	**5.40%**	**11.90%**	**48.30%**	**3.50%**	**100.00%**

Finally, the results of bus user survey and analysis showed that the young people used bus service more than the elderly, especially the ages ranging from 19-20 years old, which were occupied about 65% of all bus users. In addition, approximately 75 percents of bus users prefer air-conditioned bus and large bus and only 10 percents prefer mini bus (non-air conditioned bus). Besides that, almost half of these air-conditioned bus users fell into the age of 20-29 years old while about 13 percents are less than 19 years old.

3. BUS SERVICE CHARACTERISTICS ANALYSIS

In order to analyze the characteristics of bus services in this study, principle data of bus operation were collected from field surveys which are travel time, headway, and load factor.

3.1 Bus Headway Analysis

Because of limited budget, bus travel time surveys were collected in three bus routes: No.18, No.32 and No.34. Bus route No.18, a circle route, operated with minibus. Bus route No. 32 operated with air-conditioned bus, while bus route No.34 operated with non-air conditioned bus. Observing stations (or bus stops) were selected along these three bus routes at the crowded and main bus stops. Concurrently, the arrival and departure times of these buses were also recorded during the survey period from the respective bus terminals to obtain a comprehensive picture of bus travel time pattern from origin to destination. Furthermore, the observing stations were served as intermediate checkpoints. If so, all bus routes were surveyed at either two intermediate stations or one terminal station.

The mean, standard deviation, coefficient of variation (CV) of headway, average dwell time as well as average cycle time of any bus route were calculated in each period of time to make a comparison among other bus routes. It was believed that high variation lead to the operating deficiency of bus service. Because of considering CV values of 0.1-0.2 as high variation and CV values greater than 0.2 as very high, therefore, it can be said that any CV values more than 0.1 are considered as deficient.

According to those three mentioned bus routes, the average headway in each major bus stop and the average headway in a certain period of time were set up from the Hanoi

TRANSERCO schedules. During peak period average headway of bus route No.32 was a 5-minute interval while bus routes No.18 and No.34 were 15-minute interval.

For further analysis, this research used mean values to determine the efficiency of bus services. If the average headway of each bus route was less than the mean then that route was considered poor headway and deficiency. Study of bus headways on three routes showed the inefficient and unreliable bus service.

We could see the daily average headway curve of bus route No.18 in the figure 1 as described as not smooth, it always had large headway. The daily average headway of route No.32 and No.34 were not higher than the schedule.

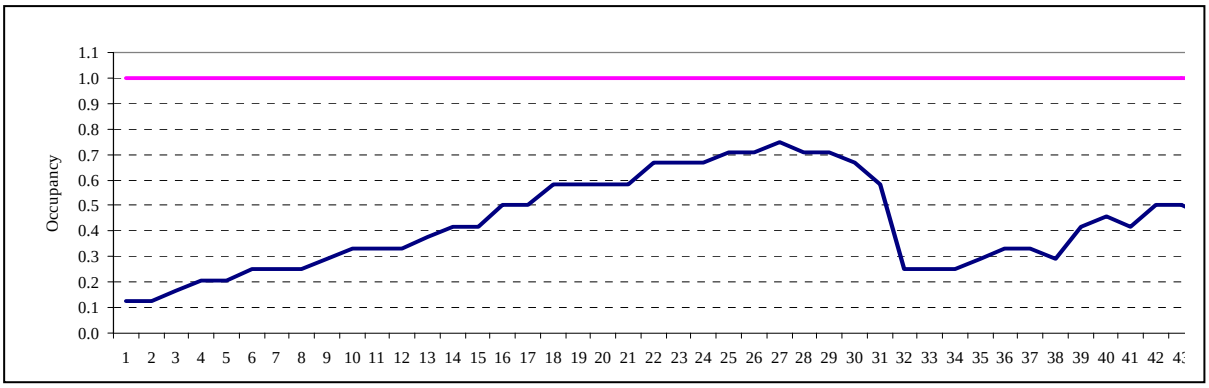

Figure 1. Bus route no 18, outbound, Evening peak period

3.2 Bus Boarding and Alighting Analysis

The numbers of boarding and alighting passengers in each bus stop were collected in three time periods, which are morning peak period (7.00-9.00), midday off peak period (13.00-14.00) and evening peak period (16.00-18.00).

For 25 bus routes in the network, the operation of each bus route was evaluated from the data of the on-board survey. Three bus service characteristics were determined in this analysis, which are the passenger changing factor, load factor through capacity of buses and number of passengers boarding and alighting on bus.

The result of boarding and alighting analysis was presented in Figure 2. It was clearly identified that the passengers traveled in bus routes No.24, No.2, No.18 and No.9 were changing most. It implied that these bus routes excluding bus route No.2 were operated efficiency in their function as circle route. Moreover, the load factor and the changing load factor were relatively good in almost all bus route surveys in Hanoi.

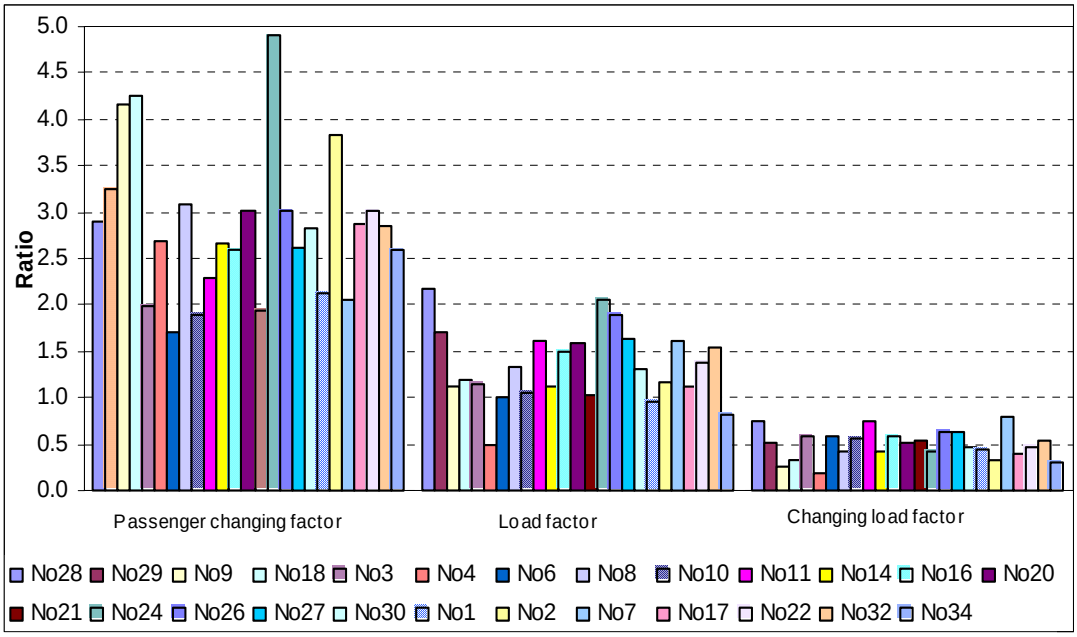

Figure 2. Boarding and Alighting Passenger Analysis

4. PERFORMANCE INDICATORS ANALYSIS

4.1 Selection of Performance Indicators

Three performance concepts were presented in the Fielding Model, 1978 (resource input, service output, service consumption) and were integrated to a framework for establishing the set of performance indicators as follows:

1. Resource-Efficiency (service output against resource input) measures services inputs to the amount of service produced.
2. Resource-Effectiveness (service consumption against resource input) measures the service inputs to exact service provided for commuters.
3. Service-Effectiveness (service consumption against service output) measures the extent to which service passengers consume outputs.

This classification considered different aspects of bus operation closely establishing performance indicator more systematically. The performance indicators selected in this study are described in Table 3.

Table 3: The Selected Performance Indicators

Construction	Focus	Meaning of the performance Indicators	Indicators
Resource Efficiency	*Labor efficiency*	Vehicle revenue km per operating employee	VRKM/OEMP
		Operating employee per operating bus	OEMP/BUS
	Vehicle utilization Efficiency	Vehicle revenue km per operating bus	VRKM/BUS
		Passenger trips per all bus	TRIP/ABUS
	Output measures and Cost	Operating expense per vehicle revenue km	OEXP/VRKM
		Operating expense per vehicle hour	OEXP/VH
	Fuel Efficiency	Vehicle revenue km per liter of fuel	VRKM/FUEL
	Resource or characteristic	Operating expense per operating bus	OEXP/BUS
		Vehicle revenue per vehicle revenue km	VRKM/VKM
Service effectiveness	*Service utilization*	Passenger trips per vehicle revenue km	TRIP/VRKM
		Passenger trips per vehicle hour	TRIP/VH
	Revenue Generation	Ticket revenue per passenger trip	TREV/TRIP
		Ticket revenue per operating bus	TREV/BUS
	Social Effectiveness	Stops per km of route length	STOP/LEN
		Operating bus per km of route length	BUS/LEN
Resource Effectiveness	*Service and Expense*	Operating expense per passenger trip	OEXP/TRIP
		Passenger trips per available bus	TRIP/BUS
	Cost Recovery	Ticket revenue per operating expense	TREV/OEXP
		Ticker revenue per total expense	TREV/TEXP

4.2 Determination of Performance Indicators

Not only the nineteen Performance Indicators Values and Statistical Values as the mean, standard deviation, minimum-maximum values, as well as coefficient of variation (CV) were computed in this study, but the descriptive statistical indicators were also used to reveal the differences in operational performance at each route level of bus operation.

Statistical Analysis of Performance Indicators can show the deficiency and effectiveness of these bus services. The CV value is considerably high (greater than 0.1), the indicator values of every bus routes should consider determining the cause of variation and the cause of inefficiency or ineffectiveness.

It is difficult to analyze the operating deficiency of bus route by using these high variation performance indicators due to its large number, which may lead to confusion in the analysis. For this reason, this study selected only high variation indicators, which show poor operating performance to determine the bus service deficiencies. Criteria of mean values of each performance indicator of all bus routes are used for this purpose.

Except the cost indicator, all performance indicators of which value was less than the mean, would be considered as poor performance indicator.

The final goal of this developed analysis is to compare the performance among all bus routes to measure the ability of bus operation in each route and give proper information for improving the bus operations.

Using score method or ranking (weighting) techniques, this study was conducted in order to determine the ability and accessibility to make the comparison in each bus route services. The weighted different factors employed in this study are based on their importance. Finally, each bus service company was compared through the performance indicators.

4.3 Performance Indicators Output

Tables 4 and 5 in Appendix revealed that most of performance indicators had very poor performance, such as TRIP/ABUS, OEXP/VH, VRKM/FUEL, TRIP/VH, TRIP/VRKM, BUS/LEN, TRIP/BUS, TREV/OEXP and TREV/TEXP. It can be identified that only operation employment per operating bus (OEMP/BUS) was the best indicator among all performance indicators.

The performance indicators of bus route No.2, No.3, No.16, No.22, No.28, and No.32 presented that these buses were the most efficient and effective bus services among the whole bus route network, while bus route No.10, No.11, No.14, No.20, No.30, No.31, No.35, No.38, and No.50 were the worst.

The reasons of deficiency and ineffective service of these bus routes might be the ticket price strategy, long route length, low service utilization, poor social effectiveness, insufficient number of staff and buses, low quality of buses as well as cost management.

Considering the low performance indicators (OEXP/BUS, OEXP/TRIP), the cost management of bus service was quite good in the first-six months of this year. In fact, the passenger trips were quite large while the cost recovery was yet very low.

Regarding the weighted score evaluation, this study demonstrated that bus route No.32, No.2, No.3, No.15, No.16, No.22 were the best, whereas bus route No.12, No.5, No.25, No.37, No.33 were the worst.

For these two mentioned results, it can be recognized that some bus routes although came up with many low performance indicators, however, finally the ability and accessibility of these bus routes were more efficiency and effectiveness than others. For example, bus route No.15 finally showed the good operating result despite the fact that there were only 30 percents of good performance indicators.

It means that these good performance indicators are very important indicators to make a final decision for efficient and effective bus route.
The problem of deficiency and ineffectiveness service would therefore be the bus operating strategy in each period.

4.4 Comparison of Performance Indicators Among Bus Company

The 10/10 company did not operate effectively as compared to other companies in Hanoi through using score method. ThuDo company operated the most effectiveness with the weighted score evaluation were 44%, 12% and 9% higher in comparison with 10/10 company,

Thanglong company and Hanoi company. The reason for poor operation of 10/10 company was operation strategy of manager and the knowledge staff. Because almost bus route's company were length bus route connecting Hanoi to local area and circle routes, so they should had their own operation strategy to attract more passengers to improve effectiveness of service.

4.5 GIS Application

This study employs the GIS through two aspects: First, the computerized map presenting the geographic information is integrated to identify the causes of deficiency of bus route network. Second, the geographic bus route resulting from data collection and analysis is performed in a computer database.

In the study, the MapInfo Professional which is GIS software was employed. Then, thematic mapping was applied to analyze and visualize the data of bus routes in bar and pie charts. The final result of GIS analysis is depicted in Figure 3.

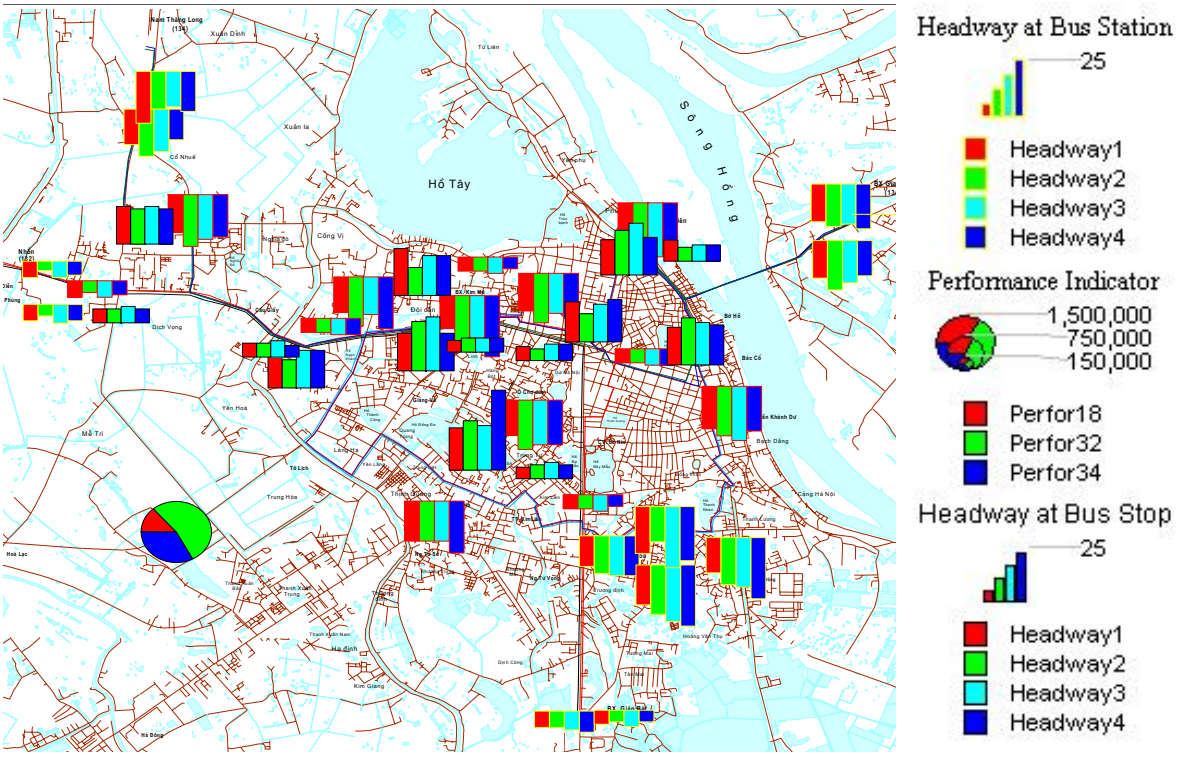

Figure 3: The Final Result of GIS Analysis

5. CONCLUSION

The combination of different methods in the analysis of Hanoi bus service which were performance indicators, bus operation analysis as well as GIS analysis was identified operational deficiencies and their causes to improve bus service effectively through three poor operating bus routes. The use of performance indicators classified into three performance concepts: Resource-Efficiency, Resource-Effectiveness, Service-Effectiveness and GIS analysis in evaluating and identifying bus service's problems in Hanoi is a new method. This

technique helps decision makers and consultants in public transportation field to upgrade bus service quality.

It is necessary that the government should use this method to deal with database and improve bus service for solving the traffic congestion and environmental problem in Hanoi.

REFERENCES

1. BLADIKAS, A.K. and PAPADIMITRIOUS,C (1985). Analysis of Bus Transit's operating Labor Efficiency using Section 15 Data. *Transportation Research Record 1013, pp.49-57.*

2. FIELDING, G.J., and ANDERSON, S.C. (1984). Public Transit Performance Evaluation: Application to section 15 Data. *Transportation Research Record 797, pp.1-7*

3. FIELDING, G.J., GLAUTHIER, R.E., and LAVE, C.A (1978). Performance Indicators for Transit Management. *Transportation. Vol.7, pp.365-37.*

4. NAKANISHI, Y.J. (1977). Bus Performance Indicators, On Time performance and Service Regularity. *Transportation Research Record 1571, pp.3-13.*

5. QUIUM A.S.M (1993). Transit performance Evaluation: Application in Operation Management and a Strategic Approach for the Improvement of Bus Operation in Bangkok, Doctoral Dissertation GT-99-3, AIT, Bangkok.

6. TALLEY, W.K. (1981). Effectiveness and Efficiency in Transit Performance, *Transportation Research, vol.15A, pp.431-436.*

7. TALLEY, W.K. (1986). A Comparison of Two Methodologies for Selecting Transit Performance Indicators. *Transportation, vol.13, pp.201-210.*

8. TANABORIBOON, Y., QUIUM A.S.M and CHANGSINGHA C. (1993), Performance Indicator Analysis: A Management Tool for the Improvement of Bus Transit Operation in Bangkok, *Journal of Advance Transportation, Vol.27, No.2, pp.207-223.*

9. Watcharia, W. (1980), Reliability of Bus Journey Times and Headways in Bangkok. Master Thesis No.GT-80-36, AIT, Bangkok.

10. PHOL, S. (2000), Performance Evaluation of Bus Transit Operation in Bangkok Using Performance Indicator and GIS Analysis. Master Thesis No.GE-99-22, AIT, Bangkok.

APPENDIX

Table 4. Performance Indicator Analysis

Company	Route No	Resource Efficiency (30%)								
		VRKM /OEMP	OEMP/ BUS	VRKM /BUS	TRIP/ ABUS	OEXP/ VRKM	OEX P/VH	VRKM /FUEL	OEXP/ BUS	VRKM /VKM
Weighted		0.4	0.4	0.6	0.5	0.7	0.7	0.3	0.5	0.2
Hanoi	1	6303	7.02	44244	262440	11.15	44654	300	493423	0.66
	3	6636	6.87	45609	312093	10.97	46237	458	500203	1.01
	4	5370	6.75	36248	231127	11.75	40083	640	425880	0.77
	6	6372	7.02	44728	231403	12.39	50163	315	554298	0.59
	10	6259	7.06	44198	203177	12.20	48514	461	539247	0.86
	11	6728	6.75	45415	210819	12.05	51497	457	547158	0.85
	12	4418	7.02	31013	88668	9.47	26581	747	293719	0.74
	15	9016	7.20	64918	208730	11.50	65861	350	746430	0.77
	20	6974	7.20	50216	203536	12.45	55175	427	625316	0.80
	23	5399	7.80	42115	73114	7.64	26198	1011	321649	1.00
	36	5572	8.10	45136	76897	8.14	28829	969	367571	0.96
10.10	5	5433	8.40	45638	53929	6.96	24038	955	317834	0.89
	8	6835	6.43	43942	304480	11.10	48181	389	487545	0.73
	9	5311	7.65	40632	147387	10.14	34217	512	412030	0.70
	18	5879	8.10	47618	99069	10.30	38456	507	490308	0.70
	19	5050	7.36	37186	171521	12.53	40192	269	465862	0.50
	21	4817	6.67	32134	197022	12.61	38591	260	405201	0.49
	25	5092	7.33	37315	71405	7.03	22755	1037	262491	0.97
	27	6384	6.67	42588	163511	10.74	43559	518	457370	0.97
	28	6033	7.48	45108	112291	7.83	30007	815	353164	0.90
	29	6076	7.33	44532	82881	7.88	30425	878	350974	0.97
	37	5149	8.40	43255	87306	6.76	22125	1173	292538	1.10
	40	6679	7.80	52092	85662	8.15	34564	675	424370	0.74
Thudo	7	10129	7.33	74231	185813	11.70	75308	405	868734	0.89
	17	11177	6.41	71672	262385	11.39	80878	582	816360	1.31
	22	6201	6.44	39925	258752	13.83	54468	512	552008	0.96
	24	8332	6.60	54988	161312	10.55	55843	1002	580149	1.87
	32	7374	6.48	47784	339502	13.80	64639	445	659317	0.83
	33	3059	8.10	24775	100041	6.08	11815	556	150645	0.52
	34	5829	6.75	39343	201981	11.99	44411	218	471872	0.49
	50	6383	7.43	47393	77930	11.61	47068	444	550110	1.00
Thanglong	2	6212	6.23	38703	364109	11.60	45760	299	448797	0.66
	13	5672	7.56	42879	109814	11.78	42445	424	505096	0.79
	14	4970	7.02	34889	184202	12.18	38459	438	424967	0.82
	16	5871	7.56	44386	218360	10.94	40795	505	485466	0.94
	26	5655	6.30	35627	182608	12.10	43460	554	430980	1.03
	30	5712	6.75	38554	191116	10.75	39015	556	414532	1.04
	31	5887	6.94	40875	128132	10.72	40102	591	438255	0.81
	35	6095	7.20	43882	152088	11.85	45895	600	520141	1.12
	38	6558	7.02	46039	125727	12.23	50969	503	563212	0.94
	39	6848	7.80	53411	184504	11.82	51421	704	631330	1.31
Statistical Value	**Mean**	7118	7.32	49503	209019	9.95	46347	695	509689	1.18
	SD	1422	0.57	9462	78560	1.99	13955	238	142023	0.25
	MAX	11177	8.40	74231	364109	13.83	80878	1,173	868734	1.87
	MIN	3059	6.23	24775	53929	6.08	11815	218	150645	0.49
	CV	0.20	0.08	0.19	0.38	0.20	0.30	0.34	0.28	0.21

Table 5. Performance Indicator Analysis

Company	Route No	Service effectiveness 40%						Resource Effectiveness 30%				Total
		TRIP/ VRKM	TRIP /VH	TREV /TRIP	TREV /BUS	STOP /LEN	BUS/ LEN	OEXP/ TRIP	TRIP/ BUS	TREV/ OEXP	TREV/ TEXP	
Weighted		1	0.8	0.7	0.7	0.1	0.1	0.2	0.9	0.7	0.7	
Hanoi	1	7.71	170	1.56	2.15	2.15	0.38	1.45	341172	0.58	0.54	223682
	3	8.71	202	1.35	1.75	1.75	0.36	1.26	397209	0.63	0.58	247920
	4	7.97	149	1.59	1.95	1.95	0.35	1.47	288909	0.36	0.33	192256
	6	6.73	150	1.98	1.64	1.64	0.26	1.84	300824	0.37	0.34	218511
	10	6.01	131	2.18	1.41	1.41	0.32	2.03	265693	0.38	0.35	202086
	11	5.80	136	2.23	1.32	1.32	0.30	2.08	263524	0.30	0.28	204736
	12	3.72	57	2.74	2.83	2.83	0.42	2.55	115269	0.27	0.25	100267
	15	4.29	135	2.88	0.98	0.98	0.21	2.68	278307	0.27	0.25	245096
	20	5.40	132	2.48	1.55	1.55	0.23	2.30	271381	0.33	0.30	219151
	23	2.51	47	3.27	2.11	2.11	0.25	3.05	105609	0.16	0.15	101571
	36	2.56	50	3.43	1.94	1.94	0.25	3.19	115345	0.20	0.19	112769
10.10	5	1.84	35	4.07	1.26	1.26	0.25	3.79	83889	0.20	0.18	92431
	8	8.25	197	1.45	2.15	2.15	0.52	1.35	362476	0.40	0.38	235626
	9	5.14	95	2.12	2.34	2.34	0.32	1.97	208798	0.26	0.24	155508
	18	3.12	64	3.55	2.35	2.35	0.24	3.30	148603	0.19	0.18	145954
	19	6.29	111	2.14	2.14	2.14	0.38	1.99	233892	0.38	0.36	174566
	21	7.57	127	1.79	2.09	2.09	0.74	1.66	243380	0.46	0.43	170584
	25	2.60	46	2.91	2.31	2.31	0.38	2.71	96907	0.33	0.31	88469
	27	4.74	106	2.43	2.06	2.06	0.47	2.26	201984	0.36	0.33	165334
	28	3.45	73	2.44	2.22	2.22	0.36	2.27	155479	0.41	0.38	127045
	29	2.53	54	3.36	1.22	1.22	0.32	3.12	112481	0.24	0.22	110684
	37	3.14	56	2.32	1.59	1.59	0.33	2.15	135810	0.33	0.31	106824
	40	2.38	55	3.69	1.22	1.22	0.20	3.43	123733	0.34	0.32	127433
Thudo	7	3.40	120	3.70	0.63	0.63	0.22	3.44	252175	0.22	0.21	256742
	17	4.35	170	2.82	1.03	1.03	0.22	2.62	311582	0.24	0.22	277278
	22	7.73	167	1.92	2.14	2.14	0.66	1.79	308512	0.42	0.39	224389
	24	3.59	104	3.16	2.09	2.09	0.29	2.94	197159	0.29	0.27	187207
	32	8.53	219	1.74	2.14	2.14	0.67	1.62	407402	0.40	0.38	283000
	33	6.06	65	1.08	1.21	1.21	0.20	1.00	150062	0.48	0.45	85504
	34	6.42	131	2.01	1.75	1.75	0.44	1.87	252477	0.40	0.37	186423
	50	2.26	50	5.52	1.90	1.90	0.24	5.13	107153	0.12	0.11	142381
Thanglong	2	10.86	235	1.15	2.34	2.34	0.68	1.07	420126	0.42	0.39	252802
	13	3.59	71	3.53	2.21	2.21	0.26	3.29	153740	0.12	0.12	151126
	14	6.86	119	1.91	1.70	1.70	0.37	1.77	239463	0.36	0.33	171068
	16	6.89	141	1.71	2.16	2.16	0.37	1.59	305704	0.51	0.48	205473
	26	5.98	118	2.18	2.17	2.17	0.67	2.02	213043	0.32	0.29	165873
	30	6.20	124	1.87	2.26	2.26	0.37	1.74	238895	0.34	0.31	171264
	31	4.03	83	2.86	2.04	2.04	0.35	2.66	164741	0.25	0.23	146010
	35	4.62	98	2.76	2.00	2.00	0.26	2.56	202784	0.20	0.18	173947
	38	3.55	81	3.71	1.94	1.94	0.25	3.45	163445	0.16	0.15	167327
	39	4.99	119	2.55	2.11	2.11	0.21	2.37	266505	0.26	0.24	215674
Statistical Value	**Mean**	6.35	135	3.30	1.73	1.73	0.47	3.07	252007	0.37	0.35	184252
	SD	2.18	51	0.91	0.46	0.46	0.15	0.85	90382	0.12	0.11	53994
	MAX	10.86	235	5.52	2.83	2.83	0.74	5.13	420126	0.63	0.58	283000
	MIN	1.84	35	1.08	0.63	0.63	0.20	1.00	83889	0.12	0.11	85504
	CV	0.34	0.38	0.28	0.27	0.27	0.31	0.28	0.36	0.31	0.31	0.29