Express Bus Services: A Case Study

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ABSTRACT: In Singapore the pubic bus, taxi and rail transit form the three component of the reliable and efficient public transport system for commuters. Among them, the bus services have the highest patronage, accounting for about 60 percent of all public transport trips. To raise the quality of service for bus commuters, the two main bus operators, SBS Transit and Trans-Island Bus Services have recently introduced express bus services primarily to reduce journey times of commuters. In total there are ten express bus services, including a special express bus service called the Rapid Bus Service, which are aimed at providing faster and smoother travel as well as a more direct route for passengers. These express services operate with limited stops along the route and enjoy uninterrupted travel on expressways on part of the journey. This paper examines the usefulness and performance of the relatively new concept of bus services in a passenger perception study involving interview surveys of 700 RBS users and non-users.

RÉSUMÉ : A Singapour, l'autobus public, le taxi et le transport ferroviaire constituent les trois composants du système de transport public fiable et efficace pour les banlieusards. Parmi eux, les services de bus ont la plus grande clientèle, représentant environ 60 pour cent de tous les voyages en transport public. Pour élever la qualité de service pour les usagers banlieusards d'autobus, les deux opérateurs principaux d'autobus, les Services de Bus Trans-Île et de Transit SBS ont récemment présenté des services d'autobus rapides, principalement pour réduire les temps de transport des banlieusards. Au total, il y a dix services d'autobus rapides, dont un service spécial d'autobus rapide appelé le Service de Bus Rapide, visant à fournir des déplacements plus rapides et plus agréables ainsi qu'un itinéraire plus direct aux usagers. Ces services rapides fonctionnent avec un nombre d'arrêts limité le long de l'itinéraire et offrent d'un voyage ininterrompu sur les voies rapides sur une partie du voyage. La communication étudie l'utilité la performance de ce concept relativement nouveau de services d'autobus dans une étude de perception des usagers impliquant les études d'interviews de 700 usagers et non-usagers du SBR.

1 INTRODUCTION

Singapore has a multi-modal public transport system which caters to the public transport needs of the densely populated island city. They are the public bus, taxi and the Mass Rapid Transit (MRT). There is also the Light Rail Transit (LRT) which connects mainly the residential areas to a MRT station and can be found in three areas in Singapore: Bukit Panjang; Sengkang and Punggol. In addition, there are also supplementary bus schemes which together form a reliable and efficient public transport system for commuters.

1.1 *Brief History of Bus System*

There are two main bus operators in Singapore: SBS Transit (SBST) and the Trans-Island Bus Services (TIBS). SBST was formed in 1973 with the merger of three private bus companies and in 2003, SBST has become both a bus and rail operator. With the government's intention to allow the formation of a second bus company to compete with SBST on an equal footing, TIBS was incorporated in 1982. In late 2001, Trans-Island came under SMRT Corporation Limited, the main rail operator in Singapore.

The bus industry has come a long way since the early days where there were many operational and management difficulties and there was constant civil unrest causing major disruption and chaos to the bus system. Even up to the early 1970s, the bus system had not improved. The service quality was still generally poor with frequent breakdowns and overcrowding; the management inefficient and the service lacking co-ordination with irregular fares and route structures.

With the formation of SBST, the then Singapore Bus Service (SBS), the bus situation began to improve. The government also initiated other bus schemes to cater for the public transport needs for specific sectors such as the school children and additional links between the residential estates and the central business district and the industrial areas. In an effort to further improve the service quality of the bus industry, TIBS the second major bus company was introduced to provide some measure of competition to SBS. Today the bus industry is well managed, efficiently operated and properly regulated to provide a high quality of service for the Singapore commuters.

1.2 *Current Bus System*

Currently, SBST operates from 15 interchanges and 18 terminals and has about 200 services while TIBS operates from 11 interchanges and 12 terminals with three major terminals in the northern part of the island and having a total of 72 services.

Working together with the authorities, the two bus operators have initiated a number of schemes to move buses smoothly and hence improve the service standard and efficiency of the bus industry. One of these measures was the provision of dedicated bus lanes in the 1980s that has proven to be successful in reducing bus travel times (Tanaboriboon et al.1986). Another priority scheme for buses was the 'B' signals scheme introduced in 1995 to allow early release of buses from traffic signals and was also found to be beneficial (Chandrasekar et al. 1999). Other initiatives include the "Give way to buses' scheme as well as eliminating the problem of illegal roadside parking which makes it difficult for our buses to manoeuvre easily on the roads.

2 EXPRESS BUS CONCEPT

The most recent scheme to encourage bus travel in Singapore was the express bus concept which was aimed at having a reduced travel time with limited stops en route and by using the expressway on certain stretches of the journey. This was not an entirely new concept as similar concepts had already been used in other countries such as Sydney, Nagoya, New York and Brazil where the services usually operate between the outer suburbs and the city centre with stops only at selected places such as rail stations.

In Singapore the two major bus operators have introduced express bus services and there are now a total of 10 such services. SBST has seven express bus services while TIBS has three such services including a special express service called the Rapid Bus Service (RBS).

The bus routes are mainly between the major residential areas in the various parts of Singapore and the Central Business District (CBD). They are aimed at providing faster and smoother travel as well as a more direct route for passengers.

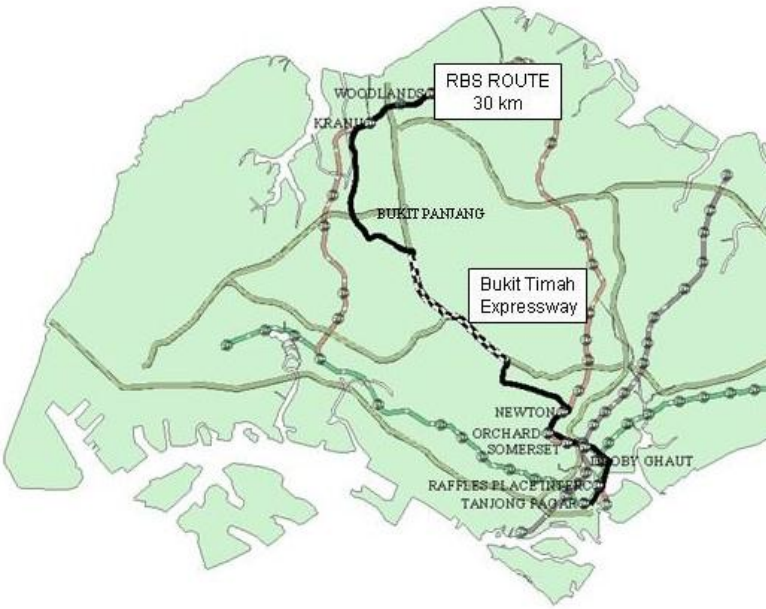

Figure 1. Route Map of RBS

These express services operate with limited stops along the route and enjoy uninterrupted travel on expressways on part of the journey. In addition, RBS buses are also equipped with the transponders to activate signals at selected intersections to enjoy signal priority at these junctions.

In this paper, a case study of the RBS will be discussed highlighting the passengers' perception and the usefulness and performance of the relatively new concept of express bus services. The paper concludes with a discussion of the potential for express bus services.

3 CASE STUDY: RAPID BUS SERVICE

3.1 *RBS Route*

The RBS operated by TIBS plies between the northern end of the island to the southern part where the CBD is located. Figure 1 gives the route plan for the RBS in relation to the island. It serves mainly the residents in two of the northern residential clusters (Woodlands and Bukit Panjang) where there are mainly high density housing.

The one-way route length of the journey is about 30 km with a scheduled trip time of 74 minutes. The RBS only stops at high demand bus stops along its route through the two residential regions. It then bypasses the rest of the areas using the Bukit Timah Expressway and Pan-Island Expressway to reach the fringe of the CBD area. At the fringe of the CBD area, the RBS again stops only at selected high demand stops before reaching the CBD area. The RBS terminates at the Shenton Way within the CBD area before turning back in the opposite direction almost along the same route for the return journey.

3.2 *RBS Features*

The RBS only stops at 50% of the bus stops along its route and a good number of them are near MRT stations in the northern residential regions as well as at the fringe of the CBD and also within the CBD area. These express bus services are designed to serve the high demand bus stops and bypassing the low demand bus stops. As compared to the normal bus services, express bus services can only be found within 1 km of the catchment area instead of the 400 metres in normal bus services.

The additional distinctive feature of the RBS is that the buses are fitted with transponders to give it priority by activating the green signal as the buses approach certain traffic signalized intersections thus giving them less interrupted flow through the intersections. The RBS buses are able to travel at a higher average operating speed of 25 km/h and thus allow for shorter journey times with scheduled mean headways of about 10 minutes during the commuter peak periods and about 13 minutes during the off-peak periods.

The RBS incorporates many beneficial features of a rail-based system and is able to provide a new platform for service innovations and creative value adding at a lower fare than the rail system. Some of the value added includes the installation of route maps with bus stop locations onboard the RBS buses as well as at the bus stops. They are also given a distinctive service number to distinguish them from the other normal services and express services.

3.3 *Usefulness and Performance of RBS*

The usefulness and performance of the relatively new concept of express bus services was examined in a passenger perception study involving interview surveys of 700 RBS users and non-users. The interview survey was conducted onboard RBS buses as well as at RBS bus stops over a one-week period covering both weekdays and a Saturday.

Of the 700 respondents, 79% of them were RBS users and nearly 77% of these users were interviewed on-board the RBS buses. The random sample indicated that there was slightly higher percentage of female respondents with about 55% of them being females. A majority of the respondents were from the physically-and-economically active age range of 20 to 50 years old forming about 78% of the respondents.

In order to have a more meaningful analysis of the survey, the RBS users were broadly classified into two categories based on the frequency of usage: (i) regular users - those who make use of the RBS at least once a week and (ii) non-regular users - those who use the RBS occasionally including first time users. Figure 2 shows that the RBS users were mainly made up of the regular user group accounting for 77% of the RBS users and more than two-thirds of the regular users take the RBS everyday.

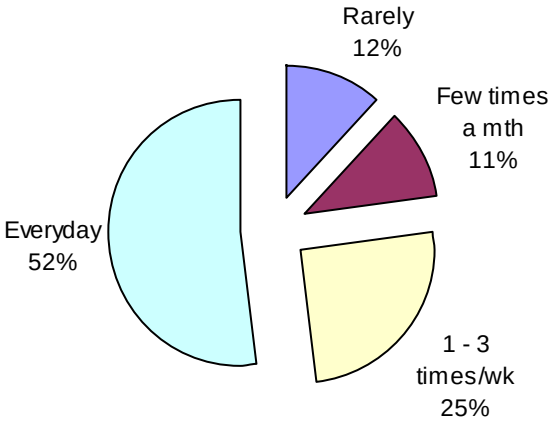

Figure 2. Frequency of Usage

The results of the survey also showed that while most RBS users were attracted from other bus services, a significant 5% of them were previously traveling on private transport modes. Figure 3 also shows that a substantial 34% of the RBS users were previously MRT users even though the rail service is considered a better mode of public transport.

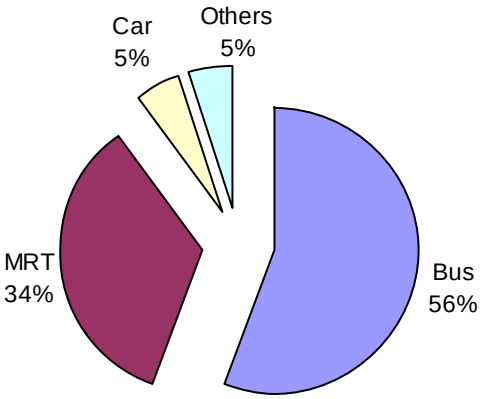

Figure 3. Mode shift to RBS

A majority (70%) of the RBS users were making work-based trips while a large proportion of the non-work-based trips were school trips.

During the commuter peak periods, RBS users perceived that the waiting time for the buses was longer than the expected waiting time of 5 to 6 minutes based on random arrivals. This is expected as passengers tend to overestimate their waiting time given the tendency to remain occasions of longer waiting and forgetting occasions of shorter waiting. It was also found that regular users were more time-sensitive concerning their waiting time and were less patient than the non-regular user as reflected in Figure 4 which compared the perceived waiting time

between regular and non-regular users. Statistically, the regular and non-regular users perceived the waiting time differently.

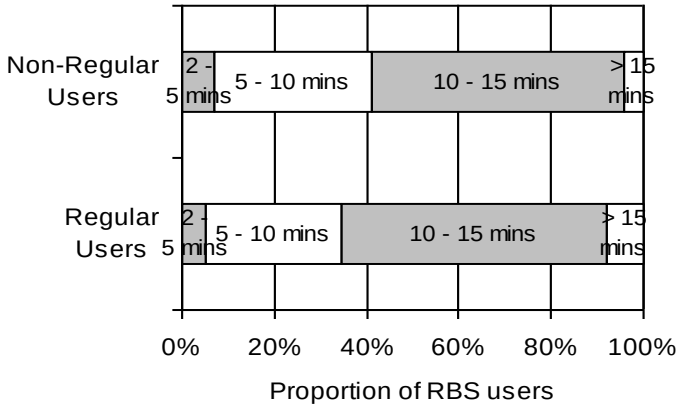

Figure 4. Perceived waiting time of regular and non-regular RBS users

In order to evaluate the performance of the service, RBS users were asked to rate ten important travel attributes of the RBS. The overall rating for each of the attributes is shown in Table 1 together with a modified relative score that is obtained by taking the difference between the average score of each attribute and the overall average score. There is general preference of bus services with limited stops as users tended to rate the limited-stop feature as the main feature which contributes greatly to the better performance of the RBS. This was more appreciated by the regular users. This showed that there was a general preference of bus services with limited stops, indicating the demand potential for such services.

"Comfort" was also rated highly by both the regular and non-regular users as the limited-stops and less crowded buses allowed a more comfortable ride than the normal bus services.

Table 1. Average score of perception of performance criteria

Feature	Regular		Non-Regular	
	Ave*	Modified Ave	Ave*	Modified Ave
Limited stops	4.04	0.35	3.98	0.31
Comfort	3.94	0.25	3.80	0.13
Ability to board	3.80	0.11	3.79	0.12
Fare	3.79	0.10	3.75	0.08
Travel Time	3.76	0.07	3.74	0.07
Courtesy	3.73	0.04	3.69	0.02
Reliability	3.71	0.02	3.65	-0.02
On-board info	3.46	-0.23	3.50	-0.17
Bus-stop info	3.43	-0.26	3.43	-0.24
Frequency	3.19	-0.50	3.33	-0.34

*In a scale ranked from 1 to 5 (1 being very poor to 5 being very good).

The fare charged is the same as the normal bus service (maximum fare of S$1.70) which is much less than the rail service (maximum fare of S$2.80) was considered a reasonable amount for the express bus service. Only less than 2% of the respondents indicated dissatisfaction over the fare.

From the ten service attributes, the users chose two features that they considered most important for an express bus service. The frequency distribution of the features of importance given in Figure 5, indicated that RBS users preferred shorter waiting time, shorter travel time, limited stops and the directness of route as the most important service attributes. There was strong correlation between the performance of RBS with time savings. Further analysis showed that the importance users placed on the service attributes were similar for both work-based and non-work-based trip. This means that there is no need to provide separate considerations for planning for the two different groups of users.

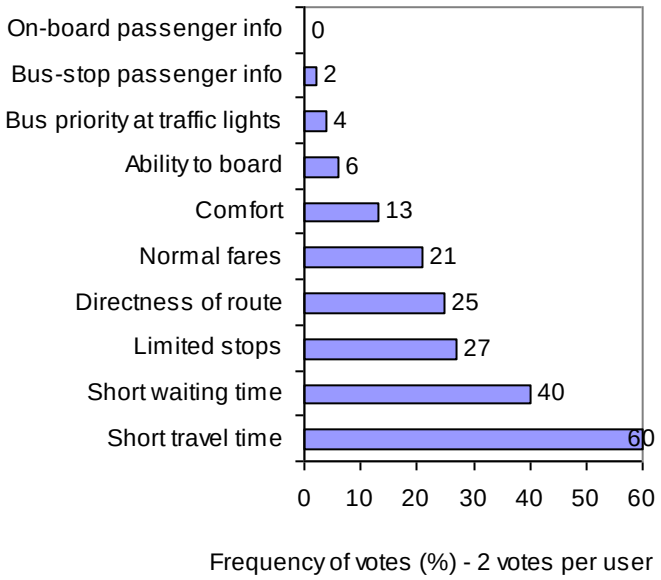

Figure 5. Frequency distribution of features of importance of an express bus service

Given the high rating of "short travel time" and "limited stops" along with the perceived importance in "short travel time", "short-waiting time", "limited stops", "directness of route" and "normal fares", there was strong indication that the RBS was well liked by users, making RBS a an attractive alternative to the existing public transport services.

Commuters not only valued these travel attributes highly but also perceived that the RBS had less-crowded on-board conditions with some 43% of the users feeling RBS was less crowded. About 48% of the users felt that the service gave them a lower likelihood of being late for appointments (Figure 6). Some 75% of the respondents perceived that the waiting time was about the same or less than other bus services. For the crowdedness and late for

appointment indicators, the difference in the performance between RBS and the normal bus service is highly significant statistically ($p < 0.001$).

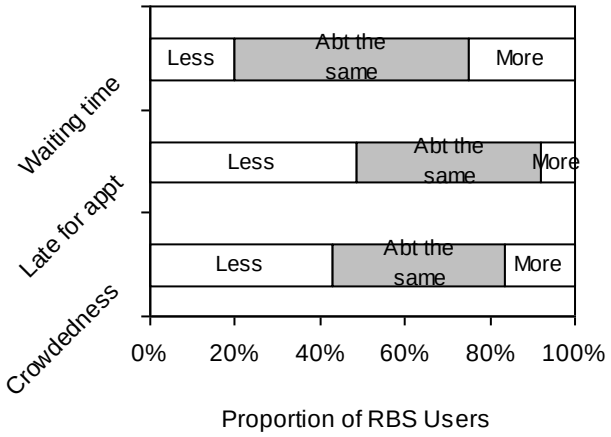

Figure 6. Comparison of features between RBS and normal bus services

Users enjoyed the shorter journeys on the RBS and the analysis in Figure 7 clearly shows the distribution of perceived reduction in travel time, which is statistically significant ($p < 0.001$).

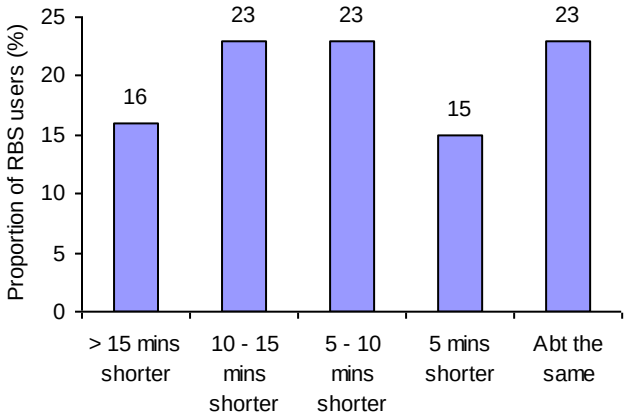

Figure 7. Comparison of travel time between RBS and normal bus services

The analysis also found that about 65% of both the users and non-users were willing to walk a further distance to catch a quicker bus service. This follows the behavior similar to that of rail passengers who are willingly to walk a longer distance for a better service and in favor of a direct, limited-stop service.

For respondents along the route of RBS, nearly all (99%) of the respondents would like to have more of such services for other destinations other than the CBD. This overwhelming response suggested a good preference for the RBS type service. To confirm this, users of RBS were made to rate their level of satisfaction for the different public transport modes. The results of the rating shown in Table 2, shows that the RBS was graded second best after the MRT, followed by the normal bus service and taxi in descending order. The results confirmed that the users considered the RBS to give a higher overall level of satisfaction than the normal bus services and even the taxis and the difference is statistically significant ($p<0.001$).

Table 2. Level of satisfaction of public transport services

Rank	PT Mode	Ave Grade*
1	MRT	4.26
2	RBS	4.06
3	Taxi	3.75
4	Normal Bus Service	3.71

* In a scale ranked from 1 to 5 (1 meaning very poor and 5 meaning very good)

An overall assessment of the performance of the RBS was conducted using a single performance index which took into account the various service attributes, the importance placed on each of these attribute and the evaluation ratings given by the users. The overall performance index calculated was found to be 3.80 which is in the good category in a scale of 1 to 5; 1 representing very poor and 5 representing very good. Hence, this exercise suggested that the RBS had performed well to the satisfaction of both regular and non-regular users.

4 CONCLUSION

The study showed that the Rapid Bus Service is an attractive public transport mode with a level of satisfaction better than the normal bus services and approaching that of the MRT which is normally considered to be more superior that buses. Almost all the respondents (nearly 99 percent) welcome more of such services and have indicated that they are even prepared to walk further to gain access to this bus service.

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