

AN EVALUATION ON PLANNING TO INTEGRATE SCHOOL BUS SERVICES INTO COMMUNITY BUS SYSTEMS

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SUMMARY

This paper deals with integration of bus systems to propose effective community bus systems. Although there is a strong claim for the necessity of such integration, there have been few actual cases. This paper describes the method of integration and effects acquired by that integration through an actual example in Yabu town. Integration with a school bus was taken up as an example, because it is a feasible method. It proposes a method of integration which does not spoil the usage of the original user. The original community bus ran every other day. However, in order to serve school bus services by community buses, it had to run every day and the cost increased.

The improvement in the some services became possible by integration. The problems of distance to bus stops and inconvenient transfers were solvable. Change from operation every other day to every day gives residents a feeling of security. Change in time tables for bus lines was difficult; there were also many people who felt the service was convenient. However, the opinion that the service became inconvenient can not be denied, either. In conclusion, however, it can be said that the community bus became more convenient by integration.

1. Background and purpose

In many rural areas in Japan, many elderly people face difficulties going out, because they cannot drive and public transport services are poor. Therefore, it is necessary to provide community transport services in order to enhance their mobility to improve their quality of life. However efficient policies need to be developed under tight local municipality budgets. Therefore integration present in different types of transportation in community transport must be made efficient.

To make community bus service more effective, Ministry of Land, Infrastructure and Transport(MLIT) (2001) introduced an integration of community buses and other buses; such as school buses, kindergarten buses, buses which companies run for commuting employees, buses which hospitals run for their own users. The Ministry of Education, Culture, Sports, Science and Technology permitted the use of school bus vehicles for transferring residents.

Although there are high expectations on efficiency promotion with integration of the bus systems, there would be inherent difficulties in implementation of bus integration because the educational institutions and welfare facilities would not use their buses for other purposes. This is because the educational institutions and welfare facilities think that their buses should be used exclusively by their users. (Chapman, 1995) It is, therefore, necessary to find a method to integrate bus systems that could be executed easily and would not affect original users' usage of the bus.

In some cases community buses and school buses run on similar routes. Integration is considered to be highly possible way to solve the problem of community transport in under-populated areas. However, there are only a few examples whereby integration was actually carried out. Thus it is necessary to show how to discuss about planning integration and effect of integration. It is a characteristic point of this research that actual community buses are taken up as a case study.

2. An overview of the case study

Characteristics of Yabu town are summarized on the right.

Community buses ran for connecting town facilities to places which were 1km or more away from bus stops. It

ran by every other day for every area. Each of the two primary schools, secondary school and the two kindergartens had a vehicle for a school bus. In Yabu town, the community bus connected the public facilities in the town area to the village of which the distance

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| <ul style="list-style-type: none">· Population : 8,728· Aged rate : 28.8%· Area : 111.8km²· The town area is deep in mountain area· Town is as area depopulation |
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to bus stops was more than 1km away. It served every area every other day. There were all together 5 educational institutions in town and each of them owned a school bus (see Figure 1).

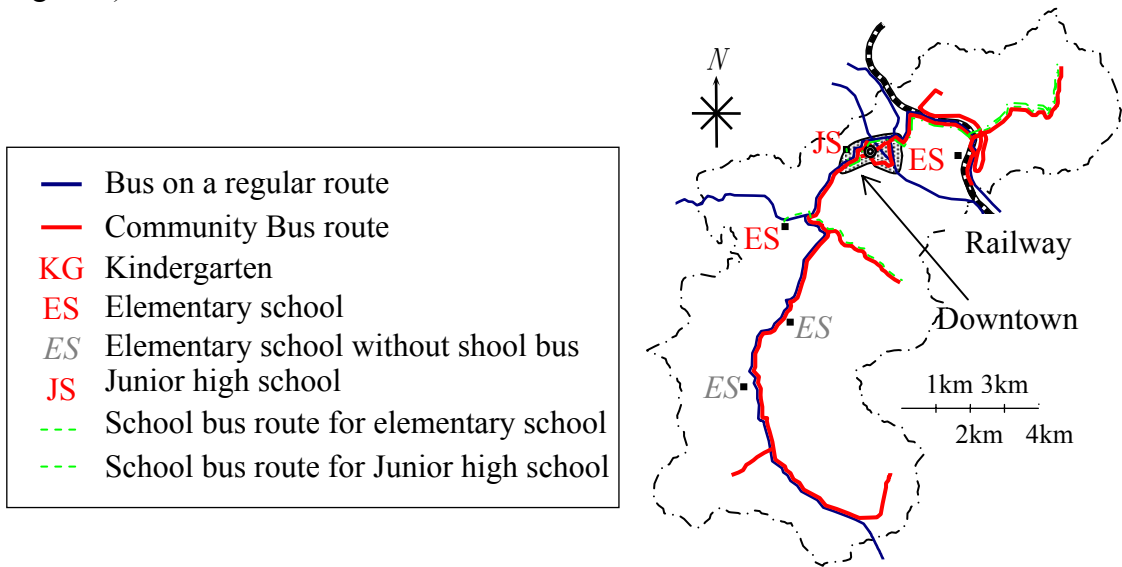


Figure 1 Geographical features of Yabu town

There were few community bus passengers. It was necessary to improve the level of this service. From the questionnaire conducted with 1,142 elderly people in December 2000, “Frequencies of bus services being low”, “needed to walk long distance to bus stop” and “Inconvenient transfer” were a problem which must be solved by improving the service level (see Figure 2).

Considering from the schedule and size of vehicles only primary schools buses can be a candidate for integration.

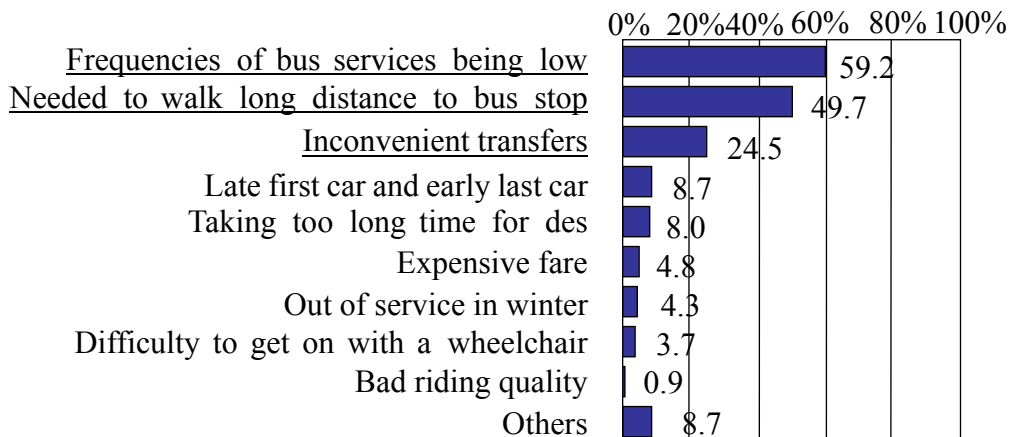


Figure 2 Disadvantage points of bus service

3. Planning integration of bus services

3.1. Method

When integrating the services, we were careful not to spoil usage of original users to make integration more adaptable. Relocation of bus stops solves the problem of reducing distances to each stop without impinging on the other users' services. However to improve the problems created by low bus frequencies and inconvenient transfers, increasing the number of vehicles or a change bus schedules are needed. But the increasing number of vehicles will increase the residents' tax burden. So authors try to solve the problems by changing the bus schedule. We assume that complaints of inadequate frequency reflect that the bus schedule is not suitable to the elderly residents' method of use. So we tried to solve the above-intentioned problems.

The difference between all desirable departing times collected from elderly respondents and the running schedules. The bus schedule is changed until the difference between the two is the smallest. The authors regard the time that the elderly drivers depart home as a desirable elderly person's departing time. The schedule is determined by supposing the target districts and counting the number of turns to visit these districts. Finally, we checked whether the condition shown in 3.2. can be satisfied or not. If not, the calculation will be made again with other suppositions on the target districts and the turns to visit these districts.

3.2. Constraints

In this case study, one of the most crucial issues is to obtain consent from the original bus users - students and their parents. The impact on the students has to be small. Thus, criteria for scheduling is summarized below;

- (i) The fluctuations of time which students must leave home are kept at about 5 minutes.
- (ii) The running schedules are adjustable for extra services during the summer vacation.
- (iii) Students should be able to use the buses when they must leave school earlier in the case of adverse weather.

In order to realize (iii), buses have to be able to run whenever the schools demand. For this, time for detours should be incorporated. Interval time at the terminal is 13 minutes including the extra time. Changing the bus schedules may occur as a result of cases (ii) or (iii), school officers contact and determine that schedule changes should be announced one day in advance.

3.3. Results

School buses are to run when school children go home (from 14:00 to 16:00). At these times, no residents should be on board. It is difficult for residents to get in a bus from school with school children because running schedules vary depending on students' grade, the day of the week and the calculation results. It is possible that 3 return services as community buses per day. Among these services, the difference becomes the minimum

between 8:00 and 9:00, 10:00- 11:00 and 14:00- 15:00 for departing, and 11:00- 12:00, 13:00- 14:00 and 16:00- 17:00 for returning.

4. The Effects of Integration

4.1. Introduction

Effect of integration is examined with points shown below

- Does integration impinge on anybody's usage?
- Does it provide a more convenient service?
- Does the service attract new users?

To make these points clear, authors examine the subject from three viewpoints; cost, opinions for service and the number of passengers.

The original community bus was operated very inefficiently. To examine the effect of integration, other effects besides those due to integration need to be eliminated. Table 1 demonstrates the changing points of services on the 1st December 2001. After this changing, the school bus and community are integrated on the 1st April 2002. We call the period before 30th November 2001 "term I", from 1st December, 2001 to 30th March 2002 "term II", and after 1st April 2002 "term III".

Table 1 Changing Points at 1st December 2001

Problem	Responses	Concrete Changes
Small number of bus services	Arrangement of schedules	Change schedules according to the time that the aged wish to go out
	Increasing services	Quit services except for "transport for maintaining the daily life"
	Resolving detours	Quit services starting at the end of the route
Needed to walk long distance to bus stop	Setting new bus stops and relocating bus stops	Move bus stops to the hospital and shopping malls
Inconvenient transfer	Shorter waiting time	Make a waiting time shorter because they need a transfers due to the route

4.2. Costs

An interview with a local bus company revealed that the costs in running community bus services is 0.61 million yen per year including the cost of labor, administration and fuels. On the other hand the operation of the school bus is contracted to the locals for a million yen per year. Assuming that the same administration fees applied, it costs 3.1 million yen to maintain the school bus for a year.

We focus on comparing term I&II and III. It is impossible to make meaningful comparisons between cases in which buses run daily and one in which buses run every other days. Then two cases are calculated. Case I is actual cost, in case II it assumed that community buses run every day. Table 2 indicates the cost of maintenance in a year.

Table 2 Costs of Maintenance in a Year (*10 thousand yen)

		Case 1	Case 2
Community bus	Running costs	610	610×2
	Vehicle fees	121	121×2
School bus	Running costs	310×2	310×2
	Vehicle fees	15+69	15+69
Sum before integration (a)		1435	2166
Community bus	Running costs	610×3	
	Vehicle fees	121+69+15	
Sum after integration (b)		2035	
Difference (b-a)		600	-131

In case I the costs of maintenance increased by 6.0 million yen a year. This means that there are many costs involved in upgrading from alternate-day services to everyday services. In the case II, the costs of maintenance decreased 1.31million yen a year. The cost of maintenance was further boosted because local volunteers ran the buses before integration. As for maintaining operations, costs such as insurance should be considered; this includes a pension due to retired drivers and employees. In addition, stand-by vehicles must be provided by a bus company in case of driver’s sickness or traffic accidents.

4.3. Opinions for service

4.3.1. Opinions from passenger

The 32 passengers (no students) are asked two questions concerning the improvement in the bus service (Figure 3). The first question is about how they view the improvement. The second one is whether the improvement makes them use the bus more. In figure 3, every activity is counted as a unit. Activities which come under the influence of the improvement are taken into account.

A majority answered that the community bus service became convenient. But those who answered that they use the buses more often are rare. The frequency of going to a hospital has not increased, even if the bus became convenient. On the contrary, an effect doesn’t appear in the number of passengers directly, but the burden has been lessened. In addition, those who answered that increased frequency of using community bus didn’t increase their frequency of going out, used the bus instead of riding together in the car driven by family members.

There are those who have answered the improvements have made their usage of bus inconvenient, especially in “Changing time table”. Those who answered declined

frequency of using community bus ride more often in a family car.

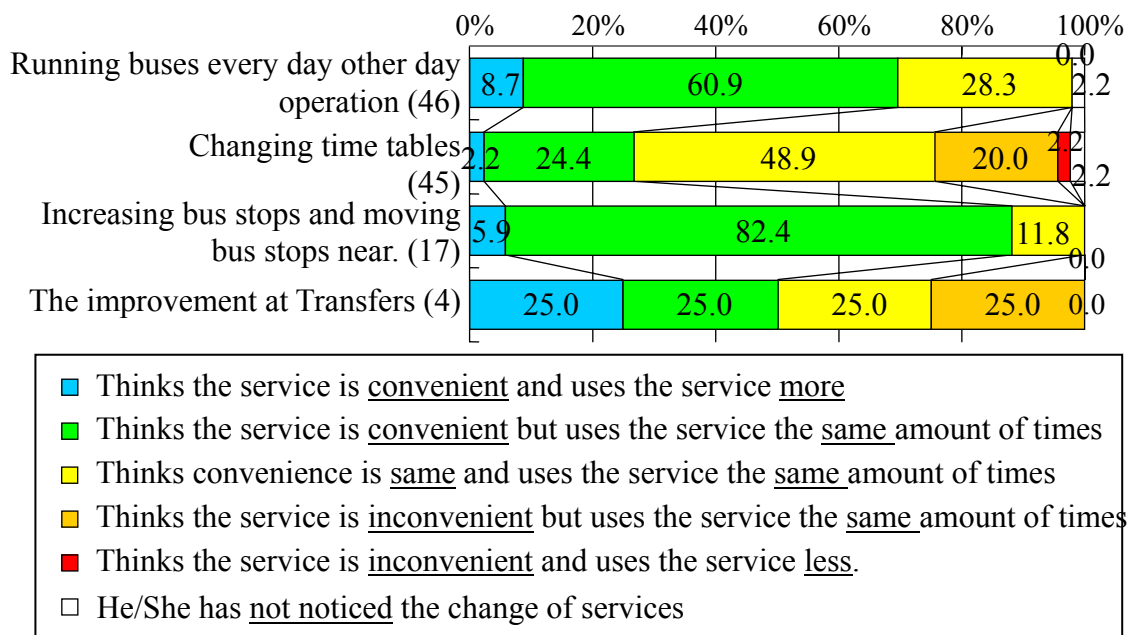


Figure 3 Opinions for the change of services

4.3.2. Opinions from Students

There were no problems in 16 months except that bus services on Sunday were delayed once due to the insufficient contact between the school and the bus company. Furthermore, no complaints were heard from the parents and the people involved with the school. It can be concluded that integration was successful as it had a minimal effect on the primary school children.

4.4. Numbers of Passengers

Table 3 indicates the numbers of passengers categorized according to the places they departed from. There are statistical increases by a t-test on the numbers of passengers from the term I to II and from the term II to III with the level of significance as 5%.

Between the term II and III, the numbers became smaller in the northern area and roughly constant in the southern area where they have only the community bus. Those who previously used the community bus to travel to the next town shifted to the new route bus, which was introduced at around the end of Term I. Since most commuters used the community bus to go to the local hospital in both the northern and southern areas, their usage did not increase with an improved service level as the frequency of their hospital visits did not change.

There were increases of 5% level of significance from the term I to II and from II to III where both the community bus and the route bus were running. This implies that some commuters have shifted from the route bus to the community bus. This shows that the community bus became as useful as the route bus in terms of transport.

__Table 3 Passengers according to the departure points (persons/ week)

		Term I	Term II	Term III
Where only with community bus	North	9.8	11.9	9.1
	South	5.3	8.6	9.0
Where both with community bus and route bus	North	0.5	1.1	0.4
	South	0.4	4.2	10.8
Running Day		Alternate days		Everyday
Number of used vehicles		1 (except for 2 school buses)		3

4.5. Discussion

When only the number of users (4.4.) is considered, it means integration increasing the number of users is desirable. However there are some persons who stopped using the bus (4.3.1.). People who stopped using the bus changed to the riding in cars with her/his family. Those whose use of the bus is increasing changed from both the local bus and car. The data shown in figure-3 gathered from villages with no parallel bus route, we can conclude that it is at least the same number of people who change from community bus to riding in the family car and who changes from riding in the car to the community bus. So, roughly speaking, the utility and disutility generated by mode-changing are nearly equal.

Finally cost is taken into consideration. Total cost was divided by the number of users shown in Table 4. It means that in period II community bus carried people most efficiently. And that efficiency had fallen by integration of bus services.

Table 4 Cost carrying one user

	Term I	Term II	Term III
Yen per passenger(1 trip)	6,092	2,620	4,042

And there was a positive effect in integration, if it was required to operate a community bus every day. Also, the relief (i.e. the ability of the elderly to go out at any time they want) has the effect which does not appear in the number of users, as 4.3.1. described.

5. Conclusion

This paper has described the methodology for integrating community and school bus services. The aim is to investigate more effective transport system in areas of low population density. The key findings are summarized below:

- i) The authors suggested a feasible way to integrate the function of school bus into community bus services without effecting school children's use of the school bus.
- ii) Integration increased operation costs for a year. That was because plans to improve service levels were executed at the same time. It was shown that a cost cutback of 1.16million yen per year would have been achieved if integration

- alone was implemented.
- iii) Mobility was boosted through the improvement of services by integration. This, however, did not lead to the increase of passengers because of the transport expenses.

The pros and cons of integration are dependent upon the service level the local residents require. That is, integration was efficient considering that local residents who needed more frequent bus services for increased mobility even if these buses do not necessarily lead to the increase of passengers. Furthermore, instead of only focusing on the statistical data, it would be important to consider the patterns of bus usage and the desired lifestyle of the users.

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