

Route Selection of the Welfare-type Community Bus in Nagasaki City

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Abstract: This study aims at discussing the future trend of the community bus and attempted to route selection by using GIS for the welfare-type community bus, which satisfies the need of elderly and physically handicapped persons in Nagasaki City. In doing so, we have conducted field survey in some sample cities of Kyushu, Japan for taking lessons from the present state analysis of community bus already operating there. As a result of the study, we have been able to identify some best possible routes for the community bus operation in Nagasaki City, which meets the requirement of the welfare community as well as of the general passengers.

Keywords: Community Bus, Geographic Information System

investigation and interview of the persons concerned.

1) Community Bus in Dazaifu City

Dazaifu City is located in the southeast of Fukuoka City having a population of about 65,000. It has many historical cultural heritages and the number of average annual tourists amounts to approximately 6,500,000 people. Accordingly, *Third Total Planning of Dazaifu City*, 1989 invited citizen's opinion to make the city more livable for both the citizens and tourists. In this opinion survey a huge number of citizens demanded public means of transportation, which connects the public facilities and nearby transport stations. In order to fulfill such demand, the city authority and the bus entrepreneurs continued discussion and the latter launched community bus named "Mahoroba-Go" in October 1998. The new bus transportation system aimed to attain mainly four objectives: 1. Realization of

1. Introduction

In recent years, the community bus, which is close to the local community plays an important role as safe and useful transportation for the elderly, the physically handicapped, etc. Community bus systems also meet various needs of local inhabitants in the area where the public transportation is unavailable or insufficient. In this study, we have discussed the future trend of community bus by taking present state of community bus in different cities of Kyushu as an example, to assist in appropriate route selection of the welfare-type community bus in Nagasaki City, which also meet the requirements of elderly and physically handicapped persons of the community.

2. Analysis of Present Status of Community Bus

According to the Kyushu district transport bureau survey study, as of 5 February 2003, community buses are operating in 34 areas of Kyushu, Japan. For knowing the present status of community bus in Kyushu, we have selected Dazaifu City and Munakata City as sample case and conducted field

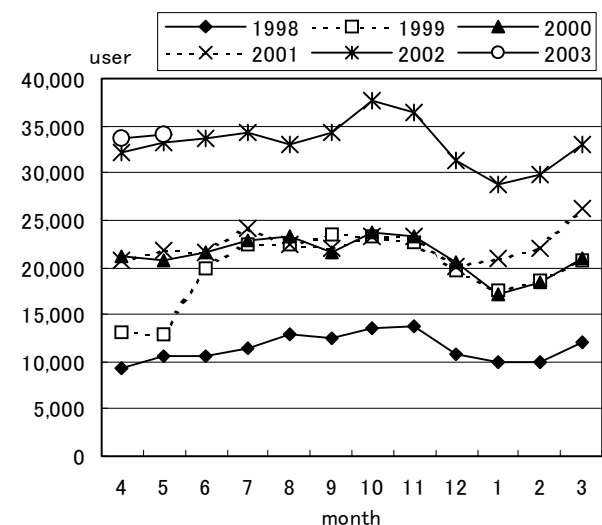


Fig.1. Monthly data of persons using community bus in Dazaifu City.

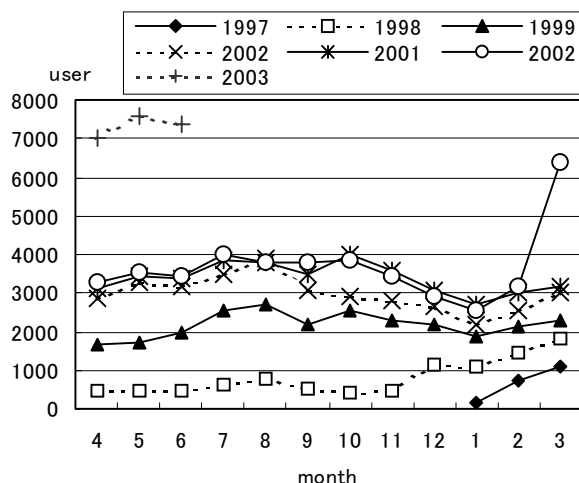


Fig.2. Monthly data of persons using community bus in Munakata City.

“a lifelong learning city” by ensuring easy access to the city’s public facilities. 2.Transforming the city into a welfare community by enabling elderly people to participate in community activities. 3.Ensuring presence of transportation means in tourist spots and areas having little or no transportation facilities. 4. Mitigation of traffic congestion as far as possible.

Presently, three routes in the city are operated by eight small and low floor buses and the fare is 100 yen flat rate for all destinations. In designing the transportation system, considerations were given towards maintenance of roads and environment, providing free ride to the persons possessing physically handicapped persons’ card and connecting places to make sightseeing, mountain climbing, visiting public and cultural facilities convenient. Monthly data of persons using community bus in Dazaifu City is shown by Fig. 1. From the figure we can see sharp rise in the number of users in recent years. This is due to introduction of new routes in June 1999 and April 2002 and the flat fare system of 100 yen for all destinations in January 2002.

2) Community Bus in Munakata City

Munakata City is located in the middle of big cities like Fukuoka and Kitakyushu, having a population of about 93,000. As a passage to the above mentioned two cities, Munakata developed into a city having large residential and education facilities. In this city, the railroad and the bus on different regular routes were managed by private transportation enterprises. But since the railroad line and the national highway were running the city region through east and west, the transportation facilities were divided into north and south, and resulted into an inconvenient transportation system. Moreover, inaccessibility to the newly opened *Allied Health Welfare Center* in “Meitomu Munakata” on January 1998, provoked demand from the citizens to

Table1. The variables used for GIS analysis

Road	Store
Welfare facilities	Railroad
Bus stop	Average entrainment density
Elderly rate	Population density
Public and cultural facilities	Building
Hospital	

introduce new means of transport. As results of these, finally community bus “Fureai-Bus” were launched in January 1998. But unfortunately the number of users was very few at the beginning. In order to increase the number of users a committee was formed and later different changes were initiated in March 2003 such as: extending bus access to big commercial institutions, changing to loop line from straight line, introducing 200 yen flat fare rate for all destinations etc. Fig. 2 shows the monthly data of persons using community bus in Munakata City.

3. Route Selection for the Welfare-type Community Bus in Nagasaki City

In Nagasaki City, the community bus “Ranran” is operating with the objective to reduce the traffic congestion in the city center, improvement of public communication and revitalization of central city area. But community bus from the view point of welfare society to reduce the transportation problem of the elderly or physically handicapped persons are not yet present in the city. Accordingly, this study aims to select best possible convenient route for the welfare type community bus in Nagasaki City, which satisfies the need of both elderly and physically handicapped persons by using GIS.

1) Variables Used for GIS Analysis

The variables used for GIS analysis is shown in Table 1 [1], [2]. The community bus staffs of Dazaifu City and Munakata City helped us in the selection process of the variables.

2) Methods

Firstly, buffering analysis is performed to obtain the point data of welfare facilities. Then the welfare facilities that do not have the bus stop in less than 200m are identified and given the highest priority of a route. And the wide area that makes community buses available to all the welfare facilities are extracted by considering the ratio of other welfare facilities and elderly rates.

Secondly, identification and input of the point of hospital, public and cultural facilities and shopping malls are carried out, and merged with welfare facilities, elderly rate, and access to the railroad data to get the

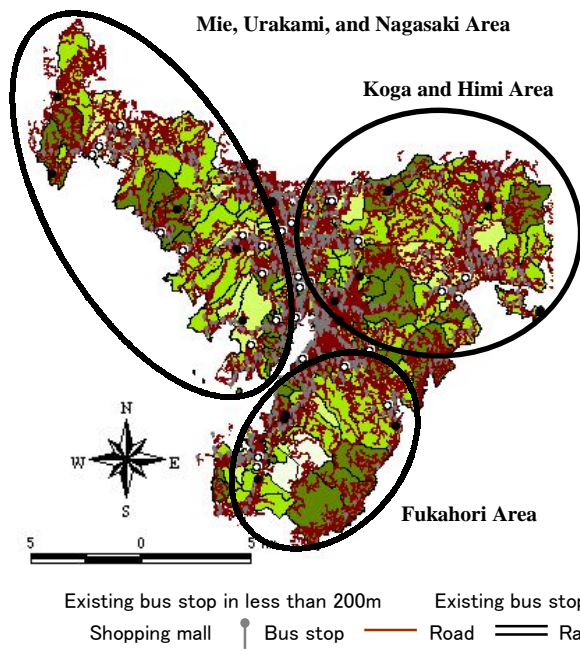


Fig.3. The wide area that makes community buses operated.

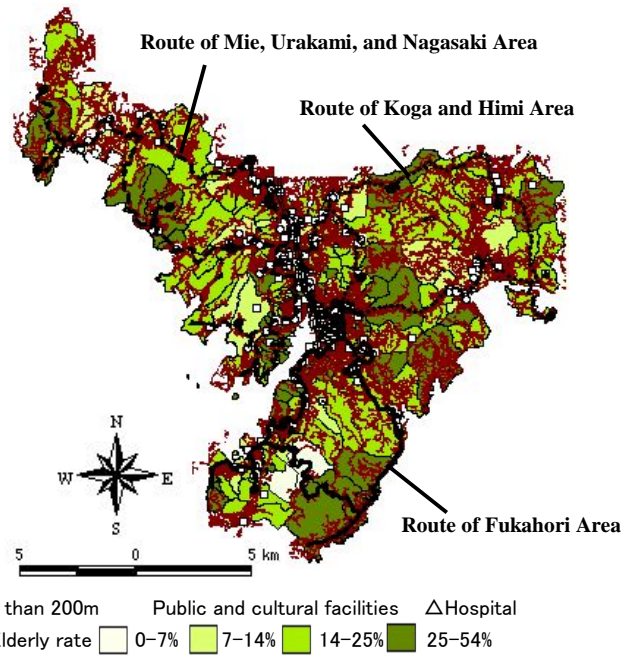


Fig.4. The wide route that makes community buses operated.

wider view of possible routes.

Thirdly, in order to increase the number of users, the average population density of a particular area is compared with the average bus users of a particular line and changed the route in order to increase the number of users.

Fourthly, A bus stop interval is set to the distance till which elderly persons can also walk comfortably (assumed to be around 200m-300m) [3], and these points are considered in selecting the routes.

Finally, buffering analysis is performed for adjusting each bus stop selected before by comparing with the polygon data of different buildings, so that as many buildings as possible may be included.

3) Result

The wide area that makes community buses operated is shown in Fig. 3. It is mostly dotted with the welfare facilities that do not have the existing bus stop in less than 200m at the northwestern part, northeastern part, and southern part of the city. Furthermore, these areas show the high elderly rate. This leads us to the route selection for community bus in three areas: Mie-Urakami-Nagasaki area, Koga-Himi area and Fukahori area (see Fig. 3).

Next, hospitals, public and cultural facilities, shopping malls frequently visited by residents and the poly line data of the railroad used as an access to city area from the outskirts of city were added. The wide route that was developed and connected them with the welfare facilities by the line is shown in Figure 4. Then, as much as possible routes are passed through the areas having high elderly rate and tried to make loop lines without any change of vehicle. Since the line was drawn

on the road, it became a curve as shown in a Fig. 4.

As an extension to this study, we are going to continue our analysis so that the community bus can complete one round trip within about 60 minutes and can consider the operating hours of hospitals, public facilities etc.

4. Conclusion

The rapid fall in the number of passengers commuting through buses due to increase in private car users are forcing many bus lines to stop operation. However, the bus is the best available secured means of transportation for the elderly population not possessing own car. But proper route selection for the bus to move becomes very essential in order to ensure optimum use by the users including elderly persons. This study is an attempt towards this goal to provide best possible route for the community bus in Nagasaki City from the viewpoint of welfare community. The results of the study might provide important guidelines to the policymakers for selecting routes for the community bus in the city.

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