

A STUDY OF TRAFFIC BEHAVIOR IN RURAL AREA

Yoshitaka MOTODA
 Professor
 Faculty of Policy Studies
 Iwate Prefectural University
 Sugo 152-52 Takizawa, Iwate,
 020-0193 Japan
 Fax: +81-19-694-2701
 E-mail: motoda@iwate-pu.ac.jp

Yuichi TAKASHIMA
 Lecturer
 Faculty of Policy Studies
 Iwate Prefectural University
 Sugo 152-52 Takizawa, Iwate,
 020-0193 Japan
 Fax: +81-19-694-2701
 E-mail: takashima@iwate-pu.ac.jp

Yoshihiro HORIGOME
 Assistant
 Faculty of Policy Studies
 Iwate Prefectural University
 Sugo 152-52 Takizawa, Iwate,
 020-0193 Japan
 Fax: +81-19-694-2701
 E-mail: horigome@iwate-pu.ac.jp

Ryuichi OIKAWA
 Graduate Student
 Graduate School of Policy Studies
 Iwate Prefectural University
 Sugo 152-52 Takizawa, Iwate,
 020-0193 Japan
 Fax: +81-19-694-2701
 E-mail: g241y003@poly.iwate-pu.ac.jp

Abstract: In this study, the authors intended to clarify the difference of traffic behavior between urban areas and rural areas, and to point out the necessity of transportation projects in rural areas. Two areas in Iwate prefecture in Japan, are selected to compare the traffic behavior. One area is located in rural area and has small populations and low population density. Another area is located in urban area and has bigger population than rural area. Small sized person trip survey and other questionnaire survey had been carried. In conclusion, generally trip length is longer in rural area than in urban area. Aged people have to depend on poor public transportation in rural area. Thus traffic condition is inconvenient in rural area and it affects life of people in such area. Therefore construction of rapid transportation system such as expressway and improvement of public transportation are necessary in rural area.

Key Words: Person trip survey, Rural area, Aged society

1. INTRODUCTION

Recently the Japanese government introduced the cost benefit analysis (CBA) for prioritizing new road projects. It is clear that the projects in urban areas have advantage to rural projects in terms of conventional CBA. However road projects are still necessary in rural areas. In this study, the authors intended to clarify the difference of characteristics of traffic behavior between urban areas and rural areas, and to point out the necessity of road projects in rural areas.

About former study, Shimizu K. *et al*¹⁾ researched traffic in rural area. They found transportation mode in rural area, and change of transportation mode in winter. Similar study was done by Kitajima O.²⁾ However their study had done about 20 years ago and traffic situation have changed a lot. And their studies include little about comparison

between urban and rural and aged people. Recently Yamada K. *et al*³⁾ researched travel behaviors of mountain area residents.

In this study, two areas in Iwate prefecture, which locates in the northern part of Japan, are selected to compare the traffic behavior. One area has the populations of about 19,000 with area of 1,149 km² (population density 16.5 person/km²). The area locates in mountainous area. Another area has the population of about 89,000 with area of 504 km² (population density 177 person/km²). The area locates in urban area. Small sized person trip survey and other questionnaire survey had been carried out to specify the difference of traffic behaviors.

2. SURVEY METHOD

2.1 Test Field

We had carried out questionnaire survey about traffic behavior at two towns in rural area in Iwate prefecture. We selected Iwaizumi town and Tanohata town as test field. Because these two towns had been depopulated for these decades and the traffic conditions are not good in these towns. The ratio of aged people (more than 65 years old) of these towns are also high compared with the average of Japan (14%). The nearest city locates about 60km from both towns. Populations are shown in table-1. The situation of traffic and geography of these towns are as follows.

Table - 1 Population

	Population (1995)	rate(%) (1995/1990)	Aged ratio (%)	Area(km ²)	Population Density (person/km ²)
Iwaizumi	13,879	-8.5	23.1	992.9	13.9
Tanohata	4,806	-4.2	21.7	156.2	30.8
Hanamaki	71,950	2.0	17.0	385.4	186.7
Ishidoriya	16,575	-0.5	21.0	118.6	139.8

(1) Iwaizumi town

Iwaizumi town locates in mountainous area. The area is 1000 km² with population of about 14,000. The major transportation systems are two national highways Route 340 and 455 and two railways. Route 340 runs from north to south. Route 455 runs from east to west. There are two railway systems. One runs from south to the center of town. The other runs from north to south at the edge of east part of the town. The frequency of the both railway services is generally poor.

(2) Tanohata town

Tanohata town locates at the coast of Pacific Ocean. The area is 156 km² with population of about 4,800. The major transportation systems are national highway Route 45 and a railway system. The both highway and railway system run from north to south. Also the frequency

of the railway service is generally poor too. We call Iwaizumi town and Tanohata town as rural area hereinafter.

2.2 Questionnaire Survey

We selected families in two towns by random sampling, and carried out questionnaire survey by hearing. The survey carried out from December 1999 to January 2000. The number of samples is shown in table-2. Questionnaire is about these matters.

- 1) OD (origin and destination) survey
- 2) Traffic and medical services
- 3) Traffic safety and reliabilities about traffic at winter season
- 4) Traffic and school
- 5) Traffic and commuting

Table-2 Questionnaire survey (person)

	Sample person	Returned	Returned rate(%)
Iwaizumi	654	543	83.0
Tanohata	575	517	89.9
Total	1,229	1,060	86.2

2.3 Traffic data in urban area

To compare the traffic in rural with the traffic in urban, we referred the traffic survey data in urban area⁴⁾ which was done by Iwate prefectural government. The survey had carried out from December 1999 to February 2000. This term is almost same time with our survey. The survey field is Hanamaki City and Ishidoriya town that locate in the same prefecture. Ishidoriya town locates next to Hanamaki City and both town and city form one urban area. The population of Hanamaki City and Ishidoriya town is shown in table-1.

Table - 3 Questionnaire survey in urban area (families)

	Sample person	Returned	Returned rate
Hanamaki	3,767	3,060	81.2
Ishidoriya	695	630	90.6
Total	4,462	3,690	82.7

The major transportation systems in Hanamaki city and Ishidoriya town are expressway, several national highways, rapid railway (Shinkansen), ordinary railway and an airport.

This area is much more convenient than the test field. The sample sizes of the survey are shown in table-3. We call Hanamaki City and Ishidoriya town as urban area hereinafter.

3. RESULTS

3.1 Trip length

Average trip length by trip purposes is shown in fig -1. The figures show that trip length is longer in rural area than in urban area in general. About going to hospital trip, the average trip length in rural area is 4.5 times longer than urban area. About welcome and send off trip 2.7 times, shopping trip 2.7 times, shopping trip 2.7 times.

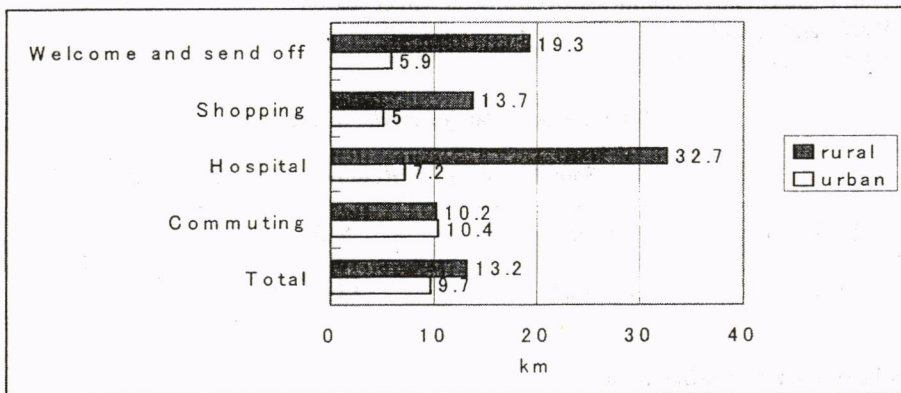


Figure - 1 Trip length

Distribution of trip length is shown in fig-2. In urban area, most of trip lengths are less than 10km. Because in rural area number of destination facilities such as shopping centers, hospitals are few and scattered, so people have to travel long distance to reach them. However, commuting trip is almost same in both areas. Because people may select homes near their offices or they may select offices near their homes.

These results show that people live in rural area trip longer than people live in urban area. Judging from the difference of trip length, travel time in rural area must be longer than in urban area in general even though average speed in rural area is higher than urban area because less traffic jams in rural area. To cope with this problem, rapid transportation system such as expressway is necessary in rural area.

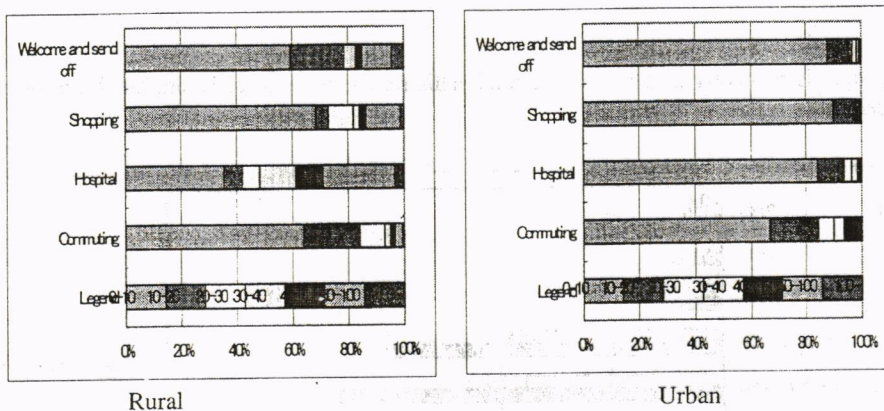


Figure - 2 Distribution of trip length

3.2 Going to hospital trip

Medical service in rural area is poorer than that of urban. Only one hospital is located in rural area while several hospitals in urban area. Medical condition is shown in table-4. As mentioned above, the average trip length of going to hospital trip in rural area is 4.5 times longer than urban area. Trip length to hospitals in rural area is longer than urban area because of the distance to hospitals. In rural area people has to travel at least one hour to reach big hospitals in near by cities. This also gives negative effects on emergency medical service. Because in rural area, both ambulance stations and hospitals are far from the area. Then if a people in rural area get sick, it will take at least more than one hour to hospital after calling ambulance service.

Table - 4 Medical condition⁵⁾

	Hospital	Bed	Doctor	Bed per 100,000 population	Doctor per 100,000 population
Iwaizumi	1	100	10	720.5	72.0
Tanohata	0	0	2	0.0	41.6
Total	1	100	12	535.2	64.2
Hanamaki	6	1,536	135	2,134.3	187.6
Ishidoriya	2	280	12	1,689.3	72.4
Total	8	1,816	147	2,051.4	166.7

Frequency of going to hospital in rural area is shown in fig-3. Both total people and aged people more than 70 years, the frequency is not so high. However the frequency of aged

people is relatively higher than the total. This maybe because of health condition of aged people.

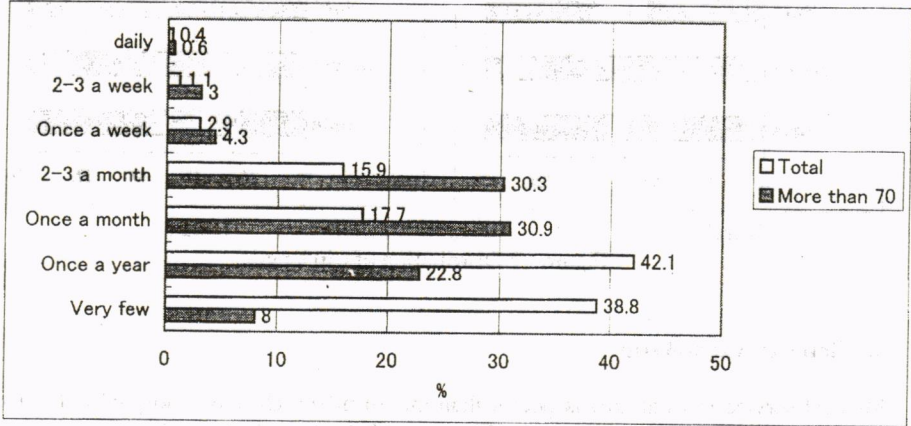


Figure - 3 Frequency of going hospital(Total N=1,060 More than 70 N=162)

The traffic mode of going to hospital trip is shown in fig-4. The figure shows that aged people (more than 70 years old) depend on public transportation compared with young people. It means public transportation to hospital is necessary. According to figure-3, and 4, public transportation such as demand bus system, which is suitable for low frequency service, is recommended for aged people to go to hospital.

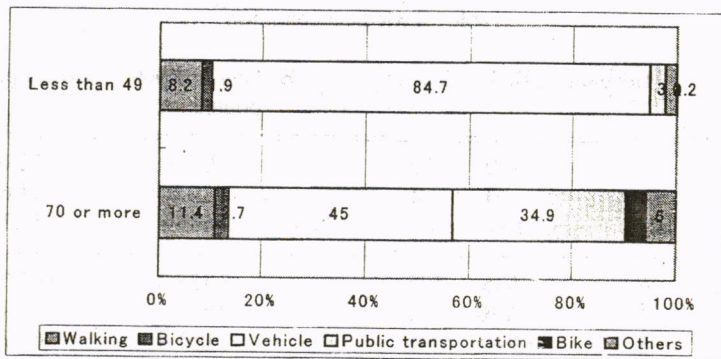


Figure - 4 Transportation mode of going hospital(Less than 49 N=365 70 or more N=149)

3.3 Shopping trip

As mentioned above, the average trip length of shopping in rural area is 2.7 times longer than urban area. Reason is that, people in rural area shop at outside of their town in general. According to buying rate at home town⁶⁾, Iwaizumi 62.7%, Tanohata 36.7% while Hanamaki 94.2%. In rural area, there is no large shopping center. Therefore people go shopping at big shopping center in near cities except for buying daily commodities in their town. This may deteriorates the economic condition in rural area. Figure-5 shows distribution of shopping town. In the figure, Miyako, Kuji, Morioka, Kitakami are the name of city near the areas.

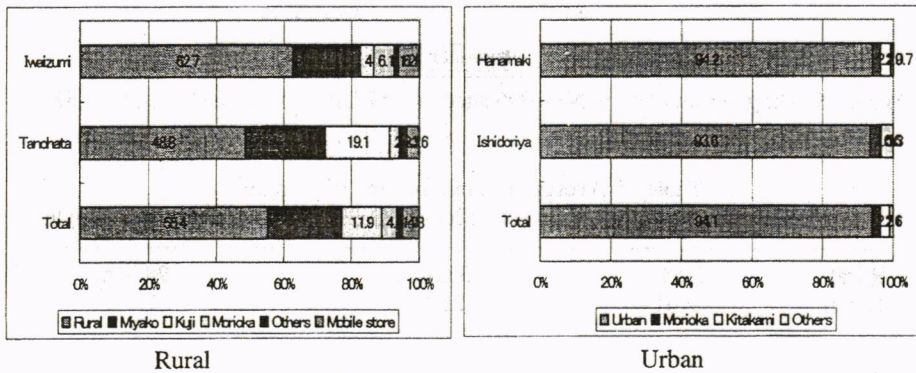


Figure - 5 Where to buy

Mobile store cars are utilized in rural area. Instead of going out for shopping, the store car comes near consumer's house once or twice in a week for selling daily goods. This may supplemental transportation tool in rural area for people who have poor transportation.

3.4 Going out ratio

We define going out ratio as the ratio of people who go out their house at least once in a survey day. Going out ratio means degree of activity of people. Figure-6 shows going out ratio of both areas. According to the figure, going out ratio in rural area is lower than urban area in general. Also going out ratio of aged people is lower than average people. It means the activities of people in rural area are lower than urban, especially for aged people.

The average trip number per day and average trip length is shown in table-5. The trip number is similar in both areas, but trip length is different especially for aged people. As going to hospital trip mentioned before, these transportation conditions may affect the difference of going out ratio of two areas.

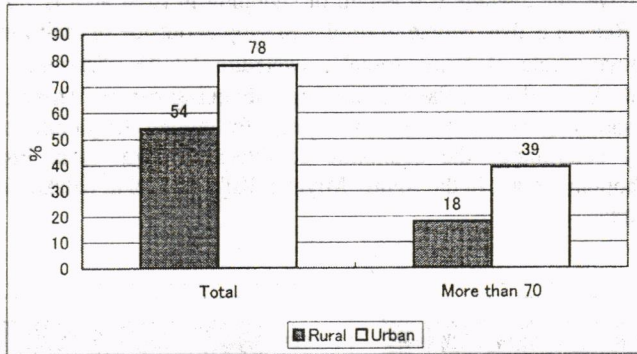


Figure - 6 Going out ratio(Rural N=1,006 aged N=157 Urban N=10,654 aged N=1,528)

Table - 5 Average trip number and trip length
 Trip number Trip length Trip length of aged people

Rural	2.54	33.3km	28.8km
Urban	2.61	25.4	7.3

3.5 Main transportation mode

Figure-7 shows main transportation mode in both areas and Morioka urban area⁷⁾ with population of 362,400 which includes Morioka city, the capital of Iwate prefecture for comparison.

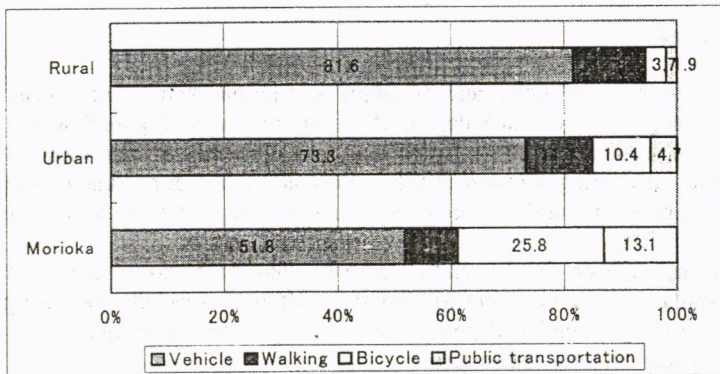


Figure-7 Main transportation mode

The bigger population is the bigger share of public transportation and the smaller share of vehicle. Public transportation share (railway and bus) is smaller in rural area. Because public transportation is poor in rural area, people have to depend on vehicle transportation. This trend is common in traffic engineering.

Figure-8 shows main transportation mode of aged people (more than 70 years old). Unlike figure-7, public transportation mode is bigger in rural area than urban area. However public transportation services in rural area are not good. They have neither enough route nor frequent service.

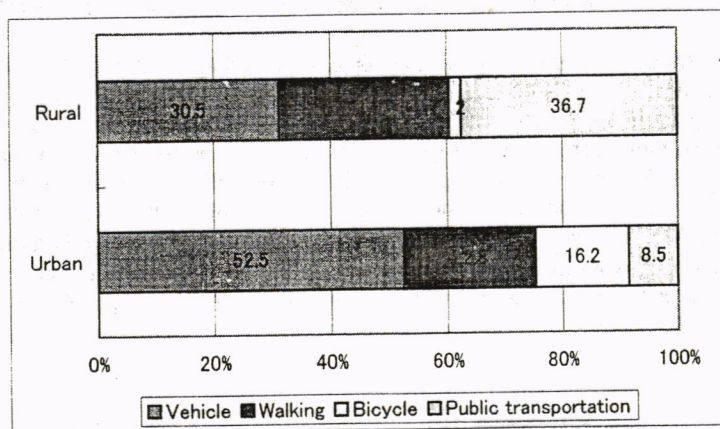


Figure - 8 Transportation mode of aged people (Rural N=49 Urban N=591)

There are two reasons why aged people depend on public transportation. One is the driving license ratio of aged people. The driving license ratio of aged people is shown in table-6. In rural area, aged people have fewer driver licenses than urban area. Second is aged society. In rural area, the aged ratio is higher than urban area as in the table-1. Therefore there are few younger people who take old people by vehicle. Then aged people have to depend on poor public transportation.

Table - 6 Driving license holder rate of aged people(%)

	Male	Female
Rural	65	2
Urban	73	7

3.6 Willingness of driving of aged people

Figure-9 shows driving license holder ratio by age in Iwate prefecture (population about 1,400,000). It is clear that younger people have high rate of driving license holder. For the male, the age under sixty, driving license holder ratio is more than 90%. Also for the female, the age under forty, the ratio is more than 90% too. The major transportation problem in rural area is that old people doesn't have own transportation. When these younger generations get older, most of old people would have driving license unlike present situation. If almost of all old people have driving license, the transportation problem in rural area might be solved? However driving ability of old people get worse because of aging and not all driving license holders will drive cars when they get old.

To know the willingness of driving of old people, we asked aged people who have driving license in rural area that they drive now or not, and if they have willingness to drive in future. The result is shown in fig-10. The driving rate of aged people is rather high. But 15% of aged driving license holders (age over 70 years) do not drive now. And about 40% of driver license holder of aged people stop driving or will stop driving in future. The sample size is only 40, however other survey supports this figure. The survey, which carried out in the middle part of main land Japan⁸⁾, showed that 44% of aged driving license holders will stop driving in future. Therefore equipment of public transportation for aged people in rural area is still recommended in future even though all people have driving license.

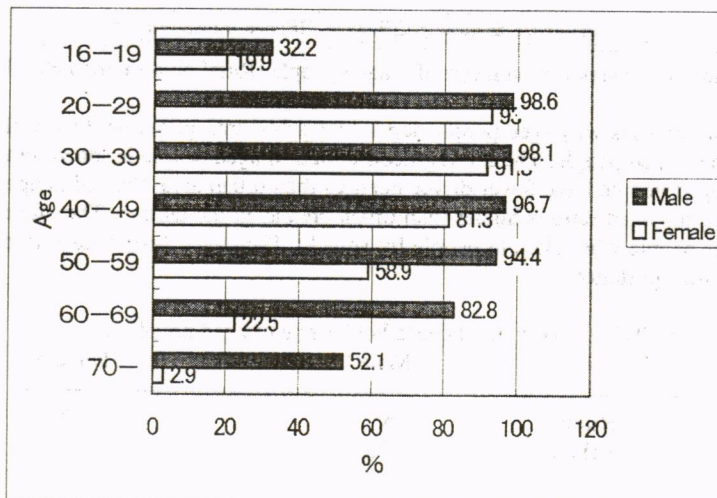


Figure - 9 Driving license ratio by age group

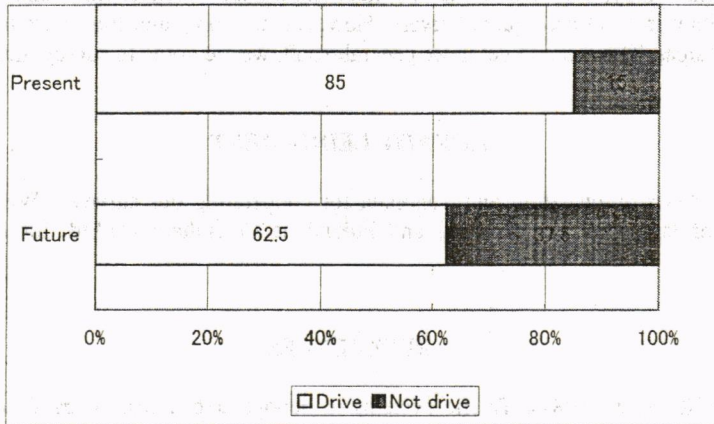


Figure - 10 Willingness to drive of aged people (N=40)

4. CONCLUSION

As far as we have studied, the conclusions are as follows.

1. The trip length in rural area is generally longer than urban area. Because in rural area, destination facilities such as shopping center, hospitals are few, and people have to travel long distance.
2. Travel time in rural area must be longer than in urban area even though average speed in rural area may be higher than urban area because less traffic jams in rural area. To cope with this problem, rapid transportation system such as expressway is necessary in rural area.
3. Medical service in rural area in terms of transportation is poorer than that of urban. Travel length to hospitals in rural area is longer than urban area because the reason mentioned above. It may affect security condition in rural area.
4. People in rural area shop outside of their town. This may deteriorates the economic condition in rural area. Mobile store cars are utilized in rural area than in urban area. This may supplemental transportation in rural area.
5. Going out ratio of rural area is lower than urban area. Especially for aged people the difference is bigger. The aged people in rural area have to depend on poor transportation.
6. The driving rate of aged driving license holders is rather high. But about 40% will stop driving in future. Therefore, equipment of public transportation in rural area is recommended even though almost all aged people will have driving license in future.

Through this study, we believe that we have shown the inconvenience and problem of transportation in rural area quantitatively. However, we compared transportation behavior in limited areas. Therefore to get more general result, we are going to survey more areas.

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