

**PROMOTION OF A PUBLIC TRANSPORT
BY MOBILITY MANAGEMENT
AND VERIFICATION OF ITS QUANTITATIVE EFFECT :
A CASE STUDY FOR COMMUNITY BUS IN OBIHIRO CITY**

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Abstract: Mobility Management (MM) is a transportation management policy that adopts soft measures for the purpose of reducing car use and promoting sustainable transportation modes, such as public transport and bicycles. MM tries to induce people to change voluntarily from using cars to a sustainable mode by means of communication. We implemented MM to promote an experimental community bus service. This project had two components: a questionnaire survey conducted in the service area and a monthly newsletter. The questionnaire was not just a “survey”, but was “communication” related to the bus promotion. One month after the survey, we implemented a follow-up survey targeting the respondents to the initial survey. As a result, MM produced a general increase in bus use, and induced mouth-to-mouth advertising. The results show that Mobility Management was effective in promoting bus use.

Key Words: mobility management, bus promotion, sustainable transportation mode

1. INTRODUCTION

In Japan, the deregulation of local bus businesses threatens to make it difficult for people without a driver's license to travel, such as the aged and disabled. Furthermore, the level of local bus service will affect the development of local communities. Recognizing these problems, local governments in Japan have tested local community bus systems that can be used flexibly. Except in a few cases, however, most community bus systems are unprofitable owing to a lack of users. Consequently, local community bus systems have become a new problem for local governments.

These unfortunate consequences of introducing a community bus system might be inevitable, as it is obviously quite difficult to introduce a successful bus business in an area where previous bus routes have been withdrawn owing to a lack of users. One reason for these problems may be that most people continue to use cars without considering the future of

their community and environment. Another reason might be that they have never considered a travel mode other than by car.

This study used Mobility Management measures (MM) to solve these problems. MM is a transportation management policy that adopts soft measures for the purpose of reducing car use and promoting a sustainable transportation mode, such as public transport and bicycles (c.f. Jones, 2003; Fujii, 2004). MM tries to induce people to change from car use to sustainable transportation modes voluntarily by using communication.

We implemented MM measures to promote an experimental community bus service called “Ring-Ring Bus” in the city of Obihiro, and verified its quantitative effects.

2. GENERAL DISCRIPTION ABOUT "RING-RING BUS"

Obihiro is located in central Hokkaido, the northern island of Japan. Its population is about 170,000, and the major industrial activities are large-scale farming and tertiary industry. Ring-Ring Bus runs in an 8 km² area that extends 2 km east to west and 4 km south to north. Ring-Ring Bus is a “demand-only bus”, in which users have to reserve a specific bus service by telephone or facsimile. Although the approximate times of the initial bus stops were fixed, the bus route was not. An operator selected the most suitable route for the reservations. Table 1 outlines the details of the Ring-Ring Bus service.

Table 1. Outline of the Ring-Ring Bus

Period of operations and operating funds:

Nov. 2003 - Feb. 2004 Investment from Obihiro City

Mar. 2004 - Apr. 2004 Investment from Tokachi Bus Company

May 2004 - Oct. 2004 Investment from Obihiro City

Vehicles: Two compact buses with 35-passenger capacities

Fare: 200 yen for adults, and 100 yen for children

No. of bus stops:

190 stops between Nov. 2003 and Feb. 2004

120 stops between Feb. 2004 and May 2004

163 stops between May 2004 and Oct. 2004

Reservations: telephone or facsimile (7:00~18:30)

Staff: 10 bus drivers and 4 telephone operators

Timetable:

7 times/day × 4 routes (= 28 trips/day), Nov. 2003 to Feb., 2004

8 times/day × 4 routes (= 32 trips/day), Feb. 2004 to May, 2004

8 times/day × 2 routes + 10 times/day × 2 routes (= 36 trips/day), May 2004 to Oct., 2004

3 . METHOD

In order to investigate the effectiveness of an intervention, it is necessary to compare a control group in which participants receive no intervention and a target group in which participants receive the intervention. If we find differences in the dependent variables (such as the frequency of bus use or intention to use the bus) between the control and target groups, the difference can be seen as an effect of the intervention. Without a control group, any differences between before and after an intervention might be owing to the effects of other factors that change temporarily, such as seasonal factors, rather than the intervention. Therefore, it is important to set up a control group when analyzing the effects of intervention in Mobility Management.

(1)OVERVIEW OF EXPERIMENT

Figure 1 shows the schedule for MM and the surveys used to investigate its effectiveness. In this case, MM had two components: a one-shot travel feedback program (TFP, see Fujii and Taniguchi, 2005), and a distributed newsletter about the bus. A TFP is a communicative MM measure that is used for travel behavior modification, and one-shot TFP is a program that includes a one-shot intervention.

At the end of January 2004, we distributed questionnaires to all households in the area through neighborhood associations (i.e., the Wave 1 survey). We prepared two questionnaires: one for the control and one for the target groups. The three-page questionnaire for the control group included questions regarding bus use and intention to answer the follow-up survey (the Wave 2 survey). The questionnaire for the target group included the same questions as used for the control group and an additional page of questions asking recipients to make a behavioral plan to use the bus service. The latter questionnaire was inserted in an envelope with an advertising leaflet for Ring-Ring Bus and two bus tickets that were valid for 4 weeks. The additional inserts were to motivate participants to use the bus. The questionnaire with the leaflet and bus tickets constituted a one-shot TFP intervention.

At the beginning of March and April, we distributed a newsletter to households in the service area as an insert in the major newspaper. The newsletters were designed to modify the readers' attitude toward cars and public transportation, including the Ring-Ring Bus. The newsletter included information about the Ring-Ring Bus service, the changing bus system, frequently asked questions about use of the Ring-Ring Bus, and general points on problems of traffic and transportation.

At the beginning of April, we distributed the second questionnaire to people in both groups who had replied to the initial survey (i.e., the Wave 2 survey). The questionnaire consisted of simple questions (see Table 2).

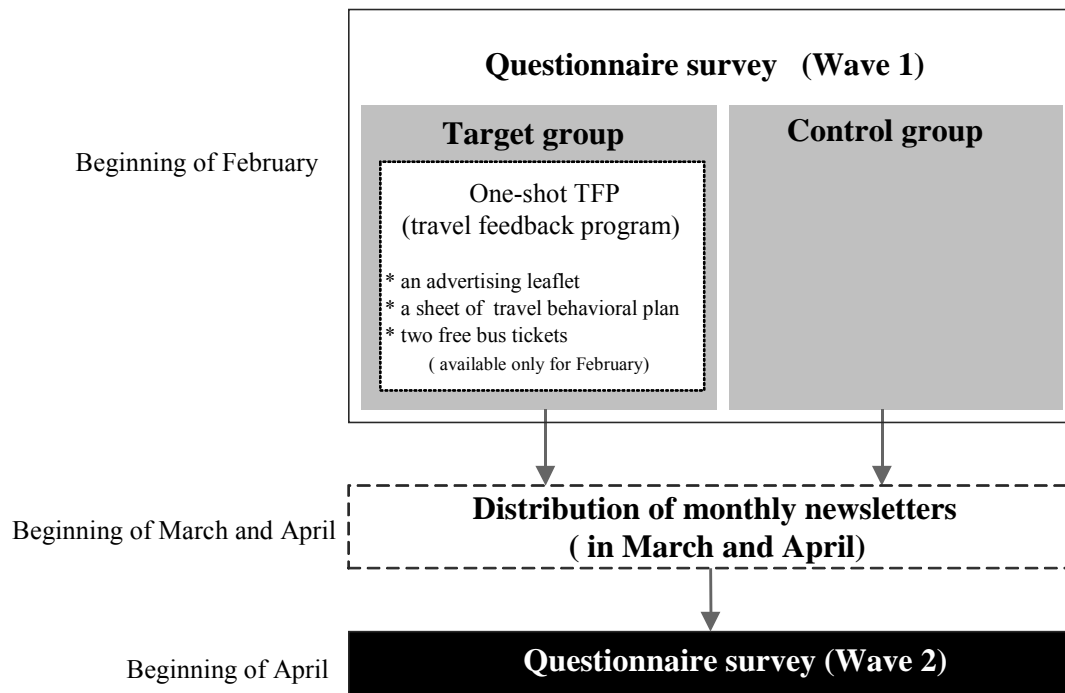


Figure 1. Procedure flow on MM intervention

(2) DETAILS ABOUT THE ITEMS DISTRIBUTED TO THE TARGET GROUP

Advertising leaflet

The Ring-Ring Bus differs from a typical bus service in that it requires a reservation made by telephone or facsimile, and there are no fixed bus routes. While these characteristics are thought to be positive in some regards, they might also impede bus use if potential riders are unfamiliar with a demand-only bus system. If people do not use the bus because they are unsure about the bus system, we should expect an increase in demand after an explanation of how to use the bus. Consequently, the advertising leaflet incorporated the following points:

- The volume of text was kept to a minimum
- The first action that users needed to do (i.e., telephone to make a reservation) was explained briefly.
- The bus characteristics were described as simply and specifically as possible.
- The colors and graphics in the leaflet were minimized.

Questions concerning a travel behavior plan

We asked for a travel behavior plan to activate an “implementation intention”, which is intermediate between a behavioral intention and an actual behavior, such as using the Ring-Ring Bus (c.f. Fujii and Taniguchi, 2003). An implementation intention differs from a behavioral intention in that the latter is an intention to perform a behavior and the former is an intention to implement a specific behavioral plan, which is expected to lead to the goal behavior.

Even when people have a behavioral intention, such as “I am going to use the Ring-Ring Bus”, they often fail to implement the actual behavior owing to the lack of an implementation intention. An example of an implementation intention is, “I am going to use the Ring-Ring Bus at a specific time to get from a specific place to a specific place”. To activate an implementation intention, we asked the target households to read the advertising leaflet outlining the Ring-Ring Bus service carefully, to confirm that they received the leaflet and free bus tickets. Then, we asked whether they might have an opportunity to use the free bus tickets, and requested that they describe a specific occasion, and when and from where

they were going to telephone to reserve the Ring- Ring Bus. Finally, we summarized the characteristics of the Ring-Ring Bus to implement the behavior that they had written down.

Free bus tickets

To promote sustainable bus use, we gave each household in the target group two free bus tickets, which were intended to modify their attitude toward bus use from negative to positive by enabling them to experience the bus at least once. This is called a “temporary structural change”, and is a method often used in bargain sales or the cold start of a business (see Fujii and Gärling, 2005). In providing the tickets we considered:

- The tickets were not cash vouchers, but small gifts. To make the tickets seem like gifts, we enclosed them in an attractive envelope, and wrote, “This is a small gift for you” on the outside.
- It is better not to enclose expensive goods.
- To prompt use of the bus, the tickets had an expiration date.

(3) DETAILS OF THE NEWSLETTERS

The newsletters were an attempt to modify attitudes to cars and public transportation, including the Ring-Ring Bus. The newsletters included information on the Ring-Ring Bus service, information about the changing bus system, frequently asked questions about use of the Ring-Ring Bus, and general information on problems with traffic and transportation. This newsletter was distributed to households in the service area as an insert in their newspaper.

(4) DESIGN OF THE WAVE 2 QUESTIONNAIRE

The Wave 2 questionnaire was distributed as a double postcard. Table 2 shows the questions on the questionnaire. In the questionnaire, we measured the following psychological and behavioral factors: the intention to use the Ring- Ring Bus, persuasive behavioral control, attitude to bus use, awareness of the positive consequences of bus use, whether they would recommend the Ring-Ring Bus to others, whether others had recommended the Ring-Ring Bus, use of the Ring-Ring Bus, use of the free tickets, and experience reading the newsletters. The responses to Q.1_1 to Q.1_4 were scored using five-point scales, in which the most positive feeling toward the Ring-Ring Bus was rated as five and the most negative was rated one.

The responses to Q.1_5, Q.1_6, Q.2_1, and 3 were discrete variables, so they were treated as dummy variables:

Q.1_5: being recommended: (Often or Yes, No) = (1, 0)

Q.1_6: recommending: (Often or Yes, No) = (1, 0)

Q.2_1: used bus: (Yes, No) = (1, 0)

Q.2_3: read newsletters: (Yes, No or Unknown) = (1, 0)

Table 2. Questions to measure factors and the endpoints of measures' scales

	Index	Question	Ends of the scale / alternatives	Type of variable
Q1_1	behavioral intention	Do you think you are going to use the Ring-Ring Bus in the future?	No / Yes	continuous
Q1_2	perceived behavioral control	Do you feel that using the Ring-Ring Bus is difficult?	No / Yes	continuous
Q1_3	attitude	Do you think that the Ring-Ring Bus is convenient?	No / Yes	continuous
Q1_4	awareness of consequences	Do you think it is better to use public transportation instead of a car?	No / Yes	continuous
Q1_5	experience of being recommended	Did family or friends recommend that you use the Ring-Ring Bus?	Often / Yes / No	discrete
Q1_6	experience of recommending	Have you recommended that your family or friends use the Ring-Ring Bus?	Often / Yes / No	discrete
Q2_1	experience of using the Ring-Ring Bus	Have you used the Ring-Ring Bus?	Yes / No	discrete
		- frequency in March	times	continuous
		- frequency in February	times	continuous
Q2_2	use of the free tickets	How many times did you use the free bus ticket? †	one / two / three / not at all	
Q2_3	reading the newsletters	Did you read a newsletter called "Ring-Ring Tushin"?	Yes / No/ Don't know	discrete

†: This question was not included in the questionnaire for the Control group.

Table 3. Numbers distributed and collected, and response rate

	No. printed (Wave 1)	No. collected (Wave 1)	No. distributed (Wave 2)**	No. collected (Wave 2) (response rate%)
Target group	16,000 [†]	1,247	510 (40.9%)	410 (80.4%)
Control group	4,000 [†]	279	118 (42.3%)	85 (72.0%)
Total	20,000 [†]	1,526	628 (41.2%)	495 (78.8%)

[†]: These are approximate numbers.

^{**}: The Wave 2 questionnaire was distributed to the respondents to the Wave 1 survey who indicated that they would answer a follow-up survey.

4. RESULTS

Table 3 shows the response rates of the target and control groups. The "Number printed" means the number of questionnaires given to the neighborhood association. We asked the neighborhood association to distribute two questionnaires to each household in the target area. Since we do not know how many questionnaires the association distributed, the actual number of questionnaires distributed is uncertain.

Table 4 compares the target and control groups for the six indexes measured as continuous variables. Table 5 shows the frequency distribution and results of the χ^2 tests on the four indexes measured as discrete variables. These tables show that the target group did recommend the Ring-Ring Bus to others and used the Ring-Ring Bus significantly more often than the control group. The response rate for the target group (38.4%) was more than double that for the control group (17.6%).

Although the difference in the frequency of bus use in February and March did not reach significance, the frequency of bus use in the target group in February was almost double that of the control group. In the target group, the frequency of bus use did not decrease from February (1.07 times/month), when free bus tickets were available, to March (1.04 times/month), when the tickets were not available. These results indicate that use of the Ring-Ring Bus was induced by the one-shot TFP, and the frequency of bus use approximately doubled.

Table 4. Comparison of the continuous variables between the two groups

		Target group			Control group			t-test		
		No of data	Mean	Standard deviation	No of data	Mean	Standard deviation	t varule	degree of freedom	significance probability
Q1_1	behavioral intention	407	3.48	1.28	85	3.29	1.29	1.22	490	(.22)
Q1_2	perceived behavioral control	404	2.70	1.37	82	2.68	1.41	0.09	484	(.93)
Q1_3	attitude	402	3.53	1.21	83	3.49	1.14	0.25	483	(.80)
Q1_4	awareness of consequences	402	4.30	1.01	84	4.44	0.86	-1.18	484	(.24)
FREQ2	frequency in February	367	1.07	2.92	79	0.51	2.51	1.59	444	(.11)
FREQ3	frequency in March	354	1.02	3.08	81	0.72	2.92	0.82	433	(.42)

Table 5. The frequency distribution and results of the χ^2 test for the discrete variables

Frequency (percentage)		Target group				Control group				χ^2 test (Pearson)		
		Often	Yes	No	Total	Often	Yes	No	Total	χ^2	DOF	p
Q1_5	Was recommended Ring-Ring bus	17 (4.2%)	133 (32.7%)	257 (63.1%)	407	2 (2.4%)	28 (32.9%)	55 (64.7%)	85	0.63	2	.728
Q1_6	Recommended Ring-Ring bus	30 (7.4%)	187 (46.3%)	187 (46.3%)	404	7 (8.3%)	26 (31.0%)	51 (60.7%)	84	6.79	2	.034
		yes	no	-	total	yes	no	-	total	χ^2	DOF	p
Q2_1	Experience of Ring-Ring bus use	157 (38.4%)	252 (61.6%)	-	409	15 (17.6%)	70 (82.4%)	-	85	13.34	1	<0.001
		yes	no	Don't know	total	yes	no	Don't know	total	χ^2	DOF	p
Q2_3	Read newsletters	319 (77.8%)	36 (8.8%)	55 (13.4%)	410	68 (80.0%)	8 (9.4%)	9 (10.6%)	85	0.51	2	.775

Table 6. Results of the regression analysis

	Behavioral intention (multiple linear regression analysis)			Recommending dummy (binary logit analysis)			Experience of bus use dummy (binary logit analysis)			Newsletter dummy (binary logit analysis)		
	b	t	p	B	t	p	B	t	p	B	t	p
One-shot MM dummy	0.00	0.12	.906	0.33	1.10	.271	1.15	3.65	<.001	-0.14	-0.48	.631
Being recommended dummy	0.25	5.86	<.001	2.01	7.91	<.001	1.33	6.51	<.001	0.74	2.97	.003
Experience of bus use dummy	0.29	6.71	<.001	2.40	8.87	<.001	-	-	-	-	-	-
Newsletter dummy	0.07	1.70	.090	0.31	1.11	.266	-	-	-	-	-	-
Constant term [†]	2.75	16.86	<.001	-1.89	-5.10	<.001	-2.14	-6.80	<.001	1.16	4.15	<.001
Goodness of fit, Number of samples(n)	R ² = 0.20; n = 490			r ² = 0.31; n = 494			r ² = 0.09; n = 494			r ² = 0.02; n = 495		

[†] Non-standardized coefficient is described in column b

b: Standardized coefficient

B: Non-standardized coefficient

t: t value

p: p value

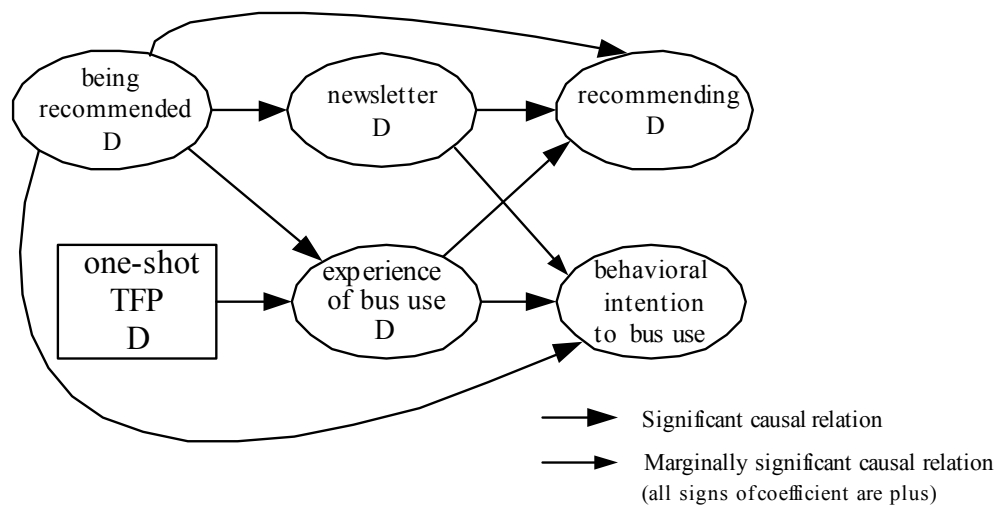


Figure 2. Causal relationship of bus use resulting from the regression analysis

The psychological and behavioral variables observed in the Wave 2 survey might be related causally. In order to investigate causal relationships, we developed hypotheses with respect to causal relationships among the variables and tested the hypotheses using observed data.

We hypothesized that the experiences of both using the bus and reading the newsletter would be influenced by the experience of another person recommending use of the bus. They would also be influenced by participating in the one-shot TFP. This is because the behaviors “use the bus” and “read the newsletter” are new behaviors for people and such new behaviors may be implemented by a specific stimulus, such as participating in the TFP or having someone recommend the bus. In addition, we hypothesized that these four factors (i.e., reading the newsletter, using the bus, someone recommending the bus, and participating in the one-shot TFP) would influence recommending the bus to others and the intention to use the bus in the future.

Table 6 shows the results of the multiple linear regression analyses and binary logit analysis to confirm the causal relationships between the factors, after eliminating non-significant coefficients. Figure 2 shows the causal relationships derived in Table 6.

The results confirm that use of the bus was induced by the one-shot TFP and being recommended dummies. The newsletter dummy was also induced by the being recommended dummy. The recommending dummy was induced by the newsletter, bus use, and being recommended dummies. Finally, the behavioral intention to use the bus in the future was induced by the newsletter, bus use, and being recommended dummies.

5. DISCUSSION

This study designed and implemented MM for the purpose of promoting a local community bus service, and analyzing its quantitative effect. The findings are summarized below:

- 1) There was a general increase in bus use owing to the one-shot TFP as a MM measure.

- 2) There was a persistent increase in bus use after the period of free bus tickets.
- 3) Reading the newsletter reinforced the behavioral intention to use the bus in the future.
- 4) The effectiveness of mouth-to-mouth advertising of the bus service in the target area was implied by the results of regression analyses; bus use induced recommending the bus and being recommended to use the bus induced bus use behavior.
- 5) The induction of mouth-to-mouth advertising was owing to Mobility Management.

Although further study is needed of the longer-term effectiveness of MM and additional psychological and behavioral effects of MM using richer measurements, the results in this study suggest that MM was effective in promoting the bus. The average number of bus users increased by 26% by two months after the implementation of MM.

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