Mobility Management in Japan: Its development and meta-analysis of travel feedback programs (TFPs)

by

Ayako Taniguchi, Ph.D. Eng.
Assistant Professor
Department of Risk Engineering, University of Tsukuba
1-1-1, Ten-noh-dai, Tsukuba, Ibaraki 305-8573, Japan
Tel: +81-(0)29-853-5754
Fax: +81-(0) 29-853-5754
E-mail: taniguchi@risk.tsukuba.ac.jp

and

Haruna Suzuki,
Doctoral Candidate
Department of Civil Engineering, Tokyo Institute of Technology
2-12-1, Ookayama, Meguro, Tokyo 152-8552, Japan
Tel: +81-(0)3-5734-2590
Fax: +81-(0)3-5734-2590
E-mail: hsuzuki@plan.cv.titech.ac.jp

and

Satoshi Fujii, Ph.D. Eng.
Professor
Department of Civil Engineering, Tokyo Institute of Technology
2-12-1, Ookayama, Meguro, Tokyo 152-8552, Japan
Tel: +81-(0)3-5734-2590
Fax: +81-(0)3-5734-2590
E-mail: fujii@plan.cv.titech.ac.jp

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Abstract
This study examined the history, current situation, and characteristics of mobility management (MM) in Japan and quantitatively analyzed the effectiveness of MM in Japan by extending a previous meta-analysis to include data up until 2003. The most frequently used MM method in Japan involves travel feedback programs (TFPs). For the meta-analysis, we collected all reports and research papers describing TFP implementations in Japan published in or before December 2005. In total, 31 cases of MM had been implemented in residential areas, schools, and workplaces. We focused on TFPs implemented in residential areas, for which many reports and greater sample sizes exist. The analysis results indicate that TFPs in residential areas of Japan reduced car use by 7.3–19.1% and increased public transport use by 30.0–68.9% on average. The analysis of effectiveness of TFP techniques, it was shown that "goal setting" leads to significant changes in travel behavior from car use to more sustainable transport.

Abbreviations:
MM: Mobility management
TFP: Travel feedback (/feed-forward) program

1. INTRODUCTION

Since the end of the 1990s, "mobility management" (MM) has attracted increased attention from both transportation policy makers and researchers in EU countries, Australia, and Japan, as a "soft" measure that is designed to change car use behavior, although MM is not always known to any transportation policy makers and researchers in any countries. Although the definitions of MM may differ slightly by country, all definitions share the idea of motivating individuals to voluntarily change to more sustainable transport modes by providing detailed travel information and incentives and by using marketing techniques focusing on personal travel behavior[1].

In a typical MM program, participants report their travel behavior to MM implementers and/or request information that can help them to change their travel behavior. The MM implementers then provide feedback such as CO_2 emission estimates for specific cars, advice on reducing car use, and individualized information on public transport. Examples of such programs include the Individualized Marketing,[2] TravelSmart,[3] Travel Blending,[4] [5] Think of Wise Ways to Use Cars,[6] [7] and the personalized travel planning in the UK reported in the Smarter Choices document.[8] Here, we refer to these behavior modification programs as "travel feedback programs" (TFPs), as detailed below.[7] [9]

For EU countries, the European Platform of Mobility Management (EPOMM) website (http://www.epommweb.org/) helps transportation management practitioners implement mobility management. The website provides numerous reports of case studies and ideas for implementing MM measures. The European Conference of MM (ECOMM) has also been held yearly since 1997. The website and conference suggest the maturity of MM practices in the EU. As part of MM, TFPs have been implemented in many EU cities, including London, Bristol, Göteborg, and Baunatal.

In Japan, the first TFP pilot study was implemented in 1999 as a soft measure to ease traffic congestion. By 2000–2002, there were several studies of TFPs, but these were more experiments by transportation researchers than large-scale practical policies. According to a meta-analysis of ten TFP cases implemented in Japan before 2002 by two of the present authors[10], households that participated in TFPs reduced their car use by 19% on average.

It should be noted that Travel demand management (TDM) has a longer history than MM in Japan. One TDM measure, "park & ride," has been frequently implemented to reduce traffic congestion in Japan. In addition, road pricing and zonal car restrictions have also been discussed as TDM measures, but they have not been implemented in any Japanese cities. In the Japanese context, measures such as park & ride, road pricing, and zonal car restrictions are now referred to as TDM, while communication-based transportation measures such as TFP are referred to as mobility management (MM). In this paper, we use "mobility management" to denote communication-based transportation measures that attempt to induce voluntarily behavioral changes from car use to other modes of travel.

Because TFPs are the most frequently used MM measure in Japan, this study focused on TFPs to evaluate MM effects in Japan. The objectives of the paper are to report on the history, current practical situation, and characteristics of MM in Japan, and to analyze quantitatively the effectiveness of TFPs by extending Fujii and Taniguchi's previous analysis to 2003.

What is a "TFP"?

Among several types of individualized MM communication practices such as personal conversation, workshops, school education, and TFPs, it is TFPs (e.g., individualized marketing[2] and travel blending[4] [5] [11]) that seem to be most effective in terms of aggregate-level effects such as regional transportation mode shares, regional amounts of CO_2 emission reductions, and number of passengers on public transportation. This is because TFPs can potentially target all households or individuals in a specific area or organization, if the program budget is sufficient. On the other hand, it is not feasible to invite that many people to workshops or to have conversations with each person in an entire area. Education in schools is another important approach for travel-behavior modification, but it takes a long time (dozens of years) before it has an aggregate-level effect.

In all TFPs, participants receive feedback or feedforward information[12]. This feedback may include information on behavioral consequences, such as CO_2 emissions from car use. Feedforward information may include travel information (e.g., time tables or maps related to alternative travel options for commuting or shopping).

TFPs differ with respect to location, technique, and procedure[10] (see Table 1) and have been implemented for three main settings: residential areas, schools, and workplaces. TFPs in residential areas typically target the daily travel behavior of any household member, but TFPs for schools and workplaces typically target commuting. TFPs may be implemented in schools as part of the school curriculum.

Table 1

TFPs use several techniques based on whether the goal is to motivate changes in travel-behavior, to request plans for changing travel behavior, to request goal-setting regarding a change in travel behavior, or to provide customized information. For example, individualized marketing does not provide motivational support[2], while travel blending does[4) 5) 11]. A TFP that involves planning may ask participants to plan how they will change their travel behavior. For example, Fujii and Taniguchi (2005) proposed a TFP, implemented in several cities in Japan[9) 12], that requires participants to form a behavioral plan for changing their travel behavior. After requesting a behavioral plan from the participants, the participants were also asked to set a goal regarding how much they would change their travel behavior. The final issue is whether the TFP provides customized information. Typical TFPs such as travel blending and individualized marketing provide customized information, but some less elaborate TFPs do not. For example, a TFP implemented in Obihiro, Japan, provided participants with non-customized information about the bus service and requested that they made a behavioral plan for how to use the bus more often[13].

TFP procedures also differ. For instance, individualized marketing involves two or three contacts to survey travel behavior and intentions to change behavior, and provide customized information as necessary[2]. Travel blending involves four contacts[4) 5)]: to motivate a behavior change, to conduct a travel diary survey, to provide customized comments, and to provide additional customized comments. A less elaborate TFP may have only a single stage. For instance, a TFP in Obihiro, Japan[13], provided participants with a single questionnaire and non-customized information. The questionnaire included a request that participants formulate a behavioral plan for changing their travel behavior.

2. CURRENT SITUATION OF MM IN JAPAN

At the time of writing in 2006, there is awareness in transport planning agencies, urban planning boards, and local governments in Japan that problems due to motorized vehicles are becoming detrimental to society and that reductions of personal vehicle use are urgently needed. However, it is also recognized that past measures such as increased road construction, traffic control, and TDM measures (e.g., park & ride) cannot sufficiently ease the situation. Mobility management measures such as TFP are expected to be an option that may break the deadlock in the traffic congestion situation. In this section, we briefly describe the history of MM (see Figure 1) and the current situation with respect to TFPs.

Communication-based mobility management measures, referred to as TFPs in this paper, were first introduced from overseas to Japanese transportation researchers and policy makers in 1998. One case that was modeled from overseas was the Travel Blending Program implemented in Adelaide, Australia[14]. At that time in Japan, travel demand management (TDM) measures such as park & ride, road pricing, and zonal car restrictions were expected to be effective in reducing car use. Such TDM plans reflected the difficulty of implementing “hard measures” such as transportation capacity expansion and or new transportation systems partly because of low public acceptance and partly

because of budgetary restrictions. Under these circumstances, the Road Bureau of the Ministry of Land, Infrastructure, and Transport (MLIT) of the Japanese government established a bounty system (grants) for promoting TDM measures.

In 1999, the first pilot TFP study in Japan was implemented in Sapporo, Hokkaido prefecture. This project was followed by a larger-scale TFP experiment in that area in 2000 funded by the road section of the Hokkaido Development Agency, a regional bureau of the MLIT. At the same time, the first experiment attempting to induce voluntarily travel behavior changes by requesting people to develop plans for changing their own behavior was implemented in Osaka[9]. Later TFP and MM measures adopted this technique of requesting a behavior plan, which has repeatedly proven effective in changing behavior[10] 2000 to 2002, several other MM measures were implemented, but more as experiments by transportation researchers than as practical policies.

In 2001, the first MM research group was organized by researchers and practitioners as one of the specialty groups of the International Association of Traffic and Safety Sciences (IATSS). This research group implemented several MM experiments to test the effectiveness of several communicative techniques and programs in terms of participant attitudes and behavior changes. The IATSS research group held an MM workshop for the Japanese Society of Civil Engineers (JSCE) in 2003. Because the IATSS research group was focused on research, the JSCE workshop objective was to balance discussion of academic research on MM techniques with practical discussion on MM implementation. In 2005, this workshop was upgraded to an official committee composed of a wider group of JSCE members.

As mentioned above, the MLIT has tried to promote TDM measures to reduce traffic congestion and promote public transport. However, coercive implementation of TDM measures such as road pricing and zonal car restrictions often prove difficult because of low public acceptance. Less coercive TDM measures such as park-and-ride programs, traveler information, staggered office hours, car pool matching and telecommuting may be politically feasible but are typically less effective because enough people may not always participate in such measures. Public transport fare reductions would be another option, but they may be again difficult because of lack of continuous monetary fund. In addition, installing high-occupancy vehicle (HOV) lanes is not possible for most roads in Japan because of the limited number of lanes. Several case studies of TDM have suggested to the Japanese government that the effectiveness of TDM may be limited, although TDM may be successful in special situations such as places where park and ride can be promoted. On the other hand, MM measures that induce voluntary changes are not as politically difficult because these measures are non-coercive. Furthermore, such measures can, in theory, be implemented wherever there is travel behavior to change. Therefore, if MM measures such as TFPs prove successful in changing people's travel behavior, public sectors such as MLIT will more actively seek wider implementation. Indeed, several early studies implemented by IATSS and JSCE research groups have shown the effectiveness of such measures[10]. Based on these findings, the Kinki Regional Council of Transportation stated in 2004 that "We should widely implement 'mobility management' that promotes voluntary travel behavior changes through direct communication with travelers.[15]".

This is the first official commitment to mobility management by a Japanese government agency. Following this statement by the Kinki Regional Council on Transportation, the concept of MM and TFP has been rapidly disseminated among numerous sections of government, including the central government, and more practical applications are underway.

The JSCE published a handbook for MM in 2005[16]. The handbook was edited by the JSCE committee on MM and includes information on practical procedures for MM and TFP, points to consider, and many examples of tools used in past cases. As illustrated in Figure 1, MM measures in Japan rapidly increased in 2005 after publication of this handbook.

Since 2005, ministries and local governments have prepared various budgets for MM programs such as subsidies to reduce car use in favor of commuter transport so as to reduce CO_2 emissions by personal vehicles and promote public transport.

In July 2006, the first Japanese Conference on Mobility Management (JCOMM) was held by JSCE and MLIT. Over 300 participants attended the 1st JCOMM, giving 64 oral and poster presentations. The JCOMM will be held annually. As illustrated above, MM is rapidly gaining strength as a political measure in Japan.

Figure 1

3. META-ANALYSIS TO EVALUATE TFP IN JAPAN

Survey Items

To analyze the state and effectiveness of TFPs, we collected reports and research papers on TFPs in Japan issued before December 2005. As shown in Table 2, we identified 31 cases of TFP. We then created a database that included information on the type of procedure, techniques, information, and measures for evaluating travel behavior change for each case[1].

Table 2

Table 3 shows the basic survey items in the literature that we reviewed, such as location and sample size. Table 4 shows the types of communication techniques used in our meta-analysis. In Table 3, the TFPs are classified by their type and number of steps. A simple TFP consists of a pre-survey and questionnaire intended for communication on such subjects as behavioral planning or advice and information. A standard TFP consists of feedback on a behavioral change added to the components of the simple TFP. A one-shot TFP consists of only a questionnaire intended to collect information and communicate advice.

Table 3

Table 4

Measures for evaluating attitude and behavior change

To evaluate the TFPs, we had to measure the effects. However, comparing the effects among all the cases was difficult because different measurements were used for each case study. Thus, in this study, we defined measurements for behavior change as indicated below and used these measurements for our analysis.

[1] Because of limitation of paper length, there is not a space to indicate specific example of case study, some of the case studies were reported in Fujii and Taniguchi(2005), Taniguchi and Fujii(2006) and Taniguchi and Fujii (in press).

1) Behavioral measurements

In this study, we calculated the rate of change in behavioral measurements reported before and after a TFP intervention. If several behavioral measurements were reported, we selected one based on the following order of priority: (1) distance of trips, (2) time duration of trips, and (3) frequency of trips. In projects that had a control group, the rate of change in behavior was calculated by comparison with the control group. Note that cases with a control group would be more preferable to cases without a control group for assessment of effectiveness of TFPs. Still, assessment without a control group would be possible by comparing before and after TFPs.

Based on the above-mentioned procedures, we calculated the rate of change in car use and public transport use, defined as "car use change" and "PT use change." Note that if one of the behavioral factors mentioned above was not reported, we considered that the effect on behavior was not measured.

2) Psychological measurements

We used measurements of intention to reduce car use and to increase public transport (PT) use (or specific bus/train use) to assess the impact of TFP intervention on psychological factors (attitudinal factors). We calculated differences in measurements of behavior intentions before and after the TFP intervention and then calculated the rates of difference to create a scaled range of measurements. These measurements are referred to here as "car use intention change" and "PT use intention change."

General analysis of the samples

Between 1999 and 2005, 31 TFPs were reported in Japan. Figure 2 shows their locations. As illustrated by this figure, many TFPs have been implemented in the Osaka and Kobe areas, which are part of the Kinki region; these projects may have been inspired by the 2004 endorsement of TFPs by the Kinki Regional Council of Transportation[15], mentioned above. By type of target group and number, 18 TFPs were implemented in residential areas, targeting 4,407 people; 10 were implemented in schools, targeting 869 people; and four were implemented in workplaces, targeting 917 people. The target population refers to the number of people who participated in all the TFP procedures. Regarding the type of TFP, standard TFPs were more frequently adopted than one-shot and simple TFPs in schools, but simple TFPs were implemented more than the other types in residential areas.

Figure 2

Figure 3

Figure 3 shows the percentage of TFPs that adopted the respective techniques. According to Figure 3, 83.9% of the cases provided motivational information. Within these cases, the motivational information dealt with the environment in 93% of cases, health in 58% of cases, and availability of specific public transport resources in 33% of cases. Furthermore, the "behavioral plan" and "feedback on CO_2" techniques were also frequently adopted in the TFP cases studied here.

Dataset for meta-analysis of TFP effectiveness

To analyze TFPs in Japan, we prepared the following datasets. Some of the projects shown in Table 2 differed in terms of the experimental interventions conducted. Thus, to investigate TFP effectiveness in terms of attitude and behavior changes caused by the various experimental interventions, we created a dataset in which observations were composed of experimental conditions rather than projects. The dataset was composed of 60 experimental conditions of the 31 projects. We call this dataset the *experimental-condition-based dataset*.

Some TFPs were implemented as "experiments" to investigate more effective design of TFPs. Therefore, some experimental conditions were implemented for the purpose of comparison with other conditions to demonstrate the effectiveness of the conditions that were supposed to be superior. Therefore, when actually implementing these TFPs, the inferior method would not be adopted. Thus, we prepared another dataset called the *project-based dataset*. In this dataset, psychological and behavioral measurements to denote the total effectiveness of a TFP, *Y*, were estimated as follows:

$$Y = (s_1E_1 + s_2E_2 + \ldots\ldots + s_JE_J) / (s_1 + s_2 + \ldots + s_J)$$

where s_j (j = 1, ..., J) is the sample size of segment j, and E_j is the TFP effectiveness for segment j. Note that target population in some TFPs was divided into some segments, e.g. heavy car users and non-heavy car users, and different interventions were implemented for different segments. E_j is the effectiveness by the optimal TFP intervention for segment j. For example, when there are two experimental TFP interventions implemented for segment j and the effectiveness is a and b ($< a$), E_j is b.

Average TFP effects for residential areas

The TFP analyses were divided by those implemented in residential areas, workplaces, and schools, because the effects likely differ by situation. As mentioned above, our study set contained only nine cases for schools and five cases in workplaces; among these, even fewer cases had control groups. Because the data from TFPs implemented for schools and workplaces might be insufficient for our analysis, we used only data from TFPs implemented in residential areas.

According to an experimental-condition-based dataset, 32 experimental conditions out of 11 cases were available to analyze "car use change," and 28 experimental conditions out of 11 cases were available to analyze "PT use change." Regarding psychological measurements, 30 experimental conditions out of 9 cases were available to analyze "car use intention change," and 20 experimental conditions out of 8 cases were available to analyze "PT use intention change."

Table 5

Table 5 shows the mean (%) and standard deviation (STD) for each of the behavioral and psychological measurements calculated using the experimental-condition-based dataset. The table also lists those values for residential area TFP experiments having control groups. The residential TFP experiments, including those with and without control groups, indicated a 7.3% reduction in car use, 68.6% increase in public transport, and 10.4% and 7.5% increase in intentions to limit car use and increase PT use, respectively. Because the data for projects without a control group may have been influenced by unexpected factors such as seasonal or weather factors, these means may contain effects other than TFP intervention. The means of the TFP experiments that had control groups indicated a 12.1% reduction in car use and 38.6% increase of public transport as well as a 9.6% increase and 0.3% reduction in intention to reduce car use and use PT, respectively[2].

[2] Number of ratio of behavioral change was less than that of behavioral intention change. Because scale for intention is just relative one and that for behavior is absolute one, ratio for behavioral change

As mentioned above, the experimental-condition-based dataset includes observations that were conducted for comparison with other conditions assumed to be superior to demonstrate the "superior intervention" technique. Therefore, the means listed above may be underestimated. Thus, we calculated the mean effectiveness of TFP interventions in residential areas using the project-based dataset. These results indicated a mean reduction in car use of 19.2% and an increase in PT use of 31.7% for the nine TFPs with control groups.

Available TFP techniques for residential areas and workplaces

Among the 31 TFPs shown in Table 2, we focused on 14 residential and workplace cases where changes in car use were reported except for the earliest pilot study for residential area implemented in Sapporo in 1999 and the earliest pilot study for workplace implemented in Kanazawa in 2001. Among the 14 TFPs, all provided information on motivating behavior modification. Almost all of the TFPs (11 of the 14) described techniques for providing customized information. In addition, almost all (11 out of 14) requested that participants create a behavioral plan for how to change their travel behavior. The effectiveness of such measures has been empirically demonstrated in a TFP experiment in Japan[9]. The average car use reductions of 18% for residential areas and 9% for workplaces were mainly induced by TFPs that included motivational support, customized information, and requests for behavioral-plan formation.

A technique that some but not all TFPs adopted was to request that participants set a behavior-change goal. In 7 out of 14 TFPs, participants were asked to set a behavioral-modification goal (Himeji, 2004; for the areas of Kawanishi-Inagawa in 2003; Keihanshin in 2004; Miki in 2004; Osaka in 2004; Suita in 2003; and Suzurandai in 2004). In all these cases, before making a behavioral plan for how to reduce their car use, participants filled out a questionnaire specifying the percentage by which they would reduce their car use. In two cases (Miki in 2004; Suzurandai in 2004) participants were also asked to specify the percentage by which they would increase their public transport use. The average car use reduction for seven TFPs that requested such goal setting was 20%, whereas that for seven TFPs without explicit goal setting requests was 10%. The average increase in public transport use for six TFPs requesting goal setting was 76%, whereas that for six TFPs without such requests was 25%. These results imply that the technique of asking participants to set behavior-modification goals is promising.

4. CONCLUSIONS

This paper has outlined the history, current practical situation, and characteristics of MM in Japan and has detailed the results of a meta-analysis of the quantitative effectiveness of TFPs as MM methods in Japan. In TFPs for residential areas, the analysis indicated reduced car use and increased use of public transport. The analyses showed project-based mean reductions in car use of approximately 19% and increases in PT use of approximately 32%. The numerical analyses of the effects of TFPs in this study all focused on behavioral changes of participants in TFPs at the disaggregated level. This is because almost all TFPs in Japan have been implemented as experiments that have small population sizes and are thus not sufficient for evaluations of aggregate-level effects. Still, the effect size of MM measures should be evaluated at the aggregate level from the viewpoint of practical transportation policy. Therefore, larger-scale MM measures should be implemented in Japan.

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can not necessarily compared with that for intention change. It could also be noted that behavior can change even if behavioral intention does not changes, because behavior-intention consistency is not always perfect.

With respect to TFP techniques, the results indicate that asking participants to set behavior-modification goals is effective in increasing the extent of behavioral change.

TFPs were implemented and reported in EU countries and Australia[1)-5), 8)]. According to the review results of TFPs in UK[8)], the effectiveness of such TFPs was reported to be 7 to 15 % reduction in car use trips for TFPs participants. On the other hand, as abovementioned in this paper, the average car use reduction by TFPs in Japan was 12.1% for TFP participants by comparison with with control group. The average car use reduction by optimized TFPs in Japan was estimated to be 19.2%. These numbers of car use reduction per person were not largely different from numbers for UK.

The use of MM measures has evolved rapidly in Japan and various TFPs have been and are being implemented. While a number of government policy makers and planners have come to believe in the effectiveness of MM, others still wonder if MM measures are worthwhile. Therefore, proof of the effectiveness of these techniques in reducing vehicle traffic and promoting public transportation must be disseminated to these skeptical governmental officials.

In addition, there is several issues as future studies;

- The data in this study did not include how many people are involved in making the changes, because there were not enough cases reported. We also consider it is one of a future study.
- In this study, because of the lack of the cases, we could not do satisfactory analysis concerning where and when we should do TFPs. This is another important future study.
- Although cost benefit analyses of TFPs have not yet performed in Japan, Department for Transport in UK reported that the cost-benefit ratio of soft transport measures such as MM would be approximately 10. Note that we expect that TFPs with requesting to make a behavioral plan would be more cost-effective than TFPs without it that have been implemented in UK. In order to confirm such expectation, cost benefit analysis should be done in Japan as well.
- Soft measures such as MM would be effective to some degree whether it implements independently, however, there might be cases that soft measure does not work, for instance, targeting the people who have a strong car use habit. Therefore, it might be desirable to implement soft measures together with hard measures such as car restriction or infrastructure constructing.
- Currently, Information Technology (IT) is rapidly advanced. These IT systems can automatically observed participants' travel behavior. Therefore it can minimize participants' reporting efforts and allowed us to provide appropriate feedback. To discuss applying IT to MM would be needed.

Further meta-analyses like that in this study should also be conducted to accumulate data on the effectiveness of MM and TFPs and further clarify the best techniques.

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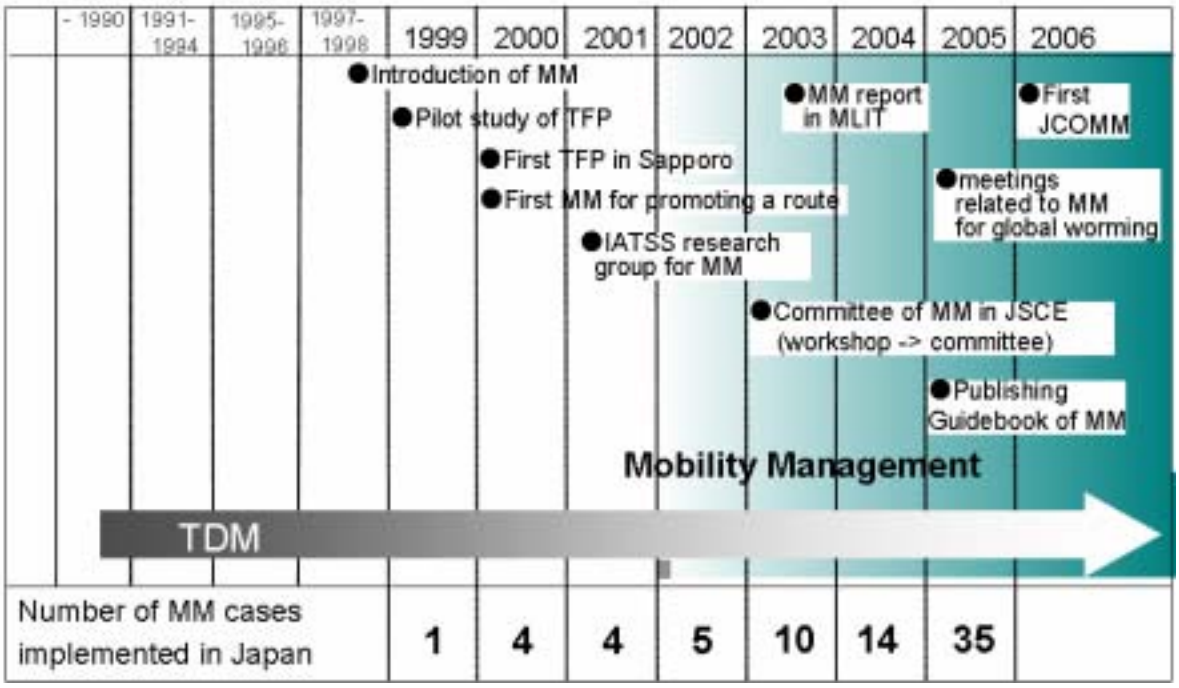

note: The number of cases shown in above figure includes the number of cases of which details were not presented or published in any conference or journals and were not, therefore, included in Table 2.

Figure 1. Chronology of Mobility Management in Japan

Figure 2. Locations of each MM case study in Japan

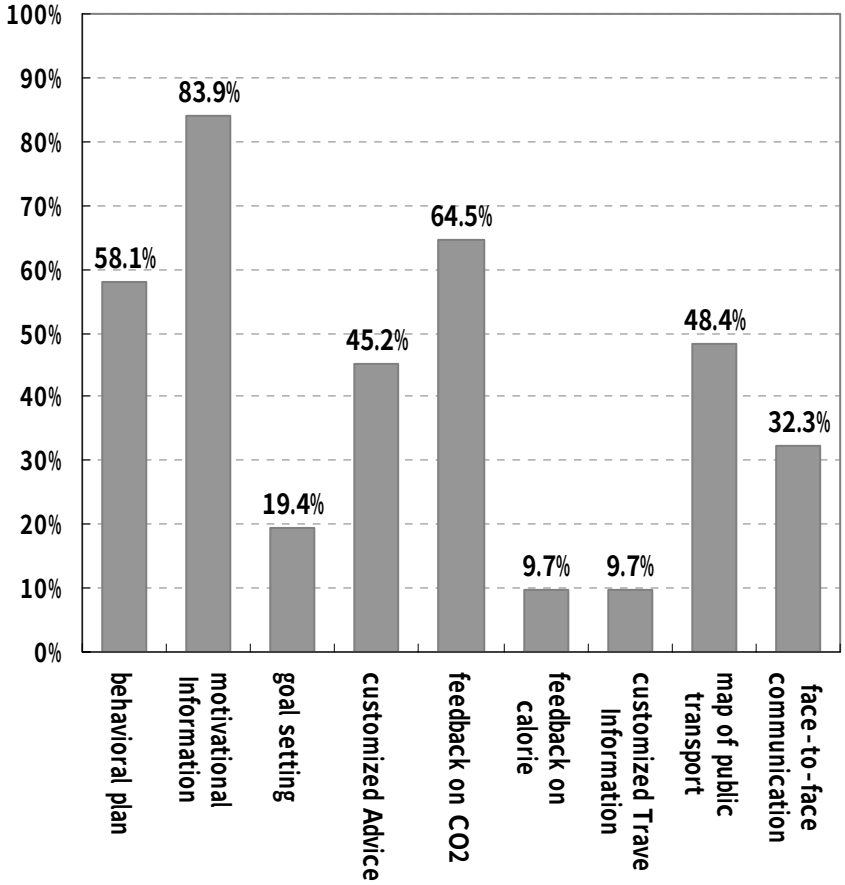

Figure 3. Percentage of TFP techniques used by the case studies

Table 1. Common features (and possible differences) of travel feedback programs [12)]

Location	**Technique**	**Procedure**
residential area (for all trips)	*motivational support*	*single stage*
workplace (manily for commute)	*request goal setting*	*multistage (travel diary*
school (mainly for commute)	*request plan formation*	*survey, feedback)*
	customized information	

Table 2. All reports and research papers related to MM measures implemented in Japan and brief summaries of those cases

(1) Residential area TFPs

Place	Year (implemented)	Sample size	Technique	Procedure	Method of measurement	Car use change (%)	Public transport use change (%)
Sapporo	(1999)	66	a) motivation b) no plan c) provide individualized information	1) travel diary survey 2) feedback on travel behavior 3) travel survey 4) feedback on travel behavior change	before/after design without control group	-8.39	11.36
Sapporo (Ainosato)	(2000)	120	a) motivation b) no plan c) provide individualized information	1) travel diary survey 2) feedback on travel behavior 3) travel survey 4) feedback on travel behavior change	before/after design without control group	-26.08	9.93
Sapporo (Ebetsu)	(2000)	349	a) motivation b) no plan c) provide individualized information	1) travel diary survey 2) feedback on travel behavior 3) travel survey 4) feedback on travel behavior change	before/after design without control group	-8.95	6.06
Takasaki City	(2000)	91	a) Trial ticket	1) simple travel survey 2) provide trial ticket 3) travel survey	before/after design with control group	—	—
Kanazawa	(2001)	19	a) motivation b) no plan c) provide individualized information	1) travel diary survey 2) feedback on travel behavior 3) travel survey	before/after design with control group	+12.00	—
Hitachi City	(2002)	58	a) no plan b) provide individualized information	1) travel diary survey 2) feedback on travel behavior 3) travel survey	before/after design without control group	—	—
Osaka City	(2001)	106	a) no plan b) provide individualized information	1) travel diary survey 2) feedback on travel behavior 3) travel survey	before/after design with control group	—	—
Suita City	(2002)	422	a) plan b) customized travel information	1) simple travel survey 2) provide customized information 3) travel survey	before/after design with control group	—	—

Kawanishi-Inagawa area	(2003)	312	a) motivation b) plan with goal setting c) provide individualized information	1) simple travel survey 2) individualized information with behavioral plan	before/after design with control group	-27.02	68.97
Sapporo	(2003)	50	a) motivation b) plan c) provide individualized information	1) simple travel survey 2) individualized information with behavioral plan	before/after design with control group	-11.78	72.01
Mihara Town	(2003)	—	a) motivation b) provide group advice c) integrated map	1) provide information 2) questionnaire	answers to questionnaire	—	—
Suzuran-dai (Hyogo-Prefecture)	(2004)	210	a) motivation b) plan with goal setting c) provide non-individualized information	1) area-specific information with behavioral plan	before/after design with control group	-18.74	50.79
Miki City	(2004)	48	a) motivation b) plan with goal setting c) provide non-individualized information	1) area specific information with behavioral plan	before/after design with control group	-26.09	31.61
Himeji City	(2004)	103	a) motivation b) plan with goal setting c) provide individualized information	1) simple travel survey 2) individualized information with behavioral plan	before/after design with control group	-12.80	3.77
Keihanshin area	(2004)	1560	a) motivation b) plan with goal setting c) provide non-individualized information	1) simple travel survey 2) feedback on travel behavior with behavioral plan	before/after design with control group	-26.92	257.28
Obihiro City	(2004)	410	a) motivation b) plan	1) request creation of behavioral plan 2) travel survey	experimental group / control group design	—	29.41
Ryugasaki City	(2005)	153	a) motivation b) plan c) provide individualized information	1) simple travel survey 2) individualized information with behavioral plan	before/after design with control group	-6.00	20.60

"—" in the column of car use and public transport use change denotes "not reported".

(2) Workplace TFPs

Place	Year (implemented)	Sample size	Technique	Procedure	Method of measurement	Car use change (%)	Public transport use change (%)
Kanazawa City (several workplaces)	(2001)	106	a) motivation b) no plan c) provide individualized information	1) travel diary survey 2) feedback on travel behavior 3) travel survey 4) feedback on travel behavior change	before/after design without control group	-0.10	29.00
Toyonaka City (1 workplace)	(2003)	79	a) motivation b) plan c) provide individualized information	1) simple travel survey 2) individualized information with behavioral plan 3) travel survey 4) feedback on travel behavior change	before/after design without control group	-6.10	—
Suita City (1 university)	(2003)	133	a) motivation b) plan with goal setting c) provide individualized information	1) travel diary survey 2) individualized information with behavioral plan	before/after design without control group	-16.50	—
Himeji City (3 workplaces)	(2004)	99	a) motivation b) plan c) provide individualized information	1) simple travel survey 2) individualized information with behavioral plan	before/after design with control group (measuring commuting trips)	-8.80	14.81
Osaka Prefecture (several workplaces)	(2004)	500	a) motivation b) plan with goal setting c) provide individualized information	1) simple travel survey 2) individualized information with behavioral plan 3) travel survey 4) feedback on travel behavior change	before/after design with control group	-15.06	43.76

"—" in the column of car use and public transport use change denotes "not reported".

(3) School TFPs

Place	Year (implemented)	Sample size	Technique	Procedure	Method of measurement	Car use change (%)	Public transport use change (%)
Sapporo	(2000)	127	a) motivation b) no plan c) provide individualized information	1) class & travel diary survey 2) feedback on travel behavior 3) class & travel survey	before/after design without control group	-18.46	3.76
Kanazawa	(2001)	39	a) motivation b) no plan c) provide individualized information	1) travel diary survey 2) feedback on travel behavior 3) travel survey	before/after design with control group	16.88	—
Sapporo	(2002)	292	a) motivation b) plan or individualized information c) provide individualized information	1) travel diary survey 2) feedback on travel behavior 3) travel survey 4) feedback on travel behavior change	before/after design without control group	2.86	79.65
Sapporo	(2002)	97	a) motivation b) plan c) provide individualized information	1) travel diary survey 2) feedback on travel behavior 3) travel survey 4) feedback on travel behavior change	before/after design without control group	12.08	17.05
Kanazawa	(2002)	71	a) no plan b) coordinator c) provide individualized information	1) simple travel survey 2) individualized advice by coordinator 3) travel survey	before/after design with control group	-14.60	—
Izumi City	(2002)	135	a) motivation b) plan	1) travel diary survey 2) workshop in class		—	—
Toyonaka	(2003)	91	a) motivation b) plan	—	—	—	—
Fuji	(2004)	164	a) motivation b) plan	1) simple travel survey 2) workshop in class 3) travel survey	—	—	—
Hadano	(2005)	81	a) motivation b) plan c) provide individualized information	1) simple travel survey 2) workshop in class 3) travel survey	before/after design without control group	13.33	49.35

"—" in the column of car use and public transport use change denotes "not reported".

Table 3. Basic survey items from the reviewed literature

	Item	Classification	Details
1	Place & Year		A length of the project and place where each project was carried out
2	Sample size	(household, individual)	The number of samples based on the final number of questionnaires collected
3	TFP types	One-Shot TFP, Simple TFP, Standard TFP	The "Standard TFP" is composed of four steps: (1) first contact, (2) providing feedback and/or feedforward information that is customized based on the individual information obtained in the first step, (3) observing how travel behavior changes, and (4) providing feedback information on changes in travel behavior. The "Simple TFP" is composed of the first two steps of the standard TFP. The "One-Shot TFP" has only one intervention (step 2).
4	Location	school, workplace, residential area	Location where the project was carried out
5	Individualized marketing	with or without	Individualized Marketing provides different communication to individuals based on their travel activity such as times of public transport use or intention to reduce car use.
6	Control group	with or without	—
7	Method of first contact	Mail, Post, Visit, Organization	For the "Mail" method, the experimenter checks addresses beforehand and then mails the information. By the "Post" method, information is dropped directly into participant's mailbox without checking addresses first. For the "Visit" method, the experimenter visits households in person and hands out information. By the "Organization" method, information is distributed through an organization such as a company, club, or school.
8	Method of sampling	Public subscription, Random sampling, Through association	For "Public subscription" sampling is done through a public media outlet such as the Internet or a magazine. By "Random sampling" samples are randomly obtained from a specific database. "Through association" is the method of selecting participants through their association with others or an organization.
9	Responsible organization	Government (central, local), Institute, Company	The organizations that carried out the project
10	Object of project		The project aim, such as the promotion of a specific type of public transportation
11	Reference		The documents or websites referenced

Table 4. Definition of types of communication techniques used

	Techniques	Details
1	Motivational information on health, environment, local transportation)	Promoting changes in attitudes toward car and/or public transport use by providing information about the benefits of public transport and personal & social demerits of car use (e.g., as related to health, the environment, and/or local transportation).
2	Feedback on travel activity (including CO_2 emissions and calorie consumption)	Providing individualized feedback on time of car use and quantity of CO_2 discharges and/or on the consumption of calories by various travel behaviors based on travel survey
3	Goal setting	Requesting a "numerical target" such as the desired percentage of car use reduction
4	Personal advice	Providing specific personal advice for behavioral change based on information such as current travel behavior or mailing address or trip purpose.
5	Customized travel information	Providing customized travel information such as public transport map or timetable for public transport resources near an individual's home or workplace.
6	Behavioral plan	Activating intention by requesting that respondents make detailed plans for how to change their travel behavior
7	Face-to-face communication	Giving people the opportunity to talk with somebody regarding behavioral change For example, at school, in a workshop, or with an advisor
8	Map distribution	Distributing route maps of public transportation and/or of the town center

Table 5. Mean and standard deviation (STD) for each behavioral and psychological factor

	Behavioral measurement						Psychological measurement					
	Car use change			PT use change			Car use intention change			PT use intention change		
Condition	n	mean (%)	SD	n	mean (%)	SD	n	mean (%)	SD	n	mean (%)	SD
All residential area TFP experiments	32	-7.3	22.6	28	68.6	137.7	30	10.4	13.5	20	7.5	11.4
Residential area TFP experiments with control groups	20	-12.1	21.5	18	38.6	63.0	22	9.6	15.2	10	-0.3	4.0

n : number of MM case studies