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Effects of information provision activities in streets on driving speeds

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Abstract

Traffic accidents in the streets have become a very serious issue in Japan. In order to reduce the traffic accidents in the streets, a proper speed reduction of the vehicle is important. Although there are many approaches to make the vehicles reduce the speed, this study focuses on a user measures to encourage the speed reduction by providing the information. Recent years, there was a traffic calming study in which some people stand the roadside and then remind the drivers to decrease their driving speeds by showing the vehicle's speed. In this study, by referring the existed study, we tried to grasp the measurement issues from the viewpoint of vehicle behavior such as reduction of the speed, evaluation by the drivers and neighborhoods consciousness, and possibility of the supports by the government in this area. Results obtained in this study are as follows. 1) When provided speed information for the over speed limit vehicles, it was found that the speed is reduced markedly near the provision position. 2) Vehicle speed provision activities were accepted favorably to the driver. In addition, the trend was noticeable to the driver who lives in the vicinity of the activities. 3) It was recognized by neighborhoods that vehicle speed provision activities are effective compared to the traffic safety campaign activity as usual. In addition, the tendency was more remarkable in the people who recognized that the vehicle speed in the street was fast. 4) The problems listed by the road administrators for the spread of vehicle speed information provision activities were the relations with other policies, the generalization of the effects, and consideration for the trouble evasion.

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Keywords: streets, traffic safety campaign, driving speed provision

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1. Introduction

The 9th Fundamental Traffic Safety Program has been devised in Japan on March 31, 2011, and street measures were newly included as one of three main viewpoints of road safety measures in the program. The reason is that the proportion of traffic fatalities in the streets has been increasing in recent years. In order to reduce the traffic accidents in the streets, a proper speed reduction of the vehicle is important. Although there are many approaches to make the vehicles reduce the speed, this study focuses on a user measures to encourage the speed reduction by providing the information. Recent years, there was a traffic calming study in which some people stand the roadside and then remind the drivers to decrease their driving speeds by showing the vehicle's speed.

In this study, by referring the existed study, we tried to grasp the measurement issues from the viewpoint of vehicle behavior such as reduction of the speed, evaluation by the drivers and neighborhoods consciousness, and possibility of the supports by the government in this area. Specifically, we carried out the Speed Information Provision Activities (SIPA) by the collaboration with neighborhoods for two districts in Toyota-city, Aichi and investigated a vehicle speed change compared with before and after, and the consciousness of drivers who passed through the streets and the neighborhoods for the activities. In addition, we carried out a hearing investigation to ask about political problems of the SIPA for the police and the road manager who will take on an important role in the activities promotion. The paper structure in this study is as follows. Firstly, feature of present study are described comparing with previous studies. Secondly, details of survey methods are explained. Thirdly, results of the surveys are pointed out. Finally, we discuss about the conclusion of this study.

1.1. Feature of present study

Previously, measures prompting the safe driving by providing information to the driver have been attempted in various ways. These can be divided into two depending on the location of the information provided. One is from the roadside with signboards, and the other is from the inside of the vehicle with a vehicle-mounted device. In both viewpoints, there are lots of studies using the ITS technologies recently (e.g. Warner and Åberg (2008), Gehlert et al. (2012), etc.). For instance, Erke et al. (2007) confirmed effects of route guidance Variable Message Signs on speed and route choice on two sites on motorways. As a result, speed measurements of 3342 vehicles showed large speed reductions. Using a driving simulator, Boyle and Mannering (2004) explored the effects of driving behavior with in-vehicle and out-of-vehicle traffic advisory information relating to adverse weather and incident conditions. They found that the advisory information are significant in reducing speeds in the area of adverse conditions, drivers tend to compensate for this speed reduction by increasing speeds downstream when such adverse conditions do not exist. On the other hand, in the practice field, many measures that utilize the human resources of the region have been incorporated. One of them is the traffic safety activities by local residents.

Generally, the traffic safety activities are known to encourage safety driving at the roadside by local residents who hold placards with a slogan. The effect of its activities is discussed in an indicator such as the number of accidents during the period in many cases. However, a causal relationship with the activity is not always clear because the various factors involved in that indicator. We think that there is a problem in Japanese traffic safety activities that have been conducted with no feeling without the clarified concrete effect.

On the other hand, studies that attempt to propose the traffic safety activities that effect has been confirmed by scientific methods have been carried out in recent years. Kojima and Kubota (2008) distributes a brochure at the roadside utilizing the method of mobility management to encourage behavior change to the driver using rat-runs. As a result, decrease in the traffic volumes of the rat-runs has been confirmed. Fuchu et al. (2011) performed activities that encourage the awareness of speeding by presenting the driver's speed using a placard from the roadside. As a result, it was confirmed that continues to decrease the vehicle speed over a period of time, even after the end of activities as well as in practice.

In order to carry out the activities continuously and smoothly, it is important to coordinate participants such as police, road manager and residents. In this study, we are focusing on speed information provision activities in streets proposed by Fuchu et al (2011), but it has the following features. First, detailed effects of the activities that are not clearly shown in the results of Fuchu et al (2011) have been confirmed. Second, the problem of the spread of the activities has been revealed from the viewpoint of drivers, residents, police and road manager.

2. Method

Object area in this study is Inoue and Tendo district of Toyota City, Aichi Prefecture. The reason why the two districts were chosen in this study is that we offered the cooperation to leaders of some districts in Toyota City when a committee of the leaders of districts was held. As a consequence, the leaders of Inoue and Tendo districts only received our suggestion. In order to carry out the SIPA, cooperation of local residents is essential. Therefore the experiments were promoted with the assistance of representatives of residents from the planning stage.

2.1. Survey of vehicle speeds

The date of the survey is shown in table 1. The implementation sites of the SIPA were determined based on the location of the speed limit signs and consultation with the representatives. Inoue is a residential area that houses lined the roadside; Tendo is where elementary school is close. Both of the sites have 30km/h speed limit, no centerline of the roadway, 4m-roadway width.

In each experiment, the representatives from several people participated. The investigation time was 10:00 to 11:00 am. This is for the following reasons. First, when measuring the speed of the vehicle, the vehicle being measured is not affected by existing another vehicle, pedestrian or bicycle is desirable. Second, the traffic safety activities are completed in 30 minutes to an hour in general. Therefore, we chose the 10:00 to 11:00 am to avoid ordinary peak time. In order to compare with SIPA periods, the vehicle speeds were similarly surveyed before and after one week of that. However, only the after period speeds in Tendo couldn't be surveyed because of the bad weather.

Contents of the SIPA presenting to the drivers were "over 30km/h", "over 40km/h" and "over 50km/h" made by plastic boards like Fig 1 and 2. These were chosen according to the vehicle speeds. To get the each vehicle speeds and these positions, radar gun, Stalker Lidar LR of Applied Concepts inc, that can measure the distance from the place of the gun as well as the vehicle speed were used. In Inoue, in which the SIPA was carried out at first, the speeding information was provided to a driver if the driver has violated the speed limit (30km/h) at 60m before the site of the SIPA like Fig 3. The reason of 60m was the distance which the driver will recognize the contents at that point. But after the survey of Inoue, we found that the influence of the few seconds to present the boards to the driver after deciding providing the information should be considered, because sometimes we had no time to provide the information to the drivers although they should be. In Tendo, therefore, the speeding information was provided to a driver if the driver has violated the speed limit (30km/h) at 100m before the site of the SIPA like Fig 4.

Table 1. Date of the SIPA

Inoue	Before	10:00-11:00am, November 29th, 2011
	SIPA	10:00-10:45am*, December 6th, 2011
	After	10:00-11:00am, December 13th, 2011
Tendo	Before	10:00-11:00am, Januray 24th, 2012
	SIPA	10:00-11:00am, January 30th, 2012
	After	-

*Because the ongoing investigation has become impossible due to a bad (Low battery) of measurement equipment, the time was shorter than the other one.

Fig 1. Picture of SIPA (Inoue)

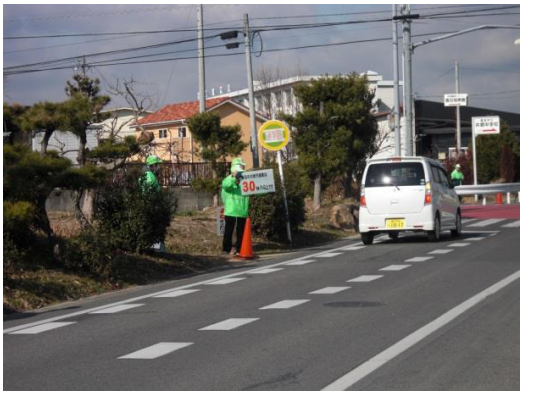

Fig 2. Picture of SIPA (Tendo)

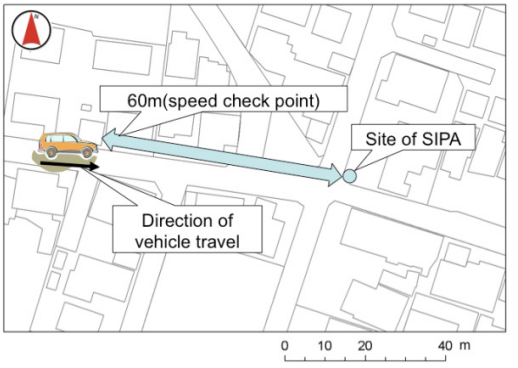

Fig 3. Site of SIPA (Inoue)

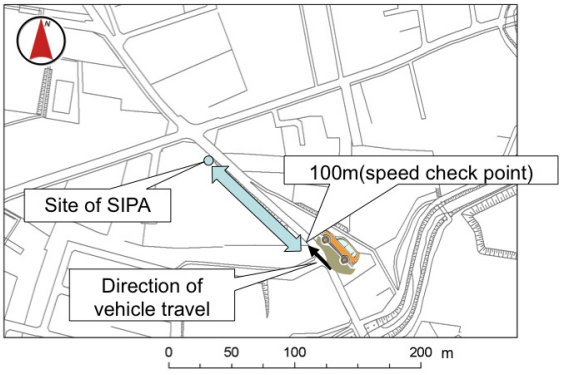

Fig 4. Site of SIPA (Tendo)

2.2. Survey of driver consciousness

In conjunction with the SIPA, questionnaire survey sheets were distributed to the drivers who stopped for the signal or the stop sign located at downstream of the SIPA. The sheets could not be handed to all of the drivers who passed through the site of SIPA because some drivers rejected receiving the sheets. Eventually, we distributed the sheets to 76 drivers among 194 vehicles passed through in Inoue, and recovered the sheets from 26 drivers. In Tendo, it was handed to 31 drivers among 94 vehicles and collected it from 11 drivers.

2.3. Survey of resident consciousness

After the SIPA experiment, a questionnaire survey was carried out to representatives of residents who manage smaller districts in Inoue, 13th of February 2012. The contents of the survey were the evaluation and acceptability of the SIPA. In order to help the answer, the results of SIPA were included in the questionnaire sheets. The sheets were distributed to 109 the representatives, and recovered the sheets from 72.

2.4. Hearing survey of police and road manager

The hearing survey was carried out to the police on 13th March 2012 and road manager on 9th March 2012 of Toyota city. The contents of the survey were the range of support for the activities with the issues in order to promote the activities. In the hearing survey, we explained the summary of the SIPA, method, and the Result of the experiment at first.

3. Result

3.1. Vehicle speeds

In this study, the continuous change of the average speed and the rate of the vehicles that recorded the speed under 30km/h from the site of the SIPA were confirmed. Conditions of measuring vehicles were as follows. We measured only the vehicles that go straight on the target link when the vehicles drive with free velocity. In addition, we analyzed the vehicles that were provided the speed by us just in the phase of the SIPA. The relationship between the analyzed vehicle and the vehicles that went straight on the target link is shown in Table 2. Especially in Inoue, the number of measurement vehicles was somewhat fewer than the vehicles which take the straight line because there were lots of vehicles that affected our targeted vehicle.

The results of the average speed change from the site of the SIPA are shown in Table 3. The average speeds without the Before one had dropped closer to the site of the SIPA. Results of analysis of variance, there was a significant difference ($p<0.05$) in the interval 10-19m from SIPA in Inoue and in the interval 10-49m from it in Tendo. We think the reason of both differences attributed distances between the sites of SIPA and the speed check points, which the distance in Tendo is longer than in Inoue.

Then, the results of the vehicle rate of 30km/h or less in the both sites are shown in Fig 5 and Fig 6. The vehicle rate of 30km/h or less in the SIPA period had extremely increased at closer site of the SIPA. Looking at the results of the After could be performed only in Inoue, vehicle rate of 30km/h or less has increased as compared to the Before about 10% in all intervals. In the SIPA period, there was no difference in the rate of vehicles 30km/h or less as compared with the Before in a section away from SIPA. Therefore, there is a possibility that drivers, who experienced the SIPA, began to aware of the speed limit throughout whole interval.

Table 2. Number of the measurement vehicles

Inoue	Before	18 / 102
	SIPA	16 / 113
	After	32 / 96
Tendo	Before	25 / 62
	SIPA	21 / 42
	After	38 / 59

*number of measurement vehicles / number of vehicles which take straight line

Table 3. Average speed change from the site of the SIPA

		Distance from site of SIPA															
		10-19m			20-29m			30-39m			40-49m			50-59m			
		Before	SIPA	After	Before	SIPA	After	Before	SIPA	After	Before	SIPA	After	Before	SIPA	After	
Inoue	Number	18	16	32	18	16	32	18	16	32	18	16	32	18	16	32	
	Mean	34.3	28.0	31.8	35.6	31.1	33.1	35.6	34.4	33.7	36.3	37.0	34.2	36.8	38.4	35.0	
	S.D.	4.7	7.4	7.4	4.6	5.6	6.5	4.4	4.3	5.8	5.2	4.8	6.1	5.0	5.2	6.7	
	P value	0.024			0.082			0.419			0.193			0.153			
Tendo	Number	25	21	-	25	21	-	25	21	-	25	21	-	25	21	-	
	Mean	38.5	26.2	-	41.1	31.6	-	42.3	35.2	-	42.9	39.5	-	43.2	41.2	-	
	S.D.	5.2	10.0	-	5.3	8.6	-	4.9	8.4	-	4.9	6.2	-	5.2	5.4	-	
	P value	0.000		-	0.000		-	0.002		-	0.048		-	0.100		-	

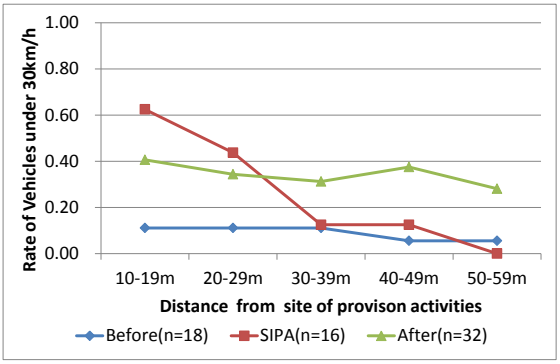

Fig 5. Vehicle rate of 30km/h or less (Inoue)

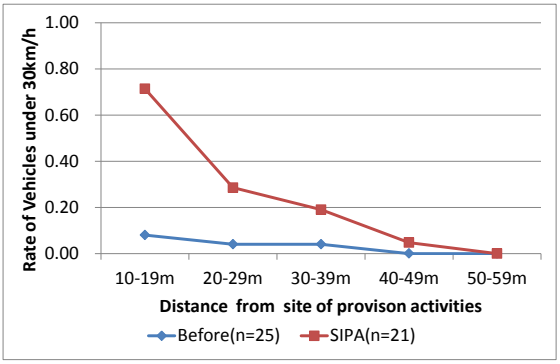

Fig 6. Vehicle rate of 30km/h or less (Tendo)

3.2. Driver consciousness

In this section, we will point out the driver consciousness about the SIPA especially their behavior and the evaluation after experiencing it. At that time, gender, age, living place, frequency of going through the road section where SIPA is carried out, experience of speeding when go through the section and recognition of the speed limit were concerned. As mentioned above, we carried out this survey in the both sites, but there were no enough respondents each site. To obtain a clear result of driver consciousness, we analyzed it by integrating both site results.

The survey sheets were distributed at a little far from the site of the SIPA because of safely handing it to the drivers. Therefore, the respondents who got the sheets and experienced the SIPA were 24% all of them. Thus, a lot of the respondents answer the question in a case that they supposed to have experienced the SIPA. Here, 89% of the respondents, who experienced the SIPA, have answered “I reduced my vehicle speed”, and 82% of the respondents, who did not experience the one, have answered ”I will reduce my vehicle speed”. In this way, the answer tendencies were similar with or without experiencing the SIPA. Therefore, we thought the experience of the SIPA does not significantly affect the analysis in this study.

The change of the driver behavior after experiencing the SIPA is shown in Fig 7. The numbers of valid response were 34 people. As described above, the drivers of more than 80% have responded that they slow down when they experience the SIPA. To see the differences according to the features of the driver, Fisher's exact test was performed. As a result, there was a significant difference only in the difference of their living place. It can be seen that the drivers who live near of performing the SIPA was going to reduce the speed more by the activities.

On the other hand, there were some answers in a free description, such as "I wonder the speed that is presented to me is whether really true or not", "I do not know the meaning if the speed limit is not clear", "I was just surprised by it". We have to take into account these issues in the future.

The result of the evaluation of the SIPA is shown in Fig 8. The numbers of valid response were 33 people. It is found that more than 90% of the drivers thought the SIPA is good or very good. To see the differences according to the features of the driver, Fisher's exact test was performed. As a result, there was no significant difference by the features of the driver.

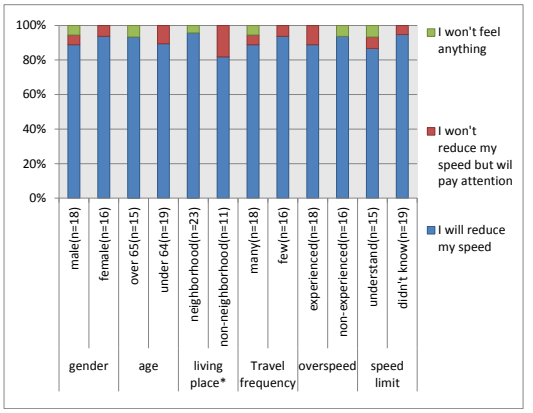

Fig 7. Change of the driver behavior after experiencing the SIPA

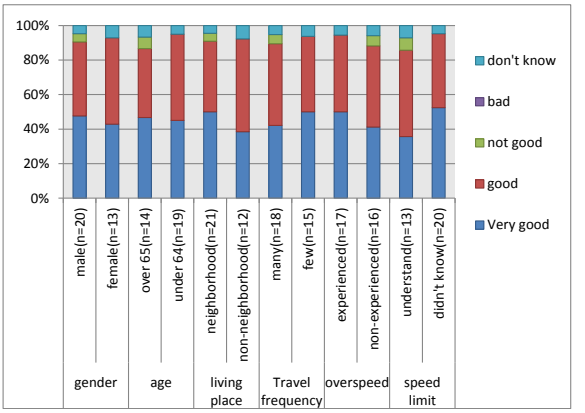

Fig 8. Evaluation of the SIPA

3.3. Resident consciousness

In this section, we will point out the resident consciousness about the SIPA compared with ordinary safety activities and a sense of participation to the SIPA. At that time, gender, age, consciousness of the vehicle speeds in their community streets, and a sense of participation in safety activities were concerned.

The result of the resident consciousness about the SIPA compared with ordinary safety activities is shown in Fig 9. A lot of residents answered that SIPA is more effective compared with ordinary safety activities. To see the differences according to the features of the resident, Fisher's exact test was performed. As a result, there was a significant difference only in the difference of consciousness of the vehicle speeds in their community streets. It is

pointed out that resident, who thinks the vehicle speeds is faster in their community streets, expects the larger effect of the SIPA.

The result of the resident consciousness about a sense of participation to the SIPA is shown in Fig 10. It is found that most of residents answered that it should do but they do not want to take initiative themselves. To see the differences according to the features of the resident, Fisher's exact test was performed. As a result, there was no significant difference by the features of resident.

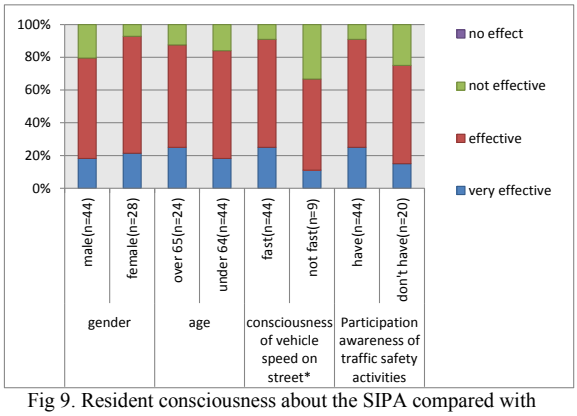

Fig 9. Resident consciousness about the SIPA compared with ordinary safety activities

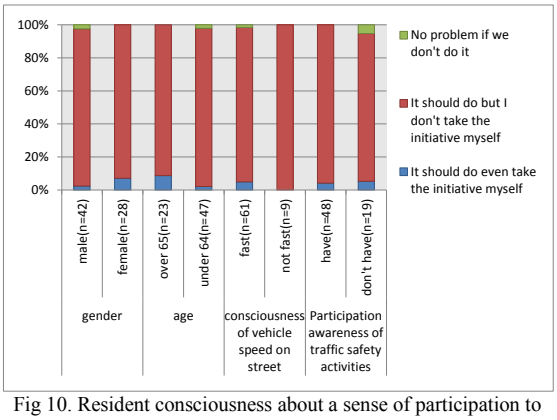

Fig 10. Resident consciousness about a sense of participation to the SIPA

3.4. Opinion of police and road manager

We organize the results of the interviews for the related organizations that will play an important role in the spread of the SIPA. First of all, the opinion of the police, who manages traffic regulation, is shown. The range of support for the SIPA by the police was limited. They said that it is difficult to directly promote and support it by them. The issues in order to promote the activities that they think is that there is a side effect, especially encroachment on privacy of the drivers.

And then the opinion of the road manager is shown. The range of support for the SIPA of them was limited as well as the police. They said that they couldn't move initiatively to support the SIPA at this time without asking for the supports from resident because they think the evidence of the effect is not enough. However, it is possible to support to the resident to lend the device such as a speed gun, in order to carry out the SIPA. The issues in order to promote the activities that they think are that there is a problem about occurring the trouble with the driver and continuousness of the effect.

4. Discussion

In this study, we tried to grasp the measurement issues of the SIPA from the viewpoint of vehicle behavior such as reduction of the speed, evaluation by the drivers and neighborhoods consciousness, and possibility of the supports by the government in this area.

Organized measurement issues are as follows. To promote the measurement like the SIPA, we think that there are some issues such as the range of the effect, the availability, the acceptability of drivers who receive the activities and residents who carry out that, and the possibility to build up the support system keeping the activities. First of all, the range of effect was somewhat limited in terms of both spatial and temporal. The activities were useful for reducing the speed in a short distance from the person displaying the message. In addition, we could not find the concrete evidence about the sustainability of the effects after the SIPA. On the availability and acceptability of the SIPA we believe there are no or little issues. However, in the practical side, it is found that residents are unlikely to participate the SIPA actively. Therefore, it is important issue to make an organization for carrying out the SIPA in the community. Moreover, it is important thing to build a system to avoid the trouble with the drivers to receive a support from the local government such as police and road manager. Finally, we think that there is the possibility to

build up the support system keeping the activities if the community can build an organization because local government can easily help the organization. Therefore, it is important issue to maintain a system to make an organization by community initiative.

This result was only confirmed in specific areas. Thus we think it is important to try to grasp the more evidence about the SIPA in other areas. In addition, we think a problem that is only a small portion of the questionnaires handed for drivers were recovered. This default may bias the results founded in this study. Therefore, it is important to follow-up survey in the similar situation. Moreover to clarify the effect, it is necessary some analysis comparing with other methods to provide information about driving speed.

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