COMMUNITY ROAD SAFETY RESULTING FROM THE INTRODUCTION OF BIG DATA ANALYSIS AND FIELD EXPERIMENTATION

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1. INTRODUCTION

In Japan, 3,904 people suffered road traffic deaths in 2016. This was a 75% reduction compared to 16,765 people in 1970. Nonetheless, the situation remains unsatisfactory due to certain road safety drawbacks typical of Japan. One is a poor road safety situation for pedestrians and bikers. The number of deaths in cars is 1.3 per 100,000, while that for pedestrians and bikers is 2.1. Another is especially high likelihood of road deaths on community roads. The data also reveal that half of fatal accidents occurred 500m or less from the victim's home. It is imperative that road administrators focus on improving pedestrian and bike safety on these roads. To that end, this study proposes to show how road administrators can best introduce humps on community roads. While humps are common in Europe, it is difficult for Japanese road administrators to introduce them, because of backlash against noise and vibration which they cause. Overcoming these problems, the paper focuses on the use of data analysis combing with field experimentation, with special emphasis on communication between administrators and roadside inhabitants.

2. LITERATURE REVIEW

Previous studies mainly focus on the effects of introducing humps, and/or narrowing structures, on community roads and are based on the inhabitants' responses as the express via questionnaire surveys. Yoshida et al (2008) point out that one problem is that inhabitants are more likely to complain about noise and vibration caused by introducing humps than they are to be worried about danger due to exceeded vehicle speeds. These authors propose further investigation into the gaps between the effectiveness of humps and inhabitants' feelings about those humps. Effects on road structures are examined by several field studies such as Ohashi et al (2014) regarding humps and Horikawa et al (2016) regarding narrowing. There are several different approaches to using traffic data to identify the most dangerous spots on community roads (Ohashi et al, 2015). So far, unfortunately, few studies deal with how to treat local opposition to the introduction of humps.

Possible solution is Symbolic Interaction Theory, which posits that individuals behave in line with the subjective meanings they apply to environmental circumstances and that these same meanings are developed through interaction with other people (Blumer, 1986). Blumer observes that society shapes an individual who in turn shapes his/her own identity and behavior through subject meanings. When a society, or even a smaller group of people, recognizes the discrepancy between a situation's reality and the societal or group image of that situation, the members attempt to change their subjective meanings in this regard. The present paper hypothesizes that the personal behaviors and attitudes of strategically placed individuals can have a strong influence on other people's subjective interpretation of the given situation. This suggests that, by winning over certain people who are opposed to the introduction of humps, road administrators can change their subjective meanings about hump and so improve local community attitude.

Photo 1. Field Inspection

Photo 2. Field Experimentation

3. METHODOLOGY

The present paper is based on case study methodology. According to Yin (2003), case study is the most suitable way of developing working hypotheses dealing with specific problems. As stated in the previous section, this paper discusses a hypothesis developed on the basis of Symbolic Interaction Theory. The case concerned is a project implemented in the Midorigahama District, Shingu Town, Fukuoka Pref.

Implementing the project, the Fukuoka Highways Office has used four approaches: field inspection; big data analysis; field experimentation; and questionnaire surveys. First, the field inspection was implemented in cooperation with the Parent Teacher Association of the North Shingu Primary School, representative inhabitants of the Midorigahama district, local police, and Shingu Town authorities (Photo1). Second, numerical information derived from big data analysis was shared with all of these parties. Third, field experimentation was implemented through cooperation with those same groups (Photo 2). The experimentation ran from October 24 to December 6. The humps used in the experimentation included sine-curves designed to reduce noise and vibration. Finally, questionnaire survey was carried out among inhabitants of the district.

Keywords: Road safety; Community roads; Humps; Big data; Symbolic interaction theory.
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4. ANALYSIS AND DISCUSSION

There were several interesting findings. First, the field inspection is an effective way sharing information about dangerous spots or routes. Big data analysis actually is effective way of determining which routes and spots are potentially dangerous to pedestrians and to bikers. Fig. 1 represents those spots at which vehicles exceed 30km/hr. It is particularly striking that such big data analysis identifies dangerous points not previously recognized. Even though local people might have a vague impression certain road points were dangerous to pedestrians and bikers, they are known to data showing exactly what the degree danger is. By sharing that same information, one can help the local community to arrive at a better understanding of the situation.

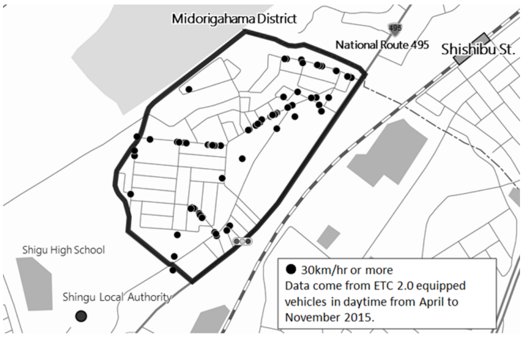

Fig. 1 The results of big data analysis

Second, the field experimentation confirms the expectations raised by the previous studies. Thanks to humps, the number of vehicles running 30km/hr or more fell by around 20%. As shown, by sampling done between 7AM and 9AM on July 1, 2016 and again on October 31, 2016, the number of vehicle exceeding the limits fell 49 to 25. Also, every vehicle speeds dropped from 33km/hr to 28km/h for the 85th percentile at the point which hump was set. Those effects diminish around 20m ahead of and 30m beyond the hump, since drivers tend to slow down to cross it. Noise decreases by 2.6 dB in the daytime and 4.9 dB at night, but vibration shows little change.

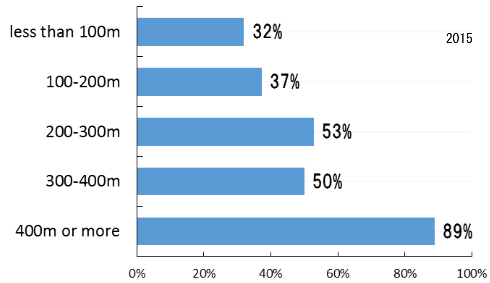

Fig. 2 It should be emphasized that the proportion of responders who answer "don't know" with regard to road safety rose in proportion to distance between their respective homes and the hump spot.

Third, the questionnaire shows that, while about the effects of hump introduction only 3% of the 516 responders answer "deleterious", 44% of them answer "don't know". Although as regards noise only 3% of 516 responders answer "deleterious", 62% of responders answer "don't know" in spite of the numerical reduction. One responder says that, because the humps have only limited effects, road administrators should consider alternative measures. Another responder says that, since the humps make roads inconvenient, they should be removed or lowered.

Since the proportion of responders answering "deleterious" is only 3%, it seemed that our four-prong approaches can be considered effective. However, although traffic data and other relevant scientific findings are favorable, this is not reflected in the inhabitants' responses. Several aspects of the field experimentation have been designed to minimize the gaps between the scientific data and the users' feelings. Large proportion of "don't know" responses means that a great number of the inhabitants are not interested in the experimentation's results, or even the experimentation itself. Fig.2 measures the proportion of "don't know" responders in relation to the distance between the hump spot and the responders' residences. The greater the distance, the higher proportion of responders who answered "don't know". Even though the road concerned is in their district, those inhabitants who do not use the road do not care about its safety. So we see that feelings about community road safety are very much a function of individual subjectivity. Therefore, if any improvement in community attitude is to be accomplished, inhabitants have to be induced to share more informed ideas about road safety with each other. We can conclude that, unless this is done, even four-prong approaches are insufficient.

5. CONCLUSTIONS

The present paper considers how road administrators can best deal with humps in spite of humps' their bad reputations among road users and those who dwell along roads. Four-prong approach is effective as regards road safety. However, we still have a large proportion of inhabitants who response "don't know" with regard to community road safety. According to Symbolic Interaction Theory, it is therefore necessary for road administrators to encourage the inhabitants to interact with each other by sharing a clear understanding of the road safety situation. To that end, there is a need for improving methods of communication for better understanding dynamic community interaction.

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