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Survey of speed humps and bumps in Bangkok and analysis of effects by probe data

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Abstract: In Thailand, where traffic accidents are rapidly increasing, measures are desired to reduce speeds on local roads, which account for more than 85% of the roads. Therefore, in this study, we assumed the introduction of speed humps and bumps, which are speed control devices, to understand the installation situation in Bangkok, and at the same time analyzed their speed control effects using probe data and driving surveys. The results revealed a total of 1400 devices, with the majority installed on pass-through roads. Only a mere 2.7% of all devices had speed humps with road markings and signs on both sides. Furthermore, 290 devices (20.67% of the total) were found to be damaged, raising concerns regarding device efficacy and safety. It was shown that speed humps and bumps could significantly reduce travel speed by probe data analysis.

1． Introduction

According to WHO (1), Thailand has 32.7 road deaths per 100,000 population, the 9th highest in the world. Since the total length of roads in Thailand is 696,689 km, of which 597,570 km (about 86%) are local roads (LR), traffic safety on LRs is quite necessary. On the other hand, 23% of traffic accidents were reported to be caused by over speeding according to the Thai National Police (2). Therefore, it is expected that traffic safety devices which reduce traffic speed on LRs will be able to reduce traffic accidents. However, in Thailand, many of them are installed voluntarily by residents and no design guideline to install them. Therefore, this research objective is to survey how many and in what situations of devices, speed humps, and bumps, are installed. And then analyze itic probe data for speed-controlling effect and clarify the possibility of using probe data.

2. Methodology

2.1 Speed humps and bumps classification

Using Google Street View, speed humps and bumps were oberved within approximately 60 km2 in Bangkok city. Speed humps and bumps will be classified based on the number of devices, the presence or absence of road markings, the presence or absence of road signs, the condition of the paint on the road markings, and the condition of damage to the road markings.

2.2 Speed analysis from probe data

Seven road sections were selected as case studies. Five of these roads have a continuous installation of similar-shaped speed humps, while the other two roads have a similar road profile, but no traffic calming devices installed. Using ITIC probe data which was recorded during a week from September 1 to September 8, 2019, travel speed was analyzed. The sections within 25 meters before and after each speed hump are defined as the "SH-deceleration section," Another section is between its section and its section "SH to SH section," and T-test was performed. Fig. 1 illustrates this concept diagram.

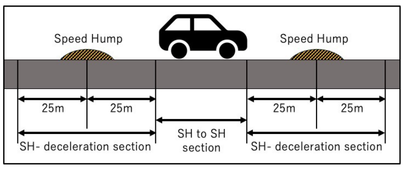

Fig. 1 Analysis sections for field survey results

2.3 Field survey

To verify the accuracy of the probe data, on-site surveys were conducted. Smartphones were mounted on the dashboard of a car, and a road section with speed humps was driven. For data collection, the smartphone application 'Bump Recorder' was used.

3. Results

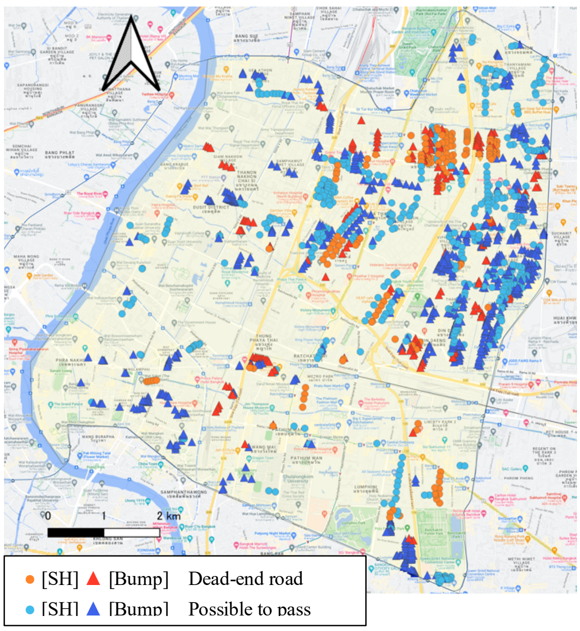

Fig.2 Map of speed hump bump

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Table. 3 Study area overview and results of speed analysis from probe data

		Road length [m]	Road width [km/h]	Hump/ bump Length	Hump/ bump height	Sample size	Mean [km/h]	85th percentile [km/h]	S.D.	P-Value
Field 1	SH to SH section	650	6	1.5	High	225	20.4	28.0	7.79	0.00**
	SH- deceleration section					402	18.2	25.0	6.65	
Field 2	Section with no SH and intersection (310m)	750	6.5	N/A	N/A	506	26.7	38.0	11.98	N/A
Field 3	SH to SH section	400	4	0.5	Low	161	13.2	21.0	7.23	0.75
	SH- deceleration section					113	13.5	22.0	6.94	
Field 4	SH to SH section	800	5	2.0	High	390	20.6	28.0	7.53	0.00**
	SH- deceleration section					464	16.8	24.0	7.21	
Field 5	SH to SH section	1000	6	2.5	High	162	22.3	31.0	9.79	0.00**
	SH- deceleration section					212	19.1	26.0	7.11	
Field 6	Section with no SH and intersection (520m)	1000	7	N/A	N/A	323	26.8	40.0	12.01	N/A
Field 7	SH to SH section	400	4	2.0	Mid.	250	22.8	31.0	8.81	0.00**
	SH- deceleration section					159	17.9	24.0	6.51	
Field S7	SH to SH section					23	24.1	27.8	3.46	0.00**
	SH- deceleration section					5	16.5	20.4	4.93	

As depicted in Fig. 2, there were 1400 discovered devices, 313 locations classified as "Dead-end road" in red and orange, and 1090 locations classified as "Possible to pass through" in blue and light blue. These findings suggest that most devices are installed in locations with possible to passing through road. As a breakdown of safety evaluation, only 2.7% of all devices had speed humps with road markings and signs on both sides. Furthermore, 290 devices (20.67% of the total) were found to be damaged, raising concerns regarding device efficacy and safety. Establishing manuals and management systems for device installation and operation is essential to ensure their effectiveness and safety.

Subsequently, statistical analysis of ITIC probe data was conducted, as shown in Table. 3, dividing sections into deceleration and acceleration areas around devices and sections with free-flowing speeds between devices. No hump roads were shown to be about 10-20 km/h higher than with devices. Conversely, Speed Hump roads are below almost 30 km/h, recommended speed. No statistically significant difference in speed reduction effect was observed for low bumps with low height and short length. Conversely, speed humps with uniform road markings, sufficient height, and length showed a statistically significant difference, revealing a maximum speed reduction effect of up to 40%.

The field survey results are represented in Table 3, Field S7. The analysis was performed using the same method as before, P-value is no significant difference. The P-value Relationship between ITIC probe data and Bump recorder is shown in Fig. 3. The relationship between "bump recorder" and "ITIC probe data" was statistically insignificant with P-Values of 0.51 and 0.64. Therefore, Both results show the same trend. In other words, the bump recorder could confirm the probe data's accuracy.

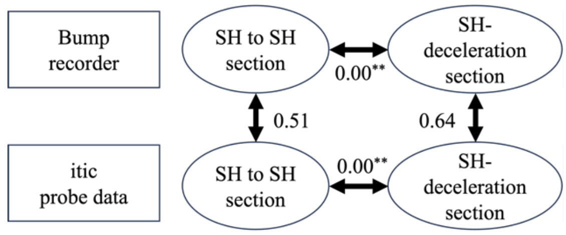

Fig. 3 Relationship between ITIC probe data and Bump recorder (P-Value)

4. Conclusion

This paper investigates and reports on the installation status of speed control devices in Thai LR. The results suggest that the influence of the device on vehicle speed can be understood by analyzing the itic probe data. Speed humps are the most common traffic calming device used worldwide to control traffic and reduce the speed of vehicles on residential roads. By understanding and evaluating the installation status, we can assist in appropriately installing traffic calming devices and promoting traffic safety. As a future study, it is necessary to analyze the driving behavior and speed suppression at speed bumps separately for two- and four-wheeled vehicles.

5. References

[1] World Health Organization. Global status report on road safety 2018

[2] กรมปี้ องกนั และบรรเทาสาธารณภัย ฝ่ ายเลขานุการคณะกรรมการ ศูนย์อานวยการความปลอดภัยทางถนน แผนที่นำทำงเชิงกลยทุ ธท์ ศวรรษ แห่งควำมปลอดภยั ทำงถนน พ.ศ. 2554- 2563