

## EMPIRICAL STUDY ON IDENTIFYING POTENTIAL BLACK SPOTS THROUGH PUBLIC PARTICIPATION APPROACH: A CASE STUDY OF BANGKOK

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**Abstract:** Road traffic accidents are the tragic artificial disease which more than thousands of people injured and dead each year. The Thai government has alert and implemented 5-E strategy to tackle the problems. However, owing to the inaccurate road accident statistics and the inefficient data collection method on causation and collision particularly, on potential and existing black spots, these are major obstacles to improve road safety. This paper investigates the possibility to introduce Hiyari-Hatto method to identify and collect data on existing and potential black spot locations. 200 local peoples who live in Soi Chokchai 4 and Soi Ladprao 39 communities in Bangkok were participated in the interview survey. The findings indicated Hiyari-Hatto method is a significant alternative method for public participatory enhancement to develop black spot database nationwide.

**Keywords:** Road traffic accidents, Potential black spots, Hiyari-Hatto, Public participation

### 1. INTRODUCTION

While the road safety improvements in Europe, North America, Australia and Japan had been seriously carried out, i.e., control of drunk driving, the mandatory use of child-restraint devices, seat belts and helmets, and improvements in passive protection, such as airbags, and black spot programs have further reduced the number of deaths and the severity of injury (Browner, 2004), resulting in significant reductions in the rates of motor vehicle fatalities, the

road traffic accidents in Thailand are rising continually with no indication of efficient improvements. In the highly motorized countries, the occupants of cars are the primary victims of traffic accidents whereas in the developing, newly motorizing country like Thailand, the majority of deaths and injuries are sustained by vulnerable road users, i.e., pedestrians, bicyclists, motorcycle and scooter riders, and passengers on public transportation. These vulnerable road users travel together on the same roads with buses, trucks, and cars, in a chaotic traffic. Mismatched collisions between the unprotected humans and the heavy vehicles cause frequent death and serious injury, even at lower speeds (Browner, 2004). Evidences show that the total number of road accidents in Thailand rose sharply from 49,625 in 1991 to 102,610 in 1994 and moderately declined to 67,800 in 1999 but rapidly increased again to 91,623 in 2002 and only slightly declined to 84,177 in 2003, see Figure 1 (Ministry of Public health, 1999, Department of Highways, 1999 and National Police, 2002). Surprisingly, the number of injuries here is much lower than the number of accidents when comparing with Japan case, see Figure 2. In reality, the number of injuries should be higher than the number of accidents as the number of those who affected / injured by the occurred traffic accidents such as drivers and passengers and/or other victims must also be recorded on scene. Otherwise, it is difficult to know exactly where the black spots and how severe those black spots are. This reflects the inefficiency of data collection process among organizations concerned in Thailand.

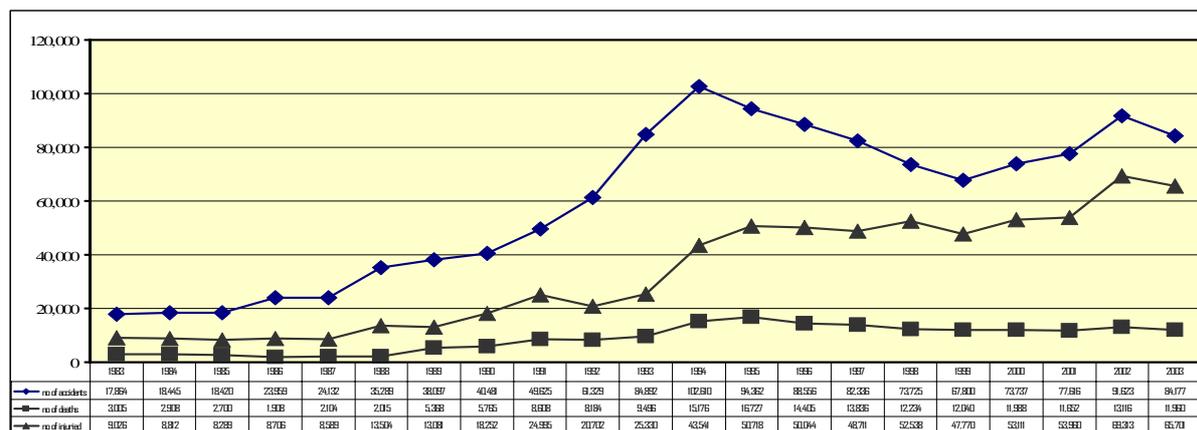


Figure 1. Change in road traffic accidents, deaths and injuries in Thailand by unit  
Sources: National Police, 2004; Department of Highways, 1999 and Ministry of Public Health, 1999.

Comparing with Thailand, the annual number of fatalities resulting from road traffic accidents in Japan peaked at 16,765 in 1970 and dropped to 8,466 in 1979 and continued to rise to 9,066 (Japan National Police Agency, 2003) until 2001 when a new trend began to decline, see Figure 2. It is important to say that this success is primarily as a result of the long-running nationwide efforts of a comprehensive set of measures under the Fundamental Traffic Safety Programs, consisting of enhancement of the road traffic environment, widespread improvement of safety awareness, promotion of safer driving practices, advancement of vehicle safety, preservation of orderly road usage, and improvement of rescue system. In addition, local communities, businesses, schools and other non-governmental organizations play significant role in reducing the death toll, e.g., promoting Hiyari-Hatto map for children and elderly and etc., (White paper on Traffic Safety in Japan, 2004).

As for Thailand, an integration of 5-E strategic approach has been implemented to tackle the rising traffic accidental rate, comprising Engineering, Education, Enforcement, Emergency Medical Services and Evaluation. Some of those are the development of a national accident

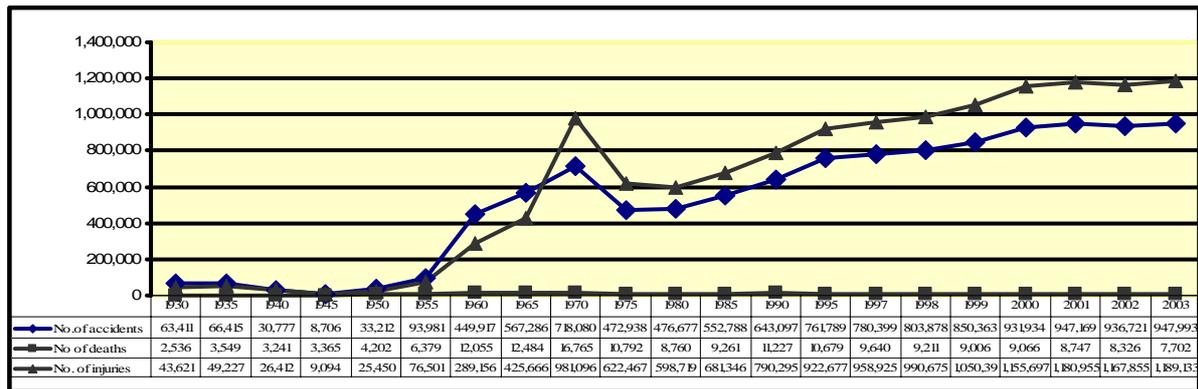


Figure 2. Change in road traffic accidents, deaths and injuries in Japan by unit  
Sources: National Police Agency, 2004, Japan.

database using GIS application, improvement of road conditions through the black Spot program, enforcement of motorcycle’s daytime running headlight, stringent punishment on aggressive behavior such as drunk-driving, unhelmeted riders, implementation of exclusive motorcycle lane, raise public awareness on road safety and safety driving training course.

However, due to the inaccurate traffic accident statistics and the inefficient data collection method, particularly on existing black spots and lacks public participation, these are fundamental obstacles to improve road safety. Identification of black spot locations is one of the road safety countermeasures that vitally important to reduce the traffic accidents. However, this method requires data collection processes by visiting the scene of road traffic accident right after having received report from the police or complaint from road users. This study introduced “Hiyari-Hatto” concept as an alternative to identify and collect data on the potential hazardous and existing black spot locations with local communities living on Soi Chokchai 4 and Soi Pavana Roads of Ladprao, Wangthonglang and Chatuchak Districts, Bangkok Metropolis.

## 2. FUNDAMENTAL CONCEPT OF “HIYARI-HATTO”

Hiyari-Hatto, initiated in Japan, is a traffic psychological method to encourage road users to participate/involve in the traffic safety program in order to elicit information through their expression of potential accident experiences that almost occurred/caused them dead or injured. This method was originally utilized for the sake of elderly peoples’ traffic safety which currently becomes broader used to raise traffic safety awareness among schools, NGOs, local communities, etc., in Japan. This public participation activity through Hiyari-Hatto marks a quantum leap towards the substantial reduction of road traffic accidents. Recently, there are Hiyari maps developed by local community available on the Website (e.g., Kamagaya City, Chiba Prefecture). Figure 3 shows the local residents’ drawing how their accidents occurred, Figure 4 represents Hiyari map or potential black spots at Kamagaya City and Figure 5 indicates name of places where Hiyari-Hatto occurred respectively. This method provides opportunity to researchers to collect valuable data on road safety through a participation of public on the expression of their Hiyari-Hatto which helps significantly to identify the potential black spot locations prior to traffic accident occurrence. Note that the remedial measures on road traffic accident causations can be derived from this technique as well. This Hiyari-Hatto method seems applicable to investigate road safety situation in Thailand.

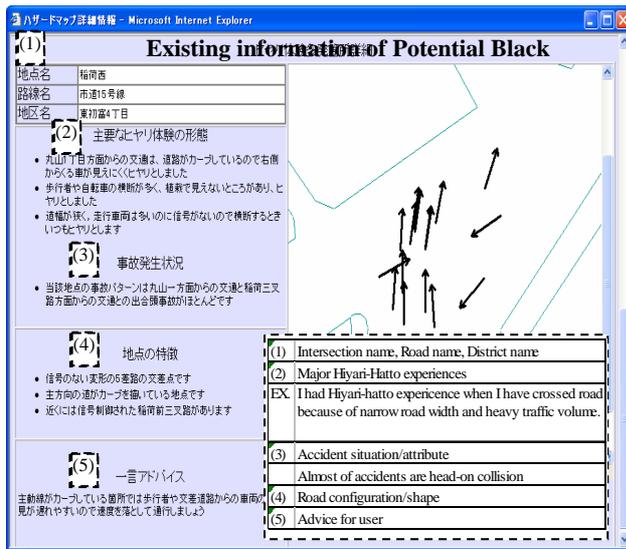


Figure 3 drawing of Hiyari-Hatto occurrence

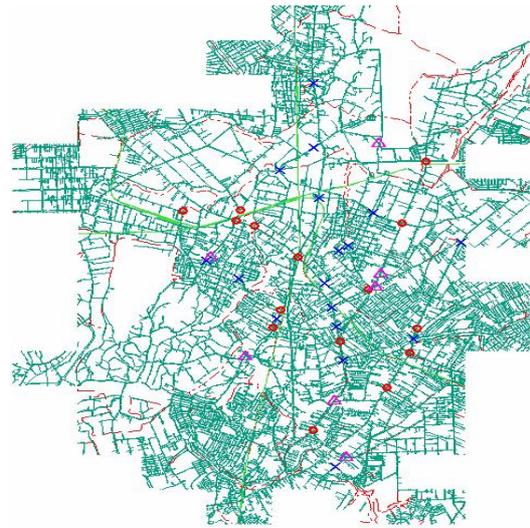


Figure 4 Potential Black spots at Kamagaya



Figure 5 Name of areas where Hiyari-Hatto took place

Source: <http://www.utef.co.jp/kamagaya/hiyarilist.asp>.

### 3. OBJECTIVE

Therefore, to raise traffic safety awareness among Thais, utilization of a psychological technique with public participation/involvement approach is vitally essential. This paper aims to investigate the possibility to adopt public participation approach using Hiyari-Hatto concept to identify potential hazardous and existing black spot locations at local residents on Soi Chokchai 4 (i.e., Soi Ladprao 53) and Soi Pavana (i.e., Soi Ladprao 39 and 41) Roads, of Chatuchak, Ladprao and Wangthonglang Districts in Bangkok.

### 4. RESEARCH METHODOLOGY

Hiyari-Hatto has been widely used in various manners, i.e., group discussion, workshop and survey for investigating the safety matter within community or organizations like medical

institutions, manufactures and transport related. However, it is quite painstaking to identify all potential hazardous and /or existing black spots on existing roads in the selected area using only Hiyari-Hatto method. So, effective countermeasures are required.

Hence, the study employed:

1) a direct public participation approach

A public participation approach on encouraging local people to express their opinion and share their potential accident experience information which contributes significantly to gathering information for identification of Potential Black Spot is vitally important to help preventing traffic accidents preceding occurrence so called "Hiyari-Hatto method."

2) cognitive map technique method

Utilizing cognitive map approach to identify accidental situation and location is one of the most effective ways to understand the occurred traffic accident situations and to effectively identify potential black spots that are well-known among local communities but not outsiders.

3) a face-to-face revealed preference survey.

A face-to-face interview using the existing situational questions is the most powerful tool to elicit information from local people with accurate information and cost effective.

4) utilization of Geographical Information System (GIS) application was employed for existing and potential black spot management.

#### **4.1 Questionnaire design**

The study employed a revealed preference survey with adopting cognitive map approach. The closed-end questionnaire for identifying potential and existing black spot was succinctly and thoroughly designed for respondents to be easily understandable, consisting of socio-economic section, potential black spot identification and existing black spot identification sections such as accident sites, spatial and temporal attributes, road configuration, transportation mode usage and cause of accidents. The cognitive map of Bangkok, particularly indicating Soi Pavana and Soi Chokchai 4 areas was attached together in each sample. And finally, the cognitive map was demonstrated to each respondent and asked them to pinpoint the location that they saw any sign of dangers, or experienced the potential and / or existing road traffic accident and required respondents to elaborate by drawing / illustrating the accident situation and its location on the blank sheet of the questionnaire provided.

#### **4.2 Target group and area of study**

1) This study randomly selected 200 users and non-auto users who have experienced or are eyewitnesses of the accident scene or vice versa that occurred along the study area. The target respondents included hired motorcycle riders, taxi drivers, shop owners, students, and etc.

2) Soi Pavana and Soi Chokchai 4 in Chatuchak, Ladprao and Wangthonglang Districts were selected as study areas. Both Soi Pavana and Soi Chokchai 4 Roads cover areas of approximately 7.5 Sq.km with 5 km-long and 9 Sq.km with 7.5 km-long respectively. There are schools, banks, post office, supermarkets, police stations and other public facilities located along these streets.

3) Duration of the surveys took place on September 11-12, and on October 5-9, 2004.

## **5. DIFFICULTY AND LIMITATION**

The major problems of the study are data unavailability and the process to let respondents draw the map of accidental locations and situations that they had seen, thought or experienced with. It is well-known and becomes common sense that Thai people are unable to read the map and of cause, draw the map. Even the interviewers also had to have map reading and drawing training in order to get acquainted with the route of study areas prior to conducting the surveys. It was found that majority of respondents could not draw the map despite their regular road users of that area and needed some kind of assistance from the interviewer to tell the direction. These problems led to a difficulty to identify the crash characteristics and hence contributing to the delay in encoding and analytical processes.

## **6. FINDINGS FROM STUDY**

Because there is no black spot information available in Bangkok, to justify the reliability of potential black spot data in this study, the existing black spots were also questioned. It is significant to note that the findings based upon Hiyari-Hatto method required carefully examination and interpretation, only samples collected from those who experienced or eyewitness of the accident scene or vice versa were analyzed. Results of the study are shown in the following sections.

### **6.1 Socio-economic characteristics of the respondents**

According to the 180 validated samples out of 200, it can classify the respondents as 71.67 percent are male and 28.33 percent are female. 6.6 percent of respondents are in the age bracket of 10-19, 31.66 percent are 20-29, 27.22 percent are 30-39 and 30 percent are in the age bracket of 40-70 years old. The major respondents are in the age between 20 to 39 years old. The occupations are varied from students (13.33%), hired motorcycle riders (35.56%), shop owners (18.89%), taxi drivers (8.89%) to government officials and company workers (11.12%). The major percentage of monthly income level is between 5100 to 15000 Baht. 58 percent own 1 to 2 motorcycles whereas 30.55 percent own 1 to 2 cars. More than 65 percent of them neither have motorcycle driving license nor car driving license while only 7.78 percent hold permanent motorcycle driving license and 6.11 percent hold permanent motor vehicle driving license and the rests hold temporary motorcycle and vehicle driving licenses. Of those who own either motorcycle or car or both indicate that 52.22 percent of them usually drive motorcycle and 29.45 percent usually drive a car for commuting and other trip purposes.

### **6.2 Identification of Potential Black Spot Locations**

By utilizing an integration of Hiyari-Hatto, a traffic psychological concept with public participation and cognitive map approach, it explicitly entails the significant results in terms of practical identification on the potential black spot locations in Soi Pavana and Soi Chokchai 4 communities. The possibility has come to realize as expected that the process by which allows local people to participate in the questionnaire survey for expressing or sharing the information and experiences of their potential road traffic accidents in their community is

pragmatically adoptable. Results from the survey indicated that 111 respondents have seen and thought the potential risk of accidents while 17 of them have had experienced a moment of potential accident. Whereas 37 respondents had seen the real scene of traffic accidents, 18 respondents have had experienced the traffic accident happened to them.

There are total numbers of 59 hazardous locations identified by the respondents. Some are identified as potential hazardous/potential black spots and some are existing black spots and some are identified as both potential hazardous and existing black spots, see Table 1. It is unfortunate that there have never been any record on the exact location of the accident scenes even at neither the police stations nor the hospitals. Even if there is such black spot data, it is quite limited and proprietary which has never been shared to public. Hence, there is no existing black spot data for comparison with the findings of these specific 59 hazardous spots. This is a fundamental problem of lacking mutual cooperation, inefficient data collection and data recording processes led to unreliable of the data in developing country including Thailand.

According to the survey, despite only less than 20 percent of respondents could draw accidental location themselves and the rests were being assisted, it is amazing that they could illustrate the incidence exactly as happened. The results of cognitive map approach adoption revealed magnificent data that are used for specifically identifying the location of accident occurrence and the road configuration /shape of each black spot as indicated in Table 1. Figure 6 and 7 illustrated examples of drawing cognitive map done by respondents living in the study area of the T-junction of Yeak Krongprab-Wat Ladprao and Soi Patanatidin intersection (Bunrudee Kindergarden School) in comparison with the real picturesque locations. Figure 8 demonstrates the comparative and collective potential black spot and existing black spot locations in GIS format according to the point of view of Soi Panava and Soi Chokchai 4 local communities. Figure 9 indicates the name of the overall potential and existing black spot locations and Figure 10 represents the real map route of Soi Panava and Soi Chokchai 4 Roads for comparison. Unfortunately, it is quite impossible to indicate cause of accidents on the GIS map.

The places where the traffic accidents most occurred are at the Y-junction of Yeak Pavana-Wat Ladprao, the T-junction of Yeak Krongprab-Wat Ladprao, and at Soi Patanatidin intersection (Bunrudee Kindergarden School). The contributory factors of the accidents were mostly human error such as driving recklessly, no signaling prior to turn or stop, and followed too closely. As observed at the sites and as indicated by the respondents, the 2 Y-junction and T-junction of Yeak Pavana-Wat Ladprao and Yeak Krongprab-Wat Ladprao (see, Figure 6) are already signalized which controlled by the traffic police but has been off and is used for only on a special occasion. The road users who drive or use these routes may have to challenge with the first come first get the road basis. However, some respondents claimed that these signalized sections sometimes caused more traffic than other non-signalized intersection. Having signalized at intersection sometimes interferes with the traffic flow resulting in delaying travel time but if allows the traffic control signal work automatically and systematically this will bring the traffic situation to equilibrium and hence reducing the traffic accidents consequently. As for the non-signalized Soi Patanatidin intersection is now awaited for the traffic signal installation which expected to be completed by the end of this year (2004) (see Figure 7).

Notwithstanding some major map reading and drawing problems, through utilizing direct public participation approach with traffic psychological method of Hiyari-Hatto, this research

could elicit the information pertaining to the accident collision and causation from the respondents which is a significant breakthrough in this identification of potential black spot study. The following section below describes the correlation between potential and existed accident attributes and its causations.

## **7. IDENTIFICATION OF COLLISION AND CAUSATIONS**

According to Figure 11, we classified the road traffic accident collisions into 5 major models based upon results of the survey. These are: car-car, car-motorcycle, motorcycle-car, motorcycle-motorcycle, and car-motorcycle-car meaning car crashed car, car crashed motorcycle and so on. It is apparent that the major collisions of potential and existing accidents were car crashed into car, car crashed into motorcycle and motorcycle crashed into car. It was obviously seen that motorcycle was vulnerable mode to car in most cases.

The data collected from the survey helped derive the causations of collisions between the potential and existed traffic accidents from the respondents. For instance, the major causes of potential traffic accidents were reckless driving, no traffic control signal/not in use/broken and get illegally passed. Slightly similar, the major causes of existed traffic accidents were reckless driving, fail to yield right of way, too closely followed and too closely overtook. These causations can be supported by the fact that both of Soi Pavana and Soi Chokchai 4 roads have similar characteristics in terms of road configurations, being sub-roads and having many housing residents, each day the Sois have to carry heavy traffic from 06:00 to 21:00 and no holiday and time break. Imagine the small alleys with heavy traffic and each sub-section is not well-equipped with the proper traffic signs or signalization and no traffic police inspection, most of vehicles want to get home or their destination as earliest as possible. This may be the reason why they drove recklessly and/or drove too closely followed or even too closely overtook.

Table 1. Potential hazardous and existing black spots of road traffic accident occurrences in Soi Pavana and Soi Chokchai 4 areas

No.	Accident at site	Road shape	potential	Existing	Total	No.	Accident at site	Road shape	potential	Existing	Total
1	Paak Soi Chokchai 4	in-out alley	2	4	6	31	Yeak Pavana-Wat Ladprao	Y-Junction	1	7	8
2	Talaad Chokchai 4 section	Y-Junction	1	1	2	32	Yeak Suksun 7 (Chao-mae-kuan-im)	intersection	1	2	3
3	B. Tahaanhai, Soi 2	straight	3	2	5	33	Sapaan Klong Nongbon	Bridge	0	1	1
4	Top Dept. Str., Soi 3	T-Junction	3	4	7	34	Chokchai 4-Soi Suksun 28	intersection	1	2	3
5	Chokchai 4-Soi 5-7 (B.Asia, B.kasikornthai)	intersection	2	3	5	35	Soi Pattanatidin (Banrudee sch)	intersection	4	10	14
6	Chokchai 4 near Soi 8 (soi 6)	straight	2	2	4	36	Yeak Soi Suksun 25	intersection	1	1	2
7	Chokchai 4-Soi 8 (8-11)	intersection	2	2	4	37	Wanghin Intersection	intersection	1	0	1
8	Chokchai 4-Soi 10	intersection	2	0	2	38	Wat Ladprakao Rd. near Soi Sena 41	straight	1	0	1
9	Chokchai 4-Soi 13	curve	0	1	1	39	Soi Ladprao 48/1 (Talaad Sapaansong)	Bus stop	0	2	2
10	Chokchai 4-12	intersection	0	4	4	40	Soi Ladprao 41 (intersection-Pavana)	> intersection	1	3	4
11	Siam-Paolo Hospital	straight	1	3	4	41	Charcoal plant-Wat Ladprao curve	curve	0	1	1
12	Yeak Kongrab-Watladprao	T-Junction	1	10	11	42	Prayoon-nives (Snooker Club-Pavana)	In-out alley	1	0	1
13	Soi Osathit 3 (Soi 16)	T-Junction	0	2	2	43	Soi Sirisopa (Bangchak Sta-Yeak pavana-Krongrab)	straight	0	5	5
14	Chokchai 4-Soi 19	T-Junction	2	1	3	44	Jindamukoon School-Pavana	In-out alley	0	2	2
15	Soi Bhutaruksa (Soi 18)	intersection	2	2	4	45	Yeak -Khong Talaad Pavana	Curve	2	2	4
16	Chokchai 4-Soi 23	T-Junction	1	1	2	46	Opposite-Soi Lert-Ubon 1 (near Caltex Sta)	Y-Junction	0	1	1
17	Chokchai 4-Soi 22 (B.Krungthai)	intersection	0	5	5	47	Talaad Supapong-pavana	curve	1	0	1
18	Chokchai 4-Soi 24 (Klangmuang V.)	intersection	2	0	2	48	Paak-soi Chacoal plant (from Pavana-side)	T-Junction	0	4	4
19	Chokchai 4-Soi 28 VS 33	intersection	2	1	3	49	Sapaan Supapong-pavana	bridge	1	2	3
20	Chokchai 4-Soi 32 VS 37	intersection	0	3	3	50	Soi Pavana 2- Flat Pattanachit	T-Junction	1	1	2
21	Chokchai 4-39 Soi Suksun 7	T-Junction	0	2	2	51	Soi Pavana 4-5	T-Junction	1	2	3
22	Chokchai 4-Soi 45	T-Junction	0	1	1	52	Si-yeak Jusco-Wanghin	intersection	0	2	2
23	Chokchai 4-Soi 49	T-Junction	0	1	1	53	Soi Pavana 1	In-out alley	0	1	1
24	Chokchai 4-Soi 52	intersection	0	2	2	54	Yu-chareon village (Sukhapibaan-Ladprao Rd.)	In-out alley	0	1	1
25	Chokchai 4-Soi 56	intersection	0	2	2	55	Chokchai 4-Soi 27	straight	0	1	1
26	Chokchai 4-Soi 70	intersection	2	0	2	56	Saam-yeak Pavana (near Pavana1-5)	T-Junction	1	1	2
27	Chokchai 4-Soi 80	intersection	0	1	1	57	Soi Ladprao 35	T-Junction	0	4	4
28	Soi Sontipattana (Soi 17)	In-out alley	0	2	2	58	Soi Chokchai 4-30 (Soi Chokdee)	In-out alley	0	1	1
29	Soi Wat Ladprao School	In-out alley	2	2	4						
30	Yeak-Soi Wat Ladprao	In-out alley	2	3	5	59	Soi Ladprao 39	T-Junction	0	1	1
Total			34	67	101	Total			19	60	79

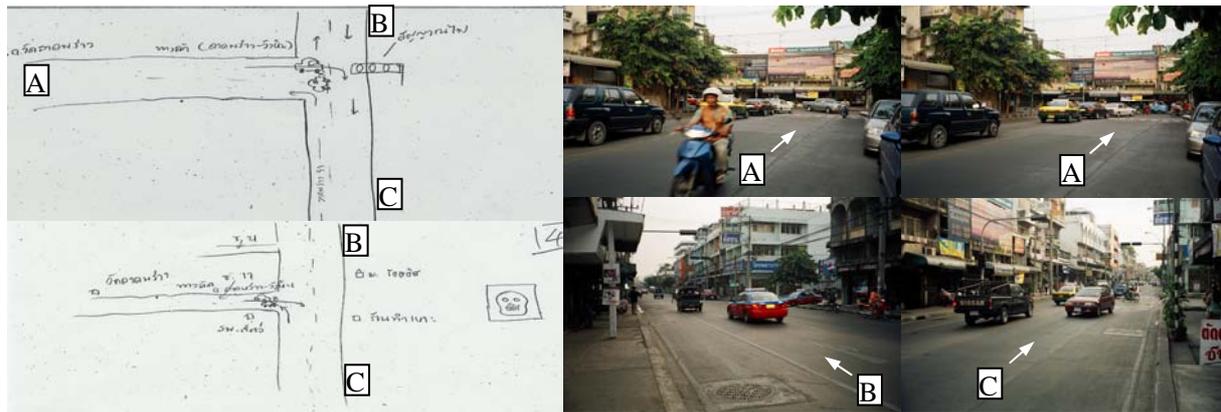


Figure 6. Respondent's drawing accidental location at Yaek Ladprao-Krongprab T-Junction comparing with the real site

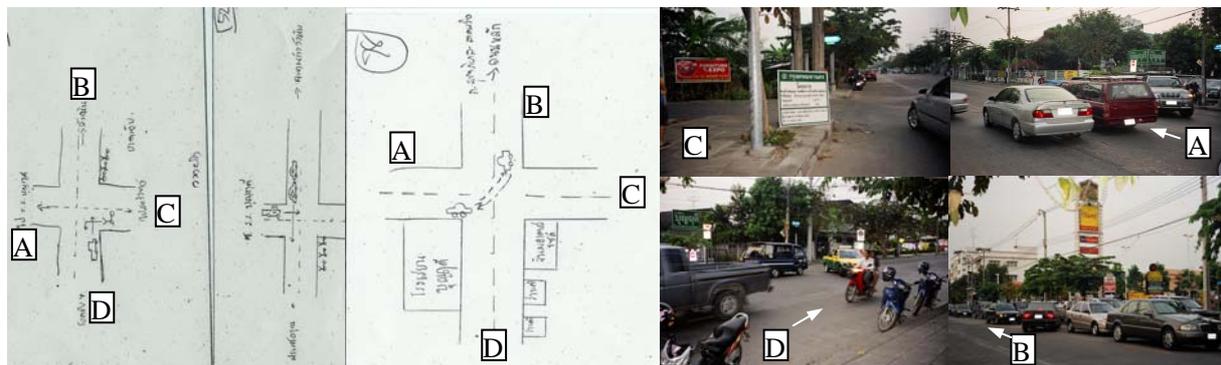


Figure 7. Respondent's drawing accidental location at Bunnudee School intersection comparing with the real site

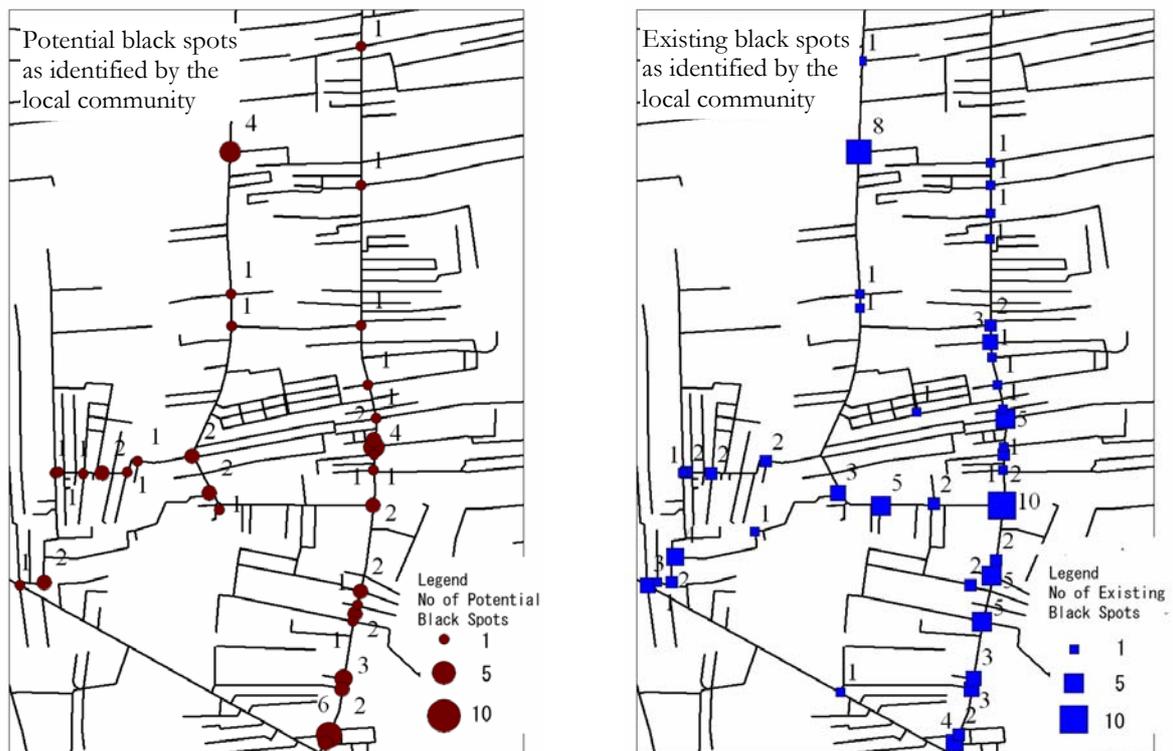


Figure 8. Comparative and collective number of identified potential and existing black spot locations on Soi Pavana and Soi Chokchai 4 Roads.

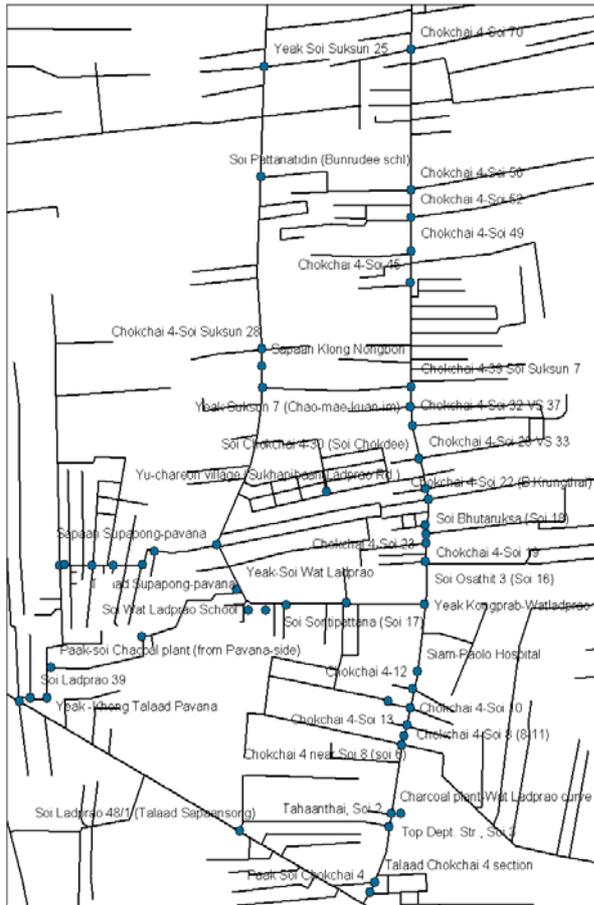


Figure 9. Overall potential and existing black spots on Soi Pavana and Soi Chokchai 4 Roads.

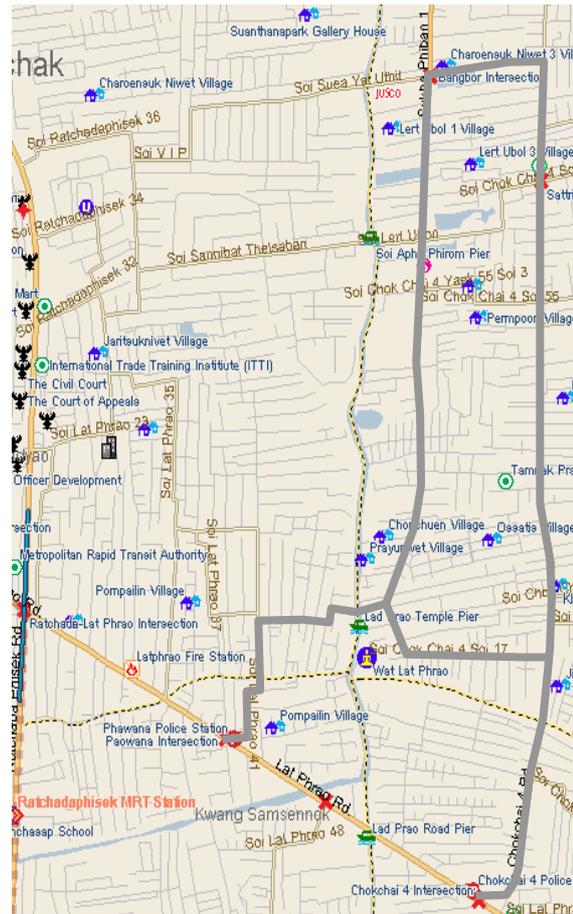


Figure 10. Existing map route of the study areas on Soi Pavana and Soi Chokchai 4 Roads.

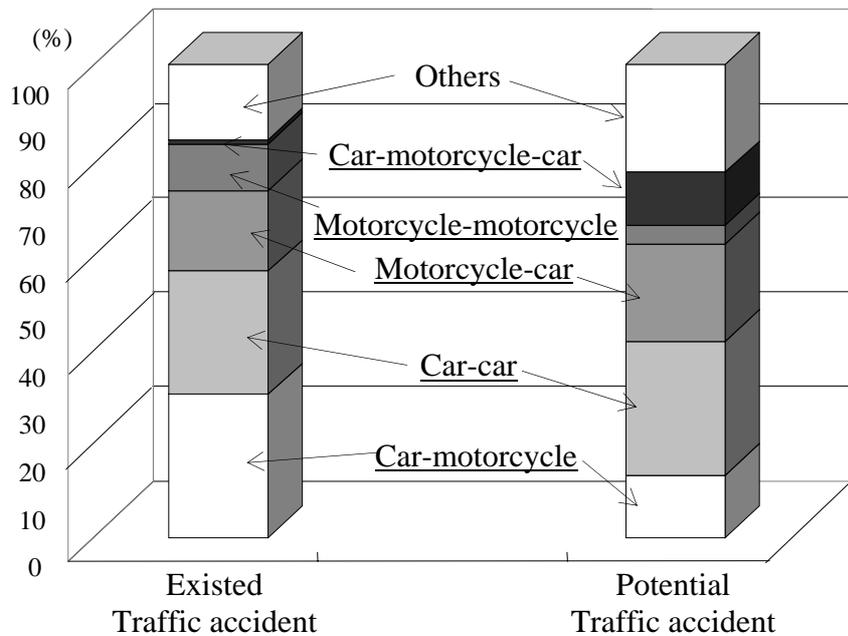


Figure 11. Comparative collisions between potential and existed traffic accidents

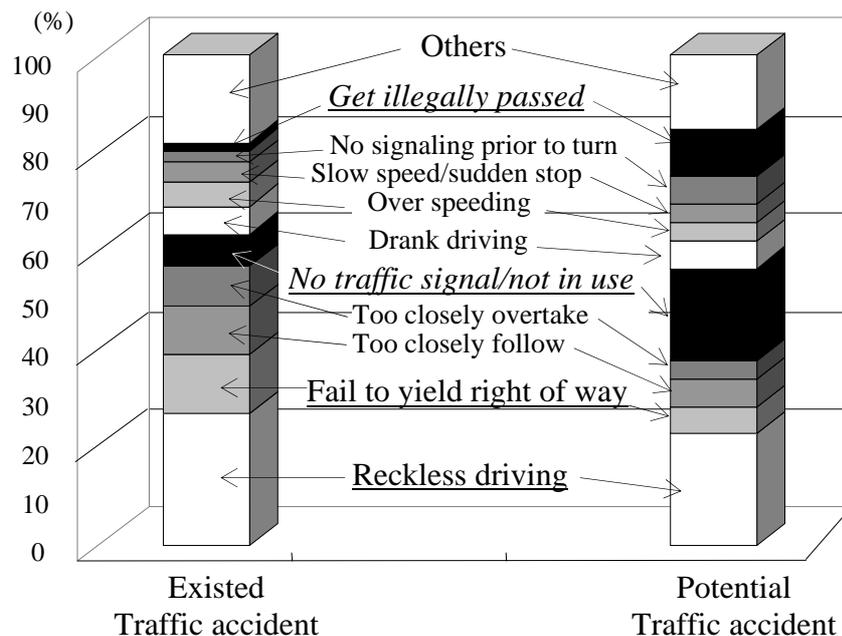


Figure 12. Comparative causation between potential and existed traffic accidents

Interestingly, the existed traffic accident and the potential traffic accident as shown in Figure 11 and 12 are somewhat distinguished. This is due probability to ones might pay more carefully attention after having instinctively noticed the perception of risk when driving in between other vehicles like car-motorcycle-car in which other might not. For instance, in case of reckless driving causation, the drivers who almost had a car crash but not yet happen so called potential traffic accident can probably be assumed that their perception of risk level toward the object ahead and likewise the rare of their vehicle is highly corresponding with their driving in association with their driving experience and skills at that moment resulted in enabling to foresee the oncoming traffic situation and make the window decision to prevent traffic accident occurrence. Dissimilarly, the drivers who experienced the actual traffic accident so called existed traffic accident might have their perception of risk but considered less or zero. Their process of thinking or perceiving and making decision towards the risk might be distracted by their own driving skills and experience (either amateur or professional) in terms of the chance of being overcome or get passed the other car or distracted by other external factors like using cell phone while driving and etc. However, these assumptions do not always appear to be true in some circumstances. Further study on these issues may require.

## 8. CONCLUSION

This paper investigates the possibility to introduce a traffic psychological method of Hiyari-Hatto through public participation and cognitive map approach to identify potential black spot with local communities on Soi Pavana and Chokchai 4 roads, in Chatuchak, Ladprao and Wangthonglang Districts in Bangkok Metropolitan. Based upon the Hiyari-Hatto concept, the findings show that information collected from the eyewitness and / or experienced traffic accident respondents, can effectively identify not only the potential hazardous and the existing black spot locations such as the T-junction of Yaek Krongprab-Wat Ladprao, the Y-junction of Yaek Pavana-Wat Ladprao and Bunrudee Kindergarden School Intersection but also the correlation between the collisions and its causations such as driving recklessly and fail to

yield right of way are major causes of the car crashed into car, car crashed into motorcycle and car crashed into motorcycle and car. This study applied GIS application to manage potential and existing black spot locations for easy understandable as illustrated in Figure 8, 9 and 10.

As referred in the Report of IATSS Report Project H833, a study of Prof. Shinpei TAKUMA, Tokyo Gakugei University (1997) suggests that based upon H.W. Heinrich's assumption in his industrial safety study, the expected Hiyari-Hatto experiences occurred 500 times during death, serious injured and slightly injured 1: 29: and 300 respectively. According to this assumption, there were probabilities of 830 Hiyari-Hatto experiences behind one death. Whether death was happened or not, many experiences of Hiyari-Hatto had occurred at the same location implying that location is considered potentially black spot. However, because there is no statistic record on the actual black spot locations available, this study is a kickoff on traffic psychological utilization of Hiyari-Hatto for an alternative method to collect potential hazardous and existing black spot in Bangkok. Hence, the paper can only show the potential and existing black spot locations collected from the Hiyari-Hatto study as represented in Table 1.

According to this preliminary study, we could derive the contributory factors of the potential and existed traffic accidents which are human and environmental errors. These causations can be solved by the use of 5-E strategy. For instance, to deal with human error education such as raise public awareness of traffic safety and provide driving safety and enforcement such as stringent the punishment of aggressive behavior or given social responsibility penalty to those who did slightly violate the traffic rules and regulation, and to deal with environmental error engineering such as improvement of road configuration, installation of traffic control signals and traffic signs as well as improvement of potential and existing black spot locations are the primary countermeasures to implement.

This study confirms the adoption of Hiyari-Hatto concept with the use of cognitive map together with public participation approach is a significant alternative to identify the potential black spot locations. This is applicable to use as a fundamental step to develop the system to gather the information nationwide. These methods can contribute significantly to the policy implication in finding effective measures to prevent the traffic accidents prior to its occurrence which can save human lives and economy in long run.

## **9. FUTURE TASKS**

Due to time limitation, this study could not perform the results on the Website. Therefore, the next step of the study will be demonstrating the results in a manner of tabular and graphical presentations on the Website so that this will allow public and transport research institutes as well as other concerned agencies to view the results anytime. Note that the development of mapping system on potential and existing black spot locations using GIS application will be taken into account and will be uploading on the website as well. Therefore, the homepage of "Hiyari-Hatto" or potential accident or potential black spot needs to be developed for the next step of the study.

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