Advantages of Map Based Accident Data

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Abstract

The increasing of population and vehicle number leads increasing of road accidents and huge of accident lost every year. Road accident prevention needs effective measures to implement in all approaches i.e. engineering, education, and enforcement but difficulty of road accident contribution analysis is an important barrier to produce the measures. A map based accident data system is a one solution to make road accident data easier to understand and produce better measures. There are many types of accident data depend on the objectives of each data collection. However, result of comparison between normal accident data and map based data found many advantages of map based data system such as easy to find hazardous locations, no need high road safety education, and some symbols can present more than just a location of the accident. The most advantage of accident map symbol system is a German system which it can represent accident severity, accident type, and special circumstance in a single symbol. If the accident data authorities publish the data in map based format, everyone in road safety section will be capable to use these data in order to develop own better road safety measures for their responsibility area.

Keywords: road accident, accident data, hazardous location, map base accident data

1. Introduction

The road accident is a one of important problems in Thailand. There are many Thai fatalities from road accidents every year. Royal Thai Police reported road accident situation in 2011 that there are 9,205 fatalities consisting 6,858 male and 2,347 female. The total property lost is 622,166,974 THB (RTP, 2012). This value excludes social lost from accident fatalities, serious injuries, and slight injuries. If no one takes actions in any accident prevention, the accident lost will increase rapidly.

Accident prevention needs good accident data and tools to support for launching effective measures. The ultimate aim of developing good road safety data systems is to use the information generated to improve the road safety situation (WHO, 2010). This study tries to find easy tools for everyone in road safety sections to use effectively. The objectives of this study consist of:

- To compare advantages and disadvantages of different accident data system
- To find the easy accident presentation methods suitable for Thailand road safety organization

2. Literature review

The accident data is the origin of road safety policies. WHO stated the importance of accident data system that "the need for data systems to be put in place to collect the information needed to allow countries to develop evidence-driven road safety policies" (WHO, 2010).

Ogden (1996) gave an accident data recommendation in "A Guide to Road Safety Engineering" that accident data should consist with the accident location. The modern accident database stores the accident location in Global Positioning System (GPS) format e.g. latitude and longitude value. The accident locations are important to find hazardous location or black spot in order to rank the accident situation of each road section and intersection.

Institute of Transport Economics Norwegian Centre for Transport Research (TOI) (2007)

published "State-of-the-art approaches to road accident black spot management and safety analysis of road networks". This report contains many details about accident data usage and summarizes varied method to find black spot.

Taneerananon (2006) introduced two important hazardous location analyzing methods.

- Crash (Accident) Number Method: This method identifies hazardous location when accidents happened in that location exceeding the critical number. The critical number came from statistical calculation.
- Crash Rate Method: Crash Rate is a number of accident divide by unit of exposure. In case of four-leg intersection, the exposure can be calculated by following equation.

$$Exposure = 2 \times \sqrt{\frac{V_1+V_3}{2} \times \frac{V_2+V_4}{2}} \quad (1)$$

Vesper (2007) explained detail about German Accident-Pin-Boards (APBs) in "Black Spot Analysis – A Comparison between Two European Counties and Thailand". Accident-Pin-Boards in Germany was defined in three types: 1-year-APB for presenting all accidents, 3-year-APB (ip) for presenting accidents with at least one injured person (ip), 3-year-APB (sip) for presenting accidents with at least one seriously injured person (sip).

DOH (2010) implemented three methods to find hazardous location from 3-year accident data e.g. accident frequency, accident rate, and accident severity.

- Accident Frequency (acfre)

$$acfre = \frac{A}{A_c} \quad (2)$$

where

A is an accident number
A_c is a critical value.

- Accident Rate (acrat)

$$acrat = \frac{R}{R_c} \quad (3)$$

where

$R_c = \lambda + k_a\sqrt{\lambda/m_j} - 0.5/m_j$
λ is an average of accident rate
m_j is a number of vehicle on road j
k_a is constant value of levels of significance

- Accident Severity (acsev)

$$acsev = 60F + 45S + 4SI + D \quad (4)$$

where

F is fatality number
S is serious injury number
SI is slight injury number
D is property damage only case number

Mustafa K. (2002) studied the benefits of using GIS in traffic accident analysis. He stated the road characteristics, demographic and socio-economic data to enhance road safety analysis can be integrated into the map based traffic accident analysis. It makes better road accident data management system.

3. Methodology

This study reviewed and compared the methods for presenting road accident data in varied approaches between figure accident data and map-based accident data. The comparison starts with the review of existing accident data presentation. Then, reviewed accident data was analyzed in term of advantage and disadvantage. Finally, comparison result was discussed about the implementation in Thailand for improving road safety management.

4. Results

This study reviewed some road accident data presentations from Europe, America, and Asia. Some organizations publish road accident data annually as annual report officially. While some reviewed accident data come from private sectors. These accident data presentation ware categorized to figure presentation and map-based presentation as in Table 1.

The figure accident data are usually used to present road accident statistics in macro perspective and official reports. These data contain much detail about road accident in many related tables. These figure data are easy to compare between each data

group. All road accident data can be presented in figure data opposite to map-based data.

From road accident data review, there are differences of accident symbols on the map depend on accident data authorities. The examples of map-based accident data presentation are in Fig. 1 – 8. All map-based accident data have same one objective to identify hazardous location on the map for accident prevention proposes.

Table 1 Review of Road Accident Data

Accident Presentation	Category
Global Status Report on Road Safety (WHO, 2009)	Figure
Road Safety Annual Report 2011 (IRTAD, 2012)	Figure
ITO Road Fatalities USA (ITO, 2012)	Map-based
SafeRoadMaps Map Analytics (SRM, 2012)	Map-based
Crash: Death on Britain's roads (BBC, 2012)	Map-based
CrashMap (CrashMap, 2012)	Map-based
Australian Road Fatality Statistics (DOIT, 2012)	Figure
Motor Vehicle Crashes in New Zealand 2010 (MOT, 2011)	Figure
New Zealand Police – Southern District State Highway Priority Map (NZP, 2012)	Map-based
Geographical viewing of accidents in EUSka (Mauricio C., 2007)	Map-based
Statistics 2007 Road Accident Japan (IATSS, 2008)	Figure
Road Traffic Accident in Korea 2010 (KoROAD, 2011)	Figure
Road Accident Statistics : 1999 – 2011 (RTP, 2012)	Figure
HAIMS 2010 (DOH, 2012)	Map-based

Due to hazardous location analysis needs number of accidents in each road section or intersection for identification process, all map-based accident data shows single symbols representing a single accident. Most accident map-based data use symbol color to present difference of accident category. There is only German map-based accident data using symbol size, symbol color and flag color to transfer accident detail.

German map-based accident data uses symbol size to present accident category depending on most accident severity in the accident. The symbol color presents accident type relating to the situation leading accident. The symbol flag color present the special accident circumstances such as drunk driving, pedestrian involved, motorcycle involved, and accident at a tree.

Fig. 1 ITO Road Fatalities USA (ITO, 2012)

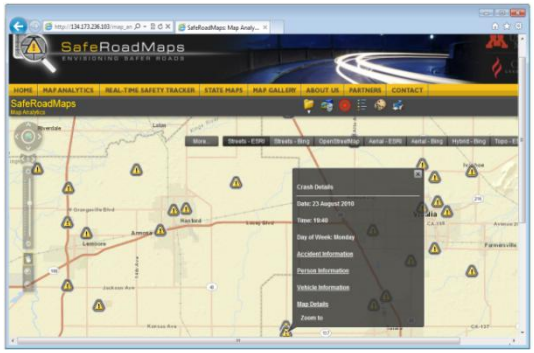

Fig. 2 SafeRoadMaps Map Analytics (SRM, 2012)

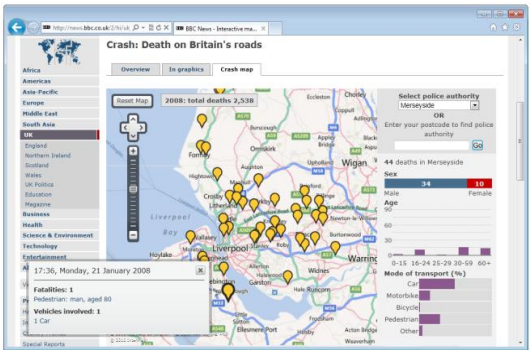

Fig. 3 Crash: Death on Britain's roads (BBC, 2012)

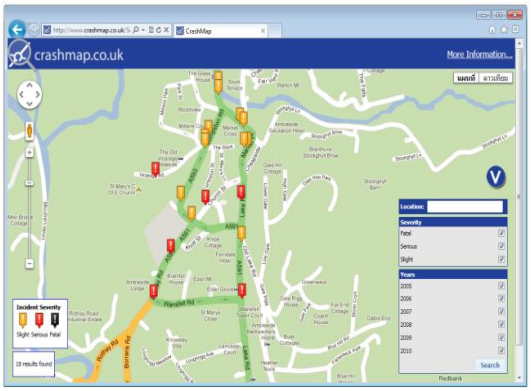

Fig. 4 CrashMap (CrashMap, 2012)

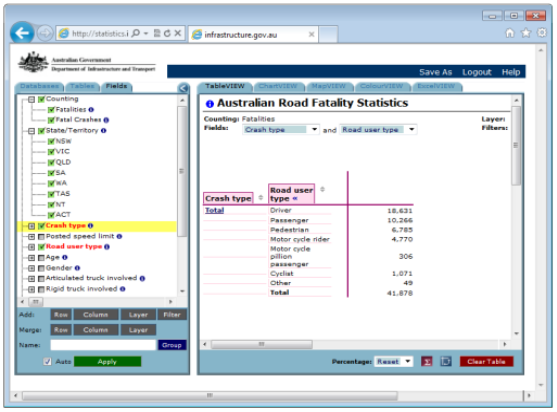

Fig. 5 Australian Road Fatality Statistics (DOIT, 2012)

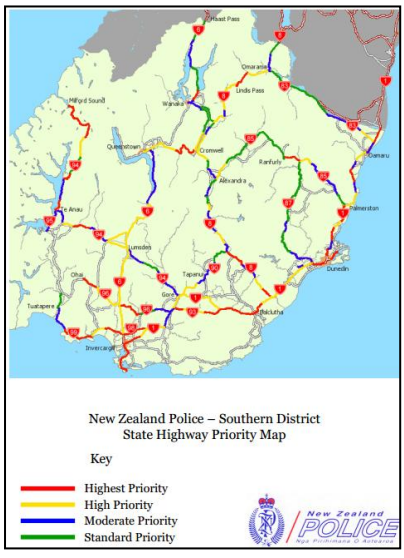

Fig. 6 New Zealand Police – Southern District State Highway Priority Map (NZP, 2012)

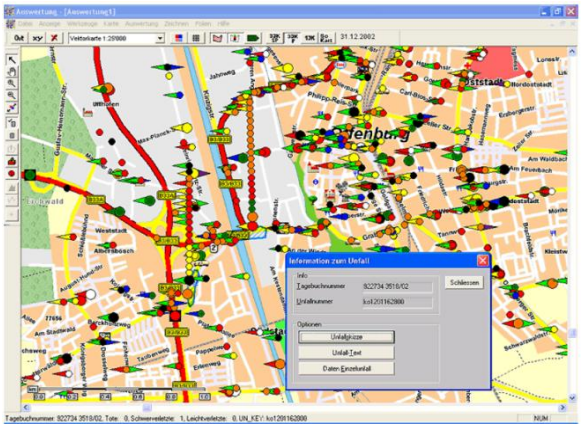

Fig. 7 Geographical viewing of accidents in EUSka (Mauricio C., 2007)

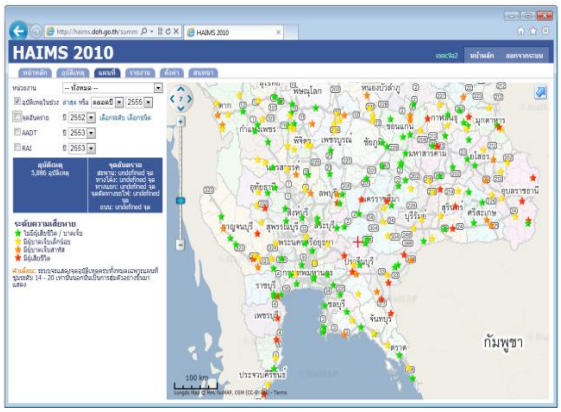

Fig. 8 HAIMS 2010 (DOH, 2012)

In Thailand, Royal Thai Police (RTP) road accident data is often used as representative of road safety situation countrywide. Due to RTP has no official map-based data, Department of Highways (DOH) map-based data named Highway Accident Information Management System (HAIMS) is most popular to identify hazardous location on road network in Thailand.

This study compares the capability of figure and map-based accident data to present some special purposes. Figure data is good to present both the overall situation and deep detail. While Map-based data has great advantage to identify hazardous locations and rank the situation priority between each road sections and intersections. The comparison result is in Table 2.

Table 2 The comparison result of figure and map-based accident data

Accident Data Presentation	Figure data	Map-based data
Number of accidents	Y	Y
Each accident data	-	Y
Large area data	Y	-
Identify accident contribution factors	Y	-
Ranking hazardous location	-	Y
Producing accident prevention measures	Y	Y

Y = Capable to present the data

In the road safety stake holders, some are specialist in road engineer such as road authority officers. On the other hand, some road safety agents have never studied about road engineer and road safety such as police. They can will have big problems if there are only figure accident data and complicated model formulas. So, map-based accident data can support their work by pointing obvious important location on the map and make road safety easier for them.

5. Discussion

Due to resource limitation, all road safety agents should focus on high impact factor for project benefit, accident situation ranking is important to manage project priority. Every road authorities should have map-based data to support their decision making. Map-based data is also advantage to enforcement and education sector for producing road safety measures fitting to different accident situation.

In among of map-based accident data, German symbol system is most interesting. The single symbol can help road safety engineers and other agents to understand each accident situation. While the other symbol systems are easier to understand but they are difficult to analyze the situation and produce prevention measures for different locations.

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