XI International Symposium
ROAD ACCIDENTS PREVENTION 2012

PROBLEMS AND SOLUTIONS IN LOGGING OF TRAFFIC ACCIDENTS LOCATION DATA

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11th and 12th October, Novi Sad, Serbia
INTRODUCTION

LOCATION RECORDS OF TRAFFIC ACCIDENTS

• Extremely important for the statistical analysis and quantitative and qualitative assessment of the degree of security of the transport systems

• When conducting statistical analysis it is necessary to collect data about the exact location of event, frequency, type and cause of traffic accidents

• The precision of determining the locations of traffic accidents is a key element for determining the required number and size of groups in statistical grouping of data
INTRODUCTION

• Unqualified personnel and lack of awareness about the exact location, especially during inquiry of less serious traffic accidents, greatly disrupts the accuracy of traffic accidents databases.

• These problems reduce the quality of the results of statistical analysis and the quality of traffic safety auditing.

• This paper explores the possibilities for introduction of appropriate techniques and procedures to ensure unambiguity and accuracy in gathering data about the locations of traffic accidents and suggests procedures for data verification.
INTRODUCTION

Lack of adequate equipment,

Insufficient education of police officers

Lack of knowledge about traffic accident location characteristics

Poorly designed computer database management system.

INACCURATE DETERMINATION OF TRAFFIC ACCIDENTS LOCATIONS

10/19/2012
DATA COLLECTING PROCEDURES AND EXISTING DATA

• Relevant data about traffic accidents in the Republic of Croatia is managed within the Ministry of Internal Affairs (MUP) mainly by the traffic police.

• Traffic police should be notified only regarding the event of severe traffic accidents.

• Police officers are then required to go to the scene of the accident and collect all the relevant information.

• Basic statistical data regarding accidents is entered by handwriting on a standard paper form.

• This form is then processed into digital database by administrative personnel or, depending on the organisational structure of a police station, by an attendant officer.

• Ministry of Internal Affairs is obliged by law to manage the accidents database and provide it to the parties participating in research of traffic safety.
DATA COLLECTING PROCEDURES AND EXISTING DATA

DATA COLLECTED AT THE PLACE OF TRAFFIC ACCIDENTS

- Information about time and location of accident (including GPS latitude and longitude)
- Information about the participants in traffic accidents
- Information about the types of injuries and material damage
- Data about road and road environment
- Information about vehicles, type and apparent cause of traffic accident.
Road safety and spatial analysis of traffic accident data

• Spatial information about traffic accidents is the most important element for conducting safety assessments and analysis in the transport system.

• By overlapping traffic accidents layer, the intersection layer and microscopic segments of the road network layer it is possible to get a combined cartographic representation of traffic accidents spatial distribution on the network.

• Based on the implementation of various types of spatial analysis in GIS application that includes the overlapping analysis, buffer analysis, etc., it is possible to conduct a detailed comparative analysis between the occurrence of traffic accidents and certain attributes of the road network elements.
Road safety and spatial analysis of traffic accident data

1. STEP

Grouping of traffic accidents data in several categories, depending on different accident characteristics and the type of traffic facilities.

2. STEP

Determination of the potential locations for safety countermeasures with the value of the potential accident reduction.

3. STEP

Sorting values of the potential reduction in the number of traffic accidents from the largest (black spots) to the smallest potential with pinpointing the priorities in the network.
Application of GIS system for that purpose in Croatia is still in the early stages of development and there are many problems that need to be solved.

Systems based on GIS technology can be used to accurately locate the places of traffic accidents which are written in the database in the form of text coordinates and addresses.

Conducting a statistical analysis with the support of GIS system enables determining the priorities and helps identifying causes of black spots on the road network which allows the definition of appropriate measures to raise the level of safety in the road transport system.

Data about traffic accident in Croatia, collected and managed by the Ministry of interior is highly inaccurate and can’t be used for any meaningful research concerning spatial GIS analysis of traffic accident grouping.
GIS analysis of actual traffic accident data

- In order to analyze the problem and determine the accuracy of traffic accidents locations, the database of traffic accidents in Croatia during 2010 is imported in GIS application.

- After data parsing and importing, a total of 44,935 accidents is identified form the 2010 text database.

- Based on the analysis of the data imported into a GIS application, significant errors in locations of traffic accidents are identified compared to position of road network elements.
GIS analysis of actual traffic accident data

<table>
<thead>
<tr>
<th>Total accidents mapped</th>
<th>Mapped outside of Croatia</th>
<th>Mapped in the Adriatic sea</th>
<th>Mapped outside of a stated county</th>
<th>Mapped outside of a stated municipality “Umag”</th>
<th>Mapped outside of a stated municipality “Virovitica”</th>
</tr>
</thead>
<tbody>
<tr>
<td>44.395</td>
<td>757</td>
<td>464</td>
<td>1.024</td>
<td>253 of 280</td>
<td>1 of 214</td>
</tr>
<tr>
<td>Error rate %</td>
<td>1.04%</td>
<td>1.73%</td>
<td>2.30%</td>
<td>90%</td>
<td>0.01%</td>
</tr>
</tbody>
</table>

Fig. 1 Map of Croatia showing absurd traffic accidents locations.
GIS analysis of actual traffic accident data

- In the detailed example of Ilica Street in the city of Zagreb, a parallel shift for the majority of recorded traffic accident locations was observed in relation to the observed street corridor.

- According to the specification obtained from the Ministry it was accepted that location data is recorded in decimal minute format (DD MM.MMM) format based on WGS84 standard.

- Analysis of traffic accidents locations revealed that incorrectly mapped locations are grouped into two main groups.
GIS analysis of actual traffic accident data

• The first group of data is clearly located on the street corridor, while in other group has a parallel shift to the south in relation to the observed street corridor.

• Based on the consistency of the error it was concluded that the coordinates of road accidents locations are probably recorded in two different formats.

• This indicates that there is a systematic error being introduced due to the misinterpretation of GPS readings, UPN form and the location information.
GIS analysis of actual traffic accident data

- Statistical analysis included the distances of recorded traffic accidents locations compared to the position of observed street.

- The Ilica street sample holds 211 records of traffic accident locations.

Fig. 2 Map representation of “Ilica” traffic accidents locations corresponding to actual Ilica street corridor and permitted error spatial buffer. DD MM.MMM format
Variance analysis of all 211 locations of traffic accidents compared to the observed corridor of the street was conducted separately for two different formats of the location coordinates.

The analysis results confirmed that the coordinates of traffic locations accidents are recorded in two different formats which include "DD MM.MMM" and "DD MM SSS" format.

Statistical analysis indicates that about 42% of the sample locations of traffic accidents are recorded in first of the above mentioned formats, while 10% of the sample was recorded in the second format type.

Remaining percentage of about 48% of data is recorded in either of the two mentioned formats.
GIS analysis of actual traffic accident data

Fig. 3 Map representation of “Ilica” traffic accidents locations corresponding to actual Ilica street corridor and permitted error spatial buffer. DD MM SS.S format
• All traffic accidents, which are located in the corridor of the street with total width of 30 m, are considered to be accurately defined locations and within 50m as possibly accurate.

• The remaining part of the statistical sample includes locations with unacceptable deviation from the actual geographic location of traffic accidents.
STATISTICAL ANALYSIS OF ACTUAL TRAFFIC ACCIDENT DATA

• For the purpose of detailed statistical analysis and the representation of the inaccuracies of recorded traffic accidents locations, a total of 10 statistical classes were defined.

• Statistical classes actually represent the distances of traffic accidents locations in relation to observed street corridor.

• Based on these analysis results it was found that from total number of recorded traffic accidents locations only about 35% are located in allowed margins of error.

• The remaining locations in the sample which include approximately 65% of recorded traffic accidents locations have unacceptable deviation from the actual geographical position of traffic accident.

• These results emphasize the need to upgrade and improve existing systems for locating traffic accidents as well as collection and recording of all relevant data.
STATISTICAL ANALYSIS OF ACTUAL TRAFFIC ACCIDENT DATA

THE NUMBER OF RECORDED TRAFFIC ACCIDENTS LOCATIONS AT CERTAIN DISTANCES FROM THE STREET FOR THE OBSERVED STATISTICAL SAMPLE RECORDED IN TWO DIFFERENT FORMATS (ILICA STREET, CITY OF ZAGREB)
STATISTICAL ANALYSIS OF ACTUAL TRAFFIC ACCIDENT DATA

The number of recorded traffic accidents locations at certain distances from the street (actual minimum distances, Ilica street, city of Zagreb)

Distance of recorded locations from the street [m]

- Number of recorded traffic accidents (actual minimum distances)

- Permitted deviations

- Possible GPS error

Number of recorded locations

- Up to 15 m: 74
- 15 to 30 m: 23
- 30 to 50 m: 16
- 50 to 100 m: 26
- 100 to 200 m: 22
- 200 to 500 m: 17
- 500 to 1000 m: 6
- 1000 to 1500 m: 0
- 1500 to 2500 m: 2
- 2500 m and more: 25
CONCLUSION AND RECOMMENDATIONS

• Data analysis of traffic accidents spatial distribution in Croatia for 2010 shows that large numbers of traffic accident locations are recorded incorrectly in the official database.

• Need for improvement in the existing system and procedures for locating traffic accidents as well as additional data verification procedures.

• Recording traffic accidents location with coordinates in different formats causes significant errors when mapping the spatial distribution of the traffic accidents.

• Inaccuracy in determining the traffic accident location arises due to insufficient training of police officers.

• The problem of the current traffic accidents database is that meaningful cartographic representation of the collected data is impossible, which significantly complicates the statistical analysis of the spatial distribution of traffic accidents.
Development of System for locating, collecting, analyzing and managing traffic accidents based on GIS platform.

Application of geocoding and geo-verification of the relevant descriptive attributes.

Application of fixed GPS receivers capable of showing the vehicle’s position in real time on a GIS map contained in the Mobile Data Terminal.

Application of the mobile data terminal for accurate georeferencing of occurred traffic accident.

Improvement of the existing database of traffic accidents.

Improvement in education of police officers.

GREATER ACCURACY AND INCREASED QUALITY OF COLLECTED DATA

CONCLUSION AND RECOMMENDATIONS
THANK YOU FOR YOUR ATTENTION!