Traffic Accident Analysis System
Using GIS

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We developed two systems which manage the data related to traffic accident. One system conducts analyses using the information on accident, road, and weather, for example, calculation of the rate of the accident depending on road condition or weather condition. Another analyzes using the information on safe facilities. For example, extraction of the sites which have accidents repeatedly. Using these functions, accident information is easily collectable and road administrator's task to create document's on safety measures is supported.
1.1 Traffic environment

- **Number of cars**
  - 89.72mil (approx)
  - 1 car / 1.2 persons eligible to get driver’s license

- **Number of driving license holders**
  - 75.55mil (approx)
  - 1 person / 1.4 persons eligible to get driver’s license

- **Number of driving license holders (Senior)**
  - 7.65mil (approx)
  - 10% of drivers
1.2 Trend of Traffic Accident

- Death toll
- Number of injury
- Number of traffic accidents

0.95 million (approx)
1.18 million (approx)
8747

Graph showing the trend of traffic accidents from 1965 to 2000.
2.1 Case study and Purpose (1)

- Organisation
  - Civil Engineering Research Institute of Hokkaido (CERI)

- Purpose
  - Analyse winter-specific accidents
  - Take preventive action against winter-specific accidents
2.2 Case study and Purpose (2)

- **Organisation**
  - Chiba Prefectural Police Force

- **Purpose**
  - Make advanced use of Traffic Information Management System
  - Establish traffic safety measures for children and elderly people
## 3.1 Data Use (Case1)

### Civil Engineering Research Institute of Hokkaido

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TYPE</th>
<th>USE</th>
<th>YEAR</th>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matching data *1</td>
<td>POINT</td>
<td>Accident Information</td>
<td>1989~2001</td>
<td>Event data (Physical injury/Death)</td>
</tr>
<tr>
<td>MICH *2</td>
<td>POINT</td>
<td>Road Information</td>
<td>1999</td>
<td>Event data</td>
</tr>
<tr>
<td>AMEDAS *3</td>
<td>POINT</td>
<td>Weather Information</td>
<td>1989~2001</td>
<td>162 sites in the region</td>
</tr>
<tr>
<td>Meteorological observatory *3</td>
<td>POINT</td>
<td></td>
<td></td>
<td>22 sites in the region</td>
</tr>
</tbody>
</table>

- Japan Digital Road Map Association’s road map, and off-the-shelf map for the background.

- *1 NPA’s statistics on traffic accident is integrated with MLIT’s traffic census data.
- *2 MLIT’s information on road facilities.
- *3 JWA’s weather information.
3.2 Data Use (Case2)

- Chiba Prefectural Police Force

<table>
<thead>
<tr>
<th>ITEM</th>
<th>TYPE</th>
<th>USE</th>
<th>YEAR</th>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accident site *1</td>
<td>POINT</td>
<td>Accident Information</td>
<td>1996~</td>
<td></td>
</tr>
<tr>
<td>Census *2</td>
<td>POLYGON</td>
<td>Aged Population</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>Primary school *3</td>
<td>POINT</td>
<td>Location</td>
<td>2002</td>
<td>869 Schools in the region</td>
</tr>
<tr>
<td></td>
<td>LINE</td>
<td>School Route</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Japan Digital Road Map Association’s road map, and off-the-shelf map for the background.

*1 Data is registered using Traffic information management system.
*2 Statistics Bureau’s population data.
*3 School routing maps managed by education committee are digitized.
4.1 Method of Analysis (Case1)

**Accident Information**
- Set Condition
  - Accident information: date, type, etc.
  - Road information: vertical slope, etc.
  - Weather information: Air temperature, Rainfall, etc.

**Analysis Type**
- Census section or Arbitrary section
- Set Route and Area

**Analysis**
- Calculate the number of accidents
- Accident rate, Fatality rate

**Accident Rate**
\[
\text{Accident Rate} = \frac{\text{Number of Accidents} \times 100,000,000}{\text{Length} \times \text{Period} \times \text{Traffic volume}}
\]

**Fatality Rate**
\[
\text{Fatality Rate} = \frac{\text{Number of Fatalities} \times 100,000,000}{\text{Length} \times \text{Period} \times \text{Traffic volume}}
\]
4.2 Visualization (Case1)

- Characteristics
  - Use traffic volume data.
  - Provide understandable presentation.

Accident Rate vs Fatality Rate

[Images of accident and fatality rate maps with color coding for low and high rates]
4.3 Evaluation of Method (Case 1)

- **Effectiveness**
  - Time for analysis and inquiry was reduced by 70 – 80 %.
  - Benefit analysis report is easily produced.
  - Safety measures are established to prevent traffic accidents.
5.1 Method of Analysis (Case 2)

Accident Information
Set Condition

- Accidents involving children and aged people.
- Accidents when crossing road.

Statistics Type
Set Zone

Creating a buffer:
- Around each extracted accident.
Option:
- Boundaries of neighboring polygons removed.

Statistics
Sum up the number of accidents

Display the sites only where the number of accident exceeds the number of accident at freely specified places, as accident prone sites.
5.2 Repetitive Accidents (Case2)

- Characteristics
  - Share data for common use.
  - Provide understandable presentation.

Using Census Data
- Low
- High

Using School Route
- Prone Site

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5.3 Evaluation of Method (Case2)

Effectiveness

- The system is useful for establishing traffic safety measures, as the trend of accidents is detected.
- Awareness of traffic safety is increased by using GIS.

- The result of questionnaire
  - 70% of schools use the data for revising school route.
  - More than 90% of schools request data (in digital format)
6 Issues for Improvement

**Case1 for Hokkaido**
- Adaptation to the change of national road construction plan and traffic volume.
- Use of DBMS and alternative operation method to deal with large volume data.

**Case2 for Chiba**
- Accumulation of information on safety facilities and regulations.
- Disclosure methods for schools, and effective use of information.
7 Conclusion

Disclosure method of the analyses result.

Data distribution method.

Diffusion of knowledge on traffic accident.

Awareness of Traffic Safety.

Prevent traffic accident.

Challenge to Achieve Secure Society
8 References

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  White Paper on Police 2002  
  [http://www.pdc.npa.go.jp/hakusyo/h14/h14index.html](http://www.pdc.npa.go.jp/hakusyo/h14/h14index.html)

- **Ministry of Land, Infrastructure and Transport**  
  Government of Japan  
  About road safety measures  

- **Civil Engineering Research Institute of Hokkaido**  
  Monthly report May 2001  
  [http://www3.ceri.go.jp/monthly0205/02_05.htm](http://www3.ceri.go.jp/monthly0205/02_05.htm)

- **Chiba Prefectural**  
  The 7th Traffic safety scheme  
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