USE OF ACCIDENT PREDICTION MODELS IN ROAD SAFETY MANAGEMENT - AN INTERNATIONAL INQUIRY

G. Yannis\textsuperscript{a}, A. Dragomanovits\textsuperscript{a}, A. Laiou\textsuperscript{a}, T. Richter\textsuperscript{b}, S. Ruhl\textsuperscript{b}, F. La Torre\textsuperscript{c}, L. Domenichini\textsuperscript{c}, D. Graham\textsuperscript{d}, N. Karathodorou\textsuperscript{d}, H. Li\textsuperscript{d}

\textsuperscript{a}NTUA, \textsuperscript{b}TUB, \textsuperscript{c}UNIFI, \textsuperscript{d}ICL
Project Information

CEDR Transnational Road Research Programme
Call 2013: Safety
funded by Germany, Ireland, UK and Netherlands

PRACT
Predicting Road ACCidents - a Transferable methodology across Europe

With the support of:

autostrade per Italia
IRF
ERF
ANEBS Committee

http://www.practproject.eu/

http://www.pract-repository.eu/
• Literature Review
  – Highway Safety Manual and Related Literature
  – Literature on APM development
  – Web-based CMF databases and Road Safety Toolkits
• Questionnaire Survey Methodology
• Questionnaire Survey Results
• Conclusions
• Predictive method for estimating the expected average crash frequency.

• Safety Performance Functions (SPFs) developed for specific facility types and "base conditions".

• Crash Modification Factors (CMFs) account for differences between the base conditions and local conditions of the considered site.

• Calibration Factor (C) accounts for differences between the road network for which the models were developed and the one for which the predictive method is applied.
LITERATURE ON APM DEVELOPMENT

• RIPCORD-iSEREST Research Project (2005-2008)
  – APMs for 2-lane 2-way rural roads,

• RISMET Research Project (2011)
  – APMs for rural intersections,

• Turner et al. (2012): 2-lane 2-way rural roads in New Zealand,

• Caliendo et al. (2007): four-lane motorways in Italy,

• Montella et al. (2008): motorways in Italy,

• Cafiso et al. (2010): 2-lane 2-way rural roads in Italy, etc.
FHWA CMF Clearinghouse

- [http://www.cmfclearinghouse.org](http://www.cmfclearinghouse.org)
- Includes 5,378 CMFs
- Directly related to the Highway Safety Manual (AASHTO, 2010)
- Detailed background information on presented CMFs is available
http://www.engtoolkit.com.au

- 67 treatments are included
- Searchable database according to:
  - Treatment type/ name,
  - Crash type,
  - Safety issue,
  - Road user group
- Detailed background information on included CMFs generally not available
• http://www.spfclearinghouse.org
• Data gathered primarily on a voluntarily basis from users
• Detailed background information on included SPF’s (sample size, study citation, statistical methodology etc.) generally not available
The Road Safety Toolkit provides free information on the causes and prevention of road crashes that cause death and injury. The Toolkit helps engineers, planners and policy makers develop safety plans for road users, including pedestrians, cyclists, heavy vehicle occupants and public transport users.

The Road Safety Toolkit is the result of collaboration between the International Road Assessment Programme (IRAP), the Global Transport Knowledge Partnership (GTfK) and the World Bank. The Toolkit was designed and developed by the GTfK Group and presented expert advice during the Toolkit's development.

The Road Safety Toolkit will be constantly improved. If you have any suggestions, please contact us by clicking the help us improve this service link below.

- [http://toolkit.irap.org/](http://toolkit.irap.org/)
- Includes 58 treatments (infrastructure, vehicle & user related)
- No CMFs included
- Rough assessment of each treatment's effectiveness using a four scale system (0-10%, 10-25%, 25-40%, 60% or more)
PRACT QUESTIONNAIRE CONTENTS

• Brief introductory part,
• Part A regarding the Decision Making Process,
• Part B regarding Data Sources,
• Part C regarding information on CMFs and road safety measures assessment
• Part D, aimed at gathering a summary of experience on road safety measures / CMFs
Aspects Considered during Measures Assessment

- Safety effectiveness
- Implementation cost
- Effective lifespan
- Experience from previous implementation
- Public acceptability

Respondents rated the aspects as:

- Safety effectiveness: Very high
- Implementation cost: Fairly high
- Effective lifespan: Not much
- Experience from previous implementation: Not at all
- Public acceptability: Not much
Use of APMs and CMFs during measures assessment
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Yes</th>
<th>No</th>
<th>No Data Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area type (rural, urban etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road safety deficiency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevailing accident type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road user category</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed limit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traffic volume</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intersection type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intersection traffic control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major Road Traffic volume</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor Road Traffic volume</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ROAD OPERATION DATA AVAILABILITY & NEED

- Speed limit:
  - Data availability Motorway/Freeway: 91%
  - Data need Motorway/Freeway: 52%
  - Data availability Rural road: 78%
  - Data need Rural road: 52%

- Road markings:
  - Data availability Motorway/Freeway: 65%
  - Data need Motorway/Freeway: 43%
  - Data availability Rural road: 48%
  - Data need Rural road: 48%

- Road signage:
  - Data availability Motorway/Freeway: 74%
  - Data need Motorway/Freeway: 52%
  - Data availability Rural road: 65%
  - Data need Rural road: 52%

- Type of junction control:
  - Data availability Motorway/Freeway: 43%
  - Data need Motorway/Freeway: 43%
  - Data availability Rural road: 43%
  - Data need Rural road: 43%

- Junction signalling data:
  - Data availability Motorway/Freeway: 52%
  - Data need Motorway/Freeway: 48%
  - Data availability Rural road: 52%
  - Data need Rural road: 48%
ACCIDENT DATA
AVAILABILITY & NEED

- Accident types
- Accident causes
- Accident severity
- Outside accident influences

Data availability:
- Motorway/Freeway
- Rural road

Data need:
- Motorway/Freeway
- Rural road
### Summary of Experience on Road Safety Measures / CMFs

**MOTORWAYS & DIVIDED FREEWAYS (without at grade intersections)**

<table>
<thead>
<tr>
<th>Countermeasure - CMF</th>
<th>NEED</th>
<th>AVAILABILITY</th>
<th>TRANSFERABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Realignment (of road segments)</td>
<td>18.8%</td>
<td>81.3%</td>
<td>26.7%</td>
</tr>
<tr>
<td>Rectangular rapid flashing beacons</td>
<td>21.4%</td>
<td>78.6%</td>
<td>7.1%</td>
</tr>
<tr>
<td>Dynamic feedback speed signs</td>
<td>33.3%</td>
<td>66.7%</td>
<td>40.0%</td>
</tr>
<tr>
<td>Landscaping and vegetation</td>
<td>35.3%</td>
<td>64.7%</td>
<td>14.3%</td>
</tr>
<tr>
<td>Audible road markings</td>
<td>47.1%</td>
<td>52.9%</td>
<td>35.7%</td>
</tr>
<tr>
<td>Sight distance and sight obstructions</td>
<td>61.1%</td>
<td>38.9%</td>
<td>21.4%</td>
</tr>
<tr>
<td>Animals and wildlife related safety treatments</td>
<td>25.0%</td>
<td>75.0%</td>
<td>15.4%</td>
</tr>
<tr>
<td>Advanced warning devices/signals/beacons</td>
<td>62.5%</td>
<td>37.5%</td>
<td>26.7%</td>
</tr>
<tr>
<td>High friction treatments (including anti-skid/slip)</td>
<td>73.3%</td>
<td>26.7%</td>
<td>42.9%</td>
</tr>
<tr>
<td>Skid resistance (in general)</td>
<td>64.7%</td>
<td>35.3%</td>
<td>40.0%</td>
</tr>
<tr>
<td>Effects of Friction on Motorcycle Crashes</td>
<td>21.4%</td>
<td>78.6%</td>
<td>15.4%</td>
</tr>
<tr>
<td>Variable message signs</td>
<td>58.8%</td>
<td>41.2%</td>
<td>43.8%</td>
</tr>
</tbody>
</table>

Complete tables are available at: [http://www.practproject.eu/](http://www.practproject.eu/)
The review of international literature indicates significant advances in the field of accident prediction modeling.

Generally, high levels of data availability were reported, particularly for motorways.

However, most National Road Administrations (NRAs) still do not systematically use such methods during decision making.