PRACT: PART 2 of 5
Use of accident prediction models in road safety management - state of the art and international inquiry
• Literature Review
  – Highway Safety Manual and Related Literature
  – Literature on APM development
  – Web-based CMF/APM 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 - New Zealand

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

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

• Cafiso et al. (2010): 2-lane 2-way rural roads – Italy

• ……
• 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
SPF CLEARINGHOUSE

- [http://www.spfclearinghouse.org](http://www.spfclearinghouse.org)
- Data gathered primarily on a voluntarily basis from users
- Detailed background information on included SPFs (sample size, study citation, statistical methodology etc.) generally not available
• 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)
State of the art & International Inquiry

RESEARCH SYNTHESIS (52)


Scope
The report analyzes the issue of Crash Modification Functions (CMFs) transferability, focusing on the Range of Replications technique and how it can give an indication of the stability of research results across countries and years. The report provides also preconditions that should be fulfilled before applying the range of replications technique. The technique can be fruitfully applied to assess external validity when a large number of studies have been reported during a long period of time.

Methodology
The proposed methodology for assessing the international transferability of road safety evaluation studies and CMFs is summarized in the following flow-chart.

- Survey relevant evaluation studies
- Assess range of countries and years represented by evaluation studies
- Only few studies were made in one or very few countries in few years
- Studies have been reported in many countries during a long period
- No basis exists for assessing international transferability
- Assess variation in study findings between countries and over time
- Study findings do not vary systematically between countries or over time
- Study findings very systematically between countries or over time
- International transferability should be unpromising
- Determine sources of variation in study findings
- Variation in study findings is mainly methodological
- No basis exists for assessing international transferability
- Develop crash modification function to describe variation in study findings

Results
The report highlights the growing demand for reliable crash modification factors (CMFs) that relate safety effectiveness to interventions, and suggests that transferable CMFs from one situation to another are a valuable tool in spreading effective safety policies. The report has documented ways to address the issue of CMF transferability, by analysing the extent to which a CMF is dependent on the circumstances in which it was developed, and provides a framework that illustrates how studies can control for the most important confounding factors related to the countermeasure analysed and thus provides guidance for uniform screening and control procedures. In this regard, the report serves as a useful guide for transferring road safety measures and in supporting countries in their efforts to collaborate on essential road safety research.
- 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
Part A. Decision making process

Part B. Data Sources

B1. Road Design Data
B2. Road Operation Data
B3. Traffic Data
B4. Accident Data
B5. User Behaviour Data / Other Related Data

Part C. Information on CMF and road safety measures assessment

Part D. Summary of experience on road safety measures (CMFs)
Part D. Summary of experience on road safety measures (CMFs)

1. Need to implement the road safety measure in your country’s road network;

2. Availability of assessment of measure / CMF;

3. Transferability of safety effect (i.e. if the measure is assessed in a different location, will the safety effect be similar and therefore transferable to your country?).
RESPONSES

23 responses

Country | Sent questionnaires | Received
--- | --- | ---
Austria | 1 | 1
Belgium | 2 | 1
Cyprus | 1 | 1
Denmark | 1 | 1
Finland | 1 | 1
Germany | 1 | 1
Greece | 1 | 1
Hungary | 1 | 1
Iceland | 1 | 1
Ireland | 1 | 1
Italy | 3 | 2
Luxembourg | 1 | 1
Netherlands | 1 | 1
Norway | 1 | 1
Slovenia | 1 | 1
Spain | 1 | 1
Switzerland | 1 | 1
UK | 5 | 3
USA | 2 | 1
Australia | 1 | 1
Total | 20 | 23
SAFETY EFFECTIVENESS ....

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

- very
- fairly
- not much
- not at all

State of the art & International Inquiry
<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>Respondent Institution</th>
<th>APM USE</th>
<th>Approved Guidelines</th>
<th>Use of other resources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>always</td>
<td>usually</td>
<td>rarely</td>
</tr>
<tr>
<td>Australia</td>
<td>Academia</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Austria</td>
<td>Road Authority</td>
<td>●</td>
<td></td>
<td>●</td>
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<tr>
<td>Belgium</td>
<td>Road Authority</td>
<td>●</td>
<td></td>
<td>●</td>
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<tr>
<td>Cyprus</td>
<td>Road Authority</td>
<td>●</td>
<td></td>
<td>●</td>
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<tr>
<td>Denmark</td>
<td>Road Authority</td>
<td>●</td>
<td></td>
<td>●</td>
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<tr>
<td>Finland</td>
<td>Road Authority</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Germany</td>
<td>Academia</td>
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<tr>
<td>Greece</td>
<td>Academia</td>
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<td>Iceland</td>
<td>Road Authority</td>
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<td>●</td>
</tr>
<tr>
<td>Ireland</td>
<td>Road Authority</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Italy</td>
<td>Academia</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Italy</td>
<td>Road Authority</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Luxenbourg</td>
<td>Road Authority</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Road Authority</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Norway</td>
<td>Road Authority</td>
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<td></td>
<td>●</td>
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<tr>
<td>Slovenia</td>
<td>Road Authority</td>
<td>●</td>
<td></td>
<td>●</td>
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<tr>
<td>Switzerland</td>
<td>Road Authority</td>
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<td>●</td>
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<tr>
<td>USA</td>
<td>Road Authority</td>
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<td>●</td>
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<td>UK (Wales)</td>
<td>Road Authority</td>
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<td>●</td>
</tr>
<tr>
<td>UK</td>
<td>Highway Consultant</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>UK</td>
<td>Road Authority</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>TOTAL:</td>
<td></td>
<td>13.6%</td>
<td>18.2%</td>
<td>45.5%</td>
</tr>
</tbody>
</table>
USE OF APMs AND CMFs DURING MEASURES ASSESSMENT

- Always: 26%
- Usually: 17%
- Rarely: 44%
- Never: 13%
APPLICABILITY CRITERIA
OF THE CMF/MODEL ASSESSMENT

[Graph showing applicability criteria for various road-related factors, including area type, road type, road safety deficiency, prevailing accident type, road user category, speed limit, traffic volume, intersection type, intersection traffic control, major road traffic volume, and minor road traffic volume. The graph indicates the percentages of 'yes', 'no', and 'no data availability' for each criterion.]
Road Design Data
Availability & Need

State of the art & International Inquiry
Road Operation Data Availability & Need

- Speed limit: 91% available, 52% needed
- Road markings: 78% available, 52% needed
- Road signage: 65% available, 43% needed
- Type of junction control: 74% available, 52% needed
- Junction signalling data: 48% available, 48% needed

Legend:
- Blue: Data availability Motorway/Freeway
- Light Blue: Data need Motorway/Freeway
- Green: Data availability Rural road
- Orange: Data need Rural road
TRAFFIC DATA

AVAILABILITY & NEED

Annual average daily traffic

- Data availability Motorway/Freeway: 100%
- Data need Motorway/Freeway: 52%
- Data availability Rural roads: 87%
- Data need Rural road: 43%

Percentage of heavy vehicle traffic

- Data availability Motorway/Freeway: 96%
- Data need Motorway/Freeway: 48%
- Data availability Rural roads: 87%
ACCIDENT DATA

Availabilty & Need

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Part D. Summary of experience on road safety measures (CMFs)
For each road safety measure (CMF), included in the following table, based on your experience, please fill in the appropriate boxes (high / low) regarding the:

- **Need** to implement the road safety measure in your country's road network;
- **Availability** of assessment of measure / CMF;
- **Transferability** of safety effect (i.e. if the measure is assessed in a different location, will the safety effect be similar and therefore transferable to your country?).
### 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></td>
<td>HIGH</td>
<td>LOW</td>
<td>HIGH</td>
</tr>
<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.
available @
www.practproject.eu