PRACT
Predicting Road ACcidents - a Transferable methodology across Europe: Project Results for Practitioners I: Repository

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Presentation Structure

1. Review of existing APM/CMF Databases and Road Safety Toolkits
2. Development of PRACT Repository
3. Repository Operation and Features
4. Example Queries
5. Conclusions

Web-based CMF databases and Road Safety Toolkits

- FHWA CMF Clearinghouse (http://www.cmfclearinghouse.org),
- AustRoads Road Safety Engineering Toolkit (http://www.engtoolkit.com.au/),
- iRAP Road Safety Toolkit (http://toolkit.irap.org/)
- SPF Clearinghouse (http://spfclearinghouse.org/),

FHWA CMF Clearinghouse

- Includes only CMFs.
- Currently includes 5,378 CMFs (421 CMFs from HSM and 4,957CMFs not in the HSM).
- A rating process of CMFs has been applied, however not as demanding as the one of HSM.
- Detailed background information on presented CMFs is available.

AustRoads Road Safety Engineering Toolkit

- 67 treatments, all concerning road infrastructure, are included, with an estimated “crash reduction effectiveness”.
- Searchable database of treatments according to:
  - Treatment type/ name,
  - Crash type,
  - Safety issue,
  - Road user group
- Information on the estimation of crash reduction effectiveness is generally not available.

iRAP Road Safety Toolkit

- Includes 58 treatments (infrastructure, vehicle & user related).
- No CMFs or APMs are included.
- Rough assessment of each treatment's effectiveness using a four scale system:
  - 0-10%,
  - 10-25%,
  - 25-40%,
  - 60% or more.

SPF Clearinghouse

- Includes only SPFs
- Data gathered primarily on a voluntarily basis from users
- Detailed background information on included SPFs (sample size, study citation, statistical methodology etc.) available only to subscribers.

Additional Value of PRACT Repository (1/2)

- Stand-alone Regression Equation APMs are not available in any of the above web databases.
- SPFs are available only in SPF Clearinghouse (to subscribers only), without however providing adequate background information.
- Existing Databases include mostly data from USA and Australia. Results from European studies are very uncommon.

www.pract-repository.eu

Additional Value of PRACT Repository (2/2)

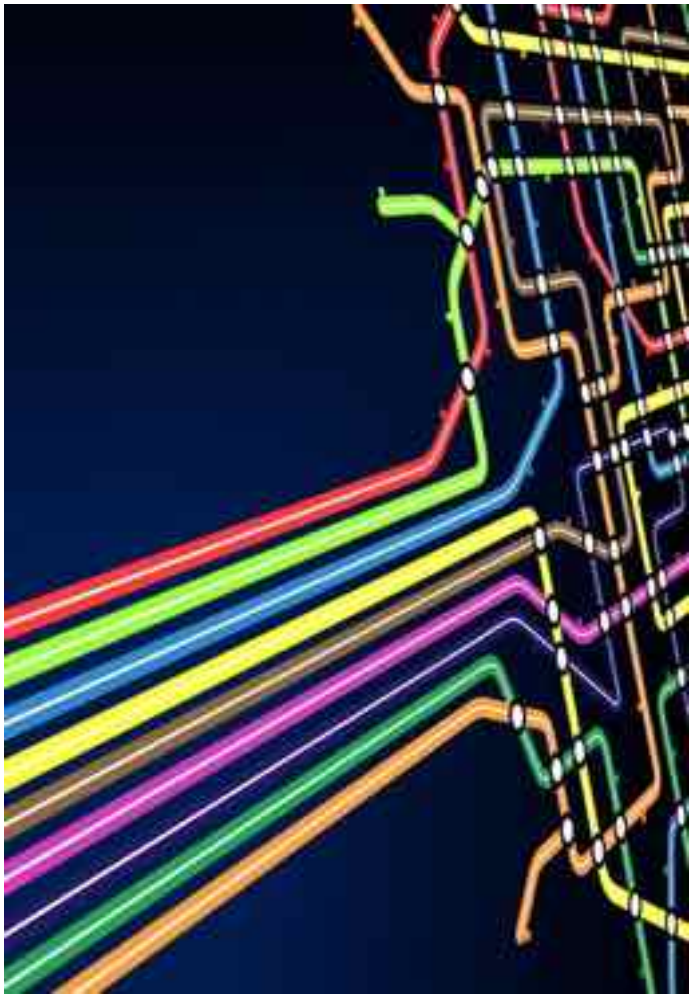
In PRACT Repository:

- All types of data required in accident prediction are available:
  - CMFs,
  - SPFs, and
  - Regression Equation APMs.
- The quality of included CMFs has been verified through an evaluation process.
- User is provided with additional information to verify the quality and the transferability of CMFs and APMs.
- Data from European studies are included.

www.pract-repository.eu

Development of Repository

- The repository has **two parts**: the CMF part and the APM part.
- Both parts are based on the respective inventories developed within PRACT review process.
- **All reviewed APMs** were included in the repository.
- Only **high quality CMFs** were included in the repository, on the basis of specific criteria.



Criteria for CMF inclusion

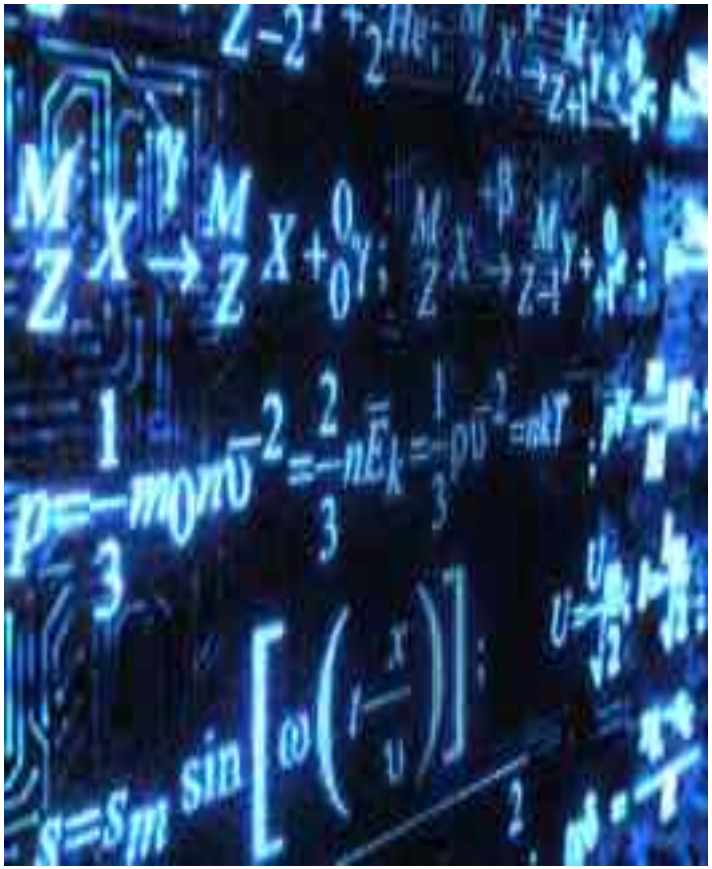
- Quality criteria refer to:
  - statistical design,
  - testing for statistical significance, and
  - sample size.
- CMFs originating from the Highway Safety Manual were considered “a priori” of adequate quality and were included in the repository.
- All other CMFs were assessed prior to inclusion in the repository, on the basis of fulfilling **all** of the quality criteria.

CMF Criterion 1: Statistical Design

- **Naive B-A analysis** (no comparison group): not accepted
- **Simple cross - sectional analysis**: not accepted
- **B-A with comparison group**: accepted, provided that:
  - the comparison group (CG) is comparable to the treated group,
  - CG is properly selected to address most common biases, and
  - there are sufficient controls to deal with time trends in accidents.
- **Empirical Bayes B-A analysis**: accepted, provided that:
  - there are no evident problems in the choice of the reference group.
- Poisson / Negative Binomial / Quasi - Poisson **Regression modelling**: accepted only for treatments with random treatment allocation (e.g. blanket treatments), not accepted for treatments applied to high risk sites.

CMF Criterion 2: Testing for Statistical Significance

- Statistically significant at **10% level** as a minimum.
- **95% interval does not include 1**.
- If 95% interval includes 1 and all other criteria are met, the CMF was included in the repository with the code "not significant" instead of the CMF value, as an indication that the treatment has no significant impact to accidents.



CMF Criterion 3: Sample Size (sites and years)

- **B-A analysis studies:** at least 10 treated sites and at least 3 years of data, both for the before and the after period.
- **Multivariate cross-sectional models** inclusion criteria depended on the number of explanatory variables (EV) and on whether observations for each year are treated as separate observations in the model e.g.:

1. If observations for each year are treated as separate observations:
   - For 5 or less EV, the criterion is: sites x years > number of EVs + 50
   - For 6 or more EV, the criterion is: sites x years > number of EVs x 10
2. If average / mean values of variables over all years are used in the model:
   - For 5 or less EV, the criterion is: sites x years > number of EVs + 50
   - For 6 or more EV, the criterion is: number of sites > number of EVs x 10

Results of Criteria Application

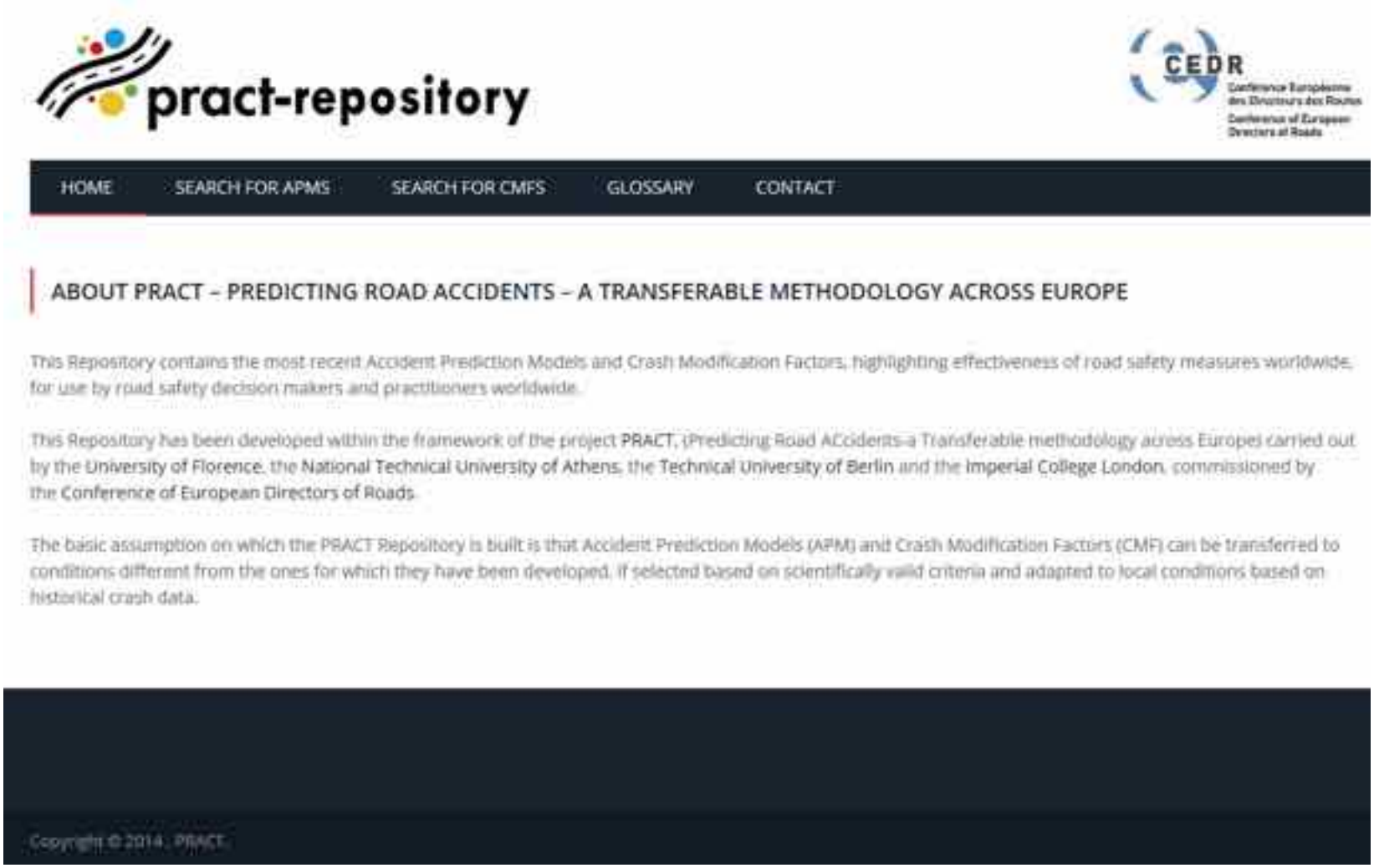
- The quality criteria were applied to the CMFs (1,526 Factors and Functions) gathered during the review process.

- **889 CMFs** were found to satisfy the quality criteria and were included in the repository.

Main Features of PRACT Repository

- Link to website: **www.pract-repository.eu**
- Five basic sections:
  - HOME: basic information about the repository and about PRACT project,
  - SEARCH FOR APMs: search the database for APMs with specific characteristics,
  - SEARCH FOR CMFs: search the database for CMFs with specific characteristics,
  - GLOSSARY: definitions of the most commonly used terms
  - CONTACT: allows the user to send email to the partners responsible for the operation and maintenance of the website.

“HOME” section



"GLOSSARY" section

pract-repository

CEDR Conférence Européenne des Directeurs des Routes Conference of European Directors of Roads

HOME | SEARCH FOR APMS | SEARCH FOR CMFS | GLOSSARY | CONTACT

YOU ARE AT: Home » Glossary

GLOSSARY

Accident Prediction Model (APM) or **Safety Performance Function (SPF)**: an equation used to estimate or predict the expected average accident frequency at a location, as a function of traffic volume and road infrastructure characteristics (e.g. number of lanes, type of median, traffic control). In PRACT repository, APMs are divided in two types: Regression Equation Models and SPFs& CMFs Models (see also respective definitions in the glossary).

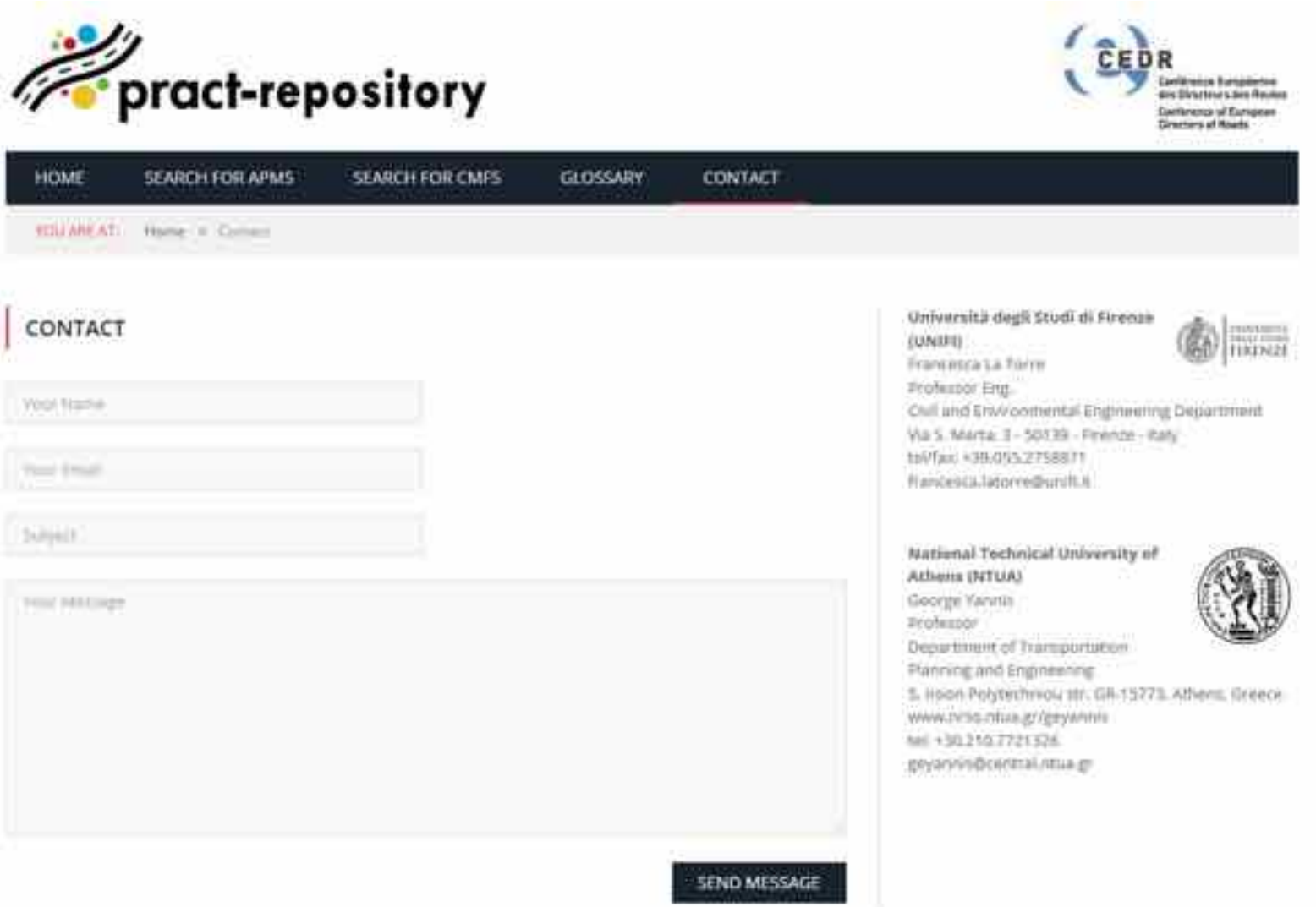
Average Annual Daily Traffic (AADT): the counted (or estimated) total traffic volume in one year divided by 365 days/ year.

Before – After Study: the evaluation of implemented safety measures in terms of crash reduction, by comparing frequency or severity of crashes before and after implementation, that often result in the development of CMFs. There are several different types of before – after studies – see also: Naive Before-After Study, Before-After with Comparison Group Study, Empirical Bayes Before-After Study, and Full Bayes Before-After Study.

Before-After with Comparison Group Study: a type of before-after study, in which a group of untreated sites that are similar in nature to the treated sites is used to control for changes in crash frequency not influenced by the treatment. For the approach to give unbiased estimates, treatment implementation must be random (e.g. a blanket treatment applied to all sites) rather than related to accident rates and reference sites must have similar characteristics to the treatment sites, including accident rates in the before period.

Crash Modification Factor (CMF) or **Function**, or **Accident Modification Factor**: the relative change in accident frequency due to a change in one specific condition (when all other conditions and site characteristics remain constant). CMF is the ratio of the expected accident frequency after a modification or measure is implemented to the estimated

“CONTACT” section



“SEARCH FOR APMs” section (1/3)

- The search page allows the user to search the database for APMs by providing any of the characteristics displayed in the figure to the right.
- If one or more of the above search criteria are left blank (or the blank field is selected at the drop-down list), the criterion is ignored. Thus, a search with all fields blank will return all the 273 entries of the APM database.

“SEARCH FOR APMs” section (2/3)

- The search leads to a **results page** with a list of the APMs in the database that meet the search criteria and their most basic characteristics.
- Further clicking on any specific ID number from this list provides the user with all the available data related to this specific APM.

“SEARCH FOR APMs” section (3/3)

1-029

APM ID: 1-029

Type of APM	Regression Equation
Is applicable to Motorways Segments?	No
Is applicable Motorway Speed Change Lanes?	No
Is applicable to Interchange Ramps?	No
Is applicable to 2-way 2-lane Rural Road Segments?	Yes
Is applicable to Rural Road Intersections?	Yes

For Regression Equation

APM variable 1	Traffic Volume of Major Road AADT1 (veh/day)
APM variable 2	Traffic Volume of Minor Road AADT2 (veh/day)
APM variable 3	Major Road median width MEDWid [feet]
APM variable 4	Number of driveways on major road within 250ft. of intersection (enter NO.)
APM equation	$AP = \exp(-15.860) \times AADT1^{1.263} \times AADT2^{0.239} \times \exp(-0.057 \times MEDWid) \times \exp(0.258 \times NO)$

APM development information

Study Design	Negative Binomial Regression
Sample Size - No of sites	
Sample Size - No of years	
Sample Size - No of crashes	

Study information

Study name	Crash models for rural intersections: four-lane by two-lane stop-controlled and two-lane by two-lane signalized. Report FHWA-RD-99-128
Year published	Year study published: 1999
Authors	Vogt, A.

Information of considered road elements

Geographic Data Origin	USA - California & Michigan
Road element	Intersection
Road type	Two-lane two-way rural road
Sampling Criteria	
No. of lanes per direction	
Inside Tunnel	
Minimum Traffic Volume AADT (veh/day)	Minimum Traffic Volume
Maximum Traffic Volume AADT (veh/day)	Maximum Traffic Volume
Intersection / Interchange type	3-leg at-grade intersection
Traffic control on intersection	Stop signs on minor road

Information of considered accidents

Period of crash data - start	1993
Period of crash data - end	1995
Crash severity	All
Crash types	At intersection
No of vehicles	
Other accident parameters	Not specified
Road user types	Not specified

Comments

"SEARCH FOR CMFs" section (1/3)

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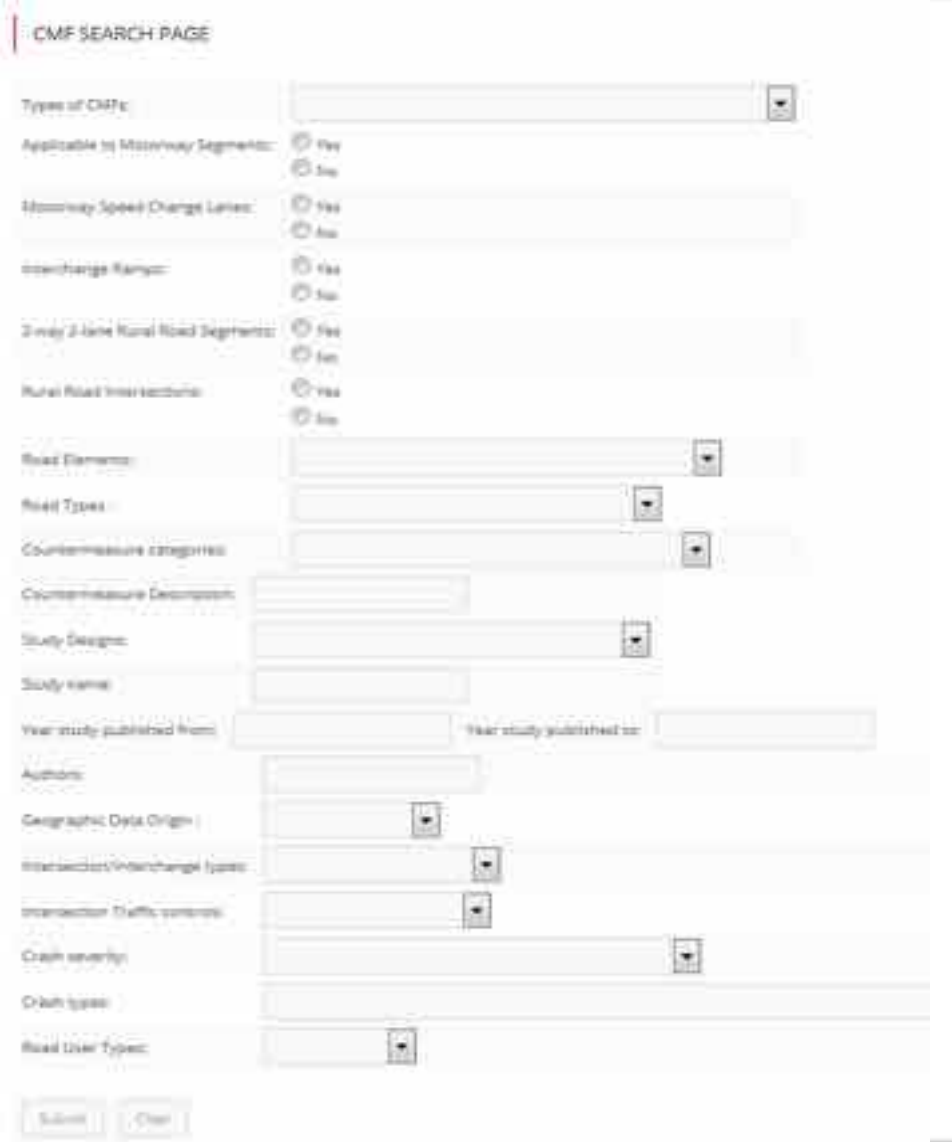
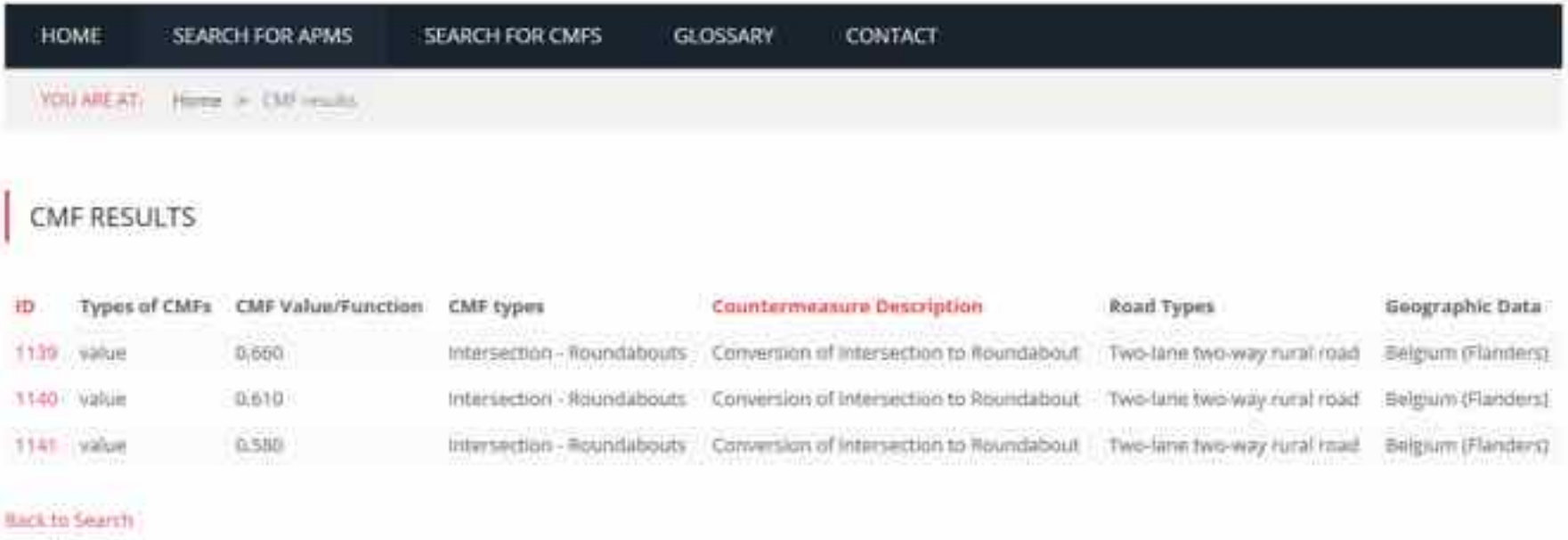


"SEARCH FOR CMFs" section (2/3)

- The search leads to a **results page** with a list of the CMFs in the database that meet the search criteria and their most basic characteristics.
- Further clicking on any specific ID number from this list provides the user with all the available data related to this specific CMF.



“SEARCH FOR CMFs” section (3/3)

1170

CMF ID: 1170

Type of CMF

CMF Value / Function

CMF variable 1 (within the study)

CMF variable 2 (within the study)

CMF variable 3 (within the study)

CMF type

Is applicable to Motorway Segments?

Is applicable Motorway Speed Change Lanes?

Is applicable to Interchange Ramps?

Is applicable to Interchange Ramp Terminals?

Is applicable to 2-way 2-lane Rural Road Segments?

Is applicable to Rural Road Intersections?

Countermeasure Description

CMF development information

Study Design

Standard error

Were results tested for statistical significance?

Sample size: No. of sites

Sample size: No. of years

Sample size: No. of crashes

Explanatory variables included in the safety performance function (if applicable, e.g. AB before-after)

Explanatory variables included in the model (for multivariate cross-sectional studies)

Model form for multivariate cross-sectional models (e.g. Negative Binomial model)

Was the potential for crash migration taken into account? If yes, how? (for countermeasures where crash migration could be an issue)

Any other sources of potential bias that you identified?

Study information

Study name

Year published

Authors

Information of considered road elements

Geographic Data Origin

Road network length

Road element

Road type

Sampling Criteria

Comparison Group Selection Criteria

No. of lanes per direction

Minimum Traffic Volume AADT (veh/day)

Maximum Traffic Volume AADT (veh/day)

Study terminal type

Intersection / Interchange type

Traffic control at intersection

Information of considered accidents

Period of crash data – start

Period of crash data – end

Crash severity

Crash types

No of vehicles

Other accident parameters

Road user types

Countermeasure information

Safety deficiency

Countermeasure category

Comments

Conclusions

The PRACT Repository is **a valuable road safety decision support system** because:

- it organizes current knowledge on accident prediction (both APMs and CMFs) in a user-friendly and easily accessible by all road safety practitioners website,
- it is a complementary database to the PRACT Tool & Guideline,
- it provides all the available background information on the APM or CMF development, to assist in the assessment of the suitability of the provided data.

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