



Road Safety Data, Collection, Transfer and Analysis

Deliverable D3.7 “Design and development of the road safety data warehouse – Final Report”

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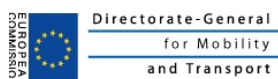
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EXECUTIVE SUMMARY

During the last two decades, the systematic efforts for gathering and harmonising road accident data at the European level have led to a significant upgrade and enhancement of the CARE database. Moreover, important data collection and harmonization efforts have provided very useful results as regards exposure data and safety performance indicators; however, the availability, completeness and level of harmonization of this data varies significantly.

At the same time, additional data and related information sources have been established at EU level, including in-depth data, behaviour / attitudes data, programmes and measures data, social cost data etc., mainly in the framework of European research projects. However, these data sources are still not of sufficient comparable quality, are still not sufficiently linked, and the aggregate data are not always accessible. Finally, an important amount of national data remains unexploited at the European level.

Consequently, there is a clear need for the consolidation of the various data (at least at an aggregate level) into an integrated system, a data warehouse. This will allow not only for better integration of the various data assembly processes, but also for the provision of a complete set of data services, with full documentation of the data and their sources, in order to support road safety knowledge and the related decision making. This data warehouse will be developed as a complete working tool for road safety stakeholders, for which not only a full description of the structure, format and content will be designed and specified, but also the related content will be provided, consisting in fact of a new system with road safety related data/information in aggregate form.

The objective of the DaCoTA WP3 is the development of the DaCoTA System, a road safety data warehouse as a comprehensive and integrated system with aggregate data and information consolidating, organising and making available all existing data and information, necessary for the support of the decision making. The proposed DaCoTA pilot system is destined to serve as example for the further enhancement of the European Road Safety Observatory (ERSO), as new structures and features were tested during the development procedure and new data and knowledge have been assembled and have become available for incorporation into the existing ERSO.

The establishment of this solid but easily accessible, integrated road safety system allows for road safety policy and decision making to use a complete set of aggregate road safety related data (road accident data, risk exposure data, safety performance indicators, in-depth data, health indicators/data) and information (programmes, measures, legislation, social cost, behaviours/attitudes, regulations).

During the first phase of the DaCoTA WP3, the description of the Data Warehouse /DaCoTA System structure, format and content was designed and specified, based on previous work undertaken within the SafetyNet project, taking into account new, additional outcomes and needs from all DaCoTA project WPs. Additionally, a first set of national and international data and information was defined and gathered through appropriate templates, along with the related explanatory meta-data and the related links and was included into a pilot system that will be further improved and enhanced during the second phase of the project.

During the second and last phase of the DaCoTA WP3 the DaCoTA System's structure, and format were finalised and its content was updated according to the data/information gathered. The DaCoTA System is available in pilot phase since July 2012 and in full operation since October 2012 at the following internet address: <http://safetyknowsys.swov.nl>. It has been presented to the European road safety community before and during the DaCoTA project Conference in Athens in November 2012. By the end of the DaCoTA project all the contents of the DaCoTA System will be available at the respective website.

0. INTRODUCTION

During the last two decades, the systematic efforts for gathering and harmonising road accident data at European level have led to significant upgrade and enhancement of the CARE road accident database. Moreover, important data collection and harmonization efforts have provided very useful results with regard to exposure data and safety performance indicators; however, the availability, completeness and level of harmonization of this data varies significantly.

At the same time, additional data and related information sources have been established at EU level, including in-depth data, attitude data, programmes and measures data, social cost data etc., mainly in the framework of European research projects. These data sources are still not sufficiently linked, and the aggregate data are not always easily accessible by the different groups of stakeholders. Finally, an important amount of national data remains unexploited at European level.

Consequently, there is a clear added value from the consolidation of the various data, at least at an aggregate level, into an integrated system as a data warehouse. This will allow a better integration of the various data assembly processes as well as the provision of a complete set of data services including full documentation of the data and their sources in order to support road safety knowledge and the related decision making.

The objective of the DaCoTA WP3 is the development of a DaCoTA (pilot) System, a road safety data warehouse as a comprehensive and integrated system with aggregate data and information consolidating, organising and making available all existing data and information, necessary for the support of decision making. The proposed DaCoTA pilot system is destined to serve as example for the further enhancement of the European Road Safety Observatory (ERSO), as new structures and features were tested during the development procedure and new data and knowledge have been assembled and have become available for incorporation into the existing ERSO.

Aggregate road safety data concern road accident data, risk exposure data and road safety performance indicators, but also causation indicators (as those resulting from in-depth data), and health indicators (as those resulting from epidemiological data).

These indicators can be combined with additional information on other important aspects of road safety, as those related to behavioural, social and political aspects. In particular, an integrated approach for supporting road safety decision making needs to include quantitative information on road users' attitudes and behaviour, on road safety measures implemented, rules and programmes (including enforcement), and on their social costs and benefits.

The outcome of DaCoTA WP3 is the establishment of a solid but easily accessible, integrated pilot road safety system that will allow for road safety policy and decision making to use a complete set of aggregate road safety related data (road accident data, risk exposure data, safety performance indicators, in-depth data, health indicators/data) and information (programmes, measures, legislation, social cost, attitudes, regulations, data/information on vehicles safety (e-safety)).

1. DATA WAREHOUSE DESIGN AND DEVELOPMENT

One of the main objectives of DaCoTA was to build a pilot DaCoTA System, the purpose of which is to provide an easily accessible web-based system, containing specific outputs of DaCoTA (statistics, interactive data, knowledge and tools, methodologies) as well as output of SafetyNet in a structured way, which will be gradually transferred into the European Road Safety Observatory (ERSO) of the European Commission (EC). It is a pilot system, in which different types of road safety data and knowledge are included, and respective structures have been tested, allowing their future exploitation into the EC ERSO system by giving easy access to data, information and tools, and thus supporting the road safety policy making in Europe.

Within the project, a pilot system was designed, developed and tested. Part of the ERSO work carried out within SafetyNet was exploited as the base for the conception of this new System, in terms of the overall structure of the website and some of the products to be included (i.e. web texts, Annual Statistical Reports (ASR), Basic Fact Sheets (BFS), road accident data, etc).

However, new insights were brought from the work carried out within all other DaCoTA WPs during the DaCoTA project, and the pilot system is designed to accommodate the updates of existing in ERSO outputs, but also new DaCoTA products and outcomes (i.e. focus on methodologies, in-depth accident data, e-safety data, etc.).

1.1 User groups and general specifications

In general, the DaCoTA-system is meant to serve any person who is interested in the data, information and tools that are made available. More specifically, users will be those interested in road safety related issues, in conducting their own analysis by making use of this data, or in comparing the performance of countries to determine what can be done to improve road safety. For those users who want to do their own analysis, it means that a certain level of knowledge of the quality and analyses of road safety data and tools is required. It is therefore expected that the users of the DaCoTA system will particularly consist of the following groups:

- policy makers (particularly use of general information and country information);
- researchers (particularly use of data for new analyses and methodologies);
- press (both data types).

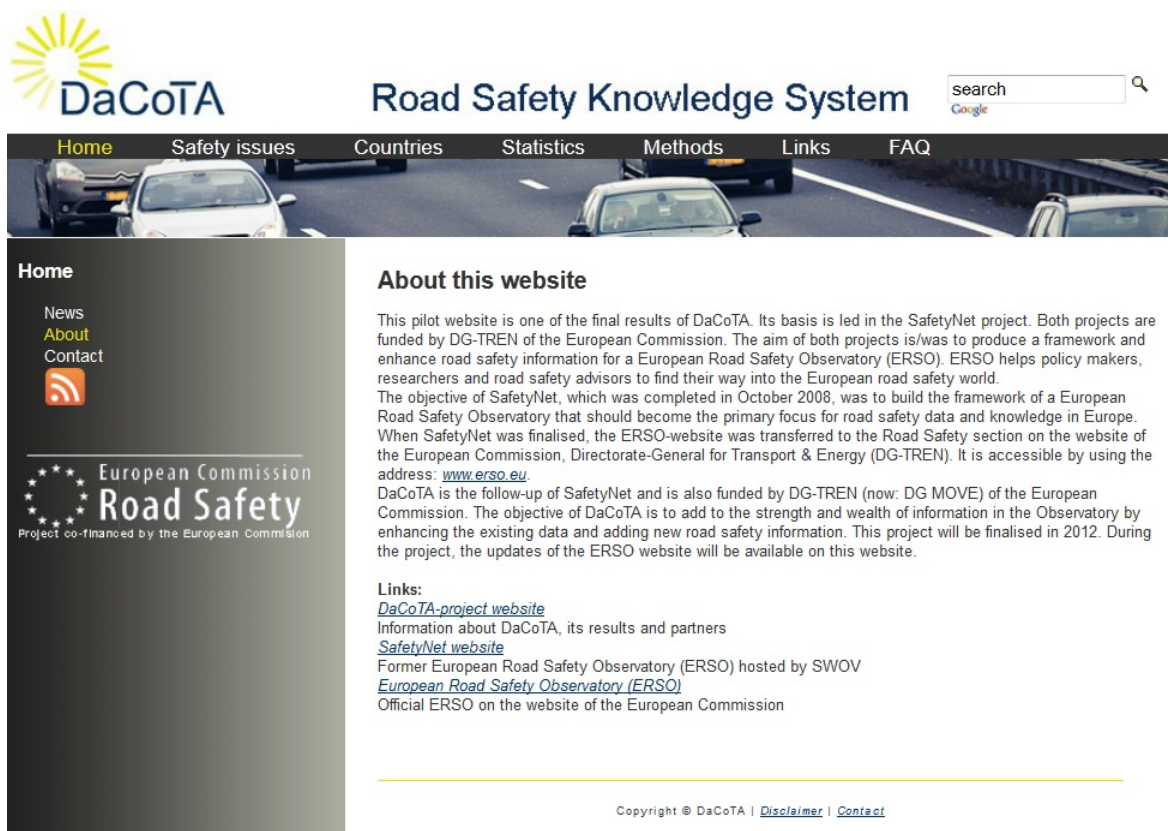
Based on the stated objectives and the target groups, the DaCoTA system should meet several specifications:

- the data should be easily accessible;
- the data should be as interactive as possible.

1.2 Content of the DaCoTA System

The contents of the DaCoTA System have been added progressively since July 2012 and are publicly available at the following internet address: <http://safetyknowsys.swov.nl>. By the end of the DaCoTA project all the contents of the DaCoTA System will be available.

The DaCoTA pilot system consists of five main components (Safety issues, Countries, Statistics, Methods, Links) and Frequently Asked Questions (FAQ) as in picture 1 below.



Picture 1: Home page of the Road Safety Knowledge System pilot website

Several different structures regarding the main categories and the contents were tested and experience with the first draft of the DaCoTA system showed that these parts need to be structured in a way that makes sense to all users, particularly those who are not very familiar with complicated jargon, like local policy makers.

We also learned that there was a need to add some information on the methodologies described, setting sufficient quality standards that will allow the users of the system to update products, data and information after the end of the DaCoTA project. This will definitely facilitate the migration of the system from DaCoTA to ERSO.

1.2.1 Safety issues

This is the knowledge base meant for the European Road Safety Observatory of the European Commission. On this part of the website, the visitor can find high quality information on important road safety issues in the form of webtexts.



Picture 2. Safety issues

The information is scientifically founded, easy to read and ready to use. For each of the subject treated, the information consists of an overview of the magnitude of the problem, prevalence and countermeasures. The subjects are related to:

- Age groups
 - Novice drivers
 - Older drivers
- Road users
 - Pedestrians and cyclists
 - Powered two wheelers
- Hazardous behaviour
 - Driver distraction
 - Fatigue
 - Alcohol/drugs
 - Speeding

- Work-related road safety
- Post crash
 - Post impact care
 - E-safety
- Road safety measures
 - Roads
 - Speed enforcement
 - Vehicle safety
- Policy issues
 - Quantitative targets
 - Cost-benefit analysis
 - Safety ratings
 - Road safety management

It has to be underlined that all these web texts were initially developed in SafetyNet and updated in DaCoTA. This was done under supervision of an editorial group (SafetyNet) and editorial board (DaCoTA), both consisting of renowned, highly esteemed road safety experts who were responsible for producing the information about a specific road safety subject. Both editions of the webtexts (SafetyNet and DaCoTA) are included in the DaCoTA pilot System.

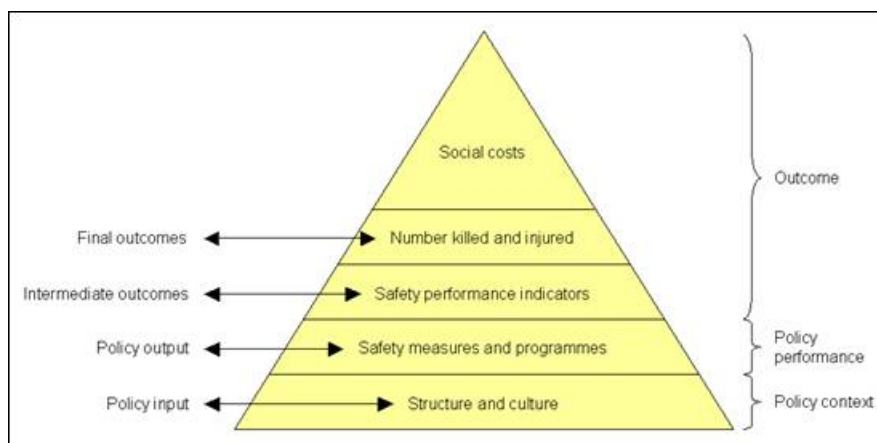
1.2.2 Countries

To help policy makers and researchers to have a good view of the road safety state of European countries, a number of country tools have been developed within DaCoTA.

More information about the road safety state of a country, including costs, SPI's, measures, culture and context can be found in the country overviews. The composite indices are developed to summarise the road safety state of all European countries and make them comparable. Furthermore, this section contains forecasts for each European country and for Europe as a whole.

- Country overviews

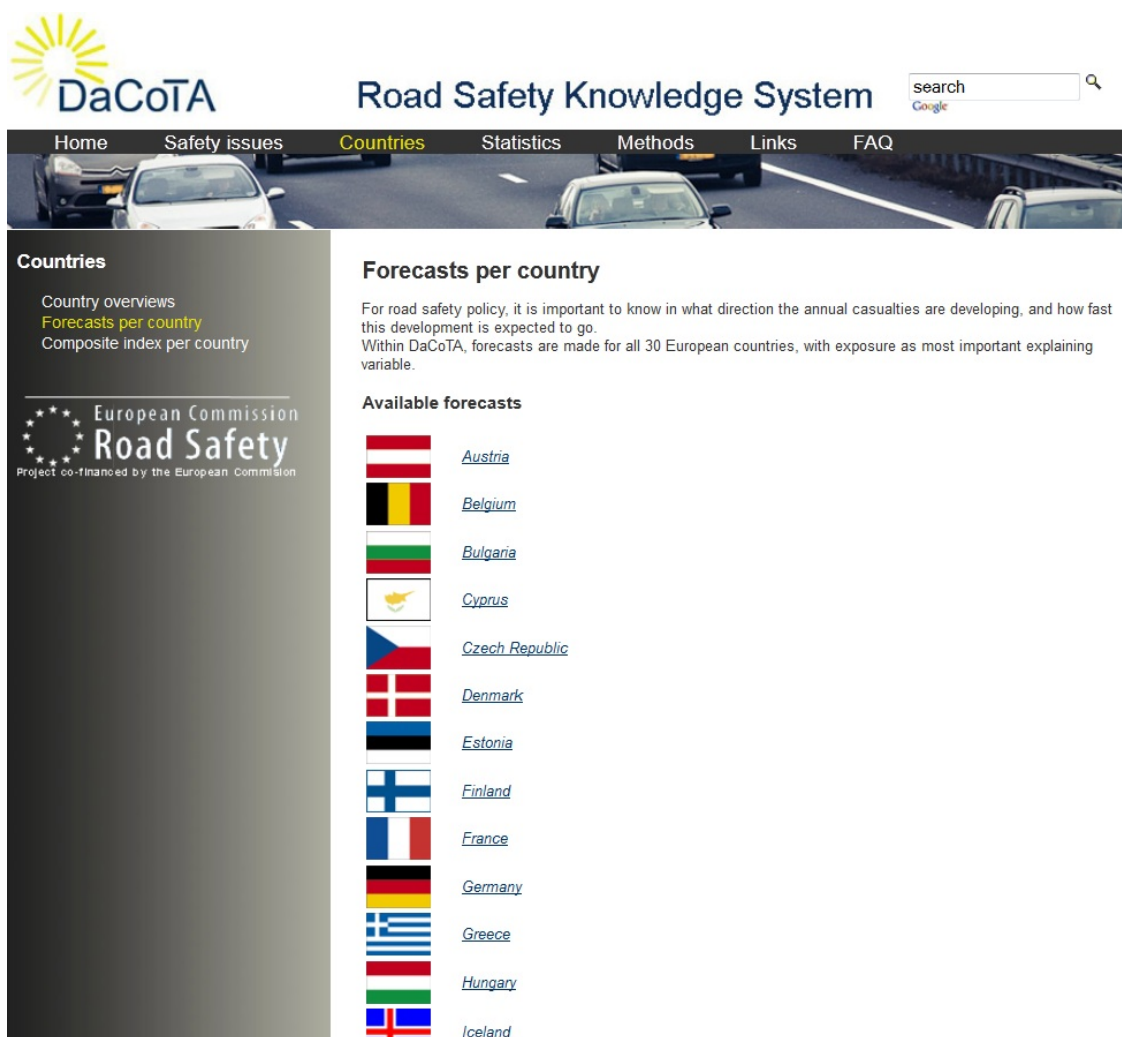
Country reports, giving the most actual situation of a country, comprising basic data, road safety measures, safety performance indicators, road safety figures and social costs related to road safety. The information follows the five levels of the road safety pyramid, as shown in picture 3.



Picture 3 Road safety pyramid

- Forecasts per country

For road safety policy, it is important to know in what direction the annual casualties are developing, and how fast this development is expected to go. Within DaCoTA, forecasts are made for all 30 European countries (picture 4), with exposure as most important explaining variable. Forecasts of the road safety situation in every country, including a description of the method adopted to produce these forecasts.



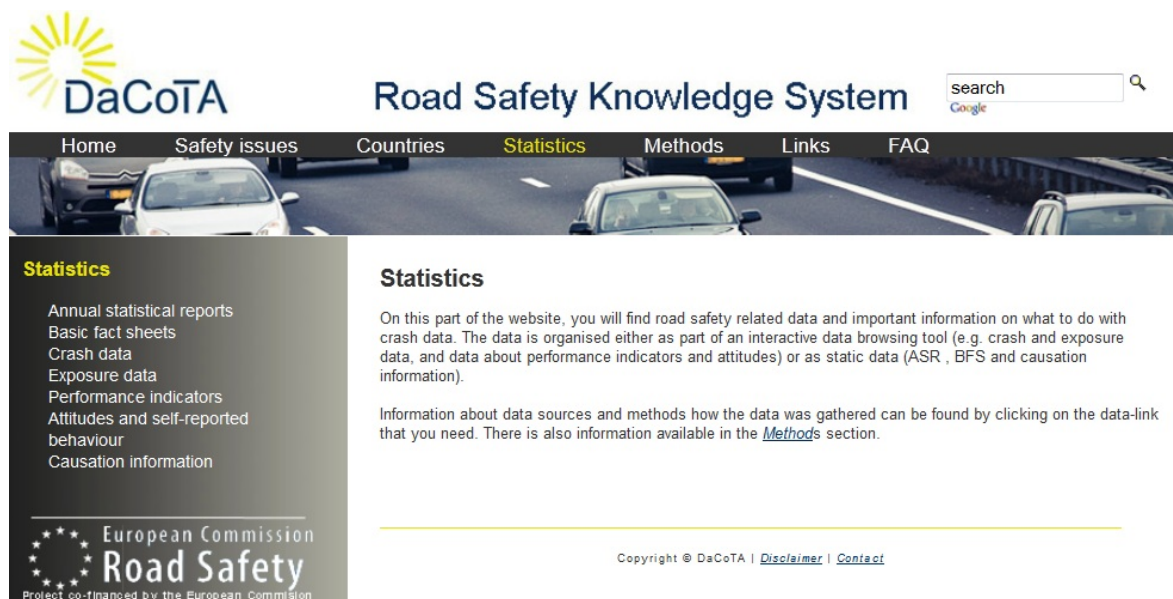
Picture 4. Forecasts per country

- Composite index per country

Comparing the road safety performance of one country with that of other countries can be very interesting and stimulating. Within DaCoTA, a road safety performance index is formulated in order to allow for comparison and benchmarking.

1.2.3 Statistics

The statistics part contains road safety related data and important information on what to do with crash data. The data is organised either as part of an interactive data browsing tool (e.g. crash and exposure data) or as static data (ASR BFS, data about Safety Performance Indicators and driver behavior/attitude).



Picture 5. Statistics

Interactive data browsing tool contains for the time being crash data and exposure data.

while static data contain:

- Annual statistical reports
- Basic fact sheets
- Data about performance indicators
- Data about Attitudes and self-reported behaviour

a) Crash data

In general, data related to crashes can be split up in three main parts: data on crashes, data on casualties, and data on vehicles involved.

For crash data, the following data will be available:

Fatalities (30 days harmonisation) by:

- country;
- year;

The casualties by:

- country;
- year;
- hour
- motorway
- vehicle type
- speed limit
- month;
- area type;
- junction;
- junction type
- day of week;
- gender;
- age;
- type of participation;

b) Exposure data

Exposure data which should be taken into account when comparing road safety levels of e.g. countries, groups of people or roads. Exposure data can roughly be classified into two groups:

- Traffic estimates: vehicle kilometres, person kilometres, vehicle fleet, fuel consumption, road length;
- Persons at risk estimates: person kilometres, population, number of trips, time in traffic, driver population.

This categorisation is somewhat arbitrary and some types of exposure data could well fit in both categories. For instance, person kilometres are often preferred over vehicle kilometres when fatalities are to be compared, because differences in vehicle occupancy rates may be captured by person kilometres (and not by vehicle kilometres). However, when the subject of a study is the occupancy rate, a comparison based on vehicle kilometres may be more reasonable.

Data is mainly available from EUROSTAT.

Some appropriate rates using exposure data that will be made available will be people killed by:

- Vehicle type (victim)

- Participation (driver, passenger etc.)
- Gender
- Vehicle (fleet)
- Country
- Year

c) Data on SPIs

Safety performance indicators are the measures (indicators) reflecting those operational conditions of the road traffic system, which influence the system's safety performance. Following the recommendations of the ETSC report "Transport Safety Performance Indicators" (2001), seven problem areas were selected in SafetyNet (Hakkert, A.S, Gitelman, V. and Vis, M.A. (Eds.) (2007) Road Safety Performance Indicators: Theory). However, only some SPIs from five of these areas can be currently included into the DaCoTA System because of availability reasons. These five areas are the following:

- alcohol-use;
- speeds;
- protection systems;
- daytime running lights (DRL);
- vehicles.

More specifically, with reference to the alcohol and drugs use, the percentage of fatalities resulting from crashes involving at least one driver impaired by alcohol is planned to be included, whereas with reference to speed two types of measures can be reported:

- average speed (during day or night)
- the percentage of speed limit offenders

These measures are provided by speed limit of the road and for those roads with speed information available.

Regarding the protection systems for seat belt wearing, the following SPIs will be included:

- Passenger cars: front seat (separated by driver and front seat passenger if available)
- Passenger cars: rear seats
- Passenger cars: correct protection of children < 12 years
- Heavy vehicles: front seat
- Coaches: passenger seats

For helmet use, the following measures are planned:

- Cyclist helmets
- Moped helmets

- Motorcycle helmets

With reference to Daytime Running Lights, the following SPIs are identified:

- DRL usage by road type
- Total DRL usage

and for the vehicles the crash worthiness, the EuroNCAP-scores, the fleet age (median age) and the vehicle fleet composition (% of passenger cars, % of motorcycles and mopeds, % of public transport, % of other vehicles such as heavy goods vehicles and lorries).

d) Data on Attitudes and Self-reported Behaviour

This data is available from the SARTRE surveys, which are currently available of the years 1991, 1996, 2003 and 2010. Per issue, information is given in an overview, grouped by country and by year. Issues which are available are the following:

- Speed related
- Alcohol related
- Seat belt wearing
- Other behaviour

These issues report on the speeding, and seat belt wearing in different situations, alcohol consumption frequency, and attitudes on speeding and drink driving penalties and the need of seat belt wearing and comfort of seat belt wearing.

Other self-reported behaviour contains the issues:

- Tailgating,
- Giving way to pedestrians,
- Driving through amber
- Overtaking.

Information on the interactive data can be found in the next paragraph.

e) Annual statistical reports

The Annual Statistical Report is a document consisting of a large number of Tables and Figures with data retrieved from the CARE database, which are not further analysed or commented. A Glossary with the definitions of the variables and values used in the Annual Statistical Report are included at the end of the report. Four editions of Annual Statistical Report will be available in the DaCoTA pilot System.

Each Annual Statistical Reports provides the basic characteristics of road accidents in 26 member states of the European Union and Switzerland and Iceland for a the most recent decade for which road accident data are available, and more detailed data for the last available year, on the basis of data collected and processed in the CARE database, the

Community Road Accident Database with disaggregate data. However, data for some countries and corresponding years were not yet available in the CARE database at the date of drafting the report.

The chapters comprising the Annual Statistical Report, as well as the related Tables and Figures have been selected by looking at the main interests of several potential road accident stakeholders. DaCoTA partners closely collaborated with the EC-CARE administration, in order to identify which types of data/information are comparable among countries and which are open to misinterpretation. Therefore, detailed Tables and Figures containing accident data and data about injured persons were excluded from this deliverable, as different definitions exist in each EU country, thus only numbers of fatalities were used, allowing for analysis and comparisons.

The last, 2012 edition of the Annual Statistical Report consists in total of 52 Tables and 26 Figures with the most interesting combination of CARE road accident data on the following major topics:

Overview – major issues

- EU-25 – Developments (also includes data other than CARE)
- Interesting Details

Time Series – last 10 years

- General time series
- Time series related to mode of transport
- Time series related to person age and gender

Fatalities 2010

- People involved
- Modes of transport
- Accident characteristics
- Various periods of time (month, day of week, hour of day)
- Type of area / road
- Type of junction
- Weather conditions

f) Basic fact sheets

Access to the CARE database is permitted only to a restricted range of users, so it has been important to develop a comprehensive range of publications based on these data that are accessible to the general public. The concept of the Basic Fact Sheet (BFS) was developed, and progressively more Basic Fact Sheets are prepared and published annually. The 'Main figures' Fact Sheet provided an overview of the accident data. The other Fact Sheets presented a range of statistics derived from analyses of the CARE database relating to a specific group of accidents or casualties, such as pedestrian casualties or accidents occurring on motorways. All Fact Sheets gave details of trends over ten years, with more detailed analyses of data from the most recent year. Only data relating to fatal accidents or fatalities are analysed because of inconsistencies between national reporting of non-fatal accidents and casualties.

Basic Fact Sheet
Main figures
Children (aged<15)
Young people (aged 18-24)
The Elderly (aged>64)
Pedestrians
Cyclists
Motorcycles & mopeds
Car occupants
Heavy Goods Vehicles and Buses
Motorways
Junctions
Urban areas
Youngsters (age 15-17)
Roads outside urban areas
Seasonality
Single vehicle accidents
Gender

Table 1: List of Basic Fact Sheets

The combination of road accident data with data on road accidents derived from the health sector can provide a better insight on the severity of the road accidents, but also on the identification of the appropriate measures to mitigate the impact of the road accidents. On this purpose, a first attempt to make an assembly of health data was made in order to identify any indicators that could be incorporated into the DaCoTA system. On that purpose, information on medical environment from EUROSTAT and also the IDB (Injury Database) was exploited. Initially, based on the available limited data, some health indicators were defined, with a similar structure to the Risk Exposure Data. More specifically, the following indicators are defined:

- Health personnel by the type of personnel
- Hospital facilities
- Main causes of deaths

Some of these health indicators were included in selected Basic Fact Sheets giving them significant added value.

Additionally, some basic causation data and information that can provide a top level overview of the topic being examined is included in some of the Basic Fact Sheets, exploiting the only resource that has harmonised information regarding causation, across a number of European countries, the in-depth SafetyNet Accident Causation Database (Methodology: SafetyNet Deliverable D5.5, Analysis: SafetyNet Deliverable D5.8). Data from 6 countries was collected in the SafetyNet project following a common methodology and, importantly, a detailed process for recording causation called the SafetyNet Accident Causation System (SNACS). This resource includes 1.006 cases split between Germany, Italy, The Netherlands, Finland, Sweden and the UK. It was therefore decided to use this resource to supplement ten fact sheets of the 2011 edition with causation data; Young People (Aged 18-24), The Elderly (Aged >64), Pedestrians, Bicycles, Motorcycles and Mopeds, Car occupants, Heavy Goods Vehicles, Junctions, Single vehicle accidents and Gender.

To reflect the nature of the BFS, each causation section was limited to two pages. The level of detail in the database is high and this conciseness limited the amount of analysis

possible in each fact sheet. Interesting points emerged for each topic, though, and the work indicates the future investigations that would be possible using the database.

For the 2012 edition a separate Basic Fact Sheet on Causation is prepared.

1.2.4 Methods

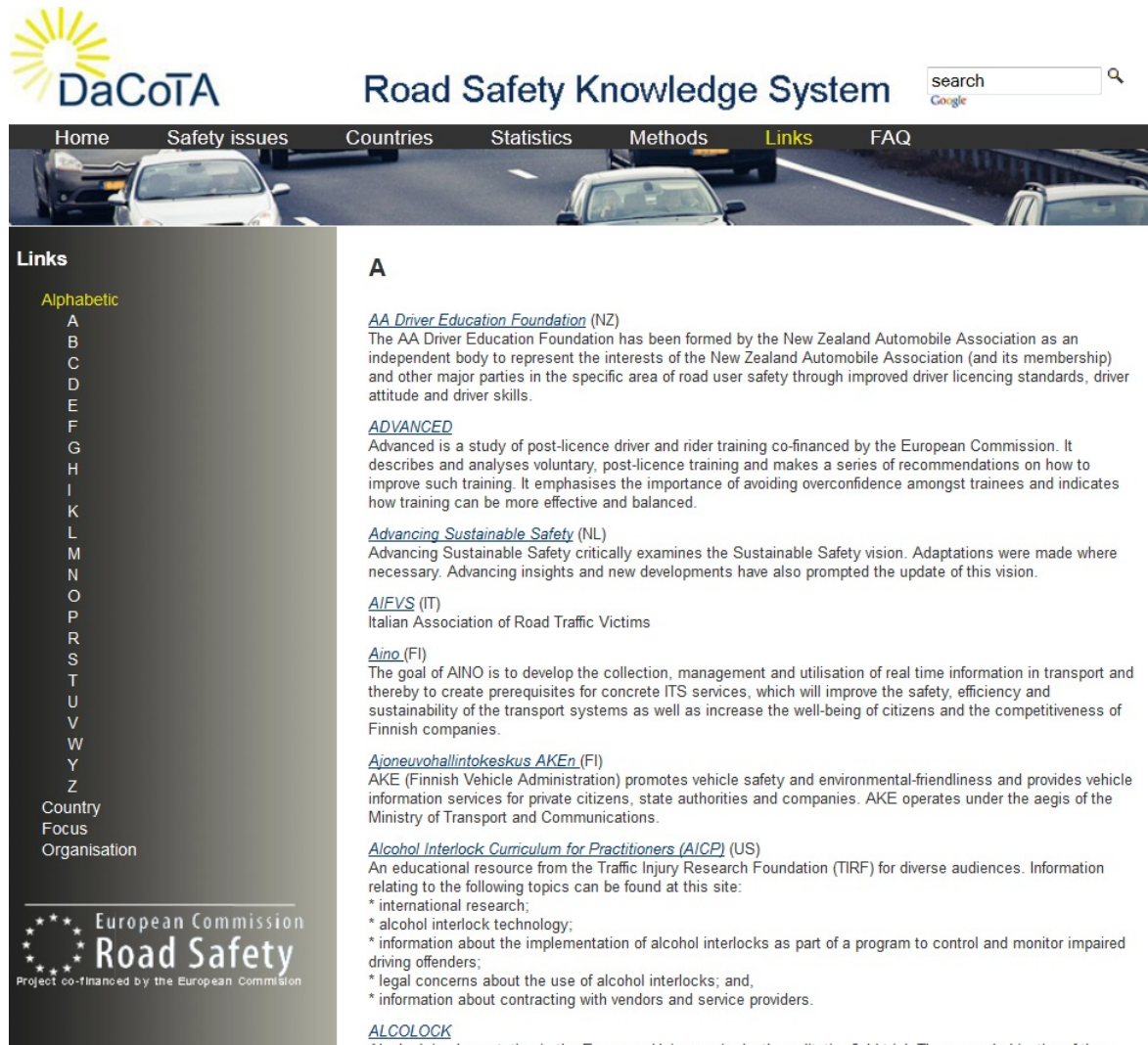
To get high quality data, information and well-structured tools, for each road safety product included in the DaCoTA pilot System a respective methodology has been developed and is described. More specifically, the procedures of gathering safety issues and collecting information for the country tools are presented, as well as the procedure for collecting statistics and the related information (meta-data) and in-depth accident investigation.



Picture 5: Methods

1.2.5 Links

The links to external files is a copy and update of the links available on the ERSO website, using initially input from the DaCoTA partners. The main objective was to gather, link and standardise road safety data as well as other sources. This should enhance the exploitation for decision making in a reliable and integrated way. The best way to deliver this type of information is by providing reciprocal web links.



Picture 6: Links

The type of information that can be disclosed includes:

- National data files
- International data files
- Research project links
- Stakeholder links

A short description is provided with each link to give the user an idea about its content. It should be noted though that the reliability of the information can only be assured as far as it concerns the work of the DaCoTA partners and not links to other sources.

D3.7 Data Warehouse Design – Final Report

The updated list includes links to:

- National and international databases;
- Governments, institutes and other organisations relevant to road safety;
- Road safety project websites throughout Europe.

The list includes the link to the website, a brief description of the organisation, project or database. Also the country and the type of link are specified and can be used to search.

Some general, worldwide road safety related information is also included in the list.

Links to governmental departments responsible for traffic and transport (e.g. the Austrian Ministry for Traffic, Innovation and Technology) are also part of the list, as well as many active road safety research institutes (i.e. VTI) and organisations such as operation and support institutes (i.e. CROW) or public authorities (i.e. FIA foundation). These links lead to more information about road safety programmes, strategies and measures.

Finally, links to specific road safety projects are included in the pilot system. These projects can be directed at:

- Governments and policy makers (e.g. CAST Campaigns and awareness-raising strategies program)
- Road safety professionals in general (e.g. ROSEBUD)
- Public (e.g. EuroNCAP)

More than 400 links are organised in several user-friendly ways, allowing the users to search for the information/data they need by:

Alphabetic order

Country

Focus (each divided by sub-categories):

Alcohol/drugs

Campaign

Data

Drivers

ITS

Knowledge dissemination

Law

Protection

Organisation:

EU project

EC level

European road safety organisations

Government

Libraries

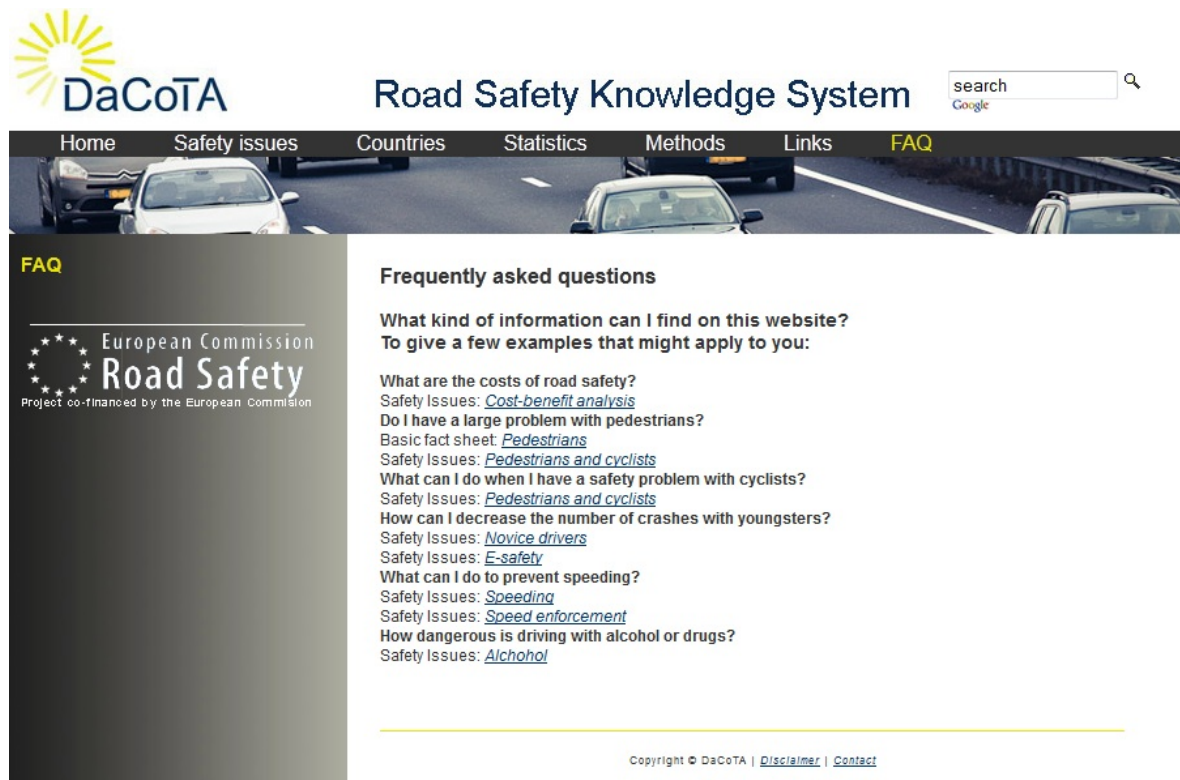
Research

Special interest group

Statistics office.

1.2.6 Frequently Asked Questions (FAQ)

Some of the most frequently asked questions by all different types of road safety stakeholders, and especially by policy makers, are included in this section and some relevant answers that can be found in the DaCoTA pilot system are noted.



Picture 7: FAQ

1.3 Process and current state

The general features of the DaCoTA system in particular have been worked out based on the functional specifications that have been defined within WP4 (D4.3). These functional specifications have been defined in consultation with the CARE experts.

The type of software that is used to design the interface has been the object of substantial discussions with the European Commission. Some possible interfaces have been examined (i.e. PC-AXIS), however, it has finally been decided that Cognos PowerPlay (not compatible with the current EC software) will be used. This is IBM software that allows the user to browse large amounts of data through a web-interface. This tool was selected because it is the only choice that allows the project partners to develop a full-fledged data browser tool within the budget and the time available in the project. The Cognos PowerPlay software was used only in the framework of the DaCoTA project for the development of the DaCoTA pilot system and consequently the European Road Safety Observatory (ERSO) will on one hand exploit the experience of the development of this pilot system (structure, features, etc.) and on the other hand will acquire all data and knowledge contained in this pilot system to be incorporated at the ERSO under the ERSO structure and functionalities (web intelligence).

The DaCoTA pilot System can now be used as a point for discussing the usefulness of such tool and the wish to have it elaborated further into a full-grown ERSO-tool with the EC. The further development of the system can take place at a later stage, outside the DaCoTA project life-cycle.

2. CONCLUSION – NEXT STEPS

The expected outcome of DaCoTA WP3 was the establishment of a solid but easily accessible, integrated road safety system that will allow for road safety policy and decision making to use a complete set of aggregate road safety related data (road accident data, risk exposure data, safety performance indicators, in-depth data, health indicators/data) and information (programmes, measures, legislation, social cost, behaviours/attitudes, regulations).

During the first phase of the project the establishment of the Data Warehouse/DaCoTA System started, as its structure, format and content was designed and specified. More specifically, the general ideas of the DaCoTA system have been worked out based on the functional specifications that have been defined within WP4 (D4.3) in consultation with the CARE experts. Cognos PowerPlay, a software enabling the user to browse large amounts of data through a web-interface, was selected for designing the interface, as it allows the project partners to develop a full-fledged data browser tool within budget and available project time. The DaCoTA System and DBT are already available as a pilot system, with some parts of the system still under construction.

During the second and last phase, the pilot system was presented and tested by various groups of stakeholders and necessary improvements took place, based on the comments and suggestions of the end users. Minor or more important re-arrangements were considered in the structure of the system, such as the existence of a separate section regarding methods where specific information will be uploaded. At the same time, the DaCoTA System content was gradually enhanced to include more road accident related data and information, as these were progressively available through the work in other WP3 Tasks, but also through other DaCoTA WPs outputs.

The proposed DaCoTA pilot system (<http://safetyknowsys.swov.nl>) can serve as example for the further enhancement of the European Road Safety Observatory (ERSO), as new structures and features were tested during the development procedure and new data and knowledge have been assembled and have become available for incorporation into the existing ERSO.

ANNEX

The DaCoTA System at: <http://safetyknowsys.swov.nl/Home/about.html>