Road Safety Data, Collection, Transfer and Analysis

Deliverable No.2.1 Report on purpose of in-depth data and the shape of the new EU-infrastructure

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EXECUTIVE SUMMARY

DaCoTA is a Collaborative Project (ICP) developed as part of the European Commission's 7th Framework Programme. Within DaCoTA, Work Package 2 (WP 2) is tasked with formulating a common methodology for research accident investigation and identifying and training new research teams across Europe.

The main goal for Work Package 2 is to harmonize in-depth crash investigation protocols and, at an EU level, identify and train crash investigation teams who will prepare for investigations according to these harmonized protocols. The DaCoTA project is aware of the need for in-depth accident data across Europe to help inform policy and industry alike. In 2009 35,000 people died on Europe's roads and although this is 36% lower than recorded road fatalities in 2001, it is still below the target set of a 50% reduction by 2010. With continued and expanded collection of in-depth data across Europe the research outputs and evidence collected will support road safety strategies towards a continued reduction in causality figures.

This report outlines the work conducted by WP 2 in reviewing current and future data needs by the EC and stakeholders, current practices and uses for the in-depth data and an outline of the methodology to be adopted by new investigation teams and an approach which can co-exist with existing research investigation teams.

Currently across Europe the collection and use of in-depth data is largely on an individual member state basis. A number of which have long running collection activities collecting highly detailed information which they use for local policy decisions and the research outputs are routinely used for industry related questions. On a European level the SafetyNet databases developed for Fatal Accidents and Accident Causation can give robust conclusions on the causes and consequences of accidents, this data however contains data from 7 member states only. In-depth (or microscopic) databases are usually small datasets pertaining to highly detailed and accurate accident data records. In contrast to this, macroscopic databases which are populated by national accident reporting systems such as the CARE database, have large accident numbers at a more general level of detail, which can indicate problem areas but cannot address the true cause of accidents.

The WP 2 partners reviewed existing EU and national projects in order to achieve a greater understanding of data needs, current practices, methods used and potential obstacles new investigation teams would face as they began data collection in their country.

Obstacles: A number of obstacles were identified that not only effect new teams but may also effect long running established teams as they increase their scope and integrate with a European system. It was deemed useful if experiences, including anecdotal solutions to the obstacles were listed by the partners for the idea of solving any potential issues for new teams. The obstacles cover all aspects of the investigation process from access to the accident site, ethical approval to the equipment used.

Sampling: Consideration was given to the sampling methods that should be adopted by a common European investigation programme. A theoretical approach was first discussed looking at the merits of different sample methods. Due to it not being practical or feasible to collect data relating to all accidents across Europe, it was decided by WP 2 that the desired sample method would be a random sample of accident types. However the sample area should be representative of the national accident population with the ultimate goal of collectively being representative of the European accident population.

Exposure Data: It is widely recognised that accurately collected exposure data allows for accident data to put into context and normalize any observations made of the data. Exposure data allows accurate risk modelling of driver behaviour and validates representativeness of the data by the driving population. Exposure data collection techniques are not widely applied to in-depth accident research studies due to the significant associated cost in resources and man power. Generally for in-depth-data accidents are compared against each other to review causes and consequences, although as the frequency of naturalistic driving (ND) and Field operational test (FOT) studies increase a link could be made between the two sets of data as control cases/parameters.

Consultations: A number of consultations with key stakeholders (EC, industry. national administrations and the research community) were conducted to understand current and future data needs. The aim of this activity was to ensure the proposed methodology would be of use to the stakeholders for research purposes, policy formulation and improving road safety. This provided input on what should be the minimum requirement for a case, the disciplines required as part of the investigation, and the basic skill-set required by an investigation team.

The consultation with the stakeholders provided support for continued in-depth data collection and its requirement for the future. A number of key research areas were identified covering driver behaviour, driving under the influence of alcohol or substances, intelligent vehicle technologies and road infrastructure design. Identifying causes of accidents especially focussing on countries with high road fatality rates and comparing with other countries for ways to improve road safety was a common theme in the consultations. The consultation with the national administrations reported a strong willingness to work with the DaCoTA project to establish new teams across Europe in the different member states.

Research Questions: The partners of WP 2 produced a matrix of research questions that were rated due to their complexity and the type of data required to answer. These were then prioritised by the partnership to questions of current and future interest, giving a list of 30 research questions/topics of which 80% could be answered with robust conclusion by in-depth data. The remaining 20% of the questions could mainly be answered by in-depth data but to achieve robust conclusions a multifaceted approach would be needed, for example including laboratory testing to verify results from real world data with repeatable tests.

The work done in WP 2 has identified a number of benefits that in-depth investigations provide from an increased knowledge of the causes of accidents, injury prevention and assessment evaluation to name a few. This type of data has been invaluable to many member states across Europe for the past few decades and to open this market to the wider European member states will only increase the knowledge base and transfer between EU countries. This will help facilitate the development of effective countermeasures and help to make Europe a competitive force on a global level for industry and road safety strategies.

By establishing the level of data required to answer the current and future research questions the WP 2 partnership is recommending a methodology where all teams will follow an on-scene data collection methodology, attending the scene soon after the accident but certainly within 1 hour of its occurrence. Although new teams will be able to follow a retrospective methodology whilst training and during the team implementation phase, building the desired skill set for the investigators and overcome any obstacles.

The protocols and data variables to be collected by the teams will also allow a training period. A two tier system of core level data and full data collection will be run concurrently. All teams will collect core level data but new or lesser experienced teams will not have to perform full data collection until their investigators are competent or the desired on-scene method is achievable. All teams will work towards achieving full data collection.

A number of potential organisations have been identified and countries of interest to the project and stakeholders, the next stage for WP 2 is to continue discussions with the interested organisations to establish teams for the planned training sessions to be held next year (2011).

TERMS AND DEFINITIONS

Accident scene	The area of a traffic accident before the vehicles and people involved have left [ISO 12353–1:2002].
Accident site	The geographic location of the accident scene (note: the accident site may be given as exact coordinates or in a less detailed way) [ISO 12353–1:2002].
CARE	Community database on Accidents on the Roads in Europe
Case	A case is a separate accident (could also be a multiple accident) that has been chosen for investigation and analysis. A case is opened the moment an accident has been chosen for investigation. Each crash investigation is treated as a case.
Crash investigation	Acquisition of factual information regarding an accident (note: can include on-scene elements, elements recorded retrospectively, or both of these) [ISO 12353–1:2002].
Data collection	Objective data collected on-scene, retrospectively or data retrieved from other sources. Data collection also includes subjective information, such as interviews.
ERSO	European Road Safety Observatory
GIDAS	German in-Depth-Accident Study
HMI	Human Machine Interface
In-depth data	Detailed (or microscopic) data collected by a team of multidisciplinary crash investigators
Infrastructure	An underlying basis or structure for an organisation or process. For purposes of D2.1, “the new EU infrastructure” refers to the proposed new pan-European network for making in-depth crash investigations.
INTACT	Swedish in-depth accident study
Investigator	A person with expert knowledge in one or more areas of crash investigation
On-scene (crash) investigation	Crash investigation conducted at the accident scene with the purpose of collecting on-scene information before physical evidence (e.g. the vehicles involved) has been removed [ISO 12353–1:2002].
OTS	On-The-Spot accident research project (UK)
Retrospective (crash) investigation	A complete crash investigation conducted retrospectively, i.e. no on-scene investigation is conducted.
Retrospective inspection	When an on-scene crash investigation has been conducted, retrospective inspections of vehicles or infrastructure may be conducted.
Road Infrastructure	All aspects relating to the road construction and road environment. Including roadside furniture, signage, traffic systems, lighting, etc.
VRU (s)	Vulnerable Road User(s)

1. INTRODUCTION

In 2008 over 39,000 people were killed on the roads of the European Union and over 1,700,000 people injured. In addition to the impact of human pain and suffering the economic impact of these fatalities is also considerable, having been estimated at €160,000 million [1] for EU-15. The reduction of fatalities and injuries is now a priority for national and EU policy makers and the European Commission [2] has adopted a target to reduce fatalities by 50% by the year 2010 compared to the year 2000 baseline.

In 2009, 35 000 people died in road accidents across the European Union – 36% less than in 2001, when the commission first set its target of cutting the annual death rate by 50%. A means to further ameliorate this trend relies on a better and more precise understanding of accident configurations and accident causation, allowing for the proposal and implementation of targeted, more efficient road safety measures; an objective which can be reached with the help of a common European in-depth accident database supported by an accident investigation infrastructure which will be able to gather the necessary data.

As part of the DaCoTA project (http://www.dacota-project.eu/index.html) which is a Collaborative Project (CP) developed as part of the European Commission's 7th Framework programme, Work Package 2 (WP 2) is tasked with formulating a common methodology for research accident investigation and identifying and training new research teams across Europe.

The main goals for WP2 are to identify research priorities requiring in-depth data, harmonize in-depth crash investigation protocols at an EU level, and identify and train crash investigation teams who will prepare to make investigations according to these harmonized protocols. The DaCoTA project is aware of the need for in-depth accident data across Europe to help inform the EC, member states and industry when considering effective safety strategies that are able to reduce road casualties across Europe.

1.1. Background

All EU member states gather road accident data, mainly at a macroscopic level, in order to provide basic information on the national road safety level, this data is recorded both in national databases and in the EC CARE [3] database. Some Member States gather additional information about the causes of accidents and injuries while others may record other safety information to support the interpretation of the evolution of road safety measures. Countries with an established road and vehicle safety information system include for example the UK, Sweden, Germany and the Netherlands. The lack of uniform road safety data provision is greatest at EU level where the only consistent data is available within CARE and EUROSTAT which does not record detailed accident data.

1.2. Objective and aim

The objective of this report was to identify research priorities; identify research questions and policy issues currently required by the EC that need to be addressed through future analyses of the data collected from detailed accident investigations.

The aim of this deliverable was to:

- To review the EC's and other stakeholders' research priorities and to propose the gathering of new information that may assist in the shaping of future policies.
- To overview data from the ERSO which will help to define future EC data collection priorities.
- To set the purpose of detailed accident investigations to be carried out in future studies.
- To determine the basic data that will be collected in future accident data collection projects.
- To define the framework of the accident investigation protocols that will be needed.

2. EXISTING DATA AND EXPERIENCE

To find out what data will finally be collected in the DaCoTA pilot study, a first step was to find out what has previously been collected in other EU-projects. Generally speaking, accident data collection can either be performed at a macroscopic level or at a microscopic level; see Figure 1. Macroscopic data is mainly established by police services and information about an accident could consist of ~50-100 variables. The macroscopic data can for example be used to obtain national statistics, monitor accident trends or identifying black spots. Microscopic data on the other hand is far more detailed and normally information about an accident consists of more than 500 variables. This data are multi-disciplinary in nature and most often collected by research institutes, hospitals, insurance companies, private companies and authorities. Microscopic data can for example be used for active and passive vehicle safety system development, road infrastructure improvements and policy making.

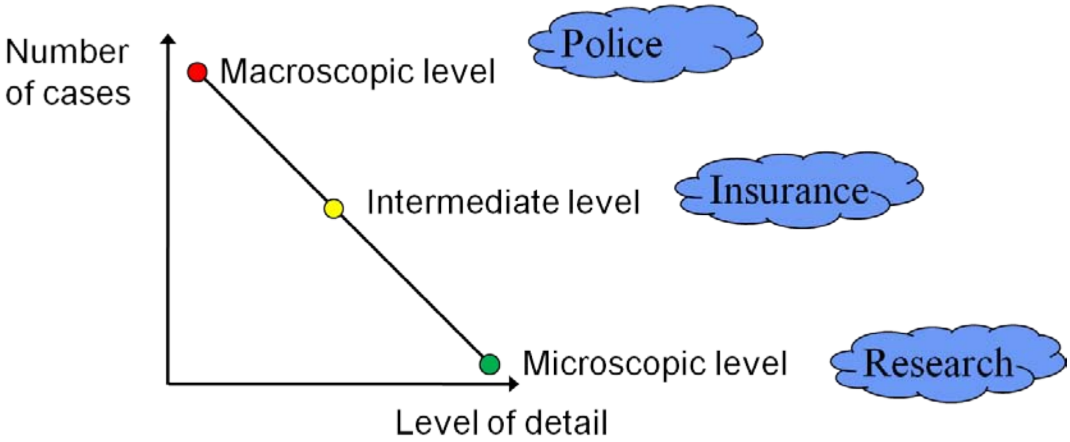

Figure 1 Number of cases and level of detail in macroscopic and microscopic data respectively.

Moreover, existing protocols from ongoing and finished EU and national projects have been reviewed to identify what collection methods are used and at which depth information is collected. Reports from all previous and existing EU projects that might have analysed accident data have also been studied searching for comments about what data has been used or what data was missing to be able to perform the desired analysis.

2.1. Macroscopic data

In Europe, the main source of macroscopic road safety data is the European Road Safety Observatory (ERSO). At the ERSO web-site (www.erso.eu) several overview documents of accident data are available. The annual statistical report (2008) gives an overview of all figures (e.g. trends of the fatalities 1991 – 2006 in the European countries, or the number of moped fatalities per age group) and the basic fact sheets address a number of specific issues (like young drivers, pedestrians, junctions, etc.).

The main variables that are analysed in the statistical reports and basic factsheets are road user variables (road user type, age, gender, and driver vs. passenger), location/road infrastructure variables (motorway, urban vs. rural, cross-roads vs. section) and time variables (year, month, day of the week, and time of day). There are also some variables concerning the conditions (weather, light) in which the accidents occurred.

Basic fact sheets are available and summarize the most important results from these macroscopic data for different road user groups (children, young people, elderly; pedestrians, bicycles, motorcycles & mopeds, car occupants, heavy good vehicles) as well as for different accident environments (motorways, urban areas, junctions).

Another important feature of these statistical reports is the lack of comparable injury data among the EU countries. As such only fatalities are included in the analyses. Therefore, although the utility of fatality data is out of question, the data included in the ERSO website fails to describe the whole picture of the burden that road traffic crashes imposed on the European Union.

2.1.1. Main figures from basic factsheets

Throughout the European Union (EU 25) the number of fatalities decreased by 30% between 1997 and 2006. Fatality rates (fatalities per million inhabitants) tend to be lower in the north than in the south and in the west than in the east.

The number of fatalities peaks for the age group 20-24 and then decreases almost continuously. While in 1997 there was a small increase for the 60 to 74 year olds, this bump has shifted in 2006 to 70 to 79 year olds (i.e. it seems to concern the same generation). 77% of the fatalities are male, with the strongest gender-imbalance between 20 and 45. For female fatalities there is an increased share of car-passengers and of pedestrians.

In all European countries (except Malta) the fatal accident statistics are dominated by rural roads with a much smaller proportion of fatalities on urban roads and only minor shares of fatalities on motorways (Greece sticks out with 38% of the fatalities on the motorways).

Fatalities peak during the day around 18:00 hours. In the weekends this peak around 18:00 hours is even higher than at weekdays. Throughout the year, fatalities peak in the vacation months (June to August). For pedestrians, this is the other way round (low in the summer, peak in December).

When reading the basic fact sheets it is important to keep in mind that they do not incorporate much information about exposure (except for population numbers and road network length). This means that a higher number of accidents for a particular group (e.g., cyclists), or a particular situation (e.g., junctions) could either be due to a higher risk or to a higher exposure.

2.1.2. Synthesis of the analyses

In the analyses presented in the basic fact sheets a number of problematic clusters can be seen, which in the following will be treated one by one.

Generally *rural roads* are problematic and this is especially so for weekends, nights, and in particular *weekend-nights*. For *young drivers*, who are the group with the highest incidence of fatalities, this cluster is especially relevant. All this is sufficiently known and has received a lot of attention in research [4-6].

A question with respect to ***young drivers*** that has not received so much attention yet is the relation between age of the driver and car-safety. Traditionally young drivers drove old cars which are less safe than new cars. It would be good to disentangle the components for the high risk of youngsters: *Lack of experience*, *lack of safety oriented attitude* and *lack of protection* in an accident. Furthermore it would be good to know whether it would be worth to strive for newer (and thus safer) cars for novice drivers. On the one hand, that would seem important as the lack of experience makes the beginning drivers the group most in need of protection. On the other hand, novice drivers (being young) might also show a lack of safety-attitude (SARTRE) and there could consequently be a problem with *risk-compensation*. These are questions that cannot be addressed on the basis of macroscopic data, because they require precise knowledge of the driving experience, interview data, and information concerning the vehicle age, condition and the presence of safety systems. These questions could be answered on the basis of in-depth data if it is accompanied by information of the occurrence of these factors in non-accident samples and also by exposure data for the relevant age groups.

With respect to the distribution across the year, the ***vacation months*** (June, July and August) are problematic. This does not concern young drivers in particular but is (more or less) the same for all age groups. The summer high fatality rate applies to rural roads more than to urban roads (for motorways it is unclear though) and to motorcyclists more than to other road users. The trend observed for pedestrians is exactly the other way around. For this peak in the summer months, it would be good to disentangle the possible causes in a more appropriate way, i.e. using relevant exposure data, but in a different way for motorcyclists (and bicyclists) than for car occupants.

For *car-occupants* the exposure during the summer is lower, because the reduction of commuting due to vacations. This means that for car occupants the *risk* per kilometre travelled most likely *increases in the summer*. This could be a consequence of the emptier roads (drivers might speed on places where they are in a traffic jam otherwise), it could be due to less experienced driving: people who do not go to work by car otherwise might do so during the vacation months because of the emptier roads. And of course it could be due to the particularities of vacation-drives. On vacation, people might drive in situations and places that are unknown to them. Additionally, the vehicles might carry more passengers, meaning that more persons are at risk during an accident and, moreover, distraction by passengers could form a problem. The drives are longer and therefore fatigue can play a bigger role. Macroscopic data are not sufficient to investigate all these possibilities in summer-accidents with cars. It would be important to know more about causal factors that are specific to the summer accidents. For example it should be investigated whether fatigue is more frequently listed as causal factor for accidents in the vacation period than for others throughout the year (suggesting that long drives are a problem) or misjudgements (pointing to a problem with less experienced driving) or inadequate speed. This information could form the basis for e.g. education and enforcement campaigns and development of new driver assisting technologies.

Motorcyclists have a much stronger seasonal variation in fatalities than car occupants. There are simply more motorcyclists on the road when the weather is fine so the *increased number of fatalities is probably due to an increased number of kilometres driven*. It would be good to know the monthly kilometres driven for motorcyclists, which can determine the actual risk per month. There seems to be an issue with riders who pick up motorcycling after substantial breaks. On the one hand does the lack of practice have consequences on the accident risk for people who start riding in the spring after the *winter break.* On the other hand there are large numbers of older riders in the fatality statistics, many of whom have probably not driven continuously since their late teens/early twenties. For these *(re-)starting older motorcyclists* it would be important to know how they could be prepared better as to reduce the dangers of inexperienced riding. Macroscopic data cannot give the necessary details to form the basis for advice for the re-starters. Another problem specific to motorcyclists seems to concern *junctions*. This might have to do with visibility and data from on-the-spot investigations are necessary to map out the contributing factors to these accidents.

Another problematic cluster concerns ***elderly pedestrians***. They are much more endangered in urban areas and during the morning hours. This seems to be an induced exposure problem. However, there are many more pedestrian fatalities in the winter and *half of the pedestrian fatalities occurred when it was dark*. Visibility seems to be a problem here and it would be good to know more about it. Is it only the pedestrians that are not visible enough, or also the opponent? In-depth data from pedestrian accidents would help to find the thorough aetiology of the problems, and by so guide towards the most effective countermeasures.

Finally, for fatalities among *bicyclists* and *moped users* there is also an overrepresentation in urban areas and at junctions, but no particular high rate of fatalities in the darkness. Visibility could be a problem, but probably in a different way than for pedestrians. It could rather have to do with heavy goods vehicles (*HGVs)* who also have an increased share of urban-area accidents. It would therefore be interesting to compare the causal factors for the fatalities under three groups of vulnerable road users: pedestrians, bicyclists, and moped users. The macroscopic data available are not sufficient for this and on-the-spot investigations for these three groups are needed.

2.1.3. Conclusion on macroscopic data

The clear advantage of macroscopic data is that they are available for the majority of the accidents in almost all European countries. They usually have been collected consistently over a large number of years, so that they allow comparisons across countries and monitoring of the trends. Macroscopic data are therefore very important to identify problems. Together with exposure data it can also serve to identify high-risk groups and high-risk situations.

In the examples above, we have however seen that macroscopic data are not sufficient as a basis for the development of countermeasures. In that case detailed information on the possible causes of the accidents is necessary for the potential fields for countermeasures behaviour, road infrastructure and vehicles).

2.2. Microscopic data

Since the mid 1990's a number of EU projects including STAIRS, PENDENT, RISER, MAIDS, ETAC and SafetyNet, have been commissioned to collect and devise methods to unify European data collection activities. This would then provide an in-depth database of comparable accidents allowing wide scale analysis and ultimately improving the understanding of the EU accident population. The DaCoTA project aims to continue this process by increasing the number of European investigation teams who supply accident data for these projects.

Currently in Europe the main source of microscopic European data are the results of the SafetyNet project. This project produced two in-depth databases, a fatal accident database with 1,296 fatal accidents which occurred between 2003 and 2004, investigated by 7 EU member states. Secondly, accident causation database with 1,006 accidents investigated between 2005 and 2008 by 6 EU member states. All investigations were conducted using a common methodology and collected key variables pertaining to the accident vehicle, road user information, injury data, causation analysis and highway and road infrastructure features. A number of reports with analyses and results from the SafetyNet project are available on the projects website (http://erso.swov.nl/safetynet/content/safetynet.htm)

Across Europe a number of member states have ongoing activities collecting microscopic data and the results are regularly used to inform road safety policy, vehicle design, improve road infrastructure design, new vehicle technology development and assessment and providing evidence based accident scenarios for testing of new safety systems for road and vehicle safety. Microscopic data is an ideal method to identify and evaluate human factor issues related to real world accidents and potential Human Machine Interface (HMI) issues faced by road users.

The advantage of this data source is the high level of detail known about each accident and how this can be related to a number of outcomes. Microscopic data is usually collected by independent research teams with a strict methodology collecting key variables pertaining to the accident, vehicle, road user, injury data, interview information, road infrastructure and scene information, accident reconstructions and accident causation analysis all of which is collected and analysed by experienced investigators.

The data collected by the in-depth collection activities is independent and transparent, as opposed to the national reporting systems which are generally based on judicial investigations, although these will be impartial investigations they will often be collected with ‘vehicle to blame’ in mind. In-depth accident data collected by the researchers is aimed at the cause of the accident, not who was to blame.

2.2.1. Sample results from European In-depth data (SafetyNet)

The variables collected in the SafetyNet project allowed for detailed analysis reviewing causative factors, pre-impact movement of the vehicles and basic injury causation analysis. The main limitation of this data was insufficient reconstruction evidence, vehicle damage information and detailed injury data.

Fatal Accident Data

The fatal database contains 1,296 accidents involving 1,449 fatally injured road users from the 7 EU member states; Finland, France, Germany, Italy, Netherlands, Sweden and the UK. The total number of fatally injured road users represented 3% of the total population of fatally injured road users in the participating countries during the data collection period. These accidents were investigated retrospectively by reviewing police accident reports and available evidence to the accident.

A summary of results relating to fatal pedestrian accidents is given below, only some points are raised here, the SafetyNet project collected over 500 variables from general make and model of vehicle to pre impact movement and travel speed. The complete SafetyNet accident dataset can be used to formulate robust accident groups or scenarios for further analysis.

Pedestrian accidents

Pedestrians represent the third largest group in the SafetyNet fatal accident dataset, but account for nearly one fifth of the total fatalities recorded. The distribution of age and gender for the pedestrian fatalities showed that males accounted for nearly two thirds (64%) of the sample and the sample was skewed to the elderly with the vast majority being over the age of 60 years old. A small minority (10%) of fatalities were under the age of 30.

Approximately one third of all pedestrians included in this sample died at the scene of the accident. Nearly two thirds of all the pedestrian accidents occurred away from junctions with approximately three quarters in areas controlled by speed limits up to 50km/h. This speed limit banding indicates that, unsurprisingly, urban areas are more common for fatal pedestrian accidents.

The data can be used to identify common accident situations for certain road user groups which result in a fatal accident. For example, an elderly male pedestrian crossing an urban road which has a speed limit of 50 km/h not close to a junction. The pedestrian is in a collision with a car (travelling at the speed limit). For emergency services this highlights the importance of getting the pedestrians to hospital quickly as ~30% of the pedestrians died at scene.

Accident Causation Data

Accidents were investigated using mainly an on-scene methodology; data was collected relating to the vehicle, road environment, human (including interview) and accident causation. A number of analyses have been conducted on the data; an example summary is given below;

Vehicle leaving lane accidents

In this analysis 354 vehicles had been classified as leaving their own lane prior to impact either intentionally (e.g. overtaking manoeuvre) or unintentionally (e.g. loss of control), the vehicle distribution for the accident group was mainly cars with 77%. The majority were single vehicle accidents (67%) which collided with roadside objects; accidents involving 2 vehicles represented 27% of the accident population and 6% of the accidents involved more than 2 vehicles. Most of the accidents occurred on rural roads (59%) with an average pre impact speed and road speed limits of 82 km/h and 80 km/h respectively. The accident category had a large proportion of younger drivers with 120 (34%) drivers being under 25 years old. The majority of the accidents occurred during the day between 06:00 hrs and 17:59 hrs (~70%). The two main critical causation events were found to be surplus speed (29%) and incorrect direction (46%) of the accidents. These were primarily linked to causative factors such as observation, distraction, planning issues, fatigue, inattention and influence of substances.

Formulating a “typical” accident situation for the accident group “leaving lane accidents” would be represented by a single vehicle accident with a young (under 25 years old) male driver, drifting out of their lane, at a speed of ~82 km/h, during the day on a rural road. Typical accident causation factors include missed observation, driver distraction and fatigue issues. The causation factor driving whilst under the influence of substances (alcohol or drugs) also featured in a small proportion of the accidents.

2.2.2. Common uses of microscopic data

Road safety constantly presents new issues and challenges that require the latest in-depth data to support potentially life-saving research. The following examples indicate how in-depth data is used in member state countries with existing in-depth projects. If a continued European in-depth project was established using a uniform data collection methodology, then similar results and uses would be expected giving the picture for the European accident population.

Vehicle design and crashworthiness

Vehicle technology is a particularly fast paced area of change, the implications of which are not yet fully understood. The effectiveness and real world limits of new safety systems must be evaluated, alongside any unintended consequences, such as undesirable changes in driver behaviour and false activations of any system.

Eco-vehicles are expected to increase in popularity over the coming years. In-depth investigation will continue to support the evaluation of potential safety issues such as high impact outcomes on hydrogen fuel cells and the effects of reduced vehicle noise on pedestrian and cyclist hazard awareness.

Laboratory crash testing with crash test dummies and computer simulation of crashes are part of crashworthiness design, however, dummies can only approximate the injury outcome for real occupants in a limited number of crash types. Computer simulation can assess a wider range of crash types but, like most virtual tools, it requires accurate data inputs to produce accurate results. Only real world in-depth studies can provide this information to the level of accuracy required and varied accident scenarios and configurations.

Policy and legislation

Predicting the effects of changes in policy, such as the proposed reduction in the drink-drive limit in the UK, requires detailed understanding of the collisions occurring when driving under influence. In-depth data reports on alcohol related collisions where road users were shown to be within current limits whereas police collected national data will refer to only illegal levels of intoxication.

In-depth data was instrumental in developing a number of the EU directives (using UK in-depth data), two examples are;

1. Frontal impact directive 96/79/EC. Vehicle structural and restraint improvements, this test has greatly improved frontal impact safety. Leading to a reduction in passenger compartment intrusion and reducing injury risk for front seat occupant heads, chest and lower extremities.
2. Side impact directive 96/27/EC. Vehicle structural and restraint improvements due to this test have greatly improved side impact safety, leading to a reduction in serious head and chest injuries.

Child occupant safety

The detailed examination of child restraint performance and child injuries in road accidents has provided data for the design and validation of a new family of child crash test dummies, as well as information for child seat manufacturers to improve their products in terms of both safety and usability. In-depth data collection activities strengthened the evidence base for new child seat laws and in the future will monitor the success of these laws and inform updated child restraint regulations.

Road Infrastructure

In-depth data can aid in the identification of localised problem sites or traffic systems**.** Benefit is provided by the added detail about accidents occurring on the road network, which ordinarily would not be reported in the national reporting system. This increases the level of understanding of the causes of accidents at these sites. This gives the potential for the implementation of effective countermeasures to reduce the likelihood of future crashes occurring perhaps at a higher severity.

Increased injury risk of impacts with roadside objects can be considered when detailed information is recorded relating to the road infrastructure features. For instance run-off road accidents are still one of the main types of accidents which occur in Europe, many of which involve impacts with roadside objects (according to EuroRAP). As part of in-depth data collection, specific details of the struck object and its location (e.g. distance from roadside) and the vehicle damage are recorded. This in-depth data can be used to identify which specific types of roadside objects are still contributing to serious and fatal injuries in road accidents and why the serious/fatal injuries are occurring.

2.3. Overview of existing protocols

Protocols from EU and national projects that have performed road accident investigations (SafetyNet, ETAC, RISER, MAIDS, PENDANT, CHILD, CASPER, CARE, EACS, ECBOS, INTACT, GIDAS, OTS, CCIS, EDA, VALT, FICA, CHICC and SWOV) were reviewed to see what has previously been collected. Variable areas and groups were taken from the Swedish project INTACT to see whether these variable groups correspond to what has been collected in other projects. The existing INTACT variables have been used as the base line as the INTACT consortium has offered its database to the DaCoTA project for existing and future research projects. For every group of variables it was checked whether the projects collect basic or detailed information within that area. It was seen that the other National in-depth accident investigation projects like GIDAS in Germany and OTS in the UK collect information within the same areas. In addition to what is collected in the INTACT project other projects also had categories specifically for motorcycles which are not handled in that much detail in INTACT. The result of the comparison can be seen in Appendix 1.

2.4. Data needs in previous projects

A review of 176 EU projects in which in-depth accident data might have been used was performed to find out what kind of accident data has been used and if any data was missing or limitations affecting the desired analysis. This was performed firstly by the work partners creating a list of in-depth studies they were aware of; this was then supplemented by a detailed search of the European road Safety Observatory website.

The most common thing that was found missing in the projects was a larger and more representative database that collects detailed accurate data over a longer period of time. The data collection systems of the existing databases in Europe are not homogenous which makes it difficult to match cases and make meaningful comparisons and predictions. More specific suggestions of further work are to collect more data from accidents involving vulnerable road users (VRUs) with particular focus on pedestrians and motorcyclists, more specifically relating to anthropometric data, protection and reconstruction evidence such as pre impact movement and speed.

There is a desire for an increased level of on-scene information including non injury accidents and accident causation analysis is required to help with the formulation of countermeasures. A belief shared by a number of projects was that an under-reporting of certain accident types and causation factors had effected and limited the final outcomes of the projects. An increased level of information regarding driving under the influence of alcohol or substances and their effects, previously data relating to these issues have been limited due to ethical and judicial complications. There is also a wish for exposure data and large scale national statistics to normalize the observations seen in the accident data. One project listed data ownership as a limitation which complicated the dissemination and exploitation of the final project results. They cited that due to the complexity of the legal organisational frameworks of the international partners in the consortium it was unclear what could be released regarding the data and who owned the results. Therefore a clear robust consortium agreement and statement of principles detailing what can and cannot be released in terms of data and research outputs should be established at the start of any project.

2.5. Obstacles

To have a clear picture of what type of obstacles could be encountered in initiating safety oriented crash investigation activities (see SafetyNet D4.5 [7] for a definition) throughout the European Union, all 10 DaCoTA WP2 partners drafted a list of obstacles they have encountered or expect to encounter in setting up a crash investigation team. The 10 WP2 partners all have experience in either working on national in-depth projects or from European in-depth studies. Some of these obstacles have been overcome while others are still not solved in all DaCoTA WP2 member countries. It is reasonable to assume that the countries that will be included in the network and the teams that will therefore be taking part in the investigation activities are in national and local contexts close to the situations familiar to the DaCoTA WP2 partners.

In Northern and Western Europe this national and local context is probably favourable or very favourable for the quick take-off of safety oriented accident investigation activities. It is quite possible that there are already investigation teams in activity in those countries. It might be that their main problems concern the status of the investigation team, that of the investigations and of the subsequent data. While the lack of a legal backbone certainly is an issue that must be tackled, the answers in such cases are primarily national and will come well after the lifetime of the DaCoTA project.

The safety oriented crash investigations must therefore be initiated within the actual legal framework and an acceptable *modus Vivendi* must be found. The way some of the DaCoTA WP2 partners have succeeded in doing this can provide useful examples for the future crash investigation network teams.

In Southern, middle or Eastern Europe the existing safety investigation capacities could be more limited. In such cases, the primary efforts may have to be geared towards the enhancement of operational capacity to conduct safety oriented crash investigations. Perhaps the lack of established investigation activities could be handled, in the short term, much in the way the shortage of trained crash investigators was overcome in Italy for the SafetyNet WP5 investigations (Persia, 2008, presentation at the SafetyNet Rome conference [8]).

The following examples should therefore be taken as solutions that have been found in particular national or local contexts. They do not necessarily indicate what could be thought of as being "good practice". All the WP 2 partners contributed to this activity proposing obstacles and solutions the information given in the table below also identifies the partner offering the information. (BE-Belgium, DE-Germany, ES-Spain, FR-France, NL-Netherlands, SE-Sweden and UK-United Kingdom)

Table 1 Obstacles for setting up crash investigation activities listed by the DaCoTA WP2 partners.

Nature of obstacle	**Relevance (stops all investigation activity / stops a particular case investigation)**	**Countermeasures** **(implemented or proposed)**
Access to accident site	We are not authorized to enter the location of the accident. Furthermore, the police are obliged to release the accident location as soon as possible. So we have to depend on their goodwill to let us investigate	Legislation (BE)

	after their investigation is completed. (BE) No problems for retrospective in-depth investigations but it can be a problem for on-scene because police do not like many people around. (ES) If access is generally denied (e.g. by Police) then stops **all** investigation (DE) Stops a particular case investigation (FR) stops a particular case investigation (SE) Stops on-scene activity Prevents from starting **Disrupts programme** in middle (UK)	The Ministry responsible for the Police and Head of Police must be convinced of the need of independent scientific accident investigation. Also: Conduct Information-event for Police officers showing the benefit of independent scientific accident investigation. This could be done repeatedly (e.g. annually) (DE) Develop good relationships with police, rescue service and emergency service at hospital… Never completely stop the investigation activity, always keep contacts with police and rescue service… Inrets is allowed by the law to access police reports for accident research. We sometimes use this fact as an argument to justify our presence on the accident scene… (FR) No law, dependent on the person in charge at scene. We ask friendly for permission to be there every time, never a problem. (SE) Consent from Police/local authority (UK)
Data protection	If the researchers become aware of certain offenses, they are obliged to report this to the legal authorities (BE) **Might be a problem** (NL)	Legislation (BE) Ask for written consent from the Ministry of Justice (NL)

		In Spain we have to fulfil the specific law for protecting personal data. (ES)
	Stops **all** investigation (DE)	Accident investigation and Data storage can only be accomplished to a level which meets the local laws on Data protection. A briefing on data protection laws and on the consequences on breaking these laws of individual researchers by the Public Prosecution authority can give access to data which is not available to the public. An accident research unit being under the organisation of a hospital meets medical confidentiality laws and allows for access to medical information also from other hospitals. (DE)
	stops **all** investigation activity (FR)	Information contained in in-depth Inrets database is considered as "indirectly nominative"—Need the approval of the Data Inspection Organisation (CNIL) (FR)
	stops **all** investigation activity (SE)	Research has specific privilege in Sweden. (SE) Agreements with relevant bodies on regional basis Avoid use of personal information on case-files Secure storage of case information
	May stop part or whole element of data collection (UK)	Secure data storage and transfer (electronic) (UK)
Ethical approval	**Might be a problem** (1) (NL)	Ask for written consent from the Ministry of Health/Justice (NL)

	stops **all** investigation activity (FR) (If the CNIL's approval is suppressed) stops **all** investigation activity (SE) Prevent collection of certain forms of information e.g. medical information (UK)	Be careful to respect the commitments of data protection taken during the establishment of the approval request to the CNIL: confidentiality, access, computer security, use (FR) Project needs an approval from ethics committee. (SE) Gained regional health authority permission and approval to collect anonymous injury data Plus local approval from each site Institute approval Crash participant approval (UK)
Data ownership and use	**All the gathered information (interviews, investigation of the vehicles…) can be confiscated**. (BE) **Might be a problem** (NL)	Legislation (BE) Ask for written consent from the Ministry of Justice (NL) In DGT case, we would be the owners and the use would be for statistic and research in road safety. (ES) Also controlled by the CNIL (see above). Inrets is the owner of the database and access can be opened to researchers only for working in the field of road safety and public health Justice could also access our data only on the requirements of the public prosecutor—Always try to be as far as possible from legal proceedings. The investigators (psychologist) commit to the fact that the data communicated by the involved persons are not used in purposes of police (FR)

	stops **all** investigation activity (SE) Prevents data sharing and analysis (UK)	By law, all registers including personal information need approval from the Data Inspection Board and therefore needs a responsible authority/organisation. (SE) Gain agreement with funding body for sharing of data in accordance to UK data protection law (UK)
Access to judicial data	We are not authorized to study the legal documents (BE) **Might be a problem** (NL) Main obstacle for in-depth investigations. All fatal and some serious road crashes are investigated by courts so we need permission for these. (ES) May stop particular cases if judicial data is needed for special studies. (DE) stops **all** investigation activity (FR) stops **all** investigation activity (SE) Prevent collection of police accident reports (UK)	Legislation (BE) Ask for written consent from the Ministry of Justice (NL) We are trying to reach an agreement with courts to make in-depth road crash investigation in Spain. (ES) A briefing on data protection laws and on the consequences on breaking these laws of individual researchers by the Public Prosecution authority can give access to judicial data e.g. from the Public Prosecution office. (DE) Inrets is allowed by law to access to the police report to do our investigation on accident (FR) Latent problem. If the court would ask for information in each case we would stop our activity. (SE) Formal agreement with police forces – building and maintaining good working relations and trust over time (UK)
Investigator status	Researchers can be called to witness in a court of law. (BE)	Legislation (BE)

	Due to work overload and lack of time, some cases might not be investigated (NL)	Hiring part-time/stand-by technical staff, or students with technical background (NL)
Notification	Might be a problem (NL) Stops **all** investigation activity (DE) stops **nearly all** investigation activity (FR) stops **all** investigation activity (SE) Prevent **all** investigations (UK)	Continuous follow up with the notification authorities (NL) It needs to be established. (ES) Especially for on-scene investigation an immediate notification is most important. An immediate, automatic notification by the rescue services or Police is desirable. Or else listening to the police/rescue radio should be permitted in conjunction with a communication to Police/Rescue service for further inquires. (DE) Ask each day or week to all rescue station of our investigation area to call us (FR) In Sweden notifications can be purchased from the Emergency services (SE) Formal agreement with police forces (UK)
Need to clear the accident site	It is always a problem (NL) Partially stops activities of particular cases. (DE)	Combined on-scene and retrospective analysis (NL) Try to be fast but in certain cases it would be possible to ask them to delay their work for a while (ES) Have a fixed sequence for on-scene research activities concerning the collection of data: Take pictures and measures of non

	stops a particular case investigation (SE) Reduce quality and completeness of cases Forces teams to rush through investigation (UK)	permanent traces first. Permanent information like vehicle damages may be collected retrospectively after the accident site has been cleared. (DE) Try to be fast and in certain cases ask them to delay their work a couple of minutes. (SE) Requires follow-up investigations (additional funding) Can be mitigated by close working relations with police and recovery firms for extended access (UK)
Funding	**It is a major problem** (NL) stops **all** investigation activity (DE) Could reduce the number of cases analysed per year - One investigators team is composed of state employees - the other one is a subcontractor funded by the two ministries on which Inrets depends Only the funding of the second team may be interrupted (FR)	Contact the Heads of the relevant Ministries in combination with the support of the EU (NL) It needs to be established. (ES) A secure long term funding is important to be able to display the long term development of the accident situation and be able to invest in the development of the research activities (e.g. well equipped research vehicles, expensive on scene measuring tools). Third-party funds (e.g. from industry projects) can be acquired (DE) Promote the interest of these in-depth studies. Improve the 'visibility' of research works using them… Due to the hardness of investigation work, it is impossible to do this job at full time all along the career. Subcontracting is a way to maintain a good level of turnover (FR)

	stops **all** investigation activity(SE) Blocks **all** investigations (UK)	Make sure the data is useable and the organizations benefit from it and therefore contribute with funding. (SE) Negotiation of funds with stakeholders (government/industry/insurance) Continual application for research grants Analyse data for third-parties to attract extra funding (UK)
Access to the medical data	Might be a problem (NL) Stops activities of particular cases. (DE) Could reduce the investigation field to primary safety only (FR) Stops one part of the investigation (SE)	Ask for written consent by the Ministry of Health and the ethical committee of the Hospital (NL) Need consent form from each person. (ES) An accident research unit being under the organisation of a hospital meets medical confidentiality laws and allows for access to medical information also from other hospitals. Ask the leadership of other hospitals for permission to access the medical info by illustrating that ethical and data protection laws are complied with. Inform medical staff of the hospitals by showing the benefit of independent scientific accident investigation. (DE) Need consent form from each person A doctor from hospital is partially employed by Inrets (FR) Need consent form from each person (SE)

	Prevent collection of certain forms of information Case completion impossible for programmes that rely on medical information (UK)	Gained regional health authority permission and approval to collect anonymous injury data (UK)
Setting up the investigation team	There is many years international experience, not really an issue (NL)	Need a good appropriate background (psychologist for interviews, technicians for technical aspects). Need to be trained by experienced investigators (FR)
	stops **all** investigation activity (SE) Takes time Not possible to collect data from day 1 of a study without a trained team	Need a critical mass of experienced investigators that can educate new investigators. Difficult if funding stops during periods. (SE) Anticipate early training needs
	Full training usually requires 6 months before competency is assured	Anticipate multi-disciplinary aspects of the programme
	Poor planning of team scheduling may reduce investigation coverage and may impact on sampling aspects and “back-office” duties (UK)	Plan the training course and allow for follow-up and hands-on practical sessions (UK)
Staff turnover	Dependant on the yearly budget. No national funding is expected the coming years (NL)	Participation in international research projects or cooperation with independent national investigators (NL)
	Stops activities of particular cases. E.g. at nightshifts. (DE)	Have training on the job program in place for training of new staff. Have as much as possible experienced staff (long term employees) on the same team together with new staff. (DE)
	Could reduce the number of cases analysed per year (FR)	attempt to have a permanent team to keep the knowledge and anticipate the turnover (FR)
	stops **all** investigation activity--stops a particular case investigation (SE)	Increase investigator status and motivate by courses, continuity and making sure the collected material is used. (SE)

	Affects training aspects as listed above (UK)	Assure good career path for accident investigation team Counselling needs Remuneration aspects Shift-work allowance (UK)
Sampling	Might be a problem as in each country (NL) Influences representiveness of data (DE) stops a particular case investigation (SE) Does not prevent investigations but may restrict the case targets Teams 'turn out' for cases that do not fit the sampling criteria (UK)	Existing methods/compromises should be applied (NL) Difficult to get representativity, need to be stated on macro variables (DE) To obtain representativity a good sampling plan is needed. (SE) Good notification systems Careful sampling strategy Careful selection of area of operation where sampling criteria can be met (UK)
Health and safety	Does not prevent an accident investigation programme *per se* but may limit some aspects of it (cases where there is personal risk to the investigator e.g. car on fire, unsafe working area of city) (UK)	Risk assessment Provision of personal protective equipment Provision of counselling services (UK)
Equipment	Non-provision of adequate tools and data capture equipment will delay or prevent investigations – quality will be reduced (UK)	Ensure that team has necessary funding to purchase appropriate equipment (UK)

2.5.1. Overcome obstacles

To simplify the start for new teams a questionnaire was sent to the considered teams to give them an opportunity to give potential obstacles a thought. Along with this questionnaire a document with examples of obstacles encountered by the DaCoTA WP2 members was also sent. These obstacles are described in the section 2.5 of the present Deliverable.

3. ACHIEVING EUROPEAN REPRESENTATIVITY

Since the late nineties when the first effort for European in-depth accident data harmonization was introduced within the STAIRS project [9, 10] the issue of achieving representative in-depth accident data has been discussed. This chapter presents sampling methods which can be suitable for in-depth accident investigations in Europe and the problems that arise when trying to apply these methods at the European level.

3.1. Theoretical viewpoint for sampling in in-depth accident investigation research

Below it will be explained why a good sampling design is important and which questions have to be considered when classical sampling routines are impossible. In the end, there are some considerations on the opportunities but also the limits of correcting samples by means of weighting.

3.1.1. Sampling design

The main components when talking about sampling are: (1) the population; (2) sampling units, (3) sampling error.

In in-depth accident investigations the *population* corresponds to all accidents that happen in a particular region/country/continent (whatever the sample should be representative of). The *sampling units* are the accidents. Each accident that happens can either end up in the sample or not (-> team goes on the spot / team does not go on the spot).

A sampling design is a set of rules that determine which sampling units are included into the sample. There are a number of sampling designs which assure (provided that they are followed strictly and that the sample is large enough) that the sample represents the population in all aspects.

3.1.2. Simple random sample

This is the purest form of sampling, which guarantees that each accident of the population has an equal chance of being investigated. Two misconceptions about this are very common:

1. An equal chance for each accident to be investigated does not necessarily mean a large chance. The chance can even be extremely small (say one in a million). The important thing is that the chance is really the same for every accident.
2. Whereas the term “random” for many laymen sounds like “thoughtless”, and seems to be something that is achieved without any effort, this is actually very difficult. If accidents are sampled without paying attention to it, the study will probably investigate those accidents that are best available. A number of known biases (only including the cases in the vicinity of the team, only including severe cases, only including cases at convenient hours, etc.) and surely many more of which the investigators are not aware result from this.

Usually a random sample is achieved by taking a list of all elements in the population and selecting elements from this list by applying some random-number generator (the selection of elements in some ordered way, e.g.: “every third” can also introduce a bias). Obviously, this procedure is not an option for in-depth investigation because a list of the accidents can only be created post-hoc.

The (probably not very realistic) way to achieve a simple random sample of all accidents in a country would be to have all accidents communicated right away to a central computer. This computer would apply a random algorithm, marking the cases that have to be investigated. The teams would have to stand-by to go wherever, whenever the computer decides that a case should be investigated.

3.1.3. Stratified sample

The accident population is first classified according to one or several variables of particular interest. This categorization has to be non-overlapping and the resulting groups are called strata. A random sample has then to be collected in each stratum. An example for a stratification variable could be the time of the accident. The advantage of such a stratification (if it is carried out properly) is that the costs are often lower (for administrative reasons, e.g. the time-strata agree with working shifts of the teams) and the error variance is lower while you still obtain the pureness from random sampling. It is crucial that all strata present in the population are included in the sample (in our example, the working shifts have to cover 24 hours altogether), and that the distribution of the population across the strata is also known. Indeed, the correct results are to be found if one respects the proportions within the strata. Suppose that 50% of the accidents happen between 6:00 and 16:00; 30% between 16:00 and 22:00; and 20% between 22:00 and 6:00, the collection of accidents in these time-strata need to correspond. Good variables for stratification are those that form groups for which the accidents are relatively homogeneous within the groups and relatively heterogeneous between the groups. The larger the difference between in-group homogeneity and between-group heterogeneity, the greater the reduction in sampling error (and therefore the smaller the sample size necessary).

Stratified sampling can also be applied when one is interested in a particular subgroup that occurs so infrequently that it would not be covered sufficiently in a purely random sample. Accident severity is such a variable, because with increasing severity the cases become less frequent on the one hand but more important to have good knowledge about on the other hand. In such a case a disproportional sampling scheme makes sense, where e.g., a very high percentage of all fatal accidents are investigated, a smaller percentage of the accidents with severe injuries and an even smaller proportion of the accidents with only slight injuries. This can be done if the true proportion of fatal, slight, and severe accidents in the sampling area is known. To gain representative results, the accidents have to be weighted anti-proportional to their sampling fraction.

3.1.4. Clustered sample

This is a simple random sample of groups (clusters) of elements. Such clusters could, for example, be police zones. First a random number of police zones from all zones in the country can be selected. Subsequently, all accidents within these randomly selected zones are investigated. Again, it is important that the elements are selected at random. To select all police zones that are happy to cooperate, is for example *not* a random sample and could introduce some biases (e.g. the selection could end up with all those police zones that give road-safety a high priority, which might in turn influence the infrastructure, the enforcement activities, the behaviour of the drivers, etc. and consequently compromise the representativity of the accidents that is collected).

Working with clustered samples often increases the practical feasibility of data collection, because it can help to reduce the distances that the investigators have to travel. It is important to note, however, that – as opposed to sample-stratification – clustering does not reduce the error-variance in a sample. To the contrary, in many cases it increases the error-variance. Unfortunately increasing the number of cases studied within each cluster does often not help much, and to gain a better sample the number of clusters from which cases are selected has to be increased.

3.1.5. Difference between stratification and clustering

When stratifying a sample, *large* differences between the resulting groups are needed, and it has to be ensured to include cases from *each* group into the sample (in the correct proportion).

For clusters, it should be the opposite: The groups should be as similar as possible, because not each cluster is studied, only a sub-set of them. The cases within the clusters must encompass the whole range of accidents and this range should be comparable between clusters. When there are large differences between clusters and not enough of them are included, the quality of the sample is severely compromised.

3.1.6. Combinations

Draw a simple random sample of clusters, first, and afterwards a simple random sample of elements within that cluster. This is typically used when the clusters are too large to question all elements. This would be the case, to pursue with the in-depth investigation. For example, if areas in a country were to be randomly selected, but that all accidents occurring on each and every area cannot be investigated. The advantages are the same as in a clustered sample. Stratification in the selection of clusters can also be applied (e.g., make sure that the police zones selected show the same proportion of rural/urban areas as found throughout the country).

3.1.7. At random?

Whatever sampling design is chosen, it always has the component of random selection of accidents (unless the clusters are defined in which *all* accidents can actually be investigated, but the random selection of the clusters still need to be taken care of). As described above, it is actually difficult to draw random samples. When each investigation is accompanied by a number of practical problems, it is probably unrealistic to assume that many research teams will be able to collect a true random sample of their countries' accidents. So what does that mean for the interpretation of the results?

If the sample is drawn at random, the researcher does not have to worry about the cases that are *not* included in the sample, because in principle there is no structural difference between the cases investigated and the rest of the population of interest. On the opposite, if the sample is not drawn at random, this means that not every accident has the same chance to end up in the sample. Consequently the possibility that those "chanceless" accidents are systematically different from those included arises.

The available methods of calculating sampling errors and confidence errors are built on the assumption of a random sample. To a certain extent, these calculations still apply to samples that are not drawn at random, but then the population needs to be redefined. Which were the cases that actually did have a chance to be included in the sample? They are defined as the population. These are the ones to which the confidence intervals apply. For all other cases, an educated guess has to be made to how similar the population they belong to is to the one which is sampled from.

3.1.8.Transformations

More likely than not, there will be some imperfections in the sampling procedure and the sample will not be representative of the whole population. In the case of accident data, this can be investigated by comparing the proportions found in the in-depth accident sample to the proportion found in the national accident statistics. Comparisons of the distributions for certain key variables can indicate to what extent the accidents in the sample reflect the distribution of accidents in the national data base.

Possible differences can be corrected by weighting the cases. Case-types that are underrepresented in the sample would then by weighted with a higher number than those which are overrepresented. However, it has to be noted that this can lead to strong distortions. This is especially the case if the number of cases on which the weighting for a particular group is based is small. Often the samples disagree with the national statistics on several variables. In practice it is often difficult to correct for more than three or four at the same time. As an absolute minimum, there should be five cases in the combination for each of the possible values for the variables in questions.

Weighting as a solution to a non-representative sample is also problematic because it is usually not known whether the weighting is appropriate for the results of the variables of interest. Research questions in in-depth investigations typically address data that are not available in the national accident data. Weighting the data can help under three conditions. Firstly, there have to be relevant variables with known proportions in the national statistics. Secondly, the variables on which the in-depth sample differs from the national statistics must not be too many. And thirdly, there may be a difference in the frequency, but the nature of the observed phenomena must be the same.

As an example, if only day-time accidents are investigated, this introduces severe bias in the in-depth data. For studies concerning the injuries resulting from particular types of impacts, it is probably acceptable to assume that relations that have been found in day-time accidents also apply to night-time accidents. Estimating, how often particular impact types occur at night becomes difficult. Correcting for differences in proportions of variables like area and road-type, speed-limit, and age of the driver could help to make a rough estimation. When it comes to the causes of the accidents, day and night might be so different that it becomes impossible to use day-time accidents to derive conclusions on night time accidents.

3.2. Considerations for sampling in DaCoTA

While the previous section gave a theoretical background of sampling principles and their reason, this section deals with the practical application of these principles in on-scene investigations.

3.2.1. Commonly occurring challenges to random sampling

For the conduction of accident research there are a number of practical constraints to be able to have a team on the spot of an accident in time. Consequently all teams will have some (or many) deviations from a random sampling procedure as it was described above. Below the most frequent obstacles to random sampling are listed.

Notification:

- Tends to be influenced by different factors (only when car is towed away, only when rescue service is sent to the accident scene). Tends to be “car-oriented” and can lead to underrepresentation of vulnerable road user injuries.

Geographical areas

- Selection is usually guided by combination of representativity for the whole country and practical considerations (accident density, proximity to university hospital, contacts to police)
- Some biases can be compensated for, but all types of regions should at least be contained in the area.
- Collection of accidents at places or periods with few accidents is very costly, e.g., urban areas, night time, countries with few accidents,
- Under-representation can be compensated by weighting to some extent (e.g. too few rural accidents). If low-number accidents (e.g. night time accidents) are absent from the sampling plan, results are not representative to them.

Link to the national data (often collected by the police)

- Essential for monitoring representativity and calculate weighting factors
- Often prohibited by data-protection laws (sometimes possible to save the relevant parameters and then de-indentify cases.)
- Sometimes possible to “generate” links with matching procedure.
- Only makes sense if national data can be considered to be the “population” of accidents (some countries have huge underreporting in national data).

Road user consent

- In most countries accident participants have to be asked for agreement to register their personal data.
- Sometimes agreements can be requested post-hoc.
- If agreement is not given, personal data have to be deleted/left out.
- “Visible” data (gender, approximate height) can still be collected.

Long term consequences

- Most teams do not have the possibility to follow up participants for very long due to data protection laws.
- Most teams do not have a formal “closing” date of a case

Uninformative cases

- Some teams have a time limit (e.g. 20 minutes) after which they do not go to the last accidents anymore (as to avoid arriving at a cleared accident scene).
- Some teams base the decision of whether still to go to an accident or not on the information from the police

- Some teams go to every case, no matter how old or how uninformative and register whatever information they can still gather (→ lots of unknowns in these cases).

3.2.2. Initial conclusions on sampling

To derive a data set which is representative of Europe the ideal sampling plan for the in-depth accident investigations is to set up teams in all countries in Europe which randomly samples accidents 24-7 all year around in an area which is representative of the nation. Obviously this is not achievable due to several practical and financial factors.

Given this large discrepancy between theory and practice a discussion was initiated with experts from the vehicle manufacturers, system suppliers and the research community representing the in-depth accident investigation infrastructures in Germany (GIDAS), France (INRETS), Sweden (INTACT) and the UK (OTS, CCIS).

The discussion was initiated with the following questions.

- What case selection procedures should be used to meet the needs of;
    - Policymakers
    - Vehicle manufacturers and other industries
    - Research community
    - Others
- Is it possible to satisfy all requirements within one study?
- How close will practical considerations let us get to the ideal?
- What statistical approach, if any, can/should be used for sampling and should all types of analysis be achievable?
    - Random sample
        - Should/can we focus on cases of interest and minimise less informing cases?
    - Stratified sample
        - How can we select crashes if we have to reach the scene rapidly to allow qualitative reconstructions of accidents?
    - Multiple selections
        - Can we operate several strategies with different criteria without it becoming too complicated?
    - Same selection strategy for each country
        - What if practical considerations prevent the same strategy being used in each country?
    - Case numbers
        - How many cases do we need for national and European generalization?
        - Is there a minimum number for any country?

In response to these questions, the following principles were indicated as priorities in the achievement of a representative pan-European accident sample.

- The most accepted deviation from true random sampling is the selection of a sampling area. Rather than selecting a number of areas at random, the solution of finding an area that is representative for the country in many ways but also logistically suited for on-scene investigations is acceptable to all participants.

- Within these areas, random sampling is considered a necessary precondition to have broadly representative results. If cases are selected on the basis of perceived information possible biases are introduced.

- Stratification reduces the sample variance and still guarantees representativeness of the sample (if a sufficiently large sample for each stratum can be guaranteed). When advanced reconstructions and on-scene investigations are desired stratification can, however, only concern criteria that are easily assessable (e.g. location or time of occurrence).

- Multiple selection criteria are in principle possible to handle (e.g. stratification according to different variables). They have to be applied consistently and the information to which they are applied has to be reliable. In practice this can be difficult. The information from the police is often unreliable. Accident consequences can usually not be reliably determined before the team arrive at the accident scene and are therefore problematic selection criteria. Different strategies for sampling in each country should not be a major problem as long as they are handled consistently and transparently and as long as no (large) biases in the sample are introduced.

- It is difficult to set a target of number of cases for each country to investigate. To enable reliable aggregated analysis of the data (given it is random sampled within the given criteria) approximately 500 cases are needed from each country. If this number is achieved in one year or several affects the possibility of analysis.

3.3. Exposure data

Exposure is used to normalize accident data to allow for comparison. By collecting exposure data, under or overrepresentations of a certain parameter can be identified. For example, if Driver A has 10 accidents while driving one million kilometres and Driver B has 5 accidents while driving 200,000 kilometres, then it can be concluded that Driver A's accident risk is lower because, per kilometre, Driver A is less likely to be involved in a collision (0.00001 involvements/km for Driver A vs. 0.000025 involvements/km for Driver B). This difference in risk could be due to:

- differences in driver characteristics (e.g. skill, experience, risk taking),

- vehicle characteristics (e.g. size, state of repair) or

- the quality of exposure (e.g. proportion of driving at night, during inclement weather, in high traffic, in urban areas, on undivided highways).

There are two ways of viewing exposure to the risk of accident in the road traffic network [11]. One can seek to determine exposure and accident rates for the vehicle or road user as moves along in the system, or one can seek to determine exposure and accident rates for particular sites or fixed objects as the road users go past. For the first type distance travelled seems generally the most appropriate exposure measure [12], while for the second type a direct count of road user movements seems the most appropriate exposure measure. There are two basic approaches used in collecting travel exposure data. One involves obtaining data while trips are in process, and the second involves obtaining data on completed trips.

An example of a European study, in which exposure data have been collected, is MAIDS (FP5 research project[13]). A control group of riders was obtained by interviewing riders at petrol stations and by video surveillance. Regarding the first one, petrol stations were chosen because stopping PTW riders on the roadway was against the law in some areas as well as a logistical challenge. These petrol stations were selected randomly in the accident collection area and were visited at random days and hours, to obtain a general population of riders. The petrol station method provided both the human and vehicle control data. Video surveillance of PTWs moving through the accident scene one week after the accident lasted for one hour, half an hour before the accident occurrence and half hour later. Two team members were present the whole duration of the exposure phase, recording traffic parameters in a check list-tick box form too. The video method provided data for the vehicle, the traffic condition and the road users' behaviour, however the method provided not enough human factor data critical to understanding the human contribution to accident risk (as the petrol station method did).

Exposure data collection techniques are not widely applied to in-depth accident research studies, because it requires a significant amount of resources (both in terms of time and budget) for the data collection, analysis and data entry in a database system. In case of the video method, the exposure data analysis could be even more time consuming than the accident data.

Given the costs of collecting exposure cases, it is often more effective to compare different types of accidents within the accident database. This method is certainly suitable for investigating the consequences of the accidents and how they can be minimized. It is usually possible to compare cases with severe consequences to those with less severe consequences. This method might however fail if one wants to investigate the facts that differentiate a crisis situation that becomes an accident to a crisis situation that does not become an accident, simply because crisis situations that did not become accidents will not be included in the database.

Many teams which perform in-depth accident investigations are nowadays also involved in "Naturalistic Driving" (ND) or "Filed Operational Test" (FOT) studies. It might be possible to recruit control cases/parameters from these studies for accident data analysis research.

3.4. Conclusion on representativity and data-quality

Setting up a pan-European in-depth accident data-base will necessarily mean that compromises have to be found between theoretical data-requirements and practical achievability.

New teams in European countries will often not have the means to start their investigations with the infrastructure that is necessary to collect a large number of cases in a random way covering all periods, area-types, degrees of severity etc. With respect to the demand of random sampling, compromises in the selection of the sampling area are acceptable. The systematic exclusion of accidents (pedestrian accidents, night-time accidents, rural-area accidents...) is regrettable because this means that generalisations to the accident types that are not included remain "guesswork" to a certain extent. However, such selective samples still give valuable information about the accident types that they *do* include.

To deal with small numbers of cases per country, it is necessary to have a homogeneous protocol for data collection and analysis, so that the cases can be analysed jointly and then will form a sample with a meaningful size more quickly.

Combining the data is possible even if the sampling designs differ between the teams and are not perfect. For this it is necessary to have *consistent and transparent selection criteria* for each team. If a particular type of accident is systematically excluded or under-represented in one country (e.g., night time accidents), the types that *are* sampled properly can still be analysed jointly with the accidents of other countries (e.g. an analysis of day-time accidents from various countries).

For interpretation many accident variables require some knowledge about these variables in less severe cases or in non-accident cases. For a large part this information can be gained from the accident sample. For some variables, especially causation variables an additional data collection from non-accident situations would seem desirable. However, financially this is probably difficult to achieve for beginning teams. Data from other sources (manufacturers, field operative trials, naturalistic driving studies, insurances, hospital discharge, questionnaires etc.) can be used creatively to fill this gap.

4. MOTIVES FOR IN-DEPTH ACCIDENT INVESTIGATION DATA

Accident investigations could cover a very big range of collected variables. The collection has to be a balance between the desired depth level and time and money to spend. To set a level for DaCoTA a number of stakeholders with interest in in-depth data were contacted and given the opportunity to prioritise areas of interest.

4.1. Viewpoint of contacted stakeholders

To achieve a greater understanding of the future data needs of stakeholders and to ensure that the DaCoTA project establishes a common methodology relevant to those needs, a consultation took place between the DaCoTA partnership and a number of stakeholders. Two methods of consultation were conducted, firstly to understand future data needs at a European policy level, and organisations representing the vehicle industry across Europe. Secondly to understand the data needs at a local level in each EU member state and increase awareness of the aims and goals of this work package the national administrations were contacted via the National Experts framework.

4.1.1. General European Data Needs

Consultations were conducted with institutions and organisations that would provide an understanding of current research needs and assist in identifying future data requirements or research interests. The following bodies were consulted at a European level:

- DaCoTA project officer on behalf of the Commission
- EUCAR - European Council for Automotive R&D
- ACEM – The Motorcycle Industry in Europe

EC Consultation

In-depth accident data is currently and will remain an important tool for the Commission to evaluate and understand road safety issues across Europe. Real world accident data will also be required to provide evidence based information in support of achieving the new EU safety target of reducing European road deaths by 50% by 2020 outlined in the Road Safety Action Plan (RSAP) [13].

The EC aims to achieve this target by making road users, vehicles and the road infrastructure safer. The commission believes this can only be achieved by a mixture of approaches from national co-operation, public awareness campaigns in order to share the knowledge and experiences between member states and by research into road safety across Europe. These approaches could be reinforced and supported by regulation and standardisation of systems if appropriate.

Research projects such as DaCoTA which combine and build on experiences learnt from previous EU projects such as STAIRS, PENDANT, MAIDS and SafetyNet will facilitate a platform for in-depth data to be collected in a harmonised methodology, leading to conclusions in driver behaviour, road infrastructure and injuries across Europe. This resource can then be used to transfer knowledge from member states with good road safety records to improving countries who are observing similar accident trends or road safety issues.

The main research priorities or challenges facing the EU road safety community over the coming years as discussed in the consultation are:

- Whether prescription medication affects driving performance
- Driver demographics, licensing of the driver (which licences they hold), driving experience, age, gender, education, exposure (kilometres driven)
- Details of the vehicle condition – technical inspection details, when was the last inspection performed, a strong interest in tyre condition (tread-depth, pressure, condition etc)
- Presence of alcohol or drugs in the drivers system
- Road infrastructure – its influence on the accident, type of road, EuroRAP rating, road inspection/audit details
- Assessment of intelligent and active safety systems – for example need to know whether to mandate for Electronic Stability Control (ESC) systems
- Incorrect operation or activation of active safety systems leading to an accident e.g. Cruise-control
- Cost of injury or injuries short term and long term

If a large scale European in-depth accident research programme is to be established a multifaceted approach will be required to include national administrations, scientific communities, and industry and policy makers to ensure all data needs are considered and to aid in the burden of funding such a project.

EUCAR Consultations

EUCAR is the European Council for Automotive R&D and provides vehicle manufactures a European platform to engage policy makers and collaboration on research topics and development. The main research priorities for EUCAR 2020 and beyond are;

- Mobility and Transport
- Energy and Environment
- Safety and Security
- Affordability and Competitiveness

Although these are broad topics and not defined research questions this further demonstrates the need for in-depth accident data collected by a methodology robust enough to provide analysis at differing levels of complexity. EUCAR reinforced that industry needs and will continue to need very accurate in-depth crash data.

EUCAR discussed issues they believe should be considered and addressed before a pan-European data collection activity commences. They feel that the data collected should be representative of Europe to understand and analyse accident trends in each member state and rate against any Europe wide trends. They appreciate getting a full accurate representation of Europe is difficult, but priority should be given to member states with high fatality rates such as, Poland, Italy and Estonia or large accident populations such as Germany, France and Spain. They estimate that a data collection activity of 2,000 cases per annum would suffice in yielding enough accident types for analysis and interpretation but weighting factors would need to be considered.

Two main obstacles to this type of activity and also historically for in-depth accident data collection are funding and data access or ownership. Although the issues of funding can be overcome by using a consortium approach this can increase the problem of data ownership.

ACEM Consultations

ACEM (the Motorcycle Industry in Europe) is an organisation which represents the interests of 12 PTW manufacturers and 15 national associations from 13 European countries. A key role of ACEM is to develop and support the interests of manufacturers at a European level in the EC and other countries. This includes facilitating studies and analyse issues of common interests relating to factors such as; environmental, economic, safety, technical transport, legal and fiscal matters. These are from the ACEM members' perspective and PTW users across Europe.

Key research areas of interest for ACEM include'

- Human factors (Education and training issues)
- Vehicle related issues (conspicuity, tampering, braking)
- Passive safety (public awareness campaigns)
- Active safety system (activation/ incorrect activation)
- The roadside environment (traffic management and design)

The main uses of in-depth data by the ACEM group is to obtain a "photograph of what is happening" in the accident population of PTW. This is not just to focus on data relating to PTW but also to understand how other road users act and interact with PTW on the road network across Europe. To understand and be able to evaluate how new safety technologies function in the real world and if a benefit of such technologies is reflected in the accident statistics or if the type of accident scenario alters. ACEM has invested into the area of in-depth accident investigation projects with the MAIDS study and are very keen for any future data collection activity to be compatible with the MAIDS data to help build on the existing knowledge base.
ACEM agreed there is a need for accurate in-depth data across Europe which evaluates the causes of accidents which will enable future questions to be answered including new technologies. Investigations need to be conducted by a common methodology to ensure any trends or common accident scenarios are "real" and not false observations.

4.1.2. National Administrations Data Needs

The national administrations of the 27 EU member states were contacted via the national expert's framework. This was conducted via a short questionnaire (see Appendix 2) with two aims,

I. to understand what the member states considered to be in-depth data and their future data needs or research priorities.

II. to establish the current situation of accident data collection activity in that country and their willingness to work with the DaCoTA project

A good response to the questionnaire was observed with 22 member states responding. A summary of the key points relating to research areas and interests of the member states from the questionnaire are presented in this deliverable. The countries that responded to the questionnaire can be seen in Table 2 below.

Table 2 Questionnaire response from European member states

Austria	Greece	Poland
Belgium	Hungary	Slovakia
Bulgaria	Iceland	Slovenia
Cyprus	Italy	Spain
Czech Republic	Latvia	Switzerland
Estonia	Lithuania	UK
Finland	Malta	
Germany	Netherlands	

In general the responses in the questionnaire were positive towards the DaCoTA project and the vast majority of the respondents stated they would be willing to work with the DaCoTA project for the implementation of a European wide investigation team.

Data sources

The majority of the countries reported that their current information sources used to address road safety issues or policy needs were sufficient. The common data sources were National accident reporting systems (85%), Roadside surveys (61%) and Access to police reports (61%).

When the respondents were asked if they use in-depth road traffic data and what level it is sourced from either national, regional or an EU level, most respondents use data selected on a national basis (n= 14, ~64%) with a further ~20% using regional samples. A small proportion reported using multiple sources of information (n=3, ~14%) which is probably an underestimate as the text comments show more countries using this technique to ‘face local road accident problems’ or for ‘some [in-depth] trial surveys but only on a local scale’.

The majority of the countries stated they had an infrastructure in place in their region or country for obtaining in-depth accident data. The trend from the questionnaire shows a general leaning towards national based data sources that, despite collecting quality data, cannot always be classified as independent. Combine this information with the accepted knowledge that independent investigations are the aim for nearly one third of the countries and we can see where the gaps are in the overall European picture.

Table 3 Data source type for obtaining accident information.

Data Source	**Freq'**	**%**
National accident reporting system	17	50
Access to police investigation reports/files	12	35.3
Access to in-depth road accident research investigation reports/files	5	14.7
Total	**34**	**100**

Table 3 shows the reality of data collected across the respondent countries. This is dominated by two sources that are neither considered independent nor truly in-depth. In only five cases is the suggested ideal followed through to reality.

Without exception, all countries using only one form of data collection infrastructure use either a national accident reporting system or access to police investigation reports/files. In almost all countries where two sources are detailed the same pattern is true; a national database and police files are used in combination. It is only when three data sources are listed that independent infrastructure becomes apparent.

Establishing an in-depth investigation team

When questioned about the benefits of having in-depth investigations conducted in their country or region the responding countries were almost unanimous in their answers, 20 of the 22 respondents stated that in-depth data is needed for policy and decision making purposes. One respondent did not give a response to this question.

The free text reasoning behind the solitary negative response was that the number of fatal accidents in their country in question was too small to make correct decisions. This gives support to establishing a European wide investigation team with an aggregated system, as this country would benefit from increased accident numbers and potential countermeasure for the identified accident causes.

This is reflected by other free text responses that show why a positive approach to this question could yield results when scaled over Europe. Comments such as: 'The National accident data (provided by the police) are insufficient to determine the causes of accidents' and 'our numbers are too small, that shows the real problem'.

Other comments suggest that the benefit could be seen through more focused analysis on topics of interest, for example; 'there is potential of having in-depth data especially for implementation of local measures such as "black spots" or to tackle the 'problems that exist in identifying alcohol related road accidents'.

In a similar trend to that shown in the previous question (above) the responses for establishing European in-depth investigation teams for research purposes alongside any existing data collection activities was almost unanimously positive. The responses (Figure 2) show that 18 of the 22 respondents see a benefit in this kind of activity being set up.

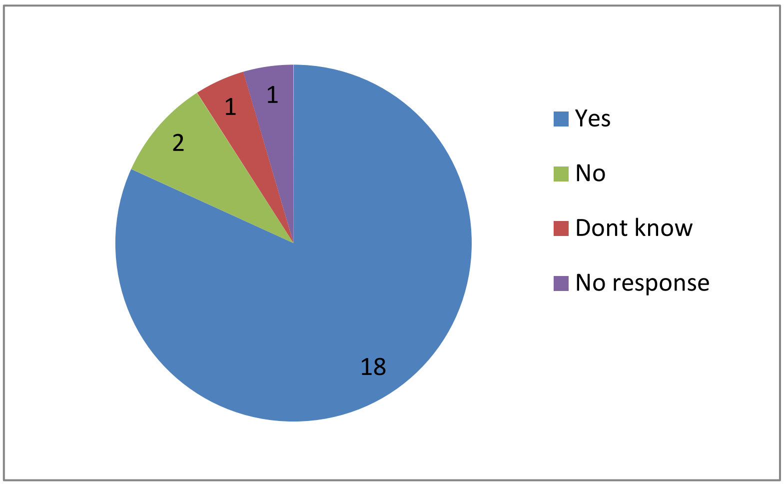

Figure 2 Responses to the question if establishing a European in-depth investigation team for research purposes would benefit road safety.

Reasons behind the negative responses ranged from "In [country] the system is adequate, across Europe this may be needed" and "There are [number] fatal accidents in 2009, the number of fatal accidents is too small to make correct conclusions". These two responses are not necessarily against such a system but merely state that the countries in question do not see the benefit of such a system alongside current investigation activities. Only one country responded with "don't know", no further clarification was given.

Positive responses to the setting up of a European in-depth investigation system look forward to the results of possible aggregated data, the responses are similar to the previous question but focus on what may be needed to get a system operating. Comments such as: 'what is needed is for more boards to emerge in Europe and push safety recommendations forward' and 'on an EU level a benefit is only seen if definitions are harmonized and collection procedures are the same' illustrate the need for political motivation and an overall organisation behind this work. The result, some suggest, could be that 'this would be an essential tool in the preparation of policies and strategies' and that it could also be 'necessary to establish an in-depth accident investigation team to collect data in order to support accident analysis and subsequently policy making'.

Potential obstacles

Respondents were asked to pick from a list the major obstacles for establishing an in-depth investigation team in their country. Any number of the 10 options could be selected with over half the respondents selecting between 3 and 5 obstacles. No country picked all 10 obstacles; neither did they pick none. (Figure 3)

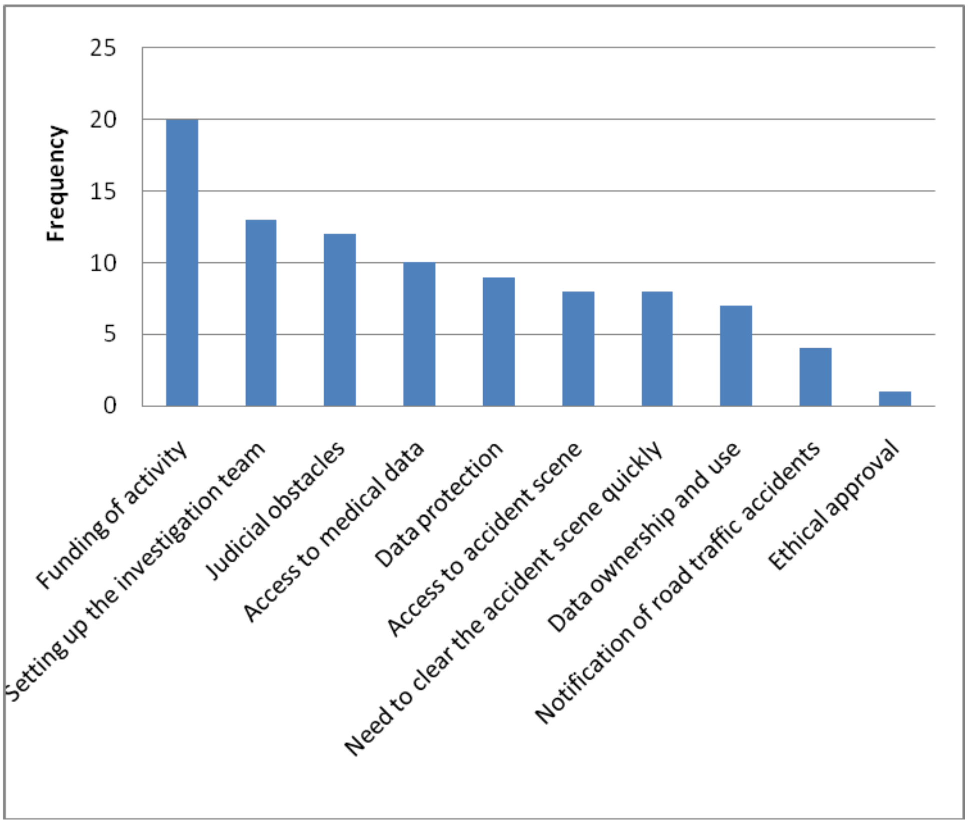

Figure 3 Frequency of obstacles for in-depth investigations

In line with the expectation the most frequent response was 'funding of activity' (n=20), this is understandably the largest obstacle in getting this kind of study operational.

Following the most frequent response, 'setting up the investigation team' has 13 individual records. This obstacle will form a major part of the DaCoTA project with a training package and trial data collection in new European countries being a significant milestone in showing the feasibility of a study of this type.

Beyond the top two responses are the common and often technical challenges of access and dissemination of the collected data. Access to both the medical data and to the accident scene rank almost as high (n=10 and n=8 respectively) while the two more legal matters of judicial obstacles and data protections are also seen as similarly challenging (n=12 and n=9 respectively).

Countries that highlighted fewer obstacles (1, 2 or 3 obstacles from the list) all selected 'funding of the activity', beyond this the two most common concerns were 'setting up the investigation team' with nearly one third of the remaining responses and 'need to clear the accident scene'. One respondent did not give any answer to this question.

Formulation of a partnership with DaCoTA

The majority of the respondents to the questionnaire answered positively when asked if national administration would support the implementation of a new in-depth accident investigation team in their country. This is very promising for the goals and aims of the DaCoTA project in establishing new teams across Europe to add accident data to a common accident data base.

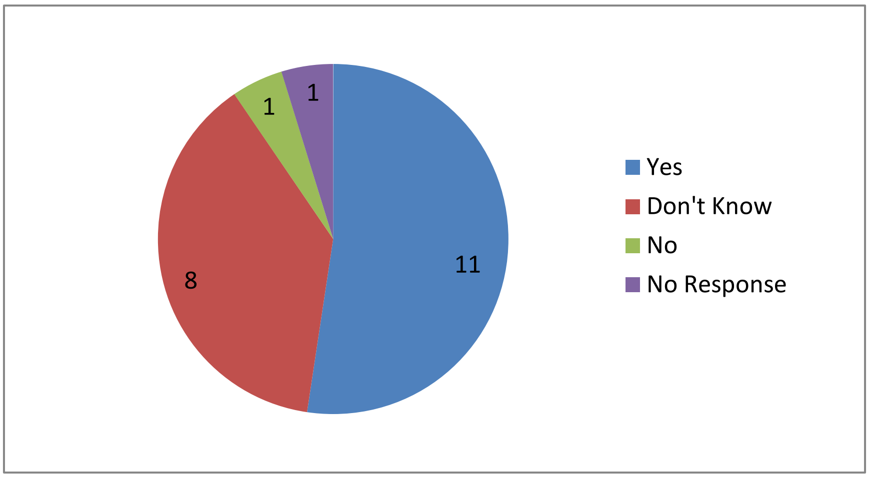

Figure 4 Support for implementation of new in-depth activity

Responses show an almost equal split between respondent countries supporting a new in-depth activity across Europe and those who remain undecided, one respondent did not answer this question

Only 2 countries responded 'no' to the introduction of a study of this type. Explanatory comments suggest that in principal support could be drawn from these countries but only "*if it can be easily integrated to existent systems*".

When asked if the country would be willing to work with the DaCoTA project to establish an in-depth investigation team in their country and provide a small number of cases to a pilot study, the overall result was positive with the majority willing to work with the DaCoTA project (Figure 5).

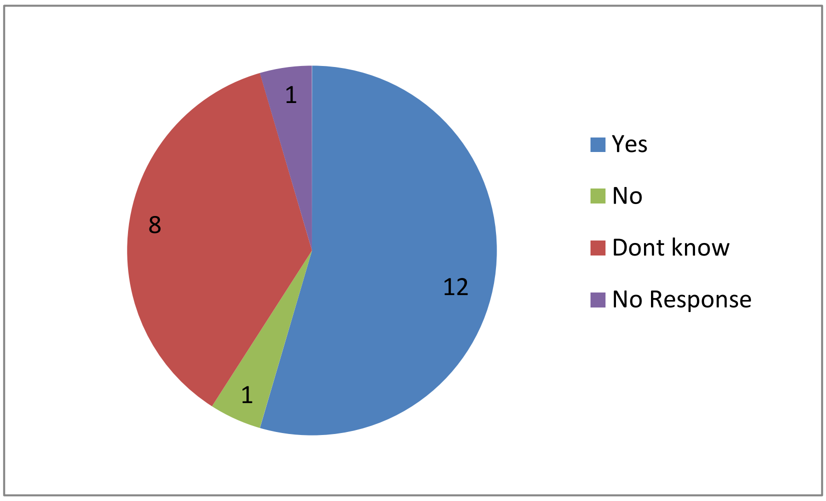

Figure 5 Respondents intentions to work with DaCoTA

Nearly 60% of the respondents (n=12) replied with a positive answer to question 10. Just over one third (n=8) remain undecided with only 1 country replying that they would not work with the EU funded DaCoTA project.

In regard to the possibility of establishing an investigation team within the country using the framework of the DaCoTA project gave a strong positive with 62% (n=13) responding it would be possible and the remaining 38% (n=8) answering don't know.

Research Priorities

In order to achieve an understanding of current research interests in the countries the participants were asked to rank a list of research topics by their priority to the road safety policy. They were asked to assume that they would be able to monitor all possible road safety issues, using a variety of methods. One respondent did not answer this question so the results are only for 21 respondents. Ranking all the responses and assigning a numerical value in the following way:

0 = No response

1 = Low priority

2 = Medium priority

3 = High priority

This gives a value which represents the overall priority of each issue. This value can range from an issue which is selected by all 21 respondents as a high priority [21 x 3 = 63] to an issue selected as low priority [1 x 21 = 21]. If a respondent selects no issue then a lower number down to 0 could be returned for an issue.

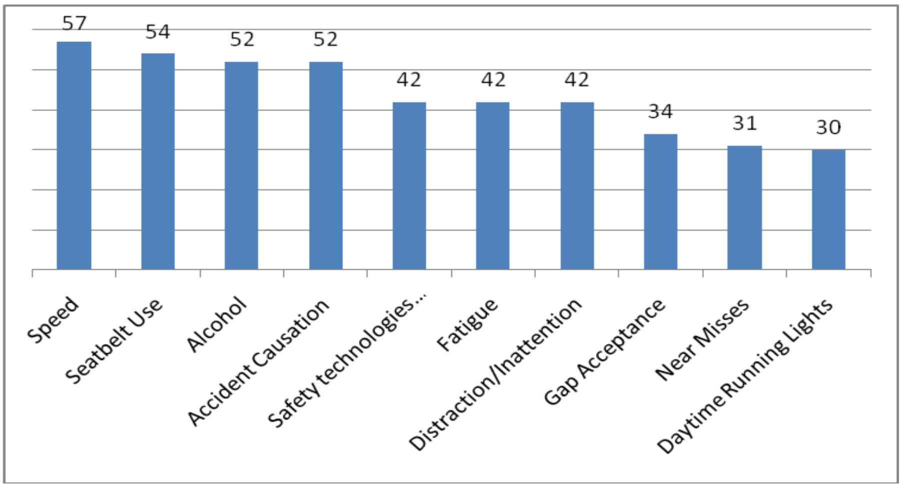

Figure 6 Ranking of safety issue priorities

Figure 6 shows the complete picture of the ranking of safety issue priorities; however a high number in the ranking can be made up by many medium/low priorities; for example, 19 x 2 = 38 would be ranked 5th in Figure 6 but could be of a fairly low priority.

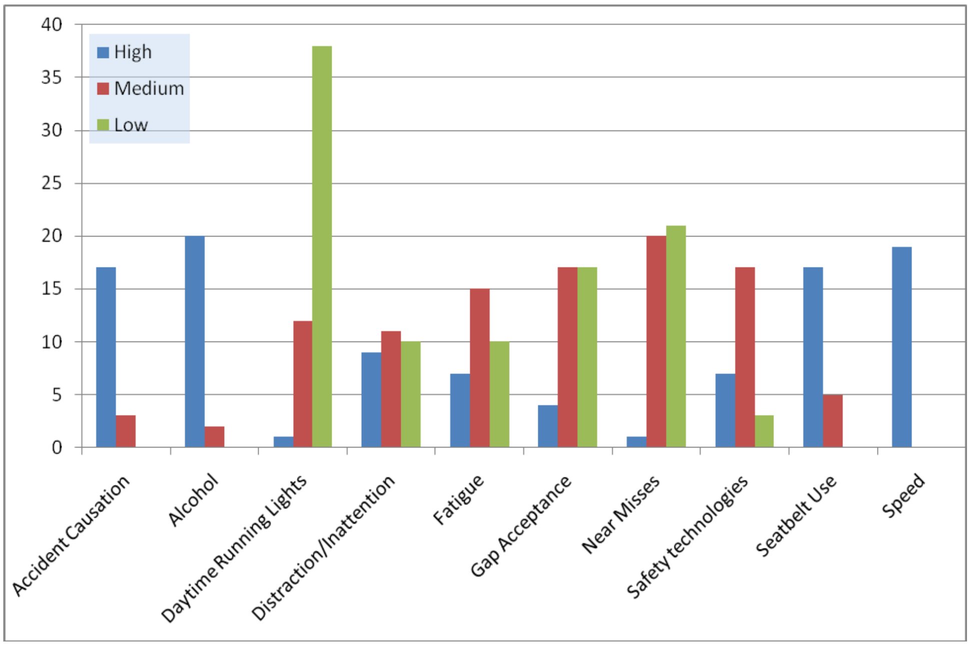

Figure 7 Safety issues by percentage (%) of High, Medium and Low responses

Figure 7 demonstrates that the medium to low priority issues do not have a large effect on the overall ranking. It will perhaps be useful to consider issues with a wide range of results such as Fatigue or Distraction/Inattention whose ranked position is made up from more Medium and low priority records.

An overview of the priorities can be seen below in **Error! Reference source not found.** High, Medium and Low priority issues. Issues ranked highly are in Red followed by amber for medium issues and green for low. No fill colour indicated a lack of response to that issue. One respondent did not answer this question so the results are displayed for only 21 respondents.

Table 4 High, Medium and Low priority issues

country	Accident Causation	Alcohol	Daytime Running Lights	Distraction/ Inattention	Fatigue	Gap Acceptance	Near Misses	Safety technologies	Seatbelt Use	Speed
1	High	High	Medium	Medium	Medium	High	Medium	Medium	High	High
2	High	High	Low	Low	Low	Low	Low	Medium	High	High
3	High	High	Medium	Medium	Medium	Medium	Medium	Medium	High	High
4	Medium	High	Low	High	Medium	High	Low	High	High	High
5	High	High	Low	High	Medium	Medium	Medium	High	High	High
6	High	High	High	High	High	High	High	High	High	High
7	High	High	Medium	High	Medium	Medium	Medium	Medium	High	High
8	High	High	High	Medium	High	Medium	Medium	Medium	High	High
9	High	High	Low		Low	Low	Low	Low	High	High
10	High	Medium	Low	Low	Low	Low	Medium	Medium	Medium	High
11		High	Low	Low	Medium				High	High
12	High	High	Medium	Medium	High	Medium	Medium	Medium	High	High
13	High	High	Low	High	High	Medium	Medium	High	High	High
14	High	High	Medium	High	High	Medium	Medium	High	High	High
15	High	High	Low	Medium	High	Low	Medium	Medium	Medium	High
16	High	High	Medium	High	Medium	Medium	Low	High	High	High
17	High	High	Low	Medium	Medium	Medium	Medium	High	High	High
18	High	High	Low	High	Medium	Medium	Low	Medium	Medium	High
19	Medium	High	Medium	High	High	Low	Low	Medium	High	High
20	High	High	Medium	High	High	High	Medium	High	High	High
21	High	High	Low	Medium	Medium	Medium	Medium	Medium	High	High
Key	High Priority			Medium Priority			Low Priority			

The results shown in Table 4 display that the key research areas for national administrations are Speed (100%), Alcohol (95%), Seatbelt usage (86%) Accident Causation (86%) as priorities for future research, compared to Near misses which was only classed as a priority by one country and Daytime running lights by two countries.

Other research priorities and topics listed by the national administrations for current and future data needs included;

- Vulnerable Road Users (pedestrians and cyclists)
- Mobile phone use (x2)
- Blind spot accidents (x2)
- Motorcyclists (including helmet use)
- Traffic education (x2)
- ITS implementation
- Medical issues (including illicit drugs and medicines)
- Ageing populations and accident scenarios
- Young drivers
- Road and traffic characteristics (including road maintenance)
- Law obedience (including issues with licences)

The consultation has provided supporting information for the DaCoTA WP 2 partnership to formulate the correct data collection methodology and level of data to be collected by existing and new teams across Europe as part of the DaCoTA project.

This process has demonstrated the need for in-depth accident data across Europe which is representative and of a good size to be useful to both policy and industry. Common research areas have been identified in the consultation periods which can be addressed using in-depth accident data.

4.1.3. Summary of Consultations

The consultation activity with stakeholders and national experts gave the work package a direction and focus for the type of data that needs to be collected in order to produce the desired analysis and ultimately answers for the stakeholders.

It is apparent that there is a great benefit and support across Europe for such an activity and an appreciation for the challenges and issues associated with such a task. All stakeholders mentioned funding as a key limitation to the activity usually resulting in compromising on the activity or completely preventing it. Sampling and representativity of the data are also key concerns and would need to be addressed when incorporating new teams and the formulation of a common methodology across Europe. Suggested guidelines and key elements the stakeholders would expect to see in such an activity included;

- A broad representation of EU countries
- Common methodology and comparable skill set
- Prioritising EU countries with high fatality rates
- Incorporating vehicle, human and road infrastructure safety
- All vehicles and road users addressed not just passenger cars
- High case numbers per annum – minimum 2,000 cases per year

From the identification of the research interests and expectations for a common methodology capable of incorporating a number of skills, it was largely felt that an on-scene approach to accident investigation would serve the stakeholders needs best and, where appropriate, supported by additional retrospective specific task focussed investigations.

4.2. DaCoTA Work Package Two Partners

As part of the consultation period the 10 DaCoTA work package 2 partners prioritised common important research questions and areas of future interests. This activity produced a list of 71 research questions of differing complexity and took into consideration the views and needs of other stakeholders who had been surveyed for their opinions and needs. The questions ranged from relatively simple queries such as “the classifications of vans in accidents” which can easily be answered by methodologies such as SafetyNet, to complex questions which would require a multifaceted approach of in-depth data supplemented by naturalistic or laboratory testing, such as “the crash compatibility of hybrid vehicles against small/medium modern cars”.

The questions were prioritised by each partner selecting 5 research questions which their organisations view as a current priority or as an area of interest for the future. This produced a list of 30 priority research questions selected by all partners. 11 of the questions were selected by multiple partners with the remaining 19 questions being selected by only one partner. The top 5 questions are shown in Table 5 along with the frequency of the selection and the complexity of the question.

The questions were ranked into three categories;

1. Complex questions
2. Difficult questions
3. Simple/General questions

Complex questions are answerable by in-depth data but would require a multifaceted response using other techniques to provide a robust conclusion. Difficult questions can be answered using an in-depth methodology of a similar standard used by existing projects such as OTS in the UK, GIDAS in Germany or INTACT in Sweden. These require experienced teams collecting highly detailed and accurate data relating to all aspects of accident investigation including, reconstructions, interviews, injury data and accident causation systems. Simple/General questions are questions which can be answered using an in-depth data collection methodology, retrospective or on-scene approach concentrating on general variables and one or two specialised case analysis techniques such as the methodology used in the SafetyNet project.

Table 5 Top five prioritised research questions

Research Question	Type	Freq'
How effective are active safety systems in collision mitigation? Do they increase driver distraction?	Complex	6
What are the differences between human errors relatively to the type of road user? (young drivers, elderly, PTW, etc.)	Simple/ General	4
Factors related to road infrastructures that have influence in the car crash in terms of design, signposting, road elements related to both passive safety as barriers and active safety?	Difficult	4
The role of speed in causing road accidents and making them more severe?	Difficult	3
The role of distraction in accident causation, e.g. use of mobile phones	Difficult	2

The most frequently prioritised questions by the partners are shown in Table 5, with the highest question being selected by 6 partners as a priority. The majority 3 out of 5 top questions were "difficult" questions, meaning that answers could be provided by an in-depth project with a robust methodology focusing on all aspects of accident investigation and research. This trend was observed across the 30 prioritised questions with 70% (n=21) being Difficult questions, 20% (n=6) and 10% (n=3) being Complex and Simple/General questions respectively.

Meaning that out of the research questions deemed to be a current priority or an area of future interest to stakeholders, industry or the research community represented by the WP2 partners, in-depth data could answer 80% of the research topics if a robust investigation methodology such as OTS/GIDAS/INTACT was adopted by the DaCoTA project. This activity also showed that in-depth data plays an integral part in providing answers and supporting information for the remaining 20% of the questions which were deemed to be complex research questions and would require a multi-disciplined approach.

The nature and results of this process of prioritising and identifying current and future research areas was further used to inform the partnership on the type of methodology to adopt for in-depth data collection activity in the future. All the research questions from the prioritisation process and suggestions for possible methodologies to answer each question can be seen in appendix 3.

This process demonstrated the need for in-depth accident data in the future to address road and vehicle safety and policy decisions. By the implementation of a European wide common accident investigation regime, a useful tool and database will rapidly be established and allow detailed analysis on varied topics for a number of stakeholders and the research community.

4.2.1. Gains for each organisation from having in-depth studies

In order to decide on the appropriate methodology and focus areas of data collection for a pan-European activity including establishing new inexperienced teams, the partnership created a list of benefits for conducting such activities.

Knowledge of accident causes:

In-depth studies provide an increased knowledge of accident causation; and on the effect of the different contributing factors (human, vehicle, and road infrastructure) on road users' behaviour. The information can help in answering the question ‘why and how accidents occur’. Thus they are a necessary complement to national statistics in understanding the total accident population and the ‘how many’ question. As a whole, in-depth investigations enable the data user to interpret and evaluate all contributing factors leading to accident scenarios and the failures that lead to an accident.

By in-depth studies the analysis can be conducted at a detailed level and not at a superficial level of proportioning blame for the accident. The aim of in-depth data is to establish all the contributing factors leading to the accident and any underlying malfunctions of the driving system.

More specific, in-depth studies can answer questions such as a diagnosis of road-signing problems that have contributed to an accident, by causing driver distraction or confusion; this is something which isn’t present in a national or macroscopic reporting systems. More generally, the data allows the analysis to distinguish between and errors and violations committed, two categories of malfunctions for which efficient countermeasures can be completely different.

Keep and develop competence:

In-depth studies are needed to keep and develop the competence in accident research.

Development of countermeasures:

Data from in-depth investigations act as a base for developing safety systems, contributing with new ideas and knowledge. The data will be used for developing, implementing and monitoring both active and passive safety measures.

In-depth investigations show the complexity of phenomena hidden behind the apparent simplicity gained through evidence (already made judgments).

Injury prevention:

In-depth data will be used to understand and gain knowledge about injury causation, injury mechanisms, human tolerance and measure consequences.

The data can also be used to assess the risk for injury in certain situations. The information about how injuries arise can lead to design changes in vehicles or the road environment to prevent injuries or mitigate their consequences.

Research priorities:

In-depth studies help to understand how accidents occur and they contribute to make priorities in research to find ways to decrease the number of accidents or reduce the consequences of an accident. They also enable accurate tracking of accident problems and can be used to predict future accident problems or risk areas.

Analysis:

Bring the quantitative values to qualitative data - possibility to analyze events even when not so frequent. In-depth data makes accident reconstruction possible and allows for answering specific questions.

Be able to connect FOT/NDS data to accidents. Help to interpret crash tests, simulations and simulator studies.

In-depth studies are needed to find the interaction of factors leading to injuries in an accident. It can also show the subtlety of interactions between variables – a factor can become a contributing factor only when associated with another factor.

Assessment evaluation:

The in-depth data can be used to retrospectively evaluate the effect of new technologies or countermeasures. An accurate analysis of accident mechanisms is useful to make a better assessment of implemented countermeasure.

4.2.2. Justification for having harmonized in-depth accident investigations in Europe

The main purpose for the data produced from in-depth investigations is to aid the process of increasing road safety for all road users. Direct or indirect justifications for having an in-depth accident investigation infrastructure are presented below.

Knowledge:

Harmonized in-depth accident investigation studies in Europe will lead to improved knowledge on traffic accidents. Detailed information that is not available in national statistics will be gained and differences on specific topics/questions in different regions can be observed/answered. The understanding and assessment of the European accident causation mechanisms will be facilitated and an opportunity to study the driver mentality across Europe is achieved. In-depth studies throughout Europe will create traffic safety awareness in countries that have not earlier been prioritizing this and identify regions with high and low effectiveness in road safety measures.

Simplify prioritisation and legislation:

Data from in-depth accident investigations will simplify European decision-making and help each country to prioritise where research funding as well as investments in e.g. road infrastructure should be placed to increase road safety. Comparable data from Europe will help each country to promote their national needs in the European debate. To demand the introduction of new vehicle technologies through legislation requires a solid empirical foundation. A large portion of the emerging technologies are preventative in nature, i.e. aim to counter and/or mitigate erratic driver behaviour in order to prevent accidents from happening. This requires extensive and detailed knowledge on accident causation in order to produce accurate and relevant legislation. The accident causation information needs to be comparable across Europe, in order not to create biased or suboptimal legislation. Harmonized data will help to define a common culture of safety and avoid misunderstanding between countries. It is more effective to have the same definitions and methods.

Road accidents are extremely expensive for the society and therefore substantial resources could be saved by improving roads and vehicles to reduce the number of accidents and thus saving lives and suffering.

Countermeasures/effectiveness:

A European database could be used to monitor effects, assess efficiency and measure the effectiveness of countermeasures and policies across Europe. The impact of vehicles and road infrastructure technologies across Europe can be evaluated. Moreover the data will be used to identify new emerging road safety issues and assess countermeasures which deal directly with a specific road safety problem.

Database robustness:

A common in-depth investigation protocol in Europe allows cross comparison between the countries on: policies, vehicles, behaviours and road infrastructures. The larger the sample of accident data the more the conclusions are reliable and statistical significance can be achieved. Data availability is important for transparency and for further development of methods.

Industry competitiveness:

A common European approach will make Europe a good competitor against the rest of the world in countermeasure development. Common European data help the development of systems to fit the European market. Vehicle industry that work in collaboration with accident investigation teams also get an earlier and more direct insight that can help them to rapidly bring product improvements into the market.

5. WHAT IS NEEDED?

All activities described in previous chapters have contributed to the decision on how future in-depth investigations ideally should be formed. The prioritisation of WP2 DaCoTA partners, EU countries together with the European organisations and institutions in need of harmonized European in-depth accident data have contributed to the chosen collection methodology and level of collected data.

5.1. Methodology

After analysing the prioritisation of research questions formulated by WP2 DaCoTA partners, the consulted stakeholders and national administrations it was apparent that the level of detailed data required could only be collected by detailed on-scene investigations. This means that the team arrives to the accident scene before all vehicles have been removed and any perishable volatile data is lost. On-scene investigations give a better view of the accident site, traces and end positions of the vehicles. They also enable an earlier contact with involved people and witnesses who will otherwise be difficult to find.

Ideally, all teams would conduct on-scene investigations from the start of a data collection activity. Unfortunately this may not be possible for all newer teams before agreements have been established with local police or with other local requirements being in place. Instead it will be allowed for new teams to conduct retrospective investigations in the pilot study to give them some time to solve any obstacle before they go on-scene. Although within a certain period of time it will be required for all teams to perform on-scene investigations, see Figure 8.

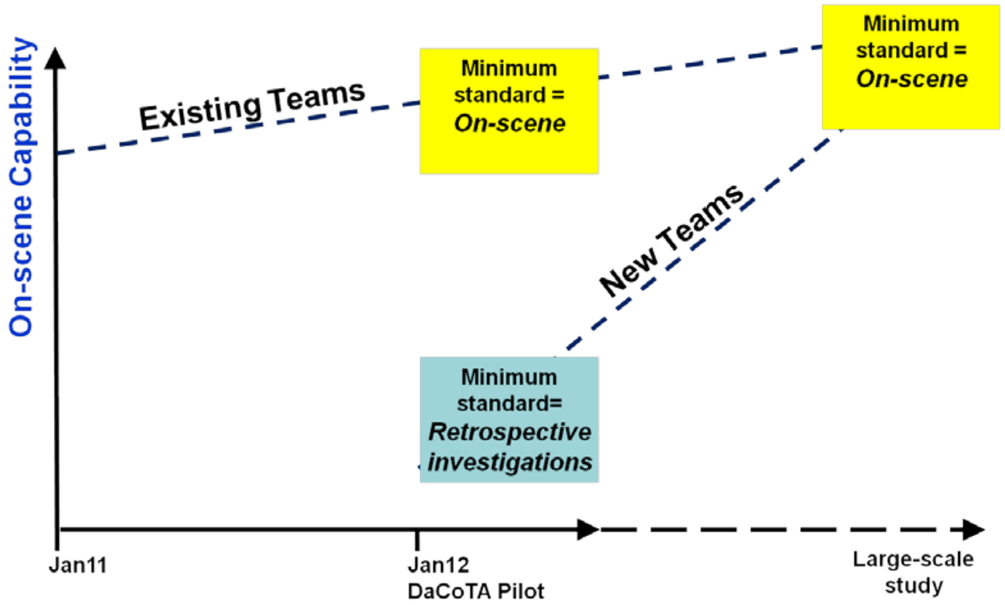

Figure 8 On-scene requirements for new and existing teams over time.

5.2. Protocols and variables

Protocols will be developed to fit the variable groups to collect and what accident collection method to be used. To avoid re-working efforts already done in previous projects, much of the work from SafetyNet and other projects will be used. A comparison between what is collected across existing collection projects has been made and was described in more detail in chapter 2.3. It has also been checked what variable groups are needed to answer each of the research questions and interests as identified by the consultations with stakeholders and WP2 partners. For the 30 most prioritised questions all of the variable groups suggested were needed to answer all these questions (appendix 4). Of the 30 questions, 6 were ranked as complex, 21 as difficult and 3 as simple (see chapter 4.2). To answer 27 of these 30 questions a detailed in-depth approach is required, therefore this sets the minimum level or requirement for the collected data. (See chapter 4.2 for more detailed description of each level).

As new teams might have problems going on-scene in the beginning and might also need some time before reaching full competence in for example making interviews, injury causation analyses and accident reconstructions, a lower level of collected data will be allowed in the beginning. See Figure 9 for a view of data collection requirements over time. All teams will be required to reach full data collection level within a certain period of time.

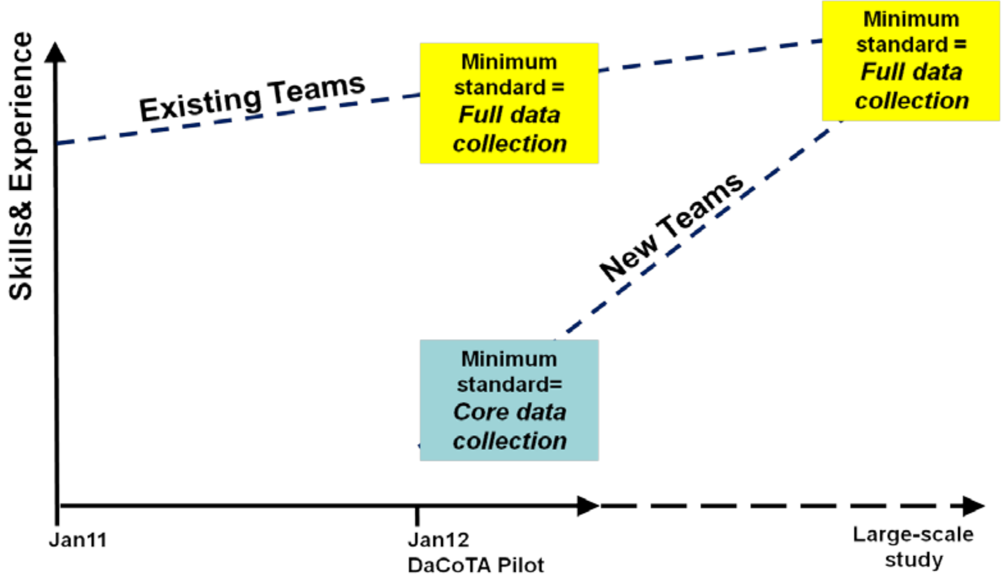

Figure 9 Levels of data collection for new and existing teams over a period of time.

5.3. Teams

The partners in WP 2 formulated a list of known teams in Europe performing accident investigations at that time, this was then compared with responses in the national administration questionnaire especially the question "if the country has a team or is interested in building up a team". A list of 18 potential organisations that are willing to work with DaCoTA and to establish an in-depth accident investigation team was created. There are a further 6 organisations who are unsure of working with DaCoTA and 8 countries whom we did not get a response from at this stage. WP 2 will continue trying to form a link with these countries and organisations in order to increase the number of teams in this activity. The matrix in Table 6 shows if there is a possible team in each country and which expertise the team holds at this point in time. It also lists the fatality rate per country to illustrate the distribution of countries with either high or low fatality rates and are interested in working with DaCoTA.

Table 6 List of possible teams in each country.

European Country	Brief expertise(s) of this team (on-scene/retro, reconstructions)	Willing to work with DaCoTA	Fatalities per million inhabitants 2008	Ranking fatality rate	WP 2 Partner
Austria	No team identified	Yes	82	15	
Belgium	Retrospective of older accidents	Yes	88	13	Yes
Bulgaria	No team identified	Unsure	139	5	
Cyprus	No team identified	Yes	104	8	
Czech Republic	Starting up team october 2010	Yes	104	9	
Denmark	On-site	No response	74	17	
Estonia	On-scene and retro	Yes	98	12	
Finland	On-scene	Unsure	65	21	
France	On-scene, reconstruction	Yes	67	20	Yes
Germany	On-Scene, PC-Crash	Yes	54	23	Yes
Greece	Possible	Yes	139	6	Yes
Hungary	No team identified	Yes	99	11	
Iceland	On-scene, reconstruction	Yes	u	u	
Ireland	Possible	No response	64	22	
Israel	No team identified	No response	u	u	
Italy	Possible	Yes	79		Yes
Latvia	No team identified	Unsure	139	4	
Lichtenstein	No team identified	No response	u	u	
Lithuania	No team identified	Unsure	148	1	
Luxembourg		No response	72	18	
Malta	No team identified	Yes	37	27	
Netherlands	Possible	Yes	41	26	Yes
Norway	On-site/retro, PC crash	No response	u	u	
Poland	No team identified	Yes	143	2	
Portugal	Possible	No response	83	14	
Romania	No team identified	No response	142	3	
Slovakia	No team identified	Unsure	103	10	
Slovenia	No team identified	Unsure	106	7	
Spain	On-scene and retro, PC-Crash	Yes	68	19	Yes
Sweden	On-scene, PC-Crash	Yes	43	25	Yes
Switzerland	No team	Yes	u	u	
UK	On-scene	Yes	43	24	Yes

U to be explained

6. CONCLUSION

The work conducted in this work package has clearly shown a strong need for in-depth data being collected at a European level. The need is not only in support of policy, legislation and industry, but also to allow road safety strategies and successes to be widely applicable across member states. The current in-depth investigation projects in member states, although extremely useful at a national level and informative at an EU level, are not sufficiently compatible or comprehensive enough in their geographical coverage, to be applicable at the European level. For example, are typical causes of accidents in a northern European country relevant in a southern European country where cultural, climate and vehicle fleet factors may well be different?

All the performed consultations and project reviews resulted in the clear need for in-depth data which is largely representative of Europe's accident population, while also including countries with less successful casualty figures (high road fatality rates), which must be the focus for major safety gains.

A large number of organisations or national administrations have stated they are willing to work with the DaCoTA project to establish a new investigation team, currently 18. WP 2 hopes to increase this interest by working further with organisations that may currently have reservations about being able to establish a new investigation team, by clearly outlining what is required by the project, the support they will get from WP 2 and the timeline involved. It is unrealistic to expect all new teams to be able to collect accident data within the life of the DaCoTA project, but WP 2 believes a large proportion of the teams will have the potential to be operational for the pilot study in 2012, with the remaining teams being operational for future EU activities.

Taking into consideration all research priorities voiced by DaCoTA partners, EU countries, European organisations and institutions, especially the need for harmonized European in-depth accident data, the new in-depth investigation protocols will specify on-scene information, vehicle data, road user injury data, human data, accident causation analyses and accident reconstructions.

Two steps of collection methodology will be used. On-scene investigations will be performed by all existing teams and all new teams capable of going on-scene. Retrospective investigations will be allowed for a certain period of time for new teams.

Two levels of collected data will be used. A minimum level with core data will be collected by everyone. All existing teams and all newer teams that are capable will perform full data collection.

Recommendations for statistical sampling of accidents for investigation will be prepared and presented by the end of the project. Different sampling criteria may well be appropriate for the pilot study and any possible future large scale project, and guidelines will be provided.

REFERENCES

1. *Priorities For EU Motor Vehicle Safety Design* 2001, European Transport Safety Council: Brussels.
2. *Saving 20 000 Lives On Our Roads, A Shared Responsibility*, in *European Road Safety Action Programme European Commission* 2003, Office for Official Publications of the European Communities: Luxembourg.
3. *Project web page of CARE* Available from: http://www.careproject.eu/database/index.php.
4. Braitman, K.A., Bean, B.K., McCartt, A.T., Chaudhary, N.K. , *Crashes of novice teenage drivers: Characteristics and contributing factors.* Journal of Safety Research 39, 47-54, 2008.
5. Engstrom, I., Gregersen, N.P., Hernetkoski, K., Keskinen, E., & Nyberg,A, *Young novice drivers, driver education and training.* Swedish National Road and Transport Research Institute, 2003.
6. Shinar, D., *Traffic safety and human behaviour*. 2007, Elsevier: Amsterdam.
7. SafetyNet, *Recommendations for Transparent and Independent Road Accident Investigation*, in *Deliverable D4.5 of the FP6 project SafetyNet*. 2008.
8. Persia, L., *In-depth data collection in Italy*, in *Presentation at the 2nd SafetyNet Conference*. 2008: Rome.
9. Lejeune, P., Laumon, B., Martin, J.L., Kossmann, I., & Sexton, B., *Linkage with National Accident Databases*, in *Deliverable of WP2 of the EU FP5 project STAIRS*. 2006.
10. Vallet, G.e.a., *Final report of the EU FP4 project STAIRS, contract no RO-96-SC.204.* 1999.
11. Chapman, R., *The concept of exposure.* Accident Analysis and Prevention, 5, 95-110, 1973.
12. Carroll, P.S., *Symposium on Driving Exposure*, in *National Technical Information Service*. 1973: Springfield, VA.
13. *Project web page of MAIDS*. Available from: http://www.maids-study.eu/.

APPENDIX 1

DaCoTA D2.1 – Project Variable Review

Main area	Accident				Road					Car												
Sub area	**General**	**Summary**	**Weather**	**Witness**	**General**	**Vulnerable Road User**	**Road Area**	**Road side**	**Collision Objects**	**General**	**Impacts**	**Impact measurement**	**Exterior**	**Exterior doors and glazing**	**Wheels**	**Trailer**	**Interior general**	**Belt & Seat**	**Airbag**	**Interior Observ.**	**EDR**	**Safety Systems**
Explanation/ Example of variables	Day, time, acc type, vehicles involved, position of accident	Free text, summary	weather conditions	whitness statements	Road name, type, traffic flow	VRU facilities	Road design, barrier, lane info and measurements	Road side info and measurements	Kind and size of collision object	vehicle info, make, model, fuel and powertrain, cargo	CDC	Measured deformation of impact, C1-C6 deformation	towing hook, fire, engine, hood, boot lid, leakage, compatibility geometry	Function and def of doors and windows	Info about wheels and tyres	Info of weight etc of trailer	Steering wheel, dash panel, footweel def	Info and deformation info about seats and belts	Info about existing and deployed airbags	Contact marks or other deformation inside vehicle	EDR data	Support and warning, brake and handling systems.
EU-projects																						
•SafetyNET	b	d	d		b	b	b	b		d						b			b			d
•ETAC	d	d	d		d	b	d	d	d	d	d	d	d	b	d	d		d	d			d
•RISER	d	d	b		b		d	d	d	d		d	d	d	d	d		d	d			
•MAIDS	d	b	d	d	d	d	d	d	d	d			d		d			b				d
•PENDANT	d	d								d	d	d	d	d	d	d	b	d	d	d		b
•CHILD	b	b							d	d	d	d					b	d	d		?	
•CASPER	b	b							d	d	d	d					b	d	d		?	
•CARE	b		b		b		b			b												
•EACS	d	d	d		d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d		d
•ECBOS	d	d	d		d		b			b												
Other projects																						
•INTACT – Sweden	d	d	d	b	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d		d
•GIDAS - Germany	d	b	d	b	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	?	d
•OTS - England	d	d	d	b	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d		d
•CCIS - England	d	d				b			d	d	d	d	d	d	d	d	d	d	d	d		d
•EDA (CEESAR/LAB)	d	d	d	b	d	d	d	d	d	d	d	d	d	d	b	d	d	d	d	d		d
•EDA (INRETS)	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d		d
•VALT -Finland																						
•FICA - Sweden	d	d	d		d		d	d	d	d	b		b	b	d	b	b			b		d
•CHICC - Sweden	d	d			b				b	d	d	d	b				d	d	d	d		b
•SWOV - Netherlands	d	d	d	d	d	d	d	d	d	d	d	d	b	d	d	d	b	d	d	d		d
Number of b=basic	4	4	2	4	4	3	3	1	1	2	1	0	3	2	1	2	5	1	1	1	0	2
Number of d=detailed	15	14	12	3	11	8	11	11	14	17	13	14	11	10	12	11	8	14	14	10	0	12
Total (b+d)	**95%**	**90%**	**70%**	**35%**	**75%**	**55%**	**70%**	**60%**	**75%**	**95%**	**70%**	**70%**	**70%**	**60%**	**65%**	**65%**	**65%**	**75%**	**75%**	**55%**	**0%**	**70%**

Main area	Truck												
Sub area	**General**	**Impacts**	**Impact measurement**	**Exterior**	**Exterior doors & glazing**	**Wheels**	**Trailer**	**Cargo & weight**	**Interior general**	**belt & Seat**	**Airbag**	**Interior Observ.**	**Safety Systems**
Explanation/ Example of variables	Vehicle info, make, model, fuel and truck type	Truck deformation classification, pillar, roof, cab & underrun protection def	Measured deformaion of impact	fire, fuels and batteries, leakage, geometry	Function and def of doors and windows	Info about wheels and tyres	Info of weight etc of trailer	Weight, load displacement and centre of gravity	Steering wheel, dash panel, footweel def	Info and deformation info about seats and belts	Info about existing and deployed airbags	Contact marks or other deformation inside vehicle	Mirrors, support and warning, brake and handling systems.
EU-projects													
•SafetyNET	d						b	b		b	b		d
•ETAC	d	d	d	d	b	d	d	d		d	d		d
•RISER	d	b	d	d	d	d	d	d		d	d		
•MAIDS	d	d								b			
•PENDANT													
•CHILD													
•CASPER													
•CARE	b												
•EACS	d	d	d	d	b	d	d	b	d	d	d	d	d
•ECBOS	b												
Other projects													
•INTACT – Sweden	d	d	d	d	d	d	d	d	d	d	d	d	d
•GIDAS - Germany	d	d	d	d	d	d	d	b	d	d	d	d	d
•OTS - England	d	d	d	d	d	d	d	d	d	d	d	d	d
•CCIS - England													
•EDA (CEESAR/LAB)	d	d	d	b			d	b	b		d	d	
•EDA (INRETS)	d	d	d	d	b	d	b	b	d	d	d	d	d
•VALT -Finland													
•FICA - Sweden													
•CHICC - Sweden													
•SWOV - Netherlands													
Number of b	**2**	**1**	**0**	**1**	**3**	**0**	**2**	**5**	**1**	**2**	**1**	**0**	**0**
Number of d	**10**	**8**	**8**	**7**	**4**	**7**	**7**	**4**	**5**	**7**	**8**	**6**	**7**
Total (b+d)	**60%**	**45%**	**40%**	**40%**	**35%**	**35%**	**45%**	**45%**	**30%**	**45%**	**45%**	**30%**	**35%**

Main area	bus										
Sub area	**General**	**Impacts**	**Impact measurement**	**Exterior**	**Exterior doors & glazing**	**Wheels**	**Interior general**	**belt & Seat**	**Airbag**	**Interior Observ.**	**Safety Systems**
Explanation/ Example of variables	Vehicle info, make, model, fuel, geometry & weight	Bus deformationclassification	Measured deformaion of impact	Fire, frame or brake damage, fuel and batteries, leakage	Function and def of doors and windows	Info about wheels and tyres	Steering wheel, dash panel, footweel def	Info and deformation info about seats and belts	Info about existing and deployed airbags	Contact marks or other deformation inside vehicle	Mirrors, support and warning, brake and handling systems.
EU-projects											
•SafetyNET	d								b		
•ETAC	d	d	d	d	b	d		d			
•RISER	d	b	d	d	d	d		d	d		
•MAIDS	d	d								b	
•PENDANT											
•CHILD											
•CASPER											
•CARE	b										
•EACS	d	b	b	d	b	d	b	b	b	b	d
•ECBOS	d	d	d	d	d		d	d	b	d	d
Other projects											
•INTACT – Sweden	d	d	d	d	d	d	d	d	d	d	d
•GIDAS - Germany	d	d	d	d	b	d	d	b	d	d	d
•OTS - England	d	d	d	d	d	d	d	d	d	d	d
•CCIS - England											
•EDA (CEESAR/LAB)	d	d	d	b			b	b	d	d	
•EDA (INRETS)	d	b	b	d	b	b	b	b	b	b	d
•VALT -Finland											
•FICA - Sweden											
•CHICC - Sweden											
•SWOV - Netherlands											
Number of b	**1**	**3**	**2**	**1**	**4**	**1**	**3**	**4**	**4**	**3**	**0**
Number of d	**11**	**7**	**7**	**8**	**4**	**6**	**4**	**5**	**5**	**5**	**6**
Total (b+d)	**60%**	**50%**	**45%**	**45%**	**40%**	**35%**	**35%**	**45%**	**45%**	**40%**	**30%**

Main area	Other vehicle		Road User							Analysis		
Sub area	**General**	**Impacts**	**Individual data**	**Trip specific**	**PRS**	**Rescue**	**Medical Outcome**	**Injuries**	**Long term injury follow-up**	**Reconstruction**	**Injury**	**Accident causation classification (including driver**
Explanation/ Example of variables	General info, vehicle type	Able to add an impact to connect to other collision vehicle	Age, gender, weight, stature and health before accident	Seat position, posture and actual used drugs	Restraining system CRS	Evacuation, extrication, treatment	Injury outcome, AIS, ISS, consequences	Add all injuries with description, and AIS	Complaints, Work absence, care, info from questionarrie	Add events, impacts and sequence per vehicle	Connecting injuries with impacts and probable injury mechanism	A GUI (graphical user interface) to add the dREAM analysis
EU-projects												
•SafetyNET	d		b	b	b	b	b	b	b			d
•ETAC	d	d	d	d	d		d	d		d	d	
•RISER	d	d	d	d	d			d		d?		d?
•MAIDS	b	d	d	d	d	b	d	d	d	d	d	d
•PENDANT			d	d	d	d	d	d		d	d	
•CHILD		d	d	d	d		d	d		b	d	
•CASPER		d	d	d	d		d	d		b	d	
•CARE	b		b	b	b		b					
•EACS	d	d	d	d	d	b	d	b	b	d		
•ECBOS	b		d	d	d	d	d	b		d	d	
Other projects												
•INTACT – Sweden	d	d	d	d	d	d	d	d	d	d	d	d
•GIDAS - Germany	d	d	d	d	d	d	d	d	d	d	d	d
•OTS - England	d	d	d	d	d	d	d	d	b	d	d	d
•CCIS - England			d	d	d	d	d	d	b	d	d	
•EDA (CEESAR/LAB)	d	d	d	d	d	b	d	d		d	d	
•EDA (INRETS)	d	d	d	d	d	b	d	d	b	d	b	
•VALT -Finland												
•FICA - Sweden			d				b					d
•CHICC - Sweden			d	d	d		d	d				
•SWOV - Netherlands	d		b	d	d	d	d	d	d	d	b	d
Number of b	3	0	3	2	2	5	3	3	5	2	2	0
Number of d	10	11	16	16	16	7	15	14	4	12	11	7
Total (b+d)	**65%**	**55%**	**95%**	**90%**	**90%**	**60%**	**90%**	**85%**	**45%**	**70%**	**65%**	**35%**

APPENDIX 2

DaCoTA D2.1 – National Administration Questionnaire

WP2

Pan-European In-Depth Accident Investigation Network

Questionnaire for National Administrations

Please return the completed questionnaire via email to Dawn Chambers-Smith, d.chambers@lboro.ac.uk
If you require assistance to complete the questionnaire or would like more information about the DaCoTA project please contact:
Dawn Chambers-Smith, Project Administrator
0044 (0) 1509 226942, d.chambers@lboro.ac.uk

Project co-financed by the European Commission, Directorate-General for Mobility and Transport

Questionnaire Purpose

The European Commission's FP7 DaCoTA project is in the process of developing a pan-European infrastructure for an in-depth accident investigation programme within the EU Member States. Such a programme is required to fulfil the need for data to support evidence-based policy making within the European Commission and in individual Member States. The objective of the programme is to ensure that in-depth safety-oriented road accident investigations are carried out in each Member State according to a common methodology set out by the DaCoTA programme. A European database will be developed to compile the data collected by the Member States. The DaCoTA programme will specify the data collection protocol, the data variables and data values to be collected. These will be geared predominantly towards addressing policy needs. The DaCoTA programme will also identify suitable partners to conduct the investigations in the Member States and these partners will receive appropriate training in the processes and methodologies where necessary.

The DaCoTA programme is taking into account the different policy requirement within the European Union and therefore several types of data will be specified within the programme. However, an evaluation of the views of the EU National Administrations is required in order to assess which data and methods will be most useful. Therefore we request that you complete this short questionnaire to help us meet your road safety policy and regulatory requirements.

EUROPEAN COMMISSION Directorate-General for Mobility and Transport
Project co-financed by the European Commission, Directorate-General for Mobility and Transport

Part 1

Background

Please could you provide us with the following details about yourself:

Name	
Role	
Institution	
Country	

Current systems

What data does your Country use to address road safety issues or to make policy decisions? *(Tick all that apply)*

Access to police investigation reports	☐
Insurance reports	☐
Independent investigations by an independent source	☐
National accident reporting system	☐
Roadside surveys	☐

Other (Please state):

What does your Country class as in-depth road traffic accident data? *(Tick all that apply)*

Access to police investigation reports	☐
Insurance reports	☐
Independent investigations by an independent source	☐
National accident reporting system	☐
Roadside surveys	☐

Other (Please state):

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If you use in-depth road traffic accident data what level is it sourced from? *(Tick one box)*

Regional ☐

National ☐

EU (accident data from other European Countries) ☐

Other (Please state):

What infrastructure, if any, do you currently have in place in your Country/Region/Administration for obtaining information regarding accidents? *(Tick all that apply)*

Access to in-depth road accident research investigations reports/files ☐

Access to police investigation reports/files ☐

National accident reporting system ☐

None of these ☐

Comments:

Current Viewpoint

Do you feel there is a need and/or a benefit of having in-depth accident data collected in your country to be able to identify common accident scenarios and problem areas to facilitate evidence-based policy decisions? *(Tick one box)*

Yes ☐

No ☐

Don't Know ☐

Comments:

Do you feel there is a benefit in establishing an in-depth accident investigation team to collect data for research purposes alongside any existing data collection activities (In your country and across Europe)? *(Tick one box)*

Yes ☐
No ☐
Don't Know ☐

Comments:

Views on establishing a new network

What would you consider are/were the main obstacles for establishing an in-depth accident investigation team in your country? *(Tick all that apply)*

Funding of Activity ☐
Data protection ☐
Ethical approval ☐
Data ownership and use ☐
Judicial obstacles ☐
Notification of road traffic accidents ☐
Access to accident scene ☐
Access to the medical data ☐
Need to clear the accident scene quickly ☐
Health and Safety ☐
Setting up the investigation team ☐

Other, Please state:

Do you think your Administration would support the implementation of a new in-depth accident investigation team in your Country/Region? *(Tick one box)*

Yes ☐
No ☐
Don't Know ☐

Comments:

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Do you think your Administration would aid financially the implementation of a new in-depth accident investigation team in your Country/Region? *(Tick one box)*

Yes ☐

No ☐

Don't Know ☐

Comments:

Would you work with the EU funded DaCoTA project to establish an in-depth investigation team in your country / region? *(Tick one box)*

Yes ☐

No ☐

Don't Know ☐

If you already have an in-depth road accident investigation team operating in your country, would you be willing to collaborate with the DaCoTA project? *(Tick one box)*

Yes ☐

No ☐

Don't Know ☐

Do you think it would be possible to establish an in-depth investigation team in your country / region? (*Tick one box)*

Yes ☐

No ☐

Don't Know ☐

If you answered 'no' please could you explain your answer:
If you answered 'yes' what support would be needed?

If you know of an organisation who you would like to conduct the investigations on your behalf, please provide their contact details:

Country's Policy Priorities

Assuming that you would be able to monitor all possible road safety issues, using a variety of methods, please rate the following topics according to their priority in your country's current road safety policy:

	Low Priority	Medium Priority	High Priority
Accident Causation	☐	☐	☐
Alcohol	☐	☐	☐
Daytime Running Lights	☐	☐	☐
Distraction/Inattention	☐	☐	☐
Fatigue	☐	☐	☐
Gap Acceptance	☐	☐	☐
Near Misses	☐	☐	☐
Safety technologies (infrastructure or vehicle)	☐	☐	☐
Seatbelt Use	☐	☐	☐
Speed	☐	☐	☐

Other, Please state:

EUROPEAN COMMISSION Directorate-General for Mobility and Transport
Project co-financed by the European Commission, Directorate-General for Mobility and Transport

Part 2 – You only need to answer the questions in Part 2 if an in-depth accident investigation team operates in your country.

Who is responsible for carrying out in-depth road accident investigations in your country?

Name of institution(s): ☐

How long has the activity been running? ☐ DDMMYY

What methodology is used to collect the data? *(Tick all that apply)*

On-scene (within hours of the accident occurring) ☐

Retrospective (within days of the accident occurring) ☐

Other, Please state:

How is the activity funded? *(Tick all that apply)*

National funding ☐

Private funding ☐

Which of the following evaluations and measurements are used: *(Tick all that apply)*

Crash reconstruction (using a recognised reconstruction tool) ☐

Crash severity calculations ☐

Consideration of safety technologies (infrastructure or vehicle) ☐

Determination of Accident Causation ☐

Determination of human behavioural factors ☐

Determination of injury severity ☐

Determination of injury causes ☐

What are the key competencies of the team? *(Tick all that apply)*

Engineering ☐

Medical ☐

Psychology ☐

Statistician ☐

Other, Please state:

EUROPEAN COMMISSION
Directorate-General for Mobility and Transport
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How is the collected data used? *(Tick all that apply)*

Policy	☐
Regulation	☐
Monitoring	☐
Public health auditing	☐
Vehicle and road design	☐
Calculation of costs	☐
Road auditing	☐
Insurance purposes	☐
Judicial process	☐
Litigation	☐

Other, Please state:

How do you think in-depth data contribute to road safety policy?

Thank you!

Please return the completed questionnaire via email to Dawn Chambers-Smith, d.chambers@lboro.ac.uk
If you require assistance to complete the questionnaire or would like more information about the DaCoTA project please contact:
Dawn Chambers-Smith, Project Administrator
0044 (0) 1509 226942, d.chambers@lboro.ac.uk

Directorate-General for Mobility and Transport
Project co-financed by the European Commission, Directorate-General for Mobility and Transport

APPENDIX 3

DaCoTA D2.1 – Research Questions and Prioritisation

The questions are coded as Simple, Difficult and Complex. Simple could be answered from SafetyNet, Difficult needs an increased methodology such as OTS/GIDAS/INTACT/CCIS and Complex would need further enhancement and possible collaboration with other studies (or a large amount of funding and strict sampling plan / methodology)

Research Question	Complexity of question	Issues	Frequency of selection
Pre Accident Information			
The use of vans: leisure or work?	Difficult	Need a record of journey purpose	
Experience of motorcyclists involved in accidents	Difficult	Currently this information is interview only. Will need a consistent approach to add this data/variable	
Causes of accidents: Driver behaviour			
What are the differences between human errors relatively to the type of road user (young drivers, elderly, PTW, etc.), and which specific difficulties are these errors revealing	Simple	If 'human errors' are the same as those highlighted through the SNACS methodology then this has already been achieved through SafetyNet WP5.2	4
What were the causes of accidents? Which are the most common human failures? Are more accidents caused due to distraction or misjudgement of a situation? Are there differences between different types of road users	Simple	Recorded in SafetyNet WP5.2 to a basic SNACS level. If more information is needed then a similar interview/variable situation arises	
What are causes of motorcycle accidents	Simple	Recorded in SafetyNet WP5.2 to a basic level through the SNACS methodology	
Direct and indirect risk factors involved in accidents with 15-24 year olds in weekends	Simple	This has been addressed to a basic level by the study of alcohol, belt use and overtaking behaviour in SafetyNet WP5.1/5.2 – also SNACS will show risk taking behaviour relevant to drivers in this age group	1
What are the common human factors, which lead to driver distraction and ultimately an accident?	Simple	This has been covered by the SNACS methodology in SafetyNet WP5.2	
Vans: what are risky driver behaviours	Simple	Accident causation SNACS, and event details to give an overall picture of the issue	
Which driver behaviours, intentions, expectances and cognitive status contribute most to the accident and which are of greatest importance in reducing accidents?(needed: interviews	Difficult	Some of this information is already alluded to through the SNACS methodology – more detailed information only available through interviews and corresponding data fields/variables	2
The role of distraction in run-off road accidents	Difficult	SafetyNet WP5.2 has recorded SNACS data for these accident types relating to distraction – detailed information on distraction types is best served by naturalistic type studies.	
Visibility problems (external and internal to the vehicle): Which are their contributions on road accidents and what are these types of problem?	Difficult	This could be done through detailed reconstruction work using road measures	
The role of distraction in accident causation, e.g. use of mobile phones	Difficult	This could be done through an in-depth study especially if enhanced interview data was included and combined with SNACS coding	2
Analyze the real influence of alcohol and cannabis on road driver behaviour and failures.	Complex	This would be difficult to achieve through an in depth study, more likely that the best results will be from scientific/laboratory studies.	1
Risk factors related to elderly drivers: Which types of abilities decrease with age	Complex	This is perhaps best approached through a naturalistic study and supporting literature	1

Estimate the influence of the speed on the problem of motorcycles conspicuity for other road users ("looked but failed to see" accidents).	Complex	This is perhaps best approached through scientific or laboratory tests	
Vehicle Information			
risk factors related to motorcycles: *mass-power relationship*	Simple	SafetyNet Wp5.1/5.2 already contains information on both machine power and vehicle weight	
classifications of vans in accidents	Simple	Van accidents already classified in most data sets including SafetyNet WP5.1 and WP5.2	
New vehicle (new registration): What is their probability to be involved in a road accident (injured or not)? Are they involved in the same type of accidents than older ones?	Simple	With the addition of exposure data this can be achieved currently. Sales/registration data not in-depth remit but national data normally available (DVLA in the UK)	1
Vehicle factors related to vans that make them more dangerous	Difficult	Currently need enhanced van data, this could include but not exclusive to carried loads, restrictions, driver certification, hazardous loads, belt use etc	1
light commercial vehicle: What is the contribution of the load on injuries	Difficult	This could be achieved through the introduction of detailed injury data and information on vehicle loads, restraints, gross weight etc.	
Passive safety: For what performance can we again expect from passive safety? What is the influence of downgrading passive safety (structure, load, limiter, curtain airbag, etc.) on road accidents and injuries?	Difficult	This is very similar to the data collection protocols of GIDAS, CCIS etc. Evolution of the SafetyNet dataset could include this information.	1
The crash compatibility of hybrid vehicles against small/medium modern cars	Complex	This is something that would be best addressed through laboratory crash tests where accurate and repeatable tests of this type could be completed. Supporting data could be available through in-depth	
Vehicle front light: Which is the contribution (on safety) of the new technologies on front lights (such as Xenon, Leds, directional lights, etc.)?	Complex	Lighting issues are hugely complex – this is probably best completed scientifically rather than relying on sporadic real world data with limited case numbers	
Are the "fog lights" effective?	Complex	Lighting issues are hugely complex – this is probably best completed scientifically rather than relying on sporadic real world data	
Vehicle with zero emission: From crashes, where is the best location to put energy?	Complex	This is something that would be best addressed through laboratory crash tests where accurate and repeatable tests of this type could be completed. Supporting data could be available through in-depth	
Advanced driver assistance systems			
Active safety: What is its influence on the passive safety and from when?	Difficult	This could be achieved through a combination of advanced scene reconstruction and detailed injury data	
How effective are new active vehicle safety systems in collision mitigation? Or do active safety warning systems increase the risk of distraction for the driver?	Complex	It is perhaps ideal to use a naturalistic methodology here to achieve high quality and reliable data. Or require good in-depth interview data	6
Does the driver adapt to the new technology driving to its limits (at the activation point for the system)	Complex	It is perhaps ideal to use a naturalistic methodology here to achieve high quality and reliable data.	
The accident reduction potential for new vehicle technology, e.g. devices that warn of close following	Complex	It is perhaps ideal to use a naturalistic methodology here to achieve high quality and reliable data.	

Evaluation of effectiveness: Improvement of the usual indicators to take into account others effectiveness (not only the number of saving lives but also environmental or economic or societal aspects).	Complex	This will need a multifaceted approach and not something that in-depth could answer in isolation.	
What is the best safety package (for 2010 - 2020 - 2030 - 2040 and 2050)?	Complex	This will ideally need a scientific approach like EuroNCAP to ensure reliable and repeatable tests – Supporting data could be available through in-depth	1
Driver's adaptation: how to take it into account in evaluation of effectiveness of the safety measure?	Complex	It is perhaps ideal to use a naturalistic methodology here to achieve high quality and reliable data.	
Information concerning vulnerable road users - Pedestrians			
What are the specificities of the vulnerable road users? What solutions on prevention and protection to put forward as a consequence?	Difficult	This could be achieved with an enhancement of both pedestrian injury data and vehicle data alongside detailed scene reconstructions	1
The value of conspicuity aids such as reflective clothing for protecting Vulnerable Road Users at night	Difficult	This was used to a basic level in SafetyNet WP5.1/5.2 and could be enhanced with exposure data etc.	
Causes of run-over: efficiency of protection elements, etc	Difficult	Vehicle data enhancement in line with other in-depth studies such as GIDAS and OTS – crush measures and damage patterns etc	
Pedestrian and crossing – which is the relation between type of crossing, road geometry and main characteristics (among the other presence of obstacles to sight), vehicle and traffic characteristics (in term of speed, posted and actual and type of vehicles) and consequences for pedestrians in case of crash?	Difficult	This is suitable for an enhancement of in-depth data, there is no reason why the above data variables could not be added to a proven European framework such as SafetyNet WP5.1/5.2	
What are the common accident scenarios for pedestrian accidents – reviewing the influences and effects of impact and travel speeds, sight obscuration's and injury outcomes	Difficult	This will need the inclusion of detailed injury data and for the analysis of sight obscuration the collection of detailed scene data	2
Does the EuroNCAP star-rating really influence pedestrian injury outcomes, particularly to the head and legs?	Difficult	This will need the inclusion of detailed injury data	2
Vehicle with zero emission: What are the effects on pedestrian accidents	Complex	This needs to be a multifaceted approach until EV become more common place. With scientific and laboratory testing compared to accident scenarios from in-depth data. With little difference in data collection from normal vehicle data.	
Information concerning vulnerable road users - Cyclists			
Cyclist and crossing - which is the relation between type of crossing, road geometry and main characteristics (among the other presence of obstacles to sight), vehicle and traffic characteristics (in term of speed, posted and actual and type of vehicles) and consequences for cyclists in case of crash?	Difficult	This is suitable for an enhancement of in-depth data, there is no reason why the above data variables could not be added to a proven European framework such as SafetyNet WP5.1/5.2	1
The effectiveness of cycle helmets	Difficult	This will require very detailed injury data to be routinely collected	1
Motorcycles			
What are the typical accident scenarios and causative factors involved in motorcycle accidents? How do these compare across the EU?	Simple	This is suited to an in-depth study and in particular the collection of causation and human factor information - SNACS	
Causes of motorcycle crashes and risk factors related to vehicle: mass-power relationship, driver: experience on riding, risk behaviour, conspicuity, infrastructure: Roadside barriers.	Difficult	Some of the variables listed here have been collected before in other studies – some enhancement would be needed to cover this subject comprehensively	2

Has the conspicuity issue been less prominent in recent accidents	Difficult	This would require historic data and an understanding of trends. The data has been collected in SafetyNet WP5.1/5.2	1
Has the accident severity/occurrence been reduced by the use of ABS/CBS, traction control systems?	Difficult	This would require historic data and an understanding of trends. The data on fitment has been collected in SafetyNet WP5.1/5.2 but will require an injury enhancement	1
Efficiency of helmets	Complex	This will require very detailed injury data above which can be routinely collected it is therefore more suited to scientific or laboratory testing	
In-Vehicle Safety			
The effectiveness of protective devices, such as seat belts	Simple	Data on seatbelts and injuries/ejections have been used in numerous studies with SafetyNet WP5.1/5.2 showing similar results	
How effective are Child Restraint Systems if properly used? How high is the rate of misuse of CRS? What are the most common types of misuse?	Difficult	In-Depth studies such as CHILD/CASPER and CCIS/OTS have recorded this data, Suitable with the inclusion of these variables into DaCoTA protocols	
Evaluation of seat belts and child restraint system efficiency. How to improve them for cars and buses	Difficult	In-Depth studies such as CHILD/CASPER and CCIS/OTS have recorded this data, Suitable with the inclusion of these variables into DaCoTA protocols	
What are the reasons that car occupants are killed in vehicles which have a good EuroNCAP rating (5-star). Likewise, what is the real-world outcome in poor performing vehicles.	Difficult	This is ideal for an in-depth approach. Data collection on these variables is well established so a simple enhancement is required	1
Better evaluation of child restraint system efficiency. How to improve them	Complex	This is perhaps best approached through scientific or laboratory tests - Using a designated project such as CASPER where in-depth accident collection and lab development and testing is used.	
Vehicle Dynamics/ Speed			
Run off road: Above all in rural/secondary roads. The role of speed as a causal factor.	Simple	A basic level of speed information is required, Travel and impact speeds	
How many crashes are caused by inappropriate speed as main factor and in which proportion it was present but not as main cause. For these cases, trying to evaluate grade of influence.	Difficult	Strong Scene and reconstruction data required to gage "inappropriate speed"	2
Set up a better relationship between speed and severity injuries.	Difficult	Good level of Injury data and reconstruction evidence to correlate	
The role of speed in causing road accidents and making them more severe (but reliable speed data can be difficult to collect)	Difficult	Accurate reconstruction evidence at pre impact and impact stage of accident	3
How effective is the presence of posted information on automatic control of vehicle speed in reducing speed and crash consequences?	Difficult	Naturalistic studies and/or high level of interview data	
Vehicle dynamics in pre crash phase. Can a system regain control after loss of control? Which pre-crash scenario lead to most severe injuries? (needed: PC-crash or similar reconstructions)	Complex	Need strong scene and reconstruction evidence plus simulation or reconstruction software and expertise	1
Vehicle Geometry			
Compatibility between vehicle-vehicle or vehicle-road environment. As example car-truck but also newer vehicle types (like hybrid or electric vehicles) and see how they will behave in a collision concerning injury risk. (needed: vehicle and road geometries before and after crash and injury outcome)	Complex	Need a strong level of scene and reconstruction evidence. This would be possible for experienced teams. Would be strong with additional approaches along side of in-depth such as naturalistic and lab work.	1
Injuries			

What are the reasons that car occupants are killed in vehicles which have a good EuroNCAP rating (5-star). Likewise, what is the real-world outcome in poor performing vehicles.	Difficult	Type of vehicle, injuries sustained. A study such as CCIS	
How are occupants killed and seriously injured in side impacts and what is the influence of the collision partner?	Difficult	Requires good knowledge of the collision, pre impact geometries. A Study such as CCIS	
Which collision parameters (Road user, vehicle, road environment. E.g. age, acceleration, rotation, angle, seat belt geometry, barrier type etc) are of greatest importance for the injury outcome?	Difficult	Need to increase on the Injury data collected in SafetyNet	2
How are elderly victims more vulnerable?	Difficult	Increased injury data is required to fully evaluate the situation	1
Does the EuroNCAP star-rating really influence pedestrian injury outcomes, particularly to the head and legs?	Difficult	This is possible for pedestrian accident but require accurate plotting of pedestrian impacts. Ideally in-depth coupled with lab testing	
What is the relationship between angular acceleration and type of brain injury sustained.	Complex	Requires high level of injury data. This would need to be linked to medical studies.	
Accident type			
Frontal crashes: To evaluate when there was not enough space to overtake and evaluate road visibility as factor that leads to the crash.	Difficult	High level of reconstruction work, scene evidence and appraisal. Plus the plotting of X,Y, T co-ordinates leading to the accident	
Crashes at Junctions: To evaluate visibility in this kind of crashes and when a roundabout would be a good solution and the design of the roundabout. What design elements can be dangerous for road safety.	Difficult	High level of scene evidence and comparisons of previous accidents and possible resolutions of the highway factors. OTS/GIDAS investigation linked with best practices for highway construction	1
Infrastructure			
Factors related to infrastructures that have influence in the car crash in terms of design, signposting, road elements related to both passive safety as barriers and active safety: make self-explaining roads and so on. How this influence is and the grade of it.	Difficult	This can be answered from studies such as GIDAS/OTS need good highway information	4
The role of road-side barriers in motorcycle accidents: Do they work properly, are they located with enough distance before the hazard, are roadside barriers causing a high rate of KSI in case of run-off roads? Evaluation of barriers with protection rider systems: do they work properly?	Difficult	This can be answered from studies such as GIDAS/OTS need good highway information. Recommendation from the RISER project	1
Cyclist and traffic – how effective are in protecting cyclists segregate lanes? Which degree of segregation is needed for different traffic conditions and posted and actual speed of vehicles? (e.g. is it safe in Zones 30 to mib cyclists and other vehicles or also in this situation segregation is needed?)	Difficult	This is suitable for an enhancement of in-depth data, there is no reason why the above data variables could not be added to a proven European framework such as SafetyNet WP5.1/5.2	
Elderly drivers: which elements related to infrastructure or vehicle are more difficult for them. How we can get safer infrastructures and vehicles for elderly drivers in terms of signposting, design of roundabouts and junctions.	Complex	Perhaps best linked with Naturalistic driving studies supported by In-depth accident data and interview data	
Rescue information			
Would a quick transport to the hospital have had influence on the outcome?	Difficult	Would need increased medical data and linked with a medical study	1

APPENDIX 4

DaCoTA D2.1 – Research Questions Complexity Matrix

Main area	Accident				Road												
Sub area	**General**	**Summary**	**Weather**	**Witness**	**General**	**Vulnerable Road User**	**Road Area**	**Road side**	**Collision Objects**	**General**	**Impacts**	**Impact measurement**	**exterior**	**exterior doors and glazing**	**Wheels**	**Trailer**	**Interior general**
Explanation/Example of variables	day, time, acc type, vehicles involved, position of accident	Free text, summary	weather conditions	whitness statements	Road name, type, traffic flow	VRU facilities	Road Design, barrier, lane info and measurements	Road side info and measurements	Kind and size of collision object	vehicle info, make, model, fuel and powertrain, cargo	CDC	Measured deformation of impact, C1-C6 deformation	towing hook, tire, engine, hood, boot lid, leakage, compatibility geometry	Function and def of doors and windows	Info about wheels and tyres	Info of weight etc of trailer	Steering wheel, dash panel, footwel def
How effective are active safety systems in collision mitigation? Do they increase driver distraction?	d	d	d	d	b	b	b		b	d	d	d					b
Factors related to infrastructures that have influence in the car crash in terms of design, signposting, road elements related to both passive safety as barriers and active safety?	d	d	d	d	d		d	d	d	d							
What are the differences between human errors relatively to the type of road user? (young drivers, elderly, PTW, etc.)	d	d	d	d	d	d	d	d	d	d	d	b	b	b	b	d	
The role of speed in causing road accidents and making them more severe?																	
Causes of motorcycle crashes and risk factors related to vehicle: mass-power relationship, driver: experience on riding, risk behaviour, conspicuity, infrastructure: Roadside barriers.																	
Does the EuroNCAP star-rating really influence pedestrian injury outcomes, particularly to the head and legs?	b	b	b	b	b	b	b	d	b	d	d	d	d				
How many crashes are caused by inappropriate speed as main factor and in which proportion it was present but not as main cause. For these cases, trying to evaluate grade of influence.	d	d	d	d	d		d	d	d	b					d		
The role of distraction in accident causation, e.g. use of mobile phones																	
What are the common accident scenarios for pedestrian accidents – reviewing the influences and effects of impact and travel speeds, sight obscuration's and injury outcomes	d	d	b	b	d	d	d	d	d	d	d	d	b		b	b	
Which collision parameters (Road user, vehicle, road environment. E.g. age, acceleration, rotation, angle, seat belt geometry, barrier type etc) are of greatest importance for the injury outcome?	d	d	d	b	d	b	d	d	d	d	d	d	b	b	b	b	b
Which driver behaviours, intentions, expectances and cognitive status contribute most to the accident and which are of greatest importance in reducing accidents?	d	d	b	d	d	d			b	d					b	d	
Analyze the real influence of alcohol and cannabis on road driver behaviour and failures.	d	d	b	d	d	d	b	d	b	d	d	b	b	b	b	d	
Compatibility between vehicle-vehicle or vehicle-road environment. As example car-truck but also newer vehicle types (like hybrid or electric vehicles) and see how they will behave in a collision concerning injury risk.		d			d				d	d	d	d	d	b	b	b	b
Crashes at Junctions: To evaluate visibility in this kind of crashes and when a roundabout would be a good solution and the design of the roundabout. What design elements can be dangerous for road safety.	d	d	d	d	d	d	d	d		b	b						
Cyclist and crossing - which is the relation between type of crossing, road geometry and main characteristics (among the other presence of obstacles to sight), vehicle and traffic characteristics (in term of speed, posted and actual and type of vehicles) and consequences for cyclists in case of crash?	b	b	b	b	d	d	d	d	d	b	b	b	b	b	b	b	b
Direct and indirect risk factors involved in accidents with 15-24 year olds in weekends																	
Has the accident severity/occurrence been reduced by the use of ABS/CBS, traction control systems?																	
Has the conspicuity issue been less prominent in recent accidents																	
How are elderly victims more vulnerable?																	
New vehicle (new registration): What is their probability to be involved in a road accident (injured or not)? Are they involved in the same type of accidents than older ones?																	
Passive safety: For what performance can we again expect from passive safety? What is the influence of downgrading passive safety (structure, load, limiter, curtain airbag, etc.) on road accidents and injuries?																	
Risk factors related to elderly drivers: Which types of abilities decrease with age																	
The effectiveness of cycle helmets																	
The role of road-side barriers in motorcycle accidents: Do they work properly, are they located with enough distance before the hazard, are roadside barriers causing a high rate of KSI in case of run-off roads? Evaluation of barriers with protection rider systems: do they work properly?	d	d	d	d	d		d	d	d	d							
Vehicle dynamics in pre crash phase. Can a system regain control after loss of control? Which pre-crash scenario lead to most severe injuries? (needed: PC-crash or similar reconstructions)	b	d	d	b			d	d	d	d			d		d	d	
Vehicle factors related to vans that make them more dangerous	b									d	d	d	d		d		d
What are the reasons that car occupants are killed in vehicles which have a good EuroNCAP rating (5-star). Likewise, what is the real-world outcome in poor performing vehicles.	d	d	b	d	d	b	b	d	b	d	d	d	b	b	b	b	d
What are the specificities of the vulnerable road users? What solutions on prevention and protection to put forward as a consequence?	d	d	d	d	d	d	d	d	d	d	d	b	b	b	b	d	
What is the best safety package (for 2010 - 2020 - 2030 - 2040 and 2050)?	b		b		b	b	b		b	d	d	d					
Would a quick transport to the hospital have had influence on the outcome?	b	b			b					b							
Number of b	6	3	7	5	4	5	5	0	6	4	2	4	7	7	9	5	4
Number of d	12	14	9	10	13	7	10	13	10	15	11	8	4	0	3	5	2
Percent (b+d)	**60%**	**57%**	**53%**	**50%**	**57%**	**40%**	**50%**	**43%**	**53%**	**63%**	**43%**	**40%**	**37%**	**23%**	**40%**	**33%**	**20%**
	0,6	0,567	0,533	0,5	0,567	0,4	0,5	0,433	0,533	0,633	0,433	0,4	0,367	0,233	0,4	0,333	0,2

	Car					Truck											
Sub area	**Belt & Seat**	**Airbag**	**Interior Observ.**	**EDR**	**Safety Systems**	**General**	**Impacts**	**Impact measurement**	**exterior**	**exterior doors & glazing**	**Wheels**	**Trailer**	**Cargo & weight**	**Interior general**	**Belt & Seat**	**Airbag**	**Interior Observ.**
Explanation/Example of variables	Info and deformation info about seats and belts	Info about ebisting and deployed airbags	Contact marks or other deformation inside vehicle	EDR data	Support and warning, brake and handling systems.	vehicle info, make, model, fuel and truck type	Truck deformation classification, pillar, roof, cab & underrun protection def	Measured deformaion of impact	fire, fuels and batteries, leakage, geometry	Function and def of doors and windows	Info about wheels and tyres	Info of weight etc of trailer	Weight, load displacement and centre of gravity	Steering wheel, dash panel, footweel def	Info and deformation info about seats and belts	Info about ebisting and deployed airbags	Contact marks or other deformation inside vehicle
How effective are active safety systems in collision mitigation? Do they increase driver distraction?	d	b	b		d	d	d	d				b	b	d		b	
Factors related to infrastructures that have influence in the car crash in terms of design, signposting, road elements related to both passive safety as barriers and active safety?				d	d	d											
What are the differences between human errors relatively to the type of road user? (young drivers, elderly, PTW, etc.)				d	d	d	d				b	b	b				
The role of speed in causing road accidents and making them more severe?																	
Causes of motorcycle crashes and risk factors related to vehicle: mass-power relationship, driver: experience on riding, risk behaviour, conspicuity, infrastructure: Roadside barriers.																	
Does the EuroNCAP star-rating really influence pedestrian injury outcomes, particularly to the head and legs?				d	d	d	d	d				b	b				
How many crashes are caused by inappropriate speed as main factor and in which proportion it was present but not as main cause. For these cases, trying to evaluate grade of influence.				d	d	b	b				d						
The role of distraction in accident causation, e.g. use of mobile phones																	
What are the common accident scenarios for pedestrian accidents – reviewing the influences and effects of impact and travel speeds, sight obscuration's and injury outcomes				d	d	d	d	b	b			b	b	b			b
Which collision parameters (Road user, vehicle, road environment. E.g. age, acceleration, rotation, angle, seat belt geometry, barrier type etc) are of greatest importance for the injury outcome?	d	d	d	d	d	d	d	b	b	b	b	b	b	b	d	d	d
Which driver behaviours, intentions, expectances and cognitive status contribute most to the accident and which are of greatest importance in reducing accidents?					d	d					b	d					
Analyze the real influence of alcohol and cannabis on road driver behaviour and failures.				d	d	d	d				b	b	b				
Compatibility between vehicle-vehicle or vehicle-road environment. As example car-truck but also newer vehicle types (like hybrid or electric vehicles) and see how they will behave in a collision concerning injury risk.	b	b	d	d	d	d	d	d	d	b	b	b	d	b	b	b	d
Crashes at Junctions: To evaluate visibility in this kind of crashes and when a roundabout would be a good solution and the design of the roundabout. What design elements can be dangerous for road safety.						b	b										
Cyclist and crossing - which is the relation between type of crossing, road geometry and main characteristics (among the other presence of obstacles to sight), vehicle and traffic characteristics (in term of speed, posted and actual and type of vehicles) and consequences for cyclists in case of crash?	b	b	b	d	d	b	b	b	b	b	b	b	b	b	b	b	b
Direct and indirect risk factors involved in accidents with 15-24 year olds in weekends																	
Has the accident severity/occurrence been reduced by the use of ABS/CBS, traction control systems?																	
Has the conspicuity issue been less prominent in recent accidents																	
How are elderly victims more vulnerable?																	
New vehicle (new registration): What is their probability to be involved in a road accident (injured or not)? Are they involved in the same type of accidents than older ones?																	
Passive safety: For what performance can we again expect from passive safety? What is the influence of downgrading passive safety (structure, load, limiter, curtain airbag, etc.) on road accidents and injuries?																	
Risk factors related to elderly drivers: Which types of abilities decrease with age																	
The effectiveness of cycle helmets																	
The role of road-side barriers in motorcycle accidents: Do they work properly, are they located with enough distance before the hazard, are roadside barriers causing a high rate of KSI in case of run-off roads? Evaluation of barriers with protection rider systems: do they work properly?																	
Vehicle dynamics in pre crash phase. Can a system regain control after loss of control? Which pre-crash scenario lead to most severe injuries? (needed: PC-crash or similar reconstructions)				d	d	d			d		d	d	d				
Vehicle factors related to vans that make them more dangerous	d	d	d		d												
What are the reasons that car occupants are killed in vehicles which have a good EuroNCAP rating (5-star). Likewise, what is the real-world outcome in poor performing vehicles.	d	d	d	d	d	b	d	d									
What are the specificities of the vulnerable road users? What solutions on prevention and protection to put forward as a consequence?				d	d	d	d				b	b	b				
What is the best safety package (for 2010 - 2020 - 2030 - 2040 and 2050)?	d	d		b	d												
Would a quick transport to the hospital have had influence on the outcome?				?		b											
Number of b	2	3	2	1	0	5	3	3	3	3	7	9	8	4	2	3	2
Number of d	5	4	4	12	16	11	9	4	2	0	2	2	2	1	1	1	2
Percent (b+d)	**23%**	**23%**	**20%**	**43%**	**53%**	**53%**	**40%**	**23%**	**17%**	**10%**	**30%**	**37%**	**33%**	**17%**	**10%**	**13%**	**13%**
	0,233	0,233	0,2	0,433	0,533	0,533	0,4	0,233	0,167	0,1	0,3	0,367	0,333	0,167	0,1	0,133	0,133

‹		Bus											Other vehicle				
Sub area	**Safety Systems**	**General**	**Impacts**	**Impact measurement**	**exterior**	**exterior doors & glazing**	**Wheels**	**Interior general**	**Belt & Seat**	**Airbag**	**Interior Observ.**	**Safety Systems**	**General**	**Impacts**	**Individual data**	**Trip specific**	**PRS**
Explanation/Example of variables	Mirrors, support and warning, brake and handling systems.	vehicle info, make, model, fuel, geometry & weight	Bus deformationclassification	Measured deformaion of impact	fire, frame or brake damage, fuel and batteries, leakage	Function and def of doors and windows	Info about wheels and tyres	Steering wheel, dash panel, footweel def	Info and deformation info about seats and belts	Info about ebisting and deployed airbags	Contact marks or other deformation inside vehicle	Mirrors, support and warning, brake and handling systems.	General info, vehicle type	Able to add an impact to connect to other collision vehicle	Age, gender, weight, stature and health before accident	Seat position, posture and actual used drugs	Restraining system CRS
How effective are active safety systems in collision mitigation? Do they increase driver distraction?	d	d	d	d				d			b	d	d	d	d	b	b
Factors related to infrastructures that have influence in the car crash in terms of design, signposting, road elements related to both passive safety as barriers and active safety?	d	d										d	d	d	b	b	b
What are the differences between human errors relatively to the type of road user? (young drivers, elderly, PTW, etc.)	d	d	d				b					b	d		d	d	b
The role of speed in causing road accidents and making them more severe?																	
Causes of motorcycle crashes and risk factors related to vehicle: mass-power relationship, driver: experience on riding, risk behaviour, conspicuity, infrastructure: Roadside barriers.																	
Does the EuroNCAP star-rating really influence pedestrian injury outcomes, particularly to the head and legs?	d	d	d	d								d	d	d	d	b	b
How many crashes are caused by inappropriate speed as main factor and in which proportion it was present but not as main cause. For these cases, trying to evaluate grade of influence.	d	b										d	b	d			
The role of distraction in accident causation, e.g. use of mobile phones																	
What are the common accident scenarios for pedestrian accidents – reviewing the influences and effects of impact and travel speeds, sight obscuration's and injury outcomes	d	d	d	b							b	d	d	b	d	b	b
Which collision parameters (Road user, vehicle, road environment. E.g. age, acceleration, rotation, angle, seat belt geometry, barrier type etc) are of greatest importance for the injury outcome?	d	d	d	d	b	b	b	b	d	d	d	d	d	d	d	d	d
Which driver behaviours, intentions, expectances and cognitive status contribute most to the accident and which are of greatest importance in reducing accidents?	d	d					b					d	d		d	d	b
Analyze the real influence of alcohol and cannabis on road driver behaviour and failures.	d	d	d				b					b	d		d	d	b
Compatibility between vehicle-vehicle or vehicle-road environment. As example car-truck but also newer vehicle types (like hybrid or electric vehicles) and see how they will behave in a collision concerning injury risk.	d	d	d	d	d	b	b	b	b	b	d	d	d	d	b	d	b
Crashes at Junctions: To evaluate visibility in this kind of crashes and when a roundabout would be a good solution and the design of the roundabout. What design elements can be dangerous for road safety.		b	b										b		d		
Cyclist and crossing - which is the relation between type of crossing, road geometry and main characteristics (among the other presence of obstacles to sight), vehicle and traffic characteristics (in term of speed, posted and actual and type of vehicles) and consequences for cyclists in case of crash?	d	b	b	b	b	b	b	b	b	b	b	d	b	b	b	b	d
Direct and indirect risk factors involved in accidents with 15-24 year olds in weekends																	
Has the accident severity/occurrence been reduced by the use of ABS/CBS, traction control systems?																	
Has the conspicuity issue been less prominent in recent accidents																	
How are elderly victims more vulnerable?																	
New vehicle (new registration): What is their probability to be involved in a road accident (injured or not)? Are they involved in the same type of accidents than older ones?																	
Passive safety: For what performance can we again expect from passive safety? What is the influence of downgrading passive safety (structure, load, limiter, curtain airbag, etc.) on road accidents and injuries?																	
Risk factors related to elderly drivers: Which types of abilities decrease with age																	
The effectiveness of cycle helmets																	
The role of road-side barriers in motorcycle accidents: Do they work properly, are they located with enough distance before the hazard, are roadside barriers causing a high rate of KSI in case of run-off roads? Evaluation of barriers with protection rider systems: do they work properly?													d	d	b	b	b
Vehicle dynamics in pre crash phase. Can a system regain control after loss of control? Which pre-crash scenario lead to most severe injuries? (needed: PC-crash or similar reconstructions)	d	d			d		d					d	d				
Vehicle factors related to vans that make them more dangerous															b		
What are the reasons that car occupants are killed in vehicles which have a good EuroNCAP rating (5-star). Likewise, what is the real-world outcome in poor performing vehicles.	b	b	d	d								b	d	d	d	d	d
What are the specificities of the vulnerable road users? What solutions on prevention and protection to put forward as a consequence?	d	d	d				b					b	d		d	d	b
What is the best safety package (for 2010 - 2020 - 2030 - 2040 and 2050)?															d		d
Would a quick transport to the hospital have had influence on the outcome?		b												b	d	b	b
Number of b	1	5	2	2	2	3	7	3	2	2	3	4	3	3	5	7	11
Number of d	13	11	9	5	2	0	1	1	1	1	2	10	13	8	12	7	4
Percent (b+d)	**47%**	**53%**	**37%**	**23%**	**13%**	**10%**	**27%**	**13%**	**10%**	**10%**	**17%**	**47%**	**53%**	**37%**	**57%**	**47%**	**50%**
	0,467	0,533	0,367	0,233	0,133	0,1	0,267	0,133	0,1	0,1	0,167	0,467	0,533	0,367	0,567	0,467	0,5

Road User					Analysis				
Sub area	**Rescue**	**Medical Outcome**	**Injuries**	**Long term injury follow-up**	**Reconstruction**	**Injury**	**Accident causation classification (including driver**		
Explanation/Example of variables	Evacuation, ebtrication, treatment	Injury outcome, AIS, ISS, consequences	Add all injuries with description, and AIS	Complaints, Work absence, care, info from questionarrie	Add events, impacts and sequence per vehicle	Connecting injuries with impacts and probable injury mechanism	A GUI (graphical user interface) to add the DREAM analysis	**Complexity of question**	**Frequency of selection**
How effective are active safety systems in collision mitigation? Do they increase driver distraction?		b			d	d	b	Complex	6
Factors related to infrastructures that have influence in the car crash in terms of design, signposting, road elements related to both passive safety as barriers and active safety?			b		d		d	Difficult	4
What are the differences between human errors relatively to the type of road user? (young drivers, elderly, PTW, etc.)	b	b			d			Simple	4
The role of speed in causing road accidents and making them more severe?								Difficult	3
Causes of motorcycle crashes and risk factors related to vehicle: mass-power relationship, driver: experience on riding, risk behaviour, conspicuity, infrastructure: Roadside barriers.								Difficult	2
Does the EuroNCAP star-rating really influence pedestrian injury outcomes, particularly to the head and legs?	d	d	d	d	d	d	b	Difficult	2
How many crashes are caused by inappropriate speed as main factor and in which proportion it was present but not as main cause. For these cases, trying to evaluate grade of influence.					d	d	d	Difficult	2
The role of distraction in accident causation, e.g. use of mobile phones								Difficult	2
What are the common accident scenarios for pedestrian accidents – reviewing the influences and effects of impact and travel speeds, sight obscuration's and injury outcomes		d	d		d	d	d	Difficult	2
Which collision parameters (Road user, vehicle, road environment. E.g. age, acceleration, rotation, angle, seat belt geometry, barrier type etc) are of greatest importance for the injury outcome?	d	d	d	b	d	d	b	Difficult	2
Which driver behaviours, intentions, expectances and cognitive status contribute most to the accident and which are of greatest importance in reducing accidents?					d		d	Difficult	2
Analyze the real influence of alcohol and cannabis on road driver behaviour and failures.	b	b			d			Complex	1
Compatibility between vehicle-vehicle or vehicle-road environment. As example car-truck but also newer vehicle types (like hybrid or electric vehicles) and see how they will behave in a collision concerning injury risk.		d	d		d	d		Complex	1
Crashes at Junctions: To evaluate visibility in this kind of crashes and when a roundabout would be a good solution and the design of the roundabout. What design elements can be dangerous for road safety.					d		d	Difficult	1
Cyclist and crossing - which is the relation between type of crossing, road geometry and main characteristics (among the other presence of obstacles to sight), vehicle and traffic characteristics (in term of speed, posted and actual and type of vehicles) and consequences for cyclists in case of crash?	b	d	d	b	d	b	d	Difficult	1
Direct and indirect risk factors involved in accidents with 15-24 year olds in weekends								Simple	1
Has the accident severity/occurrence been reduced by the use of ABS/CBS, traction control systems?								Difficult	1
Has the conspicuity issue been less prominent in recent accidents								Difficult	1
How are elderly victims more vulnerable?								Difficult	1
New vehicle (new registration): What is their probability to be involved in a road accident (injured or not)? Are they involved in the same type of accidents than older ones?								Simple	1
Passive safety: For what performance can we again expect from passive safety? What is the influence of downgrading passive safety (structure, load, limiter, curtain airbag, etc.) on road accidents and injuries?								Difficult	1
Risk factors related to elderly drivers: Which types of abilities decrease with age								Complex	1
The effectiveness of cycle helmets								Difficult	1
The role of road-side barriers in motorcycle accidents: Do they work properly, are they located with enough distance before the hazard, are roadside barriers causing a high rate of KSI in case of run-off roads? Evaluation of barriers with protection rider systems: do they work properly?			b		d		d	Difficult	1
Vehicle dynamics in pre crash phase. Can a system regain control after loss of control? Which pre-crash scenario lead to most severe injuries? (needed: PC-crash or similar reconstructions)					d			Complex	1
Vehicle factors related to vans that make them more dangerous			b					Difficult	1
What are the reasons that car occupants are killed in vehicles which have a good EuroNCAP rating (5-star). Likewise, what is the real-world outcome in poor performing vehicles.	d	d	d	b	d	d	b	Difficult	1
What are the specificities of the vulnerable road users? What solutions on prevention and protection to put forward as a consequence?	b	b			d	b		Difficult	1
What is the best safety package (for 2010 - 2020 - 2030 - 2040 and 2050)?	b		d		d	d	d	Complex	1
Would a quick transport to the hospital have had influence on the outcome?	d	d	d	d	b			Difficult	1
Number of b	5	4	3	3	1	2	4		
Number of d	4	7	8	2	17	8	8		
Percent (b+d)	**30%**	**37%**	**37%**	**17%**	**60%**	**33%**	**40%**		
	0,3	0,367	0,367	0,167	0,6	0,333	0,4		