Deliverable 5.5, Glossary of Data Variables for Fatal and accident causation databases

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Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (inc. Commission Services)	
RE	Restricted to group specified by consortium (inc. Commission Services)	
CO	Confidential only for members of the consortium (inc. Commission Services)	

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Executive Summary

SafetyNet work package 5 (WP5), in the creation of two in-depth European accident databases, has produced a comprehensive database glossary to help inform both those directly involved in the work package and those who will use the final data and analysis results. The final version of the glossary can be regarded as a repository of information generated during the completion of the task and as such combines to provide a 'Manual' for the data collection and data use within the work package and externally. Information contained within the glossary extends from the early development stages of the task to the final review, a duration of approximately 4.5 years.

The complete glossary has been designed to provide all the information relevant for a thorough understanding of the SafetyNet WP5 task. This information can be used in a number of ways as the complete document combines to produce a manual for data input (also referred to as 'coding'), data analysis and the understanding of any analysis by external parties

The SafetyNet WP5 glossary provides information in 6 key areas, all of which build into a complete picture of the WP5 project as a whole, the 6 key areas in turn provide information on glossary use, data Limitations and restrictions, the data variables, accident classification system (GDV), SafetyNet accident causation system (SNACS) and Database usage

The glossary is intended to be used as complete reference material covering all of the aspects listed in the previous paragraph. As such the glossary should be used as a guide to understanding the task and any analysis derived from the WP5 data. The glossary however, is not a specific tool for conducting full analysis as only illustrative details of data limitation and restrictions are included. These will be discussed in more detail and should be fully understood before work is undertaken as misuse could lead to misinterpretation of any results.

Introduction

WP5 of the SafetyNet project aims to design, develop and complete two European accident databases concerning (1) Fatal accidents and (2) Accident Causations. The combination of these two databases will contribute a major advance in in-depth knowledge of accidents at a European Union (EU) level despite having different characteristics.

The first database (Task 1 of Work package 5) relates to a European Fatal Accident Database, and involves the collection of data from 1,296 fatal accidents from 7 European member states (France, Finland, Germany, Italy, Sweden, the Netherlands and the United Kingdom). The second database (Task 2 of Work package 5) relates to a European Accident Causation Database and involves the collection of data from 998 on-scene in-depth accident investigations across 6 European member states (as above with the exception of France).

The first step in the development task and the beginning of the information used in the construction of this document, involved the completion of a thorough methodology development stage for the two components of the project. This period included the determination and development of the basic data variable list, the team structures including the investigation processes and procedures and the method of recording, storing and using the data.

A preliminary glossary was developed and was used to record all comments from the partners related to variable changes or modifications, this initial glossary, called the 'pilot checklist' formed the basis of the glossary as presented in this deliverable. This preliminary stage preceded all the data collection work completed in the project and is reported in Deliverables D5.1 (WP5.1) and D5.3 (WP5.2), however before full scale data collection commenced a pilot stage was conducted.

Between the first step (the methodology development), and the second step, (the pilot phase) a specific SafetyNet WP5 database was designed and developed by a team based at the Department of "Idraulica, Trasporti, Strade", University of Rome, (DITS). This database was designed in two sections - one for task 5.1 and the second for task 5.2, with a common 'spine' of data collected by both work packages.

The database was designed for remote data transfer to enable all partners to upload or download case information across the internet. A user guide to the database enabling persons external to SafetyNet to experience the data input system is included in this deliverable p. 194

The Pilot data collection phase consisted of the respective partners in both task 5.1 and task 5.2 collecting a small sample of data using the full scale data collection protocols. This process involved utilising the prototype database version for case input in order to 'iron out' any problems experienced by the teams whilst collecting or processing the data. This process was also used as preparation for the full scale activities to determine where possible difficulties

were evident. A full report of this section is available in Deliverable D5.2 and Deliverable D5.4 (for task 5.1 and task 5.2 respectively).

A final iteration of the data variables and associated database modifications was made in accordance with recommendations arising from the pilot phase. These final modifications proceeded full-scale data collection for both the fatal accident and accident causation data sets and constitute the majority of this deliverable

The glossary and supporting material available in this deliverable constitutes a 'Manual' for SafetyNet WP5 and as such is a vitally important document for the complete understanding of any analysis to be conducted or results published. Additionally, and before raw data or results are examined, an understanding of the data variables and any limitations or restrictions associated with these should be sought alongside an overview of the sampling considerations.

A copy of the SNACS manual is included in the glossary deliverable as it represents both a major technical step in the recording and analysis or accident causation data but also an intrinsic part of the 5.2 data collection protocols. This accident causation tool has been used extensively to record and analyse all data collected for work package 5.2 – Accident causation database. This appears in the glossary deliverable in the interests of completeness, however more information on this subject can be found in Deliverable (D5.6) 'SNACS Manual' which covers all information for the completion of the Driving Reliability and Error Analysis Method (DREAM).

1. Glossary User Guide

Information in the following section should be used in order to understand how the glossary and its subsidiary parts combine to provide both sides of WP5 with a manual for database and data use. All information contained applies equally to both 5.1 (fatal accident database) and 5.2 (accident causation database) unless otherwise stated.

The glossary is intended to cover only aspects of the data collection conducted in WP5 of SafetyNet. As such no information exists on pre or post data collection processes such as providing information on the collection of source material from police or insurance authorities or in providing detailed descriptions on analysis techniques used with the completed dataset. The glossary is therefore not a manual for the whole of WP5 or a substitute for consultations with experts.

1.1 General Information

The glossary is intended to illustrate the collected data variables used in WP5 of SafetyNet in addition to their respective options and any associated technical data.

The SafetyNet WP5 glossary exists in a number of forms depending on the use and associated level of data required. Two of these versions; basic and in-depth are explained in more detail in the following section. This document constitutes the in-depth version of the WP5 glossary.

In addition to the two glossary versions mentioned above a further version, entitled the 'Pilot Checklist' exists containing all the development information from the initial stages of WP5 to recent detail modifications. This 'pilot checklist' remains as a reference to the development of the task and contains detailed notes and comments from all the partners with respect to all variable changes or alterations made. Due to the size of the document it is not included in the glossary deliverable; however the final glossary version contains the culmination of the development work.

1.2 Glossary Levels

Basic Level: This glossary level contains detail sufficient to enable a basic understanding of the mechanisms of work package 5 and to allow consistent and high quality data input. Information on other aspects such as the restrictions and limitations of the data is kept to a minimum and no reference is made to factors such as data restrictions, limitations or sampling. In omitting unnecessary detail the layout of the final basic version displays only the rules of data input and therefore limits any ambiguity while encouraging positive data entry.

This glossary level provided all the information and detail necessary for the input of all WP5 cases. As such this version can be seen as the manual for

understanding any analysis or raw data at face value. This version sits within the final glossary deliverable between p. 26 and p. 85 inclusive

In-depth Level: The version this deliverable constitutes. In order to fully understand all aspects of analysis or source data it is essential to have an understanding of issues beyond the basic variable and option lists that constitute the glossaries basic level.

Additional information provided in the in-depth version includes supplementary notes for variables and options plus data input notes for each level and for the database as a whole. This information is provided in greater detail to that recorded in the basic version and is therefore more useful when performing or reviewing any analysis.

Other information included in the in-depth version includes any limitations the recorded data may have. It is clear that conducting a study across 7 European countries will highlight areas where the data will differ in terms of availability or quality, it is equally clear that understanding and using this information is crucial to allow meaningful analysis to be completed. A complete country by country breakdown of the limitations of the data is available from p. 16

Another area where additional information is required is in understanding the restrictions in the data. The restrictions can generally be divided into two distinct areas, the first relates to the level of data recordable across the 7 countries and the second concerning the restrictions caused by creating a combined European dataset and the differences between countries. More information on this is available on p. 13

1.3 Understanding the glossary

The SafetyNet WP5 glossary is split into 4 sections to reflect the layout of the database. These sections describe the 4 distinct data groups associated with road traffic accidents and are labelled as ‘Accident Level’ ‘Vehicle Level’ ‘Roadway Level’ and ‘Road user Level’.

The glossary is split into these four distinct sections to allow for easy variable identification, each variable is assigned a number and level reference in the form of a letter, the format of this notation is illustrated in Table 1:

Level reference	Variable reference	Variable title
A	5	Time of day
A	11	Accident Summary
V	15	Vehicle make
V	36	Pre-impact speed
R	54	Speed limit
R	70	Weather conditions
P	80	Impairment
P	92	Ejection

Table 1: Glossary data variable reference system

Accident Level (A) : Variables 1 - 12
Vehicle Level (V) : Variables 13 – 50
Roadway Level (R) : Variables 51 – 76
Road user Level (P): Variables 77 – 117

Format: The glossary is constructed to follow the levels of the database and their respective variables; this system allows for easy reference between any given variable in the database and the additional information recorded in the glossary.

Page 12 illustrates the overall format of the glossary and highlights the most important areas for users to fully understanding the data. Further information on these areas is given below and referenced to page 12

i Variable: The specific database title of the recorded information. This column contains all the fields, or variables, recorded throughout the database and therefore the glossary

ii Value: Often called 'Option' this column contains all the related values for each variable.

iii within the 'value' column exists complete listings of all pre-defined options or a definition of the allowable format for the response. The formats used throughout the database and glossary are as follows:

Free text: Allows for complete freedom of text answers in variables such as 'accident summary' and 'model and variant' to minimise data loss through specifying a set of pre-determined responses.

Pre-defined: The most common format for recording responses is a set of pre-determined options developed either to reflect all scenarios or to categorise responses towards a 'best fit' system to allow simpler analysis.

Numerical: Effectively a free text field dedicated solely to collecting numerical responses. Restrictions are applied to limit the value of the numerical answer in order to provide a level of quality control, the value of the response allowed is illustrated in the glossary as: 2/3/4 digit numerical.

Date: all dates recorded follow the format of dd/mm/yyyy

Time: all times recorded follow the format of the 24hour clock: 00:00 – 23:59

The variables where lists of pre-defined responses exist are displayed as a drop down box in the database.

It is also worth noting that recorded data can be split into two categories of 'recorded' and 'derived'. The distinction comes from whether the data is recorded at the scene of the accident, for example the road conditions, or whether the data is derived, for example the accident day from the

recorded accident date. Derived data is useful as it provides more information from the raw source material and, as in the example outlined above, offers a simpler or more useful variable for quick data checks or analysis.

In order to include as much data as possible in the in-depth data collection and to avoid restricting the use of the source material a number of subjective variables exist. A minimum of these variables exist in the database as they rely on derived or indicated information rather than pure data. Consistency from persons entering data is also paramount in the reliability of these variables.
Examples of these variables include related factors in the accident, Driver manoeuvre prior to accident and familiar with traffic system.

iv To guarantee a high level of accuracy during the data entry phase and to ensure the dataset is completed to a high level of quality all variables have, in addition to their respective options, a section of notes illustrating good practice, examples and general data entry advice.

The notes are generally written as rules and provide sufficient information to allow accurate and positive data entry.

v Where a variable has an extensive corresponding options table or the descriptions of the options themselves contain detailed information a link is provided within the glossary. This layout reduces the overall working size of the glossary making the location of a particular variable and relevant information easier.

A complete list of the detailed variables tables is shown below:

Table 1 - First event in accident
Table 2 - Crash participants
Table 3 - Related factors in accident
Table 4 - Vehicle Make
Table 5 - Car body style
Table 6 - Driver manoeuvre prior to accident
Table 7 - Event details
Table 8 - Collision Type
Table 9 - eSafety
Table 10 - Signs

vi Additional information on the limitations of the data collected is referenced in the glossary for each partner country. This reference refers to the information recorded on p. 16

The format of the reference is shown in the bottom of the notes section for the relevant variable and takes the following form:
[Lim'] P17, Comment 10[1]

[1] Multiple comments for a single variable use the page reference [Lim'] P17+

The recorded 'result' from the variable, often called 'Option' (ii)

Breakdown of the values or options, denoted as numeric, text or free text. (iii)

Links to additional in depth option table. (v)

Variable	Value	Notes
Number of occupants/riders in the vehicle	2 digit numeric	The total number of known occupants or riders in the vehicle. For pedestrians this is always recorded as 1. In the case of a coach/bus the exact number of occupants is often unknown. Only code the number of occupants that the source material has given details on and state in the comments box that the exact number of occupants is unknown. In a case where the total occupant number is known and in order to reduce the insertion of unnecessary detail only code the number of occupants who received injuries, comment on the total number in the comments box.
Vehicle type	1 = Car 2 = Van 3 = Truck 4 = Bus/minibus 5 = Train/Tram 6 = Agricultural vehicle 7 = Two wheeled-vehicle 8 = Bicycle 9 = Shoe vehicle (pedestrian) 888 = Other 999 = Unknown	Vehicles should be entered in order of occupant severity. N.B. this could be a pedestrian. The Vehicle type should correspond to the Crash Participant coding in accident level details. Further details of vehicle types are available in TABLE 2 in appendix
Vehicle make	See TABLE 4 in the appendix for options. 999 = Unknown	The manufacturer of the case vehicle. Full options list available in TABLE 4
Model and variant	Free text box	Vehicle model written out along with variant. Completed with enough detail to determine the specification of the case vehicle, use the exact layout as it appears on the vehicle including engine size or subscripts such as Si, GSi, GT, SE, 16V if necessary.
Car body style	See TABLE 5 in the appendix for options 999 = Unknown 777 = Not applicable	The general silhouette of the case vehicle, completed from the list available in the appendix [Lim' P63, Comment 10]
Driven wheels	1 = Front 2 = Rear 3 = 4-wheel drive/All-wheel drive	The output from the engine is fed through the front wheels only The output from the engine is fed through the rear wheels only Power is distributed to all four of the vehicle's wheels through permanent or selectable systems, this power may be distributed between the wheels by means of viscous/hydraulic or electrical means.

The collected variable name as it appears in the database (i)

Additional comments on the limitations of the data, split per country. (vi)

Notes giving coding advice and further explanations of values. Information on basic limitations restrictions. (iv)

2. Data Restrictions

For the purposes of this section the discussion will be split into two sections:

1) Relates to the level of data available and recordable across the WP5 partner countries

2) The analysis restrictions caused by creating a combined European dataset and the differences between countries.

1) The level of data is, in its simplest form, the number of different variables available for reliable collection from across the different partner countries involved in the two WP5 tasks. When considering the completed variable list that constitutes the glossary, the recorded level of data for the whole dataset can be regarded as the minimum available across the partner countries. This statement should not be misunderstood, it does not mean that the overall number of variables used was purposely kept low to reduce complexity; it is simply that the data level is set by the country collecting the minimum 'level' of data, this can be seen in figure 1.

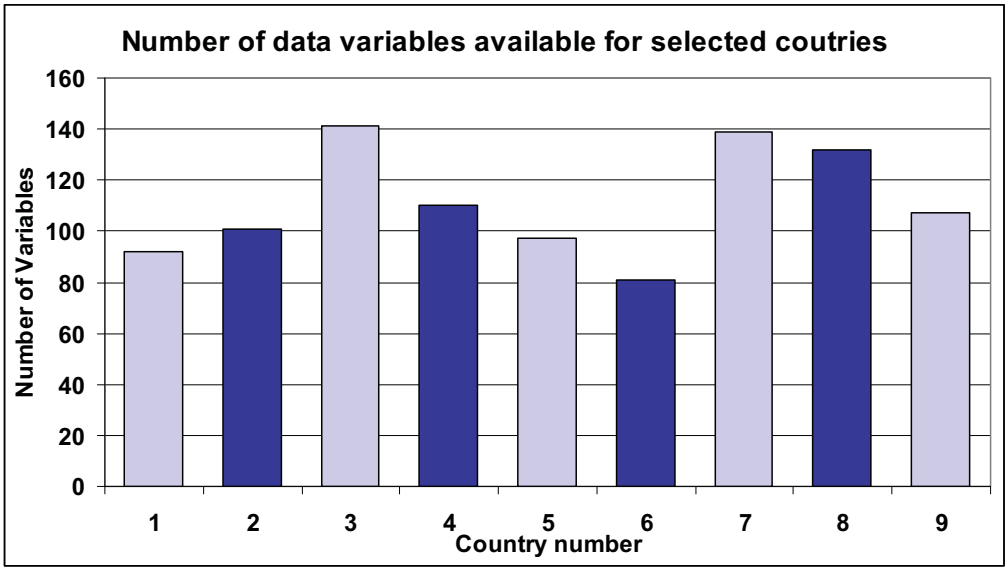

Figure 1: Theoretical data 'level' table

Considering a theoretical example of 10 countries involved in collecting accident data; it is clear that the level of data availability will vary. It can be seen from figure 1 that the theoretical level of data recorded by country 3 is beyond the scope of all the other partners involved and will therefore yield much less comparable results. A level of data at or around that recorded by country 6 is achievable by all partners. This example demonstrates that the level of data recorded by all partners involved in WP5 is set around the country recording the least, in this example country 6.

Differences in the availability of data will still occur even when a seemingly conservative data 'level' such is chosen. This can be due to the differing source materials used, the type of accident investigation conducted or confidentiality

issues. These differences are discussed and examples of common variable differences given in section 3. Data limitations, p. 16

2) Restrictions apply to analysis when variations occur in the way data is recorded or the way it exists between partner countries. It is not always possible to collect data for one variable across all partner countries and assume that it is perfectly comparable. The differences that exist between countries can make direct comparisons difficult and in some cases impossible without first understanding how the data exists in each country.
This section outlines some of the more common restrictions in the data in terms of making direct comparisons while conducting analysis. The extent of these variations are numerous and the information below is therefore not exhaustive.

GDV[2] – when analysing GDV codes it is necessary to fully understand the differences between driving on the left (UK only) and driving on the right (continental Europe) in terms of analysing the codes.

For example analysing struck side drivers fatally injured in accidents at junctions will involve determining the relative positions of the drivers; this may be done by using two GDV codes (301 or 321 for example) to highlight these specific cases. This simplified example illustrates that this issue will reoccur throughout the dataset whenever a junction or another vehicle is involved.

Alcohol level – Differing legal drink drive levels across the 7 partner countries will make direct comparisons between the effects of alcohol on fatal accidents difficult Where an alcohol level is recorded in a case a full understanding of the relevant countries drink drive law will need to be reached before meaningful conclusion can be drawn.

Vehicle Level – The difference between home market vehicles and those destined for export restricts the amount of direct comparison between similar makes and models across the dataset. For example a Swedish built Volvo sold in Sweden is likely to have a different specification to those sold across the other 6 partner countries; the same is true of an Italian built Fiat sold in Italy or elsewhere in Europe.

It should also be noted that manufactures and their respective models vary enormously across Europe, an examples of this are British built Vauxhalls which are almost identical in model and variant to the sister company Opel in Europe. Another case exists with Italian built Lancia which are common across most southern European countries, notably Italy, while relatively rare and even unavailable in Northern Europe and the UK particularly.

Speed Limits – In order to simplify the database and therefore the data entry, the database units for speed (in all speed related variables) is set to kilometres per hour (kph). For the 6 continental European countries this variable is straight forward, aligning with the signalised speed limits. It is however more

[2] GDV (Accident Classification System). Developed by Hannover medical school (MUH) and used in SafetyNet WP5 to numerically classify accident types. More information available on p. 87

complicated when UK speed limits, normally recorded in miles per hour (mph), are introduced. Conversion to kph has been employed although this does not conform completely with the European system, table 2 illustrates the differences in the recorded speed limits.

European Speed limits (kph)	Converted UK speed limits (kph)	Original UK speed limits (mph)
-	32	20
-	48	30
50	-	-
60	-	-
-	64	40
80	-	-
-	81	50
90	-	-
-	97	60
100	-	-
110	-	-
-	113	70
120	-	-
130	-	-

Table 2: Speed limit comparisons

This method of conversion will restrict direct comparisons of speed limits between the UK and the other partner countries, a system of grouping may be employed to class the speed limit with road type for example.

Weather Conditions – While it is important to consider the differences in the physical data such as those discussed above it is also useful to understand cultural, geographic or climatic differences in order to derive the greatest value from the data. One example of this is weather conditions, and in particular the extremes across the 7 partner countries. For example drivers in Finland at 68° Latitude experience extremes of cold that require completely different skills to drivers in Italy at 40° Latitude, 4800km away. This experience of driving in extreme weather conditions is unlikely to benefit either driver should the situation be reversed and is therefore the cause of further restrictions in the data.

Injury severity – The classification of injury severity and accident severity differ significantly between the seven European partners and as a result restricts certain analysis and direct comparison across the complete data set.

Signs – Although a common system exists for classing essential signs across the 7 partner countries there remains a large number of signs which differ significantly from country to country or are unique to a particular partner.

One area where restrictions exist is in the classification of the signs and roadway for multi-laned dual carriageways/motorways. The classification for this type of road differs between many of the partners leading to the simplification of the ‘Motorway’ variable, this variable exists in the database as a simple Yes/No field. This simplification restricts easy comparison of similar multi-laned roads

across countries without further knowledge of their construction, layout or legal status.

3. Data Limitations

Wherever a dataset exists certain limitations will be present. This section introduces the most common limitations and describes their effect or impact on any analysis conducted with the WP5 dataset. The list of limitations is not intended to be exhaustive, only illustrative. To list all the database variables and their exact limitations on the data would provide unnecessary information for both the understanding of the variables and analysis completed. Likewise, a detailed overview for each data variable with the exact number of missing or 'unknown' values could have been included. However, the glossary deliverable is intended as an aid to understanding the analysis and not as a tool for conducting analysis; as such this very detailed information is unnecessary for inclusion.

The limitations to the data, unlike the restrictions, may only affect a small number of cases for a given variable; this is due to their country specific nature. It has been demonstrated that the restrictions outlined in the previous section affect a whole variable uniformly due to the differences across the partner countries, in this way it is easy to understand and control for the effect this may have on any given analysis. With the data limitations the problems could be more subtle but needs to be understood in order to avoid misinterpretation of data analysis. Some variable limitations are repeated across the partner countries as similar issues with data collection are experienced, however their effect on the total data will still be different from the data restrictions.

The country specific limitations are predominantly due to the varying types of source material used across the partner countries. This method provides a high level of recordable data overall but causes minor differences country to country.

The exact effect on the data is not defined in this section as it is difficult to determine or even estimate the number of cases that could be affected by each variable. All values given in the following text are proportions estimated from each countries total case numbers. These values, depending on the type of analysis being conducted, will not be consistent throughout the data set as selections made on the road user level, roadway level and accident level will cause this to vary considerably.

The section below lists the limitations by country and highlights the most common variables that may be affected. All variable limitations apply equally to both task 5.1 and 5.2 unless stated in the text. As mentioned on p. 10 a reference to the most common limitations are present in the glossary under the associated variable field.

3.1 Overview of WP5 data – UK

1. **Length (Trucks):** Truck details are often missing (93%, 5.1) from police reports and unobtainable from the Driver and vehicle licensing agency (DVLA). Length is often unknown due to missing trailer information and would only provide an estimate of the entire vehicle length.

2. **Width (Trucks):** Truck details are often missing (93%, 5.1) from police reports and unobtainable from the Driver and vehicle licensing agency (DVLA). Width is often unknown.

3. **Kerb weight (Trucks):** Truck details are often missing (88%, 5.1) from police reports and unobtainable from the Driver and vehicle licensing agency (DVLA). Kerb weight is often unknown.

4. **Engine power (Trucks):** Truck details are often missing (80%, 5.1 - 55%, 5.2) from police reports and unobtainable from the Driver and vehicle licensing agency (DVLA). Engine Power is often unknown.

5. **Technical inspection:** This data is missing in the majority of cases and is coded as unknown. Cases in which the vehicle has had no MOT are highlighted with the police so an assumption could be made that no mention of a missing MOT equates to a valid MOT.

6. **Pre-impact speed:** 68% of 5.1 and 9% of 5.2 cases have missing pre-impact speeds. In other cases an estimate of the speed has been given by the police although this is only recorded in the general comments box for each vehicle.

7. **Group of Sign:** in 10% of cases the signs around an accident scene are only recorded for the vehicle who is at 'fault' eg crossed the median line or from the direction of the fatally injured road user, it does not mean there are no signs available for other road users only that the police don't regard them as contributory.

8. **Age:** Ages of road users are available for the drivers of vehicles in 42% of cases, this rises slightly when other occupants are in vehicles (44% of cases). All road users where an age is unavailable are coded Unknown.

9. **Familiar with traffic system:** It is rare to have addresses or police information relating to a road users home address. As this can be used to estimate a level of familiarity with the road layout most cases, 61% or 5.1 and 4% of 5.2, will be coded 'Unknown'

10. **Body region most heavily injured:** When an occupant is slightly or seriously injured some basic details of injuries are often provided however for fatal road users this is often just filled in as 'Fatal'. Approximately 70% of fatally injured road users will have accurate injury information, all others will be 'Unknown'. For 5.2, 17% of road users have 'unknown' injured body region.

11. **Number of days in hospital:** Police reports include information on what hospital the victims were sent however the information is limited when considering 'Number of days in hospital'. For fatal road users this will be the same value as 'Number of days until death' (where available, see below) although this is reduced when serious or slight road users are included.

12. **Child restraint fitted:** Very limited data available on the type or use of child restraints fitted in vehicles, data relating to the child is normally restricted to the age, seat position and injury information.

13. **Partial leathers (jacket):** just under half (44%, 5.1) of all motorcycle cases have no information available relating to protective jackets

14. **Partial leathers (trousers):** just under half (47%, 5.1) of all motorcycle cases have no information available relating to protective trousers

15. **Motorcycle helmet worn:** approximately 15% of all 5.1 motorcycle cases have no information available relating to helmet use.

16. **Motorcycle gloves:** just under half (47%, 5.1) of all motorcycle cases have no information available relating to the use of motorcycle gloves.

17. **Motorcycle boots:** just under half (49%, 5.1) of all motorcycle cases have no information available relating to the use of motorcycle boots.

3.2 Overview of WP5 data – France (5.1 only)

18. **Pre-impact speed:** This variable is always unknown (83% of cases) unless the vehicle is a truck and a copy of its tachograph disk is included in the police report. In most circumstances the pre-impact speed is not estimated and is therefore not included in the police reports.

19. **Length (Trucks):** (95% Unknown) it is not possible to give the vehicle length for articulated lorries because there are never full details about the trailer used and even if it were available we wouldn't know at what point it was hitched.

20. **Group of Sign:** Unless a sign plays an obviously important role in the accident (e.g. vehicle hit a sign) they are not always noted by the police on the scene. It is the exception, rather than the rule, that full details about signs in the vicinity of an accident are recorded in the police report.

21. **Airbag availability:** unfortunately airbag information isn't always filled in for all cars, it is possible to know whether a car model had airbags or not from the technical specifications. However, the police do not systematically note whether the airbags were deployed or not.

22. **Body region most heavily injured:** Details of injuries is often unknown for fatalities (27%) unless there was an autopsy (which is rarely the case in France).

23. **Partial leathers (jacket):** for motorcyclists it is not always fully reported what they were wearing at the time of the accident. The items worn by the riders are rarely included in the police report (62% unknown).

24. **Partial leathers (trousers):** for motorcyclists it is not always fully reported what they were wearing at the time of the accident. The items worn by the riders are rarely included in the police report (65% unknown).

25. **Helmet type:** For motorcyclists the helmet use is normally stated although it is rarely noted the type of helmet worn.

26. **Reflective/High visibility clothing (cyclist):** for cyclists it is not always fully reported what they were wearing at the time of the accident. The items worn by the riders are rarely included in the police report.

27. **Helmet type:** For cyclists the helmet use is normally stated although it is rarely noted the type of helmet worn.

3.3 Overview of WP5 data – Sweden

28. **Accident date:** Accident date is always set as the first day of the months due to confidentiality.

29. **Time of day:** Time of day is set as “unknown” in DB 5.1 due to confidentiality. For the 5.2 cases the time is set to the nearest full hour.

30. **Transient factors:** In most of the 5.1 accident reports (for 70 % of the vehicles) this variable is not mentioned and is coded as “unknown”.

31. **Vehicle Length (all vehicles):** This variable is obtained from the Swedish vehicle register and in the cases where the vehicle is a moped, an agricultural vehicle, a working vehicle, a tram or another vehicle which is not in the register this information is coded as “unknown” (43%, 5.1). This is also valid for foreign vehicles.

32. **Engine power (all vehicles):** This variable is obtained from the Swedish vehicle register and in the cases where the vehicle is a moped, an agricultural vehicle, a working vehicle, a tram or another vehicle which is not in the register this information is coded as “unknown” (30%, 5.1 - 16%, 5.2). This is also valid for foreign vehicles.

33. **Year of manufacture (all vehicles):** This variable is obtained from the Swedish vehicle register and in the cases where the vehicle is a moped, an agricultural vehicle, a working vehicle, a tram or another vehicle which

is not in the register this information is coded as “unknown” (21%, 5.1 - 12%, 5.2). This is also valid for foreign vehicles.

34. **Kerb weight (all vehicles):** This variable is obtained from the Swedish vehicle register and in the cases where the vehicle is a moped, an agricultural vehicle, a working vehicle, a tram or another vehicle which is not in the register this information is coded as “unknown” (28%, 5.1). This is also valid for foreign vehicles.

35. **Pre-impact speed:** This variable is in most accident reports not mentioned (around 55% for 5.1 and 85% for 5.2) and is coded as “unknown”. In the cases this variable is set to a value is when a qualified estimation has been made by the investigator or if the vehicle has been a truck and the tachograph has worked properly.

36. **Most harmful event:** Around 25 % of the vehicles in the DB is coded as “unknown” because this variable is very hard to code when there are multiple events and there is no proper injury analysis performed in the accident analysis of fatal accidents (5.1).

37. **eSafety:** The presence of the eSafety systems (ABS, BAS, ESP, TCS, ACS, LDW, CSS) is in most 5.1 cases not mentioned in the accident report. For the 5.2 cases the drivers do not always know what eSafety systems their car is equipped with. For most vehicles information of this could be obtained from the vehicle manufacturers’ websites but in the cases this could not be done the variable is coded as “unknown”

38. **Strong winds:** This variable is not coded in the police report therefore most of the 5.1 cases are coded as “unknown” (97%). In the cases when this is coded the accident investigator has made a comment about it.

39. **Familiar with traffic system:** For 13% of the drivers in 5.1, information of this sort is not in the accident report and this variable is coded “unknown”. 19% of 5.2 cases have this variable coded as ‘Unknown’

40. **Police injury severity:** When this variable is set to “unknown” it is most likely that the road user is not injured or slightly injured. The reason that this is not registered can be that the road user did not need medical care or that the police have not been at the accident scene.

41. **SafetyNet medical outcome:** When this variable is set to “unknown” it is most likely that the road user is not injured or slightly injured. The reason that this is not registered can be that the road user did not need medical care or that the police have not been at the accident scene.

42. **Body region mostly heavily injured:** In the 5.1 cases 20% of all road users in the database are coded “unknown”. Nearly all of these persons survived the crash and therefore there is no information about their injuries. The number of unknowns is 25% for the 5.2 cases.

43. **Numbers of days in hospital –** The accident report includes information on if the victims were sent to the hospital or not. Information is limited when considering 'Number of days in hospital' though. For those road users who did survive the accident this information is very poor and the variable is coded as "unknown" for about 35% of the road users in the database.

44. **Child restraint fitted:** For 33% of the accidents involving children information of CRS is not available.

45. **Child restraint used:** For 33% of the accidents involving children information of CRS is not available.

46. **Child restraint type:** For 33% of the accidents involving children information of CRS is not available.

47. **Partial leathers (jacket):** Information about the usage of protective Jackets exist for all but approximately 15 % of 5.1 cases.

48. **Partial leathers (trousers):** Information about the usage of protective trousers exist for all but approximately 15 % of 5.1 cases.

49. **Motorcycle helmet worn:** Information about the usage of motorcycle helmets exist for all but approximately 5 % of cases.

50. **Motorcycle gloves:** Information about the usage of motorcycle gloves are available in half of the 5.1 motorcycle cases, in these cases the variable is coded as "unknown".

51. **Motorcycle boots:** Information about the usage of motorcycle boots are available in half of the 5.1 motorcycle cases, in these cases the variable is coded as "unknown".

52. **Reflective/High visibility items worn (motorcyclist):** Information about the usage of reflective items are available in half of the motorcycle cases, in these cases the variable is coded as "unknown".

53. **Thick clothing (cyclists):** Information on thick clothing is in most cases not mentioned in the accident report. The thick clothing variable is coded as "unknown" for all cyclists

54. **Reflective/High visibility clothing:** Information on high visibility clothing is in most cases not mentioned in the accident report. Reflective clothing is coded as "unknown" for 75 % of all cyclists.

3.4 Overview of WP5 data – Italy

55. **Length (Trucks):** Vehicle Details for Trucks were often missing (82%, 5.1). Data on length is frequently missing in the data.

56. **Length (passenger vehicles):** Data on vehicle length is often missing (15%, 5.1) although it was possible to derive these on occasion from vehicle model and variant data.

57. **Kerb Weight (Trucks):** Vehicle Details for Trucks were often missing (69%, 5.1). Data on Kerb weight is frequently missing in the data.

58. **Kerb weight (passenger vehicles):** Data on kerb weight is often missing (36%, 5.1) although it was possible to derive these on occasion from vehicle model and variant data.

59. **Engine power (Trucks):** Vehicle Details for Trucks were often missing (79%, 5.1 - 47%, 5.2). Data on engine power is frequently missing in the data.

60. **Engine power (passenger vehicles):** Data on engine power is often missing (40%, 5.1 - 36%, 5.2) although it was possible to derive these on occasion from vehicle model and variant data.

61. **Number of Axles:** Vehicle Data on Kerb weight is frequently missing in the data (26%, 5.1).

62. **eSafety:** Data is often missing concerning the presence of the eSafety systems (ABS, BAS, ESP, TCS, ACS, LDW, CSS) as it proved difficult to derive this information.

63. **Pre-impact speed:** Data for this variable is not available for 67% of 5.1 and 39% of 5.2 vehicles. Recorded only when an expert witness report was available.

64. **Age:** Information concerning the age of drivers was often available whereas for passengers it was not always available.

65. **Familiar with traffic system:** It was not possible to define this variable in ~10% of 5.1 cases. For 5.2 this figure is ~20%

66. **Body region most heavily injured:** This information was available in approximately 25% of both 5.1 and 5.2 cases.

67. **Number of days in hospital:** The Police authority report did not always state the number of days a patient spent in hospital. However this information was sometimes available in the Insurance company report.

68. **Child restraint fitted:** Information on this variable was often very difficult to collect. In many cases it was not available at all.

69. **Airbags deployment:** This information was rarely available. Information on the presence of an airbag was available, however further details on whether it failed to deploy was scarce.

70. **Partial leathers (jacket):** This information was rarely available (93% missing) in all Police, Insurance or Judiciary reports.

71. **Partial leathers (trousers):** This information was rarely available (93% missing) in all Police, Insurance or Judiciary reports.

72. **Motorcycle gloves:** This information was rarely available (92% missing) in all Police, Insurance or Judiciary reports.

73. **Motorcycle boots:** This information was rarely available (94% missing) in all Police, Insurance or Judiciary reports.

74. **Pedestrian-Vehicle Interaction:** It was always very difficult to understand the exact interaction dynamics with other vehicles.

3.5 Overview of WP5 data – Finland

75. **Police injury severity:** In Finland police report injuries in three levels: fatal, injured and not-injured. Therefore in Finnish WP5.1 cases the 'Police Injury Severity' variable is recorded as 'Unknown' unless Fatal. In WP5.2 Police Injury Severity for injured is always recorded as 'Slight'

76. **Partial leathers (jacket):** Protective clothing is often 'unknown' (50%, 5.1). This applies for protective jackets.

77. **Partial leathers (trousers):** Protective clothing is often 'unknown' (50%, 5.1). This applies for protective trousers.

78. **Motorcycle gloves:** Protective clothing is often 'unknown' (58%, 5.1). This applies for protective gloves

79. **Motorcycle boots:** Protective clothing is often 'unknown' (58%, 5.1). This applies for protective boots

80. **Strong Winds:** Strong Winds are not automatically reported by police unless they were considered a contributing factor in the accident.

3.6 Overview of WP5 data – Germany

81. **Seatbelt Use:** For 5.1, 19% of cases show the usage to be unknown.

82. **Body Region most heavily injured:** data for the most heavily injured body region is missing for approximately 32% of road users.

83. **Motorcycle Helmet Type:** for the recorded 5.1 uses of motorcycle helmets approximately 24% are recorded unknown.

84. **Partial leathers (jacket):** Information about the usage of protective Jackets exists for half of the 5.1 cases.

85. **Partial leathers (trousers):** Information about the usage of protective trousers exists for half of the 5.1 cases.

86. **Motorcycle gloves:** Information about the usage of motorcycle gloves is not available in 55% of the 5.1 motorcycle cases.

87. **Motorcycle boots:** Information about the usage of motorcycle boots is not available in 55% of the 5.1 motorcycle cases.

88. **Bicycle helmet worn:** in 21% of the 5.1 bicycle accidents the helmet use was unknown.

89. **Vehicle Length (all vehicles):** Vehicle dimension information is often unknown. Records for vehicle length show 40% to be missing.

90. **Vehicle Width (all vehicles):** Vehicle dimension information is often unknown. Records for vehicle width show 40% to be missing.

91. **Pre-Impact speed:** 63% of the vehicles within the 5.1 dataset have an unknown pre-impact speed.

4. SafetyNet Work Package 5 (WP5) database glossary

For SafetyNet:

WP5.1 – Fatal Accident Database

WP5.2 – Accident Causation Database

4.1 Glossary Index

Variable title	Level	Ref #	Page #	Database version
ABS	V	44	41	5.1 + 5.2
Accident date	A	3	31	5.1 + 5.2
Accident day	A	4	31	5.1 + 5.2
Accident summary	A	11	32	5.1 + 5.2
Accident Type Classification (GDV)	A	6	32	5.1 + 5.2
ACS	V	48	41	5.1 + 5.2
Age	P	78	53	5.1 + 5.2
Airbag availability	P	87	55	5.1
Airbag deployment	P	88	55	5.1
Animal involvement	A	9	32	5.1 + 5.2
Are vehicle defects possibly causal in the accident	V	29	37	5.1
Area of most damage	V	39	39	5.1 + 5.2
BAS	V	45	41	5.1 + 5.2
Bicycle helmet worn	P	110	61	5.1 + 5.2
Body region most heavily injured	P	91	56	5.1 + 5.2
Car body style	V	17	33	5.1 + 5.2
Carriageway type	R	51	42	5.1 + 5.2
Case number	A	2	31	5.1 + 5.2
Centre Name	A	1	31	5.1 + 5.2
Child restraint fitted	P	100	59	5.1 + 5.2
Child restraint used	P	101	59	5.1 + 5.2
Collision type	V	43	40	5.1 + 5.2
Construction / maintenance zone	R	60	46	5.1 + 5.2
Crash avoidance manoeuvre	P	83	54	5.1
Crash participants	A	12	32	5.1 + 5.2
CRS type	P	102	59	5.1 + 5.2
CSS	V	50	41	5.1 + 5.2
Cycle facilities	R	63	47	5.1 + 5.2

Variable title	Level	Ref #	Page #	Database version
Died at scene/en route	P	96	58	5.1
Drive of vehicle	V	19	34	5.1 + 5.2
Driven wheels	V	18	34	5.1 + 5.2
Driver manoeuvre prior to accident	V	31	37	5.1 + 5.2
Ejection	P	92	57	5.1
Engine power	V	24	35	5.1 + 5.2
Entrapment/extrication	P	93	57	5.1
ESP	V	46	41	5.1 + 5.2
Event detail	V	41	40	5.1 + 5.2
Event type	V	40	40	5.1 + 5.2
Familiar with traffic system?	P	82	53	5.1 + 5.2
First event in accident	A	7	32	5.1 + 5.2
Fog	R	72	51	5.1 + 5.2
Gender	P	79	53	5.1 + 5.2
Group of sign	R	64	48	5.1 + 5.2
Has the vehicle passed the mandatory technical inspection	V	30	37	5.1
Hazardous cargo	V	34	38	5.1
Helmet type (Motorcyclist)	P	104	60	5.1
Helmet type (Cyclist)	P	111	62	5.1
Hit and run	A	10	32	5.1 + 5.2
Horizontal Alignment	R	59	45	5.1 + 5.2
Impairment	P	80	53	5.1
Inadequate signing	R	74	52	5.1 + 5.2
Interacted with	V	42	40	5.1 + 5.2
Junction	R	56	43	5.1 + 5.2
Kerb weight	V	26	36	5.1
LDW	V	49	41	5.1 + 5.2
Light condition	R	68	50	5.1 + 5.2
Local area	R	57	45	5.1 + 5.2
Motorcycle helmet worn	P	103	60	5.1 + 5.2

Variable title	Level	Ref #	Page #	Database version
Model and variant	V	16	33	5.1 + 5.2
Most harmful event	V	38	39	5.1 + 5.2
Motorcycle boots	P	108	61	5.1
Motorcycle gloves	P	107	61	5.1
Motorway	R	53	42	5.1
Number of axles	V	27	36	5.1
Number of days in hospital	P	95	58	5.1
Number of days until death	P	97	58	5.1
Number of events	V	37	39	5.1 + 5.2
Number of lanes	R	52	42	5.1 + 5.2
Number of occupants/riders in the vehicle	A	13	33	5.1 + 5.2
Partial leathers (jacket)	P	105	60	5.1
Partial leathers (trousers)	P	106	61	5.1
Pedestrian company	P	115	63	5.1
Pedestrian disabilities	P	116	63	5.1 + 5.2
Pedestrian Facility	R	62	47	5.1 + 5.2
Pedestrian-vehicle-interaction	P	114	62	5.1
Police injury severity	P	89	56	5.1 + 5.2
Police reported other drug involvement	P	99	59	5.1 + 5.2
Police Suspicion of alcohol involvement	P	98	58	5.1 + 5.2
Pre-impact speed	V	36	38	5.1 + 5.2
Problem with sign	R	65	49	5.1 + 5.2
Reflective/High visibility clothing (Cyclist)	P	112	62	5.1
Reflective/High visibility items worn (Motorcyclist)	P	109	61	5.1 + 5.2
Reflective/High visibility items worn (Pedestrian)	P	117	63	5.1 + 5.2
Related factors in the accident	A	8	32	5.1
Resident in country?	P	81	53	5.1 + 5.2
Road conditions	R	67	49	5.1 + 5.2
Road user classification	P	77	53	5.1 + 5.2
Roadway surface type	R	61	46	5.1 + 5.2

Variable title	Level	Ref #	Page #	Database version
SafetyNet medical outcome	P	90	56	5.1 + 5.2
Seat direction	P	85	55	5.1 + 5.2
Seat position	P	84	54	5.1 + 5.2
Seatbelt	P	86	55	5.1 + 5.2
Speed limit	R	54	43	5.1 + 5.2
Strong Winds	R	71	51	5.1 + 5.2
Surface contaminants	R	73	51	5.1 + 5.2
Taken to hospital	P	94	58	5.1
TCS	V	47	41	5.1 + 5.2
Thick clothing	P	113	62	5.1
Time of day	A	5	31	5.1 + 5.2
Traffic calming measure	R	75	52	5.1 + 5.2
Traffic Flow	R	69	50	5.1 + 5.2
Transient factors	V	32	37	5.1
Type of speed limit	R	55	43	5.1 + 5.2
Vehicle Colour	V	20	34	5.1 + 5.2
Vehicle heading at accident	V	33	38	5.1 + 5.2
Vehicle length	V	21	35	5.1
Vehicle make	V	15	33	5.1 + 5.2
Vehicle specific speed limit	V	28	37	5.1 + 5.2
Vehicle type	V	14	33	5.1 + 5.2
Vehicle width	V	22	35	5.1
Vertical Alignment	R	58	45	5.1 + 5.2
Was hazardous cargo discharged	V	35	38	5.1
Was the vehicle towing?	V	23	35	5.1 + 5.2
Was traffic calming a contributory factor in the accident?	R	76	52	5.1 + 5.2
Weather conditions	R	70	51	5.1 + 5.2
Working	R	66	49	5.1 + 5.2
Year of manufacture	V	25	36	5.1 + 5.2

4.2 Accident Level Data

#	Variable	Value	Notes
A1	Centre Name	1 = Chalmers 2 = DITS 3 = MUH 4 = INRETS 5 = TNO 6 = VALT 7 = VSRC	
A2	Case number		SE - 1001 to SE 1999 = Sweden IT - 2001 to IT 2999 = Italy FR - 3001 to FR 3999 = France DE - 4001 to DE 4999 = Germany NL - 5001 to NL 5999 = Netherlands FI - 6001 to FI 6999 = Finland UK - 7001 to UK 7999 = United Kingdom
A3	Accident date	dd/mm/yyyy	Please enter the date of the accident, starting with the day. *[Lim'] P19, Comment 28*
A4	Accident day	1 = Monday 2 = Tuesday 3 = Wednesday 4 = Thursday 5 = Friday 6 = Saturday 7 = Sunday -999 = Unknown	Entered automatically after the date is entered.
A5	Time of day	24-hour clock (00:00-24:00)	The time of the day, when the accident occurred. Time recorded is the local time of the accident location and is expressed in period of 60 minutes, using the 24-hour clock format (00.00-23:59). Midnight is defined as 00:00 and represents the beginning of a new day, not the end of the preceding day. *[Lim'] P19, Comment 29*

#	Variable	Value	Notes
A6	Accident Type Classification (GDV number)	101-199 = Driving accident 201-299 = Turning off accident 301-399 = Turning in / crossing accident 401-499 = Pedestrian accident 501-599 = Accident with parking vehicles 601-699 = Accident in lateral traffic 701-799 = Other accident types	3 digit number, determines the specific accident type from 7 separate accident classes. See appendix 2 for a complete list of variables.
A7	First event in accident	See TABLE 1 in appendix for 'first event' options	The event which occurred first when looking at the accident as a whole. The first event will be anything that is unusual such as a kerb strike or crossing median line which causes or leads to the final impact or incident.
A8	Related factors in the accident **5.1 cases only**	One or more to be selected from a list in a drop down box See TABLE 3 in appendix for 'related factors' options	Other factors that are **explicitly** mentioned by the investigating officer in the police report. If a witness says that an event occurred it should not be selected. If there are multiple related factors mentioned, code the most important factor and list the other(s) in the comment box.
A9	Animal involvement	1 = Yes 2 = No 999 = Unknown	Was an animal involved in the accident that was not associated with the crash participants?
A10	Hit and run	1 = Yes 2 = No -999 = Unknown	Did one of the vehicles in the accident fail to stop at the accident scene?
A11	Accident summary	Free text box	A description of the accident event including all the parties involved whether pedestrian, cyclist or motorised vehicle plus a description of pre and post impact movements, contact areas, orientation of the vehicles at impact, roadway conditions, roadway layout and occupant details. The description should build a picture of the overall accident without needing the original source material or referring to database variables.
A12	Crash participants	Box for numerical entry 1 – 17 See TABLE 2 in appendix for 'vehicle type' option	The total number of vehicles involved (including pedestrians and non motorised devices), a breakdown of the type and number of vehicles involved can then be determined through the subsequent checklist. **Note:** Only vehicles directly involved in the accident should be coded, vehicles not directly involved e.g. involved in an earlier accident should not be entered into this variable. It may also be necessary to split cases where two occupants from one vehicle receive fatal injuries from two separate events.

4.3 Vehicle Level Data

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#	Variable	Value	Notes
V13	Number of occupants/riders in the vehicle	2 digit numeric	The total number of known occupants or riders in the vehicle. For pedestrians this is always recorded as 1. In the case of a coach/bus the exact number of occupants is often unknown. Only code the number of occupants that the source material has given details on and state in the comments box that the exact number of occupants is unknown. In a case where the total occupant number is known and in order to reduce the insertion of unnecessary detail only code the number of occupants who received injuries, comment on the total number in the comments box.
V14	Vehicle type	1 = Car 2 = Van 3 = Truck 4 = Bus/minibus 5 = Train/Tram 6 = Agricultural vehicle 7 = Two wheeled-vehicle 8 = Bicycle 9 = Shoe vehicle (pedestrian) -888 = Other -999 = Unknown	Vehicles should be, if possible, entered in order of occupant severity N.B. this could be a pedestrian. As an example the vehicle with the fatality should be entered as vehicle 1. Cases with multiple fatalities can be entered in any order. The Vehicle type should correspond to the Crash Participant coding in accident level details. Further details of vehicle types are available in TABLE 2 in appendix
V15	Vehicle make	See TABLE 4 in the appendix for 'vehicle make' options. -999 = Unknown	The manufacturer of the case vehicle. Full options list available in TABLE 4
V16	Model and variant	Free text box	Vehicle model written out along with variant. Completed with enough detail to determine the specification of the case vehicle, use the exact layout as it appears on the vehicle including engine size or subscripts such as Si, GSi, GT, SE, 16V if necessary.
V17	Car body style	See TABLE 5 in the appendix for 'body style' options -999 = Unknown -777 = Not applicable	The general silhouette of the case vehicle, completed from the list available in the appendix

#	Variable	Value	Notes
V18	Driven wheels	1 = Front 2 = Rear 3 = 4-wheel drive/All-wheel drive -999 = Unknown -777 = not applicable	The output from the engine is fed through the front wheels only The output from the engine is fed through the rear wheels only Power is distributed to all four of the vehicle's wheels through permanent or selectable systems, this power may be distributed between the wheels by means of viscous/hydraulic or electrical means. If from inspection a vehicle with a switchable system is known to be running in Front/Rear drive this should be coded as above, if unsure code 4-wheel drive For trucks (HGV) where more than one rear axle is driven code as 'Rear' Trucks are mainly rear wheel driven, even if more than one rear axle is driven. Some specialist trucks, such as army vehicles may be all wheel drive.
V19	Drive of vehicle	1 = Left hand drive 2 = Right hand drive -777 = Not applicable -888 = Other -999 = Unknown	The location of the steering wheel in the vehicle, from the drivers' perspective. Code 'not applicable' for two wheeled vehicles and bicycles
V20	Vehicle Colour	Drop down list includes: Red Blue Yellow Green Orange Purple Pink Brown White Silver Black Gold Grey Unknown	In the case of a vehicle with advertising on it, code the colour that covers the most surface area. In the example below the vehicle would be blue. The colour combination should then be commented on.  It is common for motorcycles and scooters to be painted in more than one colour, in this case code the colour that covers the most surface area and comment on the exact colour combination.

#	Variable	Value	Notes
V21	Vehicle length (mm)	5 digit Numeric 0-99999 -999 = Unknown -777 = Not applicable	If not on the accident documentation, this information can be obtained from reference sources. It is the vehicles overall length and does not take into account any crush. For vehicles towing trailers with adjustable hitch positions, such as large Trucks, code 'Unknown' *[Lim'] P17+, Comment 1, 19, 31, 55, 56 & 89*
V22	Vehicle width (mm)	4 digit Numeric 0-9999 -999 = Unknown -777 = Not applicable	If not on the accident documentation, this information can be obtained from reference sources. It is the vehicles overall width and does not take into account any crush. This measure should be without wing mirrors. Enter 999 for unknown *[Lim'] P17+, Comment 2 & 90*
V23	Was the vehicle towing?	1 = Yes, Please comment 2 = No -777 = Not applicable -999 = Unknown	Code and comment on any type of trailer being used at the time of the incident, comments should indicate the type of trailer, weight, size, cargo and any damage etc. This is applicable for all vehicle types including cars, motorcycles and bicycles.
V24	Engine power (in kW)	3 digit Numeric 0-999 -999 = Unknown -777 = Not applicable	This information can be obtained from reference sources. Power ratings differ across model years and vehicle specifications, use model and variant variables to determine the vehicles exact power rating. Conversion rate: 1 bhp = 0.735kw Enter -999 for unknown *[Lim'] P17+, Comment 4, 32, 59 & 60*

#	Variable	Value	Notes
V25	Year of manufacture	4 digit numeric i.e. 2003 -999 = Unknown -777 = Not applicable	Refers to the year that the car was manufactured. If this information is not available then it is sometimes possible to derive this from the VIN number. Always enter a year, not an age. Only code year of manufacture if this is known, do not use the year of first registration as this information differs between different countries and vehicle registration systems, Information on year of first registration should only be recorded in the comments. Determining the year of manufacture through vehicle specifications (model and variant variable) can help to establish a year or range of years although this can be inaccurate depending on manufacturing changes and options, this information should only be recorded in the comments box. Use -999 for Unknown *[Lim'] P19, Comment 33*
V26	Kerb weight (kg)	5 digit numeric i.e. 11200 = 11,2t -999 = Unknown -777 = Not applicable	Refer to manufacturers data – kerb weight includes vehicle weight + driver (75kg) + 1 full tank of petrol Only since 1996 has the driver been included in the manufacturer's kerb weight data. If the car is older than 1996 add 75kg to the weight to take account of the driver. Total vehicle mass calculated for vehicles with more than one occupant or known loads should be included in the comments. If unknown please enter -999 *[Lim'] P17+, Comment 3, 34, 57 & 58*
V27	Number of axles (trucks only)	1 = 1 2 = 2 3 = 3 4 = 4 5 = 5 -777 = Not applicable -999 = Unknown	If trailer used, towing vehicle only. Tandem axle = 1 axle if axles are less than 1m apart In the case of any vehicle other than a truck enter Not applicable *[Lim'] P22, Comment 61*

#	Variable	Value	Notes
V28	Vehicle specific speed limit (kph)	3 digit numeric 0-999 -999 = Unknown -777 = Not applicable	Please enter the specific speed limit for the case vehicle if it is different from stated speed limit. The limits for goods vehicles, buses, coaches and towing vehicles are generally restricted on most roads with speed limits over 80Kph
V29	Are vehicle defects possibly causal in the accident 5.1 only	1 = Yes 2 = No -999 = Unknown -777 = Not applicable	Any defect which is reported in the incident documentation which had a direct impact on the causation of the incident, for example a tyre or suspension failure in a bend or an electronic failure for ABS or other active safety system. Suspected defects related to causation or any other failure of safety systems/vehicle components whether related to the causation or not should be reported in the comments box
V30	Has the vehicle passed a mandatory technical inspection 5.1 Only	1 = Yes 2 = No -777 = Not applicable -999 = Unknown	Choose “No” if vehicle is overdue for an inspection. If the vehicle has not had an inspection, but does not need one (because it is less than 3 years old) code as Not applicable. *[Lim’] P17, Comment 5*
V31	Driver manoeuvre prior to accident	see TABLE 6 in the appendix for ‘Driver manoeuvre’ options	The final manoeuvre for the vehicle immediately before the accident. This applies to all vehicles (except pedestrians) and is coded for each vehicles direction of travel. The coding should best describe the very last manoeuvre and as such should reflect the location/orientation of the accident
V32	Transient factors 5.1 only	1 = Other distraction(s) outside vehicle 2 = Distraction(s) inside vehicle 3=No distraction -999 = Unknown -777 = Not applicable	NB. Please describe in the comments box what the distraction was, e.g. animal in roadway, advertising, children inside car etc. Only code if it is explicitly mentioned in the police report or there is compelling evidence. *[Lim’] P19, Comment 30*

#	Variable	Value	Notes
V33	Vehicle heading at accident	1 = North 2 = North east 3 = East 4 = South east 5 = South 6 = South west 7 = West 8 = North west -999 = Unknown	Referring to the vehicle's direction of travel before the accident. Based on compass points down to inter-cardinal level i.e. SE, NW etc. This information is often indicated on a scene plan.
V34	Hazardous cargo 5.1 only	1 = No 2 = Yes, placarded 3 = Yes, not placarded 4 = Yes, unknown if placarded -999 = Unknown -777 = not applicable	Relates to whether the vehicle (any type of vehicle, e.g. truck, car etc.) is carrying any dangerous cargo and whether or not this is placarded. Notification of dangerous cargo carried in packages will be given by a reflective orange plate, containerised dangerous goods contained in tankers should display hazard warning plates. This includes petrol/diesel cans in cars. 
V35	Was hazardous cargo discharged 5.1 only	1 = Yes 2 = No -777 = Not applicable -999 = Unknown	Was the dangerous cargo released from the vehicle in the impact?
V36	Pre-impact speed (kph)	3 digit numeric 0-999 kph -999 = Unknown -777 = Not applicable	The pre impact speed of the vehicle, as stated in the source material. Only calculated speeds from the police reports should be entered, when a range of speeds are given the lower speed should be entered with a comment for the upper limits. Other speed calculations or estimates can be entered in the comments box, for example a collision speed calculated from crush. Additionally speed information can be derived from tachograph charts fitted to most modern trucks. *[Lim'] P17+, Comment 6, 18, 35, 63 & 91*

Events		The events boxes are used to describe the sequence of events for each vehicle throughout the accident. There is space to list up to 6 events. The fields 'Event 1' to 'object struck' are duplicated 6 times for this purpose. Start coding 'events' with the first unusual occurrence that would not be seen with normal driving, e.g. kerb strike.	
#	**Variable**	**Value**	**Notes**
V37	Number of events	1 = 1 2 = 2 3 = 3 4 = 4 5 = 5 6 = 6	Select the number that represents the total number of distinct events for the vehicle in question. Examples of events are an impact with a kerb, rollover or impact with another vehicle.
V38	Most harmful event	1 = Event 1 2 = Event 2 3 = Event 3 4 = Event 4 5 = Event 5 6 = Event 6 -999 = Unknown	Which of the events for the vehicle in question caused the most harm and damage to the road user? For fatal vehicles the most harmful event will be the one which causes the fatality. For non fatal vehicles the event which causes most vehicle damage or injury is selected. *[Lim'] P20, Comment 36*
V39	Area of most damage	1 = Front 2 = Back 3 = Left 4 = Right 5 = Roof 6 = Underside 7 = Multiple -777 = Not Applicable -999 = Unknown	The plain of the vehicle which displayed the most damage. For corner impacts, rollovers and two wheeled vehicles a judgment should be made on the most damaged plain. 'Multiple' code should be used for multiple impacts or for vehicles where a clear judgement on damage area cannot be made. Pedestrians should always be coded as 'front' even if source material states otherwise (this should be commented on).

For each event the following variables should be filled in

#	Variable	Value	Notes
V40	Event type	1 = Non collision 2 = Collision with vehicle 3 = Collision with object not fixed 4 = Collision with fixed object -999= Unknown	Select which event type occurred for event 1. An event where the case vehicle does not contact either a fixed, non fixed object or another vehicle. Examples include; Fire, Ejection and rollover. Coded when the case vehicle collides with another vehicle of any type An event where the case vehicle collides with an object that is not fixed. A non-fixed object could include an Animal, Vulnerable road user such as a cyclist or pedestrian or an object in the carriageway such as vehicle debris or fallen cargo. An event where the case vehicle collides with a rigidly fixed object or piece of roadside furniture. Includes collision objects such as posts/poles, bridges, walls, buildings, trees, ditches and embankments.
V41	Event detail	See TABLE 7 in the appendix for 'Event Detail' options	Based on your answer for event type, select an option of detail, describing the event from the list below.
V42	Interacted with	Vehicle 1 Vehicle 2 Vehicle 3 ……. ……. Vehicle 17 Not applicable Unknown	If event type = collision with vehicle, select the collision partner number from the list.
V43	Collision type	See TABLE 8 in appendix for 'Collision type' options -777 = Not applicable -999 = Unknown	Based on your selection for event type please select details of damage area/vehicle interaction. For example – Vehicle 1 stops in traffic, vehicle 2 (behind vehicle 1) fails to see this and runs into the back of vehicle 1. For vehicle 1 code rear to front For vehicle 2 code front to rear Always code pedestrian as 'front'

The above fields are repeated 6 times, to enable the sequence of events to be listed.

#	Variable	Value	Notes
V44	ABS	1 = Yes 2 = No -999 = Unknown -777 = Not applicable	Anti lock brakes, system that prevents wheels from locking while braking *[Lim'] P17+, Comment 37 & 62*
V45	BAS	1 = Yes 2 = No -999 = Unknown -777 = Not applicable	Brake assist, a system that aims to improve emergency braking performance by distributing brake pressure or activating the ABS system *[Lim'] P17+, Comment 37 & 62*
V46	ESP	1 = Yes 2 = No -999 = Unknown -777 = Not applicable	Electronic stability programme. A system that tries to maintain stability (under/over steering, Yaw) during emergency situations by braking individual wheels. *[Lim'] P17+, Comment 37 & 62*
V47	TCS	1 = Yes 2 = No -999 = Unknown -777 = Not applicable	Traction control system. A system that prevents the driven wheels from spinning while accelerating. *[Lim'] P17+, Comment 37 & 62*
V48	ACS	1 = Yes 2 = No -999 = Unknown -777 = Not applicable	Active cornering system. A system that facilitates cornering and makes it safer. I.e. reduces roll in curves, turns the headlamps towards the curve. *[Lim'] P17+, Comment 37 & 62*
V49	LDW	1 = Yes 2 = No -999 = Unknown -777 = Not applicable	Lane Departure Warning. A system that warns a driver (i.e. by noise or vibration) that he is leaving his lane. *[Lim'] P17+, Comment 37 & 62*
V50	CSS	1 = Yes 2 = No -999 = Unknown -777 = Not applicable	Collision sensing system. This system senses when a crash is inevitable and puts passengers and vehicle in a ready-for-crash-position/state (puts seats and steering wheel in an optimal position, closes electric windows, activates belt pretension.) *[Lim'] P17+, Comment 37 & 62*

For a list of eSafety systems and common fitment for the above please refer to TABLE 9 in the appendix, If the vehicle has additional eSafety features, please describe these in the comments box.

4.4 Road Level Data

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#	Variable	Value	Notes
R51	Carriageway type	1 = Two way traffic divided by a painted line 2 = Two way traffic with no division markings 3 = Physically divided roadway without traffic barrier 4 = Physically divided roadway with traffic barrier 5 = One-way traffic -888 = Other -999 = Unknown	The roadway is split with a painted line or hatchings only and traffic flows in both directions. The road is 2 way but there are no markings dividing up the road surface. This is often found in rural areas where the road is too narrow to divide up. There is a tactile division between the traffic flows which is not a specialist traffic barrier. An example is a roadway divided by a grass verge, hedge or low kerb. The division of 2 way traffic is made by some sort of specialist traffic barrier, for example metal 'Armco' barrier or concrete alternative. The traffic on the roadway flows in one direction only. This includes roundabouts.
R52	Number of lanes	2 digit numeric	The number of lanes is the total number of driving lanes on the stated vehicle's side of the road, not both sides. Bus lanes are included. Turning, filter and cycle lanes are not included. Collisions occurring on roundabouts should be coded as the number of lanes going around it.
R53	Motorway	1 = Yes 2 = No	A road with divided carriageways AND grade separated junctions, often at least TWO lanes in each direction. This definition differs throughout the EU and should therefore be coded depending on each countries classification. 

#	Variable	Value	Notes
R54	Speed limit (kph)	3 digit numeric -888 = Other -999 = Unknown	This refers to the stated speed limit on signs or other speed limit indicators. An example of another speed limit indicator applies to roads with 30mph (48kph) limits in the UK, these are often not signalised but use a system of equally spaced lampposts and no repeat speed limit signs to highlight this limit. For reference: 1mph = 1.61Kph 1Kph = 0.621mph
R55	Type of speed limit	1 = Permanent 2 = Temporary 3 = Variable (dynamic) 4 = Advisory -888 = Other -999 = Unknown	The speed limit shown on permanent roadway signs or through the use of other speed indicators remains the same irrespective of date, time or weather etc.. The speed limit is altered at areas where additional protection is required to drivers or road workers. For example, road works, maintenance or construction sites. The speed limit is increased or decreased during certain hours of the day or is modified depending on current traffic conditions, this could be used for rush hour or to alter vehicle speed prior to an accident scene. Advisory speed limit is often given for curves.
R56	Junction	1 = No junction 2 = T junction	  The type of junction in the vicinity of the accident

		3 = Y junction	
		4 = Crossroads (+ junction)	 Two road crossing
		5 = Roundabout	
		6 = Staggered junction	
		7 = Slip road	 Usually a ramp that aids transition from one roadway to another, found at all motorway junctions (UK)
		-888 = Other	

#	Variable	Value	Notes
R57	Local area	1 = Urban 2 = Rural 3 = Mixed -888 = Unknown	The general characteristics of the area where the accident took place. Cities, towns or large villages. Generally densely populated with residential, commercial and industrial areas. Roads normally have low speed limits and are street lit with a greater density of junctions. Vehicle traffic is normally slow moving and includes a greater number of pedestrians. Country area. Roads are normally bordered by hedges, fields or trees which lead to a more sparsely populated area. Vehicle speeds are generally higher. For a motorway or major road with fields either side code as rural. An area which has a combination of the features outlined for 'Urban' and 'Rural' generally found on the outskirts of a large town.
R58	Vertical Alignment	1 = Uphill 2 = Downhill 3 = Flat 4 = Blind summit -888 = Other -999 = Unknown	The lay of the carriageway in the vertical plane at the scene of the accident. A point where it is not possible to see where the road is heading.
R59	Horizontal Alignment	1 = Straight road 2 = Bend to left 3 = Bend to right -888 = Other -999 = Unknown	The way the road is laid out in the horizontal plane at the scene of the accident.

#	Variable	Value	Notes
R60	Construction / maintenance zone	1=None	There were no construction or maintenance zones in the vicinity and directly associated with the accident.
		2 = Construction zone	Roadway construction includes construction within the road or roadside area. The work is considered long-term - more than one day of work marked with signs, barricades etc. day and night
		3 = Maintenance zone	Roadway maintenance includes pavement marking, painting guardrail, cleaning ditches, mowing grass, etc. The work is considered as short-term - one day during daylight
		4 = Utility zone	An area for utility work such as electrical work within the right-of-way. The utility company must perform the work
		5 = Work zone, type unknown	Use this code when there is insufficient information to distinguish between construction, maintenance and utility
		-888 = Other -999 = Unknown	
R61	Roadway surface type	1 = Concrete	A mixture of aggregate, sand, water and cement. Light grey in colour once set.
		2 = Asphalt	Includes Tarmacadam. Usually black but can also be red or green.
		3 = Brick or block	Road surface composed of fixed individual blocks or bricks.
		4 = Slag, gravel or stone	Non-fixed aggregate material.
		5 = Dirt	Mud tracks or other roadway with no solid surface.
		-888 = Other -999 = Unknown	Includes special surface treatments.

#	Variable	Value	Notes
R62	Pedestrian Facility		Code the type of pedestrian crossing facility that was either being used at the accident scene or in close vicinity of the accident scene.
		1 = None Present	No pedestrian facility
		2 = Desire line only	No official pedestrian facility present but there is evidence (such as mud tracks) that the area is used by pedestrians.
		3 = Refuge	An area in the middle of the road that pedestrians can use to aid crossing
		4 = Drop kerb only	A section of the kerb is lowered to aid transition from pathway to road.
		5 = Pedestrian crossing without traffic control	Any roadway infrastructure that spans the width of the roadway, which is **not** accompanied by traffic lights eg Zebra crossing.
		6 = Pedestrian crossing with traffic control	Any roadway infrastructure that spans the width of the roadway, which is accompanied by traffic lights, eg. Pelican crossing
		7 = Footbridge	A walkway created to pass over the top of the roadway
		8 = Subway	A walkway created to pass under the roadway
		-888 = Other -999 = Unknown	
R63	Cycle facilities		Code the type of cycle facility that was either being used at the accident scene or in close vicinity of the accident scene.
		1 = None	No cycle facility
		2 = Advanced cycle lane separated by kerbing	The cycle lane is at the same level as the roadway but there is a physical divider.
		3 = Cycle lane on footway	The cycle lane is on a higher level compared to the carriageway.
		4 = Cycle lane separated by road markings	The cycle lane is on the same level as the carriageway and only separated by road markings.
		5 = Cycle (toucan) crossing	A crossing where pedestrians and cyclists share a wide and unsegregated crossing area.

#	Variable	Value	Notes
		6 = Cycle lane separated by grass strip -777 = Not applicable	The cycle lane is on the same level as the carriageway and separated by a grass strip.
R64	Group of signs	1 = Danger warning signs 2 = Priority signs 3 = Prohibitory or restrictive signs 4 = Mandatory signs 5 = Special regulation signs 6 = Information, facilities or service signs 7 = Direction, position or indication signs 8 = Additional panels 9 = Traffic works signs 10 = Traffic lights -888 = Other signs -999 = Unknown	Danger warning signs: Type signs are triangular with a red border. Priority signs regulate the right-of-way. International yield signs are downward triangles. Red octagons are for stop signs only. A sign for a priority road is a yellow diamond with a white border. Prohibitory or restrictive signs are usually circular with red borders. Signs ending restrictions have a black border with rightward black bars Mandatory signs are usually circular with blue backgrounds Special regulation signs are rectangular and show miscellaneous rules. Information, facilities or service signs are rectangular show the services along the roads. Direction, position or indication signs guide users on the roads to where they are going. They are usually rectangular. Additional panels may be attached to main signs for more information. Signs which warn & inform about traffic works. Standard red, amber and green traffic lights that illuminate, indicating, to the traffic, when to stop and go. This includes pedestrian crossings with traffic control. **Additional Examples** *[Lim'] P17+, Comment 7 & 20*

#	Variable	Value	Notes
R65	Problem with sign	1 = No visibility problems	There were no problem with the signs
		2 = Sign covered or obscured	The sign was either partially or fully covered or obscured from view of the driver, e.g. by a tree or snow.
		3 = Sign damaged or defaced	The sign was damaged or defaced, e.g. by graffiti.
		4 = Information missing from sign	Some information or part of the sign was missing.
		5 = Incorrect positioning of sign	The sign was either facing the wrong way or positioned too close/near to specific point.
		6 = Sign missing	The sign was missing from the sight where it previously stood.
		7 = Sign present but obscures drivers view ahead	The sign obscured the drivers' view of the roadway ahead.
		8 = Misleading sign	The sign or group of signs gave misleading information.
		-888 = Other (please specify)	Any other problem – please specify in the comments box.
R66	Working	1 = No dynamic sign	Sign is static and not dynamic, question is not applicable.
		2 = Device working properly	Nothing wrong with the dynamic signal.
		3 = Device not working	The dynamic signal is out of order.
		4= Device partially working	The dynamic signal is not functioning as it should (e.g. A traffic light where only the red and yellow phases are working and the green light has failed).
		-888= Other	
		-999 = Unknown	Unknown if the sign was working or not
R67	Road conditions	1 = Dry	No water or product of water present on the road surface. The road is completely dry.
		2 = Wet	Water contained on the roadway surface. Remember it can be wet even if it's not raining. Describe how wet the road was in the comments box.
		3 = Ice	Both thin and thick are coded 'ice'. 'Black ice' should also be noted here.
		4 = Snow	Both heavy and light

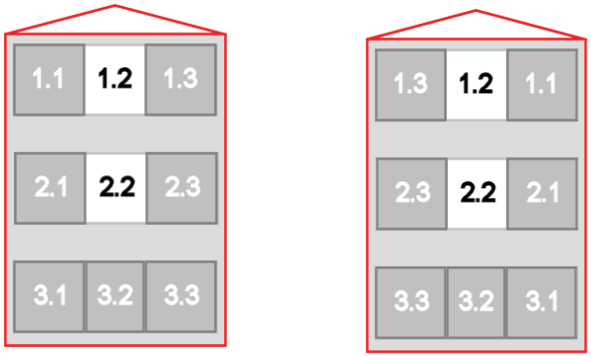
#	Variable	Value	Notes
		-888 = Other -999 = Unknown	
R68	Light condition	1 = Daylight 2 = Partial light 3 = Darkness 4 = Darkness with artificial light 5 = Dazzling sunlight -888 = Other -999 = Unknown	The light during daytime. Either dusk or dawn, when it is not complete daylight or darkness. Time of day once the sun has officially set and there is no lighting infrastructure present. Official night time but with lighting present such as street lamps **that are fully switched on**. If street lamps are present but not working or not turned on code as 'Darkness' if it is after dusk. If light conditions at the accident scene, such as in tunnels, reflects that of darkness or darkness with artificial lights then this should be coded. Sunlight that directly shines into the eyes of the road user, which could have impaired vision.
R69	Traffic Flow	 1 = Heavy traffic flow 2 = Normal traffic flow 3 = Light traffic flow -999 = Unknown	What was the traffic flow like at the time of the accident? Fairly subjective responses, based on opinion in the police reports, time of day and road type Heavier than normal traffic flow – may result in congestion, queues, slow moving traffic. Normal/average traffic flow, e.g. moving at speed limit. Below average traffic flow. The traffic flow at the time of the crash is unknown.

#	Variable	Value	Notes
R70	Weather conditions	1 = Rain 2 = Hail 3 = Freezing rain 4 = Snow 5 = Wet Snow/slush 6 = Dry -888 = Other -999 = Unknown	From light rain to heavy rain. (Useful to indicate the intensity of the rain in a comment box.) Frozen raindrops in the form of solid ice. Often happens when the air temperature is around zero degrees and the road surface temperature is zero or below which makes the rain freeze when it impacts the road surface. From light to heavy snowfall. (Useful to indicate the intensity of the snowfall in a comment box.) Falling as snow or sleet then melting on road surface, may settle in localised areas on carriageway The weather was fair.
R71	Strong Winds	1 = No 2 = Yes -999 = Unknown	Winds that are above 39 kph (according to http://www.windows.ucar.edu/tour/link=/earth/Atmosphere/wind_speeds.html&edu=high) *[Lim'] P17+, Comment 38 & 80*
R72	Fog	1 = Fog 2 = Dense fog 3 = No fog reported -999 = Unknown	Was there fog present at the scene and time of the accident? Visibility was less than 1 km. Visibility was less than 60m. There was no fog present. It is unknown if there was fog present or not.
R73	Surface contaminants	1 = None 2 = Mud 3 = Leaves 4 = Oil 5 = Diesel 6 = Gravel 7 = Discarded load	If another vehicle has dropped its load into the roadway or left contaminants on the road, for instance mud from tyres at the scene of the accident. NB. If contaminants have hidden the road markings, please indicate this in the comments box. Any load that has been detached from the vehicle carrying it

#	Variable	Value	Notes
		-888 = Other -999 = Unknown	
R74	Inadequate signing?	1 = Yes, Please specify 2 = No 3 = Unknown	Inadequate signing preceding the scene or in the immediate vicinity of the accident. Examples of this could be an absence or adequate warning signs, missing signs through damage or vandalism, poorly positioned signs, obscured signs, misleading signs etc. This variable applies to all signs types on all road classes.
R75	Traffic calming measure	1 = Yes 2 = No -999 = Unknown	Traffic calming measures preceding or present at the scene. Traffic calming measures can exist as Road humps (full or half width), chicanes (constructed through kerbs or painted), bollards to narrow the carriageway lanes etc. Mini roundabouts or other junction created calming measures should be coded within 'Junction'
R76	Was traffic claming a contributory factor in the accident?	1 = Yes, please specify 2 = No 3 = Unknown	The traffic calming contributed to one or more of the coded events in the accident.

4.5 Road User Level Data

#	Variable	Value	Notes
P77	Road user classification	1 = Driver 2 = Passenger 3 = Pedestrian	Code the classification of all road users involved in the incident. For cyclists and motorcyclists code as a driver.
P78	Age	0-999	If less than 1 year code '0' and put the actual age (in months or weeks) in comments box. Code age in whole years The age range of a driver, for example Young, Middle aged, 30-40 or Elderly can be entered in the comments box if the actual age is unknown. *[Lim'] P17+, Comment 8 & 64*
P79	Gender	1 = Male 2 = Female -999 = Unknown	Gender of the road user. If this information is not recorded in the source document code 'Unknown'. Do not guess based on pictures (where available).
P80	Impairment **5.1 only**	1 = Alcohol 2 = Drugs 3 = Drugs and Alcohol 4 = Medication 5 = Fatigue 6 = Combination of the above -888 = Other -777 = None -999 = Unknown	Code any impairment type that was suspected or proven to affect the Road User to drive at their full ability. This can also be pedestrians and cyclists. Alcohol impairment should be coded even if the level of alcohol in the road users system is below the national drive limit. Combinations not listed should be coded as 'Combination of the above' with the impairment type(s) listed in a comment box.
P81	Resident in country?	1 = Yes 2 = No -999 = Unknown	Code 'Yes' if the road user was a permanent resident of the country where the accident took place, 'No' if the road user was a temporary visitor due to travel/work Visa, Holiday or work travel (truck drivers).
P82	Familiar with traffic system?	1 = Yes 2 = No -999 = Unknown	The road user's familiarity with the traffic system in the locus of the accident. For example a home to work trip would indicate that the driver was familiar with the traffic system as the route would be frequently driven. The road users home address or home town (if available through the source material) can be used to determine the familiarity of a road system to them. Code here if the road user was inexperienced. A record of driving test pass date or months driving experience below 6 months would indicate a lack of familiarity with any road system. *[Lim'] P17+, Comment 9, 39 & 65*

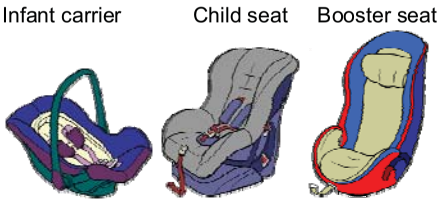
#	Variable	Value	Notes
P83	Crash avoidance manoeuvre **5.1 only**	1 = No avoidance manoeuvre reported 2 = Braking (skid marks evident) 3 = Braking (no skid marks evident) 4 = Steering (evidence or stated) 5 = Steering and braking (evidence or stated) 6 = Other avoidance manoeuvre -888 = Other -999 = Unknown	A record of the crash avoidance manoeuvre attempted by the road users. The avoidance manoeuvre should be coded whether it was successful of not. Under 'Other' include things such as use of handbrake, and note this is the comments box.
P84	Seat position	1 = 1.1 → 60 = 15.4 -777 = Not applicable -999 = Unknown	LHD model RHD model  1.1 Always = driver For drivers of vehicles with central driving positions such as agricultural vehicles code the seat position as 1.1. For occupants of vehicles not seated (passenger standing on bus/tram) or seated in areas unsuitable for the use (load areas of vans or luggage compartments of cars) code 'Not applicable' and comment on position.

#	Variable	Value	Notes
P85	Seat direction	1 = Front facing 2 = Side facing 3 = Rear facing -999 = Unknown	The orientation of the seat within the vehicle. Most cars, vans and trucks have forward facing seating. Side facing seats are common in agricultural/utility 4x4's not initially designed for seating multiple occupants, for example Land Rover Defender/Discovery. Early mini buses and some camper vans may also have side facing seats. Early 7 seat cars used rear facing seats on the third row, it is also common to find buses, coaches and trams with at least one rear facing seat.
P86	Seatbelt	1 = Used 2 = Use claimed 3 = Not used -777 = Not applicable -999 = Unknown	If stated in original source document, evidence may be recorded as friction marks to the belt webbing or swivel points indicating loading. As pretensioner activation causing the belt to be jammed reeled out or from injury patterns on the victim. A cut belt does not always indicate use as emergency services often cut restraints to remove vehicle roofs. If no evidence is available but claimed to be in use by the occupant. No evidence of use and not claimed. Evidence of non-use may be recorded as belt jammed reeled in through pretensioner activation. Steering wheel/windscreen contacts and ejection can indicate non use although should be used with other evidence if possible Code 'Not Applicable' For vehicles that do not have seatbelts fitted, for example older vehicles, buses and some trucks.
P87	Airbag availability **5.1 only**	1 = Present 2 = Not present -777 = Not applicable -999 = Unknown	Details of the airbag availability for the specific seat position. Information should be included in the form of comments on the type and location of airbags. Common bag positions include steering wheel hub, dashboard facia, seat back and door. Full length curtain airbags should be coded for the front and rear seats if occupied.
P88	Airbag deployment **5.1 only**	1 = Yes 2 = No -999 = Unknown -777 = Not applicable	Details on what airbag positions were deployed in the incident. Comment on failure to deploy of damage to the airbags if applicable. *[Lim'] P17+, Comment 21 & 69*

#	Variable	Value	Notes
P89	Police injury severity	1 = Fatal 2 = Serious 3 = Slight 4 = Not injured -999 = Unknown	The medical outcome of the incident according to the Police and recorded in the source material. Often the Police severity classification differs significantly from the final medical outcome as less information is known at the scene. *[Lim'] P17+, Comment 40 & 75*
P90	SafetyNet medical outcome	1 = Fatal 2 = Serious 3 = Slight 4 = Not injured -999 = Unknown	The Final medical outcome of the incident. Police may classify a person as slightly injured in reports but they may have later died. Code this according to your countries definitions for injury severity.
P91	Body region most heavily injured	1 = Head 2 = Face 3 = Neck 4 = Thorax 5 = Abdomen 6 = Spine 7 = Upper Extremities 8 = Lower Extremities 9 = Whole surface area 10 = Multiple regions -777 = Not applicable -999 = Unknown	Includes cranium and brain Includes ears and forehead Includes larynx, jugular vein, (oesophagus, trachea) Includes chest, lungs, heart, aorta, ribs, sternum, diaphragm Includes kidney, liver, pancreas, spleen, stomach, bowels, bladder. Cervical, thoracic and lumbar (broken neck would be coded 'Spine) Shoulders (including clavicle), arms, elbows, wrists, hands, fingers Pelvis, hips, legs, knees, ankles, feet, toes Use for burns which cover over 50% of the body Use when the most severely injured body region is unknown and there are SERIOUS injuries on more than one body area. Specify the injured body regions in the comments section. Select Not applicable if the road user is not injured. If the road user is taken to hospital to be treated for shock, make a note of this in the comments box. *[Lim'] P17+, Comment 10, 22, 42, 66 & 82*

#	Variable	Value	Notes
P92	Ejection **5.1 only**		During a collision and particularly rollover situations an occupant can be ejected from within a vehicle; the extent of this ejection can vary from partial to full ejection and is dependant on body styles and restraint use. Only applicable if the occupant(s) were thrown from a closed bodied vehicle such as a Car, Van, Truck, Bus or agricultural vehicle, this also applies to convertible vehicles with the roof down. Vehicles without bodies such as Motorcycles or Bicycles are always coded as 'Not Applicable'
		1 = None	Occupant remained fully in vehicle
		2 = Partial	A portion (upper torso, head) or body part (arm, leg) of the occupant emerged from the silhouette of the vehicle during or after the collision but the occupant remained partially within the vehicle. Comment on the extent of the ejection and ejection route if known.
		3 = Full	The occupant was fully ejected from the vehicle. Comment on ejection route if known, for example the occupant was ejected through the side window, windscreen, sunroof etc
		-777 = Not applicable	Code 'Not applicable' in the case of a cyclist or motorcyclist.
		-999 = Unknown	It is unknown if the person was ejected, either partially or fully, from the vehicle.
P93	Entrapment/extrication **5.1 only**		An occupant can become trapped within a vehicle during an accident due to vehicle factors such as deformation, door jamming or failure (electrical or mechanical) of door locks and mechanisms or through external influences such as the presence of external objects such as another vehicle, ditch side or wall etc. Emergency service intervention is often required to free the occupants.
		1 = None	The occupant was not trapped physically within the vehicle. The doors operated sufficiently and no body parts were trapped through deformation.
		2 = Partial	Trapped within vehicle due to deformed structure but able to move around. Caused by door jamming or mechanical/electrical failure, occupant not physically trapped by body parts and is therefore able to move around the vehicle interior. The presence of external objects that prohibit egress are also coded in this category

#	Variable	Value	Notes
		3 = Full -777 = Not applicable -999 = Unknown	Trapped within the vehicle by body parts and not able to move due to deformation of structures such as floor pans, foot wells, pedals or intrusion
P94	Taken to hospital **5.1 only**	 1 = Yes 2 = No -999 = Unknown	Details of the need for medical treatment required by the occupants/pedestrians The road user arrived at the hospital alive. The road user did not require medical treatment in a hospital. Code 'No' for road users who were taken to hospital despite dying on scene/en route.
P95	Number of days in hospital **5.1 only**	3 digit numeric -999 = Unknown -777 = Not applicable	Code 1 day for evidence of hospital admittance not on the duration of stay, any hospital admittance = 1 day. For example if patient was admitted at 10am and left at 11am, code as 1 day, likewise if a patient was admitted to hospital at 10am and died at 12pm this is also 1 day (although 'Days until death' (P97) will be 0 days). *[Lim'] P17+, Comment 11, 43 & 67*
P96	Died at scene/en route **5.1 only**	1 = Yes 2 = No -999 = Unknown	The casualty did not reach hospital alive or was not taken to hospital due to life being pronounced extinct at the scene or in transport on the way to hospital.
P97	Number of days until death **5.1 only**	2 digit numeric -999 = Unknown -777 = Not applicable	The total number of days after the accident before the casualty dies. If the casualty died at the scene of the incident or on the way to hospital then code 0 days. One day is considered 24 hours after the time of the incident, if death occurs less than 24 hours after the accident code 0 days.
P98	Police Suspicion of alcohol involvement	 1 = Yes 2 = No -999 = Unknown -777 = Not applicable	A record of the alcohol level for a specific road user in accordance with law. The level recorded will be above or equal to the legal limit. **Note**: to record alcohol levels below legal limits use 'Impairment' variable. **For 5.1**: Code according to the source material. **For 5.2**: According to information gathered by accident investigator(s) on the scene. The road user is above the legal drive limit for the specific country The road user is below the legal drive limit for the specific country

#	Variable	Value	Notes
P99	Police reported other drug involvement	1 = Yes 2 = No -999 = Unknown -777 = Not applicable	Other drug involvement includes any drug that is illegal. This does not include any prescription medicine.
P100	Child restraint fitted	1 = Yes 2 = No 3 = Incorrect Use 4 = Incorrect Fastening 5 = Incorrect Use + Fastening -999 = Unknown -777 = Not applicable	Was a child restraint fitted? This is a specially fitted seat or harness for a child. The child restraint was positioned incorrectly within the vehicle or CRS was unsuitable for the child The CRS was not correctly fastened within the vehicle or the child was not correctly fastened within the CRS A combination of Incorrect Use and Incorrect Fastening. *[Lim'] P17+, Comment 12, 44 & 68*
P101	Child restraint used	1 = Yes 2 = No -999 = Unknown -777 = Not applicable	Was the child restraint being used at the time of the crash? Code Not applicable in the case of a child being carried on a two wheeled-vehicle. *[Lim'] P21, Comment 45*
P102	CRS type	1 = Infant carrier 2 = Child seat 3 = Booster seat 4 = Booster cushion 5 = Impact shield 6 = Harness 3 point 7 = Harness 4 point 8 = Harness 5 point -888 = Other -999 = Unknown	

#	Variable	Value	Notes
			Booster cushion Impact shield  *[Lim'] P21, Comment 46*
P103	M/cycle helmet worn	1 = Yes 2 = No -999 = Unknown	Was the rider of the two wheeled-vehicle wearing a motorcycle helmet? *[Lim'] P17+, Comment 15 & 49*
P104	Helmet type **5.1 only**	1 = Full face 2 = Open face 3 = Full face with opening front 4 = None worn -999 = Unknown	Which helmet type was the motorcyclist wearing at the time of the crash?  Full face  Open face  Full face with opening front *[Lim'] P17+, Comment 25 & 83*
P105	Partial leathers (jacket) **5.1 only**	1 = Yes 2 = No -999 = Unknown	Was the road user wearing a specific motorcycle jacket? This may be made of natural materials e.g. Leather or man made fibres in textile jackets such as Cordura. Both construction types often exhibit armoured areas at contact points such as shoulders, elbows and back.  *[Lim'] P17+, Comment 13, 23, 4, 70, 76 & 84*

#	Variable	Value	Notes
P106	Partial leathers (trousers) **5.1 only**	1 = Yes 2 = No -999 = Unknown	 Was the road user wearing specific motorcycle trousers? These may be made of natural materials e.g. Leather or man made fibres in textile trousers such as Cordura. Both construction types often exhibit armoured areas at contact points such as Hips, Knees and shins. NB if both trousers and jacket are coded 'yes' it is indicative that full protective clothing was worn. *[Lim'] P17+, Comment 14, 24, 48, 71, 77 & 85*
P107	Motorcycle gloves **5.1 only**	1 = Yes 2 = No -999 = Unknown	 Was the road user wearing special motorcycle gloves? *[Lim'] P17+, Comment 16, 50, 72, 78 & 86*
P108	Motorcycle boots **5.1 only**	1 = Yes 2 = No -999 = Unknown	 Was the road user wearing specific motorcycle boots? Motorcycle specific boots are often mid shin in height with armoured sections in the construction, they are generally much stiffer around the ankle than general boots *[Lim'] P17+, Comment 17, 51, 73, 79 & 87*
P109	Reflective/High visibility items worn	1 = Yes 2 = No -999 = Unknown	 Was the motorcyclist wearing high visibility or reflective clothing at the time of the incident *[Lim'] P21, Comment 52*
P110	Bicycle helmet worn	1 = Yes 2 = No -999 = Unknown	The rider of the bicycle was wearing a specific bicycle helmet correctly, comment on misuse if any. *[Lim'] P24, Comment 88*

#	Variable	Value	Notes
P111	Helmet type **5.1 only**	Free text	Description if known *[Lim'] P19, Comment 26*
P112	Reflective/High visibility clothing **5.1 only**	1 = Yes 2 = No -999 = Unknown	 Was the cyclist wearing high visibility or reflective clothing at the time of the incident? *[Lim'] P17+, Comment 26 & 54*
P113	Thick clothing **5.1 only**	1 = Yes 2 = No -999 = Unknown	Thick clothing may be a winter jacket/coat or a Jumper/Sweatshirt and trousers Thin clothing constitutes T-shirt and shorts or any kind of cycling specific summer clothing *[Lim'] P21, Comment 53*
P114	Pedestrian-vehicle-interaction **5.1 only**	1 = None 2 = Glancing Impact 3 = Scooped up and came off bonnet 4 = Thrown to nearside 5 = Thrown to offside 6 = Moved sideways across bonnet offside to nearside 7 = Moved sideways across bonnet nearside to offside 8 = Thrown over vehicle 9 = Thrown straight forward	The orientation of the pedestrian when hit by a vehicle and specifically their post impact trajectory. Code option which best represents the accident as a whole or the most significant impact. Quick and light impact at an angle. Pedestrian is thrown up onto the bonnet of the vehicle. The road user was thrown towards the kerb. The road user was thrown away from the kerb. The road user moved towards the pavement, across the bonnet. The road user moved from the pavement side of the vehicle across the bonnet. The road user travelled over the vehicle towards the rear. The road user was thrown forwards, away from the vehicle.

#	Variable	Value	Notes
		10 = Thrown to side pavement 11 = Thrown into traffic lane 12 = Hit a second time by the same vehicle 13 = Hit by another vehicle 14 = Dragged by vehicle 15 = Went under vehicle -888 = Other -999 = Unknown	The road user was thrown onto the pavement by the vehicle. The road user was thrown into traffic by the vehicle. The road user was hit twice by the same vehicle. The road user was hit twice by two different vehicles. The road user became attached to the vehicle and was pulled along by it. The road user was struck by the vehicle and then fell underneath. *[Lim'] P23, Comment 74*
P115	Pedestrian company **5.1 only**	1 = On own 2 = In small group 3 = In large group -888 = Other -999 = Unknown	Was the pedestrian alone at the time of the incident, or with other people? 1 – 4 = Small group 5+ = Large group
P116	Pedestrian disabilities	1 = Deaf 2 = Blind/partially sighted 3 = Requires use of support to walk -888 = Other -999 = Not known	Did the pedestrian have any disabilities? Select all that apply.
P117	Reflective/High visibility items worn	1 = Yes 2 = No -999 = Unknown	 Was the pedestrian wearing high visibility or reflective clothing at the time of the crash?

For 5.2 only:

Variable	Value	Notes
Information source **5.2 only**	1 = Interview at accident scene 2 = Interview at hospital 3 = Interview at home 4 = Telephone interview 5 = Police records 6 = Eyewitness report 777 = Not applicable 888 = Other 999 = Not known	The source of information used to collect data for the WP5.2 accident case.
Method of investigation **5.2 only**	 1 = On scene 2 = Retrospective	How the data was collected All the information constituting a WP5.2 accident case was collected on scene. A degree of information constituting the WP5.2 accident case was collected retrospectively. This may be visiting the accident scene a day later or investigating the vehicles at a recovery yard.
Confidence level **5.2 only**	 1 = High level of confidence 2 = Reasonable confidence 3 = Low level of confidence	The degree of confidence in the reliability of the data All information was collected first hand by the on scene investigation scene A portion of the accident information was collected by other parties, for example the use of police reports or statements Accident data was collected from other sources, for example the use of witness or eyewitness reports.

4.6 Glossary Appendix

4.6.1 TABLE 1
Non-collision events

Choice of response	Definition	Source
1 = Overturn/rollover	When a vehicle rotates 90° or more, side-to-side or end-to-end. For two-wheeled vehicles, laying the vehicle down on its side is sufficient to code overturn if damage or injury is produced.	FARS
2 = Fire/explosion	Unlikely to be first harmful event – but we leave it here anyway, as is a possibility	
3 = Immersion	Vehicle completely under the water's surface.	
4 = Gas inhalation	Includes injury or death from carbon monoxide fumes leaking from a vehicle in transport.	FARS
5 = Fell/jumped from vehicle	When falling or jumping (not suicide) from the vehicle causes damage or injury. For example, a passenger of a vehicle in transport leans against the car door, it opens and the passenger falls out and is injured by the fall. This also includes road users being separated from their vehicle.	FARS
6 = Injured in vehicle	Use where an occupant is injured during an un-stabilised situation without a collision. Examples: a pick-up truck breaks sharply and its load crashes through passenger compartment injuring or killing driver; or a part of the engine comes loose and bounces back into its own vehicle.	FARS
7 = Thrown or falling object	An object that is thrown or falls onto a vehicle in motion, example tree falling onto moving vehicle.	
8 = Pavement/road surface irregularity (pothole, grooved, grates)	Road surface irregularity that causes damage to the vehicle or the users, e.g. cyclists falls from bike after riding over a pothole.	
9 = Vehicle occupant struck or run over by own vehicle	Use when occupant falls or comes out of vehicle and is struck or run over by that vehicle. Does not apply to occupants ejected during overturns.	FARS
10 = Jack-knife	Applies to a condition that occurs to an articulated vehicle, (any vehicle with a trailing unit(s) connected by a hitch; e.g., truck tractor or single-unit truck with one or more trailers, car pulling a caravan or boat on a trailer etc.) while in motion. The condition reflects a loss of control of the vehicle by the driver in which the trailer(s) swerves from its normal straight-line path behind the power unit.	FARS
12 = Equipment failure (blown tyre, brake failure, etc.)	Failure of some part of the vehicle	
13 = Separation of units	Separation of main vehicle from trailer or caravan	
14 = Ran off road – off side	Vehicle left the road on the off side. Off side- the side of the vehicle away from the curb. In UK right-hand side, other Europeans left	
15 = Ran off road – near side	Vehicle left the road on the near side. Near side- the side of the vehicle nearest the curb; UK left-hand side, other Europeans right.	
16 = Cross median/centreline	Vehicle leaves its carriageway and crosses over in to the oncoming carriageway. Only code if vehicle remains on carriageway.	

Choice of response	Definition	Source
17 = Downhill runaway	When a vehicle's breaks fail on a downhill section of road cause the vehicle to runaway down the slope. Mainly applies to lorries and caravans.	
18 = Vehicle went airborne	When a vehicle leaves the ground.	
19 = Other non-collision	As an example, driving off a cliff, where damage is not the result of an overturn or collision with an object.	FARS

Collision with vehicle

Choice of response	Definition	Source
20 = Vehicle travelling on same roadway	When one vehicle collides with another vehicle on the same roadway. Does not include parked vehicles. For parked vehicles, select option number 22.	FARS
21 = Vehicle travelling on other roadway	Differs from above in that it applies to events where a vehicle leaves one roadway and enters a different roadway, having a collision with a vehicle in transport on a different roadway. For example an accident on a cross roads, where vehicles have approached on different roads.	FARS
22 = Parked vehicle (not travelling)	Collision between moving vehicle and parked vehicle. Parked vehicles include vehicles parked outside the roadway and those parked on the roadway in lanes not designated for travel at the time of accident.	FARS
23 =Construction, maintenance or utility vehicle	Use this code when a vehicle strikes a construction, maintenance or utility vehicle either working, travelling or stopped.	FARS

Collision with object not fixed

Choice of response	Definition	Source
25 = Vehicle struck by falling/shifting cargo or anything set in motion by another vehicle in transport		
26 = Pedestrian	Collision between moving vehicle and pedestrian	CARE
27 = Non-Motorist on Personal Conveyance	Personal conveyance is a human-powered, non-motorised device not propelled by pedalling; such devices are included even when motorised. Includes rideable toys (roller & inline skates, skateboards, push chairs, scooters), motorised rideable toys (motorised skateboards, scooters, and toy cars), devices for personal mobility assistance (Zimmer frames, motorised and non-motorised wheelchairs, handicapped scooters).	FARS
28 = Bicycle	Collision between moving vehicle and cyclist	

Choice of response	Definition	Source
29 = Railway Train /Tram	Collision between moving vehicle and train or tram.	
30 = Animal	A collision with animals (domesticated or wild) that are not themselves being used as transportation or to draw a wagon, cart or other transport device.	FARS
31 = Ridden Animal or Animal-Drawn Conveyance	Used for collisions with animals being used as transportation. This includes ridden animals and animals (or teams of animals) drawing a transport device (sleighs, carts, etc)	FARS
32 = Other Object (not fixed)	e.g., fallen tree, already laying in roadway; construction cones or barrels on road (temporary).	FARS

Collision with Fixed Object

Choice of response	Definition	Source
33 = Boulder	A rock of sufficient mass that when struck by a vehicle moves very little and remains basically intact.	FARS
34 = Building		
35 = Impact Attenuator/Crash Cushion	A device for controlling the absorption of energy released during vehicle collision (“crash cushions”). It’s most common application involves the protection of fixed roadside objects such as bridge piers, at motorway exit ramps, entry to toll booths etc. Examples include barrels filled with water or sand, and plastic collapsible structures.	FARS
36 = Bridge Pier or Abutment	Support structures; most likely to be struck by vehicles passing under bridges. Bridge Abutment - wall supporting the ends of a bridge and composed of stone, concrete, brick or wood. Bridge Pier - column of stone, concrete, brick, steel or wood for supporting a bridge between abutments.	FARS
37 = Bridge Parapet End	Components of the upper portion of bridges. The end of a low wall which runs along the outer most edge of the roadway or pavement on the bridge.	FARS
38 = Bridge Parapet	Components of the upper portion of bridges. A wooden, brick, stone, concrete or metal fence-like wall which runs along the outermost edge of the roadway or pavement on the bridge or a rail constructed along the top of a parapet.	FARS
39 = Bridge Overhead Structure	Used when striking the bottom of a bridge while travelling on a roadway underneath it. Mainly applies to tall vehicles passing under low bridges.	FARS
40 = Guardrail Face	A low barrier running along the edge of a road shoulder either on the right or the left and which is primary composed of metal (plates, cable, mesh, box beam, etc.). A guardrail is not the same as a concrete traffic barrier; it is differentiated from it by the material making up the greatest part of the longitudinal portion of the structure.	FARS
41 = Guardrail End	When a vehicle strikes the end of a guardrail. Guardrails can have a separate flat or rounded piece of metal attached to the end.	FARS

Choice of response	Definition	Source
42 = Concrete Traffic Barrier	Refers to the longitudinal traffic barriers constructed of concrete and located on the outside of the road surface, in a median, or at entry/exit ramps. This includes all temporary concrete barriers regardless of location (i.e. temporary barriers during road works). This also includes concrete barriers used to protect the bridge pier or abutment. Concrete walls (vertical side surfaces) do not apply here.	FARS
43 = Other Traffic Barrier	Used for all other longitudinal barriers such as wood or rock and unknown barrier composition types.	FARS
44 = Highway/Traffic Sign Post/Sign	When the post supporting a traffic sign, or the sign itself, is hit by a vehicle in transport. Includes mile/kilometre markers.	FARS
45 = Traffic Signal Support/Signal	When the post supporting a traffic signal, or the traffic signal itself is hit by a vehicle.	
46 = Overhead Sign Support/Sign	When the sign supported is above the motorway. The difference between traffic sign and overhead sign is the location of the sign (overhead or the side of the road).	FARS
47 = Luminary/Light Support	Supports for roadway lighting systems, not including other private lighting systems (e.g., car park lights). Support does not include other fixed objects to which lighting is affixed (e.g., telephone poles).	FARS
48 = Utility Pole	Electrical, Telephone, Cable and other utility pole-type supports.	FARS
49 = Other Post, other pole, or other supports	Posts other than highway signs. (E.g., reflectors on poles along side of roadway, parking meters, flag poles, etc.).	FARS
50 = Culvert	Any structure under the roadway generally made of concrete or metal which allow water to flow below the road.	
51 = Kerb	A concrete or asphalt structure up to 30 cm in height which borders the roadway. It provides drainage control and pavement edge delineation. The face of the curb may be sloped or vertical.	FARS
52 = Ditch	A small trench or depression, with or without water, that runs alongside roadways or fields.	
53 = Embankment – Earth	Raised structures to hold back water, to carry a roadway, or the result of excavation or washout (including erosion) that is faced with earth. An embankment can usually be differentiated from a wall by its incline, whereas a wall is usually vertical.	FARS
54 = Embankment – Rock, Stone, or Concrete	Raised structures to hold back water, to carry a roadway, or the result of excavation or washout (including erosion) that is faced with rock, stone or concrete.	FARS
55 = Embankment – Material Type Unknown	Raised structures to hold back water, to carry a roadway, or the result of excavation or washout (including erosion) that is faced with an unknown material.	FARS
56 = Fence	Includes the fence posts. A fence can be made of wood, chain link, stone, etc. (not hedges serving as containment for property).	FARS
57 = Wall	A primarily vertical (+ 15° from vertical) structure composed of concrete, metal, timber, or stone which is not part of a building or a fence but typically is used for retaining earth, abating noise, and separating areas but not for containment (as is the primary function of a fence).	FARS
58 = Tree (Standing Tree Only)	Used when a vehicle strikes a standing tree. If a vehicle strikes a tree lying in the roadway, use code “Other Object (Not Fixed).” If a tree falls on a vehicle as it is passing by, use code “Thrown or Falling Object.”	FARS

Choice of response	Definition	Source
59 = Snow Bank	Used when snow fall and/or road ploughing creates essentially fixed barriers of snow/ice which are not snow-covered earth or rock embankments.	FARS
60 = Other Fixed Object	This is used when the object is fixed (considered a permanent structure) and is not described by any of the other fixed object codes. Includes utility wires and “guy” wires attached to utility poles.	FARS
999 = Unknown	This is used when it is not known what the first or most harmful event is. For example, if a series of harmful events occurred, and it’s unclear which event was first.	FARS

4.6.2 TABLE 2
Definition of crash participants

Crash Participant	Definition	Examples	Source
1 = Car	Includes Sedan/saloon, hatchback, station wagon/estate, sports, convertible, off road cars and all MPVs. Car derived vans (CDV) should also be coded in this category. For example Citroen Berlingo (a car derived from a van) or Clio Van (a van derived from a car)	   	
2 =Van	Vans are goods/cargo carrying vehicles and pickups that are not car derived. This includes, micro vans, light vans and panel vans, up to 3.5 tonnes.	 	
3 = Truck	Vehicle with at least four wheels, with a permissible gross vehicle weight of over 3.5 tonnes, used only for the transport of goods. Can be rigid or articulated. With or without a trailer. Also known as HGV.		

Crash Participant	Definition	Examples	Source
4 = Bus/Minibus	Vehicle with at least four wheels, used for transporting people. Public or private use. Seating for more than 8 passengers.	 	CARE
5 = Train/Tram	A vehicle which runs on rails.		
6 = Agricultural vehicle	Vehicle for agricultural use, with wheels or caterpillar tracks, with at least two axles.	 	CARE
7 = Two wheeled-vehicle	Vehicle with two wheels including motorbikes, mopeds and scooters.	 	CARE
8 = Bicycle	Vehicle with at least two wheels, without engine, moved by pedals or hand cranks.		CARE
9 = Shoe vehicle (pedestrian)	A person on foot includes a person on roller skates or a skateboard, pushing a bike or a pushchair.		
888 = Other	If the vehicle does not fit into any of the above categories, code other and describe in the comments box.		CARE
999 = Unknown vehicle	Only use if there are no available details about the vehicle.		

4.6.3 TABLE 3
Related Factors definitions – 5.1 cases only

Choice of response	Definition	Source
1 = Inadequate warning of exits, lanes narrowing, traffic controls etc.	Includes “inadequate warning” of any type. Inadequate warning due to obscured signs. Inadequate warning due to signs temporarily down, lack of necessary sign for merge, diverge. Not a construction site situation.	FARS
2 = Shoulder design or condition	A (hard) shoulder is a reserved area alongside a road or a motorway. Includes only situations pertaining to actual design or condition of the shoulder. Soft shoulder or shoulder collapsing. Inadequate shoulder width. Shoulder at different level from the roadway (drop-off, lifted, not flat).	FARS
3 = Other construction-created condition	Includes inadequate maintenance conditions, (i.e., Potholes, ruts in roadway) moving/changing signs. Addition of barricades. Change in traffic patterns, merging of lane.	FARS
4 = No or obscured pavement/road marking	Includes any road surface marking situations. New asphalt has covered old road markings. Roadway marking or surface has worn off. Ice/snow/mud obscuring road surface markings.	FARS
5 = Surface under water	Includes any surface under water. Permanently under water, i.e. fords. Temporarily under water, i.e. flooded areas. State in comments box whether permanent or temporary.	FARS
6 = Inadequate construction or poor design of roadway, bridge etc.	Pertains to original design of the different aspects of a trafficway (i.e., roadways, bridges, medians, guardrails, traffic barriers etc). Blind intersections due to highway design, not due to visual obstructions e.g. trees. Improper banking, lack of a lane for merging. Inadequate road surface (dirt, gravel surfaces, etc.); however, this must not be inferred; must be explicitly stated in police report as a “factor.”	FARS
7 = Surface washed out (caved in, road slippage)	Only environmentally caused situations. Destruction of a section of roadway by water (flooding, heavy rains) or other cataclysms (earthquakes, etc.).	FARS
8 = Obstructed view	The view of the roadway directly ahead or at a junction, from the drivers perspective, is obscured . This may be caused by construction zones, foliage, parked vehicles etc.	
8 = None	No related factors explicitly mentioned in the police report.	
888 = Other	Any other related factor explicitly mentioned in the police report that can not be classified above. Describe the factor in the comments box.	
999 = Unknown	This should only be used when a full police report is not available.	

4.6.4 TABLE 4
Reference for vehicle make

Acura	Caterham	Ferrari	Iveco	Mahindra	Noble	Scania	Westfield
Aixam	Caterpillar	Fiat	Jaguar	Malaguti	Oldsmobile	Seat	Wiesmann
Alfa Romeo	Chrysler	Foden	JCB	Man	Opel	Setra	Yamaha
Alpina	Chevrolet	Ford	Jeep	Maserati	Optare	Skoda	Yugo
Aprilia	Citroen	Gilera	John Deere	Massey Ferguson	Pagani	Smart	
Ascari	Claas	GMC	Kawasaki	Maybach	Perodua	SsangYong	Other
Aston Martin	Cobra	Hamann	Kia	Mazda	Peugeot	Subaru	Unknown
Audi	Dacia	Hanomag	KTM	MBK	Piaggio	Suzuki	
Austin Morris	Daewoo	Harley Davidson	Kymco	McCormick	Plymouth	Talbot	
Austin Rover	DAF	Hercules	Lada	Mercedes-Benz	Pontiac	Tata	
Bedford	Daihatsu	Hino	Lamborghini	MG	Porsche	Toyota	
Benelli	Daimler	Holden	Lancia	MicroCar	Proton	Trabant	
Bentley	Datsun	Honda	Land Rover	MINI	Raider	Triumph	
Bimota	David Brown	Hummer	LDV	Mitsubishi	Raleigh	TVR	
BMW	DeTomaso	Husaberg	Lamborghini	Morgan	Renault	Unimog	
Bova	Dennis	Husqvarna	Lambretta	Morris	Reliant	Van Hool	
Buell	Derbi	Hyosung	Laverda	Moto Guzzi	Riley	Vauxhall	
Bugatti	Deutz Fahr	Hyundai	Lexus	Motor Hispania	Rolls Royce	Vespa	
Buick	Dodge	Infiniti	Leyland	MV Agusta	Rover	Victory	
Cadillac	Ducati	Innocenti	Ligier	MZ	Royal Enfield	Volkswagen	
Cagiva	ERF	Isuzu	Lincoln	New Holland	Saab	Volvo	
Case	Fendt	Italjet	Lotus	Nissan	Sachs	Wartburg	

4.6.5 TABLE 5
Car body style

Body Style	Definition	Example	Source
1 = Sedan/saloon	A vehicle with a horizontal load area lid, hinged at about waist level.		
2 = Hatchback	A vehicle with a sloping load area door (which incorporates the rear window), hinged at roof level. The door usually extends down to just below waist level.		
3 = Wagon/Estate	A vehicle with a near vertical load area door (which incorporates the rear window), hinged at roof level. The door extends down to the load area floor, which is usually level..		
4 = Sports/Coupe	Sports: Low seated car with near-horizontal steering column. Coupe: sloping roof car with 2+2 seating	 	
5 = Derivative	A van or pick-up based on a car platform (Ford Fiesta van), sometimes this is a car based on an original van design (Fiat Doblo)		
6 = Off-Road/SUV	A vehicle which has a high ground clearance between the ground and the sill. Designed to be driven off-road with 2 or 4 wheel drive, alternatively classed as Sports Utility Vehicles (SUV). Include pick-up trucks that are not		

Body Style	Definition	Example	Source
	car-derived, e.g. Toyota Hilux		
7 = Convertible	A car without B or C pillars above waist height, nor any cant rails or fixed roof. A rollover bar may be present. Targas should be included here. Roof may be constructed from fabric or metal.		
8 = MPV	Multi Purpose Vehicle. A vehicle with a raised seating position and removable or multi positional seats.		
777 = Not applicable	Not a car or car derivative		
999 = Unknown	E.g. for hit and run accidents		

4.6.6 TABLE 6
Driver manoeuvre prior to accident – STAIRS list

Driver Manoeuvre	Description	Ref #
Driving into a parking place	The vehicle was manoeuvring into a parking area parallel or perpendicular to the original roadway.	01
Stopping in the carriageway (not in a parking bay or before a turn)	The vehicle was stopped or stopping on any type of carriageway (due to traffic queues or traffic signals etc)	02
Waiting to go ahead but held up	The vehicle was initially stationary or slow moving (due to traffic queues or traffic signals etc)	03
Starting off	The vehicle was starting off from being stationary or slow moving (due to traffic queues or traffic signals etc)	04
Stopped waiting to turn right	The vehicle was stopped at any type of junction intending to turn right	05
Stopped waiting to turn left	The vehicle was stopped at any type of junction intending to turn left	06
Going into a junction to turn left	The vehicle was slow moving in the vicinity of a junction and intending to turn left	07
Going into a junction to turn right	The vehicle was slow moving in the vicinity of a junction and intending to turn right	08
Going round a roundabout	The vehicle was manoeuvring around a large roundabout (this also includes pulling onto and exiting from)	09
Going round a mini roundabout	The vehicle was manoeuvring around a mini roundabout (this also includes pulling onto and exiting from)	10
Turning from side road onto main road	The vehicle was turning from a side (minor) road onto a main (major) road in any direction	11
Turning from main road into side road	The vehicle was turning from a main (major) road onto a side (minor) road in any direction	12
Pulling out of lay-by onto main road	The vehicle was pulling out from a lay-by situated to either side of the main (major) road. (not U-turns, see 34)	13
Pulling into lay-by from main road	The vehicle was pulling into a lay-by situated to either side of the main (major) road	14
Driving along a straight road	The vehicle was travelling along a straight section of road (any classification)	15
Driving round a right hand bend	The vehicle was travelling around a right hand bend (any road classification, any bend severity)	16
Driving round a left hand bend	The vehicle was travelling around a left hand bend (any road classification, any bend severity)	17
Driving round a series of bends	The vehicle was travelling around a series of bends (any road classification, any bend severity, swaying road GDV)	18
Changing lanes from right to left	The vehicle was changing lanes from right to left, applicable only on multi-laned roads (for overtaking see 24 – 27)	19
Changing lanes from left to right	The vehicle was changing lanes from left to right, applicable only on multi-laned roads (for overtaking see 24 – 27)	20
Swerved to avoid animal in the road	The vehicle swerved to avoid a wild, domestic or farm animal on the carriageway (any road classification and layout)	21

Driver Manoeuvre	Description	Ref #
Swerved to avoid other vehicle	The vehicle swerved to avoid another vehicle on the carriageway, the vehicle may be of any type, parked or broken down etc.(any road classification and layout)	22
Swerved to avoid person in the road	The vehicle swerved to avoid a pedestrian on the carriageway (any road classification and layout)	23
Pulling out to overtake	The vehicle was pulling out to overtake another vehicle ahead on a single carriageway road (multi-lanes see 19 -20)	24
Overtaking moving vehicle	The vehicle was in the process of overtaking another vehicle on a single carriageway road (multi-lanes see 19 -20)	25
Overtaking parked vehicle	The vehicle was passing a parked vehicle in a controlled manoeuvre, for swerving see 22	26
Undertaking moving vehicle	The vehicle was undertaking another moving vehicle ahead on a multi-laned road	27
Reversing along carriageway	The vehicle was reversing along the carriageway (any road classification)	28
Reversing out of driveway	The vehicle was reversing out of a driveway perpendicular to the direction of the carriageway (any road classification)	29
Reversing into driveway	The vehicle was reversing onto a driveway perpendicular to the direction of the carriageway (any road classification)	30
Reversing out of car park space	The vehicle was reversing out of a parking space parallel or perpendicular to the direction of the carriageway	31
Reversing into car park space	The vehicle was reversing into a parking space parallel or perpendicular to the direction of the carriageway	32
Turning in carriageway	The vehicle was turning in the carriageway, this is without the influence of any junctions or u-turns	33
Making ‘u’ turn in carriageway	The vehicle was performing a U-turn manoeuvre on the carriageway without the influence of any junctions.	34
Turning right at crossroads	The vehicle was turning right at a cross roads junction	35
Turning left at crossroads	The vehicle was turning left at a cross roads junction	36
Going straight over at crossroads	The vehicle was continuing straight ahead at a cross roads junction	37
Merging from slip road onto main carriageway	The vehicle was merging from a slip road onto the main (major) road, usually for multi-laned roads	38
Exiting from main carriageway onto slip road	The vehicle was leaving the main (major) road using a slip road junction, usually for multi-laned roads	39
Parking manoeuvre		40
Illegal manoeuvre	Wrong way down a one way street/motorway/roundabout	41
Driving in slow moving traffic		42
Other (describe)		888
Unknown		999

4.6.7 TABLE 7
Event detail

Choice of response	Definition	Source
1 = Overturn/rollover	When a vehicle rotates 90° or more, side-to-side or end-to-end. For two-wheeled vehicles, laying the vehicle down on its side is sufficient to code overturn if damage or injury is produced.	FARS
2 = Fire/explosion	Unlikely to be first harmful event – but we leave it here anyway, as is a possibility	
3 = Immersion	Vehicle completely under the water's surface.	
4 = Gas inhalation	Includes injury or death from carbon monoxide fumes leaking from a vehicle in transport.	FARS
5 = Fell/jumped from vehicle	When falling or jumping (not suicide) from the vehicle causes damage or injury. For example, a passenger of a vehicle in transport leans against the car door, it opens and the passenger falls out and is injured by the fall. This also includes road users being separated from their vehicle.	FARS
6 = Injured in vehicle	Use where an occupant is injured during an unstabilised situation without a collision. Examples: a pick-up truck breaks sharply and its load crashes through passenger compartment injuring or killing driver; or a part of the engine comes loose and bounces back into its own vehicle.	FARS
7 = Thrown or falling object	An object that is thrown or falls onto a vehicle in motion, example tree falling onto moving vehicle.	
8 = Pavement/road surface irregularity (pothole, grooved, grates)	Road surface irregularity that causes damage to the vehicle or the users, e.g. cyclists falls from bike after riding over a pothole.	
9 = Vehicle occupant struck or run over by own vehicle	Use when occupant falls or comes out of vehicle and is struck or run over by that vehicle. Does not apply to occupants ejected during overturns.	FARS
10 = Jack-knife	Applies to a condition that occurs to an articulated vehicle, (any vehicle with a trailing unit(s) connected by a hitch; e.g., truck tractor or single-unit truck with one or more trailers, car pulling a caravan or boat on a trailer etc.) while in motion. The condition reflects a loss of control of the vehicle by the driver in which the trailer(s) swerves from its normal straight-line path behind the power unit.	FARS
12 = Equipment failure (blown tyre, brake failure, etc.)	Failure of some part of the vehicle	
13 = Separation of units	Separation of main vehicle from trailer or caravan	
14 = Ran off road – off side	Vehicle left the road on the off side. Off side- the side of the vehicle away from the curb. In UK right-hand side, other Europeans left	
15 = Ran off road – near side	Vehicle left the road on the near side. Near side- the side of the vehicle nearest the curb; UK left-hand side, other Europeans right.	
16 = Cross median/centreline	Vehicle leaves its carriageway and crosses over in to the oncoming carriageway. Only code if vehicle remains on carriageway.	
17 = Downhill runaway	When a vehicle's breaks fail on a downhill section of road cause the vehicle to runaway down the slope. Mainly applies to lorries and caravans.	

Choice of response	Definition	Source
18 = Vehicle went airborne	When a vehicle leaves the ground.	
19 = Other non-collision	As an example, driving off a cliff, where damage is not the result of an overturn or collision with an object.	FARS

4.6.8 TABLE 8
Collision type

Collision orientation	Type of Collision
Front to front	Collision with vehicle
Front to rear	Collision with vehicle
Rear to front	Collision with vehicle
Side to front (90 degrees)	Collision with vehicle
Front to side (90 degrees)	Collision with vehicle
Side to front (angle not specified)	Collision with vehicle
Front to side (angle not specified)	Collision with vehicle
Sideswipe (same direction)	Collision with vehicle
Sideswipe (opposite direction)	Collision with vehicle
Rear to side	Collision with vehicle
Side to rear	Collision with vehicle
Rear to rear	Collision with vehicle
Front to top	Collision with vehicle
Top to front	Collision with vehicle
Side to top	Collision with vehicle
Top to side	Collision with vehicle
Rear to top	Collision with vehicle
Top to rear	Collision with vehicle
Front to Underside	Collision with vehicle
Underside to front	Collision with vehicle
Side to Underside	Collision with vehicle
Underside to side	Collision with vehicle
Rear to Underside	Collision with vehicle
Underside to rear	Collision with vehicle
Front	Collision with object not fixed / Collision with fixed object
Rear	Collision with object not fixed / Collision with fixed object

Collision orientation	Type of Collision
Left	Collision with object not fixed / Collision with fixed object
Right	Collision with object not fixed / Collision with fixed object
Top	Collision with object not fixed / Collision with fixed object
Underside	Collision with object not fixed / Collision with fixed object
Other	all
Unknown	all

4.6.9 TABLE 9

List of alternative terms that you might encounter, used to describe vehicle safety equipment:

Acronym	Manufactures definition	Type of safety system	Manufacturers using the system
4ETS	**E**lectronic **T**raction **S**ystem (4x4)	Traction Control	Mercedes-Benz
ABC	**A**ctive **B**ody **C**ontrol	Low level stability control (Yaw, roll etc)	Mercedes-Benz
ABS	**A**nti-lock **B**raking **S**ystem	Does exactly what is says on the tin	Pretty much everything
ACC	**A**daptive **C**ruise **C**ontrol	Brake assist, Cruise control	Jaguar, Lexus, Mercedes-Benz
ACE	**A**ctive **C**ornering **E**nhancement	Low level stability control (See ABC)	Land Rover
ADB – X	**A**utomatic **D**ifferential **B**rake (4x4)	Traction Control (Technically individual wheel)	BMW
ARM	**A**ctive **R**oll **M**itigation	Low level stability control (Gen' 2 ACE)	Land Rover
ASC	**A**cceleration **S**kid **C**ontrol	Traction Control	Smart
ASC + T	**A**utomatic **S**tability **C**ontrol + **T**raction	Traction Control, Stability Control	BMW, Mini
ASC – X	**A**utomatic **S**tability **C**ontrol + **T**raction (4x4)	Traction Control, Stability Control, ADB – X (above)	BMW
ASR	**A**nti-**S**lip/**S**pin **R**egulation	Traction Control	Alfa Romeo, Audi, Bentley, Ferrari, Fiat, Mercedes-Benz, Peugeot, Renault, Skoda, VW
B/A	**B**rake **A**ssist	Brake Assist	Toyota
BAS	**B**r**A**ke **A**ssist	Emergency Brake Assist	Mercedes-Benz
CBC	**C**ornering **B**rake **C**ontrol	Effectively advanced Brake Force Distribution	BMW, Mini, SAAB, Smart, Vauxhall
CST	**C**ontrol for **S**tability & **T**raction	Stability Control, Traction Control	Ferrari
CSV	Understeer Control	Traction and Stability control in certain circumstances (Yaw)	Citroen

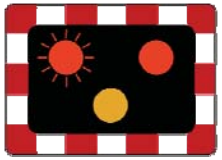
Acronym	Manufactures definition	Type of safety system	Manufacturers using the system
DSA	**D**ynamic **S**tability **A**ssistance	Stability Control, Traction Control	Volvo
DSC	**D**ynamic **S**tability **C**ontrol	Stability Control, Traction Control	Aston Martin, BMW, Jaguar, Land Rover, Mazda
DSC III	**D**ynamic **S**tability **C**ontrol Gen' **III**	Stability Control, Traction Control	BMW [01>]
DSTC	**D**ynamic **S**tability + **T**raction **C**ontrol	Stability Control, Traction Control, Brake Assist	Volvo
DTC	**D**ynamic **T**raction **C**ontrol	Stability Control, Traction Control, Brake force Distribution,	BMW [5 + 7 01>]
EBA	**E**mergency **B**rake **A**ssist	Emergency Brake Assist	Chrysler, Citroen, Ferrari, Ford, Honda, Jaguar, Land Rover, Mazda, Nissan, Peugeot, Seat, Smart, Vauxhall, Volvo
EBD	**E**lectronic **B**rakeforce **D**istribution	Electronic Brakeforce Distribution	Alfa Romeo, Audi, Bentley, Citroen, Daihatsu, Fiat, Ford, Honda, Hyundai, Jeep, Land Rover, Lexus, MG, Mini, Mitsubishi, Nissan, Peugeot, Renault, Saab, SSangyong, Subaru, Suzuki, Toyota, Vauxhall, Volvo
EBFD	**E**lectronic **B**rake **F**orce **D**istribution	Electronic Brakeforce Distribution	Alfa Romeo, Audi, Bentley, Citroen, Daihatsu, Fiat, Ford, Honda, Hyundai, Jeep, Land Rover, Lexus, MG, Mini, Mitsubishi, Nissan, Peugeot, Renault, Saab, SSangyong, Subaru, Suzuki, Toyota, Vauxhall, Volvo
E-DIFF	**E**lectronic **DIFF**erential	Traction Control	Ferrari
EDL	**E**lectronic **D**ifferential **L**ock	Traction Control	Audi, Skoda, VW
EDS	**E**lectronic **D**ifferential **S**ystem	Traction Control	SEAT
ESP	**E**lectronic **S**tability **P**rogramme	Stability Control, Traction Control	Audi, Bentley, Chrysler, Citroen, Fiat, Ford, Hyundai, Jeep, Mercedes-Benz, Nissan, Peugeot, Renault, SAAB, SEAT, Smart, VW
ESP+	**E**lectronic **S**tability **P**rogramme **+**	Stability Control, Traction Control	Nissan
ETAS	**E**lectronic **T**raction **A**ssistance **S**ystem	Traction Control	Bentley, Rolls Royce
ETC	**E**lectronic **T**raction **C**ontrol	Traction Control	Land Rover

Acronym	Manufactures definition	Type of safety system	Manufacturers using the system
HBA	**H**ydraulic **B**rake **A**ssist	Emergency Brake Assist	Bentley, Smart, VW
HDC	**H**ill **D**escent **C**ontrol	Traction Control, Brake force Distribution, ABS, Diff locks	BMW, Land Rover
MASC	**M**itsubishi **S**tability **C**ontrol	Stability Control	Mitsubishi
MATC	**M**itsubishi **T**raction **C**ontrol	Traction Control	Mitsubishi
MSR	**M**otor **S**lip **R**egulation	Traction Control	Alfa Romeo, Bentley, Fiat, Skoda
NBA	**N**issan **B**rake **A**ssist	Brake Assist	Nissan
PSM	**P**orsche **S**tability **M**anagement	Stability Control, Traction Control, Brake force Distribution	Porsche
SAYC	**S**uper **A**ctive **Y**aw **C**ontrol	Basic Stability control (Yaw)	Mitsubishi
SBC	**S**ensotronic **B**rake **C**ontrol System	Brakeforce Distribution, Emergency Brake Assist + bits of ESP	Mercedes-Benz
STC	**S**tability + **T**raction **C**ontrol	Stability Control, Traction Control	Volvo
SVDC	**S**ubaru **V**ehicle **D**ynamic **C**ontrol	Stability Control, Traction Control	Subaru
TCS	**T**raction **C**ontrol **S**ystem	Traction Control	Fiat, Honda, Mazda, Nissan, SAAB, SEAT
TRC	**TR**action **C**ontrol System	Traction Control	Lexus, Toyota
VDC	**V**ehicle **D**ynamic **C**ontrol	Traction Control, Stability Control	Alfa Romeo, Subaru
VDIM	**V**ehicle **D**ynamics **I**ntegrated **M**anagement	Combines ABS, EBD, TRC, VSC + EPS [**E**lectric **P**ower **S**teering]	Lexus
VSA	**V**ehicle **S**tability **A**ssist	Stability Control, Traction Control	Honda
VSC	**V**ehicle **S**tability **C**ontrol	Stability Control, Traction Control	Lexus, Toyota
VTD	**V**ariable **T**orque **D**istribution	4 wheel individual Traction Control	Subaru

4.6.10 TABLE 10
Examples of signs

Group of sign	Option	Examples
1	Danger warning sign	
2	Priority sign	
3	Prohibitary or restrictive sign	
4	Mandatory sign	

Group of sign	Option	Examples
5	Special regulation sign	  
6	Information, facilities or service sign	  
7	Direction, position or indication sign	    
8	Additional panels	  

Group of sign	Option	Examples
9	Traffic works sign	  
10	Traffic lights	 
11	Other sign	
999	Unknown	

5. Accident Classification System (GDV)

For SafetyNet:

WP5.1 – Fatal Accident Database

WP5.2 – Accident Causation Database

5.1 Accident types

Type 1: Driving accident
The accident occurred due to loss of control over the vehicle (because of not adapted speed or erroneous evaluation of the run of the road or the road condition or similar), without the involvement of other road users. But as a result of uncontrolled vehicle movement this could have led to a crash with another road user.

Type 2: Turning off accident
The accident occurred due to a conflict between a turning off road user and a road user coming from the same direction or the opposite direction (pedestrians included!) at crossings, junctions, access to properties or parking lots.

Type 3: Turning in / crossing accident
The accident occurred due to a conflict between a turning in or crossing road user without priority and a vehicle with priority at crossings, junctions, access to properties or parking lots.

Type 4: Pedestrian accident
The accident occurred due to a conflict between a vehicle and a pedestrian on the road unless he was walking in lateral direction and unless the vehicle was turning in. This is also applicable if the pedestrian was not hit.

Type 5: Accident with parking vehicles
The accident occurred due to a conflict between a moving vehicle and a vehicle which is parking, has stopped or is manoeuvring to park or stop.

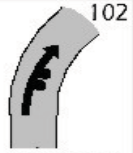
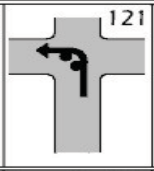
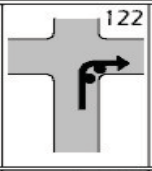
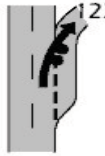
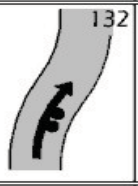
Type 6: Accident in lateral traffic
The accident occurred due to a conflict between road users moving in the same or in the opposite direction unless this conflict applies to another type of accident

Type 7: Other accident type
Accident that cannot be assigned to the types 1 – 6. Examples: Turning around, backing up, two parking vehicles, objects or animals on the road, sudden vehicle damage

Note: To determine the accident type, only the conflict situation which led to the accident is important. If and how road users collided (the accident manner) is of no importance for the determination of the accident type. The mistake of the road users (the accident cause) is basically never of importance.
If for example an accident occurs due to a conflict between vehicle and a pedestrian crossing the road, it is a pedestrian accident. This is independent of the following course of the accident (e.g. if the Pedestrian was hit or not, if the car leaves the road due to an avoidance manoeuvre, of if the car was hit by following traffic due to harsh braking) and independent of who is to blame for the accident (e.g. if the pedestrian or the vehicle had priority).

5.2 Type 1: Driving Accident

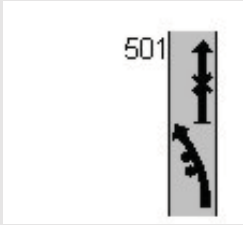
Definition: A driving accident occurred when the driver loses control over his vehicle because he chose the wrong speed according to the run of the road, the road profile, the road gradient or because he realised the run of the road or a change in profile too late.
Driving accidents are not always single vehicle accidents where the vehicle leaves the road. A driving accident can also lead to a collision with other road users.

Type 10 In a curve	10  curve	101  bend to left	102  bend to right					109 run of curve unknown
Type 11 In a curve with turning priority	11  turning priority rd	111 	112 					119 run of curve unknown
Type 12 Turning in or off to another road	12  when turning or entering	121 	122 	123 				129 direction of travel unknown
Type 13 At a swaying road	13  swaying road	131 	132 					139 direction of sway unknown
Type 14 On a straight road	14  straight	141 						149

Type 15 …gradient	15 incline decline	151	152	153			159 run of the road unknown
Type 16 …traffic island	16 traffic island	161	162	163			169 run of the road unknown
Type 17 … road narrowing	17 road narrowing	171	172	173			179 run of the road unknown
Type 18 … uneven road	18 bumpy road	181	182	183			189 run of the road unknown
Type 19 … other driving accidents	Other driving accidents 199						

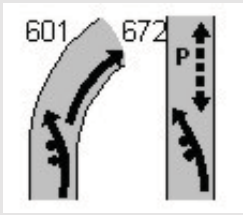
Type 1 : Special cases

Note:
Expressions in the accident description like "… started to skid" or "…run off the road" do not necessarily mean that it is a driving accident.

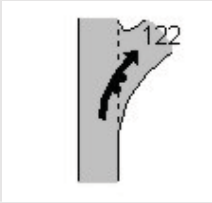


If a driver loses control over his vehicle, attempting to avoid a vehicle parking on the same side, it is an "accident with parking vehicles" (501).

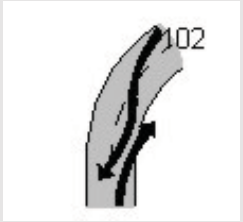
If the driver attempted to avoid a broken down vehicle, it is an "other accident type" (742).



It is an "accident in lateral traffic" if a driver attempted to avoid a pedestrian (672) or a slowly moving vehicle (601). This is independent of the fact if there was a collision with the accident causer as a result of the conflict situation, or if there was a collision with another road user or if the vehicle ran of the road.



If a driver loses control over his vehicle because of too high speed when turning off, it is a "driving accident".



If a driver cuts the curve and this results into an accident with head on traffic, then it is a “driving accident”.

If a non priority vehicle (vehicle having to wait) turns in to a superior road too fast and therefore loses control over his vehicle, it is a “driving accident” unless there is a conflict with a priority vehicle.

If a driver loses control over his vehicle because of a dizzy spell, falling asleep or because he is heavily distracted (e.g. searching a fallen down cigarette) or because of a sudden technical defect on the vehicle (e.g. a bursting tyre), it is an “other accident type”

If a driver loses control over his vehicle as a result of crosswinds, it is a “driving accident”

5.3 Type 2: Turning off Accident

Definition: A turning accident occurred when there was a conflict between a turning road user and a road user coming from the same direction or the opposite direction (pedestrians included!). This applies at crossings, junctions of roads and farm tracks as well as access to properties or parking lots.

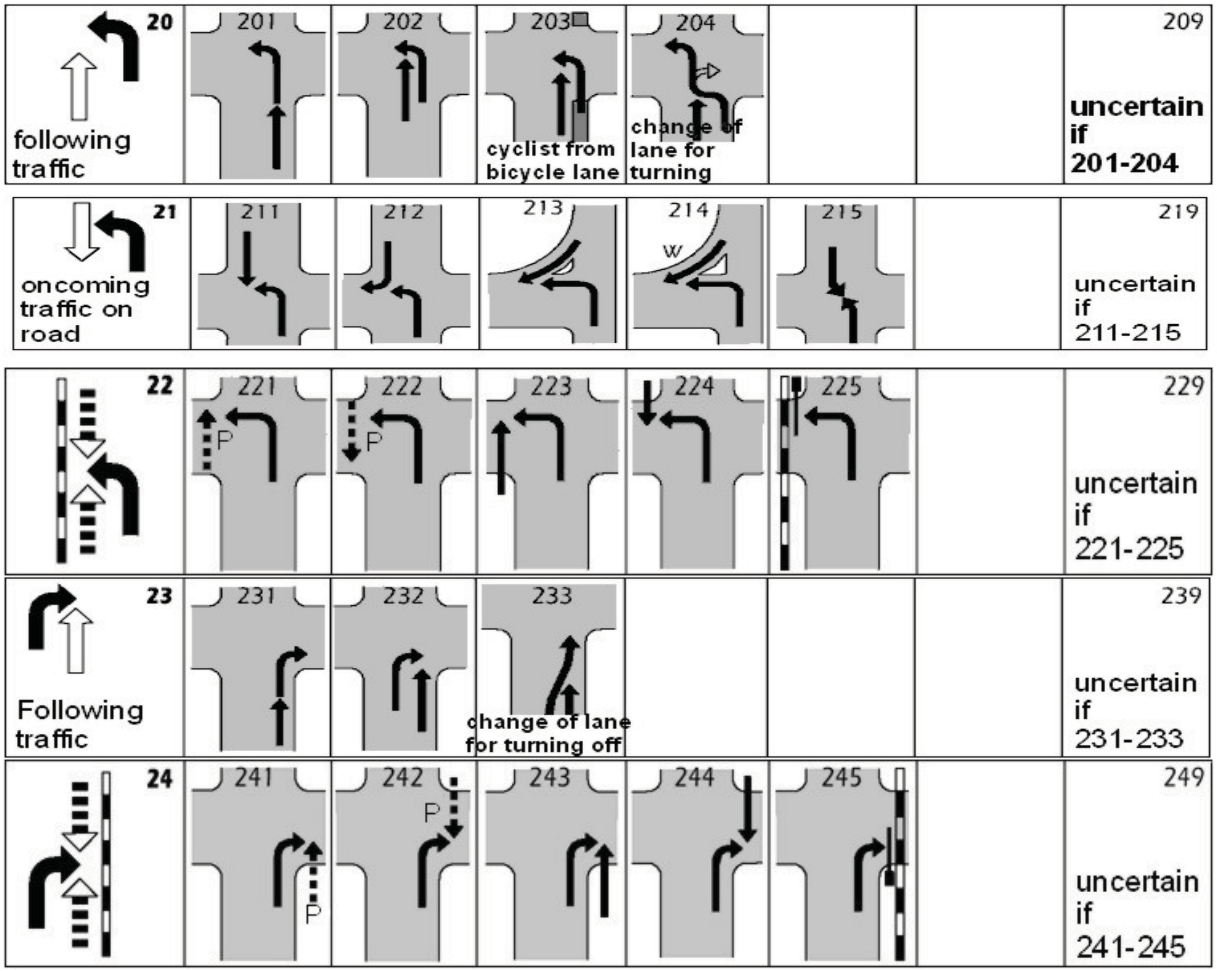
Type 20
Conflict between a vehicle turning off to the left and following traffic

Type 21
Conflict between a vehicle turning off to the left and oncoming traffic

Type 22
Conflict between a vehicle turning off to the left and a vehicle from a special path/track or a pedestrian going to the same or opposite direction

Type 23
Conflict between a vehicle turning off to the right and following traffic

Type 24
Conflict between a vehicle turning off to the right and a veh. from a special path/track or a pedestrian moving in to the same or opposite direction



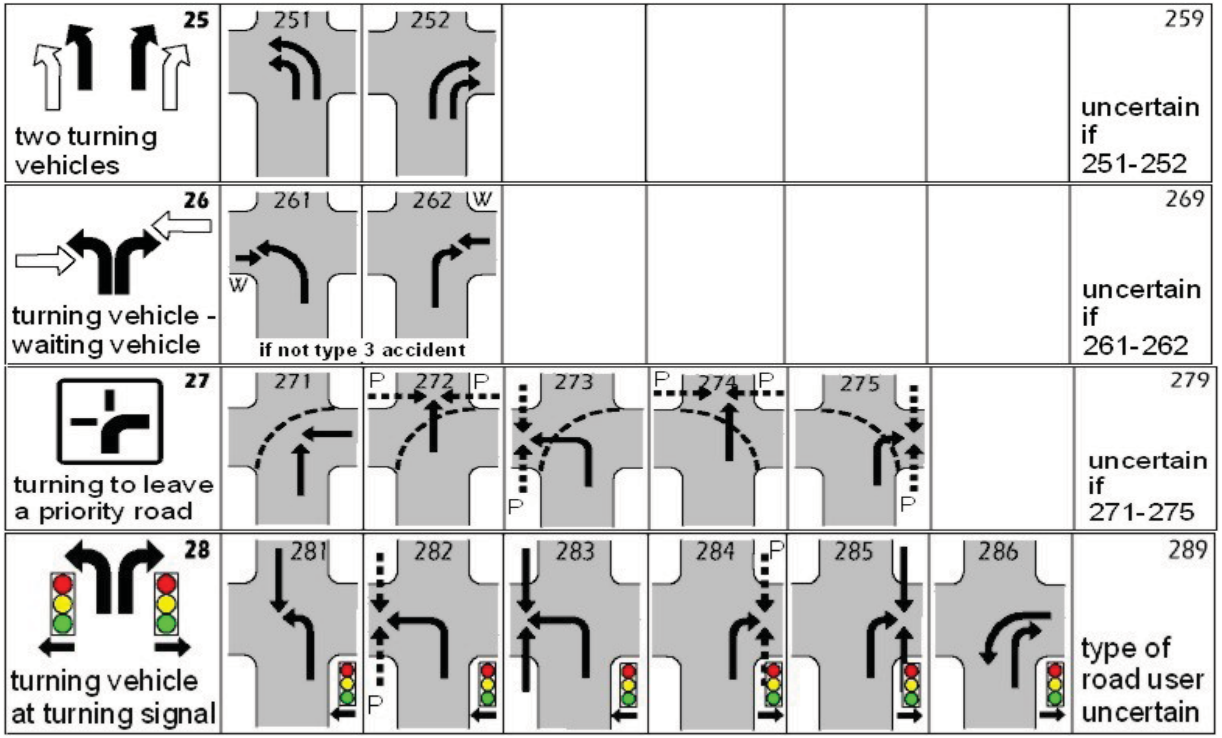
Type 25
Conflict between two turning off vehicles, moving along side in the same direction.

Type 26
Conflict between a turning off vehicle and a vehicle without priority, waiting at the headed road of the turning veh.

Type 27
Conflict between a turning off veh. from a priority rd and another road user at a traffic junct. with a turning priority road.

Type 28
Conflict between a turning off veh. and another rd user coming from the same or the opposite direction when the turning traffic is regul. by traffic lights.

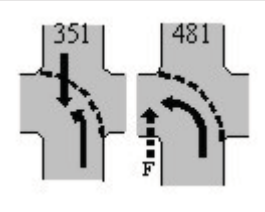
Type 29
Other turning off accidents



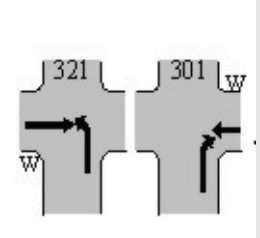
Other turning off accidents 299

Type 2 : Special cases

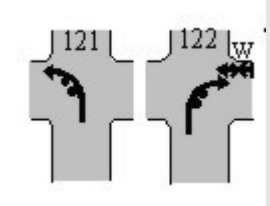
Note:
A road user following a turning priority road is not turning off. Also a conflict between a road user turning off the priority road and a waiting non priority vehicle behaving accordingly is a type 2 accident (turning off accident).



Is there a conflict between a vehicle following a turning priority road and a non priority vehicle or a pedestrian crossing the road, it is a “turning in / crossing accident” (351) or a “pedestrian accident” (481). This is not a turning off accident.



If while turning off there is a conflict with a non priority vehicle because the vehicle has entered too far into the superior road (321) or is too far left (301), then it is a type 3 accident (turning in / crossing accident)



If the driver of a turning off vehicle looses control over his vehicle when turning off because of too high speed (121) (and hits for example a waiting non priority vehicle (122)), it is a type 1 accident (driving accident).

5.4 Type 3: Turning in / crossing accident

Definition: A turning in / crossing accident occurred due to a conflict between a turning in or crossing road user without priority and a vehicle with priority. This applies at crossings, junctions of roads and farm tracks as well as access to properties or parking lots.

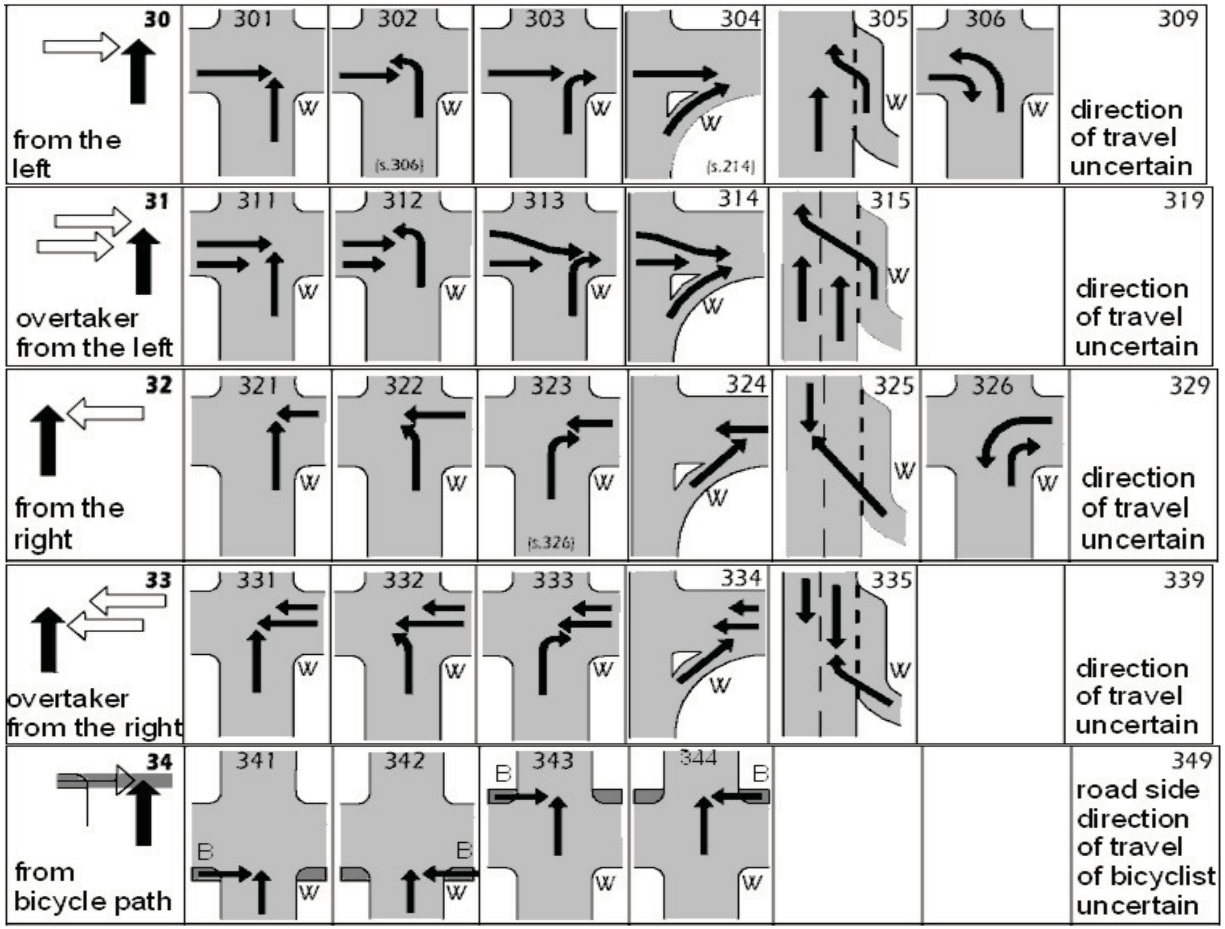
Type 30
Conflict between a non priority vehicle and a priority vehicle coming from the left, which is not overtaking.

Type 31
Conflict between a non priority vehicle and a priority vehicle coming from the left, which is overtaking.

Type 32
Conflict between a non priority vehicle and a priority vehicle coming from the right, which is not overtaking.

Type 33
Conflict between a non priority vehicle and a priority vehicle coming from the right, which is overtaking.

Type 34
Conflict between a non priority vehicle and a bicyclist with priority coming from a bicycle path.

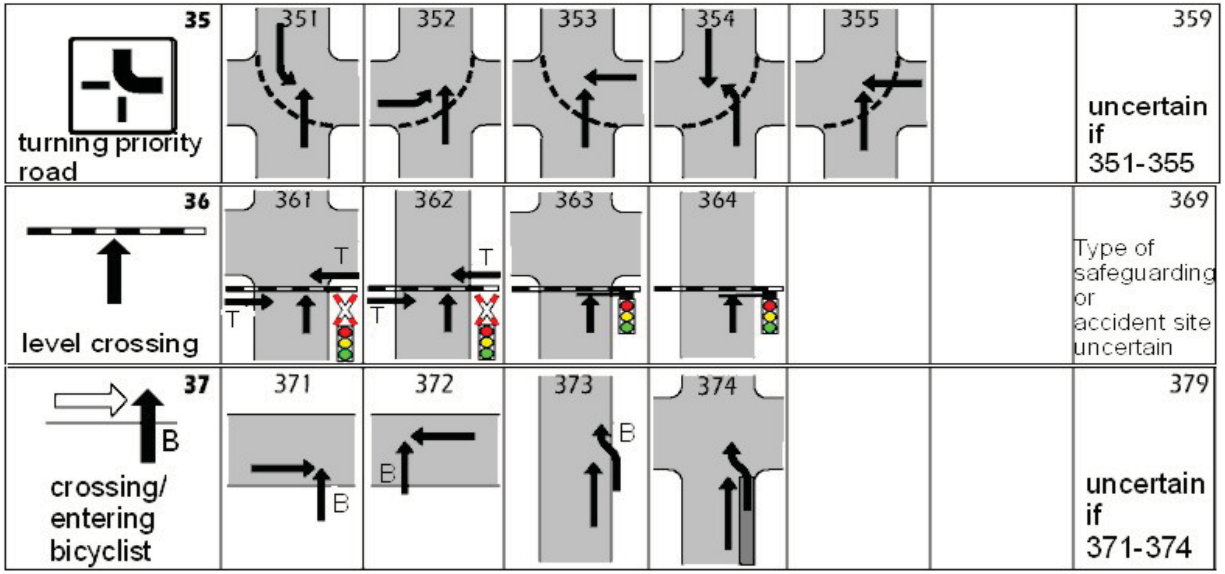


Type 35
Conflict between a non priority vehicle and a priority vehilce on a turning priority road.

Type 36
Conflict between vehicle and a railway vehicle at a level crossing. (Unless it is a turning off accident)

Type 37
Conflict between a vehicle and a bicyclist coming from a parallel bicycle path who is turning in to or crossing the road.

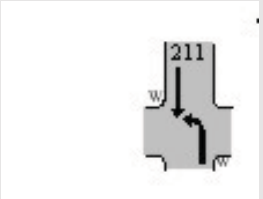
Type 39
Other turning in / crossing accidents



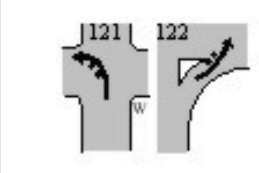
Other turning in / crossing accidents 399

Type 3 : Special cases

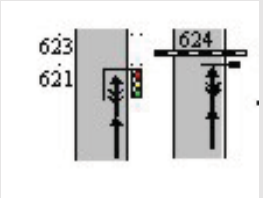
Note:
It makes no difference, whether the obligation to give way was expressed by signs, traffic lights or by a general rule (e.g. traffic from the right has priority).



If a road user without priority wants to turn left at a crossing and crashes with on coming traffic it is a type 2 accident (turning off accident).



If a road user without priority, while turning in onto a superior road leaves the road because of e.g. not adapted speed or an icy road, without there being a conflict with a priority vehicle, it is a type 1 accident (driving accident).



Is there a conflict between a non priority vehicle which is stopping, braking or going slowly because it has to wait and between a vehicle from the following traffic, it is a type 6 accident (accident in lateral traffic).

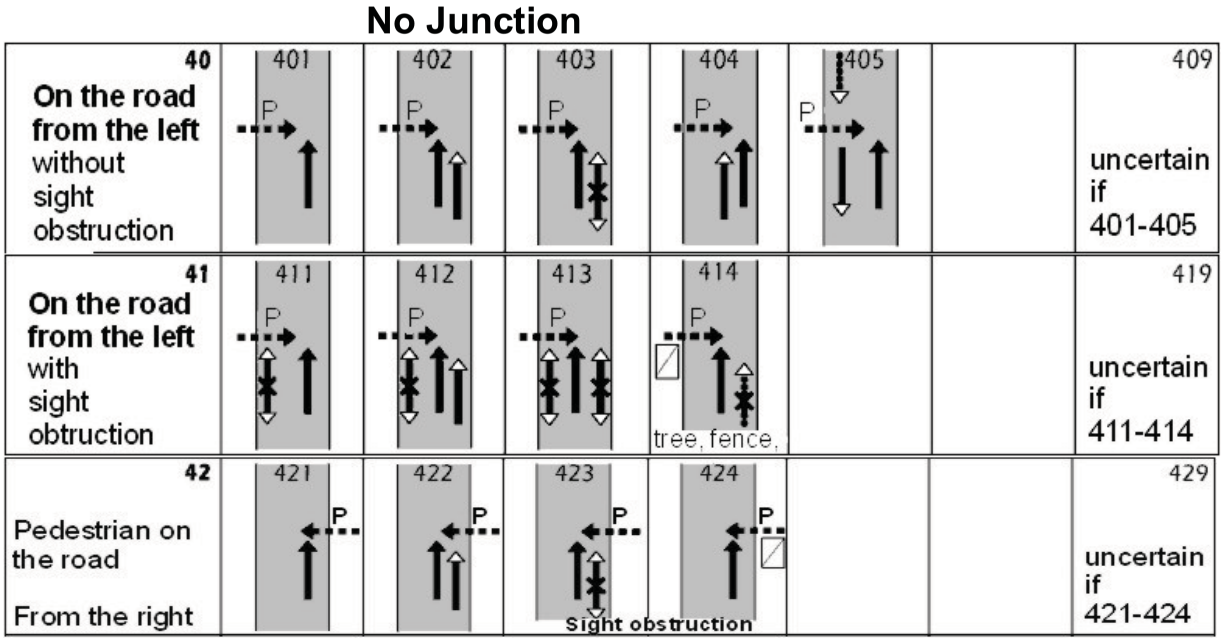
5.5 Type 4: Pedestrian Accident

Definition: A pedestrian accident has occurred due to a conflict between a pedestrian crossing the road and a vehicle unless the vehicle was turning off. This is independent of whether the accident occurred at a place without special pedestrian crossing facilities or at a zebra crossing or similar.

Type 40
Conflict between a pedestrian coming from the left and a vehicle.
(Unless type 41)

Type 41
Conflict between a pedestrian coming from the left and a vehicle which had an obstructed line of sight by parking vehicle, tree, fence ….

Type 42
Conflict between a pedestrian coming from the right and a vehicle.

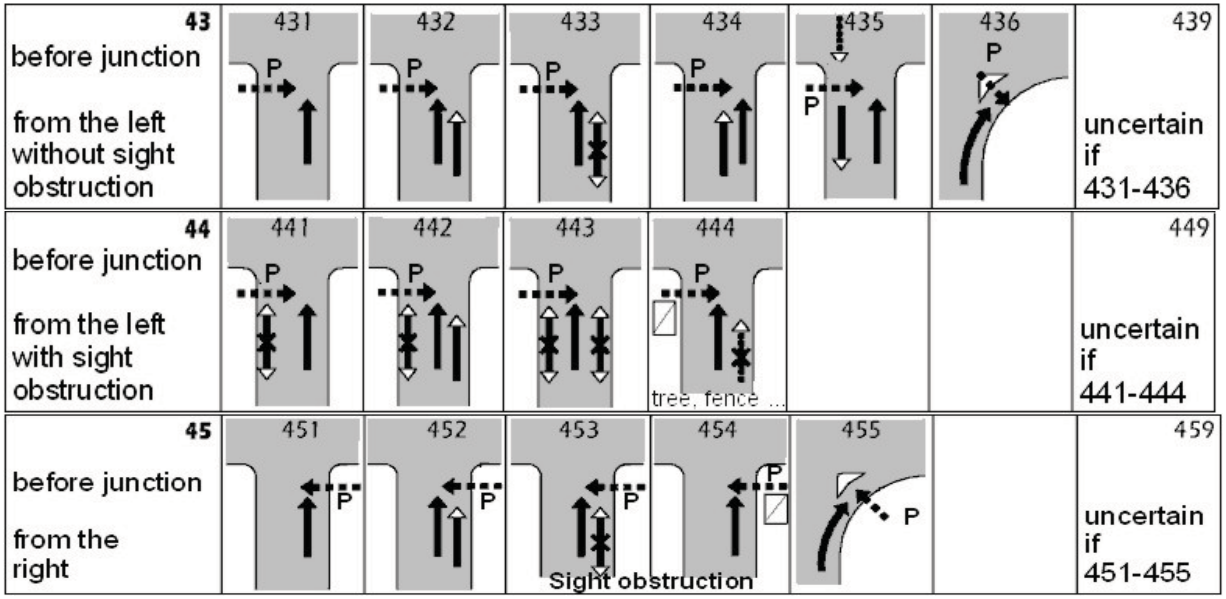


Before a Junction

Type 43
Conflict between a pedestrian coming from the left and a vehicle.
(Unless type 44)

Type 44
Conflict between a pedestrian coming from the left and a vehicle which had an obstructed line of sight by parking vehicle, tree, fence ….

Type 45
Conflict between a pedestrian coming from the right and a vehicle.



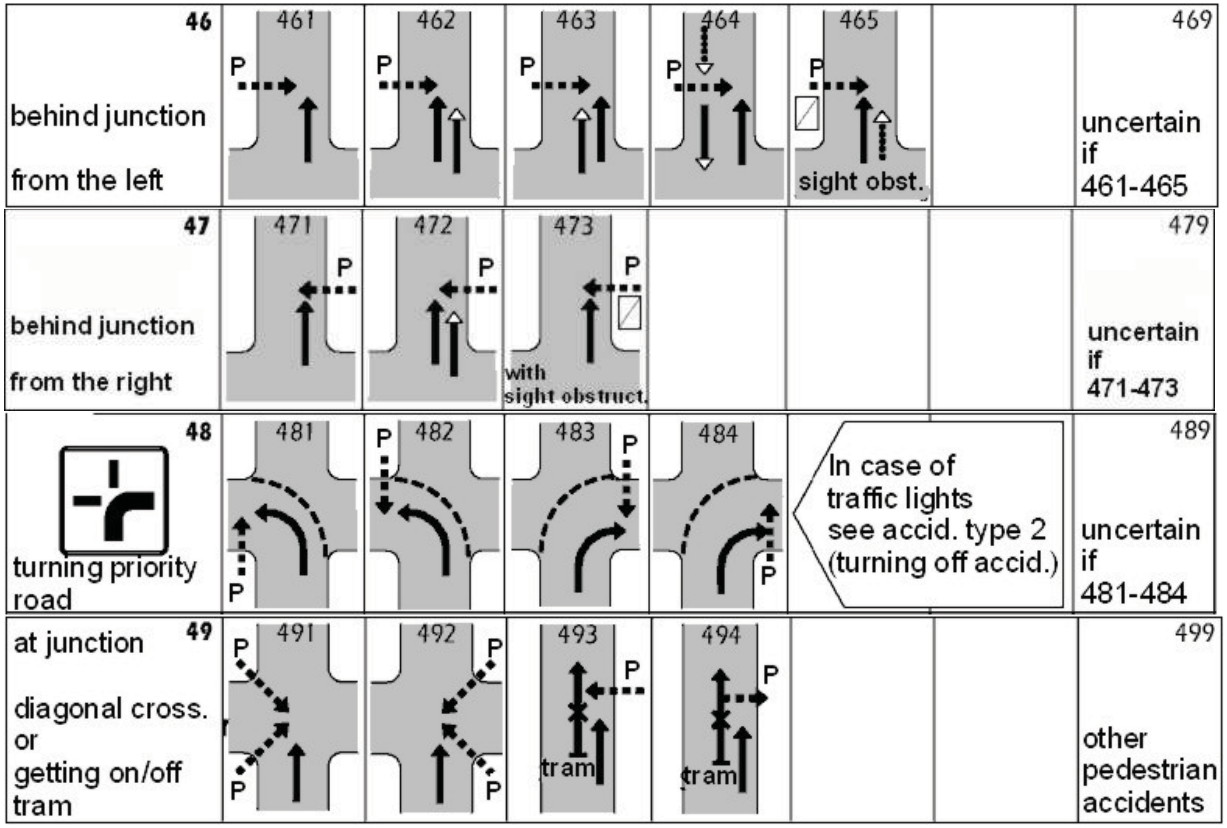
Behind a Junction

Type 46
Conflict between a pedestrian coming from the left and a vehicle.

Type 47
Conflict between a pedestrian coming from the right and a vehicle

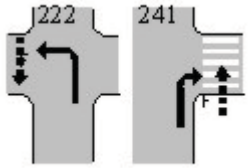
Type 48
Conflict between a pedestrian and a vehicle following a turning priority road.

Type 49
Conflict between a vehicle and a pedestrian crossing a junction diagonally, or getting on/off a tram.
As well as other pedestrian accidents.

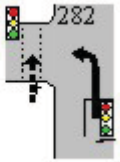


Type 4 : Special cases

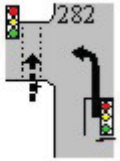
Note:
An accident is also a type 4 accident (pedestrian accident) if the conflict causing pedestrian was not hit. This includes accidents, where the conflict was caused by pedestrians that were e.g. playing, getting in or out of a car, but were not walking in lateral direction.



If at a crossing a pedestrian crosses the access road of a turning off vehicle and this results in a conflict, then it is a type 2 accident (turning off accident)



If such a conflict occurs at a crossing with traffic lights – even with a turning off signal – it is also a type 2 accident (turning off accident)



If somebody is getting out of the car and this results in a conflict between this pedestrian and another vehicle, it is a type 4 accident (pedestrian accident)

5.6 Type 5: Accident with parking traffic

Definition: An accident with standing traffic occurred due to a conflict between a vehicle from moving traffic and a vehicle which is parking, has stopped or is manoeuvring to park or stop. This is independent of whether stopping/parking was permitted or not.

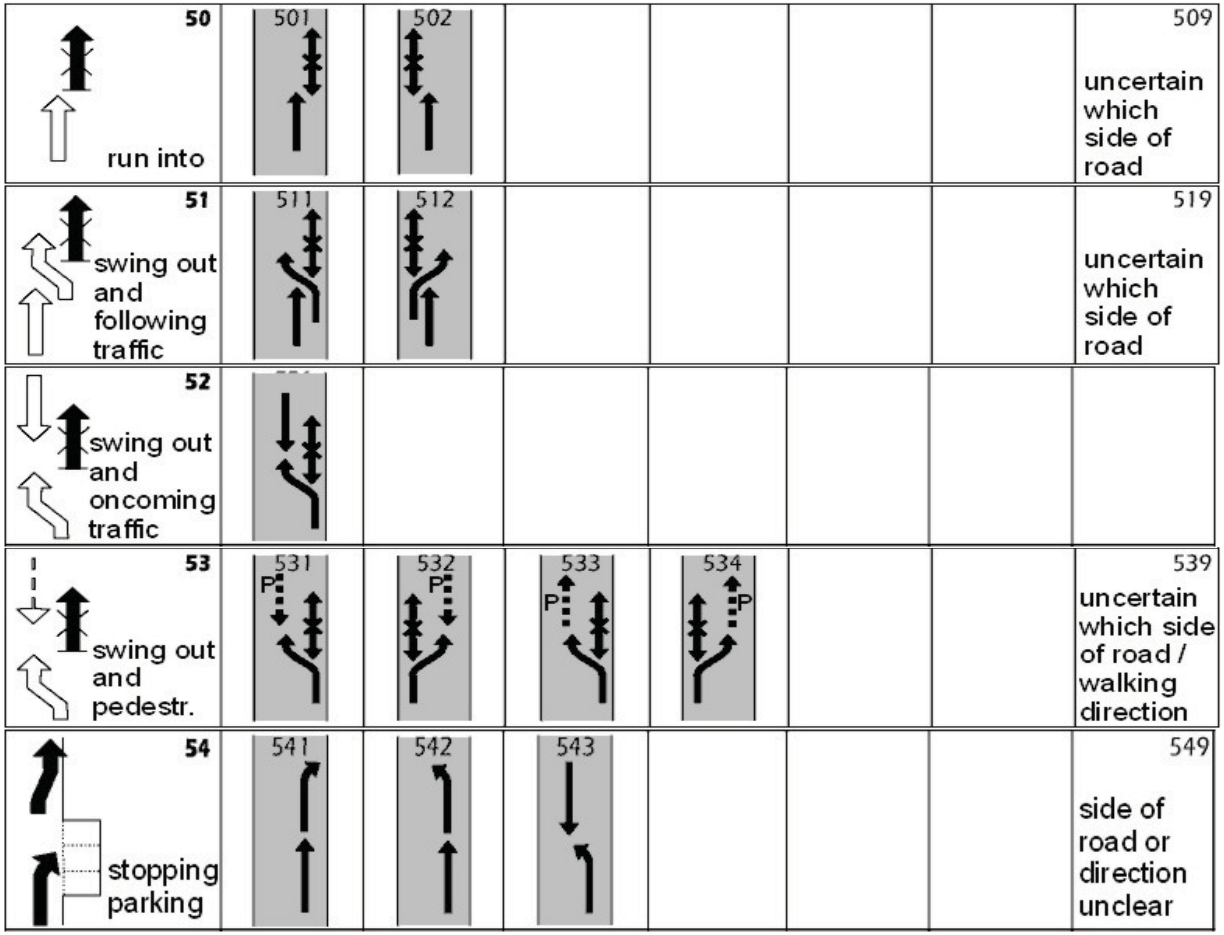
Type 50
Conflict between a vehicle and a parking vehicle in front.

Type 51
Conflict between a vehicle swinging out to avoid a parking vehicle and a following vehicle.

Type 52
Conflict between a vehicle swinging out to avoid a parking vehicle and an oncoming vehicle.

Type 53
Conflict between a vehicle swinging out to avoid a parking vehicle and a pedestrian.

Type 54
Conflict between a vehicle which is stopping to park or entering a parking space and a vehicle of the moving traffic.



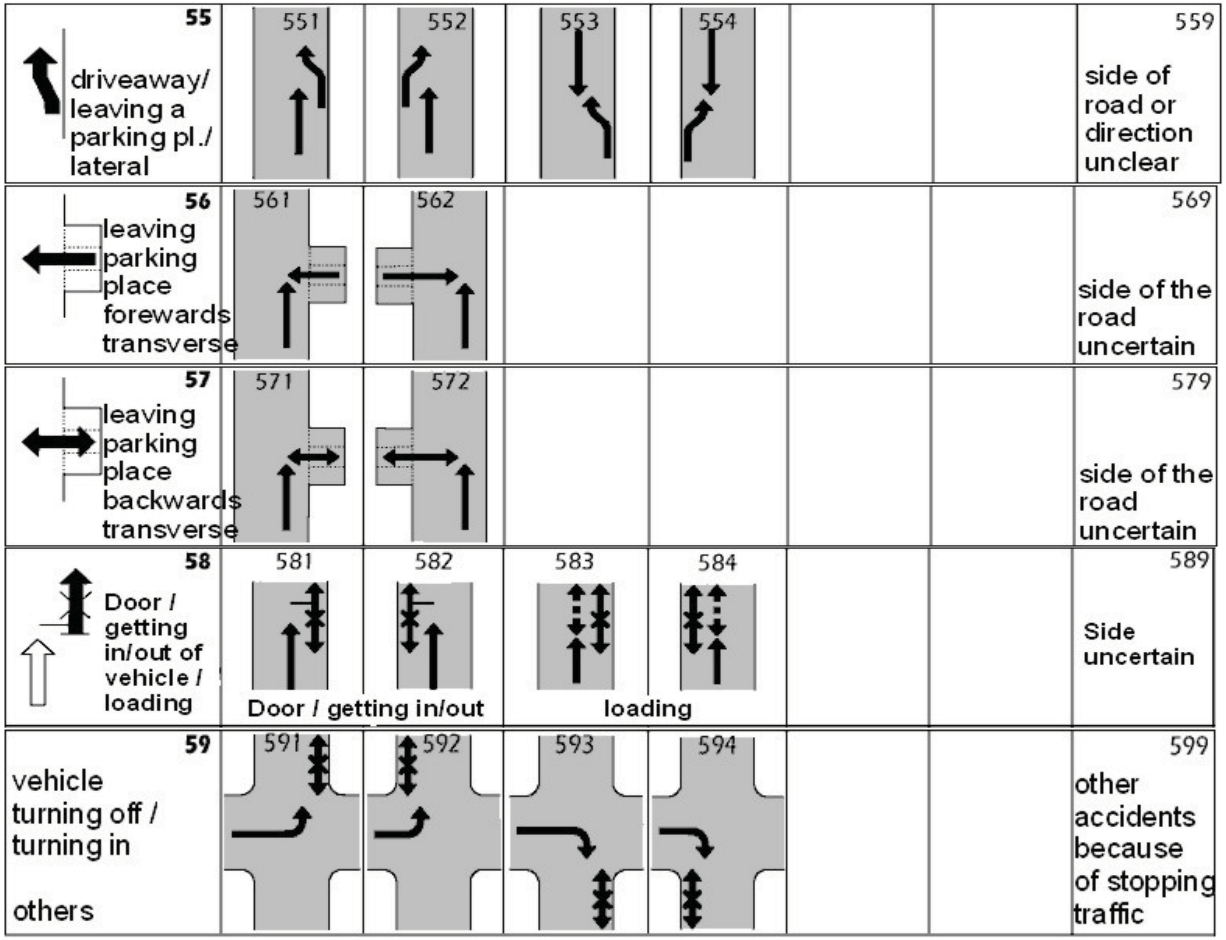
Type 55
Conflict between a vehicle driving away or leaving a lateral parking space and a vehicle of the moving traffic.

Type 56
Conflict between vehicle leaving a transverse parking space forewards and a vehicle of the moving traffic.

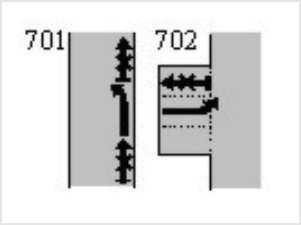
Type 57
Conflict between vehicle leaving a transverse parking space backwards and a vehicle of the moving traffic.

Type 58
Conflict because of opening a vehicle door, getting into /out of the vehicle or loading.

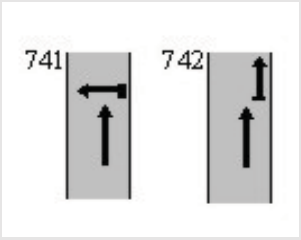
Type 59
Conflict between a turning vehicle and a parking vehicle which is located at the headed path – as well as other accidents with parking vehicles.



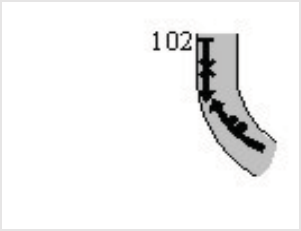
Type 5 : Special cases



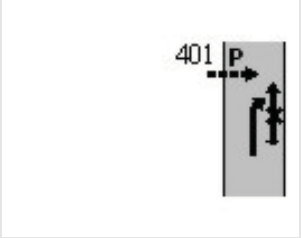
If the accident occurred with a vehicle manoeuvring to enter or leave a parking space and a standing vehicle, the accident is a type 7 accident (Other accident).



A vehicle brakes because of another broken down (or crashed) vehicle and is hit by a following vehicle. In this case it is a type 7 accident (Other accident).



If a standing/parking vehicle is hit, it need not always be a type 5 accident (accident with parking vehicles): For example if a driver looses control over his vehicle (e.g. in a curve, due to not adapted speed) and then collides with a parked vehicle, it is a type 1 accident (driving accident)



If a driver of a vehicle collides with a parked vehicle due to harsh braking because of a crossing pedestrian, the accident is a type 4 accident (pedestrian accident)

5.7 Type 6: Accident in lateral traffic

Definition: The accident in lateral traffic occurred due to a conflict between road users moving in the same or in the opposite direction. This applies unless the conflict is the result of a conflict corresponding to another accident type.

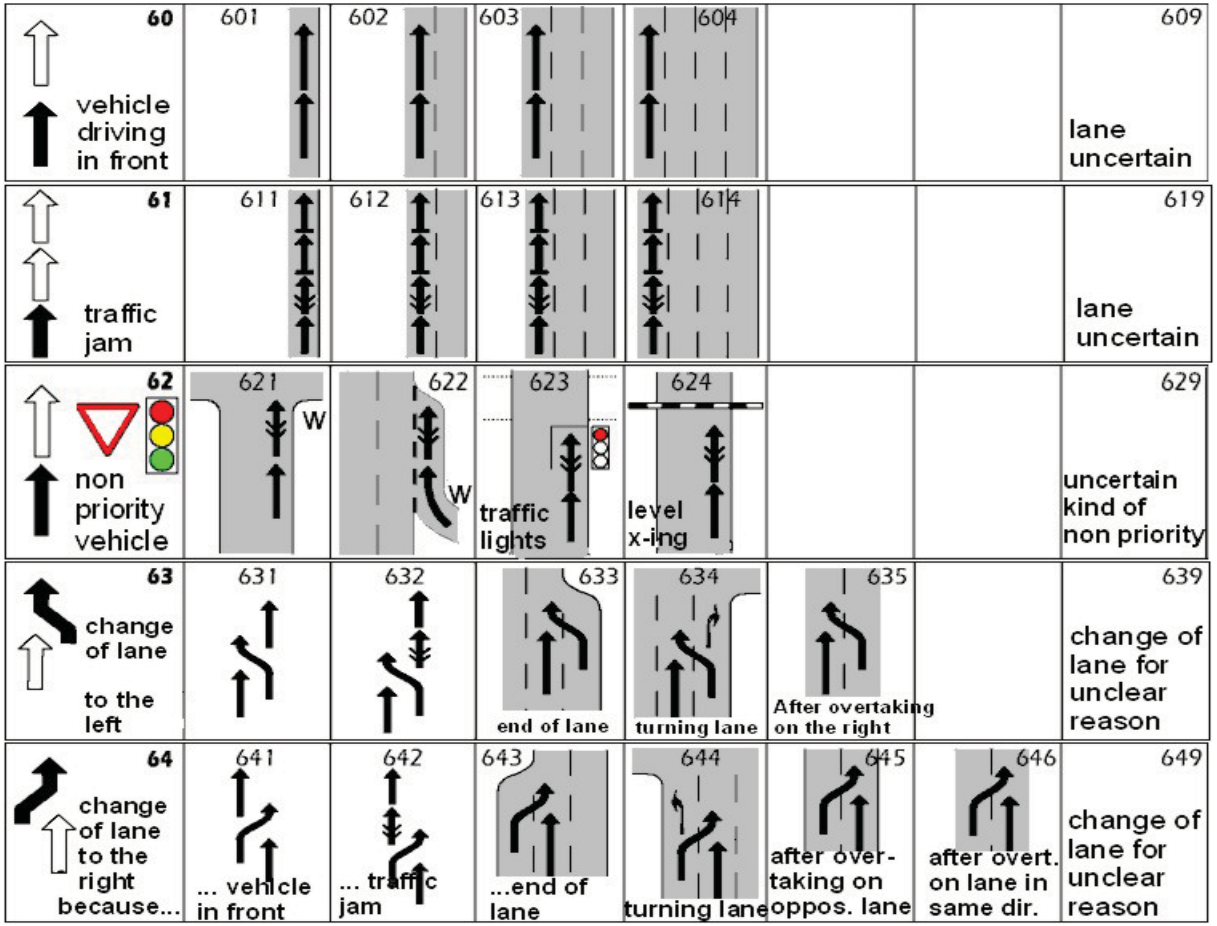
Type 60
Conflict between a vehicle and another vehicle driving in front on the same lane.

Type 61
Conflict between a vehicle which is braking, standing or going slow due to a traffic jam and a following vehicle.

Type 62
Conflict between a veh. wh. is braking, standing or going slow due to traffic or non priority and a following vehicle.

Type 63
Conflict between a vehicle which is changing lanes to the left and a following vehicle on the lane alongside.

Type 64
Conflict between a vehicle which is changing lanes to the right and a following vehicle on the lane alongside.



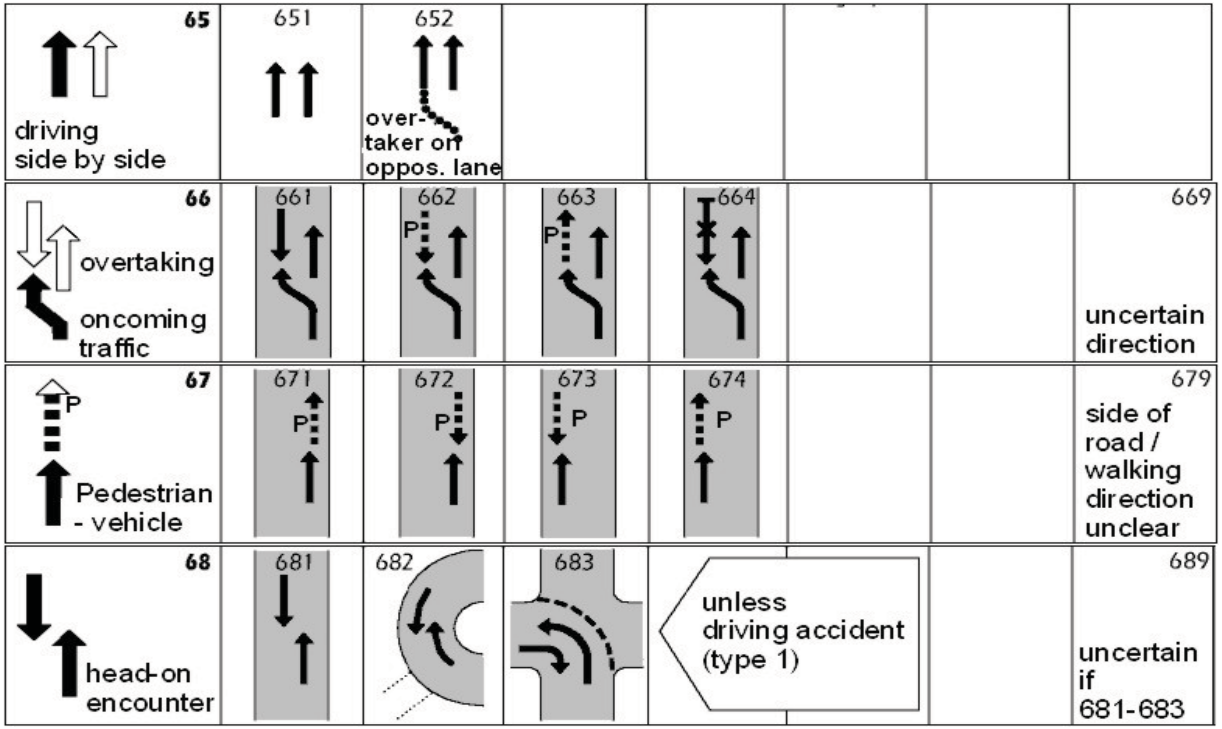
Type 65
Conflict between two vehicles, side by side, going in the same direction.

Type 66
Conflict between an overtaking vehicle and a vehicle from oncoming traffic, a pedestrian or a parking vehicle.

Type 67
Conflict between vehicle which is not overtaking and a pedestrian on the same lane.

Type 68
Conflict between two head-on encountering vehicles.

Type 69
Other accidents in lateral traffic.



Other accidents in lateral traffic 699

5.8 Type 7: Other Accident Type

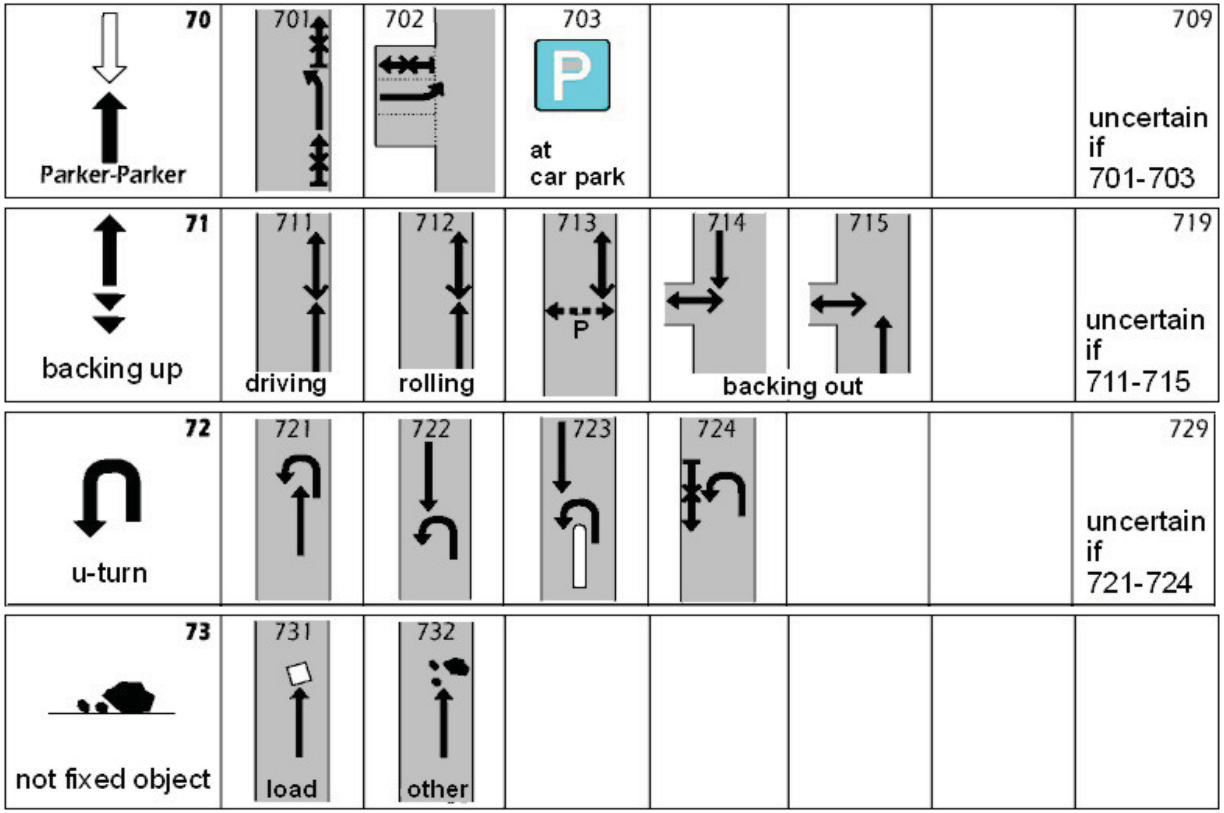
Definition: Other accidents are accidents that cannot be assigned to the accident types 1-6. Examples: Turning around, backing up, accidents between two parking vehicles, objects or animals on the road, sudden vehicle defects.

Type 70
Accident with two parking vehicles.

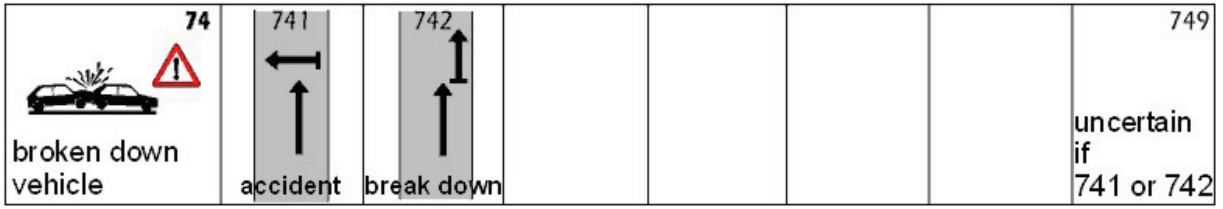
Type 71
Accident while backing up or rolling back. Unless manoeuvring to park

Type 72
Accident due to a u-turn.

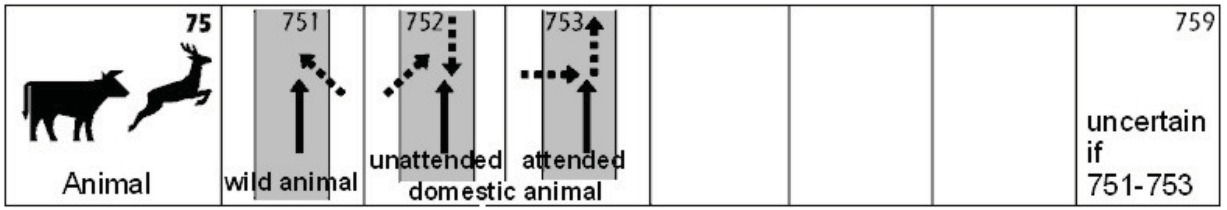
Type 73
Accident due to a not fixed object.



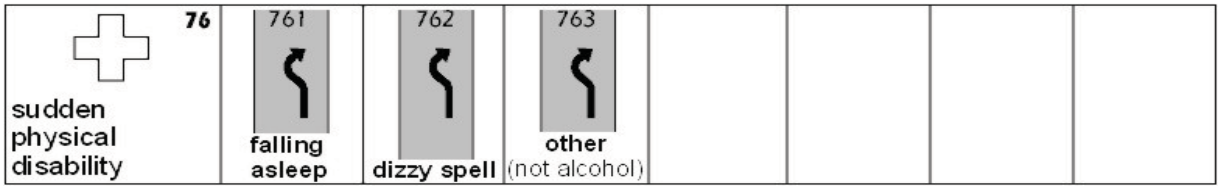
Type 74
Accident due to a broken down vehicle.



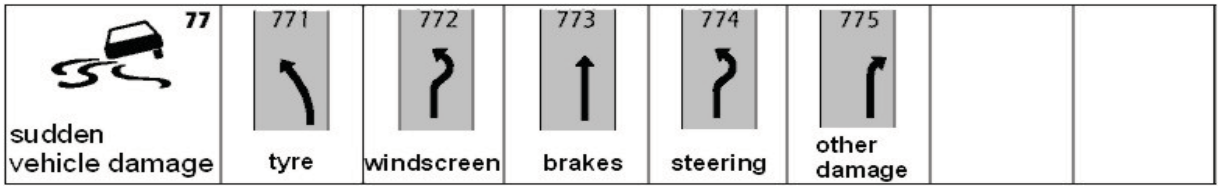
Type 75
Accident due to an animal on the road.



Type 76
Accident due to a sudden physical disability of a road user.



Type 77
Accident due to a sudden technical defect on the vehicle.



Type 79
All other accidents

Other accidents 799

6. Manual for SafetyNet accident causation system (SNACS)

SafetyNet Accident Causation System

Version 1.2

MANUAL CONTENTS

LIST OF FIGURES

6.1 Structure of manual

The manual starts with an introduction to which kind of results can be expected from a SNACS (SafetyNet Accident Causation System) analysis, as well as which the principles for analysis are. Also, the theoretical background for SNACS is described, i.e. the accident model that shapes the SNACS framework.

After the introduction comes an explanatory part divided in two parts. First, there is a general description of what can be expected from different types of collected data when doing accident analysis for active safety. This description is based on the experiences of the Chalmers Accident Investigation team so naturally they are not universal, but they may offer some guidance or insight into the accident investigation process.

Secondly, there is a part in which the various components that form the SNACS framework (Common Performance Conditions, Genotypes and Phenotypes) are described. This is followed by an example walkthrough which in a simple and illustrative way shows what a SNACS analysis can look like.

After the walkthrough comes a chapter entitled “The analysis step by step” which guides the investigator through the analysis process in great detail. The chapter has a lot of subheadings in order to make it easier to find the particular part you are looking for when you are using the manual. The more experienced SNACS investigator can use these headings to find the particular part of the analysis where s/he needs guidance.

The last part of the manual contains a short chapter on how changes can be introduced in a controlled fashion into the SNACS framework, should it prove necessary.

If this is the first time you are using SNACS, our recommendation is to read through the manual first, as this will give you the whole picture and make your analysis a whole lot easier.

In appendix A and B you will find all the tables necessary for completing the analysis. Appendix C contains a page that can be copied and used to carry out the actual analysis on. Appendixes D and E contain an on-scene checklist and an interview guide which have been used in previous projects and therefore may be of some guidance to the investigators.

6.2 Introduction

The analysis method SNACS (SafetyNet Accident Causation System) is a tool for analysing traffic accidents and incidents through a systematic and balanced description of the factors that can contribute to the development of an accident or incident scenario. The goal of the SNACS analysis is to create an understanding of accident scenarios which can function as a base for accident preventative work.

SNACS is based on the existing method DREAM[3]. DREAM, in turn, is an adaptation to the area of vehicle safety of a model called CREAM[4]. The DREAM method has a Human-Technology-Organisation perspective, which implies that accidents happen when the dynamic interaction between people, technologies and organisations fails in one way or another, and that there is a variety of interacting causes creating the accident. The latter part particularly stresses one of the most important issues of the WP5.2 project; to be able to survey the causes of the accidents.

6.3 The Accident model behind SNACS

An accident model is an abstract conceptual representation of the occurrence and development of an accident. It describes how and why accidents happen, it defines possible causes and interactions, and it directs data collection and analysis, as well as the selection of countermeasures. On every occasion where an accident analysis is carried out, a more or less explicit underlying accident model can be identified. If the model is inadequate for describing the problems of the domain, the accident analysis and countermeasure selection will be inadequate too[5].

Modern road traffic is a complex, rapidly changing and dynamic environment, which makes it a good example of a so called socio-technical system. In this system, the task of the driver is gradually becoming more and more complicated, while at the same time the demands for a reduction in the number of accidents are increasing. This leads to certain requirements that need to be met by an accident model for modern road traffic:

- It needs to provide adequate concepts for describing the factors that can lead to an accident within the domain. Because of the interdependencies and the tight structural coupling between the elements of modern road traffic, the model also needs to describe how the contributing factors interact with each other.

[3] Ljung, M., *DREAM – Driving Reliability and Error Analysis Method*, Linköping University, 2002
[4] Hollnagel, E., *CREAM - Cognitive Reliability and Error Analysis Method*, Elsevier Science, Oxford, 1998
[5] Huang, Ljung, Hollnagel & Sandin, *Accident models for modern road traffic – changing times creates new demands,* IEEE International Conference on Systems, Man & Cybernetics, Hague, Netherlands, 2004

- The accident model needs to have a well defined scope that covers the large variety of players that shape the road traffic system. This involves not only road users, but maintenance providers, designers, manufacturers, researchers, policy makers etc.

- The accident model needs to be able to handle extended time spans. This is due to the fact that whenever an inappropriate action goes uncorrected (for example, a mechanic does not tighten the wheel nuts properly), its consequences become a latent condition, and that condition can contribute to a later accident scenario[6]. Latent conditions exist in every system as results of human decision making, and they may exist there for many years if they remain undiscovered. This means that an accident model needs to be able to account for problems that could have been created a long time ago.

Apart from being an interactive procedure, driving is also context dependent and highly dynamic, with constantly changing conditions. The study of human cognition shows that in order to control a system, the human operators need as much variety as the environment, both in behaviour and in cognition[7]. An accident model for modern road traffic therefore needs to be able to give a detailed description of how drivers function in dynamic scenarios.

An accident analysis is always carried out with a purpose. If the purpose of the accident model is to decrease the number of accidents on the roads, the accident model must be suitable for preventive work. This means that it needs to be able to both explain the mechanisms of past accidents and predict the mechanisms of accidents to come. Also, these accident explanations need to be of sufficient detail and content for countermeasures to be devised, otherwise preventive work cannot be carried out.

The classical view of a human machine system contains three elements; a human, a machine and their interaction. This fragmentary view results in human action being viewed as predominantly reactive and part of a closed loop. Actions are seen as responses to events, and the accident research focuses on how to calculate the risk for “human error” in this loop.

However, to accommodate the demands mentioned above, this view is not sufficient. Therefore the theoretical principles behind SNACS have been taken from the principles of Cognitive Systems Engineering (CSE)[8]. In this perspective, the human (the driver), works in cooperation with the machine (the vehicle), and they are in fact seen as a Joint Cognitive System (JCS). The task of driving set for this JCS is much more an active than a reactive task, demanding goal achievement in a dynamic traffic environment.

[6] Reason, J., *Human Error*, Cambridge University Press, Cambridge, 1990
[7] Hollnagel, E., *Barriers and Accident Prevention*, Ashgate, Aldershot, 2004.
[8] E. Hollnagel and D.D. Woods, "Cognitive Systems Engineering: New Wine in New Bottles," *International Journal of Man-Machine Studies*, Vol. 18, pp. 583-600, 1983.

Furthermore, the CSE framework puts forth certain axioms for human behaviour that somewhat diverge from the classical view of the human component in human machine systems. These axioms can be summarized as follows:

- *Behaviour is meaningful in relation to goals rather than structures*
- *Behaviour takes place in, and depends on, a context*
- *Behaviour is proactive as well as reactive*
- *Behaviour is often automated and unconscious*
- *Behaviour always involves an act of balance between efficiency and thoroughness (safety) – the Efficiency Thoroughness Tradeoff (ETTO) Principle*
- *Meaningful behaviour is the same thing as the ability to maintain control*

For a deeper dive into why this is a change of perspective in reference to the classical view, see Hollnagels book “Barriers and Accident Prevention”.

Looking at the wider perspective, the accident model for SNACS comes from work in industrial safety. It is built from an MTO perspective (Man, Technology, Organisation), and in essence it says that accidents happen when the dynamic interplay between human, technology and organisations is flawed in one or more ways. For road traffic, this means that the human factor is always seen in the larger context of the vehicle and the traffic environment, including the organisations that are responsible for shaping the vehicle and the traffic environment. From the MTO-perspective, there is therefore very rarely a one-to-one relationship between cause and effect in an accident sequence. Instead, several coexisting factors are usually contributing to the development of the accident.

When analysing the contributing factors, the accident model makes a distinction between factors ”at the sharp end” and factors ”at the blunt end”. ”At the sharp end” is the humans which are interacting with the system(s) in real time, i.e. drivers. When something happens ”at the sharp end”, for instance, two cars collide, it is called a ”sharp end failure”.

When trying to find the factors which brought such a ”sharp end failure” about, it is not sufficient to only look at the local circumstances in time and place, i.e. what happened “then and there”. It is necessary to expand the search to also include factors which have contributed in the sense that they have shaped the context in which the accident event took place. These factors are caused by events ”at the blunt end”, i.e. events that can be remote in space and time, but which nonetheless shape the conditions for what happens ”at the sharp end”.

If there is a failure ”at the blunt end”, and the consequences of that failure are not discovered and remedied, the consequences will remain in the system as so called ”latent conditions”. These ”latent conditions” can then, together with different dysfunctional behaviours ”at the sharp end”, create accident sequences. The whole accident model can be illustrated as follows:

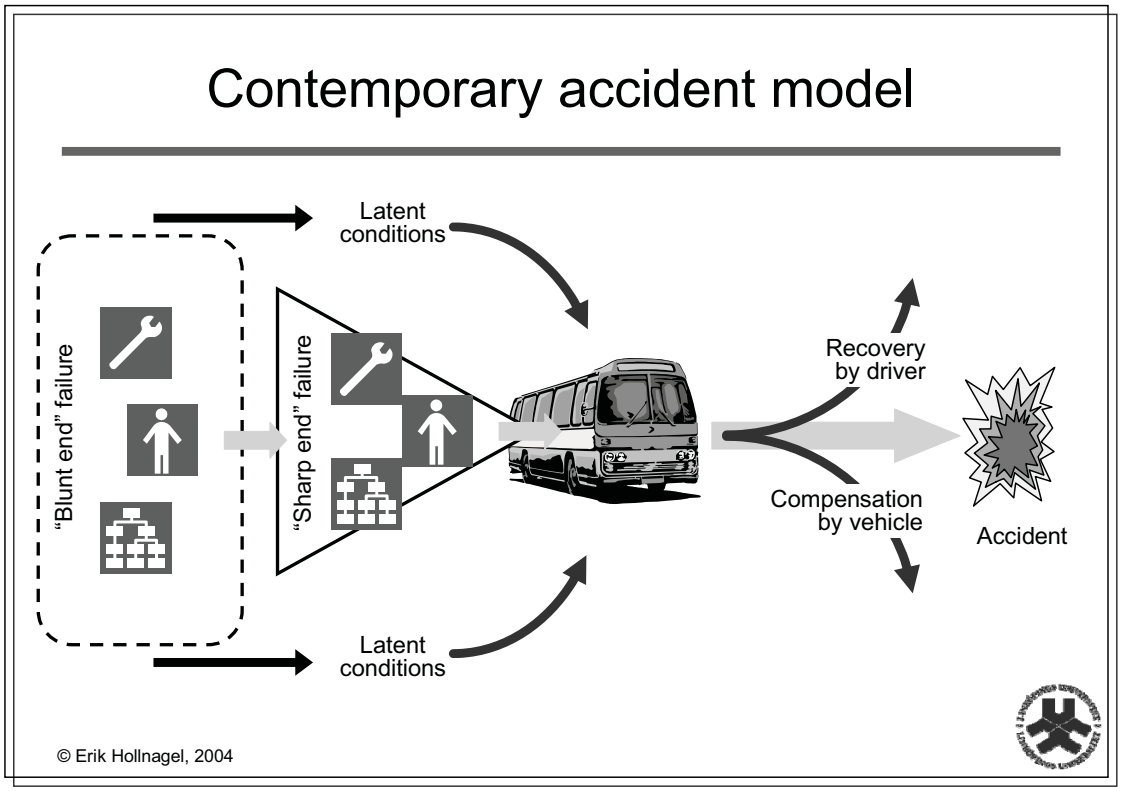


Figure 2: Contemporary Accident Model (Hollnagel, 2004)

The point with an MTO-based accident model is that it allows for an accident analysis which not only covers the immediate situation, but also the factors which have shaped the context in which the immediate situation takes place, i.e. which ”latent conditions” are present, and which ” blunt end failures” brought them about. It also allows for the set of possible contributing factors to cover the whole MTO-spectra of Man (driver and shapers of the driving conditions), Technology (vehicle and makers of vehicles) and the Organisation (traffic environment and shapers of traffic environments).

6.4 Accident investigation and different types of data

Since the Contemporary Accident Model which SNACS is based on has a wide scope, in the sense that it includes the whole MTO-range of contributing factors, and incorporates both sharp end and blunt end failures, the accident investigator is faced with quite a challenge when it comes to collecting data about accidents. This in turn, as always, calls for thorough documentation and a number of checklists to make sure that at the end of the day, all questions are asked and all measurements are taken.

To facilitate the on-scene procedure and the interviewing, an on-scene checklist and an interview guide have been prepared in this manual (see Appendix D and E) to help investigators in the on-scene work. When going out to the accident scene, the adrenaline level is naturally quite high, and even though we may feel calm and confident, we nonetheless tend to forget parts of the data collection procedure unless there is a written checklist to compare with. Most likely, every accident investigation team has their own checklists already in place, so these have been included only for comparison and inspiration if needed.

Going out to the accident scene, there are two general types of data to be collected. The first type regards what we can observe by ourselves on-scene, and the second type is the data that can be collected by interviewing the people involved in the accident (or interviewing the interviewers, e.g. talking to the police about what the drivers and witnesses told them).

6.4.1 Observation data

Regarding the first type of data, a couple of things can be pointed out. First off, as the accident model above implies, the context for the accident is very important, since an axiom of the accident model is that behaviour is context dependant. Therefore we need to be thorough and careful in our documentation of what the circumstances were like when the accident took place, so that we can assess the influence of the context on the development of the event. To aid in this procedure, SNACS has, as part of the methodology, a tool for context description and evaluation called the Common Performance Conditions Template (described below).

Also, as we all know, careful documentation with pictures and (if possible) video is of great value. From the experience of Chalmers Accident Investigation Team, if the driver interview takes place after you have been to the scene, things often turn up which the investigators were not aware of at the scene, and which therefore warrants further analysis of the accident scene. If time and equipment allows, it is also great to shoot a video from inside a vehicle while driving towards the accident scene from the respective driver's approach trajectory, to get a feeling for what the driver experienced coming up to the impact point. This will naturally not be a copy of the actual circumstances, but video or pictures in an approach sequence helps the team a lot when discussing the reasons for the accident.

6.4.2 Interview data

Also, regarding the second type of data, that is interview material, a few points can be made. First off, **there is no such thing as an objective description of the accident event.** Every story told is a story from someone's particular point of view, and even though this is nothing new, we all need to keep it in mind when analysing interview data.

Secondly, event though most drivers have quite extensive driving experience, very few have experience of accidents. This means that they never have practiced observing and reporting on accidents, and therefore the account they give will be a reconstruction based on what seems plausible to them. When doing this mental reconstruction of the event, people will invoke what they "generally know" about how accidents happen.

Such general knowledge is sometimes called scripts, or action sequence patterns. If there is a gap in a description of an event, people will fill in that gap with what they believe is most likely. An example of such a script would be that "if you are about to run into something and detect this, the logical thing to do is to brake". Braking is part of the collision avoidance script. Hence, an interviewed driver will probably claim to have braked if he had time to realise that he was in danger. This means that whether or not he actually did brake has to be verified in other ways.

That verification is also necessary because as stated among the principles for human behaviour above, a large part of human behaviour is automated and unconscious. Such behaviours are by nature very difficult to recall consciously, since they were not carried out as part of a conscious control process. In driving, this is particularly true for low level control tasks, such as accelerating, braking, steering and shifting gears. In fact, the demand in driver's education is generally that the driver should not receive his licence until these behaviours are automated, because otherwise the driver cannot keep his attention on the surrounding traffic.

Asking the driver whether s/he did brake or accelerate at a certain point in time is therefore a very difficult question to ask. This behaviour instead generally has to be inferred from the driver's description of his actions prior to the event. For example, from a narrative like "I was standing still, and then the light turned green, so I started driving…" we can infer that the driver released the brake pedal, put his left foot on the clutch (if driving a manual shift) pressed down the accelerator with his right foot while releasing the clutch, and so forth.

Another thing about interviewing people is that the choice of words is important. People will be influenced by the words chosen in the description of an event. A classical example is Loftus and Palmer's study from 1974. Test persons watched a movie where two cars collide. Then they got the question "How fast were the cars going when they (their average answers in brackets):

contacted each other?	(31 mph ~ 50 km/h)
hit each other?	(34 mph ~ 55 km/h)
bumped each other?	(38 mph ~ 61 km/h)
smashed each other?	(41 mph ~ 66 km/h)

One week later they came back and got the question ”was there any broken glass?” (There was no broken glass). 32% of the “**smashed”** respondents said yes, while only 14% of the “**hit”** respondents answered yes.

Another example that relates even closer to our work is in Loftus from 1975, where a number of persons were asked to watch a car crash on video, and then had to answer one of the two questions:

- ”How fast was the white car going **when it passed the barn** on the country road?”
- ”How fast was the white car going on the country road?”

The fact is that there was no barn in the video. One week later, the persons were called back to the testing facility and were asked if there was a barn in the movie. 17% of the respondents to the first question said yes, compared to only 3 % for the second question.

We can carry this example into accident investigation. If we have been told by one party that there was a pedestrian close to the accident scene, we may ask a driver questions such as “How fast were you going when you passed the pedestrian?”. If later information then reveals that there was no pedestrian, we may still have planted the memory of a pedestrian in the mind of the driver, which may cause him/her to adjust the accident narrative to account for the pedestrian.

Now, these examples are provided here not to scare investigators off from interviewing or to create mistrust in interviewing as a source for information. Interviews, on the contrary, are usually by far the most important source for information about why the accident occurred. In previous investigations made by Chalmers Accident Investigation Team, drivers have generally been very honest and forthcoming when interviewed about the accident, especially once they are made aware that the interview is for safety research, and that they will remain anonymous in all accident descriptions. However, it pays off to be aware of what people can be expected to reliably describe, as well as the possible traps that we may create for ourselves in the interview process.

6.5 Analysis with SNACS – principles and components

Before we go into the details of how to perform an accident analysis with SNACS, it needs to be made very clear that the whole point of SNACS is to make it possible to systematically describe and store what we know about the reasons for an accident. **SNACS in itself cannot tell us why the accident happened**. If it could, we would need neither the on-scene investigation nor the interviews. What SNACS does is provide a structured way to sort out the reasons we find for the accident, and classify them as belonging to a set of categories developed from previous research. SNACS is an organiser of explanations, not a provider.

Analysing an accident with SNACS takes place in two steps. First of all, an evaluation of the context for the event is made. Secondly, a detailed analysis of the accident is made, with the context description as support. The SNACS method has two tools to do the analysis.

The first tool is a table called Common Performance Conditions (CPC), which is used for context description and evaluation. Each CPC represents the state of a contextual variable affecting the general performance of the driver and vehicle in a traffic situation.

The second tool is a classification scheme that lists possible factors that can be involved in making a driver and vehicle loose control of a situation. On the highest level the scheme distinguishes between the effects that are present in a situation, and the causes of or reasons for those effects. The effects are called *phenotypes* (sometimes also referred to as *critical events)*, and they refer to the observable consequences of a dysfunctional behaviour. For traffic accidentology, this is basically what you see when you arrive at the scene of an accident. The causes or reasons for the effects are called *genotypes*. The genotypes are used to describe what has brought about, or can bring about, the effects.

The terms *phenotype* and *genotype* are deliberately chosen to reflect their counterparts in biology. Two humans (two phenotypes) never look exactly the same, but the underlying genotypes that generate their different looks are identical for both. The same goes for accidents and near-misses; the looks are different, but the set of possible underlying causes is the same. What differs between looks is which subset of genes or causes that is dominant or active for the particular situation (critical event/phenotype).

Causes typically cannot be observed, but must be inferred by reasoning. In addition to listing possible causes/reasons for the phenotypes (critical events), the SNACS classification scheme therefore also describe the links between them. The links can be said to represent existing knowledge about how different factors (causes and consequences) can interact with each other.

The purpose of doing a SNACS analysis is to find a probable connection among these factors; a connection that can explain the observed consequences or the event phenotype. The whole analysis process can be illustrated as in Figure 2:

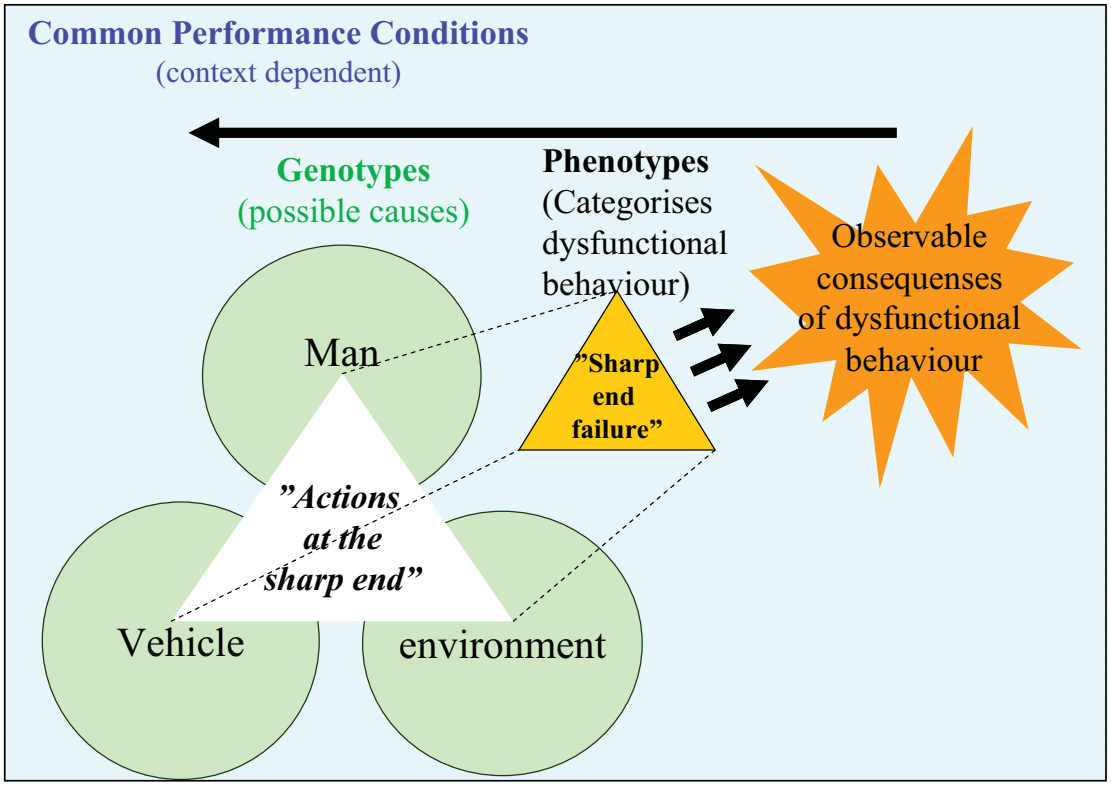


Figure 3: Analysis with SNACS

Splitting the analysis into phenotypes and genotypes makes it possible to keep the first step of the analysis (the phenotype step) fairly neutral, without jumping straight to the causation part. This makes it easier for different persons to use the method in the same way.

Once the cases are analysed, the results can be aggregated in such a way that patterns among the contributing factors can be detected. The possibility to aggregate the analysis results is a function of how the SNACS method is constructed. The reason for developing the method in this way is that even though every accident in a sense is unique, from a theoretical point of view, it is reasonable to assume that accident scenarios which include similar components also will have similar characteristics in terms of causation, and a systematic approach is needed to uncover these characteristics.

6.5.1 Common performance conditions

The Common Performance Conditions (CPC) are used to describe contextual conditions at the time and place of the accident. Each of the parameters among the CPC evaluates the state of a dimension that is always present in some way or another when driving, and which influences the driver's performance possibilities.

The CPC cover two general areas; the general driving conditions at the scene, and the driver's general condition (or drivers, for multiple vehicle accidents). The CPC for SNACS are the following:

Common Performance Conditions	
CPC	**Parameters**
Design of traffic environment	**Type of traffic environment**
	Important factors
	Complexity
	Information
Design of driver environment	**Physical environment**
	HMI – design of indiviual interfaces
	HMI – design of the interface combination
Traffic environment conditions	**Density of traffic**
	Road conditions/friction
	Visibility – atmospherical conditions and light
	Visibility – Obstructing elements
Driver conditions	**Physical and mental health**
	Speed (compared to signs)
	Time of day and week
	Number of simultaneous goals
Adequacy of training and experience	**Driving experience**
	Driver's aquaintance with traffic environment
	Driver's aquaintance with the vehicle
	Driver's education (procedures, regulations, special vehicle training)

Figure 4: Common Performance Conditions for SNACS

A detailed description on what the CPC stand for, as well as how to evaluate them, can be found in Appendix A; "CPC-template".

The main purpose of the context evaluation through the CPC is to frame the situation. The contextual conditions can give clear hints as to which types of causes are more likely than others to have brought about the accident. If the conditions were particularly demanding in one or more of the CPC dimensions, then causes related to these conditions are more likely connected to the event.

For example, suppose that you are analysing an accident where the driver has departed the roadway. If the CPC evaluation shows that the road conditions were poor due to patches of ice on the road, then causes relating to misjudgement of the road friction are likely. If, on the other hand, the road was dry, such causes are much less likely.

6.5.2 The classification scheme – phenotypes and genotypes

After the first, context descriptive step, the analysis goes on to sort out which the contributing factors are, and how they are connected. When analysing an accident scenario, there are two types of material available. The first type is empirical data. This data consist of the facts that can be gathered through inspection of the accident scene and interviews with the people involved, i.e. the observable consequences of a ”sharp end failure” (the accident itself). The second type of material consists of knowledge that the investigator brings with him/her into the analysis; a pre-understanding of which factors can contribute to the development of accident events, and their interaction with each other.

The classification scheme of SNACS therefore contains two different sections, each covering one of the two types of material. These sections have already been mentioned above, and they are called *phenotypes* and *genotypes*. The phenotypes (sometimes referred to as critical events) are used to classify the empirical material, i.e. the observable consequences of a dysfunctional behaviour. For traffic accidentology, basically, this is what you see when you arrive at the scene of an accident. The genotypes are used to classify all the factors which can be used to describe what has brought about, or can bring about, these effects. The genotypes are what the investigator brings with him/her to the scene, the pre-understanding of possible causes/reasons.

6.5.3 Phenotypes

The phenotypes are there to make it possible to categorise consequences of dysfunctional behaviour, i.e. what is observable at an accident scene. When you are categorizing such empirical material you have to deal with the fact that each accident is unique. There can never be two accidents which are completely identical, if for no other reason because they cannot take place at the same time and place.

However, it is self-evident that completely unique descriptions of accidents are pointless, because they do not provide any possibilities for comparisons. Therefore it is necessary to choose a set of, in some sense general, dimensions that hold for all situations and categorize the event according to these dimensions.

In SNACS, these dimensions have been chosen based on the fact that all accidents take place in time and space, and involve one or more masses in motion. Each accident is therefore limited to a certain time, space and energy continuum. Based on the dimensions of time, space and energy, it is therefore possible to classify the type of dysfunctional behaviour that precedes the accident with a relatively limited set of categories.

There are both general and specific phenotypes. There are eight different general phenotypes, and then each general phenotype has a subset of specific phenotypes which belong to the general phenotype. The difference between general and specific phenotypes is a degree of information. The specific phenotypes describe more delimited states than the general ones. If the investigator has sufficient information about the accident to choose a specific

phenotype then that is what s/he should do. If there is not enough information, the investigator has to stick with a general phenotype.

The general and specific phenotypes for SNACS are presented in the table below. A detailed description with definitions can be found in Appendix B.

General phenotype	Specific phenotype
Timing (A1)	Premature action (A1.1)
	Late action (A1.2)
	No action (A1.3)
Duration (A2)	Prolonged action/movement (A2.1)
	Shortened action/movement (A2.2)
Force/(power) (A3)	Insufficient force (A3.1)
	Surplus force (A3.2)
Distance (A4)	Prolonged distance (A4.1)
	Shortened distance (A4.2)
Speed (A5)	Surplus speed (A5.1)
	Insufficient speed (A5.2)
Direction (A6)	Incorrect direction (A6.1)
Object (A7)	Adjacent object (A7.1)
	Similar object (A7.2)
Sequence (A8)	Skipped action (A8.1)
	Repeated action (A8.2)
	Reversed action (A8.3)
	Extraneous action (A8.4)

Figure 5: Phenotypes (critical events) for SNACS

Some of the phenotypes are very closely related even though they are conceptually separated. Speed, Timing and Distance are for example closely related. This can cause certain problems. If for example a vehicle collides with an oncoming vehicle when overtaking, is this then a dysfunctional behaviour related to Speed (the overtaking vehicle was not fast enough to do the overtaking), Distance (the overtaking car did not have a long enough stretch of free road to do the overtaking) or Timing (the overtaking vehicle begun it manoeuvre too late or too early)? The answer to that question is that the investigator has to choose the phenotype that best describes the dysfunctional behaviour that precedes the accident, i.e. the phenotype that makes most sense given what the investigator knows about the accident.

For the example above, although all three phenotypes are logically possible, quite likely one of them is more appropriate given the circumstances around the event. Let's suppose that the overtake takes place at an uphill slope towards the crest, the speed limit is 110 km/h and the overtaker has a speed of 160

km/h. From this you can say that the speed is more than adequate (given the speed limits), but the stretch of road with an unblocked view of oncoming traffic is too short. The latter part would indicate that the distance available for the overtake is too short, making Distance a suitable genotype. However, a part of normal driver education is to teach the driver not to overtake unless there is a sufficient stretch of road with a free view, and hill crests are particularly inadequate for overtaking. Given this, the phenotype that best describes the situation would be Timing: premature action. The overtaking should have been performed later on at a more appropriate stretch of road.

In practice, this does not have to be a very complicated problem, since the linking table is constructed in such a way that phenotypes which are close also have quite similar linking from the genotypes. This means that the choice of phenotype does not have to be perfect, you can still get to the causes you need for the analysis.

6.5.4 Subjective judgement

As the above reasoning shows, the SNACS methodology clearly calls for the investigator to reason from a “normative” standpoint, i.e. the investigator has to have an opinion on what would be normal or reasonable behaviour for a driver-vehicle system in the situation at hand, because otherwise it will be difficult to classify what the deviation from the norm is. Also, the reasoning shows that the choice of phenotype will be partially based on the investigator’s judgement. In both these regards, a SNACS analysis will very clearly always be “subjective” in some sense of the word.

This can be considered both an advantage and a disadvantage. People who consider it a disadvantage will say that for a SNACS analysis we can never be sure that two investigators will perform the analysis in the same way, since subjective judgment is involved. This would be quite devastating for the methodology, were it not for the fact that all methodologies which analyse causes suffer from the same problem. As David Hume elegantly showed in his treatise on human reason, causes typically cannot be observed; they have to be inferred by reasoning. This means subjective judgement will always be involved when analysing causes, no matter whether you are investigating injury causation mechanisms in passive safety or accident contributing factors in active safety.

In light of this, we find it preferable to have a methodology which transparently shows that human judgement is involved, instead of burying that fact under protocols designed to look “objective”. As for the problem of different investigators performing different analysis, the best we can do is to clearly write down the reasons we have for making our choices and then discuss these reasons within the larger group of both your own accident investigation team and several different teams meeting for case review. As has been pointed out in the philosophy of science many times; over time a consensus within a larger group or community is as close to the truth as any methodology analysing causes will ever be.

6.5.5 Genotypes

Genotypes categorise the reasons for why a certain dysfunctional behaviour occurs. As have been stated above, these reasons or causes generally cannot be observed; instead they have to be deduced from knowledge that the investigator brings with him/her into the analysis, i.e. the investigator has a pre-understanding of which the possible factors behind accidents are.

The SNACS genotypes are sorted into different groups. On the top level, these groups correspond to the domain equivalents from the MTO-perspective (Man, Technology, Organisation) of the accident model that is described above. In SNACS, this terminology has been adjusted to the domain. Man is the road user and Technology is represented by the vehicle. Finally, the organisation part has been split into two subgroups; Infrastructure and Organisation.

The genotype groups contain factors that contribute to the actual event at the sharp end, as well as factors that have shaped the circumstances around the event, i.e. uncorrected blunt end failures which have resulted in negative latent conditions. The factors that concern the sharp end are mostly related to the road user and the vehicle, whereas the factors that concern the blunt end are related to different organisations or parties responsible for shaping the context of the event. These shapers of context are road designers, vehicle manufacturers, and organisations or persons responsible for maintaining roads/vehicles and educating the drivers to an expected standard. The main groups and their subgroups are shown in the table below:

Road user	Vehicle	Infrastructure	Organisation
Observation (B)	Temporary HMI problems in driver environment (G)	Communication driver ↔ environment (J)	Organisation (M)
Interpretation (C)	Permanent HMI problems in driver environment (H)	Maintenance - condition of road (K)	
Planning (D)	Equipment (I)	Design of traffic environment (N)	
Temporary person related functions (E)	Maintenance - condition of vehicle (K)		
Permanent person related functions (F)	Vehicle design (O)		
Communication driver ↔ driver (J)			
Experience/training (L)			

Figure 6: The main genotype groups for SNACS

There are both general and specific genotypes. The difference between the two types is a degree of information. The specific genotypes describe more delimited states than the general ones. If the investigator has sufficient

information about the accident to choose a specific genotype then that is what s/he should do. If there is not enough information, the investigator has to stick with a general genotype. A detailed description (definitions and explanations) of the general and specific genotypes can be found in Appendix B.

Road User

The Genotype group **Road User** is about how the driver thinks and functions. As can be seen in the table above, it has seven subgroups. The first three subgroups (Observation, Interpretation, Planning) are cognitive functions which are relatively domain independent, since the basic human cognitive functions work almost the same regardless of domain and situation.

The two groups of “Person Related Functions” concerns factors which directly affects driving performance. The temporary ones are of transient character (such as fatigue or stress), whereas the permanent ones categorize driver traits which persist over time, for instance night blindness or driving patterns established over a longer period of time. The “Communication” group deals with the conditions for successful communication. It has one section for the Road User group which deals with communications between drivers, and then there is another section under Infrastructure which deals with communication between the driver and the traffic environment (signs, lane markings, etc). The “Training/experience” group also has two sections. The one under Road User deals with situations where the driver is not experienced enough to deal with the situation at hand in a successful way. The one under Organisation deals with situations where a contributing reason for an accident is that a driver has not received proper training for the driving task (for example, the handling of commercial vehicles).

Vehicle

The group ”**Vehicle**” list contributing factors related specifically to how the vehicle HMI is designed, as well as to more general design factors and the functioning of the vehicle. The HMI-problems are all kinds of interaction problems that a driver can have with his vehicle, from malfunctioning displays to a hand bag blocking the gear shifter. The difference between temporary and permanent problems are that the former are easy to correct, while the latter are a part of the vehicle design, or in some other sense difficult to alter.

The subgroup of “Equipment failures” concerns all types of mechanical and electrical failures, as well as software errors. The latter may not be a common accident contributing factor today, but as more and more complex software dependent systems are introduced, this problem will most likely increase. The vehicle group also contains factors classified as different types of maintenance failures for the vehicle, as well as factors related to the design process, which can contribute to loss of control in different situations.

Infrastructure

The group ”**Infrastructure**” is about factors in the traffic environment which can have a negative impact on driver and vehicle. The ”Communication” group here concerns the conditions for communication between driver and traffic environment. “Infrastructure” also contains one part of the “Maintenance”

groups, dealing with all genotypes related to the conditions of the road. The "Design of traffic environment" group contains genotypes which address how the traffic environment has been designed.

Organisation

The group "**Organisation**" contains the genotypes which concern organisation related problems other than those shaping the immediate traffic environment. This involves factors such working hours for professional drivers, the state's responsibility to educate drivers in an appropriate way, etc.

6.5.6 Links and stop rules for procedure

The purpose of the SNACS analysis is to find a probable connection among the various factors that can explain the observed consequences or the event phenotype. In order to do this, SNACS contains a linking system, where some of the genotypes are linked to the phenotypes, and then again some genotypes are linked to other genotypes. This linking system results in analysis chains where a genotype can be both the consequent of a previous genotype, and the antecedent of another genotype, i.e. the cause of, or reason for, the occurrence of that genotype.

This thinking is not as complicated as it may sound. If factor A results in factor B, and factor B in turn results in factor C, then A can be said to be the indirect cause of C, and B can be said to be both a result of A and a cause of C. The genotypes of SNACS can therefore function both as links forwards and links backwards in a chain of reasoning, which makes it possible to deduce indirect causes (as A in relation to C in the example above).

The advantages of this are obvious. If there was only a set of direct causes the analysis would have an enormous width but no depth. Since the genotypes can act as links however, whole chains of interlinked causes and consequences can be deduced. You start with a phenotype (this being the end point of the chain of causes that you want to deduce), and then the analysis moves backwards from the event until you are either out of information about the accident, or factors that are meaningful to the analysis.

The links from genotypes to genotypes, as well as genotypes to phenotypes, are described in Appendix B. The linking is to be read from left to right, i.e. genotypes in the left hand columns are reasons for or causes of the genotypes/phenotypes in the right hand column(s). This is clearly indicated in the tables through the heading ANTECEDENTS over the columns to the left and CONSEQUENTS over the columns to the right.

The definitions for the phenotypes are in the phenotypes table. For technical reasons, the definitions of the genotypes are however a bit more distributed. The specific genotypes have their definitions and explanations under the ANTECEDENTS heading, whereas the general genotypes have their definitions under the CONSEQUENTS heading. In other words, if you want the definition of a specific genotype look under ANTECEDENTS; and if you want the definition

of a general genotype; locate it in the table where it appears under CONSEQUENTS.

Please note that the role of the linking system is to point out **possible** connections between different genotype groups. The links therefore are **possible** connections, not logically binding or inevitable connections. This means that you cannot use a link just because it is there in the appendix. **The use of a link must always be supported by the data available**.

Another important thing to notice is that the linking system is "closed". The linking is such that there must always be a general cause available for the general consequent that you wish to link backwards from. This is a construction axiom for the linking system. Every genotype which functions as a general cause in any of the groups must exist as a general consequent in some other group. Also, it can never be both cause and consequent is the same group. This would be an invitation to eternal loops, something which is clearly undesirable.

As for the extent of the linking system, not every factor can be linked to every other factor of course. That would create endless loops, and render the classification scheme useless as a tool to aid reasoning, since each and every path would be possible. Instead, the linking system should be kept large enough to allow for meaningful analysis, while at the same time not being too large to prevent a reasonably uniform analysis between different investigators. Needless to say, this balance needs to be reassessed from time to time, and evaluated in relation to the goals of the project using the analysis. This means that we from time to time have to ask ourselves whether the current structure of the method helps us reach the goal of defining accident causes in such a way that is makes accident prevention easier, or if it needs modifications (in categories or linking).

Stop rules

The categorisation scheme of SNACS is non-hierarchical. No genotypes have precedence over others, and there are no highest or lowest levels where an analysis must end. Therefore, to avoid random stops for the analysis it is necessary to have stop rules. For SNACS, the stop rules are the following:

1. *Specific genotypes have the status of terminal events. Therefore, if a specific genotype is the most likely cause of a general consequent, that genotype is chosen and the analysis stops*
2. *General genotypes have the status of non-terminal events. If a general genotype is the most likely cause of a general consequent, that cause is chosen and the analysis must continue.*
3. *If there exists no general or specific genotypes that link to the chosen consequent, the analysis stops.*
4. *If none of the available genotypes for the chosen consequent is relevant, given the information available about the accident, the analysis stops.*

This brief description of the method should hopefully become clearer below, where a walk-through example is provided to show how an example accident is analysed.

6.5.7 Extension of the genotypes

An important point for an accident model is that it should be flexible enough to allow for the continuous development and changes in modern road traffic to be incorporated. This means that an accident analysis method based on the accident model must be possible to revise iteratively in a controlled fashion.

For SNACS, it is obvious that Appendix B does not cover all possible genotypes. It does for example not include grand pianos dropping out of the blue as a genotype, even though there may have been traffic accidents due to this genotype. Instead, the selection is based on previous research in the field of traffic safety, as well as the field of industrial safety. The selection is necessary to make, since a complete list would be endless, as well as impossible to use. The selection does not pose a threat either, as long as there are well defined rules for how to make alterations and/or extensions of the genotypes if new knowledge needs to be incorporated.

To add or remove genotypes, as well as changing the linking, is possible in SNACS. There is however certain conditions that must be respected when doing this. Because the linking system in a sense is “closed” two rules must be fulfilled when making alterations. First of all, each general consequent must be found as a general antecedent in at least one more group of genotypes (i.e. one or more of the tables in Appendix B). Secondly, a genotype can never be an antecedent in the same group/table as it is a consequent in. This is trivial, since it would lead to endless loops, but nonetheless it must be stated (this is also discussed above, see 5.5)

If you follow these two rules, it is possible to modify SNACS according to new needs or new knowledge. It is however very important that the linking in Appendix B is kept consistent according to the rules above, and any modifications will need their definitions and explanations. It is therefore recommended that only persons well experienced in the methodology make such alterations.

6.6 Example accident – detailed walkthrough

Below, a simplified example is given to show what the result of an analysis may look like. The example accident is simple, to make the analysis procedure easy to follow.

Kalle collides with another vehicle at an intersection when he is going grocery shopping. It is a signalised 4-way intersection close to the city center. Kalle wants to continue straight ahead, and drives into the intersection although he has a red light. Another car, which has a green light and is coming from Kalle's left, strikes Kalle in his left side.

The accident investigation team arrives shortly. Through an interview on-scene they find out that just prior to Kalle's reaching the intersection his cell phone rang, and he picked it up to see who was calling. Kalle also tells the investigators that he was driving 50 km/h, and that he was feeling well and was in no hurry. He claims that he saw the intersection long before reaching it and saw that the traffic light was green, but he never noticed that it turned red. Kalle also said that he was quite tired, because the previous night he had not slept very well.

6.6.1 Evaluation of the Common Performance Conditions

First, we make an evaluation of the Common Performance Conditions for the accident event using the CPC-template from Appendix A. Below, a small part of the CPC table is shown:

Common Performance Conditions - Dimensions, parameters and evaluation levels

CPC	Parameters	Explanations	Comments	Evaluation level / influence on driving performance	Source of info (inspection of car, interview with driver, etc)	Quality of info very reliable (+) reliable (0) less reliable (0) not reliable (-)
Design of traffic environment	**Type of traffic environment**	What kind of traffic environment was it? Within or outside urban area? Main road or highway?	Within urban area	Country road (0) **City traffic (-)**	inspection on scene	very reliable (+)
	Important factors	Any important factors which significantly makes it easier to drive or are there any risk factors? (road construction work, hidden exits, unusually tight curve radius, holes in the road, ect?)	Nothing particular	Several supportive factors (+) **No obvious risk factors (0)** Some risk factors (0) Many risk factors (-)	inspection on scene	very reliable (+)
	Complexity	How complex is the traffic environment? Crossing roadways (crossing, circulations, exits, etc)= complex Several lanes in any/both directions = moderately complex One lane = not complex	Intersection	Not complex (+) Moderately complex (0) **Very complex (-)**	inspection on scene	very reliable (+)
	Information	Is the signing clear/easy to understand? Are the road markings clear? Is information provided early enough for the driver to have time to react? Is crucial information missing which is needed to pass the spot safely?	Functioning traffic ligtht, adequately placed	**Supportive (+)** Adequate (0) Tolerable (0) Inappropriate (-)	inspection on scene	very reliable (+)

Figure 7: Part of CPC evaluation for Kalle's accident

6.6.2 Analysis of phenotypes and genotypes

After the CPC-template has been filled in, it is time to do the cause and consequent analysis for the accident. As support for this analysis, we use the linking template that can be found in Appendix C, and fill it in using the links in appendix B and the information that we have about the accident.

For this particular accident, both vehicles can be SNACS-analysed, but we will only do the analysis of Kalle's vehicle in this analysis. Starting with the phenotype, we recall that the phenotype is there to classify what is dysfunctional in the basic dimensions of time, space and energy. The following are available (for definitions of the phenotypes, see Appendix B:

General Phenotypes	Specific Phenotypes
Timing (A1)	Premature action (A1.1)
	Late action (A1.2)
	No action (A1.3)
Duration (A2)	Prolonged action/movement (A2.1)
	Shortened action/movement (A2.2)
Force/(power) (A3)	Insufficient force (A3.1)
	Surplus force (A3.2)
Distance (A4)	Prolonged distance (A4.1)
	Shortened distance (A4.2)
Speed (A5)	Surplus speed (A5.1)
	Insufficient speed (A5.2)
Direction (A6)	Incorrect direction (A6.1)
Object (A7)	Adjacent object (A7.1)
	Similar object (A7.2)
Sequence (A8)	Skipped action (A8.1)
	Repeated action (A8.2)
	Reversed action (A8.3)
	Extraneous action (A8.4)

Figure 8: Phenotypes in SNACS

For this accident, we know that the vehicle continues into the intersection at a point in time where the functional behaviour would have been to stop for the red light. Therefore we put down "Timing: No action" as the phenotype.

As you realize, this way of reasoning is a bit on the normative side, because it involves taking a stand on what is the normal or functional thing to do in certain situations. This is however unavoidable, because if we do not do it we would have no way of defining what is dysfunctional (and do we not always measure performance against some normative standard?) The best to make of the situation is to be very clear in the explanation for the choice of phenotype.

In this case, another plausible phenotype would have been "Distance: prolonged distance", since the vehicle enters an area it would have been wise to stop short of. Had the intersection been unsignalled, this would probably have been a better phenotype, because then the dysfunctional behaviour would have involved a failure to exercise the normal caution expected when entering

an intersection. In Kalle's accident however, as he has already seen the intersection and "knows" that it is green, he also knows that he has the right of way and that there is no reason not to drive into the intersection. Timing therefore is a better explanation of the physics of the situation.

Next, we look at Appendix B and locate "Timing: No action" among the phenotypes, to see which the possible genotypes that are linked to this phenotype are. The table looks like this:

PHENOTYPES (A)			
ANTECEDENTS (REASONS/CAUSES)	**CONSEQUENTS (RESULTS/EFFECTS)**		
GENERAL Genotypes	**GENERAL Phenotypes (Critical events) with definitions**	**SPECIFIC Phenotypes (with definitions)**	**Examples for SPECIFIC Phenotypes**
Observation missed (B1) Faulty diagnosis (C1) Decision error (C3) Inadequate plan (D1) Inattention (E6) Communication failure - between drivers (J1) Communication failure - between driver and environment (J2)	**Timing (A1)** The regulation of time for actions to occur.	**Premature action (A1.1)** An action started too early, before a signal was given or the required conditions had been established.	Performing an overtake before there is good visibility. Starting/stopping too early at traffic lights. Dip the lights too early when driving in the dark.
		Late action (A1.2) An action started too late.	Not changing lanes in time.
		No action (A1.3) An action that was not done at all (within the time interval allowed).	Starting an overtake too late. Dip the lights too late when driving in the dark.

Figure 9: Extract of the phenotype row Timing (A1) from the PHENOTYPES table in appendix B

To the right in the table is the resulting phenotype (the consequent), and to the left are the possible genotypes (causes/reasons) that can generate the phenotype. In other words; if we can establish that any of the genotypes on the left has taken place, then it is legitimate to infer from this information that the phenotype Timing (A1) can take place. In the case with Kalle, we know from the interview that he never saw the traffic light turn red. From this information, we feel confident saying that the genotype "Observation missed (B1)" has contributed to the phenotype "Timing: No action" (A1.3). This gives us the start for a chain of analysis, looking like this:

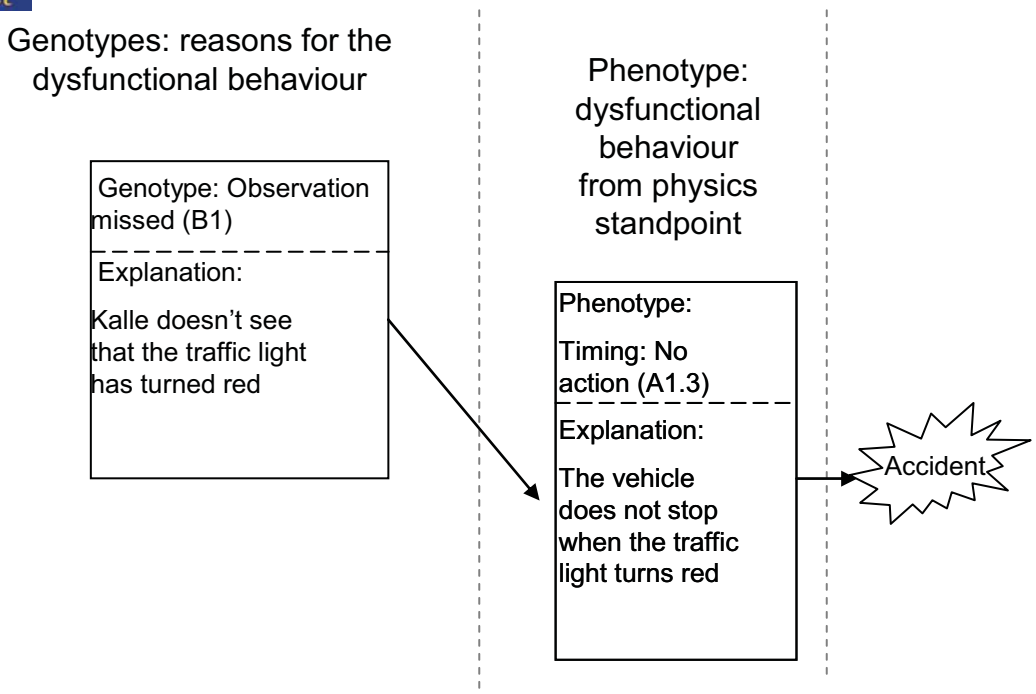


Figure 10: Beginning of SNACS analysis for Kalle

Now, the next step for us is to consider the reasons for, or causes of, Kalle's "Observation missed (B1)". From the interview as well as from our on-scene inspection, (documented facts in the CPC-table) we know that Kalle had a free line of sight. There were no obstacles (either permanent, such as signs or trees, or moving, such as other cars) that prevented Kalle from seeing the traffic light, and the traffic light itself was working fine according to the police on-scene. This means that we can discard factors relating to the maintenance of the traffic environment, line of sight problems, etc.

In fact, after we have gone through all the things we know about the accident, the only reasons left for Kalle's running the red light are that he had his attention on his phone, and that he had not slept well last night. These contributing factors are then what we believe caused his missed observation of the traffic light, and therefore we need to put them into the analysis. To do this, we locate the horizontal table row in Appendix B where "Observation missed (B1)" is located as under the heading CONSEQUENTS. As the letter in brackets after the genotype indicates, this will be in table B, called OBSERVATION. That table row looks like this:

OBSERVATION (B)			
ANTECEDENTS (reasons/causes)			CONSEQENTS (results/effects)
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Example**	**GENERAL Genotypes (with definitions)**
Faulty diagnosis (C1) Inadequate plan (D1) Distraction (E3) Fatigue (E4) Inattention (E6) Functional impairment (F1) Temporary sight obstruction (G3) Permanent sight obstruction (H5) Equipment failure (I1) Permanent obstruction to view (N2)	**Glare (B1.1)** Being faced with bright lights which makes it difficult to see.	Low sun shining right at the vehicle/person.	**Observation missed (B1)** A signal or an event that should have been the start of an action (sequence) is missed.
	Noise (B1.2) Being surrounded by loud noise which prevents perception of other acoustic signals	High volume on the stereo keeps one from hearing other road users honk the horn.	
	Tunnel vision (B1.3) Being limited in the peripheral vision.	When experiencing fear or high speed, the peripheral vision diminishes from 180 degrees to as much as 20-30 degrees.	
	Other (B1.4)		
	Other (B2.1)		**False observation (B2)** An event or some information is incorrectly recognised or mistaken for something else.
Distraction (E3) Functional impairment (F1) Incorrect information (G2) Mislabeling (H4) Communication failure - between driver and environment (J2)	**Habit/expectation (B3.1)** Being used to a certain environment makes it difficult to discover changes.	Signs which have been changed is not observed. A sign indicating that what has been a primary road for ten years, is hard to notice for people who have been driving on that road for many years.	**Wrong identification(B3)** The identification of an event or some information is incorrect.
	Other (B3.2)		

Figure 11: The genotype table for OBSERVATION

Looking at the table, we see that “Observation missed” (B1) is located to the far right, listed under the heading of CONSEQUENTS (results/effects). This means that in this table, “Observation missed” is the result of something else, and the possible reasons or causes for this state to occur are shown in the leftmost columns under the heading of ANTECEDENTS. To the far left are the possible general genotypes which can lead to “Observation missed (B1)”. The two middle columns define and exemplify the specific genotypes (specific reasons/causes) that can lead to the consequent “Observation missed” (B1).

As you remember from the description of the stop rules for the analysis above, the first stop rule is:

1. *Specific genotypes have the status of terminal events. Therefore, if a specific genotype is the most likely cause of a general consequent, that genotype is chosen and the analysis stops.*

What this stop rule means is that we should first look at the specific genotypes available for the consequent that we want to explain. In this case there are four possibilities; “Glare”, “Noise”, “Tunnel vision” and “Other”. As you also remember from above, the difference between the specific and general genotypes was a question of information. If we have enough information to choose one of the specific genotypes we should do so, otherwise we continue with the general ones.

In the case of Kalle, none of the specific genotypes apply to what we believe were the reasons for the accident (focus on phone and lack of sleep). Therefore we look at the general genotypes available (for the definitions of the general

genotypes, look them up in the tables where they appear as consequents). Here (in the leftmost column) we find two genotypes which are applicable. The first is “Distraction” (E3), since this encompasses things such as being occupied by a phone. The other is “Fatigue” (E4), which applies to Kalle's lack of sleep. Having two applicable genotypes means that the analysis chain now will split into two separate chains, looking like this:

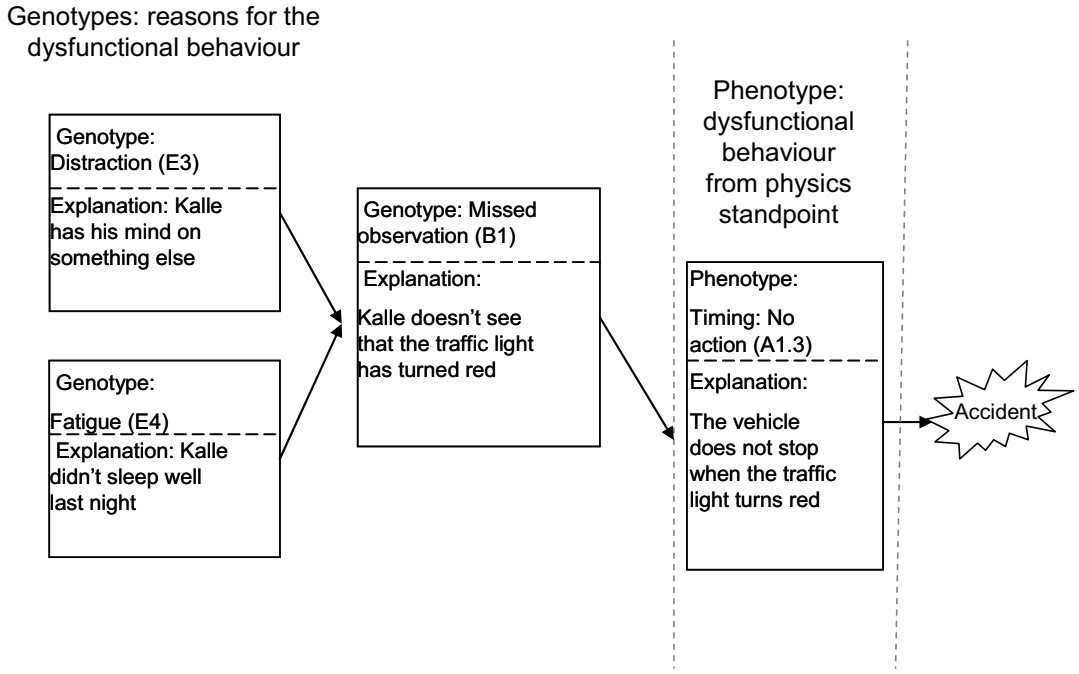


Figure 12: The analysis of Kalle's accident expands

Before we move on, please remember once again that the genotypes and links are there to make it possible to systematically describe what we know about the accident, not to tell us why the accident happened. The SNACS methodology provides a way to sort out the reasons for the accident. It is an organiser of explanations, not a provider.

Moving on in the analysis of the distraction part of the chains, we locate the factor “Distraction (E3)” in the table where it appears as a consequent. As the letter in the brackets indicates, this is in table E, “Temporary person related factors”. Below the row for “Distraction” (E3) is shown (extracted from the rest of table (E)):

TEMPORARY PERSON RELATED FUNCTIONS (E)			
ANTECEDENTS (REASONS/CAUSES)			CONSEQUENTS (RESULTS/EFFECTS)
GENERAL Genotypes	SPECIFIC Genotypes (with definitions)	Examples for SPECIFIC Genotypes	GENERAL Genotypes (with definitions)
Equipment failure (I1)	**Passengers (E3.1)** Another person in the vehicle diverts the driver's attention.	Conversations with co-passengers, children fighting etc.	**Distraction (E3)** The performance of a task is suspended because the person's attention was caught by something else or the attention has shifted.
	External competing activity (E3.2) An object or a sequence of events outside the vehicle diverts the driver's attention.	An animal appearing by the side of the road.	
	Internal competing activity (E3.3) An object or a sequence of events inside the vehicle diverts the driver's attention.	The mobile phone ringing, the navigation system alerting or the road user is thinking of something in particular.	
	Other (E3.4)		

Figure 13: Extract of the row that has Distraction (E3) as a CONSEQUENT from the table TEMPORARY PERSON RELATED FACTORS (E)

When looking at the possible ANTECEDENTS, we first look at the specific genotypes. As you can see in this table, among the specific genotypes there is one that fits Kalle's case very well, and that is "Internal competing activity" (E3.3). That specific genotype describes quite well the fact that Kalle's attention is diverted from the driving task by the incoming phone call, and therefore we choose that one as the reason for "Distraction" (E3). Now, as the first stop rule said, specific genotypes have the status of terminal events. This means that this part of the causal chain stops here, since we have found a specific genotype which explains part of the accident event.

We are not yet finished however, because we still have not accounted for Kalle's lack of sleep as a contributing factor. To do this, we locate the table where "Fatigue" (E4) is located as a consequent (which will be in table E, as the E shows), and take a look at the antecedents available for "Fatigue" (E4). The table row looks like this:

TEMPORARY PERSON RELATED FACTORS (E)			
ANTECEDENTS (REASONS/CAUSES)			CONSEQUENTS (RESULTS/EFFECTS)
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Examples for SPECIFIC Genotypes**	**GENERAL Genotypes (with definitions)**
Overload / Too high demands (M2) Management failure (M3)	**Circadian rhythm (E4.1)** Driving at a time which is normally not within the "waking hours" and that results in reduced output capacity.	Driving at night to avoid heavy traffic.	**Fatigue (E4)** Being mentally or physically tired/exhausted.
	Extensive driving spell (E4.2) Not taking breaks or pausing when driving long distances, and that leads to diminished driving ability.	Truck drivers changing trucks with each other and driving more than the allowed period of time during 24 h.	
	Other (E4.3)		

Figure 14: Extract of the row that has Fatigue (E4) as general consequent from the table TEMPORARY PERSON RELATED FACTORS (E)

As before, we first look at the specific genotypes. None of these seem applicable however, because Kalle was driving at daytime within his normal circadian rhythm, and he had not been driving for very long when the accident happened. Looking at what the stop rules say about this, we first find stop rule nr 2 which says:

> 2 *General genotypes have the status of non-terminal events. If a general genotype is the most likely cause of a general consequent, that cause is chosen and the analysis must continue.*

This means that we have to look at the general genotypes in the ANTECEDENT part of the table (for definitions of the general genotypes, look them up in the tables where they appear as CONSEQUENTS). When we do that, we see that from what we know, none of them seem applicable to Kalle either. From the interview we know that Kalle says that he was not under any pressure; in fact he was feeling calm and relaxed. At this stage, we have to go back to the stop rules to see what to do in this situation where none of the available genotypes are applicable to the accident description. First off, stop rule nr 3 says:

> 3 *If there exists no general or specific genotypes that link to the chosen consequent, the analysis stops.*

This is not the case here however, because there are both general and specific genotypes which link to the chosen consequent. Instead we have rule nr 4, which says:

4 *If none of the available genotypes for the chosen consequent is relevant, given the information available about the accident, the analysis stops.*

This rule applies to our case, because none of the genotypes available are relevant for the description of Kalle's accident. This means that we settle for the general genotype "Fatigue" (E3) as the end point of the analysis describing that Kalle was rather tired.

Now that we have systematically described all the reasons that we know about which have contributed to the accident, we put it all together into a single SNACS description looking like this:

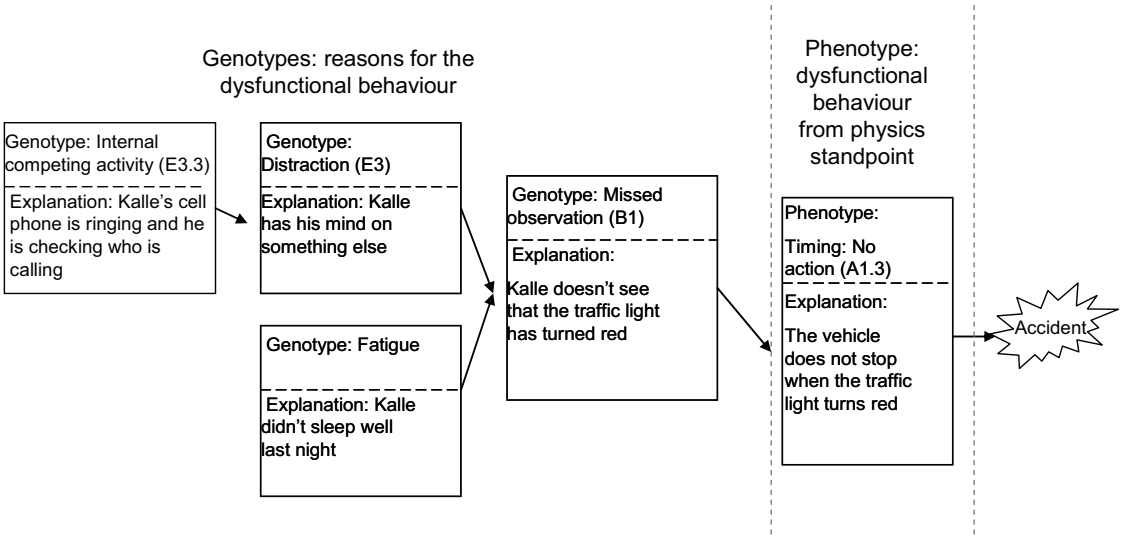


Figure 15: Final SNACS analysis of Kalle's accident

Because the choice of phenotypes and genotypes always will include an element of subjective judgement, it is very important that the motivation for choosing a certain genotype or phenotype is made transparent. You should **always** write a couple of lines explaining why you choose a particular phenotype/genotype, so that anyone else who reads the analysis can follow your thinking and start an informed discussion if there is disagreement.

6.6.3 Multiple chains of analysis

What we do with the genotype linking is to systematically describe all the chains of events that led to the phenotype, and each chain is a series of linked genotypes with a phenotype in the far end. This means that in the analysis above, **there are really two separate chains of contributing factors**, which look like this:

1) Internal competing activity → Distraction → Observation missed → Timing: No action

2) Fatigue → Observation missed → Timing: No action

Due to the way the linking system is constructed, the analysis chains constructed in it can partially share the same intermediate links. In this case, both chains have “Observation missed” as an intermediate link. This means that when you input your analysis into the database, you need to register each chain separately, even though they share intermediate links.

The reason for this construction of the system is that is helps to show not only which factors contributed, but **how** these contributions came about. When we register each link separately in the database, what will show in a final analysis of a number of accidents are not only the common contributing factors, but also the frequency of the intermediate factors.

This is important because such descriptions are helpful in the development of countermeasures. This can be illustrated in the following way. The separate registration of each link amounts to what could be called a super-positioning or layering of the SNACS analyses. If we from the database take out the analysis chains that have been registered for a particular accident type, the frequency count of overlapping chains will show the most common chains of contribution. As an example in the figure below, the analysis for the driver of the straight going vehicle in seven intersection accidents have been superimposed:

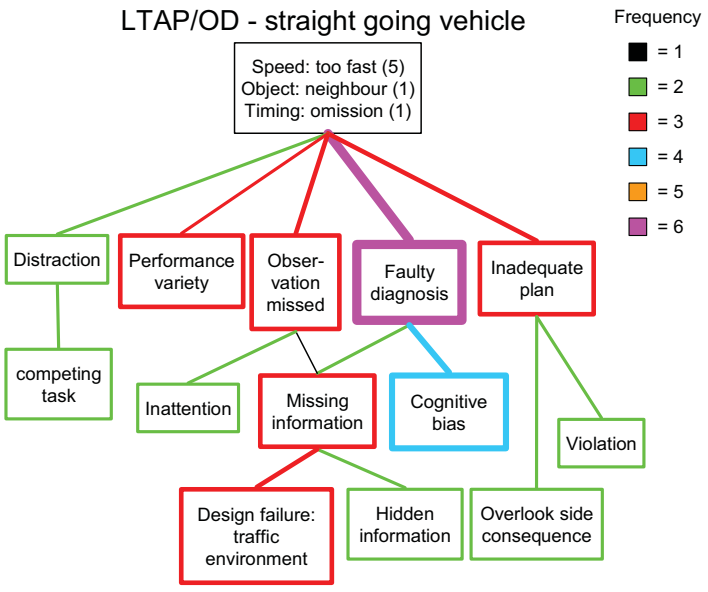


Figure 16: Analysis for seven drivers in intersection accidents superimposed

For the countermeasure developer, an aggregated analysis like the one above means that s/he can direct his/her efforts toward the link in the chain that is the weakest from his/her point of view, depending on technical and/or economical

resources. In this example, we see that countermeasures could be directed at several of the “end” factors, such as the design of the traffic environment and distraction due to competing tasks. We also see that if we could introduce for example a vehicle-to-vehicle communication system which in some way would make the driver sufficiently aware of the other vehicle’s intentions, then we would be able to break several chains at the very common intermediate link “Faulty diagnosis”. Which of these countermeasures are best or most economical are of course not up to the investigator to decide. What is important is that we provide this analysis possibility to the countermeasure developers.

6.7 The analysis Step by Step

In appendix A you will find detailed information on the Common Performance Conditions in a table that can be copied and filled in for the actual analysis. In Appendix B you will find the definitions of the phenotypes and genotypes, including examples. In appendix B you will also find the linking between the phenotypes and genotypes. A linking template to write the down the SNACS analysis on can be found in Appendix C.

- Appendix A: CPC-definitions and template
- Appendix B: Explanations of *phenotypes* (*critical events*) and *genotypes (*reasons/causes) , as well as the links between them.
- Appendix C: Linking template

For the analysis you will need copies of appendices A and C to write on, as well as a copy of appendix B to read from. Below is given a detailed formal description of how to carry out the SNACS analysis. The manual is written in a step-by-step fashion. Start with step one, when that is finished move on to step two, and so forth.

6.7.1 Accident description

Describe the accident in as much detail as possible in a written report. Try not to jump to conclusions in this report; make the description of the event as neutral as possible, in order not to forego the analysis. If you are not writing the accident report yourself, read what the others have written carefully and thoroughly. As always, **never** start an analysis before you have been through the whole material, because then you will inevitably start to search the description for facts to support your current theory rather then looking at the whole picture in as neutral a fashion as possible.

When reading the accident description, remember also that we are **not interested in who is to blame for the accident**. For a SNACS analysis, it is completely irrelevant who the police or insurance company will hold responsible. We are equally interested in all vehicles involved, regardless of what the police say about any of the parties being guilty or innocent. We are also equally interested in all vehicles regardless of whether we believe they could have done something about the situation or not. Our task is not to analyse what the possibilities of future safety systems are, it is to describe the problem at hand as neutrally as possible. If my vehicle is in the way of an approaching vehicle, then that is a problem that needs to be described so that it can be

considered for countermeasures in the future, regardless of whether I feel that I could have done something about it or not.

6.7.2 Evaluation of the Common performance conditions

Make a copy of the CPC-template (Appendix A) and evaluate the context by assigning values to the parameters in it for the accident you are investigating.

The CPC-template has four columns that need to be filled in. In the column "Evaluation level / Influence on driving performance" you circle or highlight the level that you believe is most appropriate for each row/dimension. In the "Comments" column you fill in short explanatory comments that will give another reader, or yourself at a later time, the background to why you choose each level. If there is not enough space in the box, you can always expand the box or write on the back of the paper.

Several of the CPC dimensions have different names on their evaluation levels, in order to reflect the dimension that the CPC is meant to evaluate. The evaluation scale is however the same. It has three main levels:

'+' – The circumstances for the CPC dimension are optimal or as good as they can possibly be. They support the driver in performing controlled and safe driving. This means that genotypes which relate to this CPC dimension are **less** likely as contributing factors for the accident at hand.

'0' – The circumstances for the CPC dimension are not optimal, but they are not poor or bad either. This means that the conditions most likely have neither positive nor negative influence on the conditions for driving. However, sometimes the conditions are not really bad, but still on the verge of being inadequate. Therefore this middle level is split in two evaluation steps (Adequate/Good and Tolerable). This allows the investigator to mark a level (the Tolerable level) where the circumstances are not downright poor, but still not really up to normal standard.

'-' – The circumstances for the CPC dimension are poor. They have a negative influence on the driver's possibility to perform controlled and safe driving. This means that genotypes which relate to this CPC dimension are **more** likely as contributing factors for the accident at hand.

In the two rightmost columns, you write down where you got the information that the evaluation is based on, and make an estimate as to how reliable that information is. This is important in the later analysis. If you want to anchor any of the genotypes in the context description, it is good to know how sure we are that the context evaluation is correct.

If it is impossible to evaluate a parameter because there is no information available, then you write "Information missing" in the comments column, and do not make any marking in the evaluation level column. An example of this is shown below:

Common Performance Conditions - Dimensions, parameters and evaluation levels

CPC	Parameters	Explanations	Comments	Evaluation level / influence on driving performance	Source of info (inspection of car, interview with driver, etc)	Quality of info very reliable (+) reliable (0) less reliable (0) not reliable (-)
Design of traffic environment	**Type of traffic environment**	What kind of traffic environment was it? Within or outside urban area? Main road or highway?	Within urban area	Country road (0) **City traffic (-)**	inspection on scene	very reliable (+)
	Important factors	Any important factors which significantly makes it easier to drive or are there any risk factors? (road construction work, hidden exits, unusually tight curve radius, holes in the road, ect?)	No information	Several supportive factors (+) No obvious risk factors (0) Some risk factors (0) Many risk factors (-)		
	Complexity	How complex is the traffic environment? Crossing roadways (crossing, circulations, exits, etc)= complex Several lanes in any/both directions = moderately complex One lane = not complex	Intersection	Not complex (+) Moderately complex (0) **Very complex (-)**	inspection on scene	very reliable (+)
	Information	Is the signing clear/easy to understand? Are the road markings clear? Is information provided early enough for the driver to have time to react? Is crucial information missing which is needed to pass the spot safely?	Functioning traffic ligtht, adequately placed	**Supportive (+)** Adequate (0) Tolerable (0) Inappropriate (-)	inspection on scene	very reliable (+)

Figure 17: Example of partial CPC evaluation

6.7.3 Choice of Phenotype

After you have evaluated the CPC it is time to start the SNACS analysis. **NOTE: The task is to do one analysis per vehicle involved.** The circumstances can be evaluated as a whole (except for the driver specific dimensions of course), but the contributing factors need to be evaluated for each vehicle in turn.

To do this, take out appendix B, and locate the first table of the appendix, which is named PHENOTYPES. This table contains all the available phenotypes and the possible sets of genotypes that can link to each phenotype. An extract from the table for the phenotype TIMING (A1) looks like this:

PHENOTYPES (A)			
ANTECEDENTS (REASONS/CAUSES)	**CONSEQUENTS (RESULTS/EFFECTS)**		
GENERAL Genotypes	**GENERAL Phenotypes (critical events) with definitions**	**SPECIFIC Phenotypes (critical events) with definitions**	**Examples for SPECIFIC Phenotypes**
Observation missed (B1) Faulty diagnosis (C1) Decision error (C3) Inadequate plan (D1) Inattention (E6) Communication failure - between drivers (J1) Communication failure - between driver and environment (J2)	**Timing (A1)** The regulation of time for actions to occur.	**Premature action (A1.1)** An action started too early, before a signal was given or the required conditions had been established.	Performing an overtake before there is good visibility. Starting/stopping to early at traffic lights. Dip the lights too early when driving in the dark.
		Late action (A1.2) An action started too late.	Not changing lanes in time.
		No action (A1.3) An action that was not done at all (within the time interval allowed).	Starting an overtake too late. Dip the lights too late when driving in the dark.

Figure 18: Extract of the row for Timing (A1) from the PHENOTYPES table in appendix B

To the left, under the heading of ANTECEDENTS is a list of all the genotypes which are linked to the phenotype, i.e. all genotypes that are possible reasons or causes as to why the phenotype happens. To the right, under the heading of CONSEQUENTS are the names of the general phenotypes and their definitions. In the third column, specific phenotypes (particular and well defined subcases of the general phenotype) are listed and described, along with examples from driving in the fourth column.

Start out with identifying what the dysfunctional state just prior to the accident is, and choose the phenotype which best describes that state. As is described in the example walkthrough above, what we aim for is an identification of what is physically the problem in the situation, or if that is difficult, an identification of a deviation from what would have been adequate behaviour in the particular situation (such as running a red light instead of stopping).

You can choose only one phenotype per vehicle involved. If you have two candidate phenotypes and feel that it is impossible to choose between them, then you carry out an analysis for each phenotype. When both are finished, you keep the analysis that best reflects what you know about the accident as a whole.

The choice between general and specific phenotypes is a question of information. If enough is known to choose one of the specific phenotypes then do that, otherwise stick with the general phenotype.

When you have chosen your phenotype, you make a copy of the linking template (Appendix C) and write down your phenotype of choice in the box which says phenotype.

6.7.4 The linking from different genotypes to the phenotype

Now it is time to start linking the contributing factors or genotypes to the phenotype that has been chosen. To do the linking you need the linking tables that are part of Appendix B.

Now remember from the example of Kalle above that what you want to do with the linking system is to systematically describe how all the known contributing factors brought the phenotype, and hence the accident, about. For example, if you know that windshield glare, a screaming child in the vehicle and the design of the traffic environment were all contributing factors, you need to do a separate linking analysis for each of these factors. Due to the construction of the linking system, on paper some of the chains may share intermediate links. Mentally however, you need to keep the chains separate and register each chain separately into the database.

When you do your first linking to the phenotype, you stay with the table called PHENOTYPES which you used for phenotype selection (example above). In its leftmost column are all possible genotypes for the phenotypes listed. Find the row where the phenotype you choose is listed, and look through the list of genotypes that are written on the same row.

Of the available genotypes you choose the ones that fit in with the accident description. Keep your CPC evaluation and accident data at hand, so you easily can check circumstances or facts you are unsure of. When you have decided on one or more genotypes, you write these down in the genotype boxes closest to the phenotype box on your copy of the linking template.

6.7.5 The linking from genotype to genotype

This step is repeated for each of the genotypes chosen until the analysis is complete, i.e. one of the four stop rule criteria is fulfilled.

Start with a genotype in the linking template which has no filled in links to the left, and which is not marked as an end point. Locate its linking table (this is the table where the genotype is found as a general consequent) in Appendix B by looking at the letter next to the genotype, and locating the table which has the same letter in its heading. In this table, find the row where that genotype is listed as a general consequent in the rightmost column. In the example below, we have located the table for the genotype “Observation missed (B1)” which is called “Observation (B)”.

OBSERVATION (B)			
ANTECEDENTS (reasons/causes)			CONSEQENTS (results/effects)
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Example**	**GENERAL Genotypes (with definitions)**
Faulty diagnosis (C1) Inadequate plan (D1) Distraction (E3) Fatigue (E4) Inattention (E6) Functional impairment (F1) Temporary sight obstruction (G3) Permanent sight obstruction (H5) Equipment failure (I1) Permanent obstruction to view (N2)	**Glare (B1.1)** Being faced with bright lights which makes it difficult to see.	Low sun shining right at the vehicle/person.	**Observation missed (B1)** A signal or an event that should have been the start of an action (sequence) is missed.
	Noise (B1.2) Being surrounded by loud noise which prevents perception of other acoustic signals	High volume on the stereo keeps one from hearing other road users honk the horn.	
	Tunnel vision (B1.3) Being limited in the peripheral vision.	When experiencing fear or high speed, the peripheral vision diminishes from 180 degrees to as much as 20-30 degrees.	
	Other (B1.4)		
	Other (B2.1)		**False observation (B2)** An event or some information is incorrectly recognised or mistaken for something else.
Distraction (E3) Functional impairment (F1) Incorrect information (G2) Mislabeling (H4) Communication failure - between driver and environment (J2)	**Habit/expectation (B3.1)** Being used to a certain environment makes it difficult to discover changes.	Signs which have been changed is not observed. A sign indicating that what has been a primary road for ten years, is hard to notice for people who have been driving on that road for many years.	**Wrong identification(B3)** The identification of an event or some information is incorrect.
	Other (B3.2)		

Figure 19: Linking table for category OBSERVATION (B)

Looking at the table, we see that “Observation missed” (B1) is located to the far right, listed under the heading of “general consequent” (reason/cause). This means that in this table “Observation missed” is the result of something else, and the possible reasons or causes for “Observation missed” to occur are what is shown in the two leftmost columns. To the far left is a list of the possible general genotypes that can be the causes of, or reasons for, “Observation missed” (B1). The two middle columns define and exemplify the specific genotypes that can lead to the consequent “Observation missed” (B1).

Looking for a specific cause

As you may remember from the description of the stop rules for the analysis above, the first stop rule is:

1. *Specific genotypes have the status of terminal events. Therefore, if a specific genotype is the most likely cause of a general consequent, that genotype is chosen and the analysis stops*

What this stop rule means is that we should always first look at the specific causes/genotypes available for the consequent that we want to explain. In this example there are four specific possibilities; “Glare”, “Noise”, “Tunnel vision” and “Other”. If one of these fit in with your accident description, you choose that one and write it down in the linking template, to the left of the genotype it links to (”Observation missed” in this example).

Choosing a specific genotype means that that particular analysis chain is finished, due to the stop rules. This means that you have reached the end point for that chain, and can move on to another unfinished chain. To remember this, make some kind of marking which indicates that you've reached an end point in the linking template you are working with.

Looking for a general cause

If none of the specific causes available fits with the accident description, then we move on to the general genotypes. These are listed in the far left cell on the table row of the general consequent that you previously located. Here you look at the available genotypes, and you choose one or more that fits with the accident description and your evaluation of the circumstances.

If you find one or more general genotypes that fit with the accident description, you write these down on you linking template to the left of the general consequent that they link to (in this example "Observation missed"). Having found one or more general consequents means that the second of the stop rules apply:

> 2. *General genotypes have the status of non-terminal events. If a general genotype is the most likely cause of a general consequent, that cause is chosen and the analysis must continue.*

This means that you repeat step two for each of the chosen genotypes, until either stop rule 1, 3 or 4 is fulfilled. If you on the other hand do not find a general phenotype that fits with the accident description, then this can be due to two possibilities: a) either there are no genotypes specified as general or specific causes for the general consequent you have chosen, or b) none of the available genotypes fits with the accident description. This possibility a) falls under stop rule 3:

> 3. *If there exists no general or specific genotypes that links to the chosen consequent, the analysis stops.*

Possibility b) falls under stop rule 4:

> 4. *If none of the available genotypes for the chosen consequent is relevant, given the information available about the accident, the analysis stops.*

Should stop rule 3 or 4 be fulfilled, then you have reached the end point for that analysis chain, and you move on to other unfinished chains of analysis. When any stop rules 1, 3 or 4 have been fulfilled for all chains of analysis, the analysis is finished or complete. This does not necessarily mean that we have succeeded in systematically explaining completely why the accident happened; it just means that we have categorised and sorted out everything we know about the accident in as good a way as possible.

When the analysis is finished and you register the links into the database, please remember to register each of the chains separately, even though they

may share intermediate links (see section 6.3 - *Multiple chains of analysis* above for the reasons why this is necessary).

Remember that you do not have to be 100 % sure that every chain is correct in detail, because the database allows you to grade your confidence in each chain of analysis, through the explanation fields. If something is possible but not very sure, then put it in anyway and just be sure to mark that your confidence in this particular chain is not very high.

6.8 Appendix A: CPC-template

Common Performance Conditions - Dimensions, parameters and evaluation levels

CPC	Parameters	Explanations	Comments	Evaluation level / influence on driving performance	Source of info (inspection of car, interview with driver, etc)	Quality of info very reliable (+) reliable (0) less reliable (0) not reliable (-)
Design of traffic environment	**Type of traffic environment**	What kind of traffic environment is it? Within or outside of urban area? Main road or highway?		Country road (0) City traffic (-)		
	Important factors	Any important factors which significantly makes it easier to drive or are there any risk factors? (road construction work, hidden exits, unusually tight curve radius, holes in the road, etc?)		Several supportive factors (+) No obvious risk factors (0) Some risk factors (0) Many risk factors (-)		
	Complexity	How complex is the traffic environment? Crossing roadways (crossings, circulations, exits, etc)= complex Several lanes in any/both directions = moderately complex		Not complex (+) Moderately complex (0) Very complex (-)		

		One lane = not complex				
	Information	Is the signing clear/easy to understand? Are the road markings clear? Is information provided early enough for the driver to have time to react? Is information missing which would be, needed to pass the spot safely?		Supportive (+) Adequate (0) Tolerable (0) Inappropriate (-)		
Design of driver environment	**Physical environment**	Is the driver seat ergonomically designed? Are controls and other equipment within reach? Are there any other pieces of equipment which complicates operating and overview?		Supportive (+) Adequate (0) Tolerable (0) Inappropriate (-)		
	HMI – design of individual interfaces	HMI= Human-Machine-Interaction for the driver and the vehicle: Are the individual interfaces between driver and vehicle adequately designed? Are they user-friendly? Has the interaction, with regards to safety, been well-considered?		Supportive (+) Adequate (0) Tolerable (0) Inappropriate (-)		

	HMI – design of the interface combination	HMI= Human-Machine-Interaction for the driver and the vehicle: Is the combination of different interfaces adequate for the driver or could it cause problems?		Supportive (+) Adequate (0) Tolerable (0) Inappropriate (-)		
Traffic environment conditions	**Density of traffic**	How many other vehicles were in the surroundings? Was it to be considered high or low density of traffic? If there exists knowledge on the usual traffic flow for the road(s), was traffic flow high, normal or low in relation to this?		Light traffic (0) Heavy traffic (-)		
	Road conditions/friction	Was friction good or reduced by ice, snow, water, etc? Dry asphalt=optimal Dry asphalt and degrees below zero= good Wet road and degrees over zero=good Wet road and degrees below zero=tolerable Snowy road =tolerable/poor Icy road= poor		Optimal (+) Good (0) Tolerable (0) Poor (-)		
	Visibility – atmospherical conditions and light	Was the general visibility good or was it deteriorated by darkness, fog, snow or rain?		Optimal (+) Good (0) Tolerable (0) Poor (-)		

	Visibility – obstructing elements	Did the driver have a clear line of sight towards important objects, or was visibility deteriorated by A-pillars, shrubberies or other objects? Were there any blind spots which influenced the event?		Optimal (+) Good (0) Tolerable (0) Poor (-)		
Driver conditions	**Physical and mental health**	Aspects which vary from time to time can be considered. For instance, low blood sugar because one hasn't had something to eat for a long time. In what condition was the driver? Healthy or not so healthy?		Good (0) Poor (-)		
	Speed (compared to signs)	Was the driver driving within the speed limit or was he/she driving too fast or slow? How much faster or slower?		50 km/h or less (+) 70 km/h (0) 90 km/h or more (-)		
	Time of day and week	It is a well-known psychological phenomenon that when one performs activities outside of the normal diurnal rhythm (during the time when one is normally asleep) performance is deteriorated. This is also known as circadian rhythm.		Within diurnal rhythm (+) Very early or very late (0) Outside diurnal rhythm (-)		
	Number of simultaneous goals	How many tasks did the driver have to perform in order to handle the traffic situation, including handling the vehicle? E.g., looking for a petrol station, looking for an exit,		Fewer than capacity (+) Matching capacity (0) More than capacity (-)		

		calming screaming children etc				
Adequacy of training and experience	**Driving experience**	Does the driver usually drive in all kinds of environments or just selected ones, such as a person who only drives during daytime, or only to the grocery store and back? How much experience does the driver have? Number of years with a driving licence? Mileage driven each year?		Adequate, high experience (+) Adequate, but limited experience (0) Inadequate experience (-)		
	Driver's acquaintance with traffic environment	Was it the first time the driver were at this particular spot? If not, how often did the driver usually drive through the spot of the accident?		Passes daily (+) Have passed many times before (0) Passed a few times before (0) Never passed before (-)		
	Driver's acquaintance with the vehicle	Was the car new to the driver? If not, for how long had the driver been driving his/her car? Does the driver think the car is comfortable and easy to drive?		Adequate, rich knowledge (+) Adequate, but limited knowledge (0) Inadequate knowledge (-)		
	Driver's education (procedures, regulations, special vehicle training)	For professional drivers there might be special procedures or regulations on how to handle vehicles in different situations (standard procedure for parking, transporting dangerous goods, etc.) If such procedures or regulations exist, has the driver had education in this?		Supportive (+) Adequate (0) Tolerable (0) Inappropriate (-)		

6.9 APPENDIX B: Linking table with glossary for phenotypes (critical events) and genotypes

PHENOTYPES (A)			
ANTECEDENTS (REASONS/CAUSES)	**CONSEQUENTS (RESULTS/EFFECTS)**		
GENERAL Genotypes	**Definition of GENERAL Phenotypes (Critical events)**	**Definitions of SPECIFIC Phenotypes (critical events)**	**Examples for SPECIFIC Phenotypes**
Observation missed (B1) False observation (B2) Faulty diagnosis (C1) Decision error (C3) Inadequate plan (D1) Inattention (E6) Communication failure - between drivers (J1) Information failure - between driver and traffic environment or driver and vehicle (J2)	**Timing (A1)** The regulation of time for actions to occur.	**Premature action (A1.1)** An action started too early, before a signal was given or the required conditions had been established.	Performing an overtake before there is good visibility. Starting/stopping too early at traffic lights. Dip the lights too early when driving in the dark.
		Late action (A1.2) An action started too late.	Not changing lanes in time.
		No action (A1.3) An action that was not done at all (within the time interval allowed).	Starting an overtake too late. Dip the lights too late when driving in the dark.
Observation missed (B1) Faulty diagnosis (C1) Decision error (C3) Inadequate plan (D1) Inattention (E6) Equipment failure (I1) Communication failure - between drivers (J1) Information failure - between driver and traffic environment or driver	**Duration (A2)** Continuance or persistence in time, of an action.	**Prolonged action/movement (A2.1)** A manoeuvre continues beyond the point when it should have been terminated.	Staying in the left lane too long after having performed an overtake.
		Shortened action/movement (A2.2) A manoeuvre is interrupted.	Squeezing in just in front of a vehicle which one has just been overtaking. Not completing braking at stop signs.

and vehicle (J2)			
Observation missed (B1) Faulty diagnosis (C1) Inadequate plan (D1) Fear (E2) Inattention (E6) Equipment failure (I1) Communication failure - between drivers (J1) Information failure - between driver and traffic environment or driver and vehicle (J2)	**Force/(power) (A3)** The capacity of an action being performed.	**Insufficient force (A3.1)** Insufficient ability to brake/accelerate. Insufficient engine power.	The brakes are not efficient enough. The acceleration ability is not enough to perform a safe overtake.
		Surplus force (A3.2) Too powerful braking/acceleration. Too powerful engine.	Acceleration is so strong that one easily looses control over the vehicle.
Observation missed (B1) Faulty diagnosis (C1) Wrong reasoning (C2) Decision error (C3) Inadequate plan (D1) Inattention (E6) Equipment failure (I1) Communication failure - between drivers (J1) Information failure - between driver and traffic environment or driver and vehicle (J2)	**Distance (A4)** The extent of space between objects or places.	**Prolonged distance (A4.1)** A movement taken too far. The vehicle is too far from object, destination, or intended position.	(Parking too far away from the pavement.)
		Shortened distance (A4.2) A movement not taken far enough. The vehicle is too close to object, destination, or intended position.	The driver was following too close to objects in the traffic environment, e.g. a vehicle in front. Driving cross stop lines and central lines. Driving too close to the pavement when parking.
Observation missed (B1) Faulty diagnosis (C1) Decision error (C3) Inadequate plan (D1)	**Speed (A5)** Rate of motion.	**Surplus speed (A5.1)** Action/manoeuvre performed too quickly or with too much speed or ended too early.	Speeding with regards to speed limit or other road users. Skidding in a curve.

Distraction (E3) Performance Variability (E5) Equipment failure (I1) Communication failure - between drivers (J1) Information failure - between driver and traffic environment or driver and vehicle (J2)		**Insufficient speed (A5.2)** Action/manoeuvre performed too slowly or with too little speed.	Keeping to low speed when overtaking and having to abort the action.
Observation missed (B1) Faulty diagnosis (C1 Inadequate plan (D1) Priority error (D2) Fear (E2) Distraction (E3) Inattention (E6) Equipment failure (I1) Communication failure - between drivers (J1) Information failure - between driver and traffic environment or driver and vehicle (J2) Inadequate roadside design (N5)	**Direction (A6)** The way in which the vehicle is going.	**Incorrect direction (A6.1)** Manoeuvre made in the wrong direction.	Turning right instead of left. Going backwards instead of forwards. Going off the road instead of following the lane.
Observation missed (B1) Wrong identification (B3) Decision error (C3) Inadequate plan (D1) Performance variability (E5) Inattention (E6) Functional impairment (F1) Access problems (H3) Communication failure - between drivers (J1) Information failure - between driver and traffic environment or driver	**Object (A7)** An item or an actuator.	**Adjacent object (A7.1)** An object which is in physical proximity to the object that should have been used.	The driver hits the brake-pedal instead of the accelerator. The driver pushes buttons belonging to the climate control instead of the radio.
		Similar object (A7.2) An object which is similar in appearance to the object that should have been used.	Activating headlights instead of windscreen wipers.

and vehicle (J2)			
Wrong identification (B3) Faulty diagnosis (C1) Decision error (C3) Inadequate plan (D1) Priority error (D2) Memory failure (E1) Inattention (E6) Access limitations (G1) Communication failure - between drivers (J1) Information failure - between driver and traffic environment or driver and vehicle (J2)	**Sequence (A8)** The order in or when/how the event takes place/happens.	**Skipped action (A8.1)** One or more actions of a series of actions were skipped.	Changing lanes without checking rearview mirrors or looking in the dead angle.
		Repeated action (A8.2) The previous action is repeated.	Looking out for vehicles behind several times before changing lanes.
		Reversed action (A8.3) The order of two neighbouring actions is reversed.	Changing lane and then indicating direction. Turning and then indicating direction.
		Extraneous action (A8.4) An extraneous or irrelevant action is carried out.	Braking when not necessary.

OBSERVATION (B)			
ANTECEDENTS (REASONS/CAUSES)			**CONSEQUENTS (RESULTS/EFFECTS)**
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Examples for SPECIFIC Genotypes**	**GENERAL Genotypes (with definitions)**
Faulty diagnosis (C1) Inadequate plan (D1) Distraction (E3) Fatigue (E4) Inattention (E6) Under the influence of substances (E7) Functional impairment (F1) Temporary sight obstruction (G3) Permanent sight obstruction (H5) Equipment failure (I1) Inadequate road design (N1) Permanent obstruction to view (N2) Temporary obstruction to view (N4)	**Glare (B1.1)** Being faced with bright lights which make it difficult to see.	Low sun shining right at the vehicle/person.	**Observation missed (B1)** A signal or an event that should have been the start of an action (sequence) is missed, i. e., not seen, not heard, not felt etc..
	Noise (B1.2) Being surrounded by loud noise which prevents perception of other acoustic signals	High volume on the stereo keeps one from hearing other road users honk the horn.	
	Tunnel vision (B1.3) Being limited in the peripheral vision.	When experiencing fear or high speed, the peripheral vision diminishes from 180 degrees to as much as 20-30 degrees.	
	Other (B1.4)		
Wrong reasoning (C2) Distraction (E3) Fatigue (E4) Inattention (E6) Under the influence of substances (E7) Physiological stress (E8) Psychological stress (E9) Functional impairment (F1)	**Other (B2.1)**	A car which is standing still or moving very slowly is mistakenly observed as a (faster) moving car.	**False observation (B2)** An event or some information is incorrectly recognised or mistaken for something else.

Distraction (E3) Functional impairment (F1) Incorrect information (G2) Mislabeling (H4) Information failure - between driver and traffic environment or driver and vehicle (J2)	**Habit/expectation (B3.1)** Being used to a certain environment makes it difficult to discover changes.	Signs which have been changed is not observed. A sign indicating that what has been a primary road for ten years, is hard to notice for people who have been driving on that road for many years.	**Wrong identification(B3)** The identification of an event or some information is incorrect.
	Other (B3.2)		

INTERPRETATION (C)			
ANTECEDENTS (REASONS/CAUSES)			**CONSEQUENTS (RESULTS/EFFECTS)**
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Examples for SPECIFIC Genotypes**	**GENERAL Genotypes (with definitions)**
False observation (B2) Wrong identification (B3) Under the influence of substances (E7) Physiological stress (E8) Psychological stress (E9) Cognitive bias (F2) Incorrect information (G2) Equipment failure (I1) Communication failure (between drivers) (J1) Information failure - between driver and traffic environment or driver and vehicle (J2)	**Error in mental model (C1.1)** The individual's ideas on a place or turn of events does not correspond to reality.	The driver believes making a left turn is allowed, but going left is prohibited.	**Faulty diagnosis (C1)** The diagnosis of the situation is incomplete or incorrect.
	New situation (C1.2) The individual ends up in a completely new situation and has no frame of reference for making a judgement call.	Driving on a road in the country and all of a sudden a sheep appears on the road.	
	Incorrect analogy/comparison (C1.3) The drivers understanding is based on a metaphor or an analogy which has no correspondence in the real world.	Car A reaches an intersection slightly ahead of car B. Car B has right of way but slows down. The driver of car A believes that driver B is being nice and wants A to pass the intersection first despite B's right of way. In reality B is slowing down due to a speed bump just prior to the intersection, and have no intention to let A pass first.	
	Misjudgement of time/distance (C1.4) The drivers estimation of distance or time is not correct.	Initiates a left turn before opposite traffic have passed.	
	Other (C1.5)		
False observation (B2) Inattention (E6) Under the influence of substances (E7)	**Incorrect analogy/comparison (C2.1)** The drivers understanding is based on a metaphor or an analogy which, in	Car A reaches an intersection slightly ahead of car B. Car B has right of way but slows down. The driver of car A believes that driver B is being nice	**Wrong reasoning (C2)** Concluding something based on assumptions.

Cognitive bias (F2)	reality, has no correspondence.	and wants A to pass the intersection first despite B's right of way. In reality B is slowing down due to a speed bump just prior to the intersection, and has no intention to let A pass first.	
	Error in mental model (C2.2) The individual's ideas on a place or turn of events does not correspond to reality.	The driver believes making a left turn is allowed, but going left is prohibited.	
	Other (C2.3)		
False observation (B2) Wrong identification (B3) Fear (E2) Distraction (E3) Under the influence of substances (E7) Physiological stress (E8) Psychological stress (E9) Cognitive bias (F2) Information failure - between driver and traffic environment or driver and vehicle (J2) Insufficient skills (L1) Insufficient knowledge (L2)	**Shock (C3.1)** The driver is in a state of shock.	The driver is in a state of shock because of the situation.	**Decision error (C3)** Coming to an incorrect decision due to inability of making the right choice among many decisions, or inability of making any choice at all.
	Other (C3.2)		

PLANNING (D)			
ANTECEDENTS (REASONS/CAUSES)			**CONSEQUENTS (RESULTS/EFFECTS)**
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Examples for SPECIFIC Genotypes**	**GENERAL Genotypes (with definitions)**
Faulty diagnosis (C1) Memory failure (E1) Fear (E2) Distraction (E3) Fatigue (E4) Under the influence of substances (E7) Physiological stress (E8) Psychological stress (E9) Insufficient experience (L2) Deficient instructions/procedures (M1) Overload / Too high demands (M2)	**Error in mental model (D1.1)** The individual's ideas on a place or turn of events does not correspond to reality.	The driver believes making a left turn is allowed, but going left is prohibited.	**Inadequate plan (D1)** The plan is not complete, or wrong, i.e. it does not contain all the details needed when it is carried out.
	Overlooked side effects (D1.2) The driver does not realise that his/her action will have side effects which will have a negative influence on the situation.	The driver realises that the traffic lights is turning red, and surprises vehicle coming from behind by braking very hard.	
	Other (D1.3)		
Faulty diagnosis (C1) Physiological stress (E8) Psychological stress (E9) Cognitive bias (F2) Communication failure - between drivers (J1) Information failure - between driver and traffic environment or driver and vehicle (J2) Deficient instructions/procedures (M1)	**Legitimate higher priority (D2.1)** One action is legitimately prioritised compared to another.	Altering lane in a less appropriate way in order to let an ambulance pass.	**Priority error (D2)** Not making the correct priorities and the plan will therefore not be effective.
	Conflicting criterions (D2.2) The driver needs to solve two contradictory tasks at the same time.	Listening to traffic information on the radio while at the same time talking on the mobile phone.	
	Other (D2.3)		

TEMPORARY PERSONAL FACTORS (E)			
ANTECEDENTS (REASONS/CAUSES)			**CONSEQUENTS (RESULTS/EFFECTS)**
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Examples for SPECIFIC Genotypes**	**GENERAL Genotypes (with definitions)**
Overload / Too high demands (M2)	**Learning long ago (E1.1)** It has been several years since the learning/training took place.	Encounter a traffic situation which one has not been in for many years.	**Memory failure (E1)** An item or a piece of information cannot be recalled when needed.
	Temporary inability (E1.2) The individual cannot, at that moment, handle something which normally is not a problem.	An item or some information cannot be recalled when needed, i.e. due to bad short-term memory.	
	Other (E1.3)		
None defined	**Previous mistakes (E2.1)** One has previously made mistakes in similar situations and fears to repeat them.	Anxious about a particular manoeuvre due to previous bad experience/accident.	**Fear (E2)** Being afraid of something.
	Insecurity (E2.2) The driver doubts his/her own ability of handling the situation.		

	Conceivable consequences (E2.3) One becomes scared when realizing which consequences the current situation might have.	Truck driving in the opposite direction enters the wrong side of the central line, some distance away.	
	Other (E2.4)		
Equipment failure (I1)	**Passengers (E3.1)** Another person in the vehicle diverts the driver's attention.	Conversations with co-passengers, children fighting etc.	**Distraction (E3)** The performance of a task is suspended because the person's attention was caught by something else or the attention has shifted.
	External competing activity (E3.2) An object or a sequence of events outside the vehicle diverts the driver's attention. Paying attention to this object or sequence of events could be part of the whole driving task but competing with the task concerned.	An animal appearing by the side of the road.	
	Internal competing activity (E3.3) An object or a sequence of events inside the vehicle diverts the driver's attention. Paying attention to this object or sequence of events	The mobile phone ringing, the navigation system alerting or the road user is thinking of something in particular.	

	could be part of the whole driving task but competing with the task concerned.		
	Other (E3.4)		
Overload / Too high demands (M2) Management failure (M3)	**Circadian rhythm (E4.1)** Driving at a time which is normally not within the "waking hours" and that results in reduced output capacity.	Driving at night to avoid heavy traffic.	**Fatigue (E4)** Being mentally or physically tired/exhausted.
	Extensive driving spell (E4.2) Not taking breaks or pausing when driving long distances, and that leads to diminished driving ability.	Truck drivers changing trucks with each other and driving more than the allowed period of time during 24 h.	
	Other (E4.3)		
Insufficient skills (L1) Insufficient knowledge (L2) Overload / Too high demands (M2)	**Illness (E5.1)** The individual is struck with a condition of illness which affects the ability to drive in a negative way.	Have a heart attack, suffer from dizziness, feeling nauseous, etc	**Performance variability (E5)** Reduced or increased precision of actions.
	Other (E5.2)		
Cognitive bias (F2)	**Temporary inability (E6.1)** The individual cannot, at that moment, handle something which normally is not a problem.	The driver of a car starts coughing very much and is not able to pay attention to the driving.	**Inattention (E6)** Low vigilance due to loss of focus.

	Bored/unmotivated (E6.2) The individual lacks motivation to carry out his/her task in the best way possible.	Driving the same distance to work every day.	
	Habit/expectation (E6.3) Being used to a certain environment makes it difficult to discover changes.	Signs which have been changed are not observed. A sign indicating that what has been a primary road for ten years, is hard to notice for people who have been driving on that road for many years.	
	Other (E6.4)		
None defined	**Alcohol (E7.1)** The road user is under the influence of alcohol.	A vehicle goes off the road because the driver had been drinking.	**Under the influence of substances (E7)** Being affected by different sorts of substances.
	Drugs (E7.2) The road user is under the influence of non-prescribed drugs.	A vehicle is going off the road because the driver had been injecting heroin.	
	Medication (E7.3) The road user is under the influence of prescribed drugs.	A vehicle is going off the road because the driver had been taking strong sedatives.	
	Other (E7.4)		
Overload / Too high demands (M2) Management failure (M3)	**Illness (E8.1)** The individual is struck with a condition of illness which negatively affects the ability to	Have a heart attack, suffer from dizziness, feeling nauseous, etc.	**Physiological stress (E8)** Different physical factors putting a strain on the driver.

	drive.		
	Other (E8.2)		
Information failure - between driver and traffic environment or driver and vehicle (J2) Insufficient knowledge (L2) Overload / Too high demands (M2) Management failure (M3)	**Other (E9.1)**		**Psychological stress (E9)** Different mental factors putting a strain on the driver.

PERMANENT PERSONAL FACTORS (F)			
ANTECEDENTS (REASONS/CAUSES)			**CONSEQUENTS (RESULTS/EFFECTS)**
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Examples for SPECIFIC Genotypes**	**GENERAL Genotypes (with definitions)**
None defined	**Other (F1.1)**		**Functional impairment (F1)** Reduced ability in one or more human functions.
None defined	**Other (F2.1)**		**Cognitive bias (F2)** Taking in and processing information a little bit askew.

TEMPORARY HMI PROBLEMS (G)			
ANTECEDENTS (REASONS/CAUSES)			**CONSEQUENTS (RESULTS/EFFECTS)**
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Examples for SPECIFIC Genotypes**	**GENERAL Genotypes (with definitions)**
Equipment failure (I1) Software fault (I2)	**Temporary inability (G1.1)** The individual cannot, at that moment, handle something which normally is not a problem.	The driver has a temporary blackout and has forgotten how to handle either the situation, the car or both of them.	**Access limitations (G1)** Problems for the user to reach items/actuators in the driver environment.
	Other (G1.2)		
Equipment failure (I1) Software fault (I2) Information failure - between driver and traffic environment or driver and vehicle (J2)	**Badly presented display (G2.1)** The display does not show the information in the intended/correct way.	The interface of a GPS-display is not optimized and the driver has a hard time interpreting the information given.	**Incorrect information (G2)** Information is being ambiguously, incompletely or incorrectly formulated/presented.
	Navigation problems (G2.2) Difficulties to navigate within the information systems.	The menu in the navigation system is difficult to understand, and the driver needs to pay a lot of attention to the same.	
	Other (G2.3)		
None defined	**Baggage (G3.1)** Some kind of baggage or similar object is placed in such a way that it obstructs the drivers view.	Too much luggage in the car and the driver's field of vision is completely or partially blocked when looking in the rear-view mirror.	**Temporary sight obstruction (G3)** The view is temporarily obstructed by an object.
	Passengers (G3.2) One or more passengers are placed in such a way that they block the view the driver normally has.	A very tall person is seated in position 2:2 (in the middle of the back seat) which makes it difficult for the driver to see, in the rear-view mirror, what is going on behind the car.	
	Other (G3.3)		

PERMANENT HMI PROBLEMS (H)			
ANTECEDENTS (REASONS/CAUSES)			**CONSEQUENTS (RESULTS/EFFECTS)**
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Examples for SPECIFIC Genotypes**	**GENERAL Genotypes (with definitions)**
Inadequate HMI (O2) Inadequate ergonomics (O3)	**Other (H1.1)**		**Sound (H1)** Noise levels are too high or signal levels are too low.
Inadequate HMI (O2) Inadequate ergonomics (O3)	**Other (H2.1)**		**Illumination (H2)** Being exposed to too much light, e.g. causing reflexes, glare, or not having enough light e.g. causing reduced colour, contrast.
Maintenance failure - condition of vehicle (K1) Inadequate HMI (O2) Inadequate ergonomics (O3)	**Other (H3.1)**		**Access problems (H3)** An item or an actuator is in one way or another out of reach to the user.
Inadequate quality control – vehicle (K3) Inadequate HMI (O2)	**Incorrect translations (misleading terms in manuals etc) (H4.1)** Translation of hand books and such is poor.	Ambiguous terms used in the manual.	**Mislabeling (H4)** The labeling or identification of an item or actuator is incorrect or ambiguous.
	Other (H4.2)		
Inadequate ergonomics (O3)	**Other (H5.1)**		**Permanent sight obstruction (H5)** The sight is permanently obstructed due to the vehicle design.

EQUIPMENT FAILURE (I)			
ANTECEDENTS (REASONS/CAUSES)			**CONSEQUENTS (RESULTS/EFFECTS)**
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Examples for SPECIFIC Genotypes**	**GENERAL Genotypes (with definitions)**
Maintenance failure - condition of vehicle (K1) Maintenance failure - condition of road (K2) Inadequate quality control – vehicle (K3) Unpredictable system functions/characteristics (O1) Inadequate construction (O5)	**Tyres (I1.1)** One or many tyres fail to maintain pressure, thereby not performing as expected.	A tyre explodes.	**Equipment failure (I1)** Some piece of equipment brakes or the performance of a system does not behave as expected/intended.
	Steering (I1.2) The steering system fails in, one way or another, and does not perform as expected.	The steering column breaks.	
	Brake system (I1.3) The brake system fails, in one way or another, and does not perform as expected.	A brake-disc is overheated.	
	Lighting (I1.4) The lighting fails, in one way or another, and does not perform as expected.	The left front headlight is not working.	
	Other (I1.5)		
Inadequate quality control - vehicle (K3)	**Deficient navigation system (I2.1)** Information is not available due to software problems or other such problems.	The performance of the system slows down. This can be critical for command and control, in particular.	**Software fault (I2)** The software is performing slower than expected or not at all.
	Other (I2.2)		

COMMUNICATION (J)			
ANTECEDENTS (REASONS/CAUSES)			**CONSEQUENTS (RESULTS/EFFECTS)**
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Examples for SPECIFIC Genotypes**	**GENERAL Genotypes (with definitions)**
Distraction (E3) Inattention (E6) Under the influence of substances (E7) Physiological stress (E8) Psychological stress (E9) Functional impairment (F1) Equipment failure (I1) Permanent obstruction to view (N2) Temporary obstruction to view (N4) Inadequate design of communication devices (O4)	**Noise/music (J1.1)** Being surrounded by loud noise or music which prevents perception of other acoustic signals.	High volume on the stereo keeps one from hearing other road users, for instance, honk the horn.	**Communication failure (between drivers) (J1)** A message or a transmission of information failed to come through to the receiver (another road user).
	Temporary inability (J1.2) The individual cannot, at that moment, handle something which normally is not a problem.		
	Glare (J1.3) Being faced with bright lights which make it difficult to see.	Low sun shining right at the vehicle/person.	
	Other (J1.4)		
Sound (H1) Illumination (H2) Equipment failure (I1) Maintenance failure - condition of road (K2) Inadequate quality control - road (K4) State of road (K5) Inadequate road design (N1) Permanent obstruction to view (N2) Inadequate information design (temporary or permanent) (N3) Inadequate roadside design (N5) Design of traffic flows (N6)	**Noise (J2.1)** Being surrounded by loud noise which prevents perception of other acoustic signals.	High volume on the stereo keeps one from hearing other road users signaling by using the horn.	**Information failure - between driver and traffic environment or driver and vehicle (J2)** A message or a transmission of information failed to come through to the receiver (the road user).
	Glare (J2.3) Being faced with bright lights which make it difficult to see.	Low sun shining right at the vehicle/person.	
	Information overload (J2.3) Too much information being conveyed to the road user.	Too many signs, both commercial and non-commercial, by the road, which makes it difficult to select which pieces of information it is the most important to pay attention to.	
	Other (J2.4)		

MAINTENANCE (K)			
ANTECEDENTS (REASONS/CAUSES)			**CONSEQUENTS (RESULTS/EFFECTS)**
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Examples for SPECIFIC Genotypes**	**GENERAL Genotypes (with definitions)**
None defined	**Tyres (K1.1)** One or many tyres have been inadequately maintained or checked and does not perform as expected.	A tyre explodes because it has been worn out.	**Maintenance failure - condition of vehicle (K1)** The vehicle, or parts of the equipment, is out of order due to inadequate or incorrect maintenance.
	Steering (K1.2) The steering system has been inadequately maintained or checked and does not perform as expected.	The level of servo oil is to low.	
	Brake system (K1.3) The brake system has been inadequately maintained or checked and does not perform as expected.	The brake-blocks have not been replaced in a long time.	
	Lighting (K1.4) The lighting has been inadequately maintained or checked and does not perform as expected.	A non-functioning brake light has not been replaced.	
	Other (K1.5)		
None defined	**Inadequate road markings (K2.1)** Markings in the road surface are hardly visible or non existing.	Painted arrows in the road surface indicating which way the lanes are going, have been worn out.	**Maintenance failure - condition of road (K2)** The road or parts of the road is in a poor state due to inadequate or incorrect maintenance.
	Road (surface) in poor condition (K2.2) The condition of the road surface is sub standard.	The road is full of holes or the road surface needs re-paving since too many cars have been going on studded tyres.	

	Road surface covered (K2.3) The surface of the road is covered by something that impedes driving performance.	The road surface is covered with snow, oil etc.	
	Other (K2.4)		
None defined	**Other (K3.1)**		**Inadequate quality control - vehicle (K3)** The vehicle, or parts of the equipment, has not been subject to adequate quality control by the responsible party, e.g. the user.
None defined	**Poor choice of road surface (K4.1)** The surface chosen when the road was being built is not up to standard.	The asphalt on the road is of poor quality and the road surface is decomposited.	**Inadequate quality control - road (K4)** The road or parts of the road has not been subject to adequate quality control by the responsible party, e.g. the road administration.
	Inadequate planning (K4.2) Inadequate routines for maintenance of roads which are supposed to keep a safe and functional level of standard.	The road surface has in time decomposited.	
	Other (K4.3)		
None defined	**Change of road surface friction (K5.1)** The friction in the road surface is changed due to different factors.	After the snow plough has been ploughing there is often a little bit of snow left which reduces the road friction. Rain falling after having had a long period of drought makes the road slippery when oil and dirt comes up and forms a thin layer at the top of the surface.	**State of road (K5)** The current road-holding characteristics.

EXPERIENCE / KNOWLEDGE (L)			
ANTECEDENTS (REASONS/CAUSES)			CONSEQUENTS (RESULTS/EFFECTS)
GENERAL Genotypes	SPECIFIC Genotypes (with definitions)	Examples for SPECIFIC Genotypes	GENERAL Genotypes (with definitions)
Inadequate training (M4)	**Other (L1.1)**		**Insufficient skills (L1)** Lack of practical experience to handle i.e.; a task, an activity, piece of equipment etc.
Inadequate training (M4)	**Other (L2.1)**		**Insufficient knowledge (L2)** Lack of knowledge due to unawareness, confusion etc.

ORGANISATION (M)			
ANTECEDENTS (REASONS/CAUSES)			CONSEQUENTS (RESULTS/EFFECTS)
GENERAL Genotypes	SPECIFIC Genotypes (with definitions)	Examples for SPECIFIC Genotypes	GENERAL Genotypes (with definitions)
None defined	**Other (M1.1)**		**Deficient instructions/procedures (M1)** Instructions or descriptions of procedures are either incomplete, ambiguous, unsuitable or incorrect.
None defined	**Other (M2.1)**		**Overload/ Too high demands (M2)** The road user is subjected to too much pressure or stress.

None defined	**Other (M3.1)**		**Management failure (M3)** The planning and/or the management of work or working conditions is inadequate.
None defined	**Other (M4.1)**		**Inadequate training (M4)** The user has not been trained well enough.

ROAD DESIGN (N)			
ANTECEDENTS (REASONS/CAUSES)			**CONSEQUENTS (RESULTS/EFFECTS)**
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Examples for SPECIFIC Genotypes**	**GENERAL Genotypes (with definitions)**
None defined	**Optical guidance (N1.1)** The visual guidance (in most cases painted marks) of the road is not sufficient.	No central line to tell which way the road is turning in the distance ahead.	**Inadequate road design (N1)** The planning and construction of the road is insufficient.
	Vertical alignment (N1.2) The road is built in a very hilly environment.	Too many hills which makes it difficult to see the distance ahead.	
	Horizontal alignment (N1.3) The road is built in a very winding environment.	Too many curves which makes it difficult to look and plan ahead.	
	Design of cross section (N1.4) The cross section is not well-considered enough.	The camber is inadequately designed in a curve.	
	Other (N1.5)		
None defined	**Vegetation (N2.1)** The view is completely or partly blocked by vegetation.	High hedges and bushes which reduces the visibility.	**Permanent obstruction to view (N2)** Objects in traffic the environment causing permanently reduced visibility.
	Building/fence (N2.2) The view is completely or partly blocked by buildings or fences.	A high fence in a residential area which reduces the view when going round a corner.	
	Signs (N2.3) The view is completely or partly blocked by one or more signs.	A commercial sign by the side of the road blocking the view in an intersection.	
	Other (N2.4)		

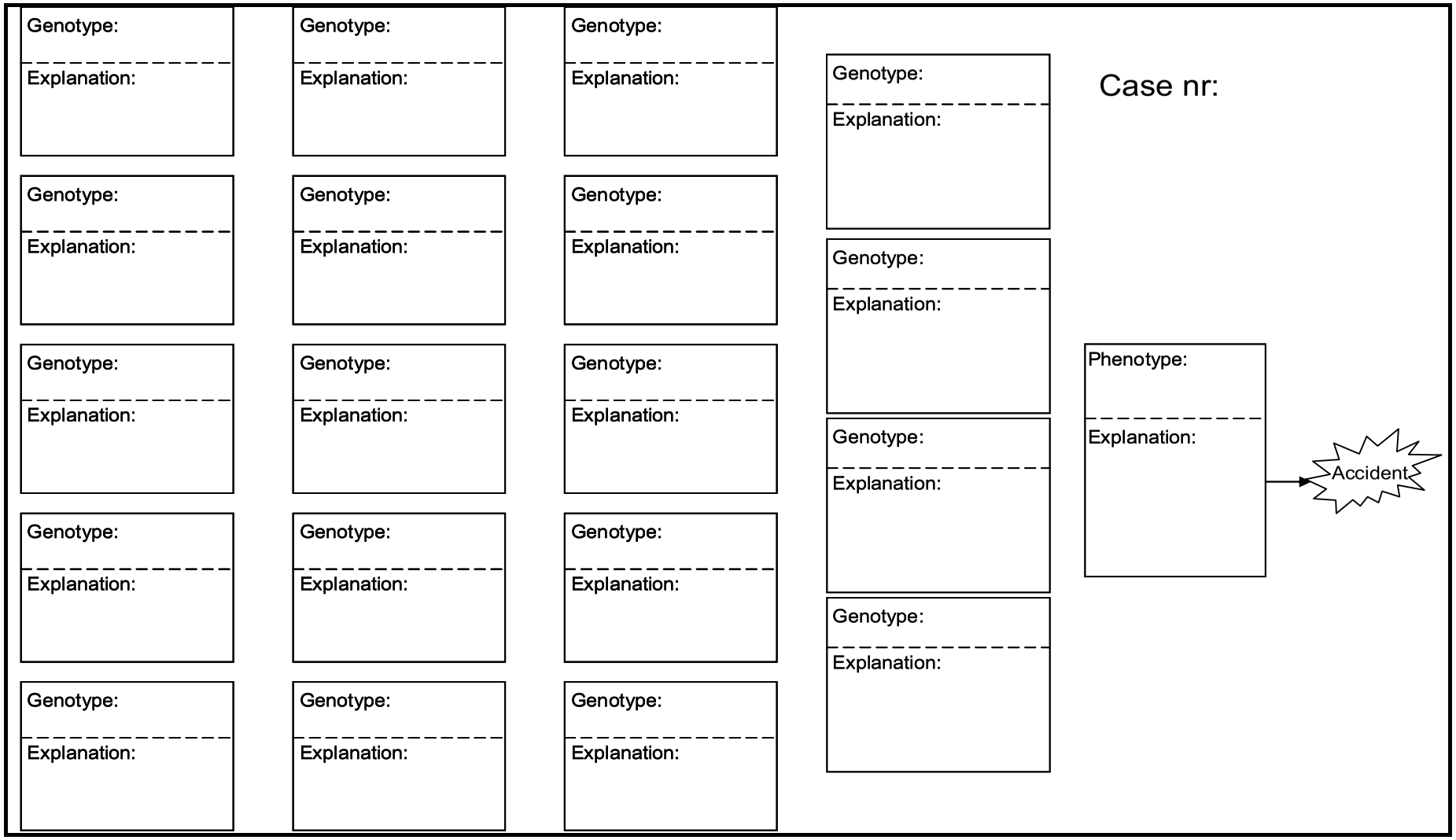
None defined	**Unclear route information (N3.1)** The design of the route information makes it difficult for the driver to scan the situation.	Several possible routes are stated on one sign post and if one is new to the place and needs to read carefully to know which way to take, a lot of attention needs to be paid to that sign post which makes it hard to concentrate on the driving and the surrounding traffic.	**Inadequate information design (temporary or permanent) (N3)** The design of the traffic control or traffic guidance is not adequate.
	Too many traffic signs (N3.2) Several traffic signs placed within a close range.	A large number of traffic signs within close proximity makes it difficult to know which one to follow.	
	Inappropriate placement of traffic lights (N3.3) The traffic lights placed in a way which makes it hard to follow them.	Standing first in line at a traffic light and not being able to see the lights because they are located almost right above ones vehicle.	
	Inappropriate placement of traffic signs (N3.4) The traffic signs are placed in a way which makes it hard to read/follow them.	A traffic sign is placed too close to a cross section and the driver is forced to take quick action which might surprise the fellow road users.	
	Other (N3.5)		
None defined	**Weather conditions (N4.1)** The view is completely or partly blocked because of the weather conditions.	A lot of snow or rain is falling, or it might be very foggy, and each of these conditions makes it hard for the road user to see what is happening in the distance.	**Temporary obstruction to view (N4)** Objects in traffic the environment causing temporarily reduced visibility.
	Other vehicle (N4.2) The view is completely or partly blocked by another vehicle.	Another vehicle passes by and blocks the view.	
	Other (N4.3)		
None defined	**Placement of road equipment (N5.1)** Objects placed in the proximity of the road, e.g. energy absorbing	An energy absorbing terminal is located too close to the driving lane.	**Inadequate roadside design (N5)** The planning and construction of the roadside is insufficient.

	structures.		
	Placement of objects in roadside (N5.2) Objects placed in a less appropriate way, in the proximity of the road.	An avenue of trees which have been planted alongside a road.	
	Design of cross section (N5.3) The cross section has not been planned well enough.		
	Other (N5.4)		
None defined	**Other (N6.1)**		**Design of traffic flows (N6)** The arrangement of, e.g. lanes, is a source of confusion.

VEHICLE DESIGN (O)			
ANTECEDENTS (REASONS/CAUSES)			**CONSEQUENTS (RESULTS/EFFECTS)**
GENERAL Genotypes	**SPECIFIC Genotypes (with definitions)**	**Examples for SPECIFIC Genotypes**	**GENERAL Genotypes (with definitions)**
None defined	**Load (O1.1)** A certain amount of load makes the vehicle behave unpredictably.	If one is driving with a lot of baggage in the trunk and enters a curve with too much speed, the car might become under steered and go off the road.	**Unpredictable system functions/characteristics (O1)** The characteristics of the vehicle become unpredictable under some circumstances.
	Other (O1.2)		
None defined	**Other (O2.1)**		**Inadequate HMI (O2)** The interaction between user and an in-vehicle system is inadequately designed.
None defined	**Other (O3.1)**		**Inadequate ergonomics (O3)** The driver seat, for instance, is inadequately designed from an ergonomic point of view.
None defined	**Other (O4.1)**		**Inadequate design of communication devices (O4)** The vehicle's light signals (indicators, brake light, head lights, reverse lights) are unable to communicate in situations when necessary.
None defined	**Tyres (O5.1)** The tyres have been inadequately constructed and does not perform as expected.	The design of tyres makes the vehicle aquaplaning.	**Inadequate construction (O5)** The vehicle has been insufficiently built or the construction has been insufficiently considered.
	Steering (O5.2) The steering system has been inadequately constructed and does	The driver looses control of the vehicle because turning the steering wheel has no effect.	

	not perform as expected.		
	Brake system (O5.3) The brake system has been inadequately constructed and does not perform as expected.	The brakes are all rusty because of exposure to water and yield almost no braking power.	
	Lighting (O5.4) The lighting has been inadequately constructed and does not perform as expected.	The front headlights produce insufficient light.	
	Other (O5.5)		

6.10 Appendix C: Linking template



6.11 Appendix D: Check list for On-scene Investigators

Case no:

Date:

Time of alarm:

Time of arrival:

Estimated time of accident:

On-scene

Location:

Type of road(s):

Road width (s):

Speed limit(s):

Traffic lights and/or other regulations:

State of road surface(s):

State of road markings:

Type of shoulder and road side(s) (guardrail, ditches, etc):

Scene surroundings – road side activities, objects blocking line of sight, etc:

Weather:

Light conditions:

Temperature:

Other:

Drivers

Vehicle A **Vehicle B**

Injuries:

Taken to which hospital (or other place for treatment):

Age:

Phone:

Description of vehicles

	Vehicle A	**Vehicle B**
Type of vehicle – (make, model, colour, no of seats):		

Reg no:		
Meter reading:		
Owner – name, adress, phone:		
Towed to:		
Loose items inside vehicle (bags, tools, etc):		
If trailer, kind and content:		
Anything on the roof (car top cargo box, etc):		
Types of mounted infotainment: (Radio/CD, navigation system, DVD-player, etc)		
Any handheld devices ? (cell phone, PDA, navigation system, dvd-player, mp3-player, other…)		

Any evidence of the above systems being in use prior to impact?		
Is it possible to tell if vehicle has handling support systems (ABS, ESP, ACC, Active Chassie, etc…)**:**		
What is the general vehicle condition – perfect condition, well kept, rusty, broken parts, etc:		
Tyres – type, profile, condition, pressure**:**		
Any visibility problems - dirty wind screen, mirrors, blocking objects:		
Any known vehicle malfunctions?		

6.12 APPENDIX E: Interview guide for investigators

• General questions • Course of events • Please describe in your own words how you experienced the situation: • When did you realise that the situation was getting out of hand? • How did you react then? • The background of the drive • What was the purpose of the trip? • Where did you come from, and where were you going? • For how long had you been driving? • What type of mood would you say you were in while driving (relaxed, tired, stressed, angry, happy, etc)? • Was there anything particular on your mind, something that you thought a lot about? • Was it a routine drive or	• Driving conditions • Condition of road/Friction • What was the road condition that day (dry, wet, icy, snow) ? • What was the road condition at the scene of the accident? • Visibility – general • Was it dark, light, dusk, dawn? • What kind of weather was it? • Was is raining or snowing ? • What was the visibility like? (Estimate the visibility in meters) • Were the windscreen wipers activated? • (Fast / normal / interval / not activated) • Visibility – line of sight • Was the visibility blocked in any way that made it difficult to see what was happening? • Was it easy to see the other road users, etc?	• The state of the vehicle • What is the general condition of your vehicle? • What kind of tyres does the vehicle have? • In what condition are they? • What condition are the brakes of the vehicle in? • Has the car had any major repairs lately? • Is there anything particularly worn or malfunctioning on the vehicle? • Similar accidents/Situations • Have you experienced any similar situations before? • What happened then? • Have you been in a situation similar to this one, but where you didn't actually collide? • What happened then? • What was the difference between these situations?	• Experience and education • Driver experience • For how many years have you had a driving licence? • How many times a week do you drive a car and approximately how far do you go? • Is driving something you enjoy, or is it something you do mainly because it is necessary? • Do you find it difficult to drive in the dark? • Are there certain traffic environments that you try to avoid if you can? • Is there any time of day when you would rather not drive, and in that case when? • If there was ice/snow on the roads at the time of the collision; have you been driving under the same type of road conditions before? •

was it special/different in any way?		• Similar accidents/Situations • Have you experienced any similar situations before? • What happened then? • Have you been in a situation similar to this one, but where you didn't actually collide? • What happened then? • What was the difference between these situations?	• Driver's familiarity with traffic environment • Do you live nearby? • Do you often drive this route? • Has anything been recently changed/ rebuilt on the spot? • If so, did you find it an improvement or not? • If you often drive there, can you tell what other kinds of road users usually drive there (commuters, tourists, locals)? • Driver's familiarity with the vehicle • For how long have you had the car? • How much have you driven it? • Do you feel like you know the car? • Does it ever behave unexpectedly? • Do you find it hard or easy to drive? • Drivers education (procedures/ regulations, special vehicles) • Do you have any driving
• Available time • • Type of traffic environment • On what kind of road did the impact occur (urban road, country road, other)? • Speed • What speed were you going at? • What speed do you usually go at on this spot? • What speed does other road users usually go at on	• Number of concurrent activities • • Was there anyone else in the car? • If there was, were you having a conversation? • What type of conversation was it (explaining, discussing, joking, gossiping, work related…) ? • What was the mood like in the car ? • Was the radio or CD/tape player on?	• Design of traffic environment • • Important factors • Is there anything in the traffic environment at the scene which makes driving particularly easy or particularly complicated? What about visibility, lane markings, exits, etc? • Complexity • Do you think the traffic	

in dense traffic? • Time of day and week day • Are you usually awake at this hour? • Do you usually drive on this week day?	going to drive? (lane choice, road choice, etc) • Did you have any help in finding your way, such as a instructions from passenger, map or navigation system? • Was the traffic situation difficult to monitor ? • Were the nearby road users behaving in any particular way before the accident situation occurred? • Were you talking on the phone prior to the event? • Were you eating or drinking something or taking something out/putting something away ? • Was there anything else going on inside the car?	guidance information on the scene (road signs, lane markings, etc) is sufficient, or is it lacking in some way? • Are there signs missing? • Is something else missing? • Is it difficult to find the right way when using the signs?	education besides regular driving licence? • Are there any particulars to keep in mind when driving this vehicle or this cargo?

7. SafetyNet Work Package 5 Database Operation Manual And User Guide

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List of Tables and Figures

Tables

Figures

7.1 Definitions

The following definitions should be applied to this document:

Activation: The procedure to get case numbers range from central server according to the availability for each member state (499 total case numbers for WP5.1 and 499 total case numbers for WP5.2).

Activation User: The user of the “Input Application” who runs the Activation from the central server.

Case Number: A unique identification number associated to each road accident case and assigned automatically by the “Input Application”, at the moment of creation of accident record in the database.

Data Base Management System (DBMS): A software package designed to store and manage databases.

Data sniffing: The illegal monitoring of the information passing through a computer network.

Fatal accident: Injury accident in which at least one road user sustains a fatal injury.

Incremental data backup: A mechanism of copying data where successive backups only contain the information that changed since a previous backup.

Input Application: The software used for data entry, browsing and uploading of data of each member state.

Local Area Network (LAN): The local computer network where the “Input Application” and the “Output Application” are visible.

Output Application: The software used for to downloading member state data from the central server.

Road user: Person on the road. In this document, road user includes **Vehicle occupant**: Road user in or on a vehicle: all drivers, riders, passengers and pedestrians.

Shoe vehicle: This term refers to a pedestrian as a vehicle involved in accident.

7.2 Introduction

The storage and manipulation of data is an important and sensitive issue. Data collected during the investigation process is stored in a database to enable easy retrieval and analysis.

As data should be collected according to common methodologies, SafetyNet WP5 partners decided to develop a database system that allows each Member State to enter data into the same database.

A European database has been developed which links together the human, vehicle and environmental data collected for each accident.

A common dataset is collected by 7 different member states. Each member state has a copy of the WP5 databases. Information on each accident or accident 'case', including pictures, is entered into these databases and then uploaded to a central server using a secure connection. Each member state can then download all the accident cases held on the central server. The integrity of the data is protected as Member States can only edit data from their country. Data from other countries can only be viewed and analysed. This type of method allows the sharing of data between Member States in a secure way.

7.3 General architecture of SafetyNet databases

SafetyNet Databases system consists of a software application written in Visual Basic for Application (VBA) completely embedded inside Microsoft Access 2003 Data Base Management System (DBMS).

The application is made up of two parts completely separate and independent. They do however have the same structure with respect to user interface forms and database tables and relationships: the Input Application (IA) and the Output Application (OA).

Using the Input Application, each partner can insert and modify data, images and pictures of its own accidents.

Using the Output Application, it is possible to view accidents data and images inserted by all partners participating in the project.

The Input Application is a local application that works offline during the data entry and editing, as well as the Output Application during the accident browsing. Only in special cases, when some data transferring is requested, the Input Application and the Output Application can connect to the central server through a Secure File Transfer Protocol (SFTP).

A central database implemented on MySQL Server DBMS has been created with databases structures similar to the ones of IA and OA. This database collects all accidents information inserted from different partners in local Microsoft Access databases and sent to the central server with an upload operation.

The central server is equipped with backup and redundancy mechanisms to ensure a secure data storage.

The last release of the application is v.2.1.

7.3.1 Local DB (Client) – INPUT APPLICATION (IA)

Each partner (client) enters accident data related to its own Centre using the INPUT APPLICATION. Data is saved in a local DB implemented in Microsoft Access DBMS.

Using the Input Application each partner can then edit and browse data of accidents inserted by its own Centre. When data entry is complete it can be uploaded into the central data base.

7.3.2 Local DB (Client) – OUTPUT APPLICATION (OA)

Each client can download updated accidents data of all partners from Central DB using the OA, where only some functions of the IA are available.

It is possible to download data of all accidents in two ways:

- in XML format and manage them through a software application, connecting by https with a web browser.

- in an OA usable format, connecting by sftp from the OA itself. Data can be accessed using the same browsing functions available in the IA.

The OA forms have different colours to warn the user and to distinguish them from the IA forms. Of course, in the OA the user can't modify data; so, it isn't possible to edit fields, nor save data. Accident data can only be browsed and analyzed.

7.3.3 Central DB (Server)

The central Server is located at D.I.T.S. It collects data of accidents sent by different partners and puts them in the central DB according to a particular schema. The central DB has been implemented using MySQL DBMS (Data Base Management System).

7.3.4 Central DB (Server) – Administration Functions

The central DB has some characteristics to act as a secure and trusted server.

Security of access

It is possible to communicate with the central server for uploading and downloading data using a mechanism of identification with username and password. The client user can connect to the central DB through a web browser (https) or directly by means of special functions buttons available in the INPUT APPLICATION or OUTPUT APPLICATION (sftp).

Security of transfer protocols

To avoid the possibility of data sniffing flowing from client to server or vice versa by people not allowed, data will be transferred using secure protocols: sftp or https. In this way it is guaranteed data encryption and the authentication of the server to which the client is being interfacing to.

Data integrity mechanisms

To avoid data loosing and integrity, a technique of mirroring (RAID 1) has been implemented server side where data are stored. This technique allows the system to automatically maintain multiple copies of data so that in the event of a disk hardware failure the system can continue to process or quickly recover data.

Moreover, regular daily incremental data backup is implemented to store another copy of data on another trusted server.

Log of accessing to central server

Information about every operation of uploading / downloading and activation on the central server is logged in a file.

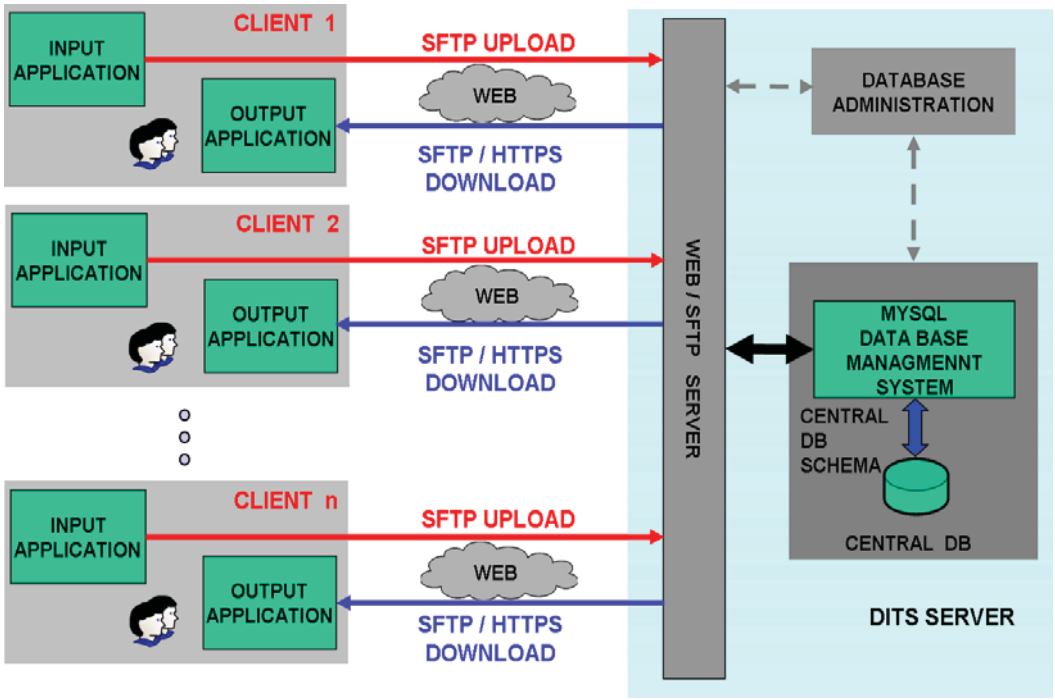


Figure 20: General structure of SafetyNet DB

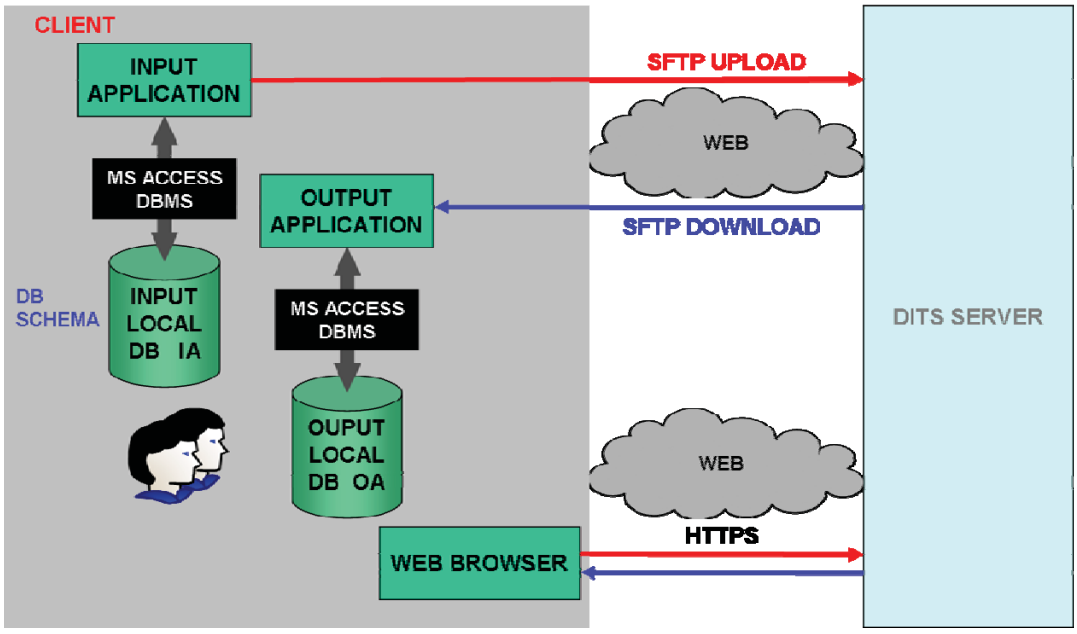


Figure 21: Structure of SafetyNet DB - Client details

7.4 Services available in input application (IA) and output application (OA)

All the functionalities available in the Input Application are listed below and summarized through a use case diagram in Figure 22**:**

- **Case Numbers Activations**: through a sftp connection, the IA gets from the central server the range of case numbers to assign automatically when new accident cases are created. When executing this task, the IA also saves in the database some information about the location in file system of the Application, the Hard Disk, the name of the machine and the user who made Activation (Activation User).

- **Text & Images Data Entry**: following a well defined sequence in data entry (Accident Level Form → Vehicle Level Form → Roadway Level Form → Road User Level Form), it is possible to insert text and image data. The internet connection is not requested because it works off line.

- **Data Upload to the Server**: once accident case data entry has been completed, it is possible to check the case as "to upload" and transfer data to the central server by clicking on the UPLOAD button. An active internet connection is requested. Only the Activation User can perform the upload operation.

The following services are available in the **Output Application:**

- **Text & Thumb Download:** through a sftp connection, the OA can check if on the central server is available an update version of data of all partners and download text data and low resolution images (thumbs) from the server.

- **Full images Download:** through a sftp connection, when a user is analysing accident cases of another partner and if an higher resolution image is needed, it is possible to download it from the central server by a simple mouse click.

Of course, both the IA and the OA allow the user to navigate through the accident cases and view all inserted data.

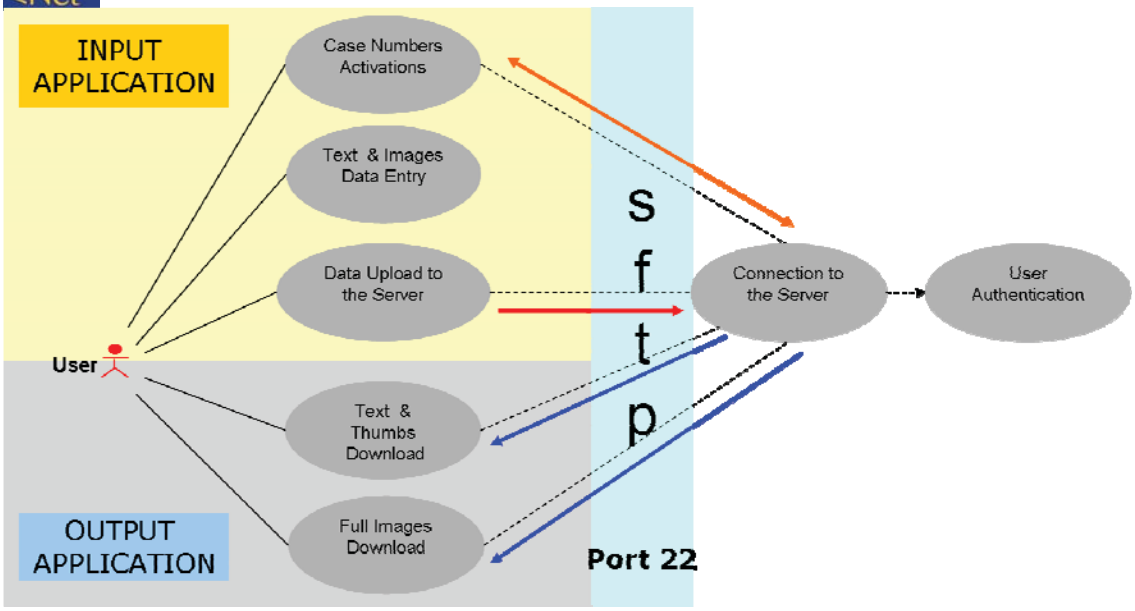


Figure 22: Services available

7.5 General architecture of SafetyNet database

The relational diagrams of databases are represented as shown below in Figure and in Figure 24, where are described the tables and the relationships of WP5.1 and WP5.2 databases:

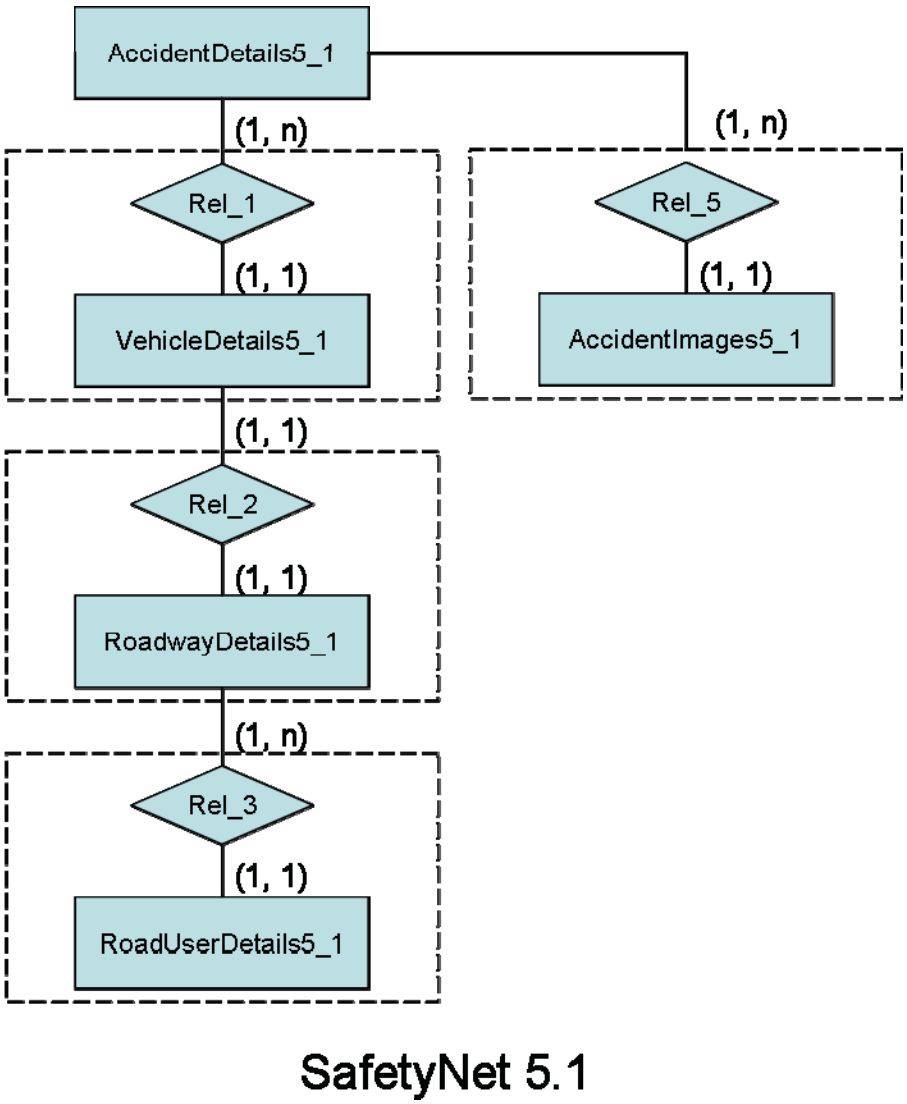


Figure 23: Entity Relationship diagram of WP5.1 Data Base

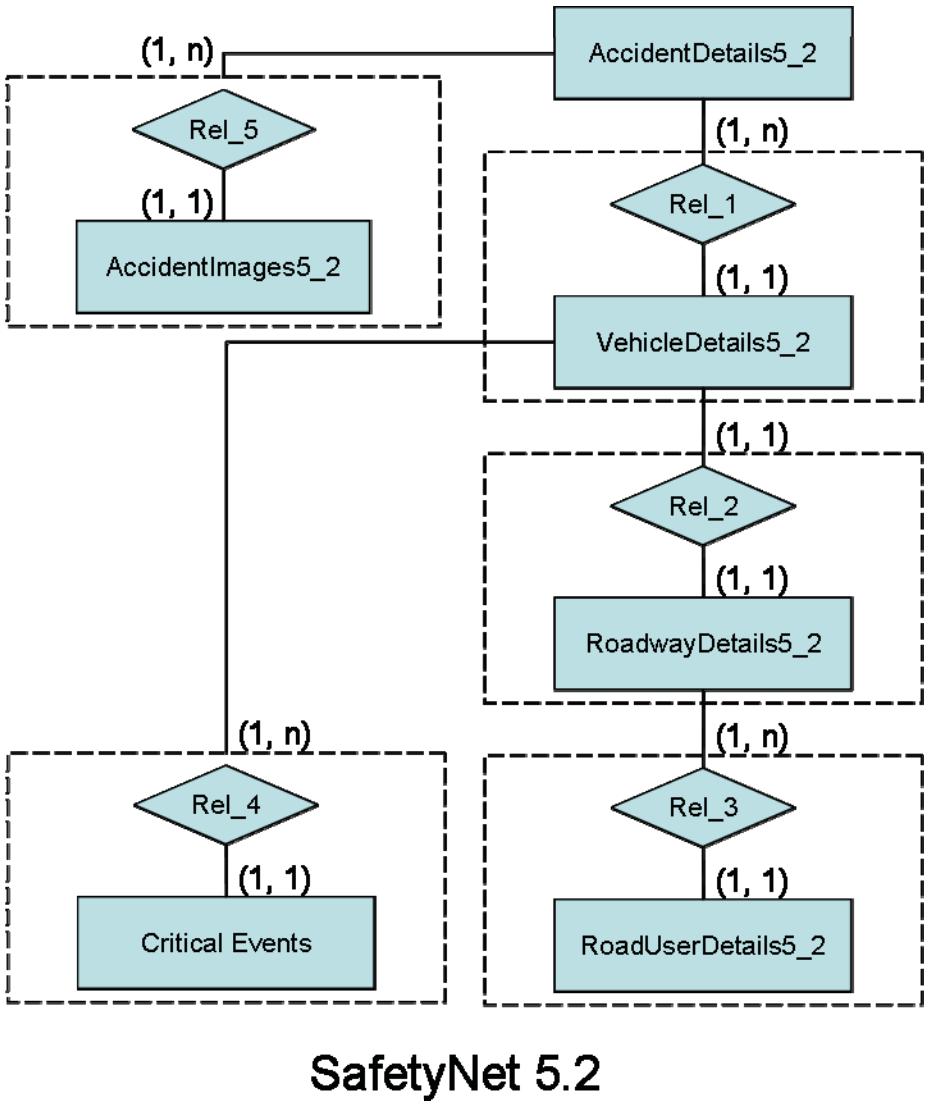


Figure 24: Entity Relationship diagram of WP5.2 Data Base

7.6 Data entry

The accident data record contains data giving an overview of the accident. The vehicles involved (including a 'dummy' record for pedestrians) are then linked to this accident data. As Environment or 'Roadway' data is recorded from the perspective of each vehicle, each vehicle has a separate linked Roadway record in the database. All drivers, riders, passengers and pedestrians are then linked with the vehicle which they occupied (pedestrian road user records are linked with the 'pedestrian vehicle' record).

The WP5 databases use the structure/hierarchy depicted in
Figure 25:

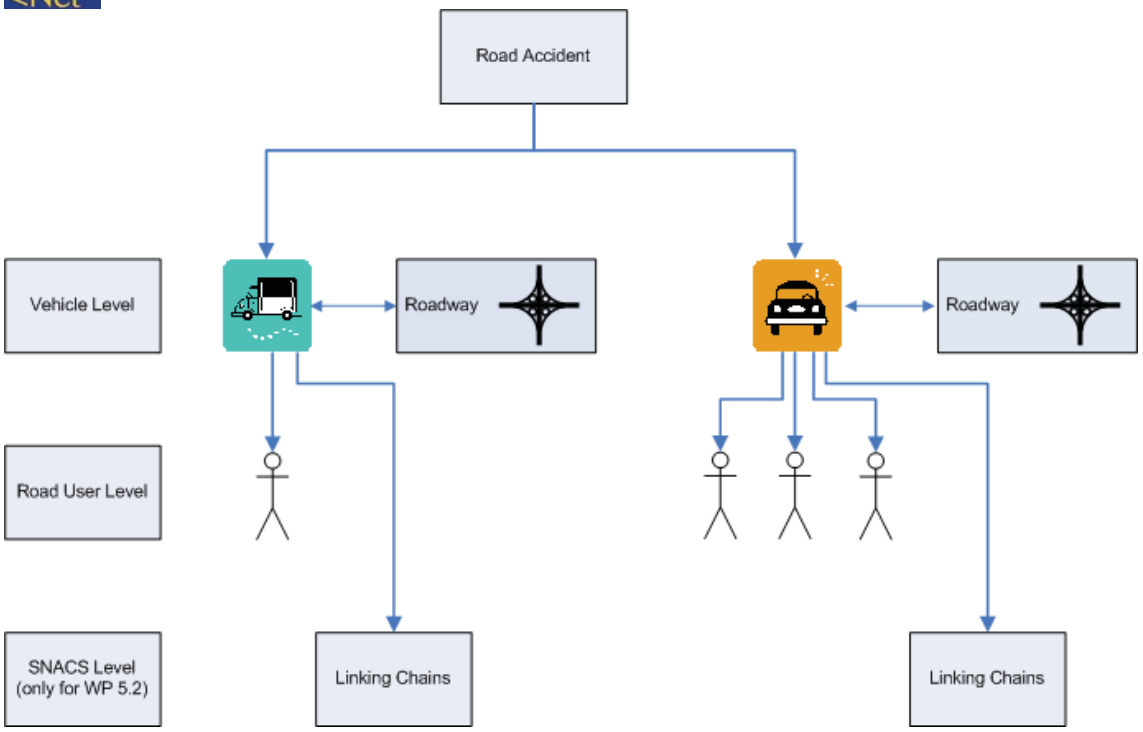


Figure 25: SafetyNet WP5 database hierarchy

According to the hierarchy shown in the above Figure 25, the forms available in the application are:

- **Accident Level Form:** a form for each case to enter data of generic accidents and save information in the associated table of the database - AccidentDetails5_1 for WP5.1 and AccidentDetails5_2 for WP5.2.

- **Vehicle Level Form:** a form for each vehicle data entry and its associated table of the database - VehicleDetails5_1 for WP5.1 and VehicleDetails5_2 for WP5.2

- **Roadway Level Form:** a form for the Roadway data entry. Each vehicle has a separate linked Roadway record in the associated table of the database - RoadwayDetails5_1 for WP5.1 and RoadwayDetails5_2 for WP5.2.

- **Road User Level Form:** a form for each Road User present in the Vehicle to store its data in the associated table of the database - RoadUserDetails5_1 for WP5.1 and RoadUserDetails5_2 for WP5.2.

Moreover, for WP5.2 Accidents, SafetyNet Accident Causation System (SNACS) data is included. The input of this type of data is achieved through the use of dedicated database forms.

Data entry related to the variables defined for each input form of the IA is done by following the logic flow shown in the following images Figure 2626 and Figure 27:

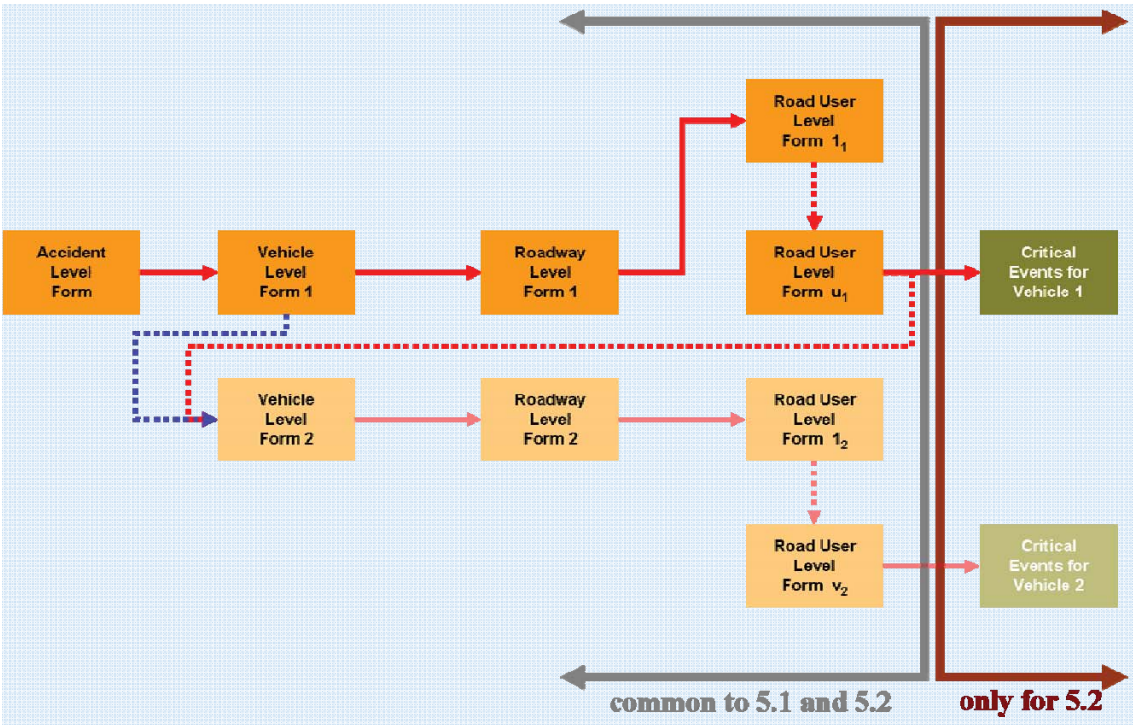


Figure 26: General Input Schema of Accident data – Vehicle detail

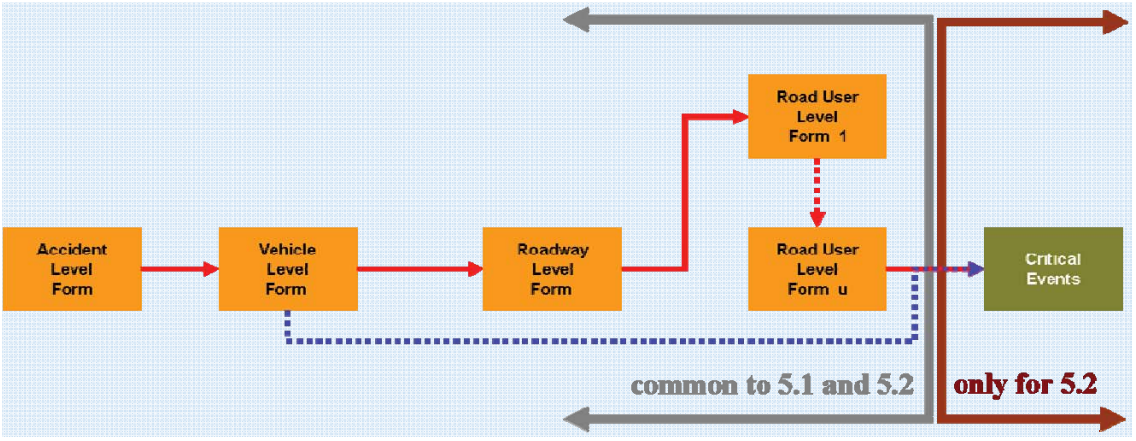


Figure 27: General Input Schema of Accident data - Critical Events detail

7.7 Data management forms

Some Data Management Forms are present, both in IA and in OA, to help the user to easily trace an accident. It is possible to select the type of accident case between WP5.1 and WP5.2; in the OA it is also possible to select the Member State and display a list of accident records ordered by case number with a summary of the most significant data fields. By clicking on the button relative to the record of interest, it is possible to directly open the case.

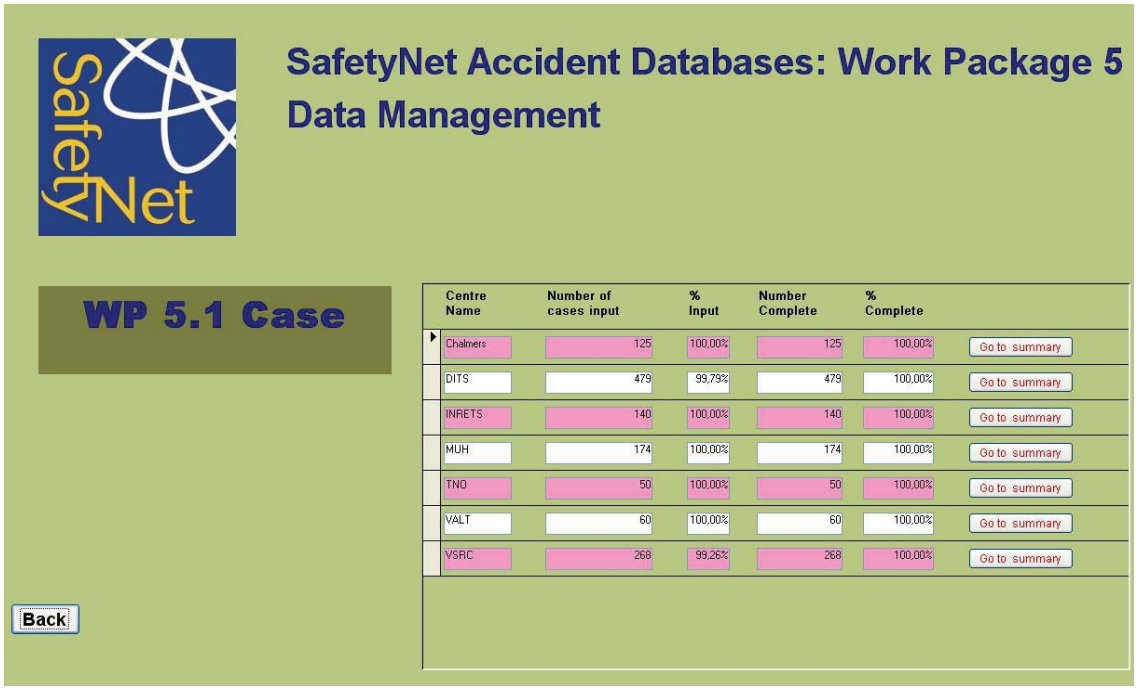
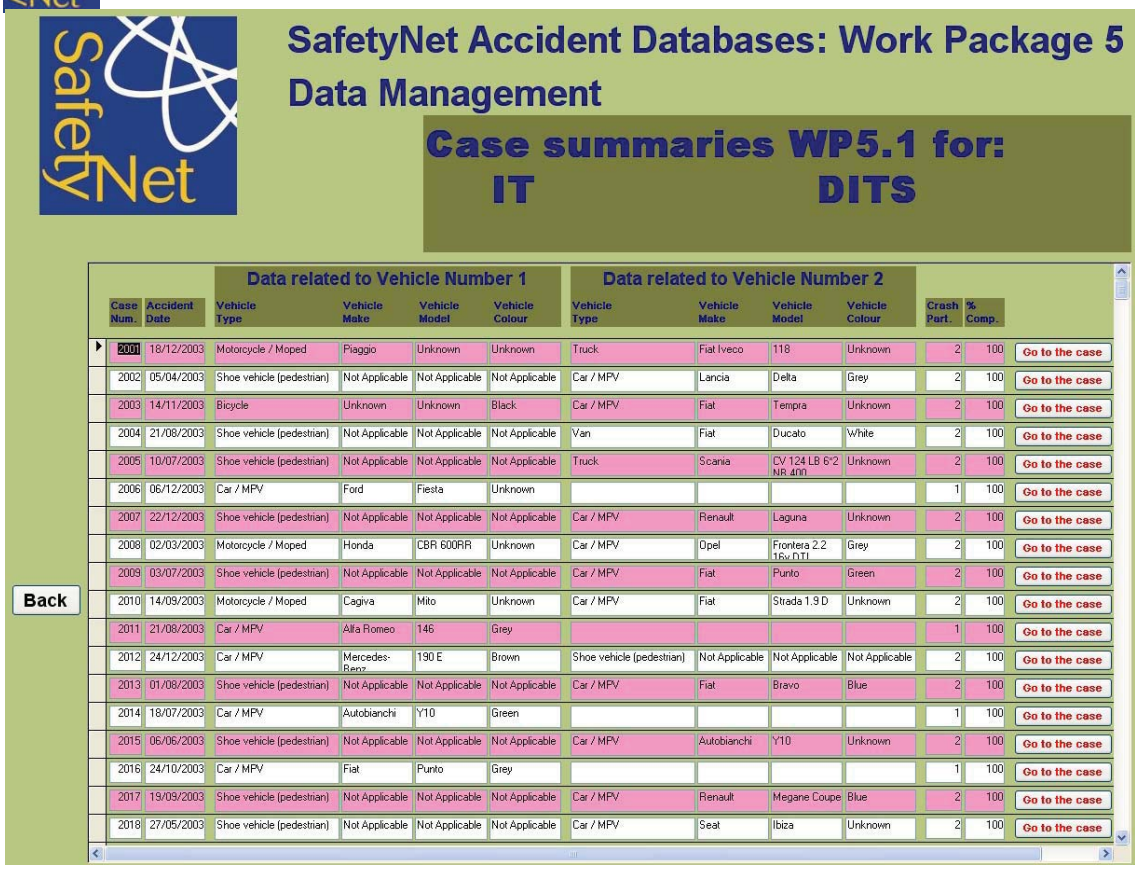


Figure 28: Output Application: Data Management Form - WP5.1 case - All Member States Data Summary



Case Num.	Accident Date	Data related to Vehicle Number 1 Vehicle Type	Vehicle Make	Vehicle Model	Vehicle Colour	Data related to Vehicle Number 2 Vehicle Type	Vehicle Make	Vehicle Model	Vehicle Colour	Crash Part.	% Comp.	
2001	18/12/2003	Motorcycle / Moped	Piaggio	Unknown	Unknown	Truck	Fiat Iveco	118	Unknown	2	100	Go to the case
2002	05/04/2003	Shoe vehicle (pedestrian)	Not Applicable	Not Applicable	Not Applicable	Car / MPV	Lancia	Delta	Grey	2	100	Go to the case
2003	14/11/2003	Bicycle	Unknown	Unknown	Black	Car / MPV	Fiat	Tempra	Unknown	2	100	Go to the case
2004	21/08/2003	Shoe vehicle (pedestrian)	Not Applicable	Not Applicable	Not Applicable	Van	Fiat	Ducato	White	2	100	Go to the case
2005	10/07/2003	Shoe vehicle (pedestrian)	Not Applicable	Not Applicable	Not Applicable	Truck	Scania	CV 124 LB 6*2 NR 400	Unknown	2	100	Go to the case
2006	06/12/2003	Car / MPV	Ford	Fiesta	Unknown					1	100	Go to the case
2007	22/12/2003	Shoe vehicle (pedestrian)	Not Applicable	Not Applicable	Not Applicable	Car / MPV	Renault	Laguna	Unknown	2	100	Go to the case
2008	02/03/2003	Motorcycle / Moped	Honda	CBR 600RR	Unknown	Car / MPV	Opel	Frontera 2.2 16v DTI	Grey	2	100	Go to the case
2009	03/07/2003	Shoe vehicle (pedestrian)	Not Applicable	Not Applicable	Not Applicable	Car / MPV	Fiat	Punto	Green	2	100	Go to the case
2010	14/09/2003	Motorcycle / Moped	Cagiva	Mito	Unknown	Car / MPV	Fiat	Strada 1.9 D	Unknown	2	100	Go to the case
2011	21/08/2003	Car / MPV	Alfa Romeo	146	Grey					1	100	Go to the case
2012	24/12/2003	Car / MPV	Mercedes-Benz	190 E	Brown	Shoe vehicle (pedestrian)	Not Applicable	Not Applicable	Not Applicable	2	100	Go to the case
2013	01/08/2003	Shoe vehicle (pedestrian)	Not Applicable	Not Applicable	Not Applicable	Car / MPV	Fiat	Bravo	Blue	2	100	Go to the case
2014	18/07/2003	Car / MPV	Autobianchi	Y10	Green					1	100	Go to the case
2015	06/06/2003	Shoe vehicle (pedestrian)	Not Applicable	Not Applicable	Not Applicable	Car / MPV	Autobianchi	Y10	Unknown	2	100	Go to the case
2016	24/10/2003	Car / MPV	Fiat	Punto	Grey					1	100	Go to the case
2017	19/09/2003	Shoe vehicle (pedestrian)	Not Applicable	Not Applicable	Not Applicable	Car / MPV	Renault	Megane Coupe	Blue	2	100	Go to the case
2018	27/05/2003	Shoe vehicle (pedestrian)	Not Applicable	Not Applicable	Not Applicable	Car / MPV	Seat	Ibiza	Unknown	2	100	Go to the case

Figure 29: Output Application: Data Management Form - WP5.1 case - DITS Data Summary

7.8 Use of the application on a LAN (Local Area Network)

In the first releases of the application v.1.x, only one user at a time could access the IA database. Partners raised the need to access the same IA for data entry and browsing by more users simultaneously. The AI architecture was for that reason modified to manage the concurrency on the database and on the application.

In the release v.2.1, it is now possible to share the DB folder and open the application on a LAN by different users at the same time. To use the SHARED MODE:

- The folder of Safetynet Application must be positioned in a Windows shared folder, accessible from other computers of the LAN;
- Each computer from which users open the Database must have installed its own Microsoft Access Application;
- The Activation User on the local server must be logged on INPUT APPLICATION from the original file system position of Activation.

When a user is working on an accident case, that case is locked and no other can open the same case.

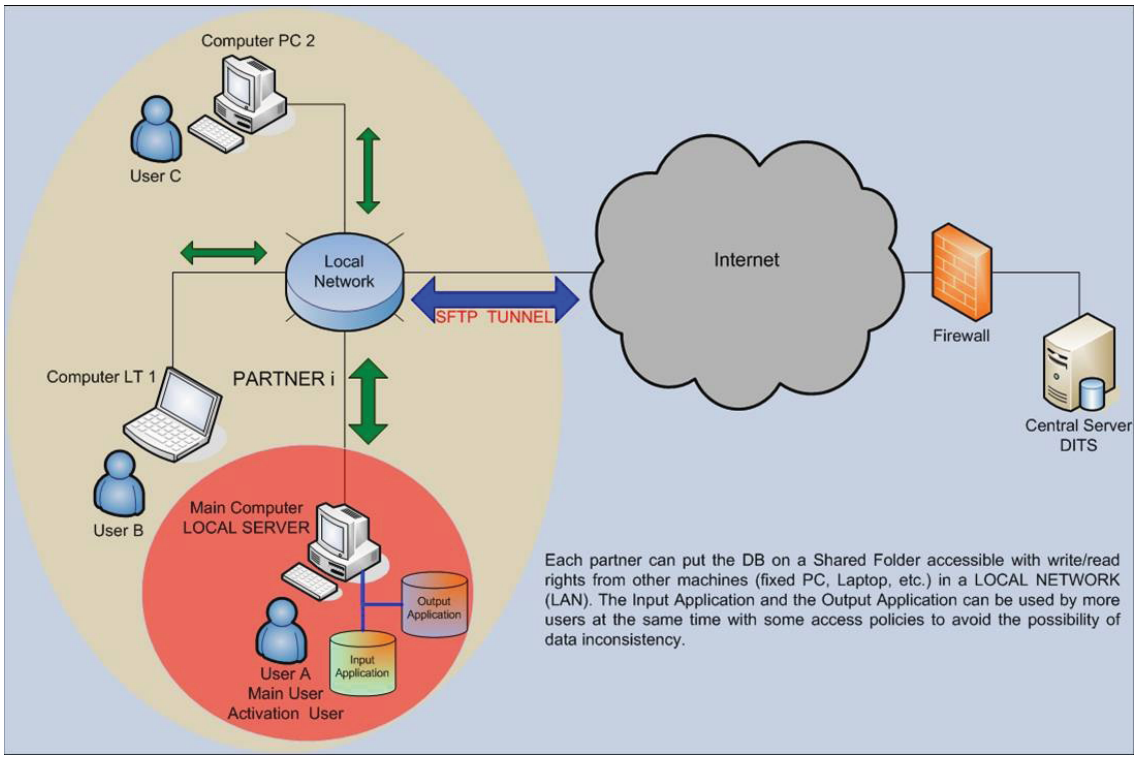


Figure 30: Use of the application on a LAN

7.9 Activation and assignment of case numbers

Each partner has a reserved interval of case numbers that can be assigned on request when a new IA is activated by remote connecting to the central server, to avoid overlapping of case number in different applications of the same partner or of different partners. All the mechanism of assigning case numbers is managed by the server located at D.I.T.S.

CENTRE NAME	case number min for 5.1	case number max for 5.1	case number min for 5.2	case number max for 5.2
CHALMERS	1001	1499	1501	1999
DITS	2001	2499	2501	2999
INRETS	3001	3499	3501	3999
MUH	4001	4499	4501	4999
TNO	5001	5499	5501	5999
VALT	6001	6499	6501	6999
VSRC	7001	7499	7501	7999

Table 3: Assignment of Case Numbers to different Member States

Each IA needs to be activated to work for data entry and edit. The activation is done through a sftp connection to the central server.
During the activation phase:

1. The Activation User must request the total number of road accident case for WP5.1 and/or WP5.2 they are going to enter.
2. Information about the position of the application in the file system, the activation user and the hard disk are stored in the database.

This information is used to prevent duplication of case records and to provide special rights to the primary user.

7.10 Client side directory structure

In order to use support applications and libraries, to save images, and to organize the support files for IA and OA, the following directory structure has been implemented:

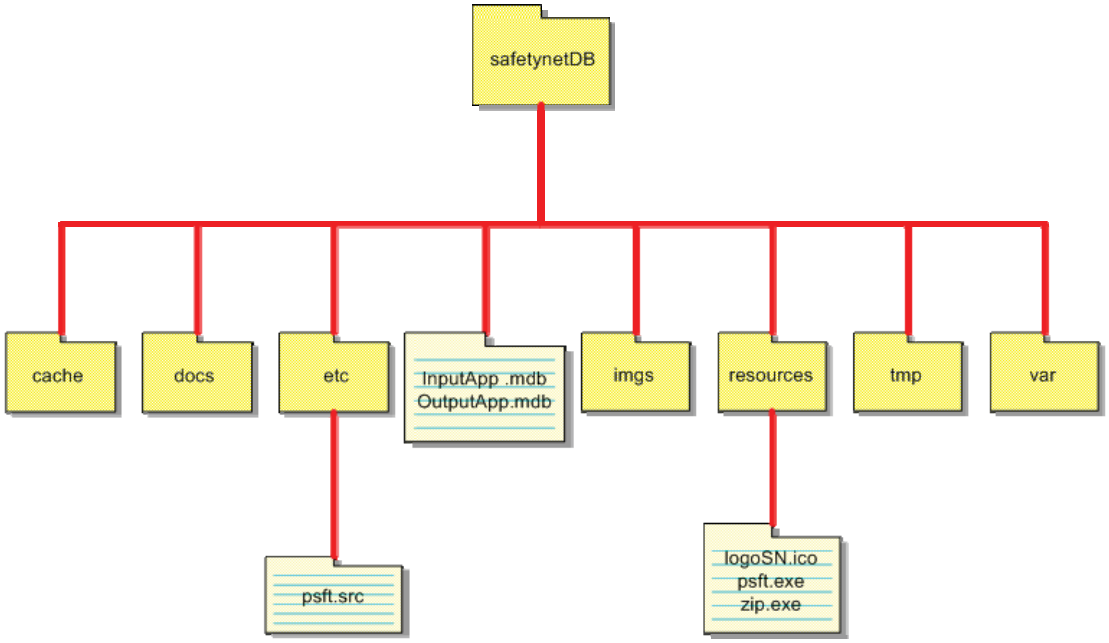


Figure 31: Client side directory structure

Files	Folders
Input images	imgs
Libraries and additional applications	resources
Documents	docs
Input Application and Output Application	safetynetDB
Log	var
Caching of images	cache
Settings / Config	etc
Temporary	tmp

7.11 Server daemon Upload/Download

A Daemon Process is always running on the server machine. It refers to the upload folder and checks for new file uploads by the users of the input application. The process then sends a feedback about the outcome data transfer and moves the received files into a temporary folder waiting to be processed.

At 00.00 Greenwich Time, another Daemon process reads uploaded files from partners during the day, puts text DATA in DB, puts images in a folder and builds the dump file to be downloaded from Output Application.

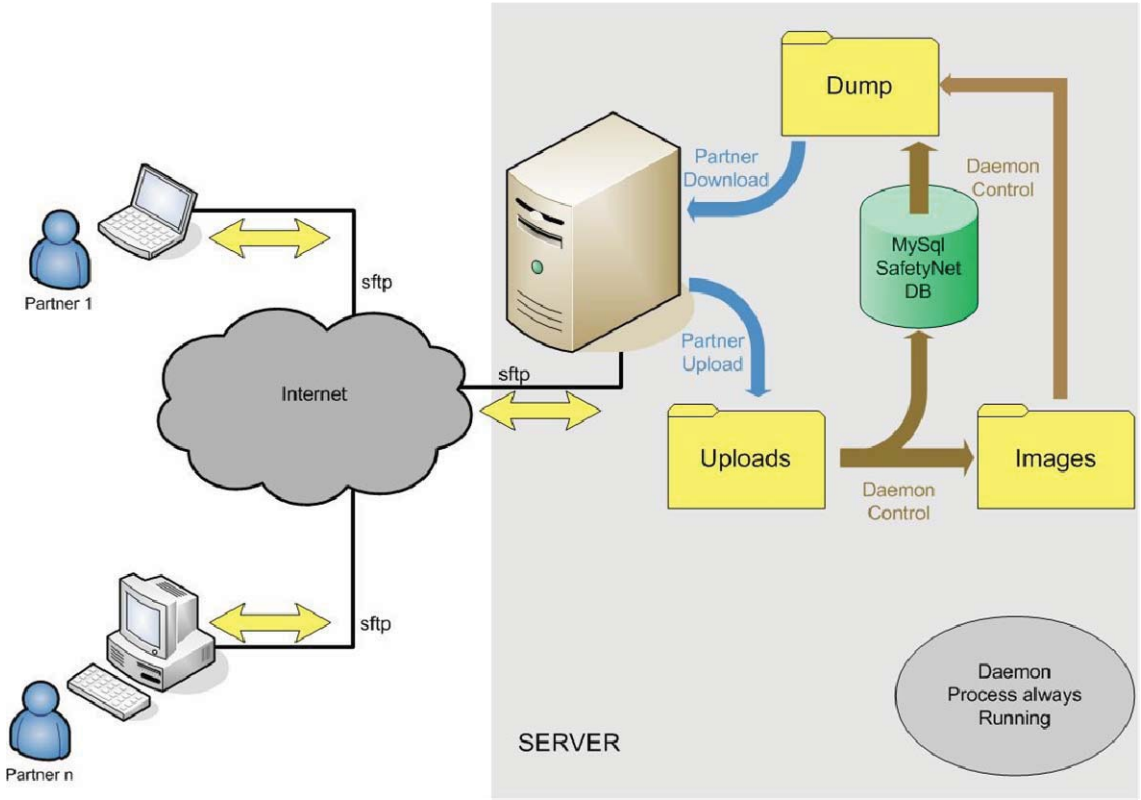


Figure 32: Server daemon UPLOAD/DOWNLOAD data flow

7.12 Image management

Images are not inserted physically in the database. For each image of an accident there is a record in one of the two tables AccidentImage5_1 or AccidentImage5_2, with a field that contains an external link to the current position in the file system of the relative image.

7.12.1 Input Application

When in browsing or input mode of IA, clicking on the button “Go to images”, it is possible to manage images of the current accident: it is possible to add or delete images or add and modify comments to image. When adding a new image, it is possible to browse the file system of your local computer and clicking on the image thumb or on the file name, automatically the image is resized to obtain a high resolution and low resolution image and converted in jpeg format if necessary.

7.12.2 Output Application

Clicking on the button “Go to images”, the OA will display in a new form all the images at low resolution (thumbs) of the selected road accident case present in the local cache memory on the file system.

By clicking on a particular thumb, the OA will check if in the local cache it is available the correspondent high resolution image; if not, it will be downloaded from Central Server and shown with the associated Comments.

Figure 33: Output Application: Example of photo Form

7.13 Safetynet accident causation system (SNACS)

The classification scheme of SNACS contains two different sections. These sections are labelled “critical events” and “causes”. The “critical events” are used to classify the empirical material, i.e. the observable consequences of a dysfunctional behaviour: this is what is visible when an observer arrives at the scene of an accident. The “causes” are used to classify all the factors which can be used to describe what has brought about, or can bring about, these effects. The “causes” are what the investigator brings with him/her to the scene, the pre-understanding of possible causes/reasons.
There are both general and specific “critical events”. There are eight different general “critical events”, and then each general “critical event” has a subset of specific “critical events” which belong to the general “critical event”. The difference between general and specific “critical event” is a degree of information. The specific “critical event” describes more delimited states than the general ones. If the investigator has sufficient information about the accident to choose a specific “critical event” then that is what s/he should do. If there is not enough information, the investigator has to stick with a general “critical event”.

The construction of a linking chain is driven by software. By selecting one of the eight general “critical events” it generates another form with the possibility to choose in a range of specific “critical events” (radio buttons) or in a range of possible general “causes” (buttons). If the user chooses a specific “critical event”, the linking chain is terminated and saved in the database. If the user chooses a generic “cause”, a new form is opened with its own specific “causes” associated (radio buttons) and other relative general “causes” that can be raised from the one actually selected. The linking chain grows in this way until the user chooses a specific “cause”. Each choice that adds an element in the linking chain needs a comment to be inserted.