CEDR Transnational Road Research Programme
Call 2012: Safety

Funded by Belgium/ Flanders, Germany, Ireland, Norway, Sweden, United Kingdom

BRoWSER: Base-lining Road Works Safety on European Roads

EuRoWCas guidance and information

	Transport Research Laboratory www.trl.co.uk
	Karlsruhe Institute of Technology www.ise.kit.edu
	Belgian Road Research Centre www.brrc.be
	Trinity College Dublin www.tcd.ie
	Slovenian National Building and Civil Engineering Institute www.zag.si

CEDR Call2012: Safety
BRoWSER: Base-lining Road Works Safety on European Roads

EuRoWCas guidance and information

Submission date: April 2015

Start date of project: 01/02/2013 End date of project: 31/10/2015

Authors of this deliverable:
Brian Lawton, TRL, United Kingdom
Jill Weekley, TRL, United Kingdom
Xavier Cocu, BRRC, Belgium
Alan O'Connor, TCD, Republic of Ireland
Mojca Ravnikar Turk, ZAG, Slovenia
Matthias Zimmermann, KIT, Germany
Dr Iain Rillie, TRL, United Kingdom (Quality Review)

Version:4.0

Contents

1 Introduction

1.1 The BRoWSER project

The project Base-lining Road Works Safety on European Roads (BRoWSER) was initiated as a response to the Description of Research Need (DoRN) for the CEDR Transnational Road Research Programme Call 2012 on Safety.

The aim of the CEDR Transnational Research Programme (2012 call) seeks "to significantly reduce risks to road workers with an objective of Zero Harm". BRoWSER responds to two of the topics within the 2012 Call under the heading of "Safety of road workers and interaction with road users". These are:

- Collect data on worker injuries and near misses by country, road administration and employer
- Understand the optimum road works layouts that enable road users to approach, travel through and exit works without causing injury to workers and others

The aim of the BRoWSER project is to help National Road Authorities (NRAs) enable a data-led approach to be taken to managing road worker safety. This knowledge of how road workers are exposed to risk from accidents and road user error is essential for effective safety management as it allows the real risks to be managed rather than those perceived to be the problem. The BRoWSER project focuses on the interaction between road workers and traffic and will allow consideration of road worker accidents, incidents and near misses alongside data for road works practices, network characteristics and road user accident data at road works.

1.2 The EuRoWCas database

The main aim of a European Road Worker Casualty (EuRoWCas) database is to help National Road Authorities (NRAs) take an evidence-led approach to managing road worker safety, and to allow benchmarking of safety. In addition, a database provides a potential mechanism for sharing information on safe road work practices.

Local implementation of EuRoWCas would provide benefit for individual NRAs but the greatest benefit would come from implementation and sharing data between NRAs across Europe. Realisation of these benefits requires action at an EU level but could be founded on the EuRoWCas standard. In support of this, BRoWSER provides evidence that this approach can work (including pilot data) and provides recommendations for how it can be achieved.

Through consultation with NRAs, some of the potential benefits for a EuRoWCas database have been identified. These are summarised and illustrated in Figure 1.

Using the standard data format, EuRoWCas-compliant databases can be set up at national (or subnational) level. This document focuses on the decisions and actions that are needed by any NRA or contractor in order to implement databases and data collection procedures that are aligned with the EuRoWCas approach. This document draws from previous deliverables within the BRoWSER project which define the technical requirements; summary content is reproduced here for ease of use but the reader is commended to read the relevant BRoWSER deliverables if more technical detail is required

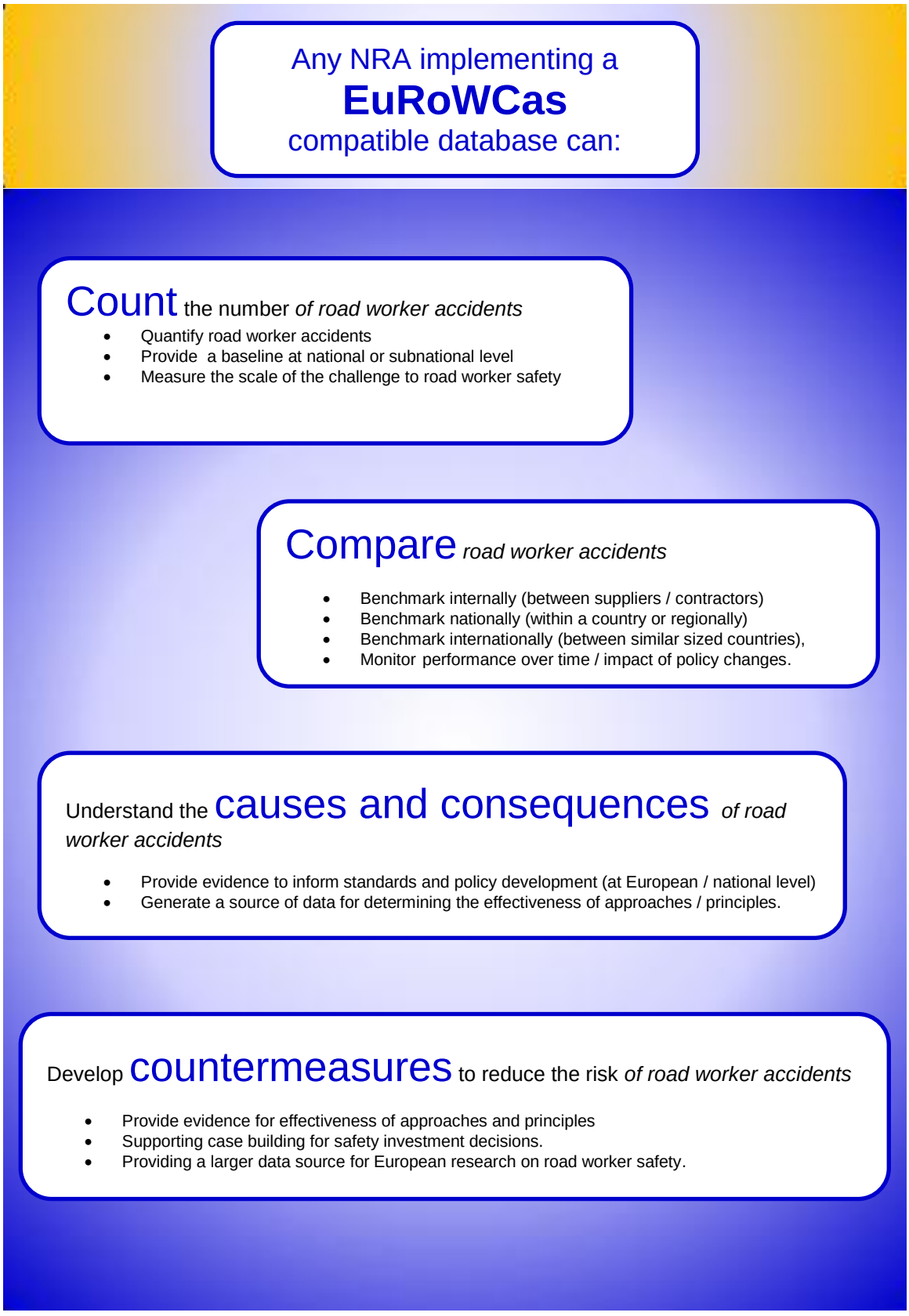


Figure 1: Benefits of EuRoWCas

2 Guidance

2.1 The four-stage process

This chapter provides guidance for implementing EuRoWCas-aligned road worker safety data collection procedures and an associated database. The guidance is structured around the decision making process which is divided into four stages as illustrated in Figure 2.

At each stage, there are questions and issues that you need to consider when making decisions and selecting from the available options. There is significant interaction between stages, and hence it may be helpful to revisit questions and decisions as objectives and circumstances change.

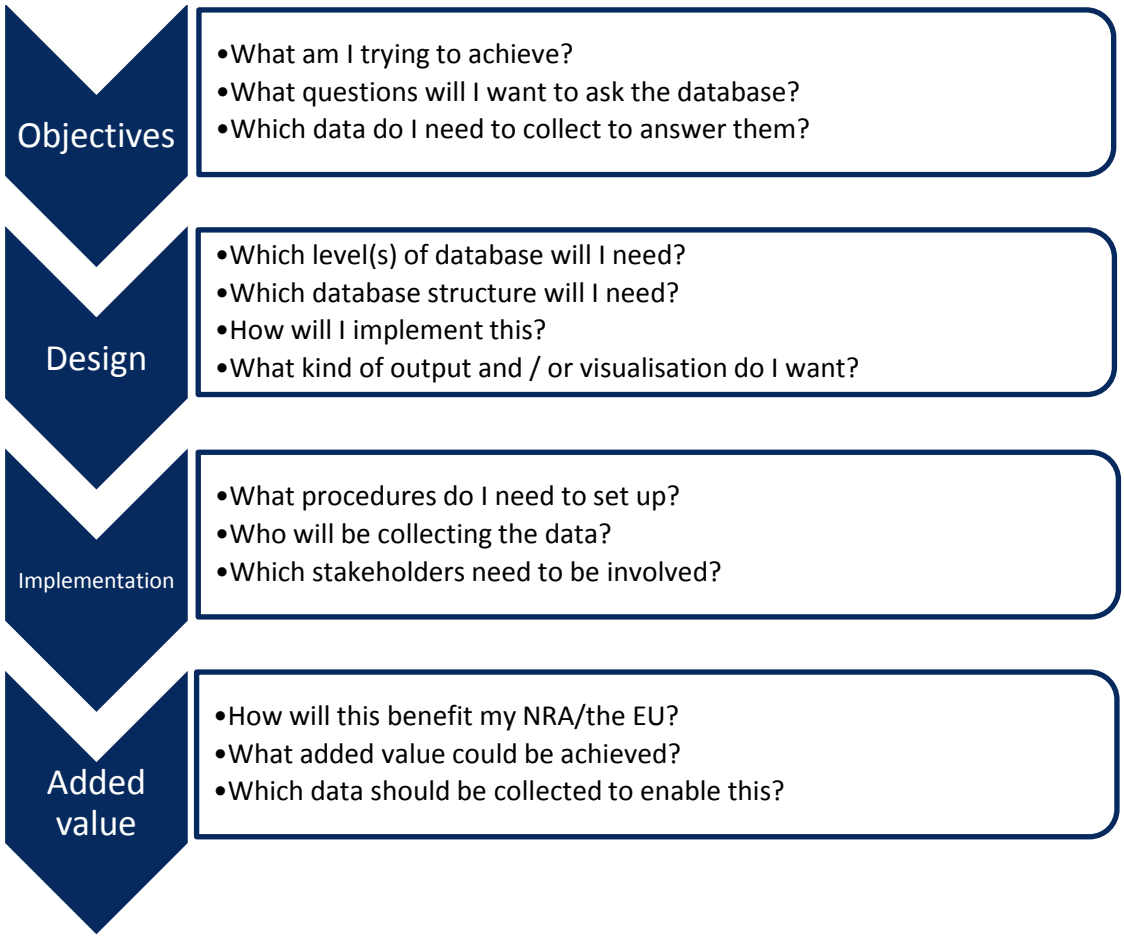


Figure 2: Decision-making process

2.2 Objectives

What am I trying to achieve?
What questions will I want to ask the database?
What data do I need to collect to answer them?

This stage of the process sets out the objectives of implementing a EuRoWCas database. By being clear at this stage, the benefits and resource requirements will be easier to understand and determine in later stages.

As examples of what could be achieved with EuRoWCas, BRoWSER deliverable D1.1 - Benefits Case (July 2013) reported on the results of a consultation exercise in which National Road Authorities, Local / Regional Road Authorities and other relevant organisations were interviewed. In total, twelve organisations were interviewed across nine European countries.

One aspect that was investigated through these interviews was the intended or desired use of these data; interviewees were asked both *'how would you use such data?'* and *'what would [the ability to compare road worker accident data with other countries] allow you to do and why would this be useful?'*. Some of the responses to these questions are reproduced and summarised below:

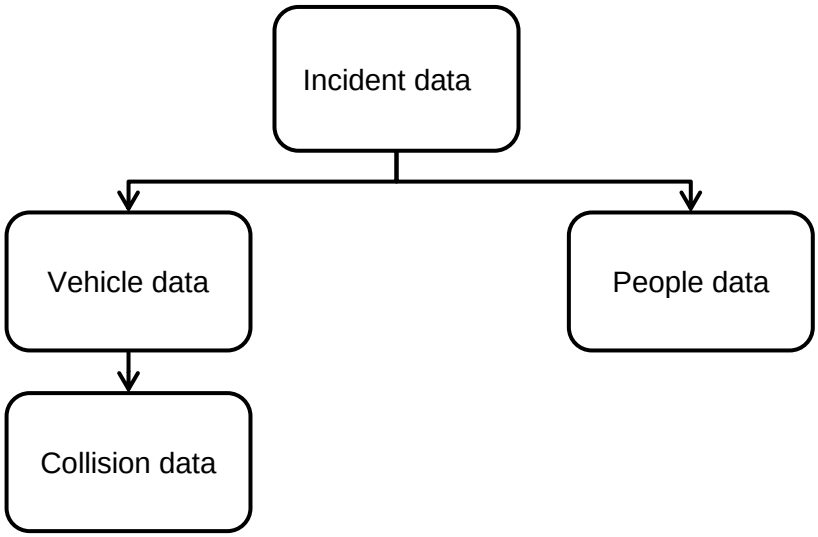
- Benchmarking / comparing performance with other countries
- Demonstrating safety record
- Metrics and trend analysis
- Monitoring performance
- Highlighting need to improve performance
- Pinpointing the issues and emerging trends
- Understanding the impact of different policies
- Case building / justification of policy including access to more data on which to base policy decisions
- Work scheme improvements
- Operational practice improvements
- Harmonisation of road work practices
- Raising awareness of road contractors / workers
- Understanding accident circumstances to improve operational practice and procedures
- Risk assessment and analysis of operational practices
- Calculation of risk exposition by road work types
- Sharing of best practice

Clarity of what is intended to be achieved via EuRoWCas will define what data are required and the quality of those data. The highest quality data will be obtained when all fields in the EuRoWCas common data standard are completed for every incident. However, in practice, and particularly during initial implementation of the system, this may be challenging or unnecessary in all countries. As a result, carefully consider the purpose of the database or databases, what you are trying to achieve and what level of data collection is needed to meet these requirements. Provided the database specification is met, data collection can be easily extended at a later date if required.

The impact of different levels of data collection changes the usability of EuRoWCas data. (The specification for the data is included in this document in Appendix A).

For each incident recorded in the database, the user must input data on three aspects: the incident circumstances, the vehicles involved and the people involved. The first fields that make up these data (the incident circumstances) define the incident and are unique. The remaining data provide additional information useful to understanding the cause(s) of the incident.

Part of the incident data input by the user is the number of vehicles and people involved in the incident. For each vehicle and person involved, an individual vehicle or person record is required, linked to the incident record. For each vehicle involved in the incident, the number of collisions is then requested, in order to allow for a vehicle to be involved in multiple collisions within the same incident. This produces the following hierarchy for the data:



There are four critical fields in the incident circumstances data – country, date, time and location – which must be completed in order to create an incident record. The benefit of having the set of critical fields is that it allows incidents to be counted, but little more. However, even this will be of benefit for road authorities who currently do not have any clear information regarding road worker injury accidents.

As more data are collected, more detailed analysis becomes possible. In terms of a relational database, the lowest level tier of data collected provides the maximum detail at which it is possible to count. For example, if only incident circumstances data are collected (i.e. no information about vehicles or people is collected) all analytical queries must be of the form *'how many accidents were there in which…'*. The criteria forming the filter part of this query (i.e. the '*in which…')* depends on the availability of data fields collected within the incident circumstances dataset; collection of more fields enables more filtering to be carried out and so allows for more detailed analysis.

If 'vehicle level' data are collected (or, similarly, 'people level' data are collected), the questions can become *'how many vehicles / people were….*' or indeed *'how many accidents were there in which one or more vehicle(s) / person / people…'*. As before, the level at which the vehicles or people data can be filtered depends on the level of data collected in each of these areas.

Therefore the data collection levels define what analysis can be carried out on the data and so define the impact of data collection. If only incident circumstances data are collected, this will provide a baseline but little else, which will limit the potential impact of the collected data. Such data would be useful for comparison of national road works safety performance and for

demonstrating the success of safety interventions, but would not be capable of providing detailed information to identify accident mechanisms from first principles or to develop operational safety controls (risk mitigation measures).

The impact of providing more detailed data is that the level of support that the data can provide to road worker safety intervention, monitoring and hazard identification also increases. More detail can guide validation of external theories relating incident risk to road works or site characteristics or other factors. Extensive detail will provide the opportunity to identify risks and issues proactively from the data. Unless all fields are mandatory, it may also be beneficial for subsequent analysis to calculate performance indicators showing the level of completion of the (enabled) data fields; this could form an additional derived field for each entry in the database.

2.3 Design

Which level(s) of database will I need?
What database structure will I need?
How will I implement this?
What kind of output and / or visualisation do I want?

The proposed structure for the EuRoWCas database system is illustrated in **Error! Reference source not found.**. The overall concept is such that, if the technical specification (included in Appendix A) is followed, the software or operating system used to host a EuRoWCas database does not matter, as the data imported into, stored within and exported from the database will be to a common standard.

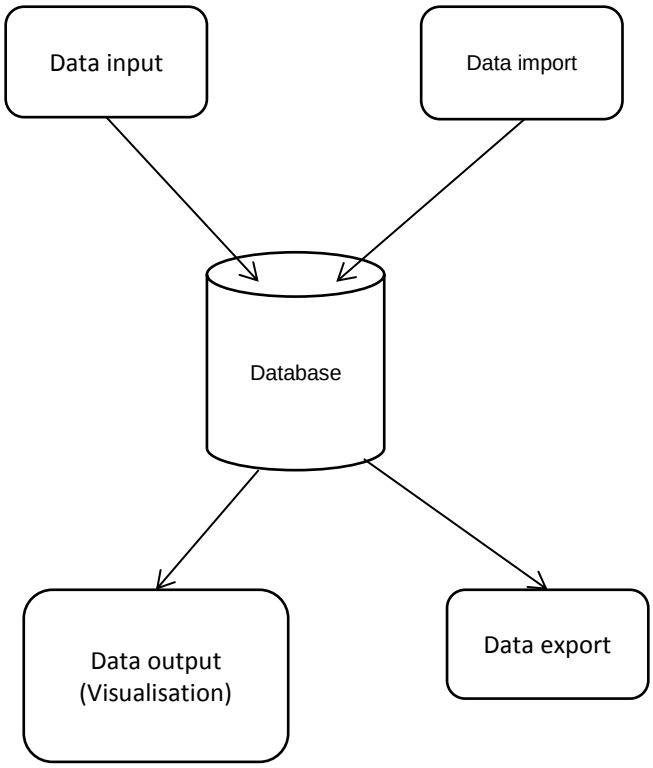


Figure 3: Database system structure

The system structure comprises five elements:

Database: The central data storage structure, which forms the main focus of the specification provided in Appendix A.

Data input: How data are input into the database directly by users.

Data import: How data are imported from other EuRoWCas data sources, for example a sub-contractor's database or a national database. The standard data format would make data import straightforward.

Data output / visualisation: How data can be extracted directly from the database and viewed / analysed through a suitable user interface.

Data export: How data can be downloaded from the database in a raw format for import into another EuRoWCas database or an analysis package. The data format is the same as that for the data import – this is what enables different levels of the database structure to interact.

The implication of the common standard approach is that there can be databases at different operational levels within the EU and Member States. For example:

- The EU-level database can take imports from country-level or region-level databases.
- Country-level databases can take data from region-level or contractor-level databases (or a combination of both).
- Region-level or contractor-level databases can take data from individual databases hosted by contractors, sub-contractors, enforcement authorities etc.

This will be possible due to the harmonisation of the data format via a publically available specification for EuRoWCas rather than via a specific product.

Therefore, once the objectives are clearly defined, then you need to decide at which operational level the database will be implemented and whether an interactive hierarchy of databases is needed.

You will then have to decide exactly how the database(s) should be implemented and either create or procure a system to meet these requirements. The specification provides for flexibility in implementation and is not based on a specific data architecture. The selection of database arrangement will be down to the individual organisation, region or nation recording EuRoWCas-compatible data.

Generally, database designs can be either ‘relational’ or ‘flat’. Within a relational database, data is held in multiple tables that are related to each other using reference fields. These tables are organised in tiers, each of which consists of one (or more) tables that relate to the tier above. This arrangement allows flexibility in the number of values recorded in the lower tiers that relate to a single record at the highest level (e.g. multiple vehicles associated with one incident). This provides for a compact database which has significant advantages when considering import and export of data. It also enables some analyses of the data to be carried out that cannot be carried out efficiently using a ‘flat’ database. It may, however, be more difficult to manage than a ‘flat’ database.

‘Flat’ databases consist of a single table of data. A flat database can also have one entry for each incident, but difficulties are encountered if the number of associated fields is variable (as for the number of vehicles, people and collisions associated with one incident). When there are a variable numbers of fields, the database needs to be pre-defined using the maximum number of vehicles, people and collisions which are ever likely to be recorded. This is difficult to define and restricts the flexibility of the system. This issue could be overcome through the use of multiple entries for one incident with a common incident reference ID; however, this can restrict the analytical functionality as there would not be a unique entry for each incident.

Provided it complies with the common standard, any approach can be followed; the same product may not necessarily be the best solution for all end users. A spreadsheet-style application may be best for a single ‘flat’ table whereas, for a multi-user system, this is unlikely to be suitable.

Any data handling software running under any operating system can be used to host a EuRoWCas-compliant database; as an example, possible database software options under different operating systems could include:

- Filemaker (MacOSx)
- Access (Windows)
- Oracle (Linux)
- FireBird (open source multi-platform)
- MySQL server (multi-platform)
- Specific customised software (e.g. the historic HA AIRS system).
- Web-based system (e.g. the Highways England AIRSWeb system)

The common standard allows for any of these options. It also allows for all these options to communicate via a common interface, i.e. the specified data import / export format.

Similarly, a benefit of the database specification approach is that it enables data output and visualisation applications to be developed and tailored as desired by any end user. There are a range of potential end users, for example:

- A data analyst may require selected fields from the data to be provided as an extract compatible with a spreadsheet package (e.g. Microsoft Excel)
- A statistician may require the “raw data” for import into a specialist data software (e.g. IBM SPSS)
- A non-specialist user may want simple tabulations and basic graphs for management reporting
- A safety manager may want the data reported in specific categories that align to the different reporting criteria particular to their national safety laws

Given the specified design of the data stored, any piece of software that is able to import these data can then be used by any user to process, display, analyse and extract information from the data.

Standardised reports would be possible at different levels, depending on the scope of the database. This could include national benchmarking for performance monitoring or improvement, or international benchmarking for comparison and cooperation. Data visualisation (geo-referenced, if the data contains accurate location information that is GIS compatible) would also be possible, either on a standardised or individual report basis.

Since different implementations of the database will collect different levels of data, there is no ‘one size fits all’ data visualisation package. When identifying a solution, there are three potential options that you should consider:

- an existing product,
- a custom solution, or
- an adaptation of an existing product to meet the end user’s needs.

The first option is for an existing commercial off-the-shelf product, requiring no adaptation or customisation. Whilst products exist that are close to this, any existing product is likely to require compromises in the output, the visualisation, the available analysis tools or potentially all three. This is because EuRoWCas is a new database application and so no existing product has the specific functionality to handle all the potential data held in a EuRoWCas database. Therefore, it is believed that the use of a commercial off-the-shelf product is not currently a possibility (but products may become available in the future).

Secondly, there is the option for a new software product to be built specifically for this purpose, using the database and export specification. This could either be designed to meet an individual user’s needs or be a universal tool making use of all the data that could be held in EuRoWCas. The latter would require central development; the former is likely to be the most expensive option open to authorities, but would, by definition, fulfil all the user’s requirements.

The third option is the adaptation and customisation of an existing product to meet the needs of EuRoWCas as discussed in the previous section. This option is likely to be the most practicable as customisation of software to handle data from different sources is a well-established technique for developing end-user specific products.

2.4 Implementation

What procedures do I need to set up?
Who will be collecting the data?
Which stakeholders need to be involved?

Having established what is required, how it will be stored and how it will be used, the final question is how this will be achieved. In short, the final stage is for you to decide who needs to gather this information and how will they do it, plus who will need to be involved to enable this to happen.

Research shows that the current level of data collection varies considerably by country and hence the approach to setting up the necessary procedures and operational arrangements would also be expected to vary. In theory, the ideal approach to data collection is to collect new data specifically for this purpose, thereby maximising the chances of getting a full data set that is fit-for-purpose; however, practical considerations cannot be ignored, such as the need to avoid duplication of effort and the need to collect these data in the most efficient and cost-effective manner. Therefore where data collection procedures are already in place you should consider using these where possible.

Research carried out for BRoWSER shows there are likely to be three main types of data source that contribute to a EuRoWCas database:

- **EuRoWCas-specific data collection** – where the data are collected specifically for this purpose,
- **existing data collection (road workers)** – where procedures already exist for collection of road worker incident data and data from this source can be processed for use in EuRoWCas,
- **existing data collection (all accidents)** – where procedures already exist for collection of data regarding all road accidents and information regarding road worker accidents can be extracted from these data.

In addition, data can be obtained using two methods – distributed, where the data are collected 'as-live' by the contractors or road workers directly into the database, or centralised, where the data are retrieved retrospectively by a dedicated user from a central database or through other methods.

	Trial-specific	**Existing (road workers)**	**Existing (all accidents)**
Distributed			
Centralised			

The best approach to data collection will be different for different countries. When deciding on the approach, one aspect that you must consider is the level of costs (in terms of effort)

required for both set-up of such data collection and ongoing data collection, together with how the benefit from collecting this data will compare with these. Where data collection is set up from scratch significant effort is usually required from various parties to engage with stakeholders, obtain buy-in, provide any necessary training and set up the procedures and systems required for the data collection to be a success. Conversely, where the approach is to use existing data collection as a base, the effort needed for set-up is likely to be fairly minimal, as it usually requires only the necessary permissions to access the data to be granted.

However, when considering the ongoing effort required, the situation is very different. Where contractors or road workers are inputting the data directly into the spreadsheet, the ongoing effort required by an NRA is minimal as the task becomes part of incident reporting for the contractor. Where existing data are used, significant effort is likely to be required to process these data in order to both identify the incidents that are relevant to EuRoWCas and convert the information into the format required. Another consideration is the level of effort required to validate the incidents recorded; that is, the effort needed to be confident that the incidents recorded via the chosen data collection approach are a true representation of the incidents that actually occurred on the network and to ensure accuracy of the data.

For ‘new data collection’, it is worth noting, however, that the ongoing effort not minimal for the contractors or road workers who are actually collecting these data. Minimising the effort required from workers on the ground is very important, and may be the principal reason for a decision to use existing data collection methods rather than cause additional (or even duplication) of workload.

Regardless of the approach selected, you will need to consider the issue of stakeholder engagement, in particular those who are primarily responsible for the collection of the data, and those whose buy-in is critical for facilitating the process. This will require dissemination of the potential benefits, so that stakeholders can understand the objectives and the value of implementation. Information for a benefits case from the consultation interviews with NRAs is provided in Appendix B.

2.5 Added value

How will this benefit my NRA / the EU?
What added value could be achieved?
Which data should be collected to enable this?

As discussed in Section 2.2, the more data and data fields that are collected, the more detailed the analysis can be and the more benefits the NRA can realise. Therefore, it is recommended that, although you may choose to carry out a staged implementation, there should be a process of monitoring and evaluation, and that data collection should be extended when possible and appropriate. This will require monitoring your objectives and implementing a continuous improvement procedure.

However in addition to the goal of achieving the full EuRoWCas dataset, there are other options that you should consider once the basic data collection procedures are established.

These are opportunities that could be enabled by additional data collection outside the remit of EuRoWCas.

One aspect that could provide significant added value and extend the use of the EuRoWCas dataset is the collection (or increased collection) of data on road works. Information relating to the frequency and duration of works on the network would allow an estimation of the exposure of road workers, and hence provide the possibility of calculating road works accident rates. This would in turn facilitate further benchmarking and comparison across European countries.

Appendix A: Database data specification

General

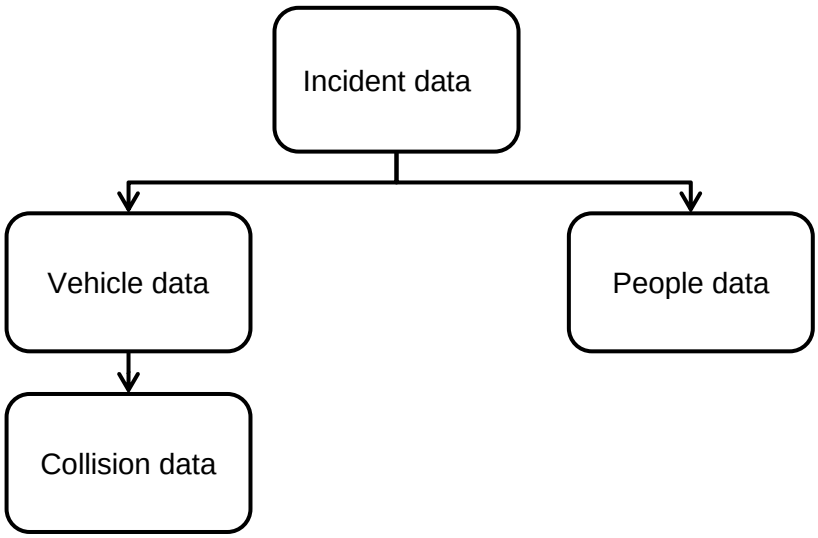
For each incident recorded in the database, the user must input data on three aspects: the incident circumstances, the vehicles involved and the people involved.

The incident circumstances data are divided in several elements:

Base data – basic information about the incident, such as time, date and location and the involvement of people and vehicles.
Site data – information on the carriageway and lane configuration at the time of the incident.
Road works data – information on the road works and associated traffic management in place at the time of the incident.
Environmental data – information on environmental factors such as weather, visibility and lighting conditions.

Part of the base data input by the user is the number of vehicles and people involved in the incident. For each vehicle and person involved, an individual vehicle or person record is required, linked to the incident record. These records should be populated automatically from the information provided in the base data input, with the user then adding additional detail to each vehicle or person record.

For each person recorded as involved in the incident, the user is asked to provide further details such as person type, whether they were involved in a collision (as opposed to a near miss), and the level of any injury that occurred. For each vehicle involved in the incident, further details are also requested. In order to allow for a vehicle to be involved in multiple collisions within the same incident (for example, a vehicle collides with another vehicle and subsequently with a restraint barrier), the user inputs the number of collisions for each vehicle. For each collision, further details are then also collected. If vehicles and/or people are known to be involved in the incident, but no further details are known about them, records are still created in the database. This produces the following hierarchy for the data:



The goal would be to collect all fields in the database for each incident. However, in practice and particularly during initial implementation of the system, this is unlikely to be possible in all countries. There are four critical fields – country, date, time and location – which must be completed in order to create an incident record. If one of the critical fields is missing, the incident cannot be recorded. These fields combine to form the unique incident identifier, or ID. All other fields are strongly recommended but optional, which allows road authorities to carry out a staged implementation if desired.

Regardless of which fields are collected in an individual implementation of the system, all fields must be included in in the data output format in order for the standardised format to be maintained. This means that for fields that are not collected in an individual implementation, a null value must be entered automatically by the system.

Data field specification structure

For each data field in the EuRoWCas database, a number of key parameters must be defined. These are:

- *Data field ID*: Identifier for each data field
- *Data field description**: Description or associated question for the data field..
- *User interface format*: Format through which the user should input the data. In most cases this is a drop-down list of options from which the user must select.
- *Internal database format*: This is the format in which the data should be stored within the database. In most cases the data should be encoded as integers corresponding to the text options presented to the user. This allows different implementations of the system to present the options in different languages whilst keeping the raw data standardised.
- *Precedents*: Associated data field(s) that define whether the particular field is enabled (relevant) or disabled (not relevant). Note that whether 'disabled' fields are visible or not is an individual choice for each implementation.
- *Dependents*: Associated data field(s) that depend on the option selected by the user for this particular field.
- *Options**: For fields presented in the format of drop-down lists, this provides the associated options that the user can select.
- *Null value*: The default value that should be taken by the field if no data are entered (or if the field is not presented to the user as discussed in Section 0). In most cases, the null value is 'unknown' – note that this is the 'Unknown' option in the drop-down list and therefore the value to be recorded in the database is the integer value associated with the 'Unknown' option.

Fields shown with an asterisk (*) will include text that will need to be presented in the native language of the user and so would be translated into different languages in different implementations.

Data fields

Base data

Data field ID	B1
Data field description	**Incident ID**
User interface format	Automated
Internal database format	Text string
Precedents	ID is automatically created based on country, date/time and location
Dependents	Forms part of V1 and P1 for each vehicle and person record
Options	N/A
Null value	N/A

This is a unique compound text string created automatically from country / date / time / location, e.g. UK_YYYYMMDDHHMM_Location. The incident ID should not be numbered due to potential duplication when aggregating datasets. If any of these fields are missing, a record cannot be created for this incident.

Data field ID	B2
Data field description	**Country**
User interface format	Drop-down list
Internal database format	Text string (two letters)
Precedents	None
Dependents	Forms part of B1. Critical field.
Options	BE; BG; CZ; DK; DE; EE; IE; EL; ES; FR; HR; IT:CY: LV; LT; LU; HU; MT; NL; AT; PL; PT; RO; SI; SK; FI; SE; UK
Null value	N/A. Critical field.

These are the EU country codes for the 28 EU Member States.

Data field ID	B3
Data field description	**Road authority**
User interface format	Drop-down list
Internal database format	Text string
Precedents	List populated automatically depending on B2
Dependents	None
Options	Options will need to be defined and encoded on a national level
Null value	Unknown

This should note the road authority responsible for managing the road on which the incident took place.

Data field ID	B4
Data field description	**Date**
User interface format	Calendar (clickable)
Internal database format	Date YYYY/MM/DD
Precedents	None
Dependents	Forms part of B1. Critical field.
Options	N/A.
Null value	N/A. Critical field

Data field ID	B5

Data field description	**Time**
User interface format	Time (selectable) – drop-down hours and minutes
Internal database format	Time HH:MM (24hr)
Precedents	None
Dependents	Forms part of B1. Critical field.
Options	N/A.
Null value	N/A. Critical field.

If exact time is not known, the user should enter an approximate time.

Data field ID	B6
Data field description	**Incident description**
User interface format	Free text
Internal database format	Text
Precedents	None
Dependents	None
Options	N/A.
Null value	Unknown

The incident description is a brief description of the circumstances and will most likely be in the national language. As such, in a pan-European database it will be included just for reference.

Data field ID	B7
Data field description	**Location and direction identifier**
User interface format	Country-specific
Internal database format	Country-specific
Precedents	None
Dependents	Forms part of B1. Critical field.
Options	N/A.
Null value	N/A. Critical field.

The location information will need to be country-specific and may be road number and marker post, coordinates, latitude and longitude etc. The location information should include indication of the carriageway direction. Each country will need to define their own format, which uniquely identifies the location concerned. For pan-European mapping purposes the system will need to convert this into standard geographical coordinates.

Data field ID	B8
Data field description	**How many vehicles were involved in total?**
User interface format	Integer input
Internal database format	Integer (inc. zero)
Precedents	None
Dependents	Creates vehicle records for each vehicle and pre-fills vehicle V1 in each.
Options	Integers (including zero); unknown
Null value	Unknown

Users should enter the number of vehicles known to be involved in the incident (including road user vehicles and road works vehicles).

Data field ID	B9
Data field description	**How many road users were involved in total?**
User interface format	Integer input
Internal database format	Integer (exc. zero)

Precedents	None.
Dependents	Creates person records for each road user and pre-fills P1 and P2=road user in each.
Options	Integers (exc. zero); unknown
Null value	Unknown

Road users should be included regardless of whether they sustained an injury. This field cannot be zero since a road user must be involved in order for the incident to be of relevance to the EuRoWCas database.

Data field ID	B10
Data field description	**How many road workers were injured?**
User interface format	Integer input
Internal database format	Integer (inc zero)
Precedents	None.
Dependents	Creates person records for each road worker and pre-fills P1 and P2=road worker, P6=yes, P8=yes in each.
Options	Integers (exc. zero); unknown
Null value	Unknown

Only injured road workers are recorded individually. The presence of non-injured road workers is recorded in field R7 as either 'road workers present' or 'road workers not present'; this is because (in the absence of road worker injury) the focus is on the potential risk to road workers, which exists independently of the number of workers present.

Site data

Data field ID	S1
Data field description	**Carriageway type**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	None
Options	Motorway; other dual carriageway; primary single carriageway; other single carriageway; unknown
Null value	Unknown

Data field ID	S2
Data field description	**Is there a hard shoulder?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	If yes, enable S3. If no, disable S3
Options	Yes; no; unknown
Null value	Unknown

Data field ID	S3
Data field description	**Was the hard shoulder open to traffic?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled / disabled by S2
Dependents	None
Options	Hard shoulder open for emergency use only; hard shoulder

	open as a running lane; hard shoulder closed; unknown
Null value	Unknown. If disabled, 'not relevant'

Data field ID	S4
Data field description	**Standard number of lanes on carriageway**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enable the correct number of lanes in S5
Dependents	For S4=n, S5 should be enabled n times. If unknown, disable S5.
Options	Unknown;1;2;3;4;5;6
Null value	Unknown.

This is the number of lanes on the carriageway (excluding any hard shoulder) in the absence of works. Note that the definition of a carriageway is "a width of road on which a vehicle is not restricted by any physical barriers or separation to move laterally". This means that for dual carriageways (where there is a barrier or separation) S4 should be the number of lanes per direction; for single carriageways, S4 should be the total number of lanes on the road. .

Data field ID	S5
Data field description	**Lane configuration**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Field created for each of n lanes in S4.
Dependents	None
Options	Unknown; Open to traffic; Open as contraflow; Closed
Null value	Unknown. If disabled, 'not relevant'.

Data field ID	S6
Data field description	**Junction detail**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	None
Options	Unknown; not at or within 20 metres of a junction; at/on a slip road; at/on a roundabout; T junction; crossroads; other junction
Null value	Unknown

Data field ID	S7
Data field description	**Permanent speed limit**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	None
Options	130kph; 120kph; 110kph (70mph); 100kph (60mph); 90kph; 80kph (50mph); 70 kph; 60kph (40mph); 50kph (30mph); 40kph; 30kph; unknown
Null value	Unknown

For individual countries the options could be customised to show only kph or mph. In this case, the underlying encoding of the options must remain unchanged regardless of which options are displayed.

Road works data

Data field ID	R1
Data field description	**Was a temporary speed limit in place?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	If yes, enable R2 and R3. If no or unknown, disable R2 and R3
Options	Yes; No; Unknown
Null value	Unknown

Data field ID	R2
Data field description	**Was this temporary speed limit advisory or mandatory?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by R1 = yes.
Dependents	None
Options	Advisory; Mandatory; Unknown
Null value	Unknown. If disabled, 'not relevant'

Data field ID	R3
Data field description	**Temporary speed limit**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by R1=yes
Dependents	None
Options	130kph; 120kph; 110kph (70mph); 100kph (60mph); 90kph; 80kph (50mph); 70kph; 60kph (40mph); 50kph (30mph); 40kph; 30kph; unknown
Null value	Unknown. If disabled, 'not relevant'.

For individual countries the options could be customised to show only kph or mph. In this case, the underlying encoding of the options must remain unchanged regardless of which options are displayed. Since different speed limits often apply across a work zone, the user should select the speed limit where the incident occurred.

Data field ID	R4
Data field description	**Road works classification type**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	None
Options	Static - short daytime (i.e. up to 8 hours); static - short nighttime (i.e. up to 8 hours); static – medium (more than 8 hours and up to 24 hours; static – long (more than 24 hours); mobile works; emergency / incident support; unknown
Null value	Unknown

Data field ID	R5
Data field description	**Country-specific road works description**

User interface format	Free text
Internal database format	Text string
Precedents	None
Dependents	None
Options	N/A
Null value	Unknown

Free text field so that users can reference standard layouts or similar (within country this could potentially pre-fill fields)

Data field ID	R6
Data field description	**Road works activity period**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	None
Options	During installation of works; during works period; during removal of works; unknown
Null value	Unknown

Data field ID	R7
Data field description	**Were there road workers present at the time of the incident?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	None
Options	Yes; no; unknown
Null value	Unknown

Data field ID	R8
Data field description	**Was advance signing present?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	If yes, enable R9. If no or unknown, disable R9
Options	Yes; no; unknown
Null value	Unknown

Data field ID	R9
Data field description	**Advance signing type**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by R8 = yes
Dependents	None
Options	Hard signs only (static); hard signs only (mobile); electronic signs only (static); electronic signs only (mobile); combination of both hard and electronic (static); combination of both hard and electronic (mobile); unknown
Null value	Unknown. If disabled, ‘not relevant’.

Data field ID	R10
Data field description	**Traffic control measures**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	None
Options	None; automatic traffic signals; manual traffic control; unknown
Null value	Unknown

Data field ID	R11
Data field description	**Approx length of road works (metres)**
User interface format	Integer input or unknown
Internal database format	Integer
Precedents	None
Dependents	None
Options	N/A
Null value	Unknown

This should be the distance from the first physical traffic management intervention to the end of the works end zone.

Data field ID	R12
Data field description	**Did the road works involve a contraflow?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	If yes, enable R13. If no or unknown, disable R13.
Options	Yes;no;unknown
Null value	Unknown

Data field ID	R13
Data field description	**Contraflow type**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by R12 = yes
Dependents	None
Options	Full; tidal; unknown
Null value	Unknown. If disabled, ‘not relevant’

Data field ID	R14
Data field description	**Was the incident on the carriageway or off the carriageway?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	If off, enable R15 and disable R16 and R17. If on, enable R16 and disable R15. If unknown, disable R15 and R16
Options	On carriageway; off carriageway; unknown

Null value	Unknown

Data field ID	R15
Data field description	**Was the incident on the verge or in the central reserve?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by R14 = off carriageway
Dependents	None
Options	Verge; central reserve; unknown
Null value	Unknown. If disabled, 'not relevant'

Data field ID	R16
Data field description	**Was the incident mainly on the hard shoulder, on a live carriageway or within the closure?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by R14 = on carriageway or both.
Dependents	If 'within closure', enable R17. If any other option, disable R17.
Options	On hard shoulder; on live carriageway (i.e. on lane open to traffic); within closure; unknown
Null value	Unknown. If disabled, 'not relevant'

If the incident occurred within a hard shoulder closure, the user should select 'within closure'.

Data field ID	R17
Data field description	**What delineation was present?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by R16 = within closure
Dependents	None
Options	Incident occurred behind cones; incident occurred behind barrier; incident occurred behind panels; unknown
Null value	Unknown. If disabled, 'not relevant'.

Data field ID	R18
Data field description	**Incident location zone**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	None
Options	Advanced warning zone; transition area (entrance); transition area (exit); works zone; unknown
Null value	Unknown

Environmental data

Data field ID	E1
Data field description	**Time of day**
User interface format	Drop-down list
Internal database format	Integer

Precedents	None
Dependents	If daylight, disable E2. If darkness or dawn / dusk, enable E2.
Options	Daylight; darkness; dawn / dusk
Null value	Unknown

Data field ID	E2
Data field description	**Lighting in use (works lighting or street lighting)**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by E1 = darkness or dawn / dusk.
Dependents	If lighting in use, enable E3. If no lighting in use or unknown, disable E3.
Options	Lighting in use; no lighting in use; unknown
Null value	Unknown. If disabled, 'not relevant'.

Data field ID	E3
Data field description	**Type of lighting**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by E2 = lighting in use
Dependents	None
Options	Works lights; street lights only; unknown
Null value	Unknown. If disabled, 'not relevant'.

Data field ID	E4
Data field description	**Weather conditions**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	None
Options	Fine; rain / snow; fog / mist; unknown
Null value	Unknown

Data field ID	E5
Data field description	**Visibility conditions**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	If poor, enable E6. If good or unknown, disable E6.
Options	Good; poor; unknown
Null value	Unknown

The description (or associated help message) should include examples of visibility constraints to assist the user in understanding conditions that may be described as poor.

Data field ID	E6
Data field description	**Visibility constraint**
User interface format	Drop-down list

Internal database format	Integer
Precedents	Enabled by E5 = poor
Dependents	None
Options	Weather; spray from vehicles; low sun; road layout (e.g. bend, hill crest); object / vegetation blocking view; other; unknown.
Null value	Unknown. If disabled, 'not relevant'

If more than one constraint is relevant, the user should select the option felt to have been the most significant factor.

Data field ID	E7
Data field description	**Road surface condition**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	None
Options	Dry; wet/damp; snow; frost/ice; flood (surface water over 3cm deep); unknown
Null value	Unknown

Vehicles data

Vehicles records are created from B8, one record for each vehicle. V1 is created and pre-filled automatically for each.

Data field ID	V1
Data field description	**Vehicle ID**
User interface format	Automated
Internal database format	Text string
Precedents	Created from B1 in the format 'Incident ID_n'
Dependents	None
Options	N/A
Null value	N/A

If no further details are known, the record for the vehicle is still created.

Data field ID	V2
Data field description	**Was this a road user vehicle or a road works-related vehicle?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	If road worker vehicle, enable V3 and disable V4. If road user vehicle, enable V4 and disable V3. If unknown, disable V3 and V4.
Options	Road works related vehicle; road user vehicle; unknown
Null value	Unknown

Data field ID	V3
Data field description	**Was the vehicle equipped with a crash cushion?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by V2 = road works related vehicle

Dependents	None
Options	Yes; no; unknown
Null value	Unknown. If disabled, 'not relevant'

Data field ID	V4
Data field description	**Road user vehicle type**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by V2 = road user vehicle
Dependents	None
Options	PTW; bus/coach; car (inc minibus up to 9 people); light goods (<=3.5 tonnes); medium goods (>3.5 tonnes but <7.5 tonnes or a minibus 9 or more people); heavy goods (7.5 tonnes or more); other motorised (e.g. agricultural); non-motorised; unknown
Null value	Unknown. If disabled, 'not relevant'.

Data field ID	V5
Data field description	**Intended manoeuvre**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	None
Options	Reversing; parked; slowing / stopping; moving off; going ahead; turning; changing lane / overtaking; unknown
Null value	Unknown

Data field ID	V6
Data field description	**Was this vehicle involved in a collision or a near miss?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	If collision, enable V7 and V8. If near miss, disable all remaining 'V' fields. Also feeds into O2.
Options	Collision; near miss
Null value	Unknown

Data field ID	V7
Data field description	**How many collisions was this vehicle involved with?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by V6 = yes
Dependents	For each collision enable V8, V9 and V10.
Options	Integers (excluding zero)
Null value	Unknown. If disabled, 'not relevant'

For each collision that this individual vehicle was involved in (recorded in V7), the following data fields should be enabled, thus creating subsets of collision data for each vehicle. This is so that the data for a vehicle which is involved in several collisions within the same incident can be recorded (e.g. a vehicle collides with another and is pushed into a barrier).

Data field ID	V8
Data field description	**What type of collision?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by V6=yes.
Dependents	If vehicle/equipment, enable V9 and V10 and disable V11. If vehicle/vehicle, enable V9 and V11 and disable V10. If vehicle/pedestrian, enable V9 and disable V10 and V11. If unknown, disable V9, V10, V11.
Options	Vehicle / vehicle; vehicle / pedestrian; vehicle / equipment; unknown
Null value	Unknown. If disabled, 'not relevant'
Notes	

Data field ID	V9
Data field description	**First point of impact on vehicle**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by V8 <> 'unknown'.
Dependents	None
Options	Front; back; offside; nearside; unknown
Null value	Unknown. If disabled, 'not relevant'

This field is independent of whether the vehicle hit something or was hit by something.

Data field ID	V10
Data field description	**Equipment / object hit**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by V8 = vehicle / equipment
Dependents	None
Options	Permanent road feature; temporary sign; temporary barrier (i.e. temporary vehicle restraint); delineator (e.g. cones); works lighting; works tools or equipment; construction materials; unknown
Null value	Unknown. If disabled, 'not relevant'

Data field ID	V11
Data field description	**Other vehicle ID**
User interface format	Drop-down list
Internal database format	Text string
Precedents	Enabled by V8 = vehicle / vehicle
Dependents	None
Options	List automatically populated by B8 and associated V1 for each vehicle.
Null value	Unknown. If disabled, 'not relevant'

People data

Person records are created from B9 and B10, one record for each road user and injured road worker. P1 is created and pre-filled automatically for each and P2 is pre-filled for each. P6 and P8 can be pre-filled for road workers.

Data field ID	P1
Data field description	**Person ID**
User interface format	Automated
Internal database format	Text string
Precedents	Created from B1 in the format 'Incident ID_n'
Dependents	None
Options	N/A
Null value	N/A

If no further details are known, the record for the person is still created.

Data field ID	P2
Data field description	**Person type**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Pre-filled depending on B9 or B10.
Dependents	If road worker, enable P5. If road user, disable P5.
Options	Road worker; road user; unknown
Null value	Unknown

Data field ID	P3
Data field description	**Person location**
User interface format	Drop-down list
Internal database format	Integer
Precedents	None
Dependents	If driver or passenger, enable P4. If on foot, other or unknown, disable P4. If P3 = on foot AND P6 = yes, enable P7.
Options	Driver; passenger; on foot; other; unknown
Null value	Unknown.

Data field ID	P4
Data field description	**Associated vehicle**
User interface format	Drop-down list
Internal database format	Text string
Precedents	Enabled by P3 = driver or passenger
Dependents	None
Options	List automatically populated by B8 and associated V1 for each vehicle.
Null value	Unknown. If disabled, 'not relevant'

Data field ID	P5
Data field description	**Road worker activity**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by P2 = road worker
Dependents	None

Options	Installing/removing TTM; conducting works/inspection; vehicle recovery; other; unknown
Null value	Unknown. If disabled, 'not relevant'

Data field ID	P6
Data field description	**Was this person involved in a collision?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Can be pre-filled for road workers.
Dependents	If yes and if P3 = on foot, enable P7. Also feeds into O2.
Options	Yes; no; unknown
Null value	Unknown.

Data field ID	P7
Data field description	**Associated vehicle (pedestrian collision)**
User interface format	Drop-down list
Internal database format	Text string
Precedents	Enabled by P3 = on foot AND P6 = yes
Dependents	None
Options	List automatically populated by B8 and associated V1 for each vehicle.
Null value	Unknown. If disabled, 'not relevant'

Data field ID	P8
Data field description	**Was this person injured?**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by P6 = yes. Can be pre-filled for road workers.
Dependents	If yes, enable P9. If no or unknown, disable P9. Also feeds into O2.
Options	Yes; no; unknown
Null value	Unknown. If disabled, 'not relevant'

Data field ID	P9
Data field description	**Injury level**
User interface format	Drop-down list
Internal database format	Integer
Precedents	Enabled by P8 = yes
Dependents	Feeds into O2.
Options	Killed; major injury; minor injury; unknown
Null value	Unknown. If disabled, 'not relevant'

For this field, 'killed' means the injured person died on site or within 30 days of the incident, 'major injury' means that the injured person was hospitalised or had seven or more consecutive days off work, 'minor injury' means that the injured person was treated at the scene and had less than seven consecutive days off work.

Other data

Data field ID	O1

Data field description	**Any other consequences**
User interface format	Free text
Internal database format	Text
Precedents	None
Dependents	None
Options	N/A
Null value	Unknown

As for the incident description, for different countries this will be in different languages and is included only for reference.

Data field ID	O2
Data field description	**Overall incident level**
User interface format	N/A
Internal database format	Automated
Precedents	Created from V6, P6, P8, P9 (see below)
Dependents	None
Options	Near miss, non-injury collision, minor injury collision, major injury collision, fatal collision; unknown
Null value	Unknown.

The overall incident level is a derived field created from the data input into fields:

- V6 (Was this vehicle involved in a collision?)
- P6 (Was this person involved in a collision?)
- P8 (Was this person injured?)
- P9 (Injury level)

The following logic applies:

- If V6 = No and P6 = No for ALL vehicles and people involved in the incident then O2 = near miss.
- If V6 = Yes or P6 = Yes for any vehicle or person involved in the incident, then if P8 = No for ALL people involved in the incident, then O2 = 'non-injury collision'.
- If V6 = Yes, P6 = Yes, P8 = Yes for any vehicle or person involved in the incident, then the 'most serious' injury level recorded in P9 (for any person) defines the injury level for the whole incident, e.g. O2 = 'minor injury collision', 'major injury collision' or 'fatal collision'.
- If V6 and P6 are unknown for all vehicles and people involved in the incident, then O2= unknown.

Appendix B: Benefits case

Benefits for a EuRoWCas database were identified from the consultation interviews with NRAs. General benefits include an improvement in data quality and utility for road worker safety analyses. In addition, access to information on good practices in road worker safety data collection and a set of standard definitions.

A summary of the benefits relating to what can be done with the EuRoWCas database is provided in **Table 1**. The benefits are provided alongside evidence for the benefit obtained via the interviews.

Table 1: Summary of benefits

What we would like to do with the data	What are the benefits	Organisation	Evidence from interviews
Benchmarking and monitoring performance			
Benchmarking internally within a country or region, monitoring performance over time and impact of policy changes	Monitor performance over time and determine performance levels Track impact of policy changes on performance	HA, England	Development of formalised metrics to monitor performance and trend analysis methods.
		NRA, Ireland	Determine what practices and policies are successful and what could be done better.
		Transport Scotland	Monitoring performance over time. Pin-pointing the real issues and emerging trends.
		FRA, WRD, Belgium	Highlight new challenges effectively. Raise awareness of road contractors / road workers.
Benchmarking internally between contracting firms and/or by project, monitoring performance over time and impact of policy changes	Identify under-performing contractors and use data to inform improvements	HA, England	Already performing analyses to compare performance by region and contractors.
Cross-European comparison and assessment (similar sized countries), monitoring performance over time and impact of policy changes	Make meaningful comparisons in performance and identify potentially useful policies	HA, England	Demonstration of safety record and performance levels.
		Transport Scotland	Comparing performance with other countries and highlighting the need to improve. Understanding what has been done elsewhere and the impact of policies/equipment.
		DRDNI, Northern Ireland	It would be useful to know how NI Roads Service is performing against others in UK and Europe. If found to be performing well, then this will act as corporate assurance. If not performing well then this would provide impetus for improvement.

What we would like to do with the data	What are the benefits	Organisation	Evidence from interviews
		NRW, Germany	Benchmarking on good practices. Harmonisation of road work practices.
		FRA, Belgium	Benchmarking on good practices. Harmonisation of road work practices.
		WRD, Belgium	Compare results to be able to objectively confirm or invalidate operational practices on the basis of their associated risk. Focus the experts' and working groups' works on measures have a high potential.
		DARS, Slovenia	Benchmarking on good practices. Raising awareness of road users, road workers, to wider society.
		NRA, Ireland	Current strategy is based on best practices in other countries. The data and database would help benchmark with other countries and compare current performance with the European standard. Allow assessment of whether or not they can do better.
		RWS, Netherlands	Determine what others are doing if they are performing better.
Determining effectiveness of approach/principles			
European level: Larger data source for European research on Road Worker Safety	Co-financing of fundamental research Consistent dataset available for fundamental research	FRA, Belgium	The Flemish Road Agency already co-finances the CEDR Research Programme.
		WRD, Belgium	In-depth analysis of practices to assess risks linked to road work types and operational practices.
		NRA, Ireland	This would allow more significant research to be performed than data from just one country and will facilitate more research on road worker safety than has been completed so far.

What we would like to do with the data	What are the benefits	Organisation	Evidence from interviews
European level: Evidence base to inform European standards and policy development – source of data on what is effective and what is not	Greater source of data for research into the impact of different policies and standards on road worker safety	HA, England	Determine what does and does not work.
		Welsh Government	Gathering of data to underpin policy.
		FRA, Belgium	Improve operational practices (work scheme) for better road user and road worker safety through lessons learned. Harmonisation of road work practices.
		Belgium Federation of Road Contractors	Understand accident circumstances to improve operational practices and procedures.
		WRD, Belgium	Objective confirmation of the benefits/dis-benefits of different operational practices. Focus experts and working groups on high potential measures. Calculation of the risk exposure by road work types.
		NRA, Ireland	Would help create a standardised / consistent work zone format across Europe (or Harmonisation or road work practices).
		NRW, Germany	After comparisons, look for the best way to improve safety for road workers.
		RWS, Netherlands	Identify the risk factors for road works. Look at the actual impact of different practices on overall safety levels.
		DARS, Slovenia	Benchmarking on good practices. Improvement of operational practice. Understanding new layout design (e.g. self-explaining road works), new equipment etc.

What we would like to do with the data	What are the benefits	Organisation	Evidence from interviews
Individual level: Source of data for small nations to use in informing their own policy development	Opportunity for smaller countries to benefit from learning from other countries	FRA, Belgium and WRD, Belgium	Both road agencies are CEDR members and are therefore interested to use data shared transnationally to inform their own policy development; including Road safety policy.
		Welsh Government	It would allow access to more data. In Wales there simply isn't sufficient number of incidents upon which to base policy decisions.
		NRA, Ireland	The current strategy is based on best practices in other countries. The data and database would therefore provide more information to further develop the current strategy.
Case building			
Quantification of resourcing of road worker safety and comparison between countries	NRAs can determine an appropriate level of resourcing for road worker safety based on those countries with a good road worker safety record	Welsh Government	How much other countries are spending on road worker safety would be useful to make the case for increased investment.
Case building for investment	With increased understanding of the effectiveness of different policies, it becomes easier to make the case for increased investment in road worker safety	HA, England	Help with case building and evidencing recommendations.
		Welsh Government	It would be good to know what does and does not work. This will help with case building and evidencing recommendations.
		DRDNI	As a result of benchmarking, if as country is not doing well then it may mean greater attention is given to road worker safety and increased investment may be sought.