ROAD SAFETY DATA IN AFRICA:

A proposed minimum set of road safety indicators for data collection, analysis, and reporting

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Abbreviations

ARSO	African Road Safety Observatory
AU	African Union
EC	European Commission
EU	European Union
FHA	Federal Highway Administration
FIA	Federation Internationale de l'Automobile
GIS	Geographic Information System
GPS	Global Positioning System
IRAP	International Road Assessment Programme
IRTAD	International Traffic Safety Data and Analysis Group
ITF	International Transport Forum
LRS	Linear Referencing System
MAIS	Maximum Abbreviated Injury Scale
OECD	Organisation for Economic Co-operation and Development
OISEVI	Ibero-American Road Safety Observatory
REC	Regional Economic Communities
SDG	Sustainable Development Goal
SPI	Safety Performance Indicators
SSATP	Africa Transport Policy Program
UN	United Nations
UNECA	United Nations Economic Commission for Africa
WB	World Bank
WHO	World Health Organization

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Summary

Road safety in Africa remains a big challenge. Globally, Africa has the highest fatality rate of all the continents, despite having the lowest motorization rate and smallest road infrastructure network.

Through the Global Plan for the Decade of Action (2011-2020), the African Road Safety Action Plan, the African Road Safety Charter, and the targets set out in the Sustainable Development Goals (SDGs), Africa has made strong commitments to improve road safety outcomes on the continent.

However, documents assessing the magnitude of the problem show that there exists a need to address it by implementing effective and efficient interventions, which require determination, professional qualification, and personnel and economic resources.

In order to make informed decisions on effective interventions to mitigate this challenge, a deeper analysis of the road safety-related environment in the region is required. The required data includes, but is not limited to, crash-related data – for example, the location of the most serious crashes, the type of road users most commonly involved in road crashes categorized by type of road environment, or the impact of foreign drivers involved a crash in a particular country.

This document outlines a process that began in 2017 to define a common set of indicators to be collected, analyzed, and monitored by African countries, as part of their efforts to improve road safety in Africa. Some of these indicators will be collected individually at country level and serve country level decision-making. A smaller subset of indicators could be reported in aggregate form to regional or global road safety observatories and inform other decisions. This data-focused effort runs in parallel with the effort led by the Africa Transport Policy Program (SSATP) to establish an African Road Safety Observatory to act as a platform for faster and more homogeneous strengthening of road safety data in the 54 African countries under the African Union (AU).

This report details road safety data systems on the continent and describes the process required to agree on a common set of police-reported, crash-related variables. It is presented in three sections. In the first section, the challenge of and the commitment to address road safety in Africa is set out, together with recommendations to improve road safety data on the continent. The second section documents relevant points to consider when deploying and improving road safety- and crash-related data systems. The third and final section documents the methodology undertaken to produce a list of agreed upon crash-related variables, as well as their values. African country representatives participated in this process, with the expectation that this list will help them to consolidate and aggregate the information they collect, as well as assisting collaboration. It was further expected that data collection would be standardized. The detailed list of these variables (including the ones chosen as the core variables) are presented as Appendix B of this report.

Part A: The rationale for road safety data in Africa

Introduction

According to the Global Status Report on Road Safety released in 2018 by the World Health Organization (WHO), "Road traffic injuries claim more than 1.35 million lives each year and have an enormous impact on health and development."

In Africa, the risk of road traffic death is increasing annually. Statistics from the WHO Africa region show that road traffic fatality estimates increased from 24.1 per 100,000 population in 2010 to 26.6 per 100,000 population in 2016. If action is not taken, road trauma in Africa is expected to worsen further, with fatalities per capita projected to double from 2015 to 2030.

The risk of a road traffic death varies significantly from region to region, and there has been little change in regional road traffic death rates of since 2010. Globally, the highest rates are still found in the African region, while the European region has a rate far below the global average at 9.3 per 100,000 population, relative to the global rate of 17 (WHO 2018).

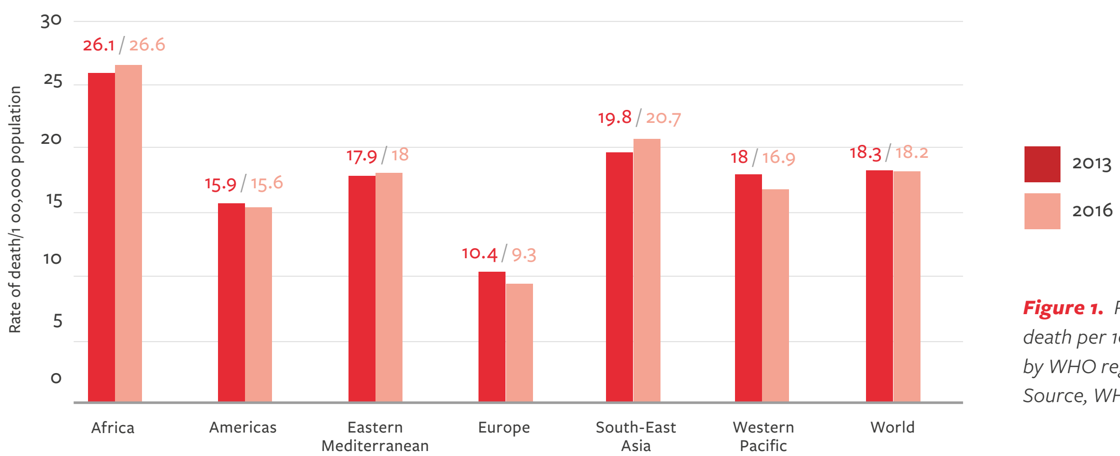


Figure 1. *Rates of road traffic death per 100,000 population by WHO regions: 2013, 2016. Source, WHO 2018*

The Global Status Report on Road Safety 2018 indicates that 53 percent of the road users killed in Africa are vulnerable road users. Of these, 40 percent are pedestrians, four percent are cyclists, and nine percent are people using two- or three-wheelers.

Despite this evidence, most of the existing data collection systems mainly focus on car occupants and produce figures that are substantially different (and in general lower) than figures derived from mathematical models using socioeconomic variables specific to each country. Therefore, this raises the issue of possible underreporting of police-based data sources on the continent.

The United Nations (UN) Global Plan for the Decade of Action for Road Safety 2011-2020 called for action across member states to stabilize and reduce the number of road fatalities and serious injuries. The plan looked to achieve this through better road safety management, safer roads and mobility, safer vehicles, safer road users, and improved post-crash response. Among the suggestions for improving road safety management was the development of data systems to monitor and evaluate outcomes. This highlighted the importance of data systems in identifying priority intervention areas, such as the most vulnerable road users or most common crash interactions, and in evaluating the effectiveness and efficiency of adopted interventions.

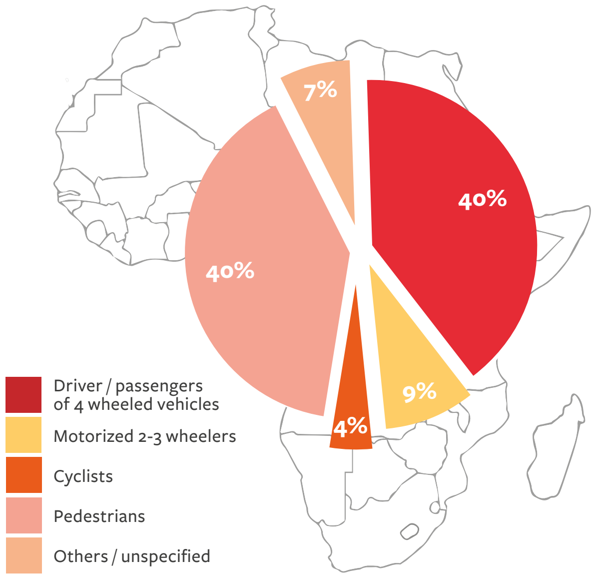


Figure 2. *Distribution of deaths by road user type (WHO Region Africa region selected). Source, WHO 2018*

The WHO status reports on road safety have highlighted the fact that there is a substantial lack of detailed knowledge on the number of road crashes and fatalities occurring in Africa, as well as on the factors that lead to road crashes or their consequences. The 2015 status report estimated that, in 2013, the number of road fatalities occurring in Africa amounted to 31 percent of total world reported road fatalities. Furthermore, it also highlighted that 40 percent or more of African countries have not taken any significant action on:

- Establishing, strengthening, and harmonizing the injury data system for health facilities;
- Engaging local research centers on road safety data management;
- Building capacity for road safety data management;
- Mandatory reporting, using standardized data; or
- Sustainable funding for road safety data management

Fewer than 18 percent of countries monitor important road safety performance indicators, such as seatbelt or helmet use.

In 2014, SSATP acknowledged that Africa's road safety performance has deteriorated to a point where it is becoming a major obstacle to Africa's competitiveness and development. Unfortunately, road safety impacts the most vulnerable road users and the poor (SSATP, 2014).

The UN Economic Commission for Africa (UNECA) found through a review of the implementation of the Africa Road Safety Action Plan that most countries which responded to the review are performing below average, as far as data management is concerned.[1] The chart below, taken from the review, illustrates the self-assessment of the countries' performance with respect to the following parameters:

- Existence of a national database
- Mandatory reporting on crash data
- Analysis and reporting system
- Harmonized data
- Harmonized vehicle and driver registration system
- Data management capacity
- Engagement with local research centers
- Enhanced injury data system
- Enhanced baseline data on road safety.

[1] UNECA, Mid-term review of the Africa Road Safety Action Plan, 2015.

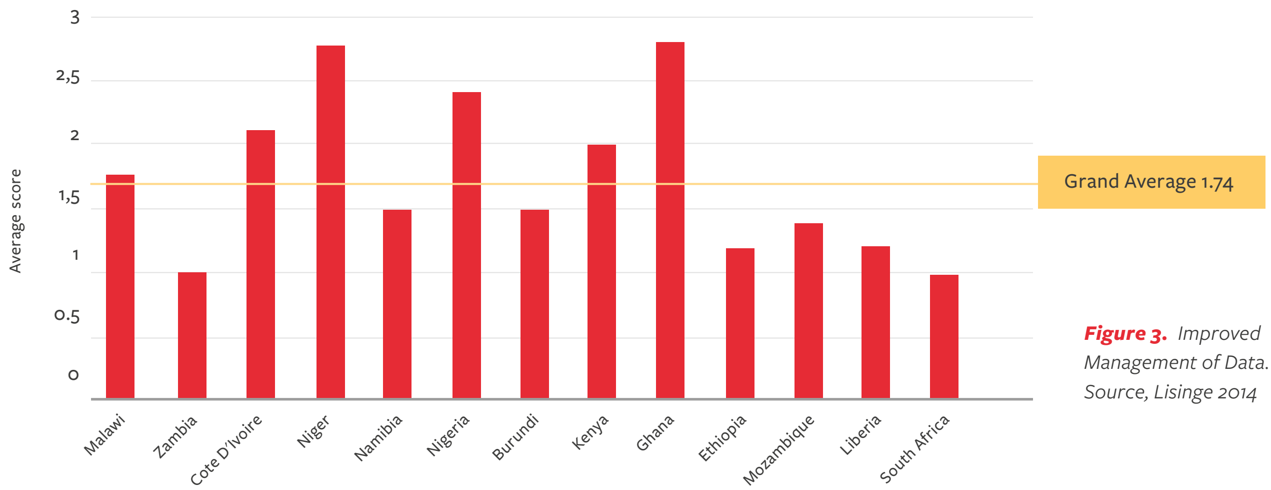


Figure 3. *Improved Management of Data. Source, Lisinge 2014*

Appendix A summarizes the main road safety initiatives on a regional and subregional level that incorporated these road safety data considerations.

The need for road safety data

Road safety data is essential to road safety management. It can be used to identify hazardous locations, diagnose safety problems, understand the types of crashes that are prevalent, assess the effectiveness of interventions, monitor country-level trends, tailor and prioritize prevention efforts, assess progress, and compare the scale of road traffic deaths and injuries relative to deaths and injuries from other causes. Having data to back up the need for action is vital, not only to gain support, but also to advocate for resources and capacity building. The lack of accurate and reliable data hampers progress towards safer road and transportation systems in any country. The availability of data is key to accurately identifying patterns of crashes and targeting those that are likely to yield the most effective results. (WHO 2018; PIARC 2007).

The most important aspect of collecting data relates to its validity. Historically, the most commonly monitored road safety indicator has been the number of crashes with severe outcomes. Fatality counts are the most precise example of this. However, in many countries around the world, the method of determining these statistics is disputed. For instance, according to the WHO Global Road Safety status report from 2018, the total number of road deaths officially reported by all African countries in 2016 amounted to 73,854 – whereas the WHO estimations suggest 291,998 deaths occurred. This is almost a 300 percent difference. And these discrepancies have widened since the WHO report from 2015.

The ability to obtain unbiased data is key to assessing the magnitude of the problem and essential in assisting decision-making for road safety policies. The WHO estimates, which are a model based on the situation in comparable countries, consider other known factors that affect the number of road traffic deaths in that country. This needs to be understood by those using the data, in order to ensure that conclusions drawn from it can be supported as findings, rather than theories.

Underreporting of road traffic data in Africa

The degree to which the statistical output of a country's data system reflects the actual road safety situation is affected by the accuracy of recording and reporting of the data.

Underreporting is a common issue of concern in Africa. Police records are the primary source used to determine the magnitude of road accidents and injuries. However, not all road accidents or injuries are reported to or recorded by the police.

Underreporting of accidents varies according to severity, vehicle type, and casualty age. It is especially frequent in the cases of single-vehicle accidents, pedestrian accidents, and accidents involving bicycles, mopeds, or motorcycles (Safer Africa 2019).

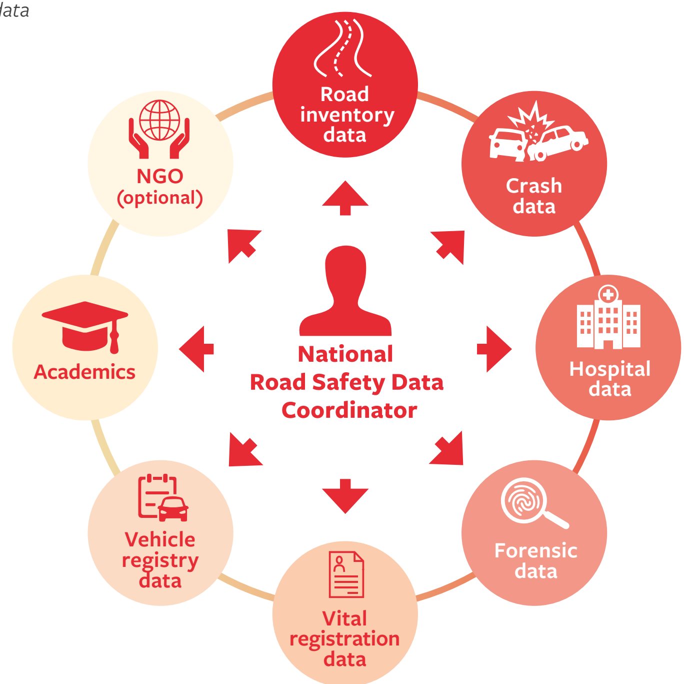
In many countries, resources for the collection of data are in decline, partly due to increasing pressure on law enforcement agencies to address other priorities. This is leading to many countries or law enforcement agencies to consider changing the types of crashes that are reported on – for example, only crashes resulting in fatalities. This could result in a relatively large proportion of crashes – especially those that result in severe injuries and have a substantial impact on quality of life and on the economy – not being reported, particularly in urban areas.

In a study conducted in Ethiopia, researchers compared the country's two main sources of road safety data and found that while police records captured 57.4–60.9 percent of road deaths and 23.5–23.9 percent of injuries, hospital records captured just 31.5–33.4 percent of road deaths and 55.2–56 percent of injuries. Deaths and injuries among females, younger victims, cyclists, motorcyclists, and pedestrians were found to have been particularly underreported by traffic police. The study concluded that neither of the two data systems independently provided accurate coverage of road traffic-related deaths and injuries. Strengthening both systems is necessary to obtain accurate information on road accidents and human causalities.[2]

The type of road safety data to collect, and how and when to collect it, is critical. One of the most important uses of crash data is to identify high-risk locations where crashes have, or are likely, to occur. To do this, the location of a crash is the single most important data item. Without this piece of information, it is not possible to identify with absolute certainly hazardous spots on a road network. Once high-crash locations are identified, it is then possible to identify contributing causes without additional crash causation information. It is, therefore, important to introduce crash reporting systems that include the accurate capturing of crash locations.

In any one country, it is possible to have several different databases, managed by different institutions. These can include the police or gendarmerie, the road administration or ministries of transport, hospitals or the health system, and insurance companies. By combining or integrating these databases, safety researchers can access a richer source of data and are better able to understand the factors that may affect the occurrence and severity of crashes. The integration of databases opens up a world of information that could lead to better safety decisions. Some countries are currently in the process of combining or linking their crash database with other traffic safety databases, such as their driver licensing database, vehicle registration database, injury database, and so on. The graphic below, adapted from the processes used by the WHO to produce their periodic Global Status Reports, summarizes potential road safety-related data sources.

Figure 4. *Road safety-related data sources. Adapted, WHO 2018*



This report focuses on a subset of road safety data that relates to crashes (or "crash data" in the graphic seen above). Historically, this is the data most often cited in safety circles and one that has drawn the most attention from international organizations since the late 1980s.

[2] Abegaz T, Berhane Y, Worku A, Assrat A, and Assefa A. Road Traffic Deaths and Injuries are Under-Reported in Ethiopia: A Capture-Recapture Method (2014).

Basic requirements for crash data analysis

In order to effectively analyze, compare, and draw informed conclusions from the data, it is necessary to fulfil the following basic requirements:

- Accuracy (to exactly describe the individual parameters)
- Complexity (to include all features within the given system)
- Availability (to be accessible to all users)
- Uniformity (to apply standard definitions)

The last parameter (uniformity) is of vital importance for comparisons at local, regional, and national levels of governance. An agreement on national standards and definitions is desirable, helping to facilitate comparison of data and contribute to accuracy.

Importance of international comparisons

A similar approach should be followed at an international level. International comparisons are important for the definition of national road safety policies, providing:

- A comparison of national crash data
- A ranking of countries
- An indication of the urgency of international support
- Information on development and progress
- Better identification of weak areas in the safety system
- Safety levels of roads and road users

In order to make international comparisons, national standards that reflect international agreements should be developed. This could be achieved by adopting international standards or developing similar guidance, allowing production of comparable datasets.

The users of crash data and the need for uniform definitions

Crash data can be extremely useful to many agencies and individuals, including:

- **Traffic engineers** – in the identification, analysis, and treatment of existing risks, as well as the prevention of future risks
- **Policy-makers** – at national, regional, and local levels in setting crash reduction targets, developing road safety action plans, and monitoring performance
- **Police** – in the identification of problem locations and times for enforcement
- **Health sector** – for resource planning, injury surveillance, health promotion, and injury prevention
- **Research community** – in preventative studies, and in testing and improving the effectiveness of road safety treatments
- **Insurance companies** – in setting insurance rates and premiums
- **Vehicle manufacturers** – in the development of safer vehicles
- **Prosecutors** – in the use of data as evidence (IRTAD – Road Safety Management)

In order to make useful comparisons across countries, it is important that consistent definitions for crash terms are used. Countries should consider using the following definitions provided by the WHO (WHO 2010):

- **Road traffic crash**: A collision or incident involving at least one road vehicle in motion, on a public or private road to which the public has right of access. This can include collisions between road vehicles, road vehicles and pedestrians, road and rail vehicles, road vehicles and animals, or fixed obstacles and one road vehicle alone. Multi-vehicle collisions are counted as a single crash, provided that any successive collisions happen within a very short time period.

- **Injury**: Physical damage that results when a human body is suddenly or briefly subjected to intolerable levels of energy. This can be a bodily lesion resulting from acute exposure to excessive energy or impairment of function resulting from lack of vital elements.
- **Road traffic injury (or casualty)**: A person who has sustained physical damage as a result of a road traffic crash, possibly with MAIS (Maximum Abbreviated Injury Scale) injury severity level of 3+.
- **Road user**: A person using any part of the road system as a non-motorized or motorized transport user.
- **Road traffic fatality**: Any person killed immediately or dying within 30 days as a result of an injury crash, excluding suicides. For countries that do not apply the threshold of 30 days, conversion coefficients are estimated so that comparisons on the basis of the 30 day-definition can be made.
- **Injury crash**: Any road traffic crash resulting in at least one injury or death.
- **Fatal crash**: Any road traffic crash resulting in a person killed immediately or dying within 30 days as a result of the crash.

The position of crash data within a road safety information system

Although road safety management systems have traditionally focused on road crash registration, a new approach has been developed in recent years, visualized as a pyramid in the graphic below.

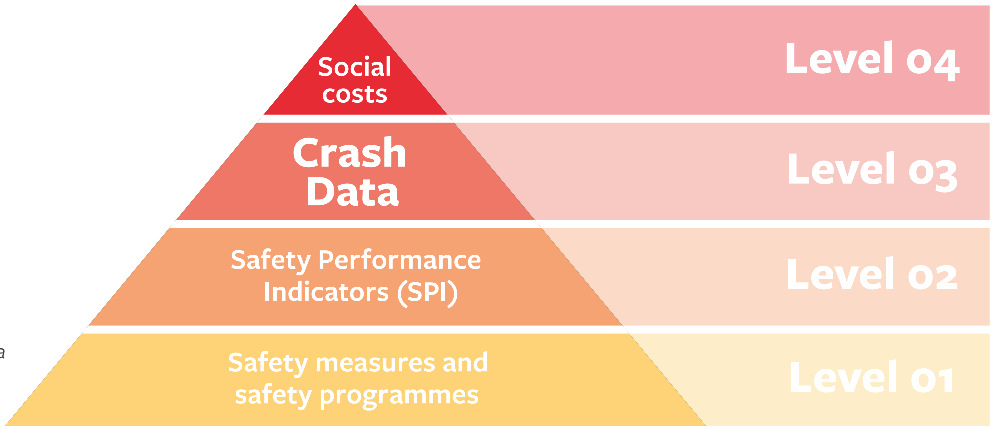


Figure 5. *Essential elements of a road safety management system. Adapted from Wegman, 2001*

The pyramid illustrates the idea that, in order to describe and understand the process leading to crashes, it is necessary to obtain data from four levels of the road safety management system:

- **Level one (Safety measures and safety programs):** Road safety policies, programs, and measures form the foundation of the road safety management system. The effective application or utilization of these elements should lead to measurable interventions and changes in the road safety situation – for example, the number of roadblocks and their impact seatbelt use.
- **Level two (Safety Performance Indicators)**: Safety performance indicators (SPIs) are measurable parameters that have a causal relationship or strong association with crashes and casualties/victims. They are not used instead of data on crashes and victims, but in addition to them. The purpose is to be able to better interpret road safety developments and to better understand the impact of policy interventions.
- **Level three (Crash data)**: The national crash database contains information on details of crashes and victims. The data is usually based on police registration of road crashes, which is processed into national crash statistics.
- **Level four (Social costs)**: The top level of the pyramid counts the social cost of crashes. This data concerns the damage that society views as negative and should therefore be prevented.

When data at all four levels are available, crashes and the reasons why they happen can be described, analyzed, and understood. This knowledge can then serve as a basis for crash management, in order to lower the social costs. The pyramid model illustrates that while the collection of crash data is usually regarded as the main element of a road safety information system, it is not the only one required to form a full overview.

The remainder of this report focuses on the collection of data, with particular attention to crash data.

Part B: Principles related to the gathering of road safety data in Africa

Challenges faced in road safety data management

Crash data should be a key source of information that is utilized in national development strategies in alignment with the AU Agenda 2063 and Sustainable Development Goals (see Box 1).

However, there are some concerns regarding crash data. These are well illustrated, for example, by the United States Federal Highway Administration guidelines for crash data improvement, which state that there may be various potential reasons for inadequate crash data. The reasons fall into three broad categories – people, processes, and/or technology.

People

There are many reasons that the quality of crash investigation and reporting may vary from agency to agency, and from officer to officer. In Africa, specifically:

- The level of training provided to officers may vary among law enforcement agencies. Furthermore, when officers are transferred to alternative roles within an agency, this can result in knowledge loss.
- Officers may lack an understanding of the crash data element definitions or of how to measure or interpret some of the information they are asked to report on.
- They may lack an understanding of the importance of crash data collection because they do not know the multitude of uses for this information.
- Road safety data management may not be a top policy priority.
- Some police agencies may not view the timely and accurate completion of the crash form as critical. Therefore, data has the potential to be delayed, prone to error, or incomplete.
- The data collection forms can be very detailed. As a result, some officers find the process tedious and therefore prefer not to make a record.

- The focus may be on undertaking rescue activities and not on reporting the crash.
- The form may be completed manually at the site of the crash, before later being entered onto an electronic system by an administrator, which may lead to errors or loss of forms.
- Police may believe that crash forms are completed simply for insurance purposes.
- Insurance is not fully utilized, resulting in crashes not making it on to the insurance register.
- There could be a measure of underreporting due to one or more of the following:
    - Police are not always informed of every crash, meaning not all crashes are reported – for example, crashes that occur in remote areas where matters are dealt with directly.
    - The police do not always go to the scene of the crash.
    - The police do not always complete a crash report form.
    - The police do not always complete the whole form in full.
    - The police do not always send the form to the national crash registration body.

One way of helping police perform better crash investigation and reporting may be to illustrate the value of the data by providing feedback on the quality of reports they are submitting. Another is to ensure that terminology and definitions on the report form are similar to those on the most commonly used international ones. Sustainable funding is vital for this to work. In some countries, data management systems have been implemented, only to later lose funding and become obsolete. But this data should always be seen as useful and a priority for numerous stakeholders.

Processes

Inaccurate data may result from the processing of crash data. This can be caused by:

- Poor editing of paper or electronic crash report forms, affecting the accuracy of the submitted crash data.
- The number of times that forms are handled by custodians of the crash database, affecting the timeliness of the data.
- Forms that are shipped to another office outside the custodial office for location coding, resulting in delays.
- Errant keystrokes by data input personnel, leading to accuracy errors.

When those responsible for processing crash data are provided with information and feedback, they are in a better position to improve their data handling and performance. In addition, putting a quality check procedure in place during the data entry process may help to minimize errors. In many instances, having an electronic form for data entry at the scene of the crash allows the police officer to capture information early and ensure it is entered into the system immediately. This, combined with a quality check at the data processing center, helps to ensure the record is captured accurately and that it contains at least the minimum amount of data.

Box 1: Five-star school journey for Lusaka students

Road safety inspections and the star rating of roads can help to identify existing road design and speed management features that may affect crash likelihood and severity. Systematic risk rate mapping, performance tracking, and safety ratings using objective data are carried out by international and national road assessment programs.[3]

Sub-Saharan Africa has the world's highest road traffic injury rates. However, for students of Justin Kabwe Primary School in Lusaka, Zambia, their journey to school has been much safer since 2017, thanks to infrastructure improvements, such as the addition of a raised platform pedestrian crossing, footpaths, fencing, and a school zone warning. Now, access roads have been raised from one- and two-star 'dangerous' status to five-star safety excellence.

Before the upgrades were made, four children had been injured on roads around the school. At peak hours, 4,700 vehicles pass the entrance, 200 people cross the road, and over 900 people walk past the school. After the project, the star rating results, assessed by the International Road Assessment Programme's (iRAP) Star Rating for Schools mobile application, reflected major improvements in safety. In particular, the school's main entrance and nearby street corner achieved star rating improvements from one to five stars and two to five stars, respectively.

Justin Kabwe Primary School in Lusaka, Zambia, before and after infrastructure improvements.

Source: iRAP: *https://www.vaccinesforroads.org/case-studies-of-success/*

Technologies

To the degree that countries can afford it, the adoption of new and innovative technologies can help improve the quality of the crash data. Specifically, for Africa:

- Electronic data collection, whether through offline or online entry of crash reports, can help improve the timeliness, accuracy, and comprehensiveness of crash data.
- The use of global positioning system (GPS) units or geographic information system (GIS)-based "smart mapping" can more precisely determine the location of crashes (see Box 1).

[3] Source: WHO Global Status Report on Road Safety, 2018.

- The creation of "data warehouses" can assist in making crash data available to users, as well as in integrating crash data with other traffic safety information system databases.
- User-friendly interfaces ease the strain of data entry personnel (whether officers at the scene or in an office) and minimize errors.
- Internet and power outages can cause frustration, delays in data entry, and loss of manual forms, if not managed efficiently.
- The data collection process can be complicated by a lack of efficient technical hardware, as well as inadequate institutional and technical capacities to support data entry and management, whether on site or in an information center.
- Sufficient, well-trained personnel to undertake the task of data collection, entry, and processing are key to ensure the electronic database is up to date with useful information.
- Various cost-effective technologies to encourage and support validation of the database should be adopted to build confidence in the accuracy of the data.

All of the above and more can affect the quality of a crash database. However, when a country has established a mechanism to assess the quality of its data, it is in a much better position to detect defects and take steps to correct them (FHWA 2014).

For low- and middle-income countries, the challenges at policy level to support crash data management go even further to include:

- Insufficient attention to road safety issues at regional and national levels.
- Lack of understanding and appreciation of the scale of the problem, as well as its negative impact on health, social, and economic costs.
- Lack of specialized institutional frameworks for road crash data management in some countries.
- Lack of defined road safety data collection methodologies, as well as the absence of disaggregated road safety data
- Lack of coordination among key stakeholders.
- Lack of sustainable funding.

Some of these challenges may be overcome by:

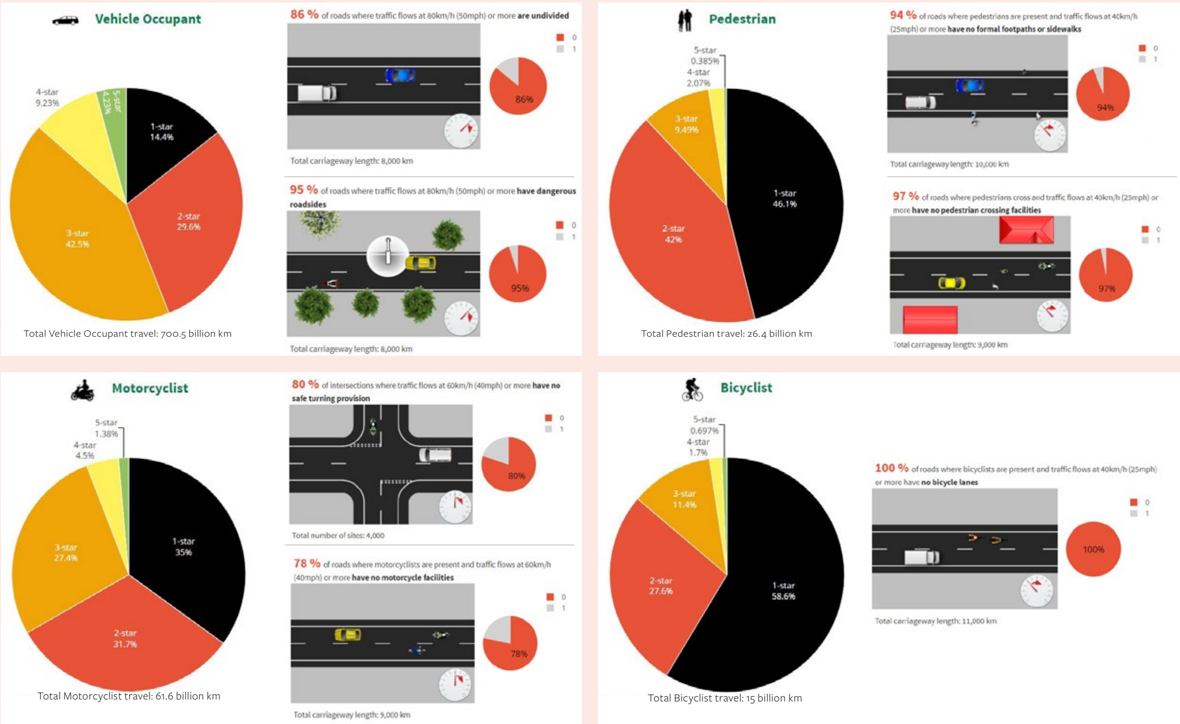
- A common dataset with a minimum set of road safety indicators, which should be established to ensure comparability among African countries (this will be further discussed in Part C of the report).
  - Consider the viability of embedding the crash data collection methodologies into existing critical processes to minimize additional resource needs and ensure the data is collected as part of something that is already active and successful.
  - Establish an accident investigation department where one does not exist, with a mandate to record, analyze, investigate, and report on all crashes to support diligent data collection.
  - Automate as much of the data collection process as possible when completed at the scene, especially key items such as GPS location and time, thereby reducing workload and data entry for the user. Automated synchronization with an electronic database may reduce errors in repeat data entry.
  - Develop reporting templates and tools that are standardized and introduced to officers who are straight out of training school. Offer continuous training after formal police training for new entrants.
- Ensure there is a demand for the data and that data-led decisions can be made.
  - Training and enforcement initiatives should be enhanced, in addition to strengthening post-crash response mechanisms.
  - Innovative and well-established technologies and best practices should be adopted to ease the task of data collection and analysis (for example, IRAP Box 1).

Box 2: Vaccines for Roads: Big Data Tool for assessing and mapping road safety problems

Ensuring that more than 75 percent of travel is on three-star or better roads by 2030 will save an estimated 450,000 lives every year worldwide and avoid 100,000 million deaths and serious injuries over the 20-year life span of road improvements.

iRAP's Big Data Tool, Vaccines for Roads V, shines a light on the safety of the world's roads, the road attributes that matter, case studies of success, and the projected human life and economic savings to be gained if countries meet the new UN Global Road Safety Targets. The tool, launched in 2018 and updated in 2020, unlocks the world's largest road infrastructure safety database. It summarizes star rating and investment plan data (over 400 million data points) based on 358,000km of roads across 54 countries globally, covering over 700 billion vehicle kilometers of travel.

Status of road infrastructure in Africa, 2020



Source: iRAP: *https://www.vaccinesforroads.org/irap-big-data-tool-map/*

The harmonization and standardization of road safety information

The need for international cooperation and harmonization

Harmonizing crash and other road safety data at a national level would benefit road crash analysis and accelerate the use of common variables and values across African countries.

Currently, existing African road crash data are not always comparable among the various countries, mainly due to the different national crash data collection systems. Data variables and values are collected under different definitions, and the various crash data collection forms have different structures, making the data systems difficult to compare. Both crash data quality and availability are affected and, as a result, data analyses and comparisons among the various African countries are not reliable. Making efforts to harmonize data would support coordinated efforts at a continental level to identify common challenges and areas of cooperation.

Cooperation across countries is essential for data coordination and benchmarking. International assessments and comparisons of safety performance (with similar peer countries, regions, cities, and so on) can help to identify and monitor national road safety issues, as well as evaluate the effectiveness of any methods implemented on a wider scale. It is important to note that this cannot be achieved unless there is consistency across crash variable definitions. Coordination also helps countries and governments to improve their road safety data quality and collection systems.

The role of road safety observatories

The term "observatory" is used to describe a variety of models that aim to collect, compare, analyze, and publish data. Some of the original observatories, which did not always include the term observatory in their names, began in developed countries and focused on crash data collection and analysis. Since then, the collection and analysis of crash data and other road safety related data has become more common in other countries too, where it has broadened beyond data gathering and analysis into policy discussions and development. Evidence-based approaches, supported by by quality crash and other road safety data, form the basis of the most successful road safety policies. The information collected by observatories includes data protocols and collection methodologies, national and in-depth crash data, exposure data, and safety performance indicators.

In Africa, various actors presently support the idea of a harmonized and coordinated approach to road safety data collection on the continent:

- The AU, through the Heads of African States, has adopted the African Union Specialized Technical Committee on Transport, Transcontinental and Interregional Infrastructure, Energy and Tourism's decision to work towards the establishment of a harmonized set of road safety indicators for African countries. This decision fully aligns with the African Road Safety Action Plan 2011-2020, the UN's Decade of Action 2010-2020, and targets set by the UN Sustainable Development Goals 3.6 and 11.2.

- SSATP is committed to improving road safety management in Africa through the development of sound policy, including the improvement of road safety information systems. One of the objectives outlined in its road safety activities results framework is the establishment of a continental observatory, as well as sub-regional observatories.

- The Federation Internationale de l'Automobile (FIA) focuses on providing guidelines for the establishment of observatories in Africa and Asia, as part of its continued support to countries to achieve the UN Decade of Action for Road Safety goals.

- The European Union (EU)-funded SaferAfrica project included some work on data and proposed the establishment of a "Road Safety Data and Knowledge Centre" to facilitate the dissemination of data on road crashes, as well as good practices, knowledge, risk factors, and so on.

- The International Traffic Safety Data and Analysis Group (IRTAD), within the Organisation for Economic Co-operation and Development's (OECD) International Transport Forum (ITF), aims to advance international knowledge on road safety and contribute to reducing the number of traffic casualties. The basis for its road safety work is the International Road Traffic and Accident Database, created in 1988. The IRTAD database collects and aggregates international data on road crashes, thereby providing an empirical basis for international comparisons and more effective road safety policies.

- An example of an initiative that seeks to address the lack of regional capacity in the collection and analysis of road safety data is the establishment of a broad cooperation between countries in Latin America and the Caribbean region, called the Ibero-American Road Safety Observatory (OISEVI). The OISEVI was created in 2012 and 18 countries joined, with the goal of sharing knowledge and best practice policy-making and planning. The main aim of OISEVI is to share road safety information, particularly best practices in policy formulation, planning, road safety strategies, and data management. It is also aimed at improving expertise in road safety and knowledge-sharing among practitioners, and at improving road safety outcomes in Ibero America. OISEVI is also supported by a regional road safety database based on the IRTAD model. The database uses the same standardized definitions and reporting as the core IRTAD system.

Building on all these experiences, the African Road Safety Observatory (ARSO) was launched in November 2018. It comprises a Transitional Steering Committee that oversees the implementation of a 2019-2021 work plan, a general assembly, national data coordinators, and national policy coordinators.

Part C: Defining a minimum crash-related data set in Africa

Process leading to proposed minimum set of road safety indicators for data collection, analysis, and reporting for africa

The need for a standardized minimum set of road safety indicators

Road crash data is collected in African countries through their own national collection systems. The variations in the systems, and the type and quality of data collected, necessitates the development and provision of a harmonized (standardized) minimum set of indicators, within a structure which allows for maximum flexibility to add indicators that fulfill individual countries' needs.

The minimum set of indicators can serve as a powerful tool, making it possible to identify and quantify road safety problems throughout Africa, evaluate the efficiency of road safety measures, determine the relevance of community actions, and facilitate the exchange of experience in this field.

It is accepted that more variables and values may be necessary to better describe and analyze the road crash phenomenon than is provided in the minimum set of indicators. The flexibility of the set makes it possible for countries to add more variables should their management systems require it.

Data contributing to essential research

The data obtained through the minimum set of indicators is not only useful for road safety management in general, but also for research purposes. The answers to some fundamental questions can be obtained from the data and used for the improvement of the road safety system. Research questions could include the following:

- What type of road users are involved in crashes?
- What type of vehicles are involved in crashes (age, type)?

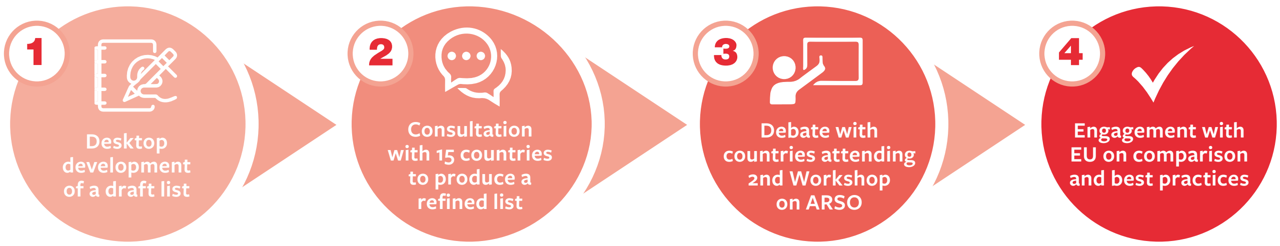
- What type of road infrastructure attributes or features are involved in consequences of crashes (for example, trees, guide rails, and poles)?
- Where are crashes frequently occurring and what is the road layout at those locations?
- What type of roads are crashes most commonly occurring on?
- Which gender/age is more likely to be involved in crashes?
- Which hour or time period is the most dangerous in terms of number of crashes?
- Which crash types can be controlled technically (vehicle or road infrastructure)?
- Which protective measures have the highest rate of reducing crashes?
- What type of countermeasures could save lives (test for cost-effectiveness)?
- Which crash type most commonly results in a serious injury or fatality?

Proposed minimum set of road safety indicators for data collection, analysis, and reporting

Methods

A minimum set of standardized data elements has been developed which allow for comparable road crash data to be available nationally, regionally, and internationally. The number of indicators varies depending on the level of reporting. The figure below summarizes these steps, although they are described in more detail in subsequent paragraphs.

Figure 6. *Steps to derive consensus on ARSO crash-related variables.*



Several steps were taken to generate the list of proposed indicators:

1. Starting in 2017, a list of indicators was produced based on the analysis of currently available national crash data collection systems in Africa, as well as other international recommendations (Safer Africa 2017; WHO 2010). More recent recommendations have also been considered as part of the review process described here (Euromed 2019).

2. A set of proposed road safety indicators was then sent to 30 countries to identify what they regard as the minimum set of key indicators that should be included in a system, in order to obtain meaningful information that may be used internally and provided externally to make valid comparisons across the region. The following 10 countries responded to the request for feedback: Botswana, Ethiopia, Gambia, Ghana, Malawi, Mauritius, South Africa, Sierra Leone, South Sudan, and Tanzania.

3. The proposed indicators were discussed in 2017 and 2018 in meetings with authorities in five additional countries: Kenya, Nigeria, Benin, Cameroon, and Togo.

4. The proposed set of indicators was circulated in English and French to government representatives from 29 countries, who were invited to a second workshop held in Abuja, Nigeria, on the establishment of ARSO. During the meeting, extensive presentations and debate took place, including a 'variable per variable' review and voting by country representatives for or against specific variables. The variables were all accepted with a few additions. A discussion on possible data sources for each variable was initiated.

5. The final document after this deliberation is attached as Appendix B[4]. The countries that participated in this debate were: Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros, Côte d'Ivoire, DR Congo, Egypt, Ethiopia, Gambia, Ghana, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Nigeria, Sierra Leone, Tanzania, Togo, Tunisia, Uganda, and Zimbabwe.

   Forty-seven variables and their values were finally adopted as the suggested minimum crash-related variables to be collected on a voluntary basis in the national crash data collection systems of African countries. While all variables were labelled "mandatory", countries could accept answers such as "N/A" where information is not available.

6. It is expected that, over time, more and more common road crash data from various countries will be available in a uniform format. The currently disaggregated data collection on road safety will gradually contain more compatible and comparable data, allowing for more reliable analyses and comparisons.

7. During the meeting in Nigeria, participants discussed whether all 47 variables or a subset of these should be shared between countries in the observatory. Guidance was provided by experienced data managers from established observatories, such as the European Commission's (EC) CARE Observatory and the Ibero-American OISEVI. The similarities between the ARSO-proposed variables and the EC's CARE Common Accident Dataset (CADaS) variables ultimately enabled the adoption of Mini CADaS.[4] – a subset of crash-data collected at national level – by regional observatories. Out of the initial 47 variables proposed, 25 were identified for sharing between countries. These 25 variables, the MiniARSO, are listed in Appendix A. Despite the specific circumstances in each country, countries selected a very similar minimum set of indicators. These 25 variables will be at the heart of the crash-related data shared with ARSO. However, to begin with, this information will not be released at the crash level, but at the aggregate level.

Evaluating adherence of country practices to proposed minimum crash variables and recommendation

Following the third workshop on the establishment of ARSO, a survey to assess the degree of adherence to the list of national crash-data variables was prepared and circulated. A document summarizing its findings will be published soon, with very encouraging findings.

Initially, it is proposed that ARSO use the MiniARSO variables as the minimum crash data requirements in targeted requests, and that this reporting be done in an aggregated format. Some countries may already collect all these variables, while, in others, it will require some work to reach that level of adhesion. The ARSO objectives do not limit themselves to the collection and analysis of data, but include data improvement strategies to accelerate the breadth, depth, and validity of data gathered.

Appendix C contains some tailored recommendations on the setting up of a crash database.

[4] Source: WHO Global Status Report on Road Safety, 2018.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WARREN
AVAILABLE in Nairobi and surroundings
· Fair price
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Thika Road Mall
adsite
WIN
ROSMOS
SACCO

Appendix A:
Main initiatives at the regional and sub-regional levels

Several actions have taken place on the continent and relevant management documents are already in place, paving the way for road safety improvements. All of these activities are fully aligned, since all outcomes were focused on the delivery of the Africa Road Safety Action Plan and the African Charter, which were both derived from the Global Plan.

African Road Safety Action Plan 2011-2020

The AU, the UN Economic Commission for Africa (UNECA), and SSATP developed the African Road Safety Action Plan 2011-2020. The Action Plan is based on the five pillars of the UN's Decade of Action for Road Safety 2011-2020 (road safety management, safer roads and mobility, safer vehicles, safer road users, and post-crash response). Key outcomes around improving data management that were identified in the plan include for member states to:

- Develop and implement a sustainable and accurate national database on road safety crashes.
- Enforce mandatory reporting and standardized data that conforms with the computerized and integrated data management system established in member states and regional economic communities (RECs).
- Develop a national crash analysis and reporting system.
- Harmonize data formats in road crash reporting in line with international standards.
- Harmonize vehicle and driver registration data systems.
- Build capacity for data management on road safety.
- Engage local and regional research centers on road safety data management.

However, a 2015 mid-term review by the United Nations Economic Commission for Africa (UNECA) revealed that there was much work to be done by African countries in the area of road safety management, in particular. Road safety management challenges in Africa were identified and a roadmap was designed to facilitate implementation of the plan.

The African Road Safety Charter

Through the adoption of the African Road Safety Charter, AU member states aimed to build a political framework to enable road safety improvement. In particular, based on the provisions of the African Road Safety Action Plan, specific duties and commitments were defined for the states that had ratified or accepted the charter.

The main objective of the charter was to serve as an advocacy tool and instrument for road safety improvement on the continent, aimed at creating an enabling environment to drastically reduce the road traffic crashes. The specific objectives of the charter are to:

- Facilitate the formulation of comprehensive road safety policies at country level.
- Speed up implementation of national, regional, and continental road safety programs.
- Contribute to the coordination of road safety on the continent.
- Promote better coordination of development partners in the road safety field.
- Enhance private sector, civil society organizations, and nongovernmental organizations (NGO) participation in road safety issues.
- Promote the harmonization of the collection, treatment, and dissemination of road safety data.

Currently, only 14 countries have signed the charter, with a single ratification. For the charter to be formally adopted, it requires ratification by 15 member states. Considerable effort from the AU and key stakeholders is required to ensure this is achieved.

SSATP 3rd Development Plan

In its Third Development Plan 2016–2021 (DP3), SSATP, a key contributor to the African Road Safety Action Plan strategy, defined the following objectives:

- Enable African countries to achieve the road safety goals of the Action Plan.
- Promote effective policy and strategy formulation, and implementation, at the country level.
- Stimulate good practice in road safety management by promoting the systematic implementation of the African Road Safety Action Plan.
- Better integrate road safety policies and interventions in locally- and externally-funded road developments.

Over the course of the DP3, SSATP supported the development of country and city level strategies, the development and strengthening of road safety agencies, capacity-building efforts at senior management level, and the establishment of a continental road safety data observatory. SSATP recognized that member countries needed to improve their capacity to manage and monitor road safety performance in order to realize effective road safety management. This could only be done with the availability of timely and good quality data. A central outcome of the DP3 was to work with key stakeholders on the continent to improve the quality of road safety data management.

SSATP led and coordinated the effort to secure the establishment of ARSO, which was launched in 2018 and held its first general assembly in 2019. For more information, please visit https://www.ssatp.org/topics/african-road-safety-observatory.

The European Commission-funded "SaferAfrica" project

The general objective of the three-year SaferAfrica project (2016-2019) was to create favorable conditions and opportunities for the effective implementation of road safety and traffic management actions in African countries by forming a dialogue platform between Africa and Europe. This initiative focused on using effective tools, embedding innovative approaches, and identifying pragmatic and fundable next steps to address identified road safety and traffic management problems. The platform was composed of European and African regional and national authorities with key road safety responsibilities and other important stakeholders, such as international institutions, research institutes, and NGOs. It operated in accordance with the principles of Africa-Europe interdependence, strengthened political dialogue, partnership co-management, and co-responsibility, established by the Joint Africa-Europe Strategy (inspiring the Africa-EU Partnership, a cooperation between the EU and the AU).

The project succeeded in enhancing the dialogue and cooperation between African and European institutions to improve road safety outcomes in Africa. It developed road safety products, including training programs and an online road safety data repository for use by African countries, through a series of projects, grouped under four pillars – road safety knowledge and data, road safety and traffic management capacity reviews, capacity building and training, and sharing of good practices.

With regards to road safety data in Africa, the project identified that there was a significant demand for road safety data knowledge to enable countries to make effective road safety policy decisions. The review revealed that although there were similarities in the existing road safety data collection systems on the continent, the differences in data collection practices, especially on road safety monitoring and evaluation, varied based on the formal systems established in the country.

Appendix B:

ARSO recommended crash-related minimum data set at country level and possible data sources after discussion by countries, data to be shared between countries (MiniARSO) (July 2018)

Crash-related minimum data set and data sources after discussion by countries (July 2018)					Data sources							
	Agreed upon crash data variables and values (country level)			Proposed for submission to ARSO (MiniARSO)	Preference order (1= best to 6= least preferred)							
Votes against during meeting		Variables	Definition and Values		Death certificate	Hospital record	Police report	Insurance report	Driver license registry	Vehicle registry	Road inventory	National ID
0	1	Crash identification number	**Definition**: The unique identifier (e.g. a 10-digit number) within a given year that identifies a particular crash. **Obligation**: Mandatory **Data type**: Numeric or character string **Comments**: The police usually assign this value, as they are responsible at the crash scene. Other systems may reference the incident using this number.	X	2	3	1	N/A	N/A	N/A	N/A	N/A
0	2	Crash date	**Definition**: The date (day, month, and year), on which the crash occurred. **Obligation**: Mandatory **Data type**: Numeric (DDMMYYYY) **Comments**: If a part of the crash date is unknown, the respective places are filled in with 99 (for day and month). Absence of year should result in an edit check. Important for seasonal comparisons, time series analyses, management/ administration, evaluation, and linkage.	X	4	3	1	2	N/A	N/A	N/A	N/A
0	3	Crash time	**Definition**: The time at which the crash occurred, using the 24-hour clock format (00.00-23:59). **Obligation**: Mandatory **Data type**: Numeric (HH:MM) **Comments**: Midnight is defined as 00:00 and represents the beginning of a new day. Variable allows for analyses of different time periods.	X	4	3	1	2	N/A	N/A	N/A	N/A
0	4	Crash location	**Definition**: The exact location at which the crash occurred. Optimum definition is route name and GPS/GIS coordinates if there is a linear referencing system (LRS), or other mechanism that can relate geographic coordinates to specific locations in road inventory and other files. The minimum requirement for documentation of crash location	Latitude and longitude (but need to aggregate it if aggregated data submitted)	3	N/A	1	2	N/A	N/A	N/A	N/A

			is the street name, the reference point, and distance from reference point and direction from reference point. **Obligation**: Mandatory **Data type**: Character string, to support latitude/ longitude coordinates, linear referencing method, or link node system. **Comments**: Critical for problem identification, prevention programs, engineering evaluations, and mapping and linkage purposes.									
○	5	**Crash type**	**Definition**: The crash type is characterized by the first injury or damage-producing event of the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Crash with pedestrian –** Crash between a vehicle and at least one pedestrian. **2. Crash with parked vehicle** – Crash between a moving vehicle and a parked vehicle. A vehicle with a driver that is just stopped is not considered as parked. **3. Crash with fixed obstacle** – Crash with a stationary object (for example, a tree, post, barrier, fence, and so on). **4. Non-fixed obstacle** – Crash with a non-fixed object or lost load. **5. Animal** – Crash between a moving vehicle and an animal. **6. Single vehicle crash/non-collision** – Crash in which only one vehicle is involved and no object was hit. Includes vehicle leaving the road, vehicle rollover, and cyclists falling. **7. Crash with two or more vehicles** – Crashes where two or more moving vehicles are involved. **8. Other crashes** – Other crash types not described above. **Comments**: If the road crash includes more than one event, the first should be recorded, through this variable. If more than one value is applicable, select only the one that corresponds best to the first event. Important for understanding crash causation, identifying crash avoidance countermeasures.		3	4	1	2	N/A	N/A	N/A	N/A
○	6	**Impact type**	**Definition**: Indicates the manner in which the road motor vehicles involved initially collided with each other. The variable refers to the first impact of the crash, if that impact was between two road motor vehicles. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. No impact between motor vehicles** – There was no impact between road motor vehicles. Refers to single vehicle crashes, collisions with pedestrians, animals, or objects.	X[5]	N/A	N/A	1	2	N/A	N/A	N/A	N/A

[5] Provided some adaptation

			2. Rear-end impact – The front side of the first vehicle collided with the rear side of the second vehicle. **3. Head-on impact** – The front sides of both vehicles collided with each other. **4. Angle impact, same direction** – Angle impact where the front of the first vehicle collides with the side of the second vehicle. **5. Angle impact, opposite direction** – Angle impact where the front of the first vehicle collides with the side of the second vehicle. **6. Angle impact, right angle** – Angle impact where the front of the first vehicle collides with the side of the second vehicle. **7. Angle impact, direction not specified** – Angle impact where the front of the first vehicle collides with the side of the second vehicle. **8. Side-by-side impact, same direction** – The vehicles collided side by side while travelling in the same direction. **9. Side-by-side impact, opposite direction** – The vehicles collided side by side while travelling in opposite directions. **10. Rear to side impact** – The rear end of the first vehicle collided with the side of the second vehicle. **11. Rear to rear impact** – The rear ends of both vehicles collided with each other. **Comments**: Useful for identifying structural defects in vehicles.									
○	7	**Weather conditions**	**Definition**: Prevailing atmospheric conditions at the crash location, at the time of the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Clear** – No hindrance from weather, neither condensation nor intense movement of air. Clear and cloudy sky included. **2. Rain** – Heavy or light. **3. Snow** **4. Fog, mist or smoke** **5. Sleet, hail** **6. Severe winds** – Presence of winds deemed to have an adverse effect on driving conditions. **8. Other weather condition** **9. Unknown weather condition** **Comments**: Allows for the identification of the impact of weather conditions on road safety. Important for engineering evaluations and prevention programs.	X	N/A	N/A	1	2	N/A	N/A	N/A	N/A
○	8	**Light conditions**	**Definition**: The level of natural and artificial light at the crash location, at the time of the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Daylight** – Natural lighting during daytime.	X	N/A	N/A	1	2	N/A	N/A	N/A	N/A

			2. Twilight – Natural lighting during dusk or dawn. Residual category covering cases where daylight conditions were very poor. **3. Darkness** – No natural lighting, no artificial lighting. **4. Dark with streetlights unlit** – Streetlights exist at the crash location but are unlit. **5. Dark with streetlights lit** – Streetlights exist at the crash location and are lit. **9. Unknown** – Light conditions at time of crash unknown. **Comments**: Information about the presence of lighting is an important element in analysis of spot location or in network analysis. Additionally, important for determining the effects of road illumination on night-time crashes to guide relevant future measures.									
○	9	**Crash severity**	**Definition**: Describes the severity of the road crash, based on the most severe injury of any person involved. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Fatal** – At least one person was killed immediately or died within 30 days because of the road crash. **2. Serious/severe injury** – At least one person was hospitalized for at least 24 hours because of injuries sustained in the crash, while nobody was killed. **3. Slight/minor injury** – At least one of the participants of the crash was hospitalized less than 24 hours or not hospitalized, while no participant was seriously injured or killed. **Comments**: Provides a quick reference to the crash severity, summarizing the data given by the individual personal injury records of the crash. Facilitates analysis by crash severity level. Several crash-related variables can be derived from collected data, including number of vehicles involved (total), number of motorized vehicles involved, number of non-motorized vehicles involved, number of fatalities, number of non-fatal injuries, day of week, and more. These variables provide counts or other information, without the user having to go back to individual records. Depending on the type of reports generated, deriving these data elements can save time and effort.	X (MAIS3+ is MiniCADaS proposal)	1	2	4	3	N/A	N/A	N/A	N/A
		Road related indicators										
○	10	**Type of roadway**	**Definition**: Describes the type of road, whether the road has two directions of travel, and whether the carriageway is physically divided. For crashes occurring at junctions, where the crash cannot be clearly allocated in one road, the road where the vehicle with priority was moving is indicated.	X[6]	N/A	N/A	2	3	N/A	N/A	1	N/A

[6] Provided some adaptation

			Obligation: Mandatory **Data type**: Numeric **Data values**: **1. Motorway/freeway** – Road with separate carriageways for traffic in two directions, physically separated by a dividing strip not intended for traffic. Road has no crossings at the same level with any other road, railway or tramway track, or footpath. Specially sign-posted as a motorway and reserved for specified categories of motor vehicles. **2. Express road** – Road with traffic in two directions, carriageways not normally separated. Accessible only from interchanges or controlled junctions. Specially sign-posted as an express road and reserved for specified categories of motor vehicles. Stopping and parking on the running carriageway are prohibited. **3. Urban road, two-way** – Road within the boundaries of a built-up area (an area with sign-posted entries and exits). Single, undivided street with traffic in two directions, relatively lower speeds (often up to 50 km/h), and unrestricted traffic, with one or more lanes, which may or may not be marked. **4. Urban road, one-way** – Road within the boundaries of a built-up area, with entries and exits sign-posted as such. A single, undivided street with traffic in one direction, relatively lower speeds (often up to 50 km/h). **5. Road outside a built-up area** – Road outside the boundaries of a built-up area (an area with sign-posted entries and exits). **6. Restricted road** – A roadway with restricted access to public traffic. Includes cul-de- sacs, driveways, lanes, private roads. **8. Other** – Roadway of a type other than those listed above. **9. Unknown** – Not known where the incident occurred. **Comments**: Important for comparing crash rates of roads with similar design characteristics, and for conducting comparative analyses between motorway and non-motorway roads.									
○	11	**Road functional class**	**Definition**: Describes the character of service or function of the road where the first harmful event took place. For crashes occurring at junctions, where the crash cannot be clearly allocated to one road, the road where the vehicle with priority was moving is indicated. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Principal arterial** – Roads serving long distance and mainly interurban movements. Includes motorways (urban or rural) and express roads. Principal arterials may cross through urban areas, serving suburban movements. The traffic is characterized by high speeds and full or partial access control (interchanges or junctions controlled by traffic lights). Other roads leading		N/A	N/A	2	3	N/A	N/A	1	N/A

			to a principal arterial are connected to it through side collector roads. **2. Secondary arterial** – Arterial roads connected to principal arterials through interchanges or traffic light-controlled junctions, supporting and completing the urban arterial network. Serving middle distance movements but not crossing through neighborhoods. Full or partial access control is not mandatory. **3. Collector** – Unlike arterials, collectors cross-urban areas (neighborhoods) and collect or distribute the traffic to/from local roads. Collectors also distribute traffic leading to secondary or principal arterials. **4. Local** – Roads used for direct access to the various land uses (private property, commercial areas, and so on). Low service speeds not designed to serve interstate or suburban movements.									
1	12	**Road surface conditions**	**Definition**: The condition of the road surface at the time and place of the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Dry** – Dry and clean road surface. **2. Snow, frost, ice** – Snow, frost, or ice on the road. **3. Slippery** – Slippery road surface due to existence of sand, gravel, mud, leaves, oil on the road. Does not include snow, frost, ice, or wet road surface. **4. Wet, damp** – Wet road surface. Does not include flooding. **5. Flood** – Still or moving water on the road. **6. Other** – Other road surface conditions not mentioned above. **9. Unknown** – The road surface conditions were unknown. **Comments**: Important for identification of high wet-surface crash locations, for engineering evaluation and prevention measures.		N/A	N/A	1	2	N/A	N/A	N/A	N/A
1	13	**Speed limit**	**Definition**: The legal speed limit at the location of the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **nnn** – The legal speed limit as provided by road signs or by the country's traffic laws for each road category, in kilometers per hour (km/h). **999 unknown** – The speed limit at the crash location is unknown. **Comments**: For crashes occurring at junctions, where the crash cannot be clearly allocated to one road, the speed limit for the road where the vehicle with priority was moving is indicated.	X	N/A	N/A	2	3	N/A	N/A	1	N/A
4	14	**Road obstacles**	**Definition**: The presence of any person or object that obstructed the movement of the vehicles on the road. Includes any animal standing or moving (either hit or not), and any object not meant to be on the road. Does not include vehicles (parked or		N/A	N/A	1	2	N/A	N/A	N/A	N/A

			moving vehicles, pedestrians) or obstacles on the side of the carriageway (for example, poles, trees). **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Yes** – Road obstacle(s) present at the crash site. **2. No** – No road obstacle(s) present at the crash site. **9. Unknown** – Unknown presence of any road obstacle(s) at the crash site. Countries where a large proportion of the road network is unpaved may wish to include the variable 'road surface type' to allow for analysis of crash rates by road surface type.									
4	15	**Junction**	**Definition**: Indicates whether the crash occurred at a junction (two or more roads intersecting) and defines the type of junction. In at-grade junctions, all roads intersect at the same level. In not-at-grade junctions, roads do not intersect at the same level. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. At-grade, crossroad** – Road intersection with four arms. **2. At-grade, roundabout** – Circular road. **3. At-grade, T, or staggered junction** – Road intersection with three arms. Includes T-intersections and intersections with an acute angle. **4. At-grade, multiple junction** – A junction with more than four arms (excluding roundabouts). **5. At-grade, other** – Other at-grade junction type not described above. **6. Not at grade** – The junction includes roads that do not intersect at the same level. **7. Not at junction** – The crash has occurred at a distance greater than 20 meters from a junction. **9. Unknown** – The crash location relative to a junction is unknown. **Comments**: Crashes occurring within 20 meters of a junction are considered as crashes at a junction. Important for site-specific studies and identification of appropriate engineering countermeasures.	X	N/A	N/A	2	3	N/A	N/A	1	N/A
3	16	**Traffic control at junction**	**Definition**: Type of traffic control at the junction where crash occurred. Applies only to crashes that occur at a junction. **Obligation**: Mandatory if crash occurred at a junction **Data type**: Numeric **Data values**: **1. Authorized person** – Police officer or traffic warden at intersection controls the traffic. Applicable even if traffic signals or other junction control systems are present. **2. Stop sign** – Priority is determined by stop sign(s). **3. Give-way sign or markings** – Give-way sign or markings determine priority.	X	N/A	N/A	2	3	N/A	N/A	1	N/A

			4. Other traffic signs – Priority is determined by traffic sign(s) other than ‘stop’, ‘give way’, or markings. **5. Automatic traffic signal (working)** – Priority is determined by a traffic signal that was working at the time of the crash. **6. Automatic traffic signal (out of order)** – A traffic signal is present but out of order at time of crash. **7. Uncontrolled** – The junction is not controlled by an authorized person, traffic signs, markings, automatic traffic signals, or other means. **8. Other** – The junction is controlled by means other than an authorized person, signs, markings, or automatic traffic signals. **Comments**: If more than one value is applicable (for example, traffic signs and automatic traffic signals), record all that apply.									
3	17	**Road curve**	**Definition**: Indicates whether the crash occurred inside a curve, and what type of curve. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Tight curve** – The crash occurred inside a road curve that was tight (based on the judgment of the police officer). **2. Open curve** – The crash occurred inside a road curve that was open (based on the judgment of the police officer). **3. No curve** – The crash did not occur inside a road curve. **9. Unknown** – It is not defined whether the crash occurred inside a road curve. **Comments**: Useful for identification and diagnosis of high-crash locations, and for guiding changes to road design, speed limits, and so on.		N/A	N/A	2	3	N/A	N/A	1	N/A
4	18	**Road segment grade**	**Definition**: Indicates whether the crash occurred on a road segment with a steep gradient. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Yes** – The crash occurred at a road segment with a high grade. **2. No** – The crash did not occur at a road segment with a high grade. **9. Unknown** – It is not defined whether the crash occurred at a road segment with a high grade. **Comments**: Useful for identification and diagnosis of high-crash locations, and for guiding changes to road design, speed limits, and so on.		N/A	N/A	2	3	N/A	N/A	1	N/A
		Vehicle related indicators										
3	19	**Vehicle number**	**Definition**: Unique number assigned to identify each vehicle involved in the crash. **Obligation**: Mandatory **Data type**: Numeric, sequential number **Comments**: Allows the vehicle record to be cross-referenced to the crash record and person records.	X	N/A	N/A	1	2	N/A	N/A	N/A	N/A

2	20	**Vehicle identification number (VIN, issued by manufacturer)**	**Definition**: Unique vehicle number attached to the engine compartment of the vehicle by the manufacturer to identify each vehicle involved in the crash. **Obligation**: Mandatory **Data type**: Numeric, sequential number **Comments**: Allows the vehicle record to be cross-referenced with registration and person records.		N/A	N/A	2	3	N/A	1	N/A	N/A
4	21	**Vehicle registration number**	**Definition**: Unique vehicle registration number appearing on the number plate and registration documents. **Obligation**: Mandatory **Data type**: Numeric, sequential number **Comments**: Allows cross-referencing with vehicle VIN number and identification.		N/A	N/A	1	2	N/A	3	N/A	N/A
2	22	**Country of vehicle registration**[7]	Whether the vehicle is registered in a country different than where it crashes.	X								
2	23	**Vehicle type**	**Definition**: The type of vehicle involved in the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Bicycle** – Road vehicle with two or more wheels, generally propelled solely by the energy of the person on the vehicle, in particular by means of a pedal system, lever, or handle. **2. Other non-motor vehicle** – Other vehicle without engine not included in the list above. **3. Two/three-wheel motor vehicle** – Two or three-wheeled road motor vehicle (includes mopeds, motorcycles, tricycles, and all-terrain vehicles). **4. Passenger car** – Road motor vehicle other than a two or three-wheeled vehicle, intended for the carriage of passengers and designed to seat no more than nine (driver included). **5. Bus/coach/trolley** – Passenger-carrying vehicle, most commonly used for public transport, inter-urban movements, and tourist trips, seating more than nine persons. Includes vehicles connected to electric conductors and vehicles that are not rail-borne. **6. Light goods vehicle (<3.5 t)** – Smaller (by weight) motor vehicle designed exclusively or primarily for the transport of goods. **7. Heavy goods vehicle (>3.5 t)** – Larger (by weight) motor vehicle designed exclusively or primarily for the transport of goods. **8. Pedestrian** **9. Animal-propelled vehicles**[8] **10. Other motor vehicle** – Other vehicle not powered by an engine and not included in the lists of values.	X	4	5	2	3	N/A	1	N/A	N/A

[7] This is one of the variables added after discussion in 2nd workshop towards establishment of ARSO

[8] This was suggested during discussion at second workshop towards establishment of ARSO.

			11. Unknown – The type of vehicle is unknown, or it was not stated. **Comments**: Allows for analysis of crash risk by vehicle type and road user type. Important for evaluation of countermeasures designed for specific vehicles or to protect specific road users.									
4	24	**Vehicle make**	**Definition**: Indicate the make (distinctive name) assigned by motor vehicle manufacturer. **Obligation**: Mandatory if the vehicle is a motorized vehicle. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type**: Character string. Alternatively, a list of motor vehicle makes can be composed, with a code corresponding to each. Such a list allows for more consistent and reliable recording, as well as for easier interpretation of the data. **Comments**: Allows for crash analyses related to the various motor vehicle makes.		N/A	N/A	2	3	N/A	1	N/A	N/A
10	25	**Vehicle model**	**Definition**: The code assigned by the manufacturer to denote a family of motor vehicles (within a make) that have a degree of similarity in construction. **Obligation**: Mandatory if the vehicle is a motorized vehicle. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type**: Character string. Alternatively, a list of motor vehicle models can be composed, with a code corresponding to each. Such a list allows for more consistent and reliable recording, as well as for easier interpretation of the data. **Comments**: Record the name of the model as referred to in the country in which the crash occurred. Allows for crash analyses related to the various motor vehicle models.		N/A	N/A	2	3	N/A	1	N/A	N/A
3	26	**Vehicle year of manufacture**	**Definition**: The year assigned to a motor vehicle by the manufacturer. **Obligation**: Mandatory if the vehicle is a motorized vehicle. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type**: Numeric (YYYY) **Comments**: Can be obtained from vehicle registration. Important for use in identifying motor vehicle model year for evaluation, research, and crash comparison purposes.	X	N/A	N/A	2	3	N/A	1	N/A	N/A
11	27	**Engine size**	**Definition**: The size of the vehicle's engine is recorded in cubic centimeters. **Obligation**: Mandatory, if vehicle is motorized. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type**: Numeric **Data values**: **nnnn** – Size of engine **9999** – Unknown engine size **Comments**: Important for identifying the impact of motor vehicle power on crash risk.		N/A	N/A	3	2	N/A	1	N/A	

2	28	**Vehicle special function**	**Definition**: The type of special function being served by this vehicle, regardless of whether the function is marked on the vehicle. **Obligation**: Mandatory if the vehicle is a motorized vehicle. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type**: Numeric **Data values**: **1. No special function** – No special function of the vehicle. **2. Taxi** – Licensed passenger car for hire with driver, without predetermined routes. **3. Vehicle used as bus** – Passenger road motor vehicle used for the transport of people. **4. Police/military** – Motor vehicle used for police or military purposes. **5. Emergency vehicle** – Motor vehicle used for emergency purposes (includes ambulances, fire service vehicles, and so on). **8. Other** – Other special functions, not mentioned above. **9. Unknown** – It was not possible to record a special function. **Comments**: Important to evaluate the crash involvement of vehicles with special uses.		N/A	N/A	N/A	2	N/A	1	N/A	N/A
2	29	**Vehicle maneuver (what the vehicle was doing at the time of the crash)**	**Definition**: The controlled maneuver for this motor vehicle prior to the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Reversing** – The vehicle was reversing. **2. Parked** – Vehicle was parked and stationary. **3. Entering or leaving a parking position** – The vehicle was entering or leaving a parking position. **4. Slowing or stopping** – The vehicle was slowing or stopping. **5. Moving off** – The vehicle was still and started moving. Does not include vehicle leaving or entering a parking position. **6. Waiting to turn** – The vehicle was stationary, waiting to turn. **7. Turning** – The vehicle was turning (includes U-turns). **10. Changing lane** – The vehicle was changing lane. **11. Avoidance maneuver** – The vehicle changed its course in order to avoid an object on the carriageway (including another vehicle or pedestrian). **12. Overtaking vehicle** – The vehicle was overtaking another vehicle. **13. Straightforward/normal driving** – The vehicle was moving ahead away from any bend. **8. Other** **9. Unknown**		N/A	N/A	1	2	N/A	N/A	N/A	N/A

		Person-related indicators										
0	30	**Person ID**	**Definition**: Number assigned to uniquely identify each person involved in the crash. **Obligation**: Mandatory **Data type**: Numeric (two-digit number, nn) **Comments**: The persons related to the first (presumed liable) vehicle will be recorded first. Within a specific vehicle, the driver will be recorded first, followed by the passengers. Allows the person record to be cross-referenced to crash, road, and vehicle records, in order to establish a unique linkage with the crash ID and the vehicle number.	X	4	3	2	5	N/A	N/A	N/A	1
4	31	**Occupant's vehicle number**	**Definition**: The unique number assigned for this crash to the motor vehicle in which the person was an occupant. **Obligation**: Mandatory **Data type**: Numeric (two-digit number, nn) **Comments**: Allows the person record to be cross-referenced to the vehicle records, linking the persons to the motor vehicle in which they were travelling.		N/A	N/A	1	2	N/A	N/A	N/A	N/A
4	32	**Pedestrian's linked vehicle number**	**Definition**: The unique number assigned for this crash to the motor vehicle that collided with this person. The vehicle number assigned under to the motor vehicle that collided with this person. **Obligation**: Mandatory **Data type**: Numeric (two-digit number, nn, from V1) **Comments**: Allows the person record to be cross-referenced to the vehicle records, linking the person to the motor vehicle that struck them.		N/A	N/A	1	2	N/A	N/A	N/A	N/A
2	33	**Date of birth**	**Definition**: Indicates the date of birth of the person involved in the crash. **Obligation**: Mandatory **Data type**: Numeric (date format – dd/mm/yyyy, or 99/99/9999 if birth date unknown) **Comments**: Allows calculation of person's age. Important for analysis of crash risk by age group, and for assessing effectiveness of occupant protection systems by age group. Key variable for linkage with records in other databases.	X	3	2	5	4	N/A	N/A	N/A	1
2	34	**Sex**	**Definition**: Indicates the sex of the person involved in the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Male** – Based on identification documents/ personal ID number or determined by the police. **2. Female** – Based on identification documents / personal ID number or determined by the police. **9. Unknown** – Sex could not be determined (police unable to trace person, not specified). **Comments**: Important for analysis of crash risk by sex. Important for evaluation of the effects of sex of the person involved on occupant protection systems and on motor vehicle design characteristics.	x	3	2	5	4	N/A	N/A	N/A	1

1	35	**Type of road user**	**Definition**: This variable indicates the role of each person at the time of the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Driver** – Driver or operator of motorized or non-motorized vehicle. Includes cyclists, persons pulling a rickshaw, or riding an animal. **2. Passenger** – Person riding on or in a vehicle, who is not the driver. Includes person in the act of boarding, alighting from a vehicle, or sitting/standing. **3. Pedestrian** – Person on foot, pushing, or holding a bicycle, pram, or a pushchair, leading or herding an animal, riding a toy cycle, on roller skates, skateboard or skis. Excludes persons in the act of boarding or alighting from a vehicle. **4. Cyclist** – Person on bicycle. **8. Other** – Person involved in the crash who is not of any type listed above. **9. Unknown** – It is not known what role the person played in the crash. **Comments**: Allows for analysis of crash risk by road user type (in combination with Vehicle type, V2). Important for evaluation of countermeasures designed to protect specific road users.	X	4	3	1	2	N/A	N/A	N/A	N/A
2	36	**Seating position**	**Definition**: The location of the person in the vehicle at the time of the crash. **Obligation**: Mandatory for all vehicle occupants **Data type**: Numeric ***Subfield:*** *Row* **Data values**: **1. Front** **2. Rear** **3. Not applicable** (for example, riding on motor vehicle exterior) **8. Other** **9. Unknown** ***Subfield:*** *Seat* **Data values**: **1. Left** **2. Middle** **3. Right** **4. Not applicable** (for example, riding on motor vehicle exterior) **8. Other** **9. Unknown** **Comments**: Important for full evaluation of occupant protection programs.		3	4	1	2	N/A	N/A	N/A	N/A
0	37	**Injury severity**	**Definition**: The injury severity level for a person involved in the crash. **Obligation**: Mandatory **Data type**: Numeric	X (MAIS3+ in MiniCADaS)	2	3	5	4	N/A	N/A	N/A	1

			Data values: **1. Fatal injury** – Person was killed immediately or died within 30 days, as a result of the crash. **2. Serious/severe injury** – Person was hospitalized for at least 24 hours because of injuries sustained in the crash. **3. Slight/minor injury** – Person was injured and hospitalized for less than 24 hours or not hospitalized. **4. No injury** – Person was not injured. **9. Unknown** – Injury severity was not recorded or is unknown. **Comments**: Important for injury outcome analysis, evaluation, and appropriate classification of crash severity (PD1). Important element for linkage with records in other databases.									
1	38	**Safety equipment**	**Definition**: Describes the use of occupant restraints, or helmet use by a motorcyclist or bicyclist. **Obligation**: Mandatory **Data type**: Numeric ***Subfield:*** *Occupant restraints* **Data values**: **1. Seatbelt available, used** **2. Seatbelt available, not used** **3. Seatbelt not available** **4. Child restraint system available, used** **5. Child restraint system available, not used** **6. Child restraint system not available** **7. Not applicable** – No occupant restraints could be used on the specific vehicle (for example, agricultural tractors) **8. Other restraints used** **9. Unknown** – Not known if occupant restraints were in use at the time of the crash. **10. No restraints used** ***Subfield:*** *Helmet use* **Data values**: **1. Helmet worn** **2. Helmet not worn** **3. Not applicable** (for example, person was pedestrian or car occupant) **9. Unknown** **Comments**: Information on the availability and use of occupant restraint systems and helmets is important for evaluating the effect of such safety equipment on injury outcomes.	X	3	2	1	4	N/A	5	N/A	N/A
3	39	**Pedestrian maneuver**	**Definition**: The action of the pedestrian immediately prior to the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Crossing** – The pedestrian was crossing the road. **2 .Walking on the carriageway** – The pedestrian was walking across the carriageway, facing or not facing traffic.		3	N/A	1	2	N/A	N/A	N/A	N/A

			3. Standing on the carriageway – The pedestrian was on the carriageway and was stationary (standing, sitting, lying, and so on). **4. Not on the carriageway** – The pedestrian was standing or moving on the sidewalk or any point beside the carriageway. **8. Other** – The vehicle or the pedestrian was performing a maneuver not included in the list of the previous values. **9. Unknown** – The maneuver performed by the vehicle or pedestrian was not recorded or it was unknown. **Comments**: Provides useful information for the development of effective road design and operation, education, and enforcement measures to accommodate pedestrians.									
○	40	**Alcohol use suspected**	**Definition**: Law enforcement officer suspects that person involved in the crash has used alcohol. **Obligation**: Mandatory for all drivers of motorized vehicles, recommended for all non-motorists (pedestrians and cyclists). **Data type**: Numeric **Data values**: **1. No** **2. Yes** **3. Not applicable** (for example, if person is not driver of motorized vehicle) **9. Unknown**		2	1	3	4	N/A	N/A	N/A	N/A
○	41	**Alcohol test**	**Definition**: Describes alcohol test status, type, and result. **Obligation**: Conditional (mandatory if alcohol use suspected) **Data type**: Numeric ***Subfield:*** *Test Status* **Data values**: **1. Test not given** **2. Test refused** **3. Test given** **9. Unknown if tested** ***Subfield:*** *Test type* **Data values**: **1. Blood** **2. Breath** **3. Urine** **8. Other** **9. Test type unknown** ***Subfield:*** *Test result* **Data values**: **1. Pending** **9. Result unknown** **Comments**: Alcohol-related crashes are a major road safety problem. Information on alcohol involvement in crashes facilitates evaluation of programs to reduce drink driving.	X	4	1	2	3	N/A	N/A	N/A	N/A

0	42	**Drug use**	**Definition**: Indication of suspicion or evidence that person involved in the crash has used illicit drugs. **Obligation**: Mandatory for all drivers of motorized vehicles, recommended for all non-motorists (pedestrians and cyclists). **Data type**: Numeric **Data values**: **1. No suspicion or evidence of drug use** **2. Suspicion of drug use** **3. Evidence of drug use** (further subfields can specify test type and values) **4. Not applicable** (for example, if person is not driver of motorized vehicle) **9. Unknown**	X[9]	2	1	3	4	N/A	N/A	N/A	N/A
3	43	**Driving license issue date**	**Definition**: Indicates the date (month and year) of issue of the person's first driving license, provisional or full, pertaining to the vehicle they were driving. **Obligation**: Mandatory for all drivers of motorized vehicles **Data type**: Numeric (MMYYYY) **Data values**: **Value (MMYYYY)** **1. Never issued a driving license** **9. Date of issue of first license unknown** **Comments**: Allows calculation of number of years' driving experience at the time of crash.		N/A	N/A	2	3	1	N/A	N/A	4
0	44	**Driver license type fitting vehicle**[10]	**Definition**: Whether the driving license allowed the driver to operate the vehicle s/he was operating. **Data type**: Yes or No									
0	45	**Age**	**Definition**: The age in years of the person involved in the crash. **Data type**: Numeric **Comments**: Derived from Date of birth and Crash date. Important for analysis of crash risk by age group, and for assessing effectiveness of countermeasures by age group.		4	3	5	6	2	N/A	N/A	1
8	46	**Driver nationality**[11]		X								
1	47	**Hit and run**	**Definition**: The behavior of a driver of a vehicle who is involved in a collision with another vehicle, property, or human being, who knowingly fails to stop to give his/her name, license number, and other information as required by statute to the injured party, a witness, or law enforcement officers. **Data type**: Yes or No **Comments**: Information captured when more than one vehicle involved in the crash but only one vehicle's data available.		N/A	N/A	1	2	N/A	N/A	N/A	N/A

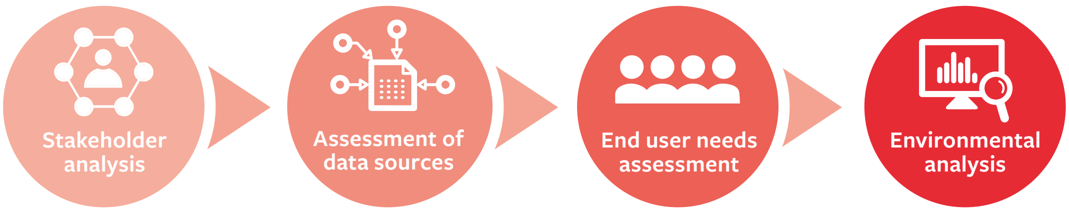
[9] Drug test y/n is what is required
[10] Added in after deliberations during second workshop towards establishment of ARSO.
[11] Added in after deliberations during second workshop towards establishment of ARSO.

Appendix C:
Establishing a crash database system

Situational assessment

Before establishing a new crash database system (or improving a current system), it is recommended that a situational assessment be undertaken (WHO, 2010). This involves four steps:

Figure 7. *Recommended steps for situational assessment. Source, WHO 2010*



Stakeholder analysis
A stakeholder analysis involves identifying organizations and individuals who have (or should have) a role in the collection and use of road safety data. Critical stakeholders will include police, transport agencies, insurance companies, and health departments, but there are likely to be many others.

Assessment of data sources and existing systems/quality
An assessment of data sources is required to determine what information is already collected and review the quality of the data. This is often a significant problem in many countries.

End-user needs assessment
An end-user assessment involves understanding who the key users are and how these key stakeholders use the information. This knowledge will help to improve the usability of the data and the subsequent development of policies.

Environmental analysis
An environmental analysis involves understanding the political environment and critical partnerships required for the successful collection, analysis, and use of the data. Without this understanding and appropriate collaboration, it is likely that the collection and use of crash data will be severely hindered. There are many examples where expensive crash data systems have been established, but data has not been entered into the system due to inadequate communications and poor cooperation.

Process for establishing a crash database system

Following this situational assessment, the recommended process for establishing a crash database system is:

Figure 8. *Recommended steps for situational assessment. Source, WHO 2010*

Get started

- An assessment of data requirements should be made. In the particular case of crash-related information, this often entails evaluating the crash report form used by police officers attending the crash.
- Assessment of staff capacity to collect, store, manage, and analyze the data, including police officers and administrative staff.
- For countries with no comprehensive crash data, information on final and intermediate outcomes should be collected, especially for high-risk routes (for example, high-volume roads) to allow measurement of safety problems and identification of measures. This collection could be undertaken as part of a corridor demonstration project.
- A crash data system should be put in place. The steps required for this include the need to:
  - Assess current data sources.
  - Engage with key stakeholders (the road agency, police, insurance, and the health sector are especially important).
  - Develop a crash report form or improve the existing one.
  - Develop a data system.
  - Put in place a process to ensure data quality.
- The focus should be on the collection of the range of data needed to address fatal and serious injury crash outcomes, which will include exposure data and final outcome data, as well as intermediate outcome data.
- Road infrastructure/asset data collection should be considered to inform safety decisions – for instance, through a road assessment program (such as iRAP Star Rating). This can provide information on likely high-risk crash locations, as well as affordable treatments in the absence of comprehensive crash data.

Make progress

- A relevant data collection strategy should be developed to ensure that essential information is collected.
- The crash data system should be routinely checked for accuracy and completeness (for example, by comparing police and hospital data), particularly regarding the follow-up of victims and their possible death after the crash.
- The database should include basic features to allow comprehensive analysis of crash problem types and be fit for use by the required stakeholders.
- Information on the availability and condition of road assets and others relating to safety outcomes should be collected.
- Countries should be encouraged to aggregate data at national level.
- Other data relevant to the setting and monitoring of road safety targets and trends should be collected, and the accuracy of this data assessed.
- All outputs (such as reports) should be assessed to ensure that they are fit for purpose and address the needs of key stakeholders.

Consolidate activity

- A comprehensive data collection strategy should be put in place and regularly monitored to ensure that it is fit for purpose, accurate, and complete.
- A crash database that contains all crash data should be fully implemented. Data should be spatially coded, and appropriate quality control checks should be put in place.
- Information on the availability and condition of road assets relating to safety outcomes should be contained within a comprehensive roadway inventory database. This may require the development of a database, or linkage to an existing database.
- Linkages should be made between key sources of data, particularly between data collected by police and hospitals, and between crash and asset data.
- Every country can define their own data collection needs, both for crash-related and other safety outcomes. However, it helps to agree on a minimum number of data elements that countries should be collecting to ease international comparison.

Country data management assessment case study:

A short questionnaire to collect basic information about the national crash information procedures and systems in selected African countries was sent out by the researchers of the SaferAfrica programme. The surveyed countries were Botswana, Cameroon, Ethiopia, Gambia, Ghana, Kenya, Lesotho, Liberia, Malawi, Mauritius, Mozambique, Namibia, Nigeria, Sierra Leone, South Africa, South Sudan, Swaziland, Tanzania, Uganda, and Zimbabwe (Mavromatis, Yannis, Laio, 2016).

The survey revealed the following interesting facts about road safety data management in the 20 countries that participated in the survey:

- The majority (75-85 percent) of the countries indicated that they have a road safety lead agency, a national strategy for road safety, and national medium-term quantitative targets.
- The targets are not defined using a rational process on known key problems and potentially efficient measures.
- The targets are based on fatalities and do not include non-fatal injuries.
- 50 percent of the countries have not defined road safety performance indicators.
- 50 percent of the countries do not have sustainable systems in place to collect and manage data on crashes, fatalities, and injuries, although 65 percent indicated that they have a central organisation in charge of data systems for road safety.
- In general, crash databases are not linked to other databases, such as those of hospitals.
- 55 percent of the countries do not have a reporting procedure to monitor road safety interventions carried out, although 65 percent indicated that they do benchmarking.

The responses indicate that there is a gap between the capturing of comprehensive road safety data and the planning of strategies, defining of road safety performance indicators, and the monitoring of performance.

Good practice system design recommendations

In examining crash-data systems to identify innovative and efficient practices, five system components were identified as core elements in respect to data collection, data storage, analysis and reporting, data accessibility, and overall resource efficiency. The assessment led to the identification of a number of components, within the elements of an overall ideal system, that should be recommended to countries when refining their data management systems.

Data collection

Data collection is an area where innovative technology can be used to improve crash-data systems. Innovative practices improve data quality, reduce staff intervention, and expedite data availability.

Data storage

Data storage is one of the most critical aspects of an efficient system. Significant time is saved by receiving reports and records electronically, with minimal user intervention. The linkages to other enterprise systems enable advanced data analysis. Having the data stored in a technologically advanced database makes data sharing, as well as transfer to other systems and users, efficient and cost-effective.

Analysis and reporting

Data analysis and reporting capabilities vary widely from country to country. Among the innovations in analysis and reporting that add value to a user's daily workflow, GIS provides a good graphical component that helps users visualize trends that may not be apparent in a simple tabular format. GIS also allows users to query information at varying levels of geography, as opposed to the traditional intersection or area query. The ability to generate custom reports reduces the need for data export, ensuring that the user is analyzing the most current information available. The usage of centralized statistical analysis and charting tools helps to enforce data consistency across an organization in outputs, as well as equipping it with the most current data available.

Accessibility

While the aforementioned systems and technological innovations can dramatically increase a country's efficiency, the time and resources that are recovered can quickly disappear if users do not have adequate access to tools and data. Waiting for exported data or specialized software installations can be time-consuming and costly. This has directed the most progressive states toward internet/intranet solutions, which run within stable internet browsers such as Internet Explorer and Google Chrome.

Overall efficiency

One of the driving objectives for an improved crash management system is to improve the overall efficiency of its practices to collect, store, maintain, and analyze crash data. Improving efficiency will reduce the demand for resources and allow the government to direct funds toward other important safety-related activities. Through the utilization of an improved crash management system, a backlog of incident reports can be eliminated. Current systems give managers and analysts quick and seamless access to the necessary resources to achieve decreased response time for critical safety issues. The table below outlines the elements of an efficient data management system, listing good practice components and system design recommendations.

Table 1. *Country-level system design recommendations*

Good practice components	System design recommendations
Data collection	• Electronic data entry • GPS locator • GIS field display for locating • Data collection standard
Crash data storage	• Store individual crash data, possibly using relational databases • Create aggregated data summaries for sharing purposes
Analysis and reporting	• Generate custom ad-hoc reports • Custom data queries • Data export to multiple formats • User-friendly GIS capabilities • Insert GIS graphics in reports • Advanced statistical analysis • Chart and graph capabilities • Links for additional databases for advanced analysis • Create aggregated counts of selected variables for reporting to other institutions, including regional observatories or international bodies
Accessibility	• Centralized web application • One-stop portal for all information • All information live linked • Password security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