Analysis of good practices in Europe and Africa

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ANALYSIS OF GOOD PRACTICES IN EUROPE AND AFRICA

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1 Executive Summary

According to the Global Status Report on Road Safety 2015 of WHO (WHO, 2015), "road traffic injuries claim more than 1.2 million lives each year and have a huge impact on health and development". Based on the WHO regions, there has been a deterioration in road fatality rates in the WHO Africa region from 24.1 fatalities per 100,000 inhabitants in 2010 to 26.6 fatalities per 100,000 inhabitants in 2013. Over the same period, there was an improvement in road fatality rates in the WHO Europe region. Road trauma in Africa is expected to worsen further, with fatalities per capita projected to double over the period 2015-2030 (Small and Runji, 2014).

The SaferAfrica project aims at establishing a Dialogue Platform between Africa and Europe focused on road safety and traffic management issues. It will represent a high-level body with the main objective of providing recommendations to update the African Road Safety Action Plan and the African Road Safety Charter, as well as fostering the adoption of specific initiatives, properly funded.

The main objective of work package 7 (WP7) is to analyse good road safety practices realised at country, corridor and regional levels in Africa and to compare these practices with those of other countries and with international experiences. Also included in this WP7, are good practices in road safety management and in the policy-making and integration of road safety with other policy areas. WP7 includes the definition of a transferability audit, tailored to Africa conditions that can be used to assess the suitability of road safety interventions in the context of African countries. Finally, promising local projects were identified, that may be implemented in selected African countries (Tunisia, Kenya, Cameroon, Burkina Faso and South Africa); to this end, a procedure for assessing the potential adaptability to the local contexts (transferability audit) will be developed in WP7 and applied to promising interventions. Following a successful transferability audit, a detailed concept definition of the retained interventions will be made by SaferAfrica participants and local road safety experts. Furthermore, factsheets on five key challenging African safety issues will be developed as synthesised working documents, containing all technical and financial information necessary for understanding the corresponding set of proposed interventions.

In this report road safety interventions are defined as those actions designed to target consciously chosen safety performance improvement objectives within the road transport system. Good practices in this area are those which have effects either directly measurable in terms of accident, casualty or injury reduction, or indirectly assessable through intermediate measures such as reducing speed, use of personal safety devices, uptake of safety systems, etc., which are known to influence safety final outcomes.

There is no standard practical definition of good practice available. In SaferAfrica criteria used in the EU SUPREME project to select and describe good practice were adopted. These criteria include characteristics such as the existence of a focus on clearly identified road safety problems and knowledge of the active mechanism put in place to mitigate them; the relative size of the safety phenomenon addressed; a quantitative assessment of the likely impact of the intervention; a reported evaluation of effects; results from costs and benefits analysis; acceptance by public and policy makers; prospect of long term effects; and transferability.

Ideally, meeting all these criteria corresponds to *best practice*; however, it is acknowledged that it is seldom the case that road safety interventions are assessed through cost-benefit analysis, and it is usually assumed that this should not deter from considering an effective intervention from being categorised as *good practice*.

Given the wide international scope of SaferAfrica, encompassing European and African countries and regions, it was realised that issues related to the transferability of interventions from one context to another needed to be addressed in a more thorough way than in the SUPREME project, which considered only European countries. Therefore, a formal procedure for detailed analysis of road safety intervention transferability is being setup and tested in another task of this WP7.

For the collection of good practices, an evaluation template was developed, considering the mentioned criteria (except transferability), to be used by project partners. A simplified version was also distributed among African Stakeholders for swift completion.

Priority areas identified within the African Road Safety Action Plan were used to target the analysis of good practice and the selection of intervention examples that have the potential to contribute to the expected outcomes. These priority areas correspond to the five pillars (Road Safety Management, Safer Roads and Mobility, Safer Vehicles, Safer Road Users, and Post-Crash Response) and the two cross cutting issues mentioned in the Action Plan.

Evidence relating to good practice was gathered from a number of different sources, based on a literature search and included related project reports, journal articles, websites, reports from financing projects for transport sector reformation (NGOs and development banks), and expert knowledge among a range of European and African project partners. Existing work carried out in other SaferAfrica work packages was also used as a source, such as the in-depth country reviews from WP3, results from the WP4 questionnaire, and the WP5 capacity reviews. Data concerning each identified good practice example were collected through templates specifically developed, one for general description and the other containing a detailed description. This detailed template also sets out the framework for the information to collect on each new road safety intervention example that might be needed for inclusion in local interventions, as will be defined and proposed later on in this work package.

In this report an account of background road safety issues and detailed descriptions of selected road safety intervention good practices are presented, for the five African Road Safety Action Plan pillars. Mention is also made to crosscutting and critical issues affecting road safety intervention effectiveness, which will be important to consider in the following tasks of this WP.

Factors of success of the reported interventions can be found at the management level (data supported rationale, proper legal setting, and context resource allocation), at the intermediate level, through appropriate application of technical skills (e.g. engineering, medical, training and social sciences), and at the operational level (construction, enforcement, and stakeholder involvement). Each intervention has its own set of conveniently detailed procedures, which ought to be rigorously applied.

Diminishing the burden of road accident disease is best accomplished by implementation of a dedicated road safety policy. Integrating road safety interventions in a program based on a rigorous diagnosis, addressing the whole problem, and involving a consistent set of actions on the various components of the traffic system is a key element in a successful combat of road deaths and incapacitating injuries by efficient application of resources. Also, such road safety programs should be executed following the principles of realism and opportunity, and be monitored and directed on an ongoing basis.

Due to the multidisciplinary nature of the road crash phenomenon, the implementation of road safety policies usually requires an integrated action from several institutional public and private actors. Furthermore, other policies may impact on road safety outputs, such as public health (post-crash response), basic education and academia (vehicles, roads, and road users), taxation (vehicles and transport modes). In fact, synergies between road safety interventions and between these and other policies' interventions are important to enhancing effectiveness and limiting costs of road safety programs. Therefore road safety policies must be adapted to the prevailing economic situation and be in line with current national political priorities and the international setting; to be effective, they also have to be supported by strong political leadership.

In total, 40 road safety intervention good practice examples from Europe, Africa and the rest of the World are described in this report, nine related to road safety management issues, seven to safer roads, five to safer vehicles, 14 to improving road user behaviour, three related to ameliorating post-crash response, and two showing the benefits of combining several interventions and gathering synergies between interventions within a specific local improvement objective. Several interventions are also described in the detailed templates.

The presented examples are not a comprehensive collection of existing practice, as such listing was not the objective of this SaferAfrica work package. In fact, besides the good practice criteria laid out, it is acknowledged that immediate availability of information contributed to the presented selection of the collected good practice examples. Nevertheless the described examples constitute a good basis for carrying out the succeeding tasks in this work package and in other relevant SaferAfrica activities.

2 Introduction

2.1 Background

According to the Global Status Report on Road Safety 2015 of WHO (WHO, 2015), "road traffic injuries claim more than 1.2 million lives each year and have a huge impact on health and development". The WHO mortality data of the world regions show that there has been deterioration in road fatality rates in the Africa region from 24.1 fatalities per 100,000 population in 2010 to 26.6 fatalities per 100,000 in 2013. Road trauma in Africa is expected to get worse, with fatalities per capita projected to double over the period 2015-2030 (Small and Runji, 2014).In contrast to Africa, road traffic mortality rates in Europe improved over the period 2010-2013.

As is the case elsewhere, road traffic accidents resulting in deaths and injuries have an enormous impact on public health and the economy in Africa. The road safety target in the 2015 UN Sustainable Development Goals (SDG's) and the African Road Safety Action Plan (ARSAP) is to reduce the number of deaths and injuries by 50% by 2020. This poses a major challenge and implies innovations and new initiatives in terms of public policy are needed for making this goal a reality. For Africa, this would translate into a saving of more than 130,000 deaths per year and a reduction of millions of injuries per year (ARSAP).

In Africa several actions are already on-going and important policy documents are already in place. The African Union (AU) and United Nations Economic Commission for Africa (UNECA developed the African Road Safety Action Plan 2011-2020 (ARSAP) on the basis of the UN "2011-2020 a Decade of Action for Road Safety". ARSAP is also organised in five pillars with the following specific objectives:

1. Road safety management. To build institutional capacity, improve capacity building at local government level, develop local research and road safety monitoring.
2. Safer roads and mobility. To properly consider road safety in infrastructure development and introduce or improve facilities for pedestrians and other vulnerable road users.
3. Safer vehicles. To review safety standards for vehicles and safety equipment.
4. Safer road users. To review standards and rules for the provision of license to private, commercial and public transport drivers and strengthen the law enforcement.
5. Post- crash response. To improve capacities in term of on-site care, transport of the injured to appropriate medical facilities, and trauma care.

In 2015, UNECA conducted a Mid-term Review of the Action Plan in order to assess the progress made by each country. The "Roadmap for accelerating the implementation of the African Road Safety Action Plan" resulted from this review, in which four main challenges were identified to be addressed with higher priority by policy makers, in order to facilitate the implementation of the actions identified in the Action Plan and reach the UN 2020 target. These were:

- Data Collection, Analysis & Reporting
- Funding Road Safety
- Road Safety and Traffic Management
- Capacity Building and knowledge transfer

As highlighted in a working paper by SSATP (Small and Runji, 2014), too often low capacity levels in Africa lead to strategy tasks being outsourced, without a dedicated process allowing the transfer of sufficient knowledge and the development of critical road safety management expertise in a country.

In this context, European experience in Road Safety and willingness of African countries for Road Safety, suggest that Europe could play an important role for supporting African countries in improving their road safety and traffic management conditions to achieve better performance. SaferAfrica, through the implementation of the Dialogue Platform, will create the conditions and opportunities for an effective implementation of actions on road safety and traffic management. Although this deliverable is not focused on the Dialogue Platform, the main results presented here will inform the activity of the Dialogue Platform.

SaferAfrica is organised into nine work packages (Figure 2-1) through which the road safety related weaknesses and strengths existing on the African continent will be analysed and the criticalities in socio-economic, organisational and operational dimensions will be identified. The analyses will be conducted at different scales (continental, national, local) with the objective of identifying the needs in the most effective way.

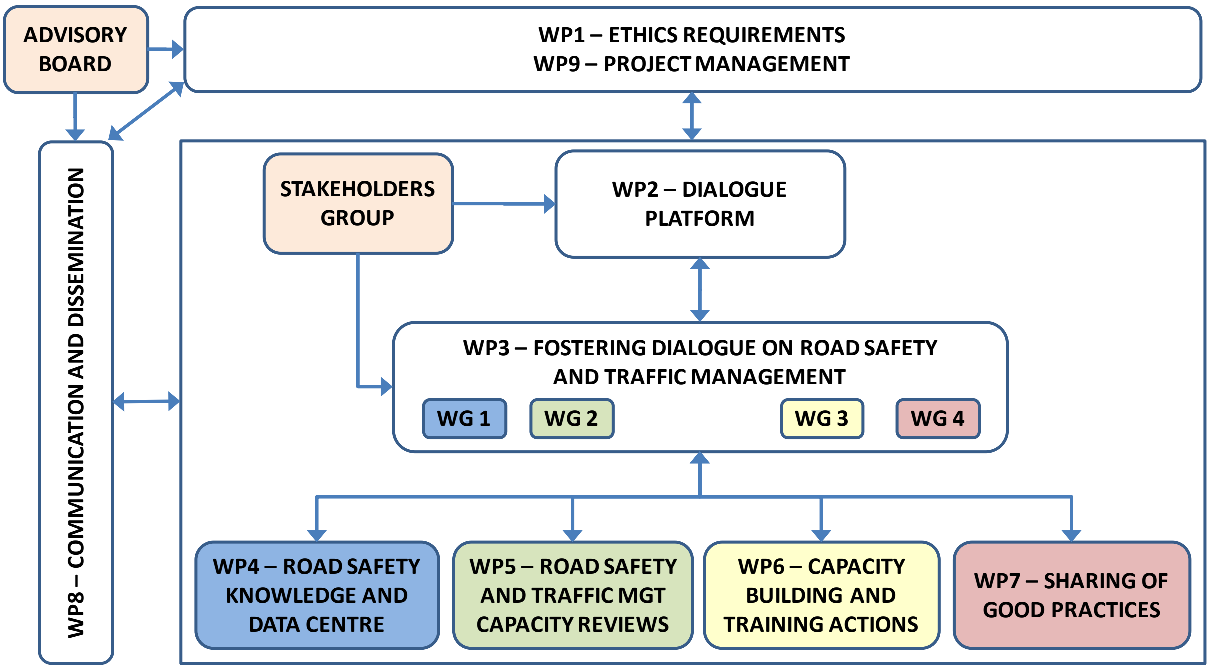

Figure 2-1 Interrelationship of SaferAfrica work packages

2.2 Scope of the report

The focus of this deliverable is upon the work carried out in WP7 – Sharing of Good Practices. WP7 aims to analyse good road safety practices realised at country, corridor and regional levels in Africa and to compare these practices with those of other countries and with international experiences. A number of interventions will be identified from the analysis of good practice and their transferability into the local African situation will be assessed. These could be practices from outside of Africa to within Africa or existing practices from an African country to other African countries. These will cover issues related to and spanning the five pillars with detailed descriptions presented to the Dialogue Platform in the form of factsheets.

The final goal of WP7 is to facilitate the definitions of different types of future local interventions to be implemented at the country level in the form of local projects. This will be done in conjunction with an analysis of road safety data (WP4) and an analysis of current road safety actions and legislations (WP5). The final selection of local projects will be done on the technical level of the Dialogue Platform in conjunction with activities within WP3.

To achieve these, WP7 comprises three tasks, the first consisting on the collection and analysis of European and African good practices in road safety interventions, in order that road safety measures and policies with high potential for casualty reductions in African countries are identified and selected as examples for further consideration. In task two, a method is being developed to assess the transferability of the example measures to different African contexts and to identify barriers to their implementation, in order to help define how to address them. In task three this information and interaction through the Dialogue Platform will allow to select a set of local projects and to prepare a series of factsheets describing integrated interventions to address broad safety issues, suitable for further ***support and implementation outside of the project***. The outcome will be a set of interventions that are known to have substantial impacts on road casualties and that are believed to be capable of implementation in the context of specific African countries at both national and local levels.

This deliverable reports specifically on the activities undertaken for the first task in WP7, the analysis of good practice. The method undertaken in order to determine good practice is presented in section 3, followed by an analysis per pillar of the African Road Safety Action Plan (presented in sections 0 to 8) and then a consideration of cross-cutting and critical issues affecting road safety intervention efficiency (in section 9). The final chapter (section 10) provides recommendations moving in to the subsequent tasks of WP7.

Appendices 1-3 contain a list of abbreviations, a summary of the answers to the SaferAfrica questionnaires, and references to the general documentation analysed. Appendix 4 contains a template for abridged description of road safety interventions. Detailed descriptions of the most relevant examples of road safety interventions implemented mostly in Europe and Africa are presented in Appendix 5.

3 Methodology

Broadly, road safety interventions are actions designed to target consciously chosen safety performance improvement objectives within the road transport system (Wilpert and Fahlbruch, 2002). These interventions may concern any part of this system (road users, infrastructure, vehicles and the interaction between them), cover any stage of an accident (pre-collision, collision and post-collision) or be designed to mitigate one of the safety components, i.e.: exposure, risk and unrecoverable personal injury [Cardoso, 2007.].

To be efficient, road safety interventions should be carried out as part of integrated programs involving actions on the various components of the traffic system. Desirably, these programs should address the whole problem, comply with a set of key recommendations and be designed through a system approach. Decisions concerning its preparation should be based on rigorous diagnosis and lead to a consistent set of interventions. Involving public participation in that preparation is also important, to ensure that the planned interventions are highly likely to be accepted by road users and other individual and institutional stakeholders (such as road administrations and other public bodies). The principles of realism and opportunity should govern the safety programs' execution and this should be controlled and directed on an ongoing basis. As other national policies, these programs must be adapted to the prevailing economic situation and political context, and be in line with current political priorities and the international setting [OECD, 1984).

In order to undertake the analysis of good practice, this work package adopts a number of methodological steps which were first determined by answering three key questions:

- What is meant by good practice?
- Where should the specific focus of good practice lie for SaferAfrica?
- Where will the evidence for identification of good practice be found?

Each of these is described in the following sections.

3.1 Concepts of good practice in road safety interventions

In order to determine a criterion for identifying 'Good Practice' in relation to road safety interventions, the concepts adopted by the SUPREME (2007b) project were followed. SUPREME acknowledged that there is no standard definition of "Best, Good or Promising Practice" available, but that obviously it refers to a road safety policy that has proven to be successful. Successful road safety policy brings about a sustained reduction in the number of road accidents or accident victims, in particular the number of fatalities and serious injuries. Thus, road safety policy must include measures that are known to reduce the number of accidents or their severity, or that can reasonably be expected to improve road safety. SUPREME (2007b) identified eight criteria that could be used in order to select and describe best practice:

1. Focus of the measure: Best Practice Measures (BPM) should have a clearly defined focus. This includes a clear definition of the road safety problem to be solved and precise idea of how the measure will affect this problem.
2. Size of the road safety problem: BPM aim at reducing traffic accidents or risk factors which stand for a large proportion of severe injuries and fatalities in road accidents.

3. Expected effects on safety: BPM provide a quantitative assessment of the likely impact of the measure on accidents or on risk factors.
4. Evaluation of effects: An evaluation of effects of BPM on road safety is ideally based on accident statistics. Ideally, the implementation of BPM results in an obvious reduction of fatalities and severe injuries.
5. Costs and benefits: BPM provide a cost-benefit analysis with the result that benefits exceed their costs.
6. Acceptance: BPM have good public and policy maker acceptance.
7. Sustainability: BPM are not single events, they are rather characterised by duration and continuity. Likewise, their effects on road safety are long term effects.
8. Transferability: BPM include strategies for using the measure successfully on a larger scale, either on the regional, national or European level.

These criteria have been used within SaferAfrica to also describe *Good Practice*. Ideally, meeting all these criteria corresponds to best practice; however, it is acknowledged that it is seldom the case that road safety interventions are assessed through cost-benefit analysis, and that this should not deter from considering an effective intervention from being considered as good practice.

Given the wide international scope of SaferAfrica, encompassing European and African countries and regions, it was realized that issues related to the transferability of measures from one context to another needed to be addressed in a more thorough way than in the SUPREME project (SUPREME 2007b). Only interventions implemented in Europe were analysed in the SUPREME project, and the involved researchers had some experience of the traffic systems in several countries, besides their own country's traffic system. This enabled the application of an informal procedure for considering transferability between different countries, by means of meetings and discussion. Developing a formal procedure for analysing road safety intervention transferability was considered necessary and is being setup in Task 2 of WP7, for application to selected interventions in pilot countries or regions.

An evaluation template, based upon the mentioned criteria (excepting transferability), was developed for use by project partners when identifying Good practice (see Appendix 5) and this was simplified for distribution among African Stakeholders for ease of completion (see Appendix 4). These templates provide detailed descriptions of specific road safety interventions, together with supporting evidential documentation, which will be used later in WP7 when undertaking the transferability audit.

3.2 Africa Road Safety Action Plan priority areas

In order to target the analysis of Good Practice, and later proposals for local projects, reference has been made to the priority areas identified within the African Road Safety Action Plan (ARSAP). This was to ensure that examples identified would relate to priority areas in Africa. It should be noted that the ARSAP priority areas were defined following a broad consensus on main African road safety issues and reflect a subjective starting point on the problem. Other areas of focus would also result in good practice examples however to define the scope of the work reported on here, examples of Good Practice were sought that have the potential to contribute to the expected outcomes within each pillar (Table 3-1).

Table 3-1 Summary of the African Road Safety Action Plan

Pillar	Expected outcomes
Pillar 1: Road Safety Management	1. Established and strengthened Lead Agencies
	2. Improved management of data
	3. Developed/strengthened partnership and collaboration
Pillar 2: Safer Roads and Mobility	1. Safer road infrastructure for all road users
	2. Capacity building and training
Pillar 3: Safer Vehicles	1. Road worthiness of vehicles 1.1. Introduce incentives for importation of safer vehicles 1.2. Introduce periodical inspection of vehicles
Pillar 4: Safer Road Users	1. Educated general public (road users)
	2. Use of helmets
	3. Use of seatbelt
	4. Drink-driving and driving under the influence of other drugs
	5. Use of mobile phone while driving
	6. Speeding
Pillar 5: Post-Crash Response	1. Improved emergency care 1.1. Introduce emergency medical services coordination centres at strategic locations 1.2. Provide fully equipped ambulances with medical supplies, and crash extraction and rescue equipment 1.3. Develop capacity for long term hospital trauma care and rehabilitation 1.4. Introduce health facilities along main highways
Crosscutting Issues	1. Rural transport safety
	2. Evaluation of the Decade of Action

In addition to categorising practices and interventions according to the 5 pillars of road safety, the Supreme categorisation of interventions have also been applied when completing the evaluation templates in order to better identify cross-cutting themes (SUPREME, 2007b):

- Education and campaigns
- Driver training, testing & licensing
- Rehabilitation and diagnostics
- Vehicles
- Infrastructure
- Enforcement
- Statistics and in-depth analysis
- Institutional organisation
- Post-accident care
- Bundles (two or more interventions that are more effective when implemented together e.g. law and enforcement).

3.3 Main sources of information

Evidence relating to good practice had been gathered from a number of different sources including making use of existing work carried out by the other WPs in SaferAfrica. The process is illustrated in Figure 3-1. Sources of information exploited are listed below:

- Review of literature
    - Project reports
    - Journal articles
    - Websites
- Distribution of Good Practice evaluation template among NGOs and other stakeholders (e.g. identified World Bank initiatives included in financing projects for Transport Sector reformation)
- Expert knowledge among a range of European and African project partners
- SaferAfrica parallel activities in other WPs
    - WP3 in-depth country reviews (D3.1)
    - Expert review and additional evidence presented in WP3 templates, based upon WP4 Questionnaire 1 evidence (D3.1)
    - Results from the second questionnaire distributed by WP4 asking for specific examples of good practice within Africa
- WP5 capacity reviews

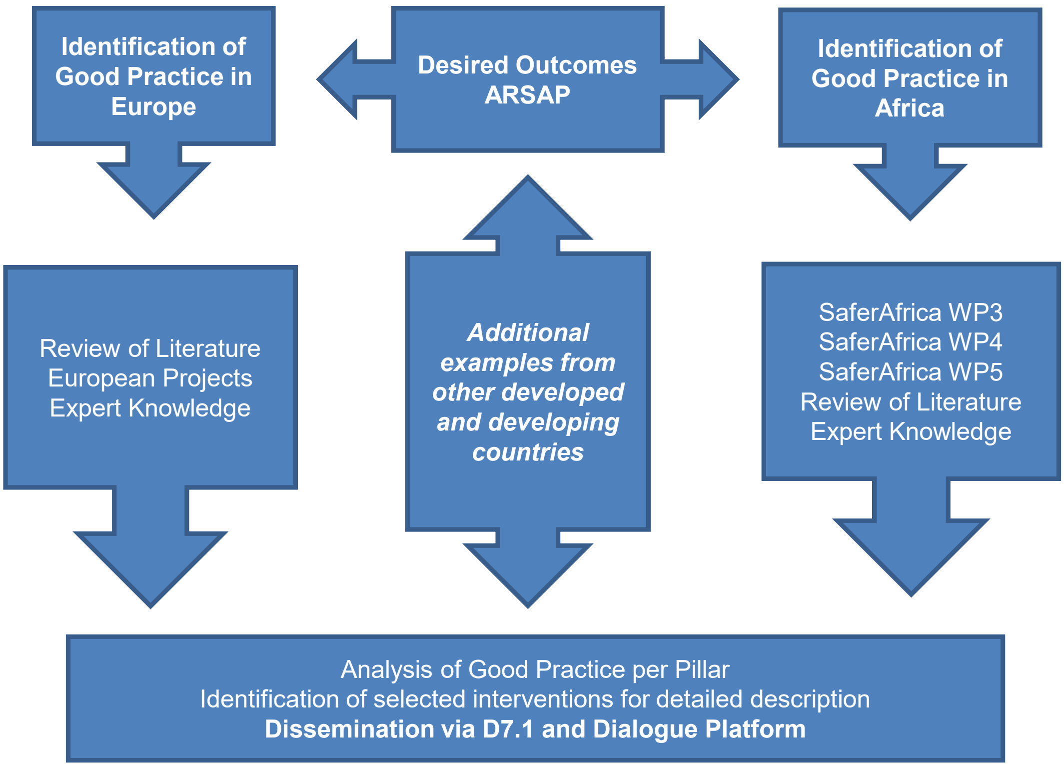

Figure 3-1 Evidence gathering process related to good practice in road safety interventions

Although the initial priority was identifying good practice examples in Africa and Europe this was widened to other developed and developing countries. Examples from other developed countries were chosen where they had effective interventions that could potentially be applied to Africa. Examples from other developing countries were included as the experience of these countries was thought to be closer to Africa than more developed countries. All data sources were screened to identify interventions that could potentially be classed as good practice. Results from the SaferAfrica WP3 templates and WP4 questionnaires are summarised in Appendix 2. Further details relating to specific information sources are given in sections 4 to 9 for each pillar and also in Appendix 3.

A pro-forma was developed to record key details of each potential good practice measure. This pro-forma included information on which pillar and Supreme category the intervention fitted into, the scope (e.g. local, whole country), the target accident type and road user group, specific detail of the intervention, data on the scale of the problem (e.g. percentage of accidents), the expected effects and the results of any evaluation study. Costs and acceptance of the intervention as well as factors relating to feasibility, effectiveness and potential problems with implementation could also be recorded. This allowed the intervention to be evaluated as to whether it could be counted as good practice according to the methodology described above (Section 3.1).

The level of detail varied from intervention to intervention. The key criteria to evaluate good practice for SaferAfrica is whether an intervention is effective and whether there is enough detail to evaluate whether the intervention could be implemented in Africa. The full evaluation of the latter will be reported on in D3.2 (Transferability Audit). Unfortunately many interventions are not formally evaluated and little information exists about their effectiveness – this was partially true for the interventions implemented in Africa. Therefore the expert knowledge of the SaferAfrica partnership was utilised to select the interventions with the most potential for effectiveness. The completed pro-formas relating to interventions described in this report can be found in Appendix 5.

In the next six sections a review is made of major issues related to each ARSAP pillar, and selected examples of successful implementation of road safety interventions are presented in detail. This report does not claim to be exhaustive. It is a collection of good practice examples evaluated as such by the SaferAfrica partnership from information that was available at the time of writing.

4 Road safety management

Road safety management is the first pillar of the Decade of Action's Global Plan (WHO, 2011). As highlighted in the World Report on Road Traffic Injury Prevention (WHO-WB, 2004), fatal and long term crash injury is largely predictable, largely avoidable and a problem amenable to rational analysis and remedy. Research and experience in North America, Australasia and Europe has shown that substantial reductions in road deaths and serious injuries have been achieved through the application of evidence-based measures against the background of increased motorisation. Improving road safety performance requires a systematic and planned approach and establishing an effective road safety management system is the means by which countries and organisations can achieve this.

According to the African Road Safety Action Plan, a few countries in Africa have established and substantially implemented modern road safety policies, including functioning Lead Agencies, crash information systems producing regular data that is disseminated and used to continuously improve the effectiveness of road safety actions, and promotion of coordination between relevant public and private institutions. Indeed, for this reason, the ARSAP document promotes three main expected accomplishments: establish/strengthen of Lead Agencies, improved management of data and develop/strength partnership and collaboration.

The World Report on traffic injury prevention highlights the fundamental role of the Lead Agency in ensuring the effective and efficient functioning of the road safety management system. A lead agency should be able to guide the national road safety effort, with the power to make decisions, manage resources and coordinate the efforts of all participating sectors of government .Strategies and measures aimed at improving road safety without a designated agency mandated to lead their implementation and a realistic and sustainable funding base are likely to be unsuitable and make no positive impact on results. In particular, the lead agency plays a dominant role in most of the seven institutional management functions representing the foundation on which road safety management systems are built (Bliss and Breen, 2008). In particular, it takes responsibility within government for the development of the national road safety strategy and its results focus that is the overarching institutional management function. It is usually engaged in several functions comprising: horizontal inter-governmental coordination arrangements; vertical coordination of national, regional and local activities; coordination of delivery partnerships between government, professional, non-governmental and business sectors and parliamentary groups and committees, ensuring a comprehensive legislative framework; securing sustainable sources of funding and creating a rational framework for resource allocation; high-level promotion of the road safety strategy across government and society; periodic monitoring and evaluation of road safety performance; and setting up a research and development programme and promoting knowledge transfer activities.

As the World Report on Road Traffic Injury Prevention notes, a variety of lead agency models can be effective in road safety. Successful practice underscores the need for the agency to be a governmental body and for its leadership role to be accepted and fully supported by the rest of government to ensure the development of appropriate capacity and funding. The agency might take the form of a designated, stand-alone bureau with a coordinating committee or cabinet representing several different government agencies. It might also be part of a larger transport organisation or be part of the Premier's department. The agency might undertake much of the work itself or else it might delegate aspects of work to other organisations, including provincial and local governments, research institutes or professional associations (WHO-WB, 2004).

The World Report on Road Traffic Injury Prevention also noted that many low to middle income countries lack road traffic injury surveillance systems in the transport and health sectors that are able to generate reliable data on road traffic crashes and injuries (WHO-WB, 2004). Thus, establishing and supporting data systems to set and monitor final and intermediate outcomes and output target as well as to create, transfer and apply knowledge are essential to provide a solid foundation for road safety planning and decision-making. All countries are encouraged to develop data collection procedures to cover:

- final outcomes, at least deaths and serious injuries by road user type;
- exposure measures (for example, relating outcomes to population levels, licensed driver numbers, distances travelled);
- safety performance indicators and including levels of mean traffic speeds, seat belt wearing, drink driving and vehicle and infrastructure safety ratings;
- institutional delivery outputs (including different categories of enforcement effort; ambulances deployed, safe roads constructed etc.);
- socio-economic costs associated with road trauma; and underlying economic factors, including new vehicle sales.

Finally, the World Report also highlighted the need for the development of a range of close working partnerships. These include bi-lateral and multi-sectoral partnerships amongst the roads/transport, health, justice/police and transport sectors at national, regional and local levels. For instance, Non-Governmental Organizations (NGOs) may both support and provide leadership in key areas of road safety; they are particularly effective when they measure their success by their ability to influence road safety results (Breen, 1999). Also the business sector shares responsibility for road safety and can make an important contribution with initiatives which are in line with national road safety strategy goals.

An extensive literature review was undertaken to identify good practices in road safety interventions focussed on Road Safety Management, in African countries as well as at an international level (Europe and rest of the World). The focus was on the three above mentioned expected outcomes taken from the African Road Safety Action plan:

1. Establish and strengthen Lead Agency
2. Improved Management of Data
3. Develop and strengthen partnership and collaboration.

To identify existing good practices for the three sub-pillars in Europe and in the rest of the world the EC funded projects and other relevant publications were sourced (Table 4-1).

Table 4-1 Selected projects and publications sourced to identify good road safety management practices

Projects/Publications/Institutions sourced
Bliss T., Breen J., World Bank - Country Guidelines for the Conduct of Road Safety Management Capacity Reviews and the Specification of Lead Agency Reforms, investment Strategies and Safe System Projects
EC SUPREME project Handbook for measures at the country level
ERSO (EC SafetyNet project)
AfDB, Road Safety in Africa - Assessment of Progresses and Challenges in Road Safety Management System
SSATP – African Transport Policy Program
Mid Term Review of the African Road Safety Action Plan – UNECA
Global Road Safety Partnership

The results of the literature review related to Pillar 1 – Road safety management are listed in Appendix 3.

4.1 Overview

Table 4-2 shows the summary of the main evidence on road safety management interventions.

Table 4-2 Synthesis of main evidence on road safety management interventions

Type of intervention	Number of studies		Source countries
	Africa	Rest of World	
Establish/strengthen Lead Agency	9	8	Europe, Finland, France, Great Britain, Latvia, Netherlands, Poland, Sweden, Burkina Faso, Burundi, Cameroon, Ivory Coast , Ethiopia, Guinea Conakry, Lesotho, Namibia, Nigeria, Zambia, Malaysia, Australia, New Zealand, USA
Improved management of data	1	9	
Develop/Strengthen partnership and collaboration	2	5	
Total	12	22	

4.1.1 Establish and strengthen Lead Agency

Concerning **establish/strengthen Lead Agency**, international good practice examples are listed from countries that have been active in road safety over a long period of time and which have developed a strong Road Safety Management System (such as Great Britain, Sweden, the Netherlands and New Zealand) or are in a transition phase of developing a stronger road safety management (such as Poland and Malaysia, both of which are making efforts to reverse road casualty trends against the background of increased motorisation and the acknowledged need to strengthen road safety management capacity.

A variety of lead agency models can be effective in road safety and each country needs to create a model appropriate to its own circumstances. Successful practice underscores the need for the agency to be a governmental body and for its leadership role to be accepted and fully supported by the rest of government to ensure the development of appropriate capacity and funding. Four types of governmental lead agency structures have been identified in good practices countries:

- Stand-alone lead agencies
- Road authority as lead agency
- Transport Ministry as lead department
- Stand-alone lead agency in Head of State's Department.

International examples of stand-alone lead agencies are very limited. The most typical form of lead agency in European countries seems to be a well-established road safety department within the government transport ministry. The third lead agency model is the road authority, where powers for road safety management have been delegated by a government Ministry. The fourth lead agency model is that of a central road safety bureau within the Premier's Department. All agencies involve complex organisational structures and processes and many actors.

Moving to African countries, good practices examples are few. A road safety study by the African Development Bank (AfDB, 2013) aimed at assessing the road safety management system in African countries provides an overview of the status of lead agencies in Africa. A questionnaire to collect comprehensive information related to the current status and progress of road safety from regional member states was prepared and distributed to regional member countries, and responses were obtained from 17 countries. As illustrated inTable 4-3, the survey shows that about 65% of countries have a road safety policy. Half of the countries have various legal instruments to implement the policy. Furthermore, most countries have a central road safety lead agency exclusively responsible for road safety. In half of the countries, the lead agency is accountable to the Ministry of Transport. The road safety lead agencies in Cameroon and Morocco are accountable to the Prime Ministers and in Nigeria to the President.

According to D3.1 of SaferAfrica, related to the assessment of the ARSAP (Table 4-3), all countries except Congo, Liberia and Tanzania have a designated lead agency on road safety. For 33 countries there is available funding for this lead agency. Thirty eight countries have developed a National Road Safety Strategy (NRS) but full funding for implementation of this NRS is available in only few countries (Angola, Botswana, Kenya, Mauritius, Morocco and Zambia). Many of the countries with a national road safety strategy have introduced targets for death reduction.

Table 4-3 Status of countries with respect to road safety policy and lead agency (AfDB, 2013 and SaferAfrica D3.1)

	Afdb, 2013			Saferafrica D3.1			
Country	Policy	Lead Agency	Accountability	Lead Agency present	Lead Agency funded	NRS strategy present	Funding for NRS Strategy
Algeria				Yes	Yes	Yes	Partially
Angola				Yes	Yes	Yes	Yes
Benin				Yes	Yes	Yes	Partially
Botswana				Yes	Yes	Yes	Yes
Burkina Faso	Yes	Yes	Ministry of Transport	Yes	Yes	Yes	Partially
Burundi	-	-	N/A				
Cameroon	Yes	Yes	Prime Minister	Yes	Yes	Yes	Partially
Centr. Afric. Rep.				Yes	Yes	Yes	Partially
Chad	Yes	Yes	Ministry of Transport	Yes	Yes	Yes	N/A
Congo				-	N/A	Yes	Partially
Cote d'Ivoire				Yes	Yes	Yes	Partially
D. R. of the Congo				Yes	Yes	Yes	Partially
Egypt	Yes	Yes	Ministry of Infrastructure	Yes	-	Yes	-
Erithrea				Yes	Yes	Yes	Partially
Ethiopia	-	Yes	Ministry of Transport	Yes	Yes	Yes	Partially
Gabon	Yes	Yes	Ministry of Transport	Yes	N/A	Yes	-
Gambia	-	-	N/A	Yes	-	Yes	N/A
Ghana	Yes	Yes	Ministry of Transport	Yes	Yes	Yes	Partially
Guinea				Yes	Yes	Yes	Partially
Guinea Bissau				Yes	-	Yes	-
Kenya	N/A	Yes	Ministry of Transport	Yes	Yes	Yes	Yes

	Afdb, 2013			Saferafrica D3.1			
Country	Policy	Lead Agency	Accountability	Lead Agency present	Lead Agency funded	NRS strategy present	Funding for NRS Strategy
Lesotho				Yes	Yes	Yes	Partially
Liberia				-	N/A	N/A	N/A
Lybia				Yes	-	Yes	-
Madagascar				Yes	Yes	Yes	Yes
Malawi				Yes	Yes	Yes	Yes
Mali	Yes	Yes	Ministry of Transport	Yes	Yes	Yes	Yes
Mauritania				Yes	Yes	Yes	Yes
Mauritius				Yes	Yes	Yes	Yes
Morocco	Yes	Yes	Prime Minister	Yes	Yes	Yes	Yes
Mozambique				Yes	-	Yes	Yes
Namibia				Yes	Yes	Yes	Yes
Niger				Yes	Yes	Yes	Yes
Nigeria	Yes	Yes	President	Yes	Yes	Yes	Yes
Rwanda				Yes	Yes	Yes	Yes
Senegal				Yes	Yes	Yes	Yes
Sierra Leone	-	Yes	Ministry of Transport	Yes	-	Yes	Yes
Somalia				Yes	Yes	-	-
South Africa				Yes	Yes	Yes	Yes
Sudan				Yes	-	Yes	Yes
Swaziland				Yes	Yes	-	-
Tanzania	Yes	-	N/A	-	Partially	-	-
Togo				Yes	Yes	-	-
Tunisia	Yes	Yes	Ministry of Interior	Yes	Yes	Yes	Yes

	Afdb, 2013			Saferafrica D3.1			
Country	Policy	Lead Agency	Accountability	Lead Agency present	Lead Agency funded	NRS strategy present	Funding for NRS Strategy
Uganda	-	-	N/A	Yes	-	-	-
Zambia				Yes	Yes	Yes	Yes
Zimbabwe				Yes	-	-	-

The results of Table 4-3 show that in most African countries, road safety lead agencies do not have the legal power and dedicated financial and human resources and therefore unlikely to be unable to coordinate road safety stakeholders and set and enforce safety regulations and standards.

According to information sourced by SSATP, Cameroon, Ethiopia, Nigeria and Zambia (not included in the survey of the AfDB) can be considered examples of good practices:

- In Cameroon, The Ministry of Transport has established a Road Safety Department (RSD) charged with several management functions such as control of driving schools and vehicle inspection centres, and road safety awareness campaigns and road accident prevention.
- A National Road Safety Council (NRSC was established in Ethiopia within the Ministry of Transport, to spread and facilitate road safety improvements on a federal level.
- The Federal Road Safety Corps (FRSC) in Nigeria is one of a few outstanding road safety lead agencies in Sub-Saharan Africa. It is well organised, has a professional management, use modern technology in its operations, and is able to show results.
- The Road Transport and Safety Agency (RTSA) is the national lead agency in Zambia. Its operational assignment includes nationwide driver and vehicle examination and licensing, which is carried out by Traffic Inspectors at the regional offices; in addition, a National Road Safety Plan is in place until 2013.

4.1.2 Improved management of data

Regarding the second intervention, **the Improved management of data,** international good practice examples are listed from regions and countries that have developed efficient road safety data collection and management systems.

A comprehensive road safety data system would encompass data collection and analysis mechanisms that cover the following aspects (WHO, 2010):

- final outcomes – including at least road user deaths and serious injuries, and characteristics of the accidents that result in them;
- exposure measures – e.g. demographic data, number of licensed drivers, traffic volume data, infrastructure factors – linked to represent the overall level of activity within the traffic system, and to help interpret of crash data and produce risk indicators.

- intermediate outcomes – e.g. mean traffic speeds, seat-belt and helmet wearing rates, drink–driving, and vehicle and infrastructure safety ratings;
- socio-economic costs associated with road traffic injuries;
- institutional outputs – including various enforcement efforts.

At country level, several best practices examples come from countries, such as Australia, New Zealand, Great Britain, that show a strong lead agency playing a major role by supporting appropriate data systems, linkages and management capacity to set and monitor targets and strategies. In some countries government insurance departments or organisations and university departments also share responsibility, and there can be a legislative duty on the part of different authorities to collect road traffic crash data and monitor performance.

Almost all of the 17 African countries surveyed by the AfDB have a formal system of regularly investigating and recording road traffic accidents. In most countries the police are responsible of data collection, but in francophone countries similar institutions such as National Guard and Gendarmerie also take the responsibility. In a few countries transport agencies also carry out traffic accident investigation and recording. Hospitals are also important sources of supplementary information for injury road crashes. All countries investigate and keep a record of fatal road crashes. Most countries investigate and record non-fatal injury accidents. Property damage only accidents are also reported in more than half of the countries. 60% of countries have a uniform and standardised road crash reporting system. Moreover, most countries have centres where national road crash data is aggregated. However, the survey results indicate that road crash recording systems are not computerised in most African countries. An exception, and thus a potential good practice, may be considered the traffic accident databases and information system on road safety recently implemented in Cameroon. It is a centralised and integrated information system to collect, manage and analyse traffic crash data in order to drop paper based data collection methods.

At regional level it is worth mentioning the European Road Safety Observatory (ERSO) which gathers harmonised specialist information on road safety practices and policy in European countries. ERSO collects a wide range of information types including a series of data protocols and collection methodologies, national and in-depth accident data, exposure data and safety performance indicators.

4.1.3 Develop and strengthen partnership and collaboration

Regarding the third intervention, **developing and strengthening partnership and collaborations,** International and European good practice examples are represented by countries, such as Great Britain, Sweden and US, that have developed a range of close working partnerships, often using direct funding mechanisms and other implementation tools. These include bi-lateral and multi-sectoral partnerships amongst the roads/transport, health, justice/police and transport sectors at national, regional and local levels. Many non-governmental organisations also work actively on road safety. These include bodies which address specific road safety themes such as new car assessment programs, professional sectoral organisations such as highway and transportation organisations, road user organisations, safety organisations which often fulfil an umbrella role nationally for non-governmental road safety interests, insurance organisations and industrial groups.

There are few examples of road safety partnership and collaboration in African countries. In the Mid Term Review of the ARSAP, UNECE cites two best practices of Memorandum of Understanding between stakeholders in Zambia and Namibia.

4.2 Selected interventions for detailed description

Improving road safety performance requires a systematic and planned approach, the establishment of an effective road safety management system, and the close cooperation of several transport system stakeholders in implementing evidence-based interventions.

In this section examples of good practice in establishing and strengthening road safety lead agencies, in improving data collection and management on safety related transport system aspects, and in developing and strengthening partnerships and collaboration are discussed.

Examples were taken from European countries, Africa and the rest of the World, where road safety lead agencies do have legal power and dedicated financial and human resources, thus allowing for their effective role in coordinating road safety stockholders and fostering their cooperation, as well as in facilitating setting and enforcing safety regulations and standards.

Good practice examples were selected to highlight the different roles institutions, both public and private, may select to take in their quest for improving road safety levels. For each example, a short description of the background of the measure and the setting for its application are provided. Main objectives and overcome difficulties are also discussed.

Overall, nine examples are described, as follows:

- Land Transport Safety Authority, from New Zealand;
- Department for Transport, in Great Britain
- The Swedish Road Administration
- The Federal Road Safety Corps, in Nigeria
- Road crash injury data systems in Victoria, Australia
- The national road crash registration and correction for underreporting of road traffic accidents in the Netherlands
- Traffic accident databases and information system on road safety in Cameroon
- The US Insurance Institute for Highway Safety
- MoU for road safety stakeholders in Zambia

4.2.1 Land Transport Safety Authority, New Zealand

The Land Transport Safety Authority (LTSA) is an example of stand-alone lead agency. The LTSA was established in 1993 and is responsible for the implementation of road safety in New Zealand. In late 2004 the LTSA merged with the national transport funding organisation to become Land Transport New Zealand which was set up to deliver a new integrated transport policy and to address multiple goals of sustainable development. These institutional arrangements have since undergone further reforms, and this description is confined to the role and activities of the LTSA.

The LTSA's organisational structure, illustrated in Figure 4-1, consisted of six divisions: Strategy, Policy, Operations Corporate Services, Communications and Education and Information Systems and Technology.

The Strategy Division conducted the target-setting work, provided road safety research, statistics, performance monitoring and economic analysis and managed the national Crash Analysis System. The LTSA established in-house capacity within its Strategy Division to develop and implement the Road Safety to 2010 strategy, as well as setting up and providing the secretariat for the coordination body—the National Road Safety Committee ($NRSC_{NZ}$). Through the $NRSC_{NZ}$, the LTSA brought together the key governmental partners who could deliver road safety results, chaired reviews of road safety performance, prepared background papers on current performance, and made proposals for follow up action. Outside its long-term vision of transport providing an affordable, integrated, safe, responsive and sustainable transport system, New Zealand has not established a specific long term road safety vision. However, the major strategic theme of the current Road Safety to 2010 Strategy published in 2003 is one of building safety into the road traffic system and into other government policies impacting on its safety quality. The target-setting method and modelling underpinning the Road Safety to 2010 Strategy targets was carried out by lead agency specialists and consultants, and peer reviewed by independent road safety experts from Australia and the United Kingdom with substantial experience of national and regional strategic planning in road safety. The Road Safety to 2010 Strategy set ambitious targets to reduce deaths by 35% by 2010 together with a range of targets for final and intermediate outcomes and institutional outputs. New Zealand's final outcome targets are bottom up targets based on analysis by in-house and external experts of cost-effective measures which could be undertaken during the target period and which were proposed by the lead agency. The final decision on the level of targets was made by the National Road Safety Committee, the national coordinating body. Regional targets were also set and monitored.

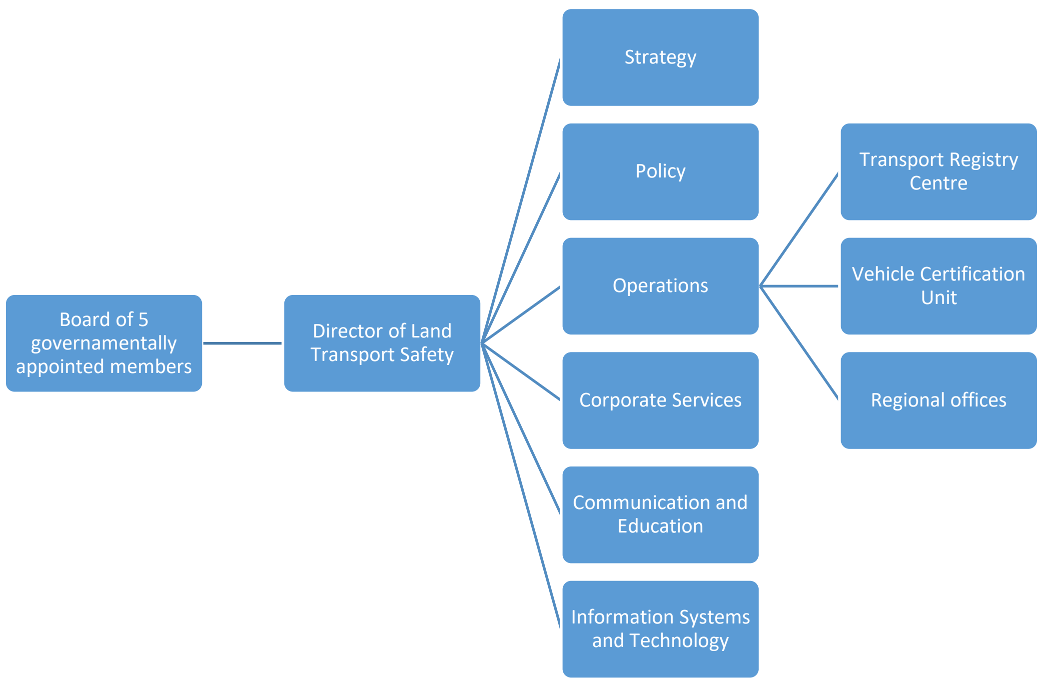

Figure 4-1 New Zealand's Land Transport Safety Authority organisation

The Policy Division carries out policy analysis, research and development for road safety interventions such as the development of standards and rules relating to the design and operation of the road network and the conditions of entry and exit for vehicles, operators and users. There have been three national road safety plans promoting interventions to improve the safety of the network and the conditions of entry and exit to and from it for vehicles and users. The overall compliance regime consists of education, enforcement and performance assessment interventions. Various implementation activities have been undertaken to support these interventions relating to legislation, funding, coordination, monitoring and review, building tools for analysis and evaluation, communications and information support, and research coordination.

The Operations Division promotes compliance with standards and rules by means of community education, enforcement (including auditing of LTSA agents) and performance assessment. The Vehicle Certification Unit conducted audits of motor vehicle certification agents and commercial license transport operators in each region to ensure vehicle compliance standards were maintained. It also carried out investigations of heavy vehicle crashes. Its regional offices monitored and reviewed performance on local networks, coordinated interventions with local road safety partners and managed vehicle and operator compliance. The Transport Registry Centre facilitated the entry and exit from the land transport system and managed the collection of user charges and Accident Compensation Corporation levels.

The Corporate Services Division provides information services, human resources, financial contract and facilities management, and reprographic and legal support for core LTSA activities. It also undertakes the organisation's corporate planning, including annual business planning and budgeting activities.

The Communications and Education Division provides the communication and information support for core activities. It also became engaged in education to encourage compliance with standards and rules and managed the road safety advertising program.

The Information Systems and Technology Division provides the tools and support for systems and technology which delivered the LTSA services. It manages the provision of information, data and systems that allowed staff and agents to carry out their work effectively.

As mentioned above, the LTSA also chairs the National Road Safety Committee ($NRSC_{NZ}$) and provided a dedicated secretariat to support it and three other management committees, the National Road Safety Working Group, the National Road Safety Advisory Group and the Industry Consultative Group, and it establishes road safety partnerships with each of the member agencies of the $NRSC_{NZ}$ to achieve agreed targets. The $NRSC_{NZ}$ brings together the Chief Executives of the main government partners of the Road Safety strategy and is the Minister of Transport's highest level road safety advisory group. Its role is in communicating, coordinating and agreeing top level strategy between agencies on road safety issues and over-sighting progress towards the achievement of national targets.

The National Road Safety Working Group (NRSWG) leads on operational matters. It comprises senior representatives of the $NRSC_{NZ}$ organisations and is responsible for detailed policy preparation and coordination between the member organisations, the preparation of quarterly $NRSC_{NZ}$ meetings and the setting up of working groups on specific issues.

The National Road Safety Advisory Group (NRSAG) provides a forum for a wide range of agencies involved in road safety to express their views on road safety issues and to provide a base from which joint projects can be initiated.

The Industry Consultative Group (ICG) was established by the LTSA to create a forum for the land transport industry to liaise with the LTSA. It provides a strategic overview of commercial vehicle safety issues in the land transport sector operates in an advisory capacity and reports to the National Road Safety Council Working Group.

4.2.2 Road safety management in Great Britain

4.2.2.1 Roads and Vehicles and Standards Directorate

The Department for Transport's (DfT) Roads and Vehicles and Standards Directorate is the lead agency for road safety in Great Britain. The organisational structure is illustrated in Figure 4-2 and comprises four divisions.

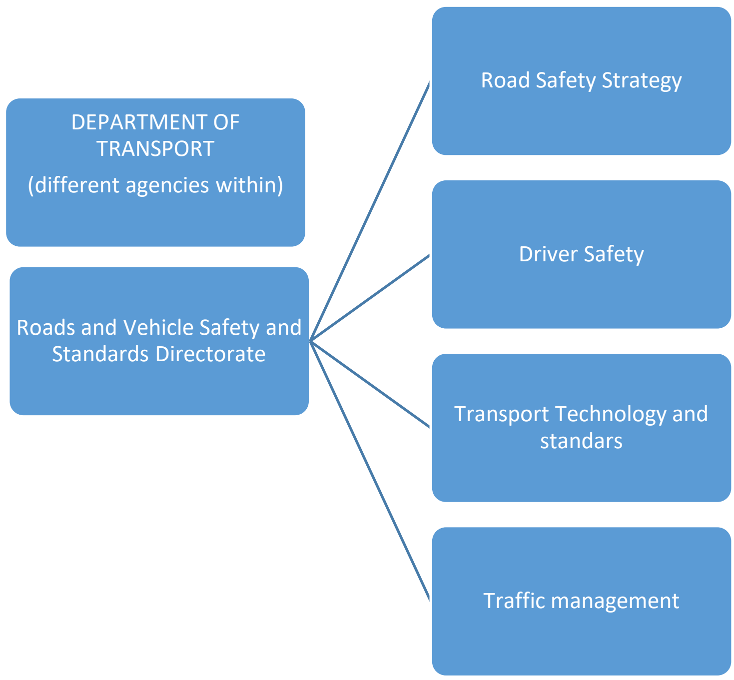

Figure 4-2 Great Britain's Roads and Vehicles and Standards Directorate organisation

The Road Safety Strategy sector is focused on the development and monitoring of strategies and targets and on vulnerable road user safety including motorcycling, local authority liaison, demonstration projects and research. The Driver Safety sector works on policy and promotion associated with vehicle speed, impairment, driver training and testing, seatbelts, mobile phones, fatigue, work-related road safety and other driver-related issues. The Transport Technology and Standards (TTS) is responsible for setting and ensuring compliance with national vehicle policies and construction standards to reduce the likelihood of road crashes and reduce their impact, working closely with the EU, the United Nations Economic Commission for Europe and many UK bodies. TTS manages a wide-ranging research program into existing and promising technology, particularly the improvement of vehicle dynamic safety standards and the analysis of costs, benefits and effectiveness. The Traffic Management sector is responsible for policy on traffic regulation and management, street works regulations traffic signs, cycling and walking.

Road safety is a shared responsibility at governmental level between the European Union (which has had key responsibilities in areas such as vehicle safety and driver licensing standards) and national and local government. Several agencies which carry out driver and vehicle licensing, testing and vehicle certification also come under the umbrella of the Department, as does the agency responsible for national roads. The DfT commits to Public Service Agreement targets for road casualty reduction which are the national road safety strategy targets and it works with a wide range of partners to achieve them. Road safety engineering and police enforcement activities are highly decentralised.

Reducing transport casualties is one of DfT’s five main objectives. The DfT works to Public Service Agreement targets for road casualty reduction which are the national road safety strategy targets. The DfT’s Roads and Vehicle Safety and Standards Directorate has the principal responsibility for the development, delivery and monitoring of the national road safety strategy.

In preparing the first targets in the mid-1980s, an Inter-Departmental Working Group was established to conduct a high-level review of road safety performance and strategic needs. The DfT reviews road safety performance in-house and commissions reviews from independent research bodies and experts to monitor progress with the national strategy as well as analyses from its statistical division, responsible for compiling annual police-reported crash statistics. A high-level expert group was set up by DfT in developing the current national strategy for the identification of the most important road casualty problems and solutions throughout the road traffic system on the basis of data analysis, survey and research. The road safety strategy is assessed by the Department every 3 years. Progress can be assessed by the Parliamentary Select Committee on Transport, by the Road Safety Advisory Panel and the new Road Safety Delivery Board (2008).

Great Britain has no specific road safety vision for the long term safety of its road traffic system. The Safety Targets and Accident Reduction Steering (STAR) Group was set up by DfT to provide technical support and advice to ministers on the setting of targets. It comprised representatives and technical experts from local authorities, the Royal Society for the Prevention of Accidents (RoSPA), the Parliamentary Advisory Council for Transport Safety (PACTS), the Transport Research Laboratory (TRL), the DfT and its regional offices and individual experts. This group was subsequently replaced by a new Road Safety Advisory Panel. In preparing the 2010 targets, the DfT commissioned background papers on current performance, forecasting and modelling of different scenarios, and made proposals for follow up action. Analyses included surveys of the current safety performance of different aspects of the road system, future trends, analysis of information on the effectiveness of different interventions in achieving road safety outcomes, socio-economic appraisals and the identification of useful implementation tools which were published in working papers. In-depth consultation on draft proposals was carried out with key government stakeholders as well as more broadly with road safety stakeholders to assess the level of support for different strategy and program options.

Against the background of changes in general public service delivery, the first national casualty reduction target was set in Great Britain to reduce casualties by one third by 2000 compared with the average for 1981–85. Although the overall target was not achieved due to increasing minor injuries, deaths declined by 39% and serious injuries by 49%. The target process led to an increased profile for road safety, increased resources and more discussion of national and local action. Following a period of forecasting, research and analysis overseen by the STAR Group, a consultation exercise was launched in 1996 on developing a new strategy and targets. Bottom-up targets were proposed by the DfT, approved by Cabinet and parliament and published within the safety strategy, Tomorrow's Roads: Safer for Everyone in March 2000, having the target to achieve a 40% reduction in killed and seriously injured casualties, a 50% reduction in children killed and seriously injured and a 10% reduction in the casualty rate for slight injuries per kilometre travelled by 2010. Local authorities set their own targets, consistent with the national targets, in their Local Transport Plans and performance was monitored. The Strategic Framework for Road Safety, published in 2011 by DfT, has set the Vision for 2020: reducing road fatalities by 37%. According to this vision, the target can be achieved implementing a set of strategies comprising focus on specific target groups (cyclists and children in deprived areas) and on the implementation of IT technologies for vehicles.

4.2.2.2 Parliamentary NGO role in seat belt wearing laws

The UK umbrella organisation, the Parliamentary Advisory Council for Transport Safety, brought together key NGOs such as the Royal Society for the Prevention of Accidents (ROSPA), the British Medical Association and the Automobile Association (AA) in an effective coalition in support of compulsory front seat belt use in the 1980s. The UK seat belt legislation was delivered by private members legislation (an amendment to a Government Bill (front and rear belts) as well as a Private Members Bill for rear seat belt wearing for children. This legislation was tabled and guided through parliament by parliamentary members of the leading NGOs.

4.2.3 Road safety management in Sweden

4.2.3.1 Swedish Road Administration

The Swedish Road Administration (SRA) is the national authority assigned the overall sectoral responsibility for the entire road transport system, and, thus, is also the lead agency for road safety management. Its mission is to create a safe, environmentally sound and gender-equal road transport system. Road safety is integrated into all areas of operation. The aggregate structure is set out in Figure 4-3.

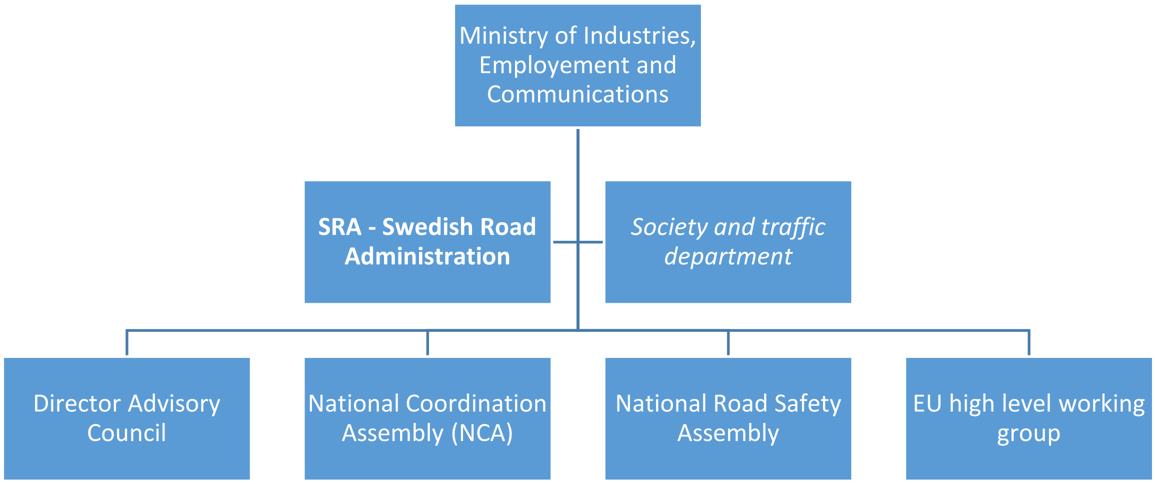

Figure 4-3 Road safety management in Sweden

Since road safety is integrated into road transport policy, Swedish organisation is quite complex. The overall responsibility for road safety rests within the Journeys by Citizens Department which is one of two main horizontal Departments of the Swedish Road Administration. A Traffic Safety Director who has the central controlling function for all road safety work is a key member of the Director-General's senior management team. Road safety expertise is located mainly within the Society and Traffic Department of the Administration. The operational activity is mostly conducted by the seven regional offices.

The Cabinet, supported by the Ministry of Industry, Employment and Communications and SRA is at the top of the national decision-making hierarchy. Three organisational entities deal with the coordination of interventions, each having their own small secretariat situated within the SRA. These are:

- the SRA's Director General's Advisory Council on Road Safety which is a high level group of 7 governmental and non-governmental partners and stakeholders. It was set up as an advisory group to the Director-General with members invited on an individual basis;
- the National Coordination Assembly (NCA) has 8 members (Ministry of Enterprise, Energy and Communications, Swedish Association of Local Authorities and Regions, National Society for Road Safety, National Police Board, Swedish Work Environment Authority, Folksam, Toyota Sweden AB, Swedish Road Administration). The aim is 'to share knowledge and coordinate the activities of key players with the intention of making Vision Zero a reality.
- The National Road Safety Assembly (RSA) brings together a very broad group of partners and stakeholders (about 40 members with road user and transport industry stakeholders being prominent) at national (three meetings a year) and regional levels. The Assembly

works in specific areas—speed, drinking and driving, seat belt use, children and young people in traffic and two-wheeled motor vehicle crashes—and reports over 3000 individual activities.

There is also coordination with European partners as Sweden is a member of the European Union and UNECE which determine international vehicle safety standards. At EU level, the SRA, as an agent of the Ministry, contributes to the European Commission's High Level Working Group on Road Safety and its sub-groups and the Motor Vehicles Working Group which work on the EU road safety policies. The SRA was also a founding partner of the European New Car Assessment Programme (Euro NCAP) and the European Road Assessment Programme (EuroRAP) which provide consumer information and safety rating to road users in Europe.

Road safety in Sweden is a shared responsibility at the governmental level between the European Union (which has had key responsibilities in areas such as vehicle safety and driver licensing) and national and local governments. The SRA developed and leads the Vision Zero policy and is responsible for the achievement of national targets underpinned by a performance agreement with the Ministry of Industry, Employment and Communications. The Vision Zero is that eventually no one will be killed or seriously injured within the road transport system. In 1998, Vision Zero was adopted as a goal of the National Transport Policy. Vision Zero is profoundly influencing global road safety thinking and policy. It has led to innovative strategies and solutions which have inspired and engaged national stakeholders as well as road safety professionals worldwide. A Commission of Inquiry into Road Traffic Responsibility was set up in 2000 to review shared institutional responsibilities and the establishment of a new Inspectorate in support of Vision Zero. The SRA establishes and reviews road safety performance in-house, in cooperation with other government agencies (e.g., the Swedish Institute for Transport and Communications Analysis (SIKA) and the Road Traffic Inspectorate) and external experts and discusses these within its consultation bodies. The SRA chairs reviews of road safety performance; it commissions background papers and makes proposals for follow-up action.

There is a long tradition of research and analysis in the target-setting process is Sweden. Analytical work has typically been commissioned from several research organisations and consultants to assist with the preparation of new road safety programs and targets. These identify the key problem areas and the potential contribution of a variety of interventions. Consultation takes place with key stakeholders through a range of consultation bodies. Sweden's most recent interim road safety target was to reduce deaths by 50% by 2020

Swedish practice in recent years has been for top-down quantitative national fatality targets to be set together with Vision Zero. Sweden was one of the first European countries to establish a results management framework using intermediate outcome targets, including increasing seat belt use, reducing speed or reducing drinking and driving. It is anticipated that targeting and monitoring a range of intermediate outcomes will provide the basis for the new strategy to meet its interim casualty reduction targets.

4.2.3.2 Swedish lead agency initiatives to engage the business sector

Sweden has been activating different actions to engage the business sector and other organisations through establishing the National Road Safety Assembly (see paragraph4.2.3.1). This consultative and coordinating body encourages traffic stakeholders to make far-reaching promises to improve road safety. The taxi and road haulage sectors, for example, have made commitments regarding the increased use of seat belts, better observance of speed limits and driving without alcohol.

In addition, the SRA helps to establish the European New Car Assessment Programme (Euro NCAP) which publishes ratings on the crash performance of new cars that has led to significant improvements in safer car design for car occupants; at the same time, this Lead Agency uses Euro NCAP safety ratings in performance monitoring in Swedish Road Administration travel policies to encourage demand for improvements in vehicle safety. It also encourages the local car industry to fast track the fitment of alcohol interlocks, seat belt reminders and electronic stability control systems as well as encouraging road haulage and taxi companies to adopt a range of safer practices (such as the fitment of alcohol-lock devices to detect excess alcohol and seat belt reminders) by stipulating safety demands such as these in transport contracts.

The Agency also supports the non-governmental organisation National Society for Road Safety to develop performance ratings for the road safety activities of road haulage companies.

4.2.4 Nigerian Federal Road Safety Corps, Nigeria

The Federal Road Safety Corps (FRSC) in Nigeria is one out of a few outstanding road safety lead agencies in Sub-Saharan Africa. It is an example of Stand-alone lead agency in Head of State's Department. The FRSC proposes, as part of the coming National Road Safety Strategy to create a high level national council, with a mandate to manage and monitor road safety performance of all stakeholders. It has considerable human, logistical and financial resources, has a professional management and use modern technology in its operations. The FRSC works in the field of the 5 pillars of the UN Decade of Action for road Safety and of the African Road Safety Action Plan and in particular:

- Pillar 1 – Road Safety Management: research on contributing accidents factors and development cooperation;
- Pillar 2 - Safer roads: recommend maintenance, implementation of appropriate measures on highways;
- Pillar 3 - Safer vehicles: Production of number plates;
- Pillar 4 - Safer roads users: production of driver licenses, highway codes and regulations, general road safety education, enforcement on mobile use phone;
- Pillar 5 - Emergency response: emergency services and towing.

FRSC is particularly active is in the following fields:

- Enforcement: implementation of biometric measurements of license applicants and security coded number plates;
- Emergency rescue services: set up of call centre, ambulance units, emergency wards and roadside clinics free of charge;
- Involvement of volunteers;
- Promotion of road safety: communication with decision-makers at the highest level, training, conferences seminar and key strategic sessions regularly organised.

The Corps was used as a case study for road safety lead agencies at the conference 'Steps to the 5 pillars' in Addis Ababa in November 2012.

4.2.5 Australian Road crash injury data systems, Victoria, Australia

The crash injury data system in Victoria, Australia provides an example of shared management of crash, exposure and health data. Responsibilities fall principally to VicRoads - the Road Safety Lead Agency for the State of Victoria, Victoria Police, the Transport Accident Commission, the Department of Human Services and Monash University Accident Research Centre (MUARC).

Crashes annually are reported to the police on a standardised crash report form. Crash reports are received within 10 days, though crashes involving fatalities are reported daily. Data collected from collision reports are used to identify and validate safety camera sites, identify blackspot locations and areas for enforcement and local road safety initiatives, identify locations for road environment improvements, report under the Victoria Police Business Plan, and measure annual road trauma outcomes.

The Road Information Systems group at VicRoads supports road crash data systems management. The information from the police collision forms obtained from Victoria Police is GIS coded and linked to other information databases in VicRoads. Classification of accidents is added as well as alcohol data from the hospitals and coroner. VicRoads' Road Crash Information System (RCIS) provides access to fatal crashes within 24 hours and information on injury crashes within about 2 months delay. The RCIS is used to identify high-risk sites and to provide updates on government performance indicators. A parallel system has been developed for Intranet and Internet access on the Vic- Roads website which is updated every 6 months. VicRoads also supports multi-disciplinary in-depth crash investigation covering enforcement, vehicle and road design and driver behaviour.

The National Coroners' Information System (NCIS) manages the development of information contained in the Coroner's database includes medical reports, pathologist reports on causes of death, witness and Police reports. This data supplements crash data already in the Police and VicRoads crash databases and is managed by Monash University.

The Monash University Accident Research Centre is responsible for the Victorian Injury Surveillance and Applied Research Program (VISAR) which has been funded by the Department of Human Services. It provides a comprehensive injury surveillance system, including death data from the Australian Bureau of Statistics, coroner data from the National Coronial Information System, as well as hospital admissions and emergency department data.

The Victorian State Trauma Registry monitors the state wide system of trauma management in order to reduce preventable deaths and permanent disability from major trauma. The aim of such a registry is to collect information on major trauma patients from every hospital and health care facility managing trauma patients across the State.

Finally, the National Transport Injury Database (NTID) contains hospital data for in-patients in Australia and is checked and amended for duplicates and anomalies.

4.2.6 The Dutch national road crash registration (BRON) and Correction for underreporting of road traffic accidents

All road traffic crashes in the Netherlands that are recorded by the police in reports or registration sets are included in the national road crash register BRON. The registration is compiled by the Centre for Water, Traffic and Environment (WVL) which is part Rijkswaterstaat (the national road authority) of the Ministry of Infrastructure and the Environment. BRON contains a large number of characteristics of the crash, drivers and casualties involved. The crash location is linked to the

National Roads Register (NWB). Vehicle information is added using the vehicle registration as a basis.

BRON contains 90% of fatal crashes. For crashes of lesser severity the registration is less complete. In order to correct for underreporting, comparison or linking with other sources makes it possible to estimate the real numbers of injury accidents.

The estimation of the real number of traffic fatalities is made by the Dutch Central Bureau for Statistics (CBS), comparing three data sources:

- crash registration by the police;
- court files on unnatural deaths;
- files on causes of death from municipal population records.

These three data sources are compared by linking date of birth, date of death, type of unnatural death (suicide, traffic crash, etc.), municipality of death, and gender. The data are stored and can be obtained at CBS. Data can be disaggregated to age group, gender, region, modality, day of the week and month. CBS is responsible for overall data management and for collecting and linking the court and municipality data. WVL of the Ministry of Transport is responsible for collecting the police records. CBS and WVL work together to arrive at the final database. The reporting rate of the real number of traffic fatalities is very high: 99.4 % (data for 2004). The individual reporting rates were 90 % (police records), 88 % (court data) and 95 % (municipality records). The costs are not exactly known, but assumed to be rather low (a few person months a year), because existing databases can be used (data sources: SUPREME, 2007).

Concerning injured road accidents, the Institute for Road Safety Research (SWOV) supplements the BRON data with data from the National Basic Register Hospital Care (LBZ); this allows more reliable information to be produced about the real severity of injuries sustained in traffic crashes. The identification of matching cases is possible by making use of six variables: date/time of crash / hospital admittance, date of birth, gender, region of hospital, severity in police record (killed, not on the spot, hospitalised, A&E treated), external cause of injury in hospital record.

4.2.7 Traffic accident databases and information system on road safety in Cameroon

A reference for the data collection process in African countries is the project for the design and implementation of traffic accident databases and of an information system on road safety recently implemented by CTL, SWOV and VIAS for Cameroon.

Before the implementation of such systems, Cameroon showed a lack of data and tools available to decision makers to support them in identifying road safety problems, assessing the potential effectiveness of the selected measures and to actually evaluate the effectiveness of those measures. In particular, there was neither a reliable database of traffic accidents nor an information system centralizing all accident data or a National Road Accident Collection Form. Each institution (National Police, Gendarmerie, hospitals) set up its own system for collecting traffic accident revealing shortcomings and errors (omissions, lack of accuracy or misinterpretation).

Thus, the aim of the project was to improve the whole accident data collection process in Cameroon enhancing the timeliness, the accuracy and the completeness of data. A quality database on road safety, included in a centralized and integrated information system for accidents data collection, management and analysis has been implemented, in order to drop paper based data collection methods. However, their adoption is not expected by all the actors involved in road safety data collection within the project duration. Especially for Police and Gendarmerie the implementation and dissemination of these tools for accident data collection is a gradual process.

Two information systems, developed by the CTL, have been adapted to the needs and conditions of Cameroon:

- SFINGE, structured on "primary" databases addressed to National Police, National Gendarmerie, *Ministère de Transports* (MINT) and *Observatoire National de Santé Publique of the Ministère Santé Publique*, (ONSP)
- SAFETY MANAGER addressed to the Analysis Centre of *Ecole Nationale Supérieure des Travaux Publics* (ENSTP).

SFINGE has been integrated and adapted in order to process also data on road traffic injuries collected at hospitals. It allows the:

- Collection of traffic accident data directly at the accident site (for example, using a laptop computer) and the immediate computerization of the data;
- Management and processing of data and its computerization (that is, the manual transfer of data from the data sheet to the software);
- Analysis of data included in the database in order to automatically create statistics and reports, according to user-defined queries (for example filtering data by date, by user, by road or zone, etc.);
- Transfer of data from the "primary" database to the central one (at the Analysis Center of ENSTP);
- Geo-referencing of data on a map (Google Maps and / or other) to allow accurate identification of accident location.

The SAFETY MANAGER is an information system organised in two parts:

- the "private" part for data acquisition, management and analysis and for the safety measures planning and selection.
- the "public" part, which is available to all citizens (in the form of a web portal), to carry out communication activities on road safety.

The private part is composed of different functions:

- Acquisition and management of data, such as creating new accident files, exporting and importing data from different sources (Police, Gendarmerie, ONSP, etc.);
- Management of databases;
- Road safety analysis: definition of subsets of accident data, crashes mapping, report preparation, descriptive analysis of traffic accidents.
- Selection of road safety interventions: creation of projects for selecting interventions, identification of critical road infrastructure elements, identification and classification of crashes, identification of accident causation, identification and economic evaluation of measures.

The purpose of the public part is to provide a tool for communication of accident data and road safety results. This part is composed of different elements:

- Statistics on traffic accidents in Cameroon and in CEMAC zone, including maps and diagrams;
- Crowdsourcing tool to give citizens the opportunity to express opinions for proposed interventions or to indicate specific problems directly on a map;
- Information on various aspects of road safety, e.g. policies, projects, technical documents, communication and training tools.

The two information systems are integrated each other in order to facilitate data flow between the actors responsible for data collection and management and those responsible for specialized road safety analyses.

4.2.8 The US Insurance Institute for Highway Safety

The Insurance Institute for Highway Safety (IIHS) is an example of business sector involvement in road safety. It is a non-profit making research and communications organisation funded by motor vehicle insurers. IIHS is a leader in identifying what works and does not work to prevent motor vehicle accidents and reduce injuries in crashes which occur. The Institute's research focuses on interventions aimed at all three factors in motor vehicle crashes (human, vehicular, and environmental) that can occur before, during, and after crashes to reduce losses. The centre, which includes a state-of-the-art crash test facility, is the focus of most of the Institute's vehicle-related research. The Institute's affiliate organisation—the Highway Loss Data Institute—gathers, processes, and publishes data on the ways in which insurance losses vary among different kinds of vehicles.

4.2.9 MoU for road safety stakeholders in Zambia

The Zambia Road Safety Memorandum of Understanding was signed in 2014 by a select group of key stakeholders including the Lead Agency - the Road Traffic Safety Authority (RTSA), the Sub Saharan Africa Transport Policy programme - the Global Road Safety Partnership (GRSP), the Roads Development Agency, the Zambia Red Cross, Ministry of Transport, Ministry of Education, Zambia Police and others from the civil and private sector. The MoU sets to improve coordination among actors and to promote innovation and the introduction of high impact interventions, bold decisions and actions to proficiently address all aspects of road safety. It is designed to clearly spell out what key stakeholders would do differently over an agreed period, and how the initiatives would be coordinated and funded. The MoU is managed by the RTSA, and the implementation of the specific actions will rest with the individual stakeholders who are each required to provide reports at a national forum.

4.2.10 Summary

In conclusion, best practices in Road Safety Management are represented by Lead Agencies that ensure the effective and efficient functioning of the road safety management system. They must be responsible and accountable for road safety leadership, having the power to make decisions, manage resources and coordinate the efforts of all participating sectors of government and civil stakeholders. Although Lead Agencies can take different institutional forms, they share common functions and resourcing requirements. They must be adequately funded and publicly accountable for their performance. They must also actively engage and collaborate with all groups in society that can contribute to improved safety outcomes. Their effectiveness is considerably enhanced by strong and sustained political support for the initiatives they promote. Best practices in road safety data management also include systems that allow to monitor and assess road safety performance, as well as to support research and increase knowledge. Collected data should include at least: final outcomes, exposure variables, intermediate outcomes, socio-economic costs associated with road traffic injuries and institutional outputs.

5 Safer roads and mobility

Safer Road and Mobility represents Pillar 2 of the African Road Safety Action Plan (ARSAP). Two main outcomes are expected from this pillar: *Safer road infrastructure for all road users*; and *Capacity building and training on road safety* (cross cutting outcomes). Table 5-1 shows the summary of the type of studies identified which looked at interventions to ensure safer roads and mobility.

Table 5-1 Synthesis of main evidence on safer roads and mobility interventions

Type of intervention	Number of studies		Source countries
	Africa	Rest of World	
Safer road infrastructure for all road users	5	12	Austria, UK, Netherlands, Sweden, Slovakia, Germany, Portugal, Belarus, France, Zambia, Tanzania, Ghana, Mozambique, Malawi, Cameroon, Namibia, South Africa, EUA, New Zealand,
Capacity building and training	2	5	
Total	7	17	

Concerning the first outcome, road infrastructure is the central element of a road transport system. It can be defined as the basic facilities, services and installations needed for the functioning of transport on highways, roads and streets. It would need to be designed and operated in such a way that road users understand what they can expect and what is expected from them, taking into account the limited human information processing capacity, and minimising resulting mistakes human beings are capable of.

Road infrastructure is a wide area and covers land use and network planning, (re)construction and design of road sections and intersections, signing and marking, maintenance, and quality assurance procedures (safety impact assessment, safety audits and safety inspections).

According to the ARSAP, in African countries an appropriate consideration in infrastructure development should be given and appropriate facilities for pedestrians and other vulnerable road users should be introduced or improved. To ensure basic safety conditions of the infrastructure, the ARSAP is particularly focused on the application of road safety audit and inspection procedures in African countries.

Several definitions of road safety audit and inspection exist. According to Elvik et al. (2009), based on reviews of the different definitions, the following general definitions may be formulated:

- Road safety audit (RSA): a formal systematic road safety assessment of a road scheme carried out by an independent, qualified auditor who reports on the project's accident potential for all kinds of road users (Matena *et al.*, 2007). RSA are carried out in all stages of the design cycle (feasibility, preliminary design, detailed design and before opening).
- Road safety inspection (RSI): a preventive tool consisting of a regular, systematic, on-site inspection of existing roads, covering the whole road network carried out by trained safety expert teams, resulting in a formal report on detected road hazards (Cardoso *et al.*, 2007)

Other infrastructure safety measures such as site-specific remedial measures, better road hierarchy governing road design and equipment, forgiving roadsides have also proven to be effective and would certainly contribute to fewer accidents if implemented.

All the above mentioned procedures fall commonly under the umbrella of the Road Infrastructure Safety Management (RISM), defined as a set of procedures that support road authorities in decision-making related to improve the road safety of a road network.

Thus, RISM procedures introduce effective and efficient tools to help reduce the number of accidents and casualties. These tools are needed, because respecting design standards is not sufficient to guarantee satisfactory road safety levels under all conditions. Moreover, design standards by themselves are no guarantee for optimal safety levels, especially in instances where lower limits are pursued in combination with other design constraints. In many countries a strict revision of road geometric and other related design standards is required to ensure that fundamental road safety thinking is incorporated in these standards and guidelines. The successful implementation of RISM procedures requires an adequate level of investment, supporting regulation, availability of relevant road safety data and adequate institutional management capacity. Making RISM procedures compulsory is preferable, as awareness of RISM alone is rarely sufficient for success.

The implementation of effective road safety measures requires a certain degree of knowledge by professionals who deal with road safety such as road designers, policy makers, technicians in general. However, the main difficulty for African development is a lack of road safety education in universities and of specialised professional training, but also the lack of training standardisation (Small and Runji, 2014). For this reason, the ARSAP emphasises the need for road safety capacity building as a crosscutting outcome for all five the pillars of the DoA.

An extensive literature review was undertaken to identify good practices in road safety interventions focussed on safer roads and mobility, in African countries as well as at international level (Europe and rest of the World). The focus was on the two above mentioned expected outcomes taken from the African Road Safety Action plan:

1. Safer road infrastructure for all road users;
2. Capacity building and training of road safety (cross cutting outcomes).

To identify existing good practices for these two aspects from Europe, Africa and the rest of the world, the following EC funded projects and other relevant publications were sourced (Table 5-2).
A dedicated questionnaire was also prepared and answered by some African stakeholders in order to identify other local best practices in African countries.

The results of the literature review related to Pillar 2 – Safe road and mobility are listed in Appendix 3.

Table 5-2 Selected projects and publications sourced to identify good safe road infrastructure and mobility interventions

Projects/Publications/Institutions sourced
Be-Safe, Belarusian Road Safety Network, Deliverable 1.3: Curriculum of the 1st level University Master on Road Safety
Delft Road Safety Course (available on line)
EC SUPREME project Handbook for measures at European level
EC SUPREME project Handbook for measures at the country level
Global Road Safety Partnership
Elvik R., Høye A., Vaa T., Sørensen M., The Handbook of Road Safety Measures – second edition, 2009
iRAP (the International Road Assessment Programme)
IRTAD, Road Infrastructure Safety Management (OECD/ITF)
Mid Term Review of the African Road Safety Action Plan – UNECA
Road Infrastructue Safety Protection - Core-Research and Development for Road Safety in Europe (RIPCORD
Saferafrica, Deliverable 6.1: Road Safety Curriculum for Africa
SafetyCube project - Safety CaUsation, Benefits and Efficiency
SSATP – African Transport Policy Program

5.1 Overview

5.1.1 Safer road infrastructure for all road users

Tools and procedures for a pro-active approach to Road Infrastructure Safety Management already exist. In the European Union, good practice is represented by the Directive 2008/96/EC particularly for road infrastructure on the Trans-European road Network. The Directive legally specifies the requirements for road infrastructure safety management. A good practice of the application of this Directive can be seen in Austria, which decided to apply the provision of the Directive on the entire motorway network.

With specific regard to RSA and RSI, documented experiences from Europe and elsewhere show that formal systematic audits and inspections are a demonstrably effective and cost-beneficial tool to prevent road accidents in the short term. Some studies have quantified the effect of road safety audits on accidents. In a Danish study of 13 road construction projects with road safety audits; it was concluded that the auditor's comments led to improvements that were estimated to prevent 25–28 accidents per year (Jørgensen and Nilsson, 1995). In a German study, it was estimated that a road safety audit may prevent up to 70% of all accidents on newly constructed roads (BASt, 2002).The Surrey County Council in Great Britain undertook a study of 19 audited and 19 non-audited traffic schemes. Comparisons were made between the effects of the projects on injury accidents. For sites with audited schemes, the average number of casualties dropped by 1.25 per year from 2.08 to 0.83, while casualty crashes at the sites that were not audited dropped by only 0.26 per year from 2.60 to 2.34 (Surrey Country Council, 1994).

An evaluation of road safety inspection for 300 high-crash locations in New York reports a 20–40% reduction in accidents (FHWA 2006). Another US study conducted in South Carolina showed that road safety inspection had an accident reduction of 12.5–23.4% and one site had a reduction of 60% in fatalities (FHWA 2006). Road safety inspection may lead to the implementation of several different measures, each having its own effect on accidents reduction.

Within African, some countries (Malawi, Zambia, and Tanzania) have made the application of RSA and RSI mandatory.

With respect to RSA, the European RISM Directive, states that Member States shall ensure that a qualified auditor is appointed to carry out the work. Pre-requisite skills and qualifications for auditors currently vary considerably among European states. However, it is recommended that pre-requisites for auditor training include qualifications or experience in elements of road safety engineering, road design and/or traffic management (EURO-AUDIT, 2007).

A good practice is made by the example of the UK where RSA team member is required to have previously attended at least ten days of formal training in accident investigation or road safety engineering to form a solid theoretical foundation on which to base practical experience.

Making dedicated road safety manuals and guidelines accessible can also promote the implementation of a road safety oriented approach through facilitating the use of RISM procedures by road administrations. At the same time, it is important to ensure that tools and procedures are practical and relatively easy to apply. In this sense, guidelines could represent a useful resource for practitioners. Good examples of clear and comprehensive practical guidelines are the ones used in UK (Highways England, 2018) and Portugal (Cardoso and Bairrão, 2006; Cardoso, 2018; Cardoso, 2011) for conducting RSA and RSI.

Some low-cost procedures can effectively reduce fatalities from road accidents particularly for developing countries like Africa. For instance, a Road Assessment Program is useful to identify unsafe road sections and to improve them. It has been particularly effective in developing countries because it allows them to identify hazardous road sections even without a robust accident database, which is the case of several African countries. These methods involve the collection of road characteristics data which are then used to identify safety deficits or determine how well the road environment protects the user from death or disabling injury when a crash occurs. An example of international good practice is represented by KiwiRAP of the New Zealand Transport Agency, whilst an African good practice is the development of new simplified methodology on road safety assessment using automated image analysis of National Highways in Mozambique. The introduction of Sustainable Safety and the subsequent re-engineering of the Dutch network has had a major impact also.

Studies show that implementing new safety standards and upgrading road networks can save many lives and reduce trauma and the number of injuries. A number of countries including the Netherlands, Sweden, and Malaysia, have announced proposals to upgrade the safety of roads to 3-star standard (according to the Road Assessment Program) or better by either 2020 or 2025. Slovakia has shown to be a good practice upgrading road network's sections: 77 % of the improved road sections are now rated as 3-star, with 1-star sections having disappeared completely (EU, 2017).

In recent years, some developed countries like Sweden and the Netherlands, provide examples of good practices where pro-active road safety approaches have been proposed: Vision Zero, Sustainable Safety (OECD, 2008). These approaches support the notion that the only acceptable long-term vision for a developed society is a road transport system where no one is killed or seriously injured. Achieving this target needs to reshape the actual road transport system on the basis of principles like shared responsibility between road users and providers of the elements affecting the safety of system, and prevention. It is recognised that road users make mistakes and it is important to redesign a road transport system to accommodate human error, designing them to as far as possible prevent crashes from occurring and if these should still occur, minimising the impact on injuries; the concepts of prevention, forgiving and self-explaining. In particular, evidence from pilot projects shows that the latter can reduce road casualties by 30% (IRTAD, 2015).

Road design and (re)construction can play a central role in assuring a safe infrastructure. In particular, the design characteristics need to be consistent with the function of a road and the behavioural requirements (e.g. speed) and along a particular stretch of road.

Junctions often have much higher accident frequencies than other road sections because of their numerous potential points of conflict. One way to mitigate crash risk is to minimise the differences in speeds, direction and mass of road users. On road sections this is best achieved by segregating slow moving and vulnerable road users from fast moving motorised traffic and by physically separating traffic driving in opposing directions.

At junctions this is best achieved by grade-separation, especially on roads with high speeds in rural areas. Where this is not feasible or justifiable, the implementation of roundabouts has proven to be a safe and efficient option which has gained popularity in many countries all over the world over the last years. Roundabouts are aimed at lowering junction speeds and removing right angle and head-on collisions. Roundabouts also have a greater capacity than normal give-way or signalized junctions. A driver approaching a roundabout is forced to lower his entry speed, which reduces crash severity. When converting an ordinary junction to a roundabout, injury crashes will decrease by 32 % for a three-leg junction and 41 % for a four-leg junction; corresponding figures are 11 % and 17 % when converting a signalized junction to a roundabout (Elvik and Vaa, 2004).

Another part of the road that should not be forgotten is the roadside. Obstacles alongside the road, such as trees, severely aggravate the consequences of an accident, once a vehicle runs off the road. Paved shoulders increase the opportunity for a driver to correct and return to their lane in time. Obstacle avoidance roadsides or roadsides protected by guard rails prevent secondary collisions once a driver cannot correct in time. Flexible or break-away roadside fixtures such as light poles and signs reduce the chance of serious injury in case of a collision. A best practice regarding roadside management is represented by a pilot project leading to the implementation of measures against tree collisions in France.

Signs and markings can provide important information to improve road safety on roads, regulating, warning and guiding road users. By letting people know what to expect, chances are greater that they will react and behave appropriately. Signs and markings need to be applied in a consistent way, to be placed at logical locations, and be easy to understand and visible. To separate driving directions or to prevent vehicles running off the road, rumble strips are sometimes milled into the asphalt surface of a road shoulder or between lanes in opposite directions in combination with ordinary road markings. In the field of Signs and Markings, rumble strips help to reduce accidents resulting from lane departure, head-on collisions and off-road accidents; research from different countries has shown that the number of injury accidents can be reduced by over 30 % by shoulder rumble strips and by over 10 % by centreline rumble strips.

Making roads safer for all users also includes speed management especially where motorised vehicles use the same space as pedestrians and cyclists. In many countries, low speed zones have been introduced in residential areas, near schools, hospitals and in shopping areas. In Europe, 30 km/h zones are most common. In home zones the maximum speed is even lower: 10-15 km/h. In both cases, besides putting appropriate signs, low speeds must be maintained by physical measures, such as road narrowing, speed humps and curves. Good practice in that sense is available from the Netherlands (the implementation of woonerf and 30 km/h zones in residential areas) and the German state transport ministers that have approved legal changes that allows for easier application of 30 km/h limits near schools and hospitals. So far, the limits have been restricted to residential areas. The changes should make it easier for local authorities to set 30 km/h zones along main roads where schools are present.

African good practices are represented by eight traffic calming measures to be implemented on crash prone highways in Ghana and by the implementation of 30 km/h zones close to schools and shopping areas in Ghana, Zambia and Namibia (SSATP, 2008).

ITS solutions like Variable Message Signs (VMS), both in urban and rural roads, have been applied in several countries; they give adequate and situation and time-dependent information to road users such as the adaptation of speed limits and communication of warnings depending on traffic, weather and road conditions; dynamic speed limits can help to harmonise traffic flow and increase throughput on congested sections. It has been observed that warning displays alone do not have much influence on speed behaviour, while speed limits justified by warnings or explanations have significant effects. Despite methodological weaknesses in many of the evaluation studies for different kinds of VMS there are strong indications that VMS help to reduce injury accidents and harmonise traffic flow. According to evaluations carried out in the ROSEBUD project for systems in Norway, Sweden and Finland, cost-benefit ratios are between 0.65 and 1.45.

5.1.2 Capacity building and training of road safety

Several European institutions have developed courses on traffic safety and transport sciences especially developed for foreign students, as reported in the overview of existing training courses performed in WP6. (Viera gomes et al, 2018). A distinction can be made between courses that lead to a master degree developed in the academic field and professional courses that lead to a specific certificate.
Examples concerning the first type are the road safety master courses developed for engineering and economics faculties of Universities of Belarus in the field of the EU Tempus project Be-Safe, and the Road Safety Management Master's Degree Program of the Renault corporate foundation.

Examples of courses leading to a specific certificate are Sweden's 'International course in Vision Zero', the 'Delft Road Safety Course' of the Delft University which has a specific program developed for Ghana, and the VIAS course in Douala (Cameroon): '*Atelier de formation en sécurité routière et bonnes pratiques dans le transport*' (Road Safety Training Workshop and Good Practices in Transportation).
Besides the few examples cited above, there are no other relevant best practices on capacity building in African countries.

5.2 Selected interventions for detailed description

As mentioned previously, road safety interventions within Pillar 2 of the ARSAP aim at achieving a safer road infrastructure for all road users or training and building capacity on road safety. In this section five examples of road design and maintenance policy setting interventions are presented:

- 5.2.6 The hierarchical mono-functional road network – The Netherlands
- 5.2.1 Infrastructure Safety Management on Austrian Motorways

- 5.2.3 UK Road Safety Audits guidelines
- 5.2.4 KiwiRAP – Road Assessment Program in New Zealand's
- 5.2.5 Simplified methodology for road safety assessment using automated image analysis of National Highways in Mozambique

Examples of current good practice road safety courses are also discussed, namely:

- 5.2.2 Education and training of auditors and instructors in Austria
- 5.2.8 Delft Road Safety Course - Delft University (The Netherlands)
- 5.2.7 Road Safety Master Courses for engineering and economics faculties: EU TEMPUS project Be-Safe.

5.2.1 Infrastructure Safety Management on Austrian Motorways

EU Directive 2008/96/EC on road infrastructure safety management was transposed into Austrian national law by adding two articles to the Austrian National Roads Code in 2011. The Code now foresees all tools of the Directive to be applied to the Austrian sections of the Trans-European Road Network (TERN). The Austrian motorway agency ASFINAG – an executive agency under the Austrian Ministry of Transport, Innovation and Technology – is responsible for implementing the tools. Although not required by the Directive, ASFINAG applies Infrastructure Safety Management on all sections of its network of motorways and expressways (as of 2012), including those that do not belong to the TERN. The whole network is subject to a road toll. The following tools are implemented:

- *Road safety Impact Assessment (RIA)* – According to the Austrian National Roads Code, RIA is a strategic and comparative analysis of the impact of a new – or substantially modified – national road on road safety of the network. RIA is to be applied before new construction of a section exceeding 2 km in length, or before the closing down of a road section. In addition to the requirements of the Directive, the socio-economic costs of crashes are included within the investigation framework and the "zero option" (i.e. "build nothing") is also assessed.
- *Road Safety Audits (RSA)* – Road safety audits are applied to all construction projects for new sections in four phases (feasibility, preliminary design, detailed design and before opening). Prior to implementing the Directive there were only three stages; the requirement for an additional audit shortly before traffic approval was a new stage introduced in 2011. Audits are also carried out during the roadwork and renovation projects.
- *Road Safety Inspections (RSI)* – RSIs are applied yearly to at least 150 km of the network for thorough analysis, using the Austrian RSI Handbook and its RSI checklists. On this basis, every section of the entire network should undergo inspection by an independent expert around every ten years. The road sections in need of thorough inspection are subject to a distinct prioritisation process (on the basis of crash rates[1]) and deficiencies are to be consistently fixed. In addition, the entire network undergoes regular (usually annual) RSIs by

[1] In several European countries, RSI may be performed as a completely proactive activity, which addresses potential defects irresponsible of historic accident data (Cardoso et al, 2007).

road surveyors, based on simplified criteria. To further improve the quality of its network ASFINAG invited “ASFINAG Pilots” – a number of dedicated frequent drivers, private or business related – to provide ASFINAG with their observations of the road, e.g. potholes, road cracks, lane grooves, storm and thunderstorm damage, hidden or unrecognisable traffic signs, and deficient signage of roadwork zones.

- *Treatment of High-Risk Sites* – The definition of a High-Risk Site (based on a road section of up to 250 m length or junction) is as follows:
    - At least three similar injury accidents (according to collision type) in three years, at a traffic volume (expressed as the average annual daily traffic, or AADT) of up to 10,700, or at least four injury accidents at an AADT of up to 16,700, five at 22,600, and six at 28,600
    - At least five similar crashes (including damage-only) in one year.

  ASFINAG decides on adequate treatments for identified sites in the course of a process that also involves representatives from other stakeholders, such as district authorities and the police.
- *Network Safety Ranking* – ASFINAG developed a methodology for safety ranking based on accident cost rates of its network. An annual safety ranking is reported for the approximately 270 sections of the network (usually covering accident data for the three preceding years). The ranking, together with detailed information on accident characteristics, informs the decision on which immediate measures are to be taken on the most costly (in terms of costs to society) of those sections, i.e. those sections with the highest potential for accident reductions.

5.2.2 Education and training of auditors and instructors in Austria

In Austria, road safety auditors and inspectors undergo a joint five day course organised by the Austrian Research Association for Roads (FSV). The course features a comprehensive set of issues including:

- Road planning and maintenance;
- Facilities and measures for pedestrians, cyclists, and powered 2-wheelers;
- Planning of urban roads and intersections;
- Road furniture and optical guidance;
- Lighting technology;
- Traffic control and traffic lights;
- Aspects of large vehicles;
- Accident analysis and treatment of high-risk sites;
- Psychological aspects;
- Human perception.

Road Safety Audit or Road Safety Inspection contracts are only being granted by ASFINAG (see paragraph 5.2.1) to certified auditors and inspectors. The certification, issued by the Austrian Ministry of Transport, Innovation and Technology, requires completion of the above course. In order to be trained and certified as RSA, a university degree in a relevant field (or adequate alternative education) and several years of work experience in road design and in the transport safety field is a prerequisite.

5.2.3 UK Road Safety Audits guidelines

The first guidance on RSA was firstly introduced in UK in the early 1990s. At present, RSAs in the UK are conducted in accordance with GG119 of the Design Manual for Roads and Bridges: Volume 5 (Highways England, 2018). This manual includes:

- Definition of relevant terms used.
- Scope of the audit and definition of the relevant schemes and stages in the design and construction process at which audits shall be undertaken.
- Audit team training, skills and experience.
- Auditing process and the requirement for monitoring highway improvement schemes after opening.
- Checklists and examples of audit reports.

The RSA is defined as a process for checking the safety of highway improvement schemes. There are some key factors that are highlighted in the guidelines: RSA is a formal process carried out systematically throughout the design cycle and it is restricted to road safety matters; the scope of RSA is not a technical check that the design conforms to standards and it does not consider structural safety; they are conducted from the road users' point of view and carried out by a team independent from road designers and builders.

On UK trunk roads and motorways, RSA are mandatory for all new road and improvement schemes (GG119), while on local UK roads they are recommended as good practice (1988 Road Traffic Act implies a requirement for new roads).

There are four stages within the design and implementation of a highway scheme when a RSA might be undertaken:

- Stage 1: Completion of Draft Design
- Stage 2: Completion of Detailed Design
- Stage 3: Completion of construction (Pre-Opening Stage)
- Stage 4: Monitoring (1-3 years following construction)

The audit team has to be independent of the design team and requires at least two people: an Audit Team Leader and an Audit Team Member (Observers may also join the team to gain experience in RSA). Auditors should have relevant experience and training. For instance, the Audit Team Leader is required to have a minimum of four years accident investigation or road safety engineering experience, to have completed a minimum of five Road Safety Audits, and should have attended at least ten days of formal crash investigation or road safety engineering training.

At all stages the Audit Team prepare a written report, including the specific road safety problems identified, supported with the background reasoning and recommendations for action to mitigate or remove the problems. The audit report details aspects of the scheme design of concern to the Audit Team and their recommendations for addressing these. The designer may choose which recommendations to accept and incorporate in the design and which ones not to accept, as they are the sole responsible entity for the design scheme. However, the designer should provide their response to the RSA recommendations in an Exceptions Report, which has to include justifications for not following some RSA recommendations and for not addressing all issues.

In order to consider the needs of non-motorised users and support efforts to increase safety and accessibility by non-motorised modes, standards for Non-motorised User Audits were introduced in 2005 (HD 42/05). The cost of undertaking a RSA ranges from around £800 for a minor access to a development to £2,000 for a major signal junction (Sustrans, 2011). As mentioned in section 5.1.1 the Surrey County Council (1994) found that the average number of casualties dropped by 1.25 per year in audited sites while registering a reduction of only 0.26 casualties per year in un-audited sites (from 2.60 to 2.34).

5.2.4 KiwiRAP – Road Assessment Program in New Zealand's

The New Zealand's Crash Analysis System (CAS) has been designed to systematically link accident data with data from New Zealand's road maintenance and management system (RAMM) used by all road authorities in New Zealand by linking the road data (condition, traffic flow etc.) to maps of the roads. Crash data is also linked to these maps, allowing them to be combined with road data.

Accident, traffic and road data, mainly through CAS, assisted New Zealand's authorities in applying an extensive Road Assessment Programme, at first on the rural road network, named *KiwiRAP*. In 2012 this progressed to urban roads with Urban *KiwiRAP*. The programme is under the umbrella of the International Road Assessment Programme (*iRAP*), and consists of three protocols:

- Risk Mapping: using historical traffic and accident data to produce colour-coded maps illustrating the relative level of risk on road network sections. Two metrics are mapped as part of *KiwiRAP*: *Collective Risk*, based on the average annual number of fatal and serious accidents occurring per kilometre of State Highway; and *Personal Risk*, based on the average annual fatal and serious injury accidents occurring per 100 million vehicle-km travelled.
- Star Rating: road inspections to look at the engineering features of a road (such as lane and shoulder width or presence of safety barriers). Road links are awarded one to five stars, depending on the level of safety that is "built-in" to the road.
- Performance Tracking: involving a comparison of accident rates over time to establish whether fewer or more people are being killed or injured and determine if countermeasures have been effective.

In addition to KiwiRAP, as far as intersections are concerned, a High-Risk Intersections Guide provides practitioners with best practice guidance to identify, target and address key road safety issues at high-risk intersections. The guide focuses on identifying intersections with an established or estimated occurrence of fatal and serious injury accidents, as opposed to road accidents that result in less severe outcomes. Similar to KiwiRAP Risk Mapping, this guide defines two main types of risk metric for intersections: the *Collective Risk* is measured as the total number of fatal and serious accidents or deaths and serious injuries per intersection in a crash period; and the *Personal Risk* is the risk of death or serious injury to the occupants of each vehicle entering the intersection.

If specific criteria about Collective Risk and Personal Risk values are met, an intersection is classified as "high-risk".

5.2.5 Simplified methodology for road safety assessment using automated image analysis of National Highways in Mozambique.

The project, funded by the World Bank, is conducted by a joint venture between the research Centre for Transport and Logistics (CTL) of Sapienza University of Rome and FRED Engineering. The main objective consists in developing a new methodology, based on automated image analysis, to identify critical road sections of the National Highways in Mozambique. The underpinning idea is to be able to recognise road safety issues connected with road infrastructure characteristics rapidly and without specific need of road traffic accident data.

The analysis of road sections is based on video capturing while driving. Specific software scans the images, identifies a set of road infrastructure attributes and provides a risk classification of road sections based on the attributes. In this way, the methodology is intended to be more rapid and less costly than regular road safety inspections.

The simplified methodology for Road Safety Assessment has been defined based on scientific evidence-based research and the knowledge about Africa roads characteristics. A software package has been developed including techniques for automated image recognition of road attributes. The methodology and the software application have been validated on a 500 km national highway subsection.

5.2.6 The hierarchical mono-functional road network – The Netherlands

The reclassification and re-engineering of the Dutch road network is an example of good practice of self-explaining roads and a practical application of the Sustainable Safety Vision. Categorising the road network is a prerequisite for (re)designing roads in such a way that they reflect their function and elicit the desirable traffic behaviour. This increases the consistency and predictability of the road network operation and thereby reduces opportunities for human error and increases safety.

The Dutch road authorities re-categorised their roads into one of three categories, each with its own and exclusive function: through roads for the movement of traffic (roads with a traffic flow function) ; access roads providing access to properties and opening up residential areas and rural settlements (roads with a traffic exchange function); and distributor roads connecting the two road types. On access roads motorised vehicles and vulnerable road users have to interact; therefore, vehicle speeds must be low: 30 km/h in built-up areas, 60 km/h in rural areas. On through roads, with grade separated intersections and physical separation of opposing traffic streams and no access to properties or for slow moving traffic, speed limits are 100 or 120 km/h. On the distributor roads sections, separated pedestrian and bicycle facilities allow vehicle speeds of 50 km/h in urban areas and 80 km/h in rural areas. At intersections on distributor roads, slow and fast moving traffic have to merge again, so speeds must be reduced, e.g. by a roundabouts or other speed control measures. Each road category is clearly recognisable by typical road design characteristics and distinguishing road markings.

An assessment undertaken ten years after the implementation of the reclassification showed that from 1998 through 2007, almost all road authorities designed a categorization plan, and it is estimated that more than 41,000 km of 30 km/h roads and more than 33,000 km of 60 km/h roads were constructed, which means that about 70% of all urban roads have a speed limit of 30 km/h and almost 60% of all rural roads have a speed limit of 60 km/h. It was estimated that 80% of urban and rural roads and streets have an access function. This number implied the redesign of almost 90% of urban and 75% of rural access roads. The related estimated safety effects resulted in a reduction of

50 to 75 fatalities on 30 km/h roads and a reduction of about 60 fatalities on 60 km/h roads in 2018 (Weijermars and Wegman, 2011).

5.2.7 Road Safety Master Courses for engineering and economics faculties: EU TEMPUS project Be-Safe

The main objective of Be-Safe was to develop and test two first level University Masters courses in Road Safety in Belarus. This would take place according to the Bologna Process standards (60 ECTS[2]), one for engineering faculties and one for Economics faculties in four Belarusian universities: the Belarusian National Technical University, the Brest State Technical University, the Belarusian State University of Transport and the Belarusian State University of Economics.

An analysis carried out in cooperation with Belarusian Universities and stakeholders highlighted that there was a need to strengthen the role of research to start managing road safety policy based on an evidence-based approach in Belarus. For this reason the development of master courses were focussed on transferring to Belarus the most recent knowledge and good practices developed in the European Union in the field of road safety with the help of EU Universities: the research Centre for Transport and Logistics of Sapienza University of Rome, the Transport Safety Research Centre from Loughborough University and the Department of Transportation Planning and Engineering of National Technical University of Athens.

With reference to the definition of effective and useful Master curricula on road safety, a user needs analysis was carried out to clearly understand local conditions and needs both in terms of research and teaching on road safety. The analysis highlighted that the local university system guaranteed an adequate level for designing, managing and analysing road safety; however there was a huge gap: the isolation from the international research world that led to a need to update content and methods of courses for students, to update research topics in the field of road safety, to update technical equipment in the current laboratories, useful for the aims of a road safety Master.

In order to improve the employment opportunities at local level of the Masters' graduates the academics from local technical universities suggest focusing first of all on technical and practical skills, on the use of innovative software programmes and on the international overview of the courses.

A last aspect underlined by the user needs analysis was the importance of taking into account the newest approaches on road infrastructure safety management. Directive 2008/96/EC constituted an essential tool in evaluating the influence of certain criteria at initial planning, detecting road safety issues, prioritising the potential technical-social-economic impacts, analysing scenarios, proposing interventions and finally controlling their implementation and effectiveness. For this reason, the methodologies defined in Directive 2008/96/EC were included within the Masters curricula considering the difference between the technical and the economical universities.

According to those results, the new Masters programmes were defined accordingly as a 1 year 60 credit Masters with transparent quality assured content in accordance with the Bologna Process that allowed the course to be recognised within the Lisbon Convention and on par with the European Area of Higher Education.

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[2] ECTS – European Credit Transfer and Accumulation System; they represent the workload and defined learning outcomes of a higher degree course or programme. 60 ECTS are the equivalent of a full year of study or work.

A set of "core competencies" for technical road safety professionals as well as economic ones were identified. These competencies were intended to provide a broad framework for educating new safety professionals. They represent a fundamental set of knowledge, skills, and abilities needed to effectively function as a professional in road safety.

A Masters for technical universities needs to focus on specific aspects related to engineering and management aspects. In particular, the Masters objective is to create road safety professionals able to:

- Define road safety management processes.
- Deal with collection, aggregation and analysis of traffic accident data.
- Thoroughly analyse accidents and select the most effective countermeasures.
- Perform the basic aspects of road safety audits and inspections, and concurrently evolve their experience and expertise on a continual basis relying on the provided theoretical background.
- Plan the road safety strategies for the short, medium and long term.

Thus, the Masters Curriculum for technical universities deals with topics such as road safety management, analysis of road safety data (crash data, safety performance indicators, exposure data, background data), selection of countermeasures (e.g. for infrastructure, vehicles, education and enforcement, etc.), definition of plans, etc. The main ambition of the engineering master is to license road safety professionals able to work as: experts for Public Administrations, mainly focusing on designing road safety strategies, designing road safety action plans incl. selection of road safety interventions, management of road safety management centres or observatories; experts for transport companies, mainly dealing with internal road safety management, in-depth analysis, road safety audits and inspections; consultants, able to provide high level independent expertise to Administrations and Companies on road safety issues related with technical aspects; researchers. The Core Competencies for the engineering curriculum are:

- Basic concepts of road safety.
- Road safety management.
- Collection and analysis of crash data.
- Contributing crash factors, countermeasure selection and evaluation.
- Road safety policies and plans.
- Road Infrastructure Safety Management.

The Masters for the economic universities focus on specific aspects related with macro- and micro-economics and econometrics. In particular, the Masters objective is to create road safety professionals able to:

- Define road safety policies.
- Data collections processes and methodologies.
- Predict or assess the results (impacts) of these policies.
- Define strategies to improve the safety of (public and private) company workers.

Thus, the Masters Curriculum for economic universities deals with topics such as prediction models, estimation of social costs of road accidents, assessment of impacts, company safety management, policies definition, etc. The main ambition of this Masters is to license road safety professionals able to work as: experts for Public Administrations, mainly focusing on definition of road safety policies and assessment (e.g. through econometrics models) of road safety interventions; experts for companies, mainly dealing with risk assessment of vehicle fleets and drivers (workers), mobility management, and specification of the minimum requirements for a Road Traffic Safety Management System (e.g. BS ISO 39001): consultants, able to provide high level independent expertise to administrations and companies on road safety issues related with economic aspects. The core competencies for the economic curriculum are:

- Basic concepts of road safety.
- Road safety management.
- Road safety policies and plans.
- Econometric models for policy impacts evaluation and forecasting.
- Economic evaluation and efficiency assessment tools.

EU Partners supported the Belarusian academics in the definition of master curricula and the preparation, as well as in delivering the lessons with a "Train the Trainer" method.
In addition, each local university has been provided with a laboratory dedicated to road safety.

5.2.8 Delft Road Safety Course - Delft University (The Netherlands)

The Delft Road Safety Course (DRSC) results from cooperation between the Delft University of Technology, the SWOV Institute for Road Safety Research, the Delft Post Graduate Education and the Road Safety for All. As of 2015 the Road Safety Course in Delft is organised in association with the FIA Foundation Road Safety Leadership Initiative.

The Delft Road Safety Course is a postgraduate course aiming at capacity building for road safety professionals in Low and Middle Income Countries (LMIC). The annual course is one of the core activities, besides organising local courses abroad and supporting training and research programs in LMICs.

The DRSC course is 'evidence based and data driven' and takes its conceptual framework from the Safe System Approach. The philosophy behind the course is to support the development of road safety strategies and academic educational programs in the LMIC, i.e. both at universities and for policymakers. The program is focused on how to conduct a road safety analysis as well as selecting efficient and effective interventions using scientific evidence. At the end of the course, participants are expected to be able to make a road safety plan and to support the development of road safety programs in the areas of education, enforcement and engineering. The train-the-trainers approach will also support participants to develop curricula at their homeland universities.

Participants may have a background in engineering, behavioural sciences, public health, law enforcement, transportation and land use planning, statistics, economics, public policy etc. Potential participants may, for instance, aim to play a role as lecturer or trainer, or be affiliated to road safety policy and research. They may work for central or regional public authorities, for international organisations, in the private sector, as a consultant, at universities, research institutes, police or NGOs, etc.

The course takes a period of two weeks, although it continues afterwards by means of a dedicated alumni network. This alumni network provides relevant information on new developments in the field of road safety and facilitates discussions between all those involved in the course (fellow participants, course leader, lecturers and external partners).

The course is structured in different modules covering the following topics:

- Awareness and Public Support;
- Hot topics: vehicles, speed, seat belts, two wheelers and alcohol;
- Safe System Approach and Road Safety Data;
- Smart Cities and Enforcement;
- Science & Policy;
- Engineering and effects of measures;
- Education;
- Designing a Road Safety Strategy.

5.2.9 Summary

In conclusion, there are several best practices for Safer Roads, which cover different areas such as RISM, land use and network planning, (re)construction and design of road sections and intersections, traffic and speed management. RISM, in particular RSA and RSI, are essential to ensure that road safety is taken into consideration in every stage of the life cycle of an infrastructure. In order to be effective, design measures require that the design characteristics need to be consistent with the function of a road and the behavioural requirements and along a particular stretch of road. Road network classification avoids multi-functional roads, and subsequently ensures that the design and lay-out of a road reflect its true function.

Finally, concerning Capacity Building, best practices are represented by academic curricula and training courses for professionals that take into account the multidisciplinary nature of road safety; they are aimed at training future professionals and experts to be able to identify and implement efficient measures in the areas of engineering, enforcement, education and emergency services, taking into consideration social and economic aspects as well.

6 Safer vehicles

Vehicles have a significant contribution to achieved road safety levels. Roadworthiness and crashworthiness are primarily defined at factory design and construction stages; however, owner's operation and maintenance care are key determinants in the actual vehicle park safety level.

This is appropriately acknowledged in the Global Plan for the Decade of Action for Road Safety (WHO, 2011), in which seven activities are recommended for implementation at the national level.

These activities include the adoption of motor vehicle safety regulations developed by the World Forum for the Harmonization of Vehicle Regulations (UN WP 29), and encouraging managers of governments and private sector fleets to purchase, operate and maintain vehicles that offer advanced safety technologies and high levels of occupant protection. Technical and regulatory recommendations include: encouraging the implementation of new car assessment programmes in all regions of the world (to increase consumer awareness of motor vehicle safety performance); ensuring that all new motor vehicles are equipped with standardised seat-belts and anchorages (as a minimum safety feature); improving implementation of standards protecting occupants in front and side impact crashes);generalising the deployment of proven crash avoidance technologies (Electronic Stability Control and Anti-Lock Braking Systems); increasing the application of pedestrian protection regulations and research into safety technologies designed to reduce injuries to vulnerable road users. Use of fiscal and other incentives is also suggested as a viable tool to nudge motor vehicle owners and operators into buying those that provide high levels of road user protection and to discourage import and export of lower safety standard vehicles. However, it is not evident that this type of efforts are being implemented in developing countries.

A recent WHO publication (2017) restated the relevance of establishing and enforcing a minimum set of vehicle safety standard regulations (frontal and side impact, electronic stability control, pedestrian protection, seat-belts and seat-belt anchorage regulations, child restraint regulations) as well as establishing and enforcing regulations on motorcycle anti-lock braking and daytime running lights.

The African Road Safety Action Plan, also identifies the important role to be played by the private sector in updating the commercial fleet in African countries, as well as the need for vehicle safety standards to be reviewed for all motor vehicles (including safety equipment in import regulations) and for law enforcement of those standards to be strengthened. Five main issues are highlighted in the Plan of Action log frame:

1. Develop and implement motor vehicle and related equipment safety standards.
2. Make regular inspection of vehicles mandatory and ensure enforcement of this obligation.
3. Implement or strengthen enforcement in accordance with good practices.
4. Encourage the use of fiscal and other incentives for motor vehicles that provide high levels of road user protection and discourage the import of new or used cars that have reduced safety standards.
5. Setup and implement regulations on transportation of dangerous goods.

These activity areas were the focus of the literature search within this pillar, in Europe and in Africa, as well as other parts of the world (e.g. Asia, South America, USA, Canada and Australia). Particular importance was given to references describing practices which were reported to have a strong impact on road safety, or the source country was an emerging economy where road safety practices

related to motor vehicle safety had been proven to reduce road accidents and injuries. Table 6-1 summarises the most important references on motor vehicle safety interventions that were reviewed.
Following the evaluation of the ARSAP carried out in WP3 (Mignot *et al*, 2018), it was concluded that most analysed countries do not have vehicle standards according to the UN recommendations (only two out of 46 in the Dashboard of Road Safety measures).

Table 6-1 Selected projects and publications sourced to identify good vehicle safety (and related protection devices) practices

Projects/Publications sourced
EC GADGET-*Guarding automobile drivers through guidance education and technology* pro ject (1999)
EC PEPPER-Police Enforcement Policy and Programmes on European Roads project (Gil and Malenstein, 2007)
EC ROSEBUD-Road Safety and Environmental Benefit-Cost and Cost-Effectiveness Analysis for Use in Decision-Making project (2006)
EC SUPREME Summary and Publication of Best Practices in Road Safety in the Member States project report F4 Thematic vehicles (2007)
EC SAFETYCUBE project DSS ()
EC SUNFLOWER project (2002)
ERSO (EC SafetyNet project)
Handbook of Road Safety Measures (Elvik *et al.*, 2009)
WHO – Save Lives: A road safety technical package (2017)
AUTOFORE - Study on the Future Options for Roadworthiness Enforcement in the European Union (2007)
Review of best practice road safety initiatives in the corporate and/or business environment (Haworth *et al.*, 1999)
WHO - Powered two- and three-wheeler safety: a road safety manual for decision-makers and practitioners (2017)
WHO - Seat-belts and child restraints: a road safety manual for decision-makers and practitioners (2009)
WHO - Helmets: a road safety manual for decision-makers and practitioners (2010)

6.1 Overview

As a key **element** of the traffic system, vehicle characteristics and performance affect both the pre-crash and crash phases of Haddon's safety matrix (Haddon, 1970).

Since the last quarter of the previous century, considerable improvements were achieved in vehicle safety technology, helping drivers to prevent crashes from occurring (primary or active safety) and contributing to lowering the severity of injuries on vehicle occupants and on impacted vulnerable road users (secondary or passive safety).

Broughton *et al.* (2000) developed a method to investigate the likely number of casualties in 2010 as part of the preparation for the new target for casualty reduction for Great Britain. The effects of three policies were assessed, including improved secondary safety for car occupants, reduced drink and driving, and road safety engineering. They found that 14% more drivers would have died if they had been driving cars with the 1980-81 level of passive safety rather than their actual cars with the 1996 level. As part of the SUNflower project, data from Great Britain and Sweden were analysed using this method, the overall estimated effect of vehicle safety improvements being calculated as a 15% to 20% reduction in occupant fatalities over the period 1998-2000 (Koornstra, *et al.*, 2002). In a posterior evaluation, Broughton (2003) reported an estimated reduction of at least 19.7% in the number of killed and seriously injured victims in Great Britain, in 1998, in comparison with what might had occurred if no improvements were achieved in cars secondary safety since 1980 (Broughton, 2003).

More recently, Hoye (2017) concluded that the risk of being killed or seriously injured in a car accident has decreased by 4.2% per year, mainly due to improved crashworthiness; however, the risk of being seriously injured in a car accident increases by 2.3% per year, for each year the car ages.

Developments in vehicle safety are determined by a combination of international and national regulations, consumer information, car industry policies and product liability considerations. Regulatory requirements and voluntary business decisions (partially lead by anticipated consumer demand), lead car manufactures to implement vehicle safety technologies, which are now standard or deemed as mature systems that contribute to safety benefits (for e.g.. ABS - Advanced Braking System, airbags, seat belt pre-tensioners and fuel cut-offs), and to develop and test newer systems, some that are proving their worth (e.g.. ESP - electronic stability control and ISA - intelligent speed adaptation) and others for which it is still too early to provided evidence effects (e.g. dynamic cruise control, automatic collision avoidance systems, and pedestrian and cyclist detection and crash prevention systems, which detect situations where the vehicle is on a collision course with pedestrians or cyclists). Evidence-based legislation contributes to a uniform acceptable level of vehicle safety across the whole car fleet.

Regulations related to vehicle safety technology are not applied uniformly in all countries, despite efforts at the international level to harmonize these regulations, namely at the UN World Forum for Harmonisation of Vehicle Regulations. The main goal of these efforts is to facilitate the implementation of practice in this regard and to make practices such as de-specification (in which manufacturers take advantage of absence of regulations to remove safety related technological devices used as standard in other countries) more difficult (WHO, 2015).

Enforcing vehicle safety technology regulations at the factory gateway (for new cars) and at the customhouse (for new and second hand imported vehicles) is not sufficient to ensure that vehicles in the car fleet are fit for safe operation.

Proper maintenance has to be ensured by vehicle owners and operators, through a network of mechanical workshops equipped with specialised equipment operated by professional mechanics. In low and middle income countries, this network is not fully laid out and workshops are generally not equipped to deal with modern vehicle technology and electronics (Figure 6-1), calling for special care in regular and rigorous mandatory vehicle inspections. Due to this background, the efficiency of modern vehicle safety technologies may be lower than in high income countries.

Low compliance with vehicle operating limits has a negative impact on road safety levels, especially as regards heavy commercial vehicles. Violation of maximum gross weights and axle loads has a widely known accelerating effect in bridge and pavement structures deterioration (CSIR, 1997); the negative effects on safety are less well known and result from the difference between actual traffic operation characteristics and those assumed at the design stage (St. John and Harwood, 1991).

However, success in this type of intervention is heavily dependent on enforcement and active stakeholder involvement.

Figure 6-1 Mechanical workshop in Ouagadougou, Burkina-Faso

Several vehicle safety technologies related interventions were identified in the bibliographic search, as summarised in Table 6-2 and Appendix 3.

Table 6-2 Synthesis of main evidence on vehicle safety interventions

Type of intervention	Number of studies		Source countries
	Africa	Rest of World	
Vehicle safety standards	0	3	Norway, UK. USA;
Periodic vehicle inspection	2	17	Norway, Sweden, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Czech Republic, Estonia, Lithuania, Hungary, Slovenia, Kenya, Tanzania, USA, Turkey, New Zealand;
UN standards for vehicles	0	5	UK, Cameroon, Argentina, Brazil, Chile, Mexico;
NCAP star rating	0	5	
Vehicle overloading prevention	2	1	
Total	4	31	

Elvik *et al.* (2009) identified 29 interventions related to vehicle design and protective devices, and four interventions referring to inspection of vehicles and mechanical workshops. Upon first analysis, some of these interventions would have no or limited application in African countries, either due to climatic reasons (e.g. studded tires) or average vehicle maintenance abilities (intelligence cruise control and ITS in general).

In EC's SUPREME (2007) project, 23 vehicle safety interventions were identified, with benefit-cost ratios ranging from 1 to 7.7. The interventions described in this project were intended for European countries, where motor vehicle manufacturing and maintenance is highly regulated, and did not include a discussion on the effects of existing regulations.

In EC's ROSEBUD (2006) project a total of 68 vehicle safety interventions were identified (25 active, 39 passive and 4 related to telematics vehicle); 19 of these measures had a benefit-cost ratio greater than one. Several interventions had alternative implementation configurations. The benefit-cost ratios range between 1 and 652. In this project, results of cost-benefit and cost-effectiveness analysis were rated qualitatively, as a function of the benefit-cost ratio or the cost for sparing one fatal victim per year, according to the following criteria (EC, 2003):

- Poor:
  - B/C-ratios < 1 or;
  - 'cost per life year saved' > $20000€
- Good:
  - B/C-ratios between 1 and 3 or;
  - 'cost per life year saved' between $10000€ and $20000€
- Excellent:
  - B/C-ratios > 3 or;
  - 'cost per life year saved' < $10000€.

An abridged summary of key aspects of those measures is presented in Appendix 3 (Table A3-5).

6.2 Selected interventions for detailed description

As identified in the dashboard of road safety measures in Africa (see Table A2-3 and the SaferAfrica WP3 report; Mignot, *et al.*, 2018) there is a great need for improvements in the way technical vehicle safety aspects are addressed in several African countries.

The interventions selected in the scope of the safer vehicle pillar fall within the ARSAP stated priorities of improving the importation of safer vehicles and of introducing periodical inspection of vehicles, both with the aim of ensuring the vehicle fleet road worthiness. The examples are especially concerned with the technical aspects of vehicle homologation; furthermore, an example is presented highlighting the road safety aspects of heavy commercial vehicle overloading – a widespread problem which is frequently considered uniquely from the (rather limited) asset management viewpoint, despite the strong direct impact it has on road safety outcomes.

The following vehicle safety related interventions are described in this section:

- Introduction of EuroNCAP star rating in 1997 in the UK
- Implementation of motor vehicle safety regulations as developed by the United Nation's World Forum for the Harmonization of Vehicle Regulation
- Periodic vehicle inspection Turkey

- ABS and helmets in two-wheeled vehicles in the EU
- Heavy vehicle overweight control in the Douala-N'Djamena corridor, in Cameroun.

A more detailed description of key characteristics of the first two interventions is presented in Table A5-5 and Table A5-6 (Appendix 5).

6.2.1 Introduction of EuroNCAP star rating in 1997 in the UK

The European New Car Assessment Programme (EuroNCAP) was developed with the aim of bringing comprehensive consumer information on the crash performance of cars sold in the European Union, and the protection they provide to crashed vehicle occupants as well as pedestrian and cyclists hit by cars. A general purpose was to apply pressure to vehicle manufacturers to improve safety considerations in vehicle specifications.

The assessment protocol involves measuring occupant trajectory and vehicle deformation, as well as analysing dummy instrumentation data. All cars are tested with safety equipment fitted as standard throughout all member states of the European Union, and the results are conveyed through a qualitative 1 to 5 stars system.

Originally, frontal (64 km/h, 40% offset), side (impact of a 950 mobile deformable barrier at 50 km/h) and pedestrian impact (eighteen component checks) tests were performed, with an assessment of how well the car and the manufacturer's recommended child restraints protect young children (Hobbs and McDonough, 1998; Lie *et al*, 2001). The assessment protocol is continuously evolving, being periodically revised. The rating scheme for 2020/2021 includes criteria for adult occupant protection (seven parameters and weighing 40% of the total score), child occupant protection (four parameters and weighing 20% of total score), vulnerable road user (seven parameters and weighing 20% of the score) and safety assist criteria (six parameters and weighing the final 20% of score; Euro NCAP (2018).

Vehicle safety standardisation thorough a programme such as Euro NCAP is an intervention within the vehicle pillar of the African Road Safety Action Plan. However, as demonstrated in the SUPREME project, it is also related to education and campaigns, as well as institutional organisation. Given the extended life cycle of motorised vehicles, car fleet renewal is a lengthy process; once incorporated in vehicles, the effects of evolving new vehicle specifications are long lasting. This is an intervention best suited for country level application and, preferably, at a supra national level (regional, e.g ECOWAS or SADC in Africa), to capitalise on international trade and uneven geographical distribution of car manufacturing. Euro NCAP addresses only passenger car safety, and does not include tests for buses, trucks, motorcycles and trucks.

All types of accident are concerned by this intervention, which affects a wide range of road user classes (e.g., car drivers, passengers, motorcyclists, pedestrians, novice and older drivers), despite being directly applied just to cars. Both the pre-crash and the crash phases of Haddon's matrix are affected, inside and outside urban areas. No direct influence on driving or road user behaviour is expected, at least in the short term. However, the evolving increase in the percentage of vehicles with Advanced Driver-Assistance Systems (e.g. electronic stability control) that reduce the accident probability may influence driver behaviour in the long run, especially if the effect is noticeable by road users. All other factors constant, pedestrian and occupant protection systems are likely to only have a limited impact on the severity of crashes (especially in view of cars becoming increasingly heavier); the same applies to car crashworthiness, which protects vehicle occupants in case a collision occurs. No remarkable effects are expected on accident exposure.

Most direct funding for this intervention is provided by car manufacturers and car owners. The basis of Euro NCAP star rating system is rather complex, especially in its current version and planned developments, as it includes both passive and active safety technologies. Results from the performed tests are technically relevant for manufacturers and useful for the general public, since it is conveyed in a synthetic manner that is easily understood by the layman. Several types of organisations are interested in Euro NCAP information, besides car manufacturers and drivers' clubs: public administration, insurance companies, enforcement agencies (Police, judicial system and legal institutions), research institutions and taxi owners associations. Overall, the Euro NCAP procedure is internationally accepted by the general public, car users and other stakeholders in most developed countries. However, developing countries have not adopted these procedures and therefore manufacturers are not obliged to provide the same high safety standard build quality of products.

It was estimated that UK's car occupant fatalities between 1997 and 2000 were reduced by 11.2% (Broughton et al, 2000). The application of Broughton's model to the Swedish, Dutch and British victims resulted in a 15-20% reduction in car occupant fatalities in those countries, in the period from 1980 to 2000. According to Lie and Tingval (2001), a general reduction in the risk of severe or fatal injuries is expected for each star improvement in EuroNCAP car rating. Loyd *et al* (2015) estimated that UK's 4.2% fewer car occupants died between 2005 and 2013 due to improvements in car safety equipment.

With these favourable effects, in the action plan for the UN Decade of Action (UNDoA) it is stated that activity is welcomed to encourage implementation of new car assessment programmes in all regions of the world in order to increase the availability of consumer information about the safety performance of motor vehicles (WHO, 2017 Save LIVES. A road safety technical package).

The application of NCAP in Malaysia was estimated to result in 7.6% to 8.4% fewer car fatalities between 2014 and 2030 (Loyd *et al*, 2015). Implementation of Latin NCAP in Argentina, Brazil, Chile and Mexico, would correspond to sizable reductions in car occupant fatalities between 2015 and 2030: -2.4% to -7.4%, in a normal timescale implementation; and -4.8% to -12.4% in a quick implementation (Cuerden *et al*, 2015; and Wallbank *et al*, 2017).

There are yet no estimations of the effects of enlarging the scope of GlobalNCAP to African countries.

Implementation of GlobalNCAP depends on authorities' commitment and skills, and on the active role of a national public institution for vehicle standardisation and homologation. This intervention may be integrated with comprehensive policies aiming at the improvement of national vehicle fleets and at the progress of mechanical workshops' quality. Close monitoring of car sale advertising and enforcement of adherence to vehicle standards is required as well.

6.2.2 Implementation of motor vehicle safety regulations as developed by the United Nation's World Forum for the Harmonisation of Vehicle Regulations

The UN Decade of Action for Road Safety encourages all countries to apply and promulgate motor vehicle safety regulations as developed by the UN's World Forum for the Harmonization of Vehicle

Regulations. In particular, six motor vehicle safety regulations are defined as a minimum for today's world markets:

- Seat belts and anchorages for all seating positions (UN regulations UNR14 and UNR16).
- Occupant protection in frontal collision (UNR94).
- Occupant protection in side or lateral collision (UNR95).
- Pedestrian protection (Global Technical Regulation GTR9).
- Electronic Stability Control & ABS (ESC) (GTR8).

The first four regulations (UNR14, UNR16, UNR94 and UNR 95) address issues related to vehicle crashworthiness and survivability of vehicle occupants in case of a crash; the fifth (GTR9) refers to improving the survivability of pedestrians hit by vehicles; the last regulation (GTR8) is concerned with crash avoidance, preventing an accident from happening.

Additionally, reference is made to a seventh priority regulation (R129), related to enhanced child restraint systems developed specifically to diminish misuse of child restraints and make these systems more effective.

These regulations are stated for new cars; extending their application to older cars in current vehicle fleets is also very important. A stepwise application approach may be selected, in which these standards are applied to new cars as a first step and then their application to vehicles already in circulation is gradually implemented.

In the recent 2015 WHO status report on road safety (WHO, 2015) it was concluded that implementation of these requirements is poor globally, with only 27% of the countries applying UN frontal impact test regulation and even less (26%) applying the side impact test regulation (Figure 6-2).

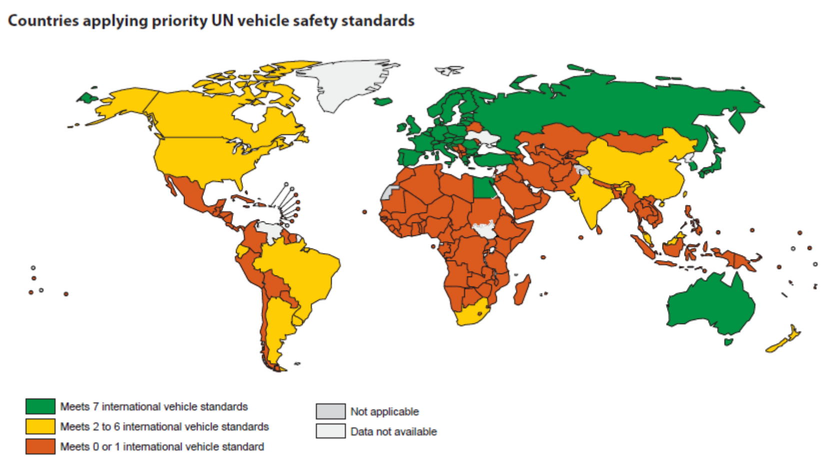

Figure 6-2 Distribution of countries applying key UN vehicle safety standards (WHO, 2015)

Applying vehicle safety standards is an intervention directed to the vehicle pillar of the African Plan of Action, and primarily included in the vehicle category of the SUPREME project; secondarily, it is also related to enforcement, as well as institutional organisation. Given the extended life cycle of motorised vehicles, car fleet renewal is a lengthy process, taking 20 years or more to fully obtain a car fleet complying with newly approved standards; conversely, once incorporated in vehicles, the effects of evolving new vehicle specifications are long lasting, even though maintenance and monitoring are essential.

Most direct funding for this intervention is provided by public institutions (in charge of vehicle homologation) and car owners. Overall, no reference was found on social or stakeholders' opposition to the UN's primary vehicle safety standards.

Implementation of UN's primary vehicle safety standards depends on legislation, on the authorities' commitment and skills, and on the active role of a national public institution for vehicle standardisation and homologation. This intervention may be integrated with comprehensive policies aiming at the improvement of national vehicle fleets and at the progress of mechanical workshops' quality. Close monitoring of car sale advertising and enforcement of adherence to vehicle standards is required as well.

6.2.3 Periodic vehicle inspection Turkey

Periodic Technical Inspection (PTI) of motorised vehicles consists of the regular inspection of vehicles, carried out by specialised mechanical technicians in approved inspection garage sites specially built for these activities. The frequency of PTI depends mainly on the vehicle category, type of operation (private or commercial) and age. The main driver of this intervention is the circumstance that vehicles deteriorate with normal ageing and operation, they may develop serious technical defects, and that the majority of vehicle owners and drivers are only able to detect very serious deficiencies, usually when there are already grave reductions the vehicle performance. Modern vehicles are too complex for most owners to inspect and repair.

This intervention aimed at the improvement of the system of mandatory periodical inspection of vehicles in Turkey, in order to put it on par with similar current EU systems. It is an intervention primarily included in the vehicle category of the SUPREME project, and secondarily related to enforcement.

Implementation of this country-wide intervention started in 2009 and took several years, through a comprehensive approach, and its effects are expected to be long lasting, as long as activities of main responsible parties – mainly traffic and vehicles authorities, police forces and inspection centres – are kept at reasonable levels of performance.

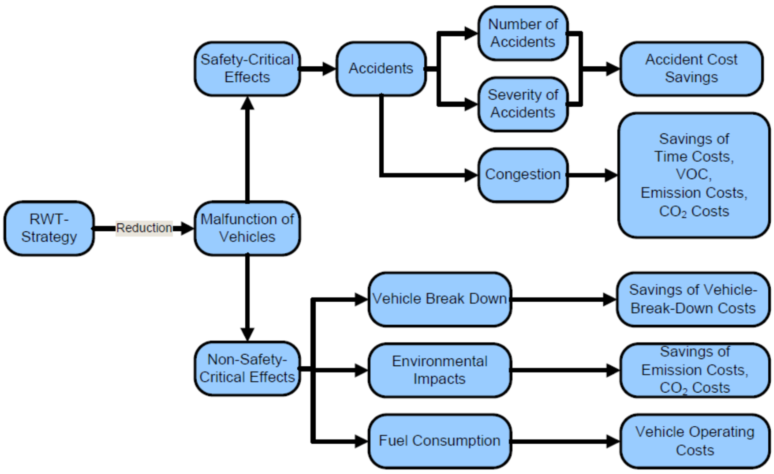

Figure 6-3 Impact of vehicle roadworthiness enforcement strategies on transport economic costs (Baum et al., 2007)

Previously, a system of simple technical check-ups and document verifications was in place. The Turkish government decided in 2004 to introduce Directive 96/96/EC, and later on the current version of the EU Directive 2014/45/EU., both setting the minimum requirements to put in place by Member States regarding the periodical inspection of vehicles, and define the category of vehicles to inspect, the frequency and the minimum content of the inspection.

Currently, 204 fixed, 5 motorcycle, 76 mobile and 13 mobile tractor stations are operating in two regions (87% of the country), with the option to install further stations, in case of higher demand.

The comprehensive nature of the vehicle requirements put on test in the inspections ensures that all types of accident are influenced and that both pre-crash and crash phases are considered (active and passive safety devices). . All road users are beneficiaries of this intervention, even though pedestrians and cyclists only indirectly. The conformity of tested vehicle systems verified during the inspections ensures that vehicles have reduced risk of accidents and severity. Effects are expected on both injury and property damage only accidents.

Using 2007 as the basis year, it is estimated that the intervention will affect directly 12.4% of total number of accidents (102,000 out of 825,561 registered crashes) and 8.9% of the total number of fatalities (450 of the 5,007 annual fatalities), as referred in Turkish road traffic statistics for 2011 (ISSN 1300-1175).

Assuming that the percentages of impacted accidents and fatalities remained constant, the estimated reduction in the total number of accidents during the period 2008-2013 is 612,000 and the projected decrease in the number of fatalities is 2,700. In a preliminary assessment of the effects of this intervention (Figure 6-3,) an average annual reduction of 82,925 accidents was estimated for the first year of full implementation (2008), resulting in savings amounting to US$ 274 million (Schulz and Scheler, 2017). These authors estimated that, since PTI was fully introduced a total of approximately 2,700 fatalities were spared; also, there were over 102,000 fewer annual accidents on average, corresponding to annual savings of US$ 340 million. There is a potential increase of benefits when coverage rises from 87% to 100% of the country.

In addition to the effects on road safety outcomes, positive impacts on air pollution are expected as well (see Figure 6-3,), even though they have not been measured in this preliminary assessment of benefits in Turkey.

In the AUTOFORE project such benefits were duly considered, in the evaluation of scenarios for changing current PTI procedures. This project considered the situation in 12 EU Member States (Denmark, Germany, Greece, Spain, France, Ireland, Italy, Czech Republic, Estonia, Lithuania, Hungary and Slovenia). In these countries, accidents due to technical defects account for 5.8% of the total number of accidents (43536 out of 750622 accidents), of which 48% (20847) are avoidable. These percentages are considerably lower than those estimated for Turkey (respectively 12.4% and 8.9%). A final benefit-cost-ratio of 2.1 was calculated for changes in the frequency of passenger car inspections, which seem, therefore, highly beneficial from a societal point of view.

Additional inspection of New Electronic Vehicle Components was an alternative intervention scenario evaluated in the AUTOFORE project that aims at guaranteeing that the benefits from electronic systems (such as anti-lock braking system, airbags, cruise control and electronic stability control), persist during the vehicle lifetime. It was found that the benefit-cost ratio for the additional testing of ESP in the 12 participating European countries is 2.6.

Lack of data impeded the AUTOFORE consortium from performing a rigorous economic analysis of a wider application of periodic inspections for powered two-wheelers and of roadside inspections of heavy good vehicles. Nevertheless, good accident evidence supports the recommendation for extending the Directive on PTI to two-wheeled motor vehicles (CITA, 2010). However, at this stage it is recognised that there may be problems with the inclusion of mopeds in the Directive.

6.2.4 ABS and helmets in two-wheeled vehicles in the EU

Two-wheeled vehicle riders are particularly vulnerable to crashes, not only in collisions with other vehicles, but also in single vehicle accidents – even when not involving a collision with a dangerous obstacle.

ABS is very effective in preventing falls in emergency braking, ensuring high front brake effectiveness under strong load transfer while allowing for keeping the vehicle stability. Upright crashes with braking and sliding fatal crashes are significantly decreased by ABS. (Rizzi *et al.*, 2016). Helmets are very effective in preventing serious head injuries, on motorcyclists, moped riders and cyclists (SUPREME, 2010). In the EU, helmets are compulsory for motorised two wheelers in all Member States (and they have to comply with ECE regulation 22.05), and generally bicycle helmets (EN 1078) are not compulsory for cyclists. In some Member States (e.g. Netherlands), helmets are not obligatory for light mopeds (less than 25 cc, or with speed limited to 25 km/h), but in several Member States there is mandatory use of helmets complying with ECE regulation 22.05.

The advantages of mandatory use of helmets by motorcyclists and moped riders are generally recognised and accepted. For cyclists, the benefits of helmets are disputed and potential reduction in bicycle use is a frequently mentioned disadvantage of mandatory cyclist helmet. However, a bicycle helmets contain a thick layer of polystyrene which absorbs the force of an impact and can reduce the consequences of a crash, being particularly effective in case of head injury crashes

(SUPREME, 2010). Good practice examples involving motorcycle and moped helmets are further discussed in section 7.1.1.

Otte (2001), in Germany, calculated that the number of fatal or seriously injured cyclists would decline by 20 % if all cyclists wore helmets, and slight injuries would slightly increase (by around 1 %), as some of the serious injuries would turn into slight injuries due to the helmet. In Holland, where there is widespread availability of dedicated cycling infrastructure, the effect is reported to be much smaller (about 2% if just young and elderly wore helmets). From a safe system perspective, the combination of no cycling infrastructure and no helmet on roads with speed limits higher than 30 km/h is not desirable and potentially very serious. One should also consider that wearing helmets on bicycles riding on roads with vehicle speeds of 80 km/h is not very effective in reducing injury severity in case of a collision, because at that speed the chance of being killed as vulnerable road user is almost 100%

In ROSEBUD, Winkelbauer (2006) calculated a benefit-cost ratio of 2.3 or 1.1 when looking at all road crashes, and 4.1 or 2.1 when looking at bicycle crashes only, depending on the cost of bicycle helmet (20.00€, or 40.€). In New Zealand, Taylor and Schuffham (2002) showed that mandatory bicycle helmets would be cost-effective for children, but not for adults.

There is considerable debate on the overall effectiveness of laws stating the mandatory use of helmets by bicyclists, due to possible reductions in willingness to use this transport mode. According to Elvik (2013), bicycle helmets clearly reduce the risk of injury to the head; concerning facial injury, the evidence suggests that the protective effect is smaller, but on balance there does seem to be a slight protective effect; the risk of neck injury does not seem to be reduced by bicycle helmets. When the risk of injury to head, face or neck is viewed as a whole, bicycle helmets do provide a protective effect. This effect is statistically significant in older studies; new studies indicate only a statistically non-significant protective effect.

Data on most unprotected road users (pedestrians, cyclists and powered two-wheelers) single crashes are not yet detected in the standard police reported accident statistics, which means that existing studies on this subject fail to fully address the phenomenon (Methorst *et al.*, 2016).

6.2.5 Heavy vehicle overweight control in the Douala-N'Djamena corridor, in Cameroun

6.2.5.1 Background

Overloading heavy goods vehicles has negative impact in infrastructure lifetime and the environment, degrade vehicle performance and traffic operation, and overall degrades the economy (namely by unfair competition with other road transport operators complying with established regulations).

It is well known that overloaded vehicles reduce the life of roads and structures, by premature deterioration of roadways and accelerated degradation of bridges and viaducts. Damage to roadways caused by vehicular traffic mainly depends on the number of axles passing in each section, the axle weights, vehicle speeds and the type of roadway (flexible pavement, rigid pavement or gravel). Under normal circumstances, the effect of an overweight axle can be represented by a power of 4: for example, an axle with twice the legal weight limit will have an effect 16× greater than an axle with the legal weight limit (Luskin and Walton, 2000).

However under specific conditions, effects 256 times greater have been reported in the USA; and in France effects four times greater in fatigue cracking and 256 times greater in rutting were reported by the OECD (1988), when doubling the axle weight.

In South Africa it was concluded that overloaded heavy vehicles (representing 15% to 20% of the total traffic) were responsible by 60% of the damage to roads (CSIR, 1997).

Overloading also contributes to higher fuel consumption, early wear and tear on vehicles and premature breakdown. Furthermore, overloaded vehicles are less stable due to increased centre of gravity height, greater vehicle inertia (e.g. trailer or semi-trailer.). Also, on-board stability tools (ESP, anti-rollover system, etc.) may become less effective; the risk of rollover, lane departure or knife-jacking is increased. The risk of brake failure also increases with overloaded vehicles. The braking capacity depends on the brakes themselves and also on the tyre and suspension performances, all designed for the maximum allowable weight of the truck. Excess weight reduces the braking capacity of a truck, and may even damage the braking system. Overloading also can induce tyre overheating, with a higher risk of tyre blow-outs.

An overloaded vehicle becomes under-powered, which results in lower speeds on ascending slopes as well as greater risk of congestion, inefficient engine braking and speeding on down-hill slopes. Overtaking also takes longer, and thus incurs additional risks for the other road users. These are issues that affect road operating conditions (decrease in service level and capacity) and directly increase the risk of accidents, degrading assumed road safety levels.

Truck performance on level and uphill grades is affected by the length and longitudinal slope of the grade as well as the vehicle's starting speed and its weight to power ratio. Figure 6-4 presents typical variations of truck speed along selected up-hill slopes, for various weight to power ratios (St. John and Harwood, 1991).

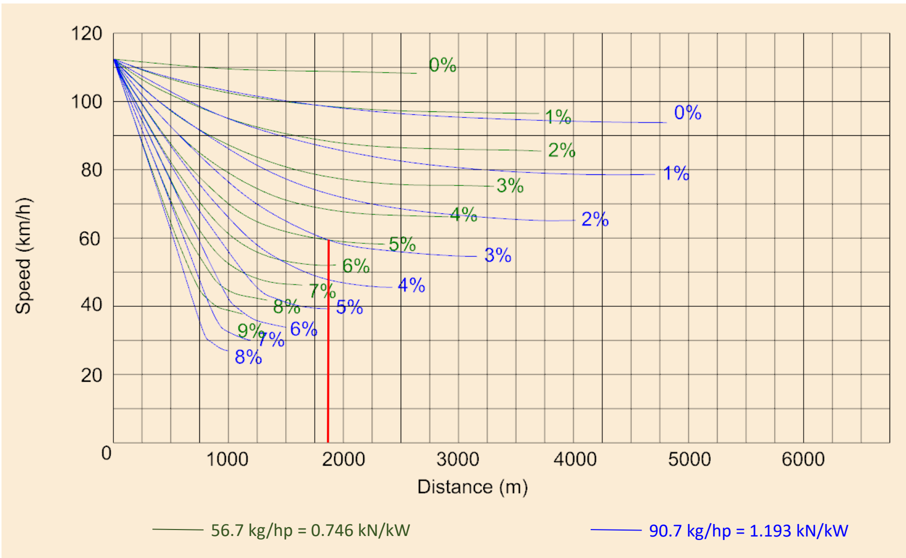

Figure 6-4 Truck speed variation on up-hill ramps, for different weight to power ratios (adapted from St. John and Kobett, 1978)

As shown by the red vertical line in the graph, the speed reduction of a 90.7 kg/hp truck on a 2 km long 3% ramp is equal to the speed reduction of a 56.7 kg/hp truck on a 2 km long 5% ramp. This means that a 60% overloaded truck will have its speed performance on a mild ascending ramp degraded to values equivalent to those on steep grades, for its legal maximum weight-power ratio.
In fact, the example truck would have its speed reduced from 110 km/h to 78 km /h on a 2 km long 3% ramp, if it complied with the maximum ratio of 56.7 kg/hp; whilst, the same truck will have its speed reduced to 60 km/h, when overloaded to 90.7 kg/hp. Therefore, widespread truck overloading will generate traffic speed differences between trucks and cars considerably greater than anticipated at the design stage; if no passing lane exists in those road sections, their accident risk will be much higher too, as shown in Figure 6-5 .

Usually, at the design stage, the provision of passing lanes on ramps is decided on the basis of calculated truck-car speed differences, for instance using 15 km/h as critical criterion: a lane for slow moving trucks is installed when the speed of a standard truck is 15 km/h slower than the standard car. As demonstrated, overloading distorts the assessment of truck-car speed differentials at the design stage, resulting in passing and crawling lanes being designed shorter than what is effectively needed, and causing a higher accident risk.

A similar type of distortion affects the reasoning applied at the design stage to decide on the installation of emergency escape ramps and arrester beds on steep and long downhill ramps, to limit the consequences of runaway heavy vehicles. This decision is usually based on criteria related to brake heating, which depends on the energy to dissipate heat. Heavy vehicle overloading increases the energy that needs to be dissipated on a given slope, meaning that the ramp is mechanically steeper than physically, resulting in longer distances between arrester beds than effectively needed, and higher accident risk. Furthermore, as the energy is greater than assumed at the design stage, the length of the arrester bed is shorter than required; this prevents the full absorption of a vehicle's kinetic energy and increases crash severity.

Therefore, widespread truck overloading is also a serious safety problem.

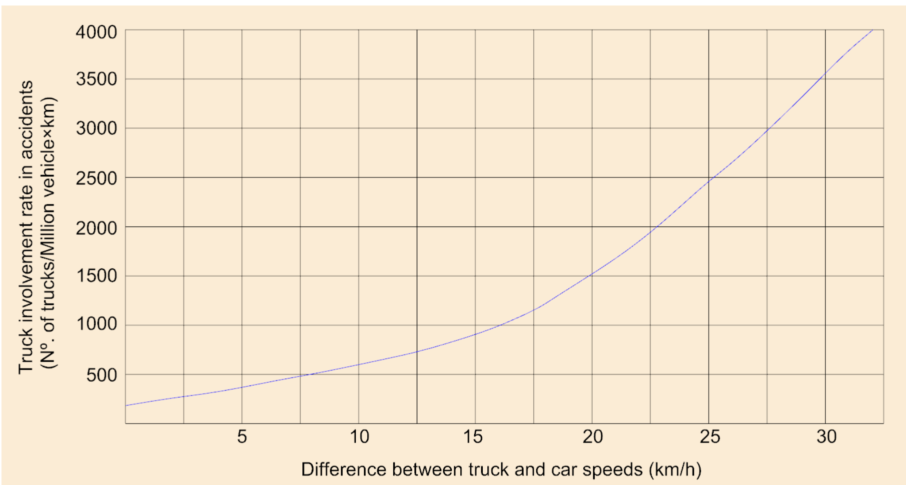

Figure 6-5 Truck involvement in accidents as a function of speed difference to the speed of cars (Lamm et al, 1999)

The benefits of effective axle-load control are evident in avoiding premature degradation of pavements and bridges, reducing road user costs (vehicle operating costs and travel time costs), increasing the interval between periodic maintenance and rehabilitation actions, and preventing the occurrence of accidents involving trucks.

Inadequate implementation of effective axle-load control can be explained by main two groups of factors. One such group is concerned with government lack of will to tackle the overloading problem, a factor which may be related to the inefficiency of the public administration institutions responsible for controlling road freight traffic, frequently occurring in the context of very low salaries in the public sector and in the police forces (Pinard, 2010). The other group concerns the organisation and management of transport freight operators, which is poor in some African countries. The practice of overloading by transport freight operators is reasonable in the short run, since its marginal costs are low (Martíneza *et al*, 2018). The same is not true, when a broader economic approach is taken and long run evaluations are made.

6.2.5.2 Interventions

This intervention was carried out by Cameroons' authorities in the Douala-N'Djamena that connects the port city with the rest of the country and ensures international road connections with Chad and the Central African Republic. It was started in 1996, with the approval of legislation on road maintenance and protection. It consisted in close monitoring of overloading practices and in vigorously enforcing axle load and gross weight regulations along the 1844 kilometre corridor. Originally aimed at increasing the life of the road pavement and structures' life time, this intervention also had impacts on road safety.

The overload control policy comprised the installation of 10 weighting stations at key locations in the corridor (Figure 6-6) and the effective enforcement of both the vehicles' gross weight and the individual axle loads. Truck weight limits in Cameroon are 13 tons for single axle weights and 50 tons for vehicle gross weight. Vehicles exceeding the tolerance limits were fined 25,000 CFA francs/ton (38 €/ton) for loads below 5000 kg and 75,000 CFA francs/ton (115 €/ton) for loads in excess of 10000 kg. Overloaded vehicles remain immobilized at the weighing station until full payment of the fine and may only continue their journey after unloading of the excess weight in compliance with the regulations.

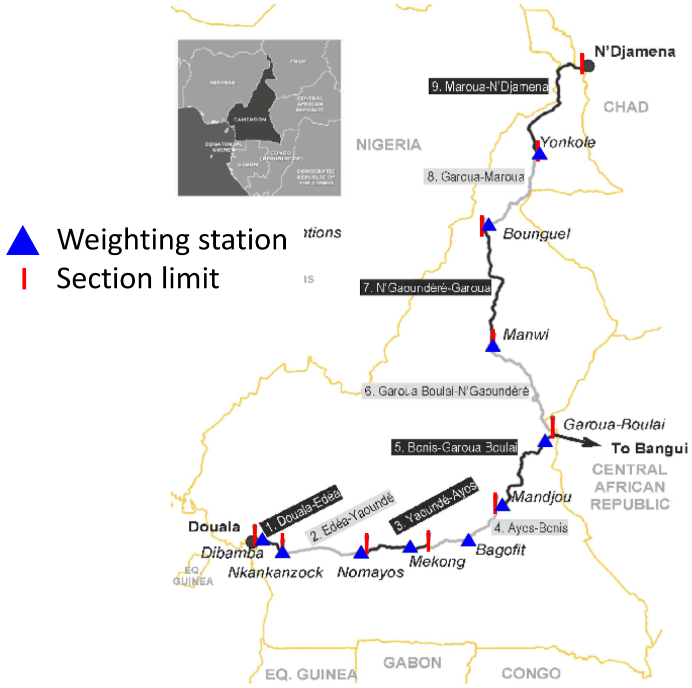

Figure 6-6 Weighting control in the corridor Douala-N'Djamena, in Cameroon (adapted from Martíneza et al, 2018)

The new regulations and enforcement policy raised opposition from some industries relying on road transport (e.g. timber and fuel), and generated conflicts with road freight operators and other stakeholders, namely drivers and shippers. These were mitigated by means of education campaigns on the procedures for checking vehicle loading and on how to properly carry out cargo stowage.

Progressive generalisation of compliance with the rules has led transport operators to understand the benefits of protecting the service life of their vehicles and the road for themselves in terms of operating costs. Since the start of the intervention, road transport operators have been renewing their fleets, further reinforcing their interest in maintaining reasonable levels of compliance with regulations and preventing early wear of their vehicles.

Before the intervention, in measurements made in 1998 it was concluded that overall 85% of trucks were overloaded, 32.5% with gross vehicle mass between 120% and 140% the legal maximum, and 34% with even higher gross weight (more than 140% the maximum allowed). At this time, it was estimated that each passing heavy vehicle in the corridor corresponded to 2.87 standard axles (13 t).

By 2003 each passing vehicle corresponded to 0.89 standard axles and this number has been kept approximately constant until 2015 (Martíneza *et al*, 2018). The official annual report of the Ministry of Public Works, states that in 2014 only 5.9% of trucks were overloaded, with most of them less than five tonnes over the limit.

These measurements confirm the global effectiveness of the adopted policy and its implementation. However, some drawbacks remain and still hamper the full attainment of the corridor's road service life, namely due to lack of control of fuel tankers weight which seems to be dependent on new international agreements.

Results from a cost-benefit analysis of the intervention show that every euro (1 €) invested (between 2000 and 2015) by authorities in the overload controlling generated a reduction of €19.4 in operating costs (for transport operators) and a decrease of €4.6 in road maintenance and rehabilitation costs (for the public administration).

Effective control of widespread truck overloading involves other actions besides sensible geographical distribution of enforcement weighting stations and rigorous regulation application by the police or official controlling agents. Active involvement of stakeholders (e.g. drivers, freight operators, shippers and logistics operators) is needed, including training on how to comply with existing vehicle weight rules and information campaigns on the benefits to the transport system operation and road safety. Area wide approaches are required for this type of intervention, as tight control in a corridor may generate traffic diversions to alternate routes (with unforeseen road safety problems) and market competition distortions. Coordination with other transport policies is advisable, such as transport liberalization, port operation reforms and international regional agreements.

6.2.6 Summary

In general, interventions aimed at improving the safety of vehicles refer to factory design and construction issues and operation and maintenance relevant for car roadworthiness and crashworthiness. Despite the economic significance of heavy (both passenger and goods) vehicles and the increasing importance of PTW in (private and public) there are few references to interventions directed at vehicle safety standards for these categories. NCAP star ratings have a beneficial effect in vehicle consumer choices, in factory design, and in automakers decisions regarding vehicle equipment provided as a standard (e.g. ABS, side airbags, etc.). Implementation of UN vehicle standards is expected to contribute significantly to road safety improvements, as well as the improvement of periodic inspection systems. Effective interventions in these areas involve a combination of legal provisions establishing requirements, technical expertise in mechanical engineering and vehicle equipment standardization, and adequate inspection and enforcement strategies. Heavy vehicle overweight is an often overlooked road safety problem in Africa that may be effectively controlled by active involvement of stakeholders, sensible geographical distribution of enforcement weighting stations and rigorous application of related regulations by the police or official controlling agents.

7 Safer road users

An extensive search of literature, past funded projects and other studies was undertaken to identify good practices in road safety interventions focussed on safe road users, both in Africa and also in Europe and other parts of the world. The focus was on expected outcomes from actions within the African Road Safety Action plan and for safe road users, there were six outcomes identified, which were:

1. Use of helmets
2. Use of seatbelt
3. Drink-driving and driving under the influence of other drugs
4. Use of mobile phone while driving
5. Speeding
6. Educated general public (road users)

To identify existing good practices in each of these six areas for Africa, questionnaires were distributed and the method described in section 3 was used. To identify existing good practice in each of these six areas for Europe, particularly those where impacts on road safety had been measured, the following EC funded projects and other relevant publications were sourced (Table 7-1).

Particular emphasis was given to practices from the rest of the world which were reported to have a strong impact on road safety, or the source country was an emerging economy where road safety practices related to road users had been successfully implemented (i.e. proven to reduce road accidents/injuries or led to safer road user behaviour).

In terms of the areas of good practice for each outcome identified for safer road users, examples of good practices in the following areas of engagement were looked at for Africa and the rest of the world:

1. Implementing/changing laws (e.g. banning hand held mobile phone use, reducing drink driving limits…);
2. Introducing or changing penalties (e.g. fines, bans, points on licence, prison);
3. Introducing or increasing enforcement (e.g. patrols, speed cameras…);
4. Publicity campaigns (e.g. through use of television adverts, leaflets, newspapers, internet…);
5. Educating road users (e.g. in schools, workplaces…);
6. Training (e.g. pre-licence training, training/awareness courses for offenders…).

Table 7-1 Projects and publications sourced to identify good practices in Europe

Projects/Publications sourced
EC GADGET project
EC ESCAPE project
EC PEPPER project
EC ROSEBUD project
EC ROSE25 project
EC SUPREME project report F6: Enforcement
EC SUPREME project report F1 Education/campaigns
EC SUPREME project report F2 Education/driver training/licensing
EC SAFETYCUBE project DSS
EC SUNFLOWER project
EC DRUID project: Deliverable 7.1.1: Review of guidelines, booklets, & other resources: state of the art
ERSO (EC SafetyNet project)
Handbook of Road Safety Measures (Elivk & Vaa, 2004)
PIARC publication: Best Practices for Road Safety Campaigns
WHO – Save Lives: A road safety technical package
WHO – Managing Speed
WHO - Powered 2 & 3-wheeler safety: a road safety manual for decision-makers & practitioners
WHO - Seat-belts & child restraints: a road safety manual for decision-makers & practitioners
WHO - Drinking and driving: a road safety manual for decision-makers and practitioners
WHO - Speed management: a road safety manual for decision-makers and practitioners
WHO - Helmets: a road safety manual for decision-makers and practitioners
EC SARTRE project (no relevant data)
EC VERA 1 and 2 projects (no relevant data)
EC CAPTIVE project (no relevant data)
EC SaferBraIn project (no relevant data)
EC Cast project on Campaigns and Awareness-raising Strategies in Traffic Safety

7.1 Overview of Good Practices

7.1.1 Use of helmets

Table 7-2 shows the summary of the type of studies identified which looked at interventions to encourage and increase motorcycle helmet use.

Table 7-2 Use of helmets

Type of intervention	Number of studies		Source countries
	Africa	Rest of World	
Laws	0	9	Kenya, Benin, Guinea, Burkina Faso, Uganda Spain, Italy, Vietnam, Taiwan, Colombia, Thailand, Iran, Cambodia, USA**
Penalties	0	3	
Enforcement	2	5	
Publicity	5	7	
Education	0	0	
Training	1	1	
Total	5*	11	

*Some sources look at more than one 'area', so the numbers will overlap
**Repeals of laws

Five campaigns were identified which supported interventions for increasing helmet use in African countries. One of these was a national motorcycle helmet campaign in Kenya entitled 'No Helmet, No Ride' which was introduced in 2012. The aim was to raise awareness of the consequences of not wearing a helmet in order to increase helmet usage amongst motorcyclists. The campaign consisted of a series of posters, billboards, and radio adverts and was run alongside stricter enforcement of helmet legislation by the police. More recently, the Kenyan National Transport and Safety Authority (NTSA) introduced stricter traffic regulations for operators of motorcycles, particularly aimed at Boda-boda (motorcycle taxi) riders, which includes it being mandatory for operators and pillion passengers to wear helmets, among other rules. Failure to follow the new regulations will lead to either a fine or imprisonment or both. As of yet, the effects of the impact of the campaign or the new regulations has not been reported on. In the road safety capacity review performed in Kenya by the SaferAfrica workpackage 5 it is reported that although heavy fines are associated with non-compliance, enforcement is hampered by the highly politicised position of these transport operators (Schermers et al, 2018).

Also, in Uganda, a campaign promoting 'helmet vaccines' (UHVI) was introduced in 2013 to build awareness and support for helmet use, to support the police in their efforts to increase helmet use, particularly among Boda-boda riders and their passengers, and support the government in introducing a new helmet standard. The campaign included radio campaigns, helmet donations and workshops providing information on helmet use and road safety skills to motorcycle drivers, plus police enforcement. Two years after the campaign was introduced, helmet use among Boda-boda riders increased from 49% to 77%.

One example of where a company in Africa has launched a road safety programme for their employees is in Mali, where in 2017, Nestle, as part of their 'Nestle Mali Commits' program, introduced compulsory wearing of helmets by their employees and their partners. This initiative began in Burkina Faso and may well be extended to Nestle personnel in other countries in Africa. No effects of the impact of this initiative have been reported on yet.

The majority of studies from the rest of the world investigated the effects of introducing or updating a law on motorcycle helmet use, often alongside a publicity campaign and sometimes more stringent law enforcement, which mainly involved increased patrolling. As well as European countries (Spain, Italy) and USA, studies from other Emerging Economies and developing nations were also identified where road user-related safety interventions had been successfully implemented (e.g. Vietnam, Iran, Cambodia, Thailand). The safety measures used to evaluate the success of the interventions included motorcycle accident and injury rates and also levels of helmet use.

7.1.2 Use of seatbelts

Table 7-3 shows the summary of the type of studies identified which looked at interventions to encourage and increase seatbelt use.

Table 7-3 Use of seatbelts

Type of intervention	Number of studies		Source countries
	Africa	Rest of world	
Laws	1	1	Benin, Guinea, Burkina Faso, Tunisia Netherlands, Belgium, Denmark, France, UK, Australia, Canada, Costa Rica, USA
Penalties	0	2	
Enforcement	1	5	
Publicity	4	3	
Education	0	1	
Training	0	0	
Total	4*	6*	

For seatbelt use, four campaigns, which have considered this area, have been sourced from Africa. The campaigns were in Benin ('PTA du CNSR in collaboration with NGOs'), Burkina Faso ('Ministère des Transports'), Guinea ('African day of road safety and WDR') and Tunisia ('Attach to life…Fasten your Seatbelt'). Some of these campaigns also considered helmet use (Benin, Guinea) and speeding (Guinea). The campaign from Tunisia involved the enforcement of a mandatory seatbelt law which had not previously been enforced in urban areas. The law began to be enforced in April 2017 for drivers and front seat passengers, and along with publicity campaign, traffic control checkpoints were set up to monitor compliance with the law. In the first year, there was found to be a reduction of around 9% in fatalities and injured occupants in urban areas.

The six studies/reports from the rest of the world that included an evaluation of the impact of interventions aiming to increase seatbelt use, mainly focussed on the effects of enforcement. This included one meta-analysis (based on 17 studies), which found that the overall effect of seatbelt enforcement on seatbelt use was a 21% increase during the enforcement periods and a 15% increase after the enforcement periods (Erke et al., 2009). In France, a combination of increased enforcement alongside increased fines and penalty points for drivers not wearing seatbelts led to continually increasing levels of seatbelt wearing in the years following the increases (WHO, 2009). A combination of targeted seatbelt enforcement (i.e. police controls) and seatbelt publicity campaigns increased compliance rates for using seatbelts in cars from 80.1% to 87% of drivers in Denmark between 2000 and 2005.

Some campaigns looked at child restraint systems as well as the use of seatbelts. In the Netherlands (SUPREME, 2007), a successful publicity campaign ('Goochem the Armadillo') focussed on the use of seatbelts and child restraint systems in the rear on for children aimed 4-12 years old was carried out between 2004 and 2006. This coincided with a new regulation for the transport of children by car which came into force in 2006. It found that the share of children being transported with a protective device (either seatbelt or child restraint system) increased from 75% to 90% and the use of child restraints increased from 25% to 56% between 2004 and 2006.

In South America, the government of Costa Rica led a successful programme known as '*Por amor use el cinturón*' ('For love use your seat belt') to reintroduce a seat belt law in 2005 after the previous law had been abolished some years earlier (WHO, 2009). In 2003 and 2004, intensive publicity campaigns were carried out to increase public awareness of the new law and the increased enforcement/penalties that would accompany it. After the law was introduced and enforcement began, seatbelt use increased from 24% to 82% (based on survey results).

7.1.3 Drink/drug-driving

Table 7-4 shows the summary of the type of studies identified which looked at interventions to discourage/reduce drink-driving and drug-driving (both recreational and medicinal use).

Table 7-4 Drink/drug driving

Type of intervention	Number of studies			Source countries
	Africa	Rest of world		
		Drink	Drug	
Laws	0	4	1	Benin, Guinea, Burkina Faso
Penalties	0	5	0	
Enforcement	0	5	1	Netherlands, UK, Sweden, France, Belgium, Germany, USA, New Zealand, Canada, Mexico, Australia
Publicity	3	3	3	
Education	0	0	0	
Training	0	1	0	
Total	3	10*	3*	

* Some sources look at more than one 'area', so the numbers will overlap

For drink and drug driving, three campaigns have been sourced in Africa which have considered this area. The campaigns were in Benin ('PTA du CNSR in collaboration with NGOs'), Burkina Faso ('Ministère de Transport') and Guinea ('African day of road safety and WDR'). These campaigns also considered helmet use (Benin, Guinea) and speeding (Guinea).

For the ten studies identified from the rest of the world with results which showed impact for interventions to reduce drink-driving, including one meta-analysis (Erke *et al*, 2009), most investigated either changes or introduction of new laws, enforcement techniques, penalties, or a combination of these. In France in 2002, penalties for driving under the influence of alcohol were increased and new laws were introduced (i.e. lower BAC limits), plus increased enforcement (e.g. breath tests). Following this, alcohol impaired driving incidents were found to decrease by almost 40% between 2003 and 2004 (GRSP, 2007).

Anti-alcohol publicity campaigns have also been shown to reduce drink driving numbers, particularly alongside changes to enforcement. The 'Bob' anti drink-driving campaign was a successful campaign in Belgium in 1995, where incidents of Driving under the influence (DUI) were found to reduce by 4% during and then 9% after the campaign (SUPREME 2007).

A study by Ma *et al* (2015) found that in Ontario, Canada, both a remedial alcohol programme known as 'Back on Track' and licence suspension were associated with a reduction in drink-driving reoffending, with reoffending rates reducing by 21% and 65% respectively.

Mexico has also been found to have had some success with reducing the monthly percentage of deaths and crash rates associated with alcohol, by lowering its BAC limit from 0.15 to 0.05 and introducing tougher penalties when breaking the law (Gomez-Garcia et al, 2014).

All three studies related to drug-driving included an evaluation of relevant publicity campaigns and their effects on driver behaviour and related road death rates. In 2003, a campaign in the UK was launched to increase the awareness of the penalties for drivers caught driving under the influence of illegal drugs and the similarities to drink driving penalties. In one particular area of the UK (Durham), drug related road deaths reduced from 12 to 0 in 2 years and from survey results, it was found that awareness of the penalties for drug driving increased from nearly 0 to 40% over 2 years. After a law was introduced in Australia in 2004 which gave police powers to conduct random roadside saliva testing on drivers suspected of being under the influence of drugs, survey results of drug using respondents showed that those who drove under the influence reduced from 45% to 35% (DRUID, 2007).

As well as illegal drugs, driving under the effects of prescribed and non-prescribed medication was also considered as part of this topic. A campaign in Australia in 1999 focussed on the use of these types of medicines while driving with the aim of raising public awareness of the potential effects on driving ability (DRUID, 2007). Research revealed that prior to the campaign, 31% thought their medicine wouldn't affect driving. After the campaign, this reduced to 13%.

7.1.4 Mobile phone use whilst driving

Table 7-5 shows the summary of the type of studies identified which looked at interventions to discourage/reduce hand-held mobile phone use whilst driving.

Table 7-5 Mobile phone use

Type of intervention	Number of studies		Source countries
	Africa	Rest of world	
Laws	0	2	Benin, Guinea, Burkina Faso
Penalties	0	1	
Enforcement	0	0	UK, USA
Publicity	3	0	
Education	0	0	
Training	0	0	
Total	3	3	

For mobile phone use, three campaigns have been sourced from Africa which have considered this area. The campaigns were in Benin ('PTA du CNSR in collaboration with NGOs'), Burkina Faso

('Ministère de Transport') and Guinea ('African day of road safety and WDR'). These campaigns also considered helmet use (Benin, Guinea) and speeding (Guinea).

Very few studies were found from countries across the rest of the world which evaluated the impact of introducing interventions to reduce mobile phone use while driving. This could be due to the issue of mobile phone use while driving being a more recent issue compared with drink driving, speeding and seatbelt use. Therefore laws banning their use while driving and subsequent penalties (e.g. fines, driving bans) have been a much more recent occurrence and not as much time has passed to be able to evaluate the effects of any interventions introduced.

Of the studies that were found, two were from the USA which investigated the effects of introducing laws prohibiting the use of hand held phones/devices in a number of US states. One study (Jacobson *et al*, 2012) found that the bans became more effective at reducing injury accident rates over time and were more effective in areas with high driver density (i.e. less effective in areas with low driver density), while the second study (McCartt et al, 2006), found that the rate of hand-held use reduced significantly after the law was introduced (from 6% before to 3.5% after).

In the UK in 2007, tougher penalties were introduced for hand-held phone use (i.e. 3 penalty points and fine doubled to £60) and from a survey undertaken in the same year, found reduced levels of use compared with 2006 (reductions of 1.4% for car drivers and 3% for other drivers).

In addition to these three studies, another study also referenced in a DaCoTA project report (ROSPA, 2002, cited in DaCoTA, 2012) found in Japan, a large reduction in the number of crashes involving mobile phone use (52%), in the number of people injured in these crashes (53%) and in the number of people killed in mobile phone crashes (20%) following the introduction of a ban in 1999.

7.1.5 Speeding

Table 7-6 shows the summary of the type of studies identified which looked at interventions to discourage and reduce speeding (i.e. travelling above the posted speed limit).

Table 7-6 Speeding

Type of intervention	Number of studies		Source countries
	Africa	Rest of world	
Laws	0	1	Benin, Botswana, Guinea, Burkina Faso, Cameroon, Congo UK, Sweden, Norway, Netherlands, France, USA, Australia, Brazil
Penalties	0	4	
Enforcement	1	8	
Publicity	6	2	
Education	1	0	
Training	0	1	
Total	6*	11*	

*Some sources look at more than one 'area', so the numbers will overlap

Six studies/articles which discussed the introduction of interventions to discourage and decrease speeding were sourced from Africa, all of which included some form of publicity campaign, and one was known to also include increased enforcement (speed checkpoints) and education (road safety briefings/presentations).

As part of the UN Global Road Safety week in 2017, FIA affiliated automobile clubs around the world organised initiatives to promote the UN's theme of speed management, including media campaigns, marches and school based advocacy. In Botswana, the automobile club Emergency Assist 991 and Botswana Police Service held an hour long march in collaboration with a local school which designed posters on the theme 'save lives slow down' for the march. Flyers were also distributed and interactions with drivers on speed awareness. No effects of the impact of this initiative have been reported on yet.

In 2017, a road safety campaign to reduce traffic accidents and improve the image of MONUSCO (UN peacekeeping force) in the Democratic Republic of Congo (DRC) was launched. It aimed to increase the awareness of safe driving of MONUSCO personnel to help reduce traffic accidents. This included respecting speed limits, among other areas. It included briefings and presentations on road safety, road safety broadcasts, introducing random vehicle checkpoints, and producing publicity materials to display and distribute. In 2014/2015, MONUSCO personnel were involved in at least 159 accidents, but since the campaign was introduced in 2017, a minimum of 30% decrease has been observed.

Eleven studies were identified from countries across the rest of the world which included an evaluation of interventions aimed to reduce speeding. Most included an evaluation of some type of enforcement, mainly fixed speed cameras, but also manual methods (e.g. police using mobile cameras at sites). One of these was a systematic review (meta-analysis) of 45 evaluation studies on speed (Erke *et al.*, 2009) undertaken as part of the PEPPER project, which found that the overall effect of speed enforcement on accidents was an 18% reduction. When looking at permanent speed cameras only, it was a significant reduction of 34%, with the reduction being a non-significant 11% for manual speed enforcement methods.

In the UK, a study of the implementation of fixed speed cameras over 4 years (2000-2004) resulted in a 70% reduction in vehicles exceeding the speed limit (18% at mobile sites). On average, speeds dropped by 6% and there were found to be 42% fewer KSI casualties at these sites.

In Brazil, after the first year of introducing speed cameras, there was a reduction of 8.6% in crash fatalities. In second and third years, further reductions of 17.6 and 25.7% were recorded respectively (WHO, 2008).

Increasing penalties for speeding has also been used as a method for reducing the number of speeding drivers and therefore the number of speed-related crashes. In Australia, the Western Australia State Government introduced a trial period in which driver demerit points for offences relating to speeding, among other driving offences, were doubled during specific holiday periods. The results showed that total crashes where speed was a factor were down 40% during double demerit periods and that fatal crashes were reduced by 52% and injury crashes by 43%.

In addition, the effects of training speed offenders have also been evaluated in a study by IPSOS Mori (2018). The National Speed Awareness Course is a short retraining course offered by most police forces in England and Wales as an alternative to penalties for low-level speeding offences. It was found that participation in the course was more effective at reducing speed reoffending than a fine and penalty points (23% less likely to be detected reoffending after six months compared to drivers who accepted the fine/penalty points). The effects on injury accident rates was not as clear due to small numbers of accidents in the samples, but it was expected that if speed reoffending rates are reduced, then this would also have a positive effect on injury accident rates.

It should be noted that speeding behaviour can be reduced by implementing interventions that are associated with other pillars. For example, within the pillar 'safer roads and mobility', infrastructure changes such as speed bumps can reduce speeds in particular locations. Experience has shown that to efficiently tackle speeding these cross-pillar links are critical, leading to speed management schemes, which are discussed further in chapter 9 (section 9.3).

7.1.6 Education and Licencing

Table 7-7 shows the summary of the type of studies identified which looked at interventions which included some type of road safety education in general, aiming to improve driver/rider behaviour and reduce risky driving. This could also include learner driver training, licencing and drivers' working hours.

Table 7-7 Road safety education and licencing

Type of intervention	Number of studies		Source countries
	Africa	Rest of world	
Laws	0	4	Benin, Botswana, Côte d'Ivoire, Ghana, Malawi, Mozambique, Namibia, Senegal, Tanzania, Zambia, Burkina Faso, Cameroon, Congo, Gambia, Guinea, South Africa
Penalties	0	0	
Enforcement	1	2	
Publicity	8	3	
Education	5	4	
Training	0	1	Norway, Latvia, Sweden, Denmark, UK, USA, New Zealand, Australia
Total	12*	11*	

*Some sources look at more than one 'area', so the numbers will overlap

In 2017, the SARSAI ('School Area Road Safety Assessment and Improvements') programme was launched in ten countries across Africa. As part of this, 30 high risk school areas took part in the programme's works, which included initial safety assessments, improvements to infrastructure, introduction of safety engineering methods and monitoring and evaluation, but also community and school road safety education. According to an article by Poswayo *et al* (2018), the SARSAI programme in Tanzania had reduced accident injury rates in children by 26% one year since implementation and reduced the severity of the injuries that occurred. However, it is not clear from the available results how much this reduction could be attributed to the road engineering measures and how much is attributable to the road safety education. This is partially due to both types of measures having been carried out jointly, gathering synergies from each other, as discussed in section 9.

Some campaigns in Africa enlisted the support of people in the public eye, to promote road safety campaigns. For example, in Senegal, the national football team supported the Decade of Action for Road Safety by being photographed wearing the campaign's symbol during the African Cup of Nations in 2012, and this was featured across the nation's media to help raise road safety awareness. However, no effects of the impact of using public figures in road safety campaigns such as this has been published as of yet.

A road safety awareness programme was launched in the Gambia in 2014 funded by the British Embassy alongside the Staff Association of the National Roads Authority (SANRA). The main aims were to develop a greater awareness of road safety through introducing road safety education in schools from early on and improve awareness in other road users through campaigns, as well as funding crossing points and road safety signs at major junctions. No impact effects have yet been published for this programme.

Another way that campaigns have been used to help improve road safety awareness in road users is through campaigns undertaken by Non-Governmental Organisations (NGOs). For example, Shell South Africa set up and run the 'Shell Safe and Sound' campaign for road user awareness, among other safety issues (e.g. online safety, personal security, safety at home or work). It is an online resource for adults and children to learn more about safety on the road. For children, there are road safety-related online games and downloadable comics containing more games and activities to improve road safety awareness.

Inviting drivers and other road users along to road safety education programmes can be another way of increasing awareness of road safety issues. In Botswana in 2016, two companies, Atlas Copco and Scania Botswana, ran a two-day programme in co-operation with UNITRANS, the Department of Road Transportation and Safety, Botswana Police and the Ministry of Health, on 'Fatigue Management and Road Safety'. It was mainly aimed at bus and truck drivers, but other members of the public could also participate. As well as increasing road safety awareness, particularly about driver fatigue, wellness tests were also provided. Over 300 people participated in the programme throughout the 2 days, but impacts on road safety have not since been reported.

In 2015 in the Zambia, the Zambia Road Safety Trust introduced a Road Safety Initiative to introduce Road Safety Education in schools and encourage reduced speeds in school zones through safer infrastructure. After 3 years of implementing the Initiative and providing education to over 70000 primary school children, the result was a 20 percent reduction in child fatalities and injuries, which at least in part was a result of introducing Road Safety Education into the schools where the safe infrastructure was implemented. There are also similar initiatives in Kenya including additional road users such as truck drivers (Schermers et al, 2018).

In addition to the twelve studies from Africa, a further eleven studies or reports were sourced from countries across the rest of the world which contained examples of road safety education interventions that have been shown to improve road safety. This included one meta-analysis reported in the EC funded SafetyCube project, where a random-effects meta-analysis examining the relationship between pedestrian safety education for children and safe pedestrian behaviour was undertaken. A total of 25 studies were included from eight countries (14 from the UK) studying children with the age range 3-11 years. Training/education was found to be associated with a significant improvement in pedestrian safety behaviour immediately following training and several months after (Schwebel et al 2014).

In some countries, changing the way that learner drivers can obtain their licence (e.g. age, stages of training) has impacted accident risk. For example, in Sweden the minimum age for learning to drive was reduced from 17.5 years to 16 years in a reform to the law implemented in September 1993, while the licensing age remained 18. This was to give learner drivers an opportunity to acquire more experience and training, through accompanied practice, before the driving test. There was found to be a 46% decrease in the accident risk for drivers following the new system compared to those following the old system (accident risk per million km) (Gregersen et al, 2000). The number of accidents in the first 2 years of solo driving also fell by 15%. Similarly in New Zealand, the introduction of the Graduated Driver Licence System (GDLS) for car drivers and motorcyclists in 1987 was found to be closely followed by a significant reduction (22%) in motorcycle traffic crash hospitalisations for the 15–19 year age group (Reeder et al, 1999). Under the GDLS, a learner licence is issued for 6 months, then after passing an on-road test, a restricted licence is issued for 18 months, after which a full licence is issued.

A campaign in Norway which combined education alongside publicity and enforcement was the 'Speak Out' campaign (SUPREME, 2007). This campaign, which began in 1993, encouraged young people who are passengers in cars to speak out if the driver is driving in an unsafe manner, and combined education in schools with enforcement (i.e. roadside checks by police). For 16 to 19 year olds, there was found to be an overall accident injury reduction of 12% by the 3rd year after the campaign was introduced.

For over 50 years, there have been publicity campaigns used in the UK to encourage safe driving and road safety, using TV, radio and newspaper adverts. Since 2000 in the UK, a long running series of campaigns have been used to highlight a multitude of road safety issues, all under the 'THINK!' branding. The 'THINK!' brand was introduced as part of the UK Government's 2000 road safety strategy, 'Tomorrow's Roads, Safer for Everyone', with the aim of reducing fatal and serious injuries by 40% by 2010. Alongside engineering and enforcement measures, the 'THINK!' campaigns contributed successfully to achieving this target by 2008 (PIARC, 2012).

In Europe, the CAST project was developed to produce guidelines to design, implement and evaluate road safety campaigns that could be used by the Member States, by the EC for its own campaigns and by other stakeholders. A manual was produced designing, implementing and evaluating road safety communication campaigns (Delhomme *et al*, 2009); guidelines for evaluating road safety campaigns were issued as well, with a practical tool (Boulanger *et al*, 2009).

7.2 Selected interventions for detailed description

There is an extensive body of scientific literature and other types of description of implemented road safety interventions focussed on improving road users' behaviour and drivers' proficiency, in Africa, Europe and other parts of the World. The examples below were selected with a focus on expected outcomes within the African Road Safety Action plan: use of helmets; use of seatbelts; driving under the influence of alcohol and other drugs; use of mobile phone while driving; speeding; general public education on roadway use.

Particular emphasis was given to practices in the following main areas of engagement: implementing or ameliorating laws (e.g. banning hand held mobile phone use and reducing drink driving limits); introducing or changing existing penalties (e.g. fines, bans and demerits points on driving); introducing or increasing enforcement (e.g. patrols, breathalysers, alcohol meters and speed cameras); education campaigns (e.g. through use of television adverts and newspapers adds); educating road users (e.g. in schools, workplaces...); and training (e.g. pre-licence training and awareness courses for repeated offenders).

In this section, the following six interventions are described in detail:

- The effect of introducing Vietnam's first mandatory law on helmet use and head injury and fatality rates
- Tunisia: enforcement of the law related to mandatory seatbelt use within the front seats in urban areas

- Impact Evaluation of the National Speed Awareness Course (UK)
- Effects of reducing BAC limits and increasing penalties on drink-driving - Short-term impact of changes in drinking-and-driving legislation in Mexico
- Driver/rider licencing: The effect of the New Zealand graduated driver licensing system on motorcycle traffic crash hospitalisations
- The 'Speak Out' Publicity Campaign (Norway)

Key characteristics of those six interventions are also described in Appendix 5, with the characteristics of the nine road safety interventions listed below:

- Seatbelt legislation in Costa Rica; communication campaign "*Por amor*";
- Introduction of mandatory helmet use in Colombia: helmet-law training;
- Mandatory helmet in Italy: effect of law change in brain injuries;
- Helmet use in Kenya; campaign "No helmet-no ride";
- Seatbelt law enforcement in the EU;
- Communication campaign on drug driving in the UK;
- Toughening mobile phone penalties in the UK;
- Implementation of Deputy Safety Volunteers in Burkina Faso;
- Communication campaign "Zuska" in Kenya.

7.2.1 The effect of introducing Vietnam's first mandatory law on helmet use and head injury and fatality rates

This was a study reported in the WHO report 'Powered two- and three-wheeler safety: a road safety manual for decision-makers and practitioners' (2017) and by Passmore *et al* (2010) and Nguyen *et al*, (2013) which evaluated the impact of a mandatory law in Vietnam on motorcycle helmet use and helmet wearing rates and head injury/fatality rates.

In 2009, 27 million vehicles were registered in Vietnam, of which 95% were powered two-wheelers. In 2008, there were 11243 reported deaths and 7771 serious injuries on the roads in Vietnam, 60% of the fatalities were motorcycle riders and passengers.

Since 1997, Vietnam has had partial motorcycle helmet legislation, but implementation and enforcement was limited and fines very small. Therefore, in 2007, Vietnam introduced its first comprehensive mandatory helmet law, which included stricter patrolling and penalties. The new helmet law required ALL riders and passengers to wear helmets on ALL roads without exceptions, as opposed to earlier laws. Subsequent loopholes identified in the law (e.g. the correct and secure fastening of helmets, mandatory helmet wearing for children over 6 years old and making adults transporting children legally responsible for their helmet wearing) were subsequently resolved in 2009, by introducing penalties for these infringements.

The mandatory helmet law was introduced by the National Traffic Safety Committee on behalf of the Vietnamese Government. This is a multidisciplinary council introduced in 1997 made up of representatives from 15 ministries and agencies (e.g. transport, police, health, education) which help develop and implement national road safety programmes. What also strengthened this new law was that the NTSC established partnerships with NGOs, private companies and other agencies to help achieve national road safety objectives and it also had support from the country's prime minister, who issued the legislation.

In order to further the success of the implementation of the law, penalties for non-use or misuse of helmets (e.g. not fastened) were significantly increased from 20000-40000 Vietnam Dong (€0.75-1.50[3]) prior to the 2007 law to 100000 – 200000 Dong (€3.76-7.52) after. Police were given further powers to enforce the law and issue the penalties. Finally, three months prior to implementation of the law, the government used the civil service as role models, requiring that all government employees (over 4 million) wear helmets before the law came into effect, and over 50000 helmets were distributed to low income families nationwide. All of this was undertaken alongside intensive public education of the new law and penalties and social marketing to ensure all were aware prior to implementation.

To determine the effectiveness of the new law, a roadside observational study was undertaken in three regions in Vietnam to monitor helmet use among riders and their passengers, before and after the law took effect (i.e. 1 month before the law was introduced in Nov 2007 and then periodically up to just over 4 years after implementation in February 2011) (Nguyen et al, 2013). In the 6 months after the law was introduced, helmet wearing in the *Da Nang* region for riders increased from 27% (November 2007) to 99% (June 2008), while helmet wearing increased from 21% to 99% in passengers ($P<0.001$). Helmet wearing also increased in the two other regions (*Yen Bai* and *Binh Duong*), although the increases were slightly less but still significant (up to 89% - 95%). Over the remaining study periods up to 2011, these high wearing rates were generally maintained.

In addition to monitoring helmet wearing, data on all road traffic injury patients with head injuries admitted to 20 provincial and central hospitals (out of 100) 3 months before and after the new law came into effect on 15 December 2007 were collected and indicated that the risk of head injuries decreased by 16% and the risk of death by 18% (both statistically significant). And one year after the legislation took effect, national police data reported 1557 lives saved and 2495 serious injuries prevented compared to the same time in 2007 (Passmore et al, 2010).

It is thought that when wearing rates did go down in certain regions over the four year observation period, it was most likely to be a result of reduced enforcement in that area, so it is clear the enforcement of the law and issuing of fines by police is imperative to the success of introducing a law like this. Another barrier to reducing serious injuries in crashes involving motorcyclists is the correct wearing of helmets and the quality of the helmet worn. A survey conducted soon after the law was introduced found that up to 80% of motorcycle helmets on the market did not meet national standards, so laws were introduced soon after to ensure substandard products were less able to be sold, and the helmet law introduced in 2007 was further enhanced in 2008 to include non-fastening as being the same as non-wearing.

In summary, the main factors contributing to the effectiveness of the helmet wearing law in Vietnam were as follows:

1. stricter penalties for non-use (fines 10 times greater than previous);
2. advanced public education and social marketing;
3. the government used the civil service as role models, requiring that all employees wear helmets three months before the law came into effect;
4. stringent enforcement from day one of the law being introduced;

[3] The average monthly wage is €120; wide wage variations exist in the country.

5. all roads were included in the law reducing potential for confusion;
6. 'affordable, high-quality, climatically appropriate helmets were readily available to the population';
7. Political support - the Prime Minister issued the legislation ;
8. 50000 helmets were distributed to low income families prior to implementation.

7.2.2 Tunisia: enforcement of the law related to mandatory seatbelt use within the front seats in urban areas

This campaign from Tunisia, known as "*Attachez Vous à la Vie…Attachez Votre Ceinture*" or "Attach to life…Fasten your Seatbelt", involved the enforcement of a mandatory seatbelt law which had not previously been enforced in urban areas.

The scope of the road safety problem in Tunisia is large, as it is the country in North Africa most affected by road deaths after Libya, with 2679 road deaths in 2013, which equates to 24.4 killed per 100,000 inhabitants (WHO, 2015).

There has been a law in Tunisia since 1986 which required vehicle occupants to wear seatbelts on highways and rural areas. And in 2002, all drivers and front seat passengers were required to wear seatbelts on all roads (including urban areas), but this law was never enforced (roadsafetyngos.org [4]), including fines not being systematically issued and when they were, they were only around 40 Tunisian Dinar (approximately 16 Euros)[5]. Also, public opinion of wearing seatbelts in urban areas was that they were not necessary as driving in urban areas was seen as low risk on low speed, congested roads (www.lecourrierdelatlas.com [4]).

The introduction of a new mandatory law was championed by a road safety campaigner who had experienced a bereavement of a close family member by a speeding driver and had subsequently founded the Association of Road Safety Ambassadors (ASR, also known as '*Les Ambassadeurs de la Sécurité Routière*'), a Non-Governmental Organisation, which focusses on improving the road safety areas of seat belt laws, speed reduction and road safety education in Tunisia, by involving and empowering road users.

With the drive of the ASR and the eventual support from the Tunisian government, the new law began to be enforced in April 2017 for drivers and front seat passengers in the Tunis area, and along with publicity campaigns, traffic control checkpoints were set up to monitor compliance with the law. The effects of the law change were studied by using accident rates up to one year before and one year after the law was introduced (2016 - 2018).

Although increased seatbelt use will not reduce the actual number of accidents occurring, seatbelts are effective into reducing the number of vehicle occupants being seriously injured or killed (Andersson, 2017), therefore reducing the cost to society of medical emergencies, rehabilitation and lost working hours related to serious injuries in collisions.

In terms of fatalities, there was found to be a reduction of 8.81% in the first year of the mandatory law introduction (2017-2018). When compared with 2016 figures, the reduction was found to be

[4] http://roadsafetyngos.org/sh_team/afef-ben-ghenia-les-ambassadeurs-de-la-securite-routiere-tunisia/
[5] https://www.lecourrierdelatlas.com/tunisie-le-port-de-la-ceinture-de-securite-bientot-obligatoire-en-tunisie--7009

35%, and when compared with 2013, a reduction of 44%. When considering serious injuries, there was found to be a reduction of 9.45% in the first year.

In addition, when undertaking monitoring at traffic control checkpoints in urban areas, drivers and front seat passengers were observed wearing a seatbelt in 89% of cars. It should be noted that as observations were not made during free flowing traffic, this figure may be artificially high as drivers may put on their seatbelt when entering a check point.

The main reasons for the success of this campaign were considered to be:

1. Strong support from NGOs such as the ARS, plus other private and public sectors;
2. Governmental support to implement and enforce the law;
3. Increased enforcement of the law;
4. Use of publicity (e.g. social media, news media) to improve public awareness of seatbelt use in urban areas and the impending new law;
5. Use of traffic control checkpoints to monitor compliance once the law was introduced.

The sustainability of the effects of the law on seatbelt use is considered to be high as the intervention is continuous so that seatbelts are also mandatory in the back seats in urban areas and more road users are involved and reinforce the campaign's actions. Also the government has become more responsive to the campaign's messages and requests to carry on reinforcing the campaign.

7.2.3 Impact Evaluation of the National Speed Awareness Course (UK)

In the UK, the percentages of vehicles exceeding the speed limit in free flow conditions have declined slightly for most vehicle types since 2011 (DfT, 2017). Although in 2016, the percentage of cars found exceeding the speed limit on motorways (based on survey results) was found to be 46%, for high speed single carriageways it was 8%, for 30 mph roads it was 53% and for 20 mph roads it was 81% (Ipsos MORI, 2018). So for most road types, the proportion of speeding vehicles is still high.

In 2015, exceeding the speed limit was reported as a contributory factor in 4.9% (5,272) of reported injury accidents in the UK, and this number has remained stable since 2011. For fatal accidents alone, the rate was 15% in 2015, which was a 12.8% increase since 2011 (Ipsos MORI, 2018). So accidents involving speed remains a substantial problem in the UK.

The National Speed Awareness Course (NSAC) is a short retraining course offered by most police forces in England and Wales as an alternative to penalties for low-level speeding offences. A study commissioned by the UK Department for Transport and carried out by Ipsos MORI and the Institute for Transport Studies at the University of Leeds (Ipsos MORI, 2018) was undertaken to evaluate the impact on speed reoffending rates and accident rates of participating on the course compared with accepting the penalties of obtaining points on the driving licence and/or fines.

The reason for police forces introducing courses such as these originated from when there was an increase in fixed speed cameras on the UK roads in the 1990', which led to any increase in the number of motorists being prosecuted for speeding. This resulted in increased public dissatisfaction of the number of motorists being prosecuted driving close the speed limit, so the introduction of driver retraining schemes as an alternative to penalties was seen as an attempt to curb this increasing dissatisfaction.

Individual police forces started to introduce their own diverse speed awareness courses and in 2007, these courses were brought together to form the NSAC. At the time (Ipsos MORI, 2018) was published, 41 of the 43 police forces in England and Wales offered the NSAC to first time speeding offenders.

There are two main objectives of the NSAC. Firstly, it aims to encourage compliance with speed limits by providing drivers with a better understanding of the benefits of complying with speed limits and the consequences of not doing so, and secondly, to maintain the public acceptance of the speed limit enforcement regime, including the use of speed cameras and increased levels of enforcement of the limits by offering these courses as an alternative to fixed penalties and points.

In the majority of situations, first time speeding offenders will be offered a place on the course as an alternative to penalty points and/or fines, as long as their speed was no more than 10% plus 9 mph above the speed limit. Above this, the driver will not be given a choice and will be summoned to court to face receiving penalty points, a fine and possibly even a disqualification from driving if the speed was significantly high or a large amount of penalty points have been accumulated. Drivers who have already been on the course within the past 3 years will also not be offered the course as an alternative to points and/or a fine. In addition, a course may not be offered if the location of the speeding was in a particularly dangerous location (e.g. outside a school). The driver will have to pay for the course, which is approximately the same as a speeding fine (currently £100), but as the course is not a seen as a conviction, unlike a fine and penalty points, it will not be recorded as a conviction on the driver's licence.

The course is undertaken within one day, normally about four hours, and is designed to address all aspects of a driver's perceptions and thoughts about their speeding behaviour, their motives, views on risk and the consequences of their speeding. It is hoped that drivers on a NSAC will come out of the course with a better understanding of the risks associated with speeding and a better awareness of their own driving behaviour, which will lead to less speeding on the roads and therefore less speed-related crashes.

When evaluating the impact of the NSAC, it was found that participating in the course was more effective at reducing speed reoffending than a fine and penalty points. Overall, between 2012 and 2017, 13.4% of those who participated on the course were detected reoffending, compared with 15.5% of those who did not accept the course and accepted the fine and penalty points instead. When looking at the length of time after the initial course offer was made (i.e. 6 months, 12 months, 18 months…), reoffending rates were also found to generally be greater for those who didn't accept the course (from 5% 6 months after to 21% 36 months after for those who accepted the course compared with 7% to 23% for those who did not). More experienced drivers were found to more likely decline the course offer, as were those with previous motoring convictions. So although the course does appear to successfully keep speed reoffending rates down more than fines and penalty points do, it does appear that for some members of the driving population, particularly those who have previous driving convictions, the course is not seen as being a better option compared with penalties.

An evaluation of the impacts of the course on accident rates compared with accepting penalties was also undertaken, but the results were not as clear and not statistically significant partly due to the small number of accidents in the samples. For example, 216 of the course participants (1.48%) were involved in a collision at some point after the course, compared with 33 of those who did not accept a place on the course (1.72%).

In terms of cost savings associated with reduced collisions due to NSAC participation, these have been estimated at between £56.66 and £91.33 per participant between 3 and 10 years after attending the course, although the calculation of these numbers have been based on a number of assumptions of unreported injury and minor collisions.

In conclusion, the main factors contributing to the success of the UK's NSAC are:

1. Strong support from national government to implement the course nation-wide across the majority of police forces in England and Wales;
2. Public awareness and acceptability of the course as an alternative to penalty points and fines, as penalty points in particular can affect insurance policies greater than going on a NASC and some drivers ability to drive for work;
3. The course content is not looked on as a punishment, but as a way to educate and inform the majority of drivers who have been caught speeding just above the limits to enable them to voluntarily change their driving habits by providing them with the awareness and understanding of the importance of adhering to speed limits.

7.2.4 Effects of reducing BAC limits and increasing penalties on drink-driving - Short-term impact of changes in drinking-and-driving legislation in Mexico

In Mexico in 2011, the mortality rate was 14 deaths per 100,000 inhabitants for road traffic accidents, which is thought to most likely be to be an underestimation (up to 30%) due to issues in the recording of road traffic deaths in the country (Gómez-García et al, 2014b). One of the many risk factors involved in these accidents is the consumption of alcohol. Legislation on levels of alcohol consumption and driving is generally established at a local level and in most areas, the permitted Blood Alcohol Concentration (BAC) level has been 0.08 g/dL (Gómez-García et al, 2014b).

Between 1999 and 2011, approximately 10% of drivers responsible for crashes on urban and suburban roads were found to have consumed alcohol. Another study reported that 20% of drivers who underwent an alcohol test were found to be positive for alcohol, with 3% being above the allowed limits (Gómez-García et al, 2014b).

In response the State of Jalisco, Mexico, amended its drink driving legislation, in 2010, by lowering the BAC level from 0.15 g/dL to 0.05 g/dL, in line with international best practice, and also introduced tougher penalties for not abiding by the amended law (WHO, 2017b). It was known as the 'Lifeguard Law' ('*Le Salvavidas*'). Before the law was introduced, the penalty for being caught driving above the permitted BAC level was a fine of 30 days minimum wage (approximately 133 dollars) and after the amended law, the fine was increased to 150 to 200 days minimum wage (approximately 663-884 dollars) for BAC up to 0.08 and even stricter penalties beyond this level (i.e. removal of vehicle and then at the highest BAC levels, both the vehicle and driver 'are placed at the disposal of the authorities').

To evaluate the effect of the amended law, a number of data sources were used which contained information from databases about mortality, hospital discharges and traffic collisions for the period from 1999 to 2011. After the law was amended in 2010, a statistically significant reduction in the deaths associated with alcohol was found into 2011 (5.7%, $p = 0.018$). A significant reduction was also found in the monthly trend of collisions after the law was amended. However, up until December 2011, no changes in hospital mortality were found and discharge rates were also similar to those before the introduction of the amended law.

The main reasons that the amended law did not impact fatality rates as much as was first hoped was a lack of enforcement of the amended law (e.g. random breath-test checks) and limited publicity of the new amended law (e.g. through advertising campaigns). Therefore in August 2013, the 'Mobility and Transportation Law of the State of Jalisco' was introduced, which although it replaced the 'Lifeguard Law', it did uphold the previously set lower BAC limits and tougher penalties, but also introduced further changes to help reduce drink driving and drink driving-related accidents. These included random alcohol checks, with a payment of a fine or 'administrative immutable arrest' from 12 to 36 hours, depending on the levels of alcohol involved. Any reoffending within 2 years would also lead to driving licence suspension. This was also accompanied with a hard-hitting social marketing campaign which highlighted the new regulation and penalties, and also made clear the risks of drunk driving (WHO, 2015). Initial results have shown that the additions to the law in 2013, plus the random checks and publicity campaigns have led to significant changes in the rates of alcohol-related deaths and accident rates in this area of Mexico (WHO, 2015 and [6]).

In summary, the initial success of this amended law can be a result of the following factors:

1. Introduction of amended law with lower drink-driving levels (in 2010);
2. Tougher penalties for drunk-driving (in 2010 and 2013);
3. Enforcement through random police checks (2013);
4. A 'hard-hitting' publicity campaign (2013).

7.2.5 Driver/rider licencing: The effect of the New Zealand graduated driver licensing system on motorcycle traffic crash hospitalisations

The aim of a Graduated Driver Licencing System is to allow new drivers to build up their level of driving experience and skills gradually, in low risk situations. To enable this, they are normally made up of a number of well-defined structured stages.

In New Zealand, a comprehensive Graduated Driver Licencing System (GDLS) was introduced in 1987 for all car drivers and motorcycle riders (Reeder et al, 1999). The main difference between car and motorcycle riders is that the GDLS system for car drivers is aimed at the 15 – 24 year age group, whereas the GDLS is aimed at all new motorcycle riders, regardless of their age.

At the time the GDLS was introduced in New Zealand, 20% of fatalities and 25% of hospital admissions were found to be motorcycle riders, although motorcycles only represented 5% of all licenced vehicles and 1.4% of total distances driven on New Zealand's roads (Reeder et al, 1999).

There are three main stages to New Zealand's GDLS for motorcyclists. These are a (i) learner licence, (ii) restricted licence and (iii) full licence:

i. A learner licence will be issued to a rider when an eyesight test has been passed, a theory test taken, road code knowledge displayed and motorcycle handling skills in an off-road environment have been demonstrated. When the licence is issued, the rider will be restricted to an engine of no more than 250cc, speeds of up to 70km/h, and must have their licence with them at all times and display an L-plate. They must not carry pillion passengers, must adhere to stricter drink driving maximum levels (30mg rather than 80mg/100ml blood) and have a curfew imposed on them between 22:00 and 05:00 hrs. The learner licence

[6] https://www.informador.mx/Jalisco/Rechazan-fracaso-de-ley-salvavidas-ha-contenido-el-numero-de-muertes-dice-Semov-20131022-0188.html

normally has to be held for at least 6 months and after this time, a practical on-road test must be passed to obtain a restricted licence.

ii. When a restricted licence is issued after a minimum of 6 months learning and the on-road test is passed, similar restrictions to the learner licence still apply, but speed limits are less restricted and passengers can be carried in a sidecar.

iii. After a minimum of 18 months, a full licence can be issued without the need for further testing. These minimum times can be reduced if the rider agrees to attend further training.

To evaluate the effect of introducing a GDLS on road safety, the number of motorcycle riders and pillion passengers injured in motorcycle crashes were sourced from data in the New Zealand Health Information Services (NZHIS) between 1978 and 1994. This study focussed on non-fatal data. The data was split between three ages groups of riders: (i) 15-19 years, (ii) 20-24 years and (iii) 25 years and older. When the GDLS was introduced in 1987, this coincided with a significant 22% reduction in the amount of motorcycle rider hospital admissions in the 15-19 age group. There were no significant results for the other two age group ranges, but there was a non-significant reduction from 1987 in the 20-24 age group. These were thought to be a result of the GDLS, particularly due to a reduction in exposure to high-risk situations, but also linked to a reduction in the falling number of motorcycle licence holders and motorcycle vehicle registrations, also over these years. However, this reduction may also be another effect of the introduction of the GDLS. When looking at car drivers, Baughan and Simpson also found a reduction in injury accident numbers in the 15-19 year age group (23% reduction) and the 20-24 year age group (12%).

In summary, the success of the GDLS, including its contribution to reducing the number of injured motorcyclists being hospitalised, particularly in the 15-19 year age range, is likely to be a result of:

1. The introduction of the system being government-led and nation-wide, and being a legal requirement for all new motorcyclists (and drivers) to have to go through the GDLS process;
2. The least experienced riders not being exposed to high risk situations (and their passengers) until the riders have more riding experience and have proven their knowledge and awareness through theoretical and practical testing;
3. A reduced number of riders in the 15-19 age group being licenced.

7.2.6 The 'Speak Out' Publicity Campaign (Norway)

The 'Speak Out' campaign was a campaign in Norway which combined education alongside publicity and enforcement (SUPREME, 2007; Amundsen *et al*, 1999). This campaign, which began in 1993 and introduced by the Norwegian government Public Roads Administration (NPRA), encouraged young people who are passengers in cars to speak out if the driver is driving in an unsafe manner, and combined education in schools with enforcement (i.e. roadside checks by police). In terms of the scope of the problem, 16-19 year olds make up approximately 21% of killed or seriously injured car passengers in Norway and 7% of all killed car drivers and passengers put together (SUPREME, 2007). Accidents at weekends were found more likely to be serious than during the week.

For this reason, the campaign's primary target group was young people between 16 and 19 years who were travelling as passengers in cars, especially on weekends and at night. The aim is to encourage these passengers to tell the driver of the car they are a passenger in to drive more carefully and responsibly if they are not driving safely. And the type of unsafe driving it is aimed towards is, for example, drink driving, drug driving or driving too fast.

It aims to spread the positive message amongst these young passengers that it's ok to 'speak out' against any group pressure that may discourage safer driving and increase the risk of serious accidents and injuries, and therefore eventually make responsible driving the social norm.

The information and campaign message was disseminated through school visits and information posts and through information films and merchandise such as t-shirts. Alongside this educational publicity campaign, enforcement of non-compliance of safe driving was also undertaken through controls at visible control posts by police officers in uniform, with the aim of sanctioning those who are unlikely to be influenced by this campaign.

The effects of the campaign were that, three years after the campaign was introduced in the region of *Sogn og Fjordane*, an overall reduction in injuries and fatalities of 12% in the 16-19 year age group was found. When looking at car passengers only, the reduction was 36% by the third year (see Figure 7-1).

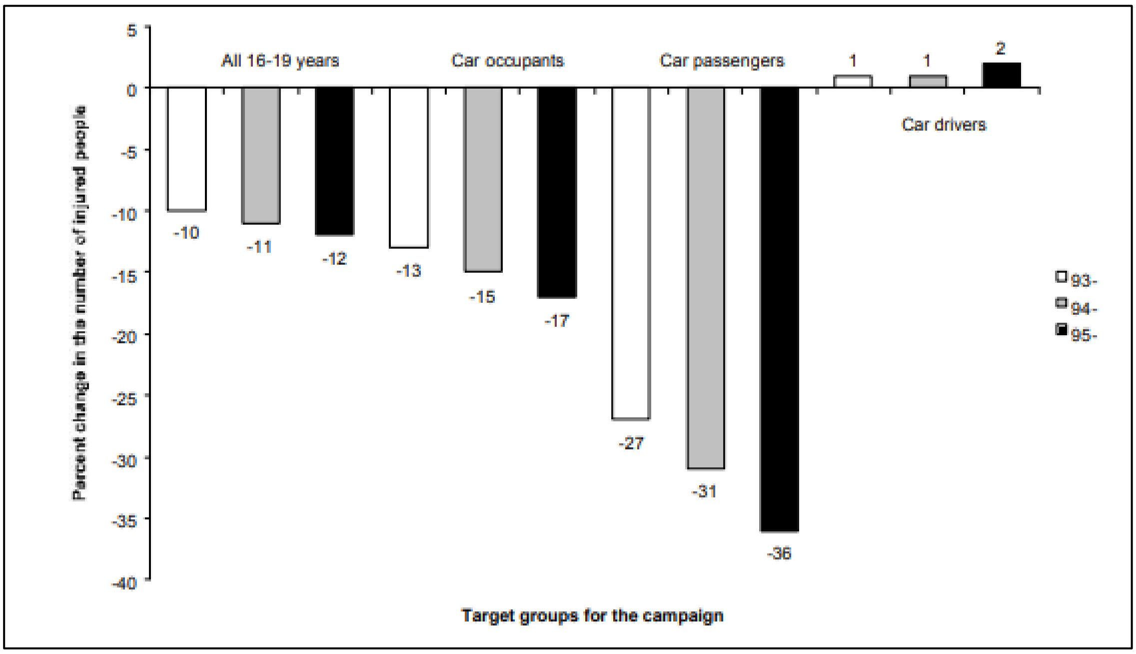

Figure 7-1 Estimated effects of the 'Speak Out!' campaign on the number of killed or injury 16-19 year old – reproduced from Amundsen et al (1999)

In a questionnaire survey undertaken in another Norwegian region (Telemark), about 50% of the respondents felt they were more aware of the risks associated with being a car passenger after being exposed to the Speak Out campaign information and many believed they would address risky driving more often and may even find alternative means of transport (Supreme, 2010).

A cost-benefit ratio for this campaign was calculated by Amundsen *et al* (1999) and was found to range from 1.9 (including development costs and taking the lower limit of the confidence interval for the safety effect) to 16.8 (excluding the development costs and taking the best estimate of the effect). And between 1993 and 1998, it is thought the campaign has prevented 30 fatalities or injuries in the 16-19 age range, which equates to approximately 33.6million NOK (3.5 million euros), compared to the approximate cost of the campaign of 2 million NOK (€206 000).

Similar versions of this campaign has been taken up by other countries in more recent years (e.g. UK[7] and Australia[8]), showing that the campaign's effectiveness can reach far beyond its origins in Norway.

In summary, the effectiveness of the 'Speak Out' campaign can be attributed to the following:

1. Support from the government and the campaign being led by a government department;
2. Intensive publicity and education aimed at 16-19 year olds in locations such as schools, plus distribution of t-shirts and campaign video to reinforce message that it's ok for passenger to Speak Out if they feel the driver's driving is unsafe;
3. Targeting passengers in the 16-19 year age range, who will have most influence over the actions of drivers of a similar age, plus who will be most affected by unsafe driving in terms of injury severity;
4. Using enforcement concurrently with the campaign, in the form of police controls stopping those who are unlikely to be affected by the campaign and not heed their passengers' advice.

7.2.7 Summary

In general interventions aimed at altering road user behaviour are most effective when they combine campaigns and enforcement, particularly when a new law is introduced. For seatbelt use, increased enforcement and campaigns have been successful both in Africa and Europe. For drink and drug driving, campaigns were found to be effective in Europe and for drink driving this was coupled with increased sanctions. For speeding, most studies looked at enforcement with fixed speed cameras and increased demerit point found to be effective in reducing accidents. Mobile phone use interventions are much less well studied with a couple of studies finding that law change reduced the use of hand-held mobile phones and one study finding a reduction in accidents. Education and licensing is a very broad area. Education in combination with interventions with other type of intervention such as infrastructure changes was found to be effective, as was the introduction of graduated driving licences. Campaigns need to be specifically tailored to their intended audience and are most effective when combined with other interventions.

[7] http://roadsafetygb.org.uk/news/campaign-encourages-young-people-to-speak-out-about-unsafe-driving/

[8] http://roadsafety.transport.nsw.gov.au/campaigns/dont_rush/index.html

8 Post-crash response

8.1 Overview

Victims of a road accident need support at several levels: emergency care, collision investigation, legal support, and sometimes treatment, rehabilitation and reintegration. Proper post-crash response should address all those needs, even though injury treatment and mental health care are the major and most pressing concerns (WHO, 2009).

At the scene of the accident, first response systems are needed for activating emergency aid, ensuring proper extraction from vehicles, guaranteeing adequate prehospital care and providing swift transport to trauma care centres or at least emergency treatment facilities. In some cases, special acute stress coaching may be desirable at the scene of a crash.

In some countries, mobile emergency medical services (EMS) are provided during transport. The prompt emergency response to crashes occurrence is essential to saving lives (Sasser et al, 2005; and WHO, 2009).

At treatment facilities, the application of proper triage, screening and resuscitation protocols is required, prior to hospital treatment procedures and care. Ideally, trauma counselling and support groups are desirable, especially in serious crashes, namely those involving public transport vehicles.

Treated victims need follow-up rehabilitation interventions, in order to regain normal functions and resume routine daily activities, which may involve Physiotherapy (diagnose and treatment of movement dysfunctions or injuries to tissues and structures) and Occupational Therapy (assessment and intervention to develop, recover, or maintain the meaningful activities or occupations of victims). Ultimately, permanent disabilities may be the result of crashes, in which case disabled victims need re-integration support, to manage those disabilities and attempt workplace reintegration. Treatment of post-traumatic stress disorder (PTSD) and other disabling conditions may require further mental health care.

According to Mock *et al* (2003), a comparative study on trauma mortality patterns in cities in a high-income country (Seattle, USA), a middle income country (Monterrey, Mexico) and a low-income country (Kumasi, Ghana) showed that the differences in mortality in the three cities can be attributed primarily to differences in the percent of prehospital deaths.

To these authors, improvements in trauma system organisation (involving planning for EMS, prehospital triage, transfer criteria, and transfer arrangements between hospitals) have been documented to result in 15–20% reduction in mortality. Following a review of Medline studies, they identified weak issues for both pre-hospital and hospital based care that need to be addressed: human resources (staffing and training); physical resources (infrastructure, equipment and supplies); and administration and organisation.

Trauma systems deal with understanding, preventing, and treating injuries; and they support not only crash victims but all types of diseases and health problems, making it difficult to specifically study the interactions with the transport system. For instance, emergency medical services may be required at the scene of both an accident and a criminal activity, as well as be requested to support citizens struck by sudden illnesses such as heart attacks. Addressing trauma system shortcomings impacting on road safety is usually done within the context of a health policy rather than in a road safety strategy.

Since prompt emergency response to crash occurrence is essential to save lives, several studies dealing with emergency and trauma care focus on crash notification time and on the emergency medical services (EMS) response time. In several African countries emergency response to accident injuries are faced with specific sets of logistic problems, due to low density of hospitals, long distances to accident scenes, and other land use aspects. Often response is too slow and victims wait too long before help arrives and they are transferred to a proper medical service centre. Furthermore, in many African countries hospital admission policies are another factor hindering quick assistance to injured victims, as patients, including trauma victims, are not admitted or receive just rudimentary first aid, unless there is proof of insurance or an ability to pay the hospital costs. Also availability of beds across hospitals and trauma specialization are not well co-ordinated, which may result in extra delays or in patients being moved from hospital to hospital.

Soro and Wayoro (2017) mention that most of the road traffic deaths in Sub-Saharan Africa occur in the pre-hospital phase and that more than half of the African countries do not possess formal pre-hospital care system. These authors assessed the potential impact of post-crash care on road mortality in 23 Sub-Saharan African countries, using a panel Bayesian normal linear regression with normally distributed non-informative priors fitted to a data set covering the time period 2001–2010.

The Gross Domestic Product per capita and the populations in the age range 15–64 years are related to higher fatality rates; increasing lengths of the road network and the population life expectancies are linked to lower fatality rates.

Concerning trauma system indicators, the results suggest that the road mortality rate (number of deaths per 100,000 habitants) is:

- negatively correlated with the:
  - estimated share of seriously injured transported by ambulance,
  - existence of an emergency access telephone service,
  - emergency training for doctors;
- positively related with the:
  - emergency training for nurses.

This last finding is unexpected. However, Soro and Wayoro (2017) mention two possible explanations: usually, in Sub Saharan Africa, less attention has been dedicated to improve the training of medical and nursing staff to deal with seriously injured or diseased persons; insufficient training of emergency care personnel and the inappropriate equipment in the hospitals.

The evidence from high income countries is somewhat inconclusive. There are studies revealing a positive association between the ambulance delay times and the ratio of fatal and serious injuries in road traffic accidents, with those waiting the longest at the crash scene being at greater risk of mortality. However, there are other conflicting results, which in some cases may be related to the average distance to cover and to differences in training on safe extraction of casualties from vehicles and on the type of injuries to look for and treat at the scene of the accident.

When long term developments are taken into account, a clear picture emerges for the benefits due to improvements in post-crash care. Van Beeck *et al* (2000) cited the amelioration of trauma care as an explaining factor in the decline in road mortality in 21 industrialized countries between 1962 and 1990. In Sweden, Bjornstig (2004) estimated a decrease of 20% in the road accident fatality rate among victims who were not instantly killed.

Generally, in a World Health Organisation publication (WHO, 2017) seven key post-crash activities are listed for countries to properly take care of road accident victims:

- develop prehospital care systems;
- improve hospital trauma care systems;
- provide early rehabilitation and support to injured patients;
- encourage the establishment of appropriate road user insurance schemes that remove administrative and financial barriers to hospital entrance for accident victims;
- establish thorough investigation of serious crashes, to know main factors in the national context;
- provide encouragement and incentives for employers to hire and retain people with disabilities;
- and encourage and support research and development into improving post-crash response.

Several post-crash response related interventions were identified in the bibliographic search, as summarized in Table 8-1 and Appendix 3.

It must be noted that a functioning single emergency number presupposes that effective emergency centres are working, ensuring proper co-ordination between incidents responses, ambulances and hospitals. To this end, access to police and other services has to be ensured, was well as to plus traffic and route information.

Table 8-1 Synthesis of main evidence on post-crash response interventions

<table>
<tr><th rowspan="2">Type of intervention</th><th colspan="2">Number of studies</th><th rowspan="2">Source countries</th></tr>
<tr><th>Africa</th><th>Rest of World</th></tr>
<tr><td>Single emergency number</td><td>1</td><td>0</td><td rowspan="7">Kenya, Ghana, South Africa, Uganda, Sierra Leone plus 23 Sub-Saharan African countries

Estonia, Cambodia, Iran, Mexico, Nepal, Switzerland, Turkey plus Latin America</td></tr>
<tr><td>First aid course for drivers</td><td>1</td><td>1</td></tr>
<tr><td>Emergency First Aid Responder System (EFAR)</td><td>3</td><td>3</td></tr>
<tr><td>Transport by ambulance</td><td>23</td><td>2</td></tr>
<tr><td>Emergency medical care</td><td>2</td><td>1</td></tr>
<tr><td>Appropriate road user insurance</td><td>1</td><td>0</td></tr>
<tr><td>Total</td><td>31</td><td>7</td></tr>
</table>

8.2 Selected interventions for detailed description

As mentioned before, crash victims need support at several levels. Indeed, post-crash response involves primarily direct activity and contributions from other society's systems (e.g., health, finance, judiciary), besides those coming from the transport system. However, the most pressing needs relate to emergency medical services, which ought to ensure rapid first aid and transport to medical facilities where treatment under proper conditions and supervision may be swiftly provided. The selected interventions within this pillar address especially the emergency services needed in the first moments following a crash. Three interventions are detailed in the following sections:

- First Aid courses in driver education;
- Emergency First Aid Responder System (EFAR) by lay-persons;
- Establishment of an appropriate road user insurance scheme to finance rehabilitation services for crash victims.

The first two measures are mainly related to laying out the conditions for provision of non-professional medically conscious first aid at the accident scenes; the latter is intended to ensure that the medical staff attending an unfamiliar injured victim are spared the ethical dilemmas arising from unknowing if the victim will be able to personally afford the hospital bill.

8.2.1 First Aid courses in driver education

Several European countries (e.g. Austria, Bosnia and Herzegovina, Estonia, Germany, Hungary, Latvia, Lithuania, Slovakia, and Switzerland) require that first aid courses are included in formal driver education and training (SUPREME, 2010).

Most fatalities die in the first minutes after the crash, before the arrival of the emergency services. With these courses, drivers are habilitated to provide immediate first aid action on the spot, at an accident scene, in the first minutes after a crash occurred; drivers are also able to provide psychological support for victims and other people involved.

The courses are usually prepared by health organisations such as the Red Cross. Ideally, a first aid education system would consist of an initial training during driver instruction followed by updated first aid training sessions at regular intervals. Communication campaigns may also help remind drivers of their skills and enhance their willingness to perform early pro-active intervention at accident scenes, before authorities arrive.

8.2.2 Emergency First Aid Responder System (EFAR)

This intervention consisted in the implementation of a community-based emergency first aid responder (EFAR) system in the community of Manenberg in the Cape Town area, in South Africa (Sun and Wallis, 2012). The system was intended to complement to the existing emergency medical service (EMS) system.

This type of intervention consists of training lay-persons in basic emergency first aid skills, ensuring they are fit to manage emergency scenes and to provide basic support to accident victims, as well as victims of other violent events. Trainees may be volunteers from community members, from special interested road user groups or from especially relevant groups (e.g. drivers, taxi drivers, commercial drivers, community leaders). EFARs may volunteer to assist victims at the scene of an accident, may be called upon by bystanders during an emergency, or can be dispatched via SMS from an EFAR communications centre.

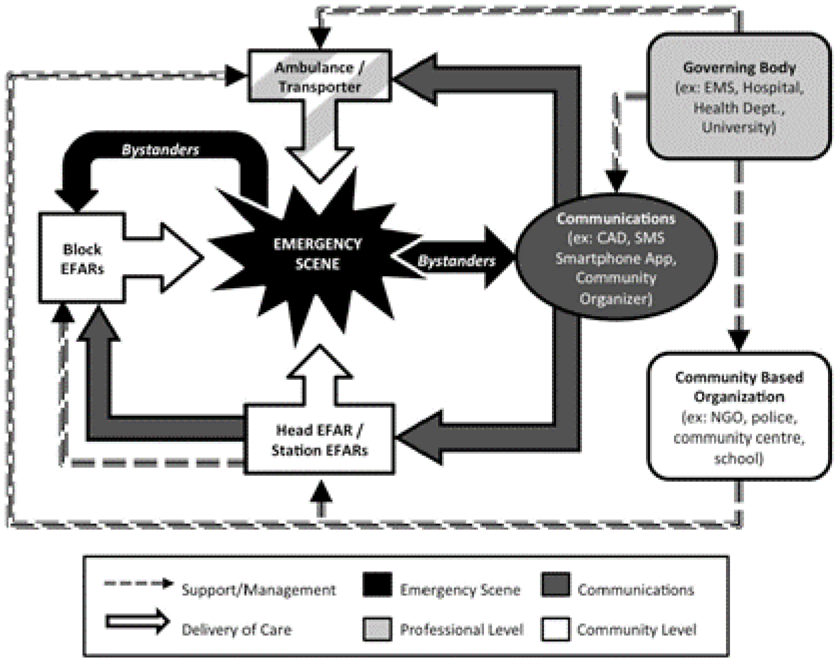

Figure 8-1 EFAR system overview and coordination with the rest of the EMS (EFAR, 2018)

The EFAR system (Figure 8-1) in Manenberg was initiated in 2011 and its implementation was cheap and easily done. Firstly, a preliminary assessment was made, of the most frequent categories of medical and traumatic emergencies in the community, and which were the most serious and fatal. Existing community-based services in Manenberg were involved in the process, such as the neighbourhood watch and those contributing to HIV/AIDS awareness campaigns. This allowed the assessment of how those community-based services are delivered, how effective they are, and how the EFAR could be efficiently reached. Following this preliminary analysis the EFAR service was structured as a two tier service, comprising a baseline, or basic foundation; and an advanced EFAR system, functioning as a community-based version of the city emergency medical service (METRO EMS) and ambulances, comprising specialised and specially equipped personnel. This advanced system was more sparsely distributed.

Basic EFAR training curriculum addresses the four major categories of need identified, and was developed to provide practical capabilities enabling trainees to manage emergency scenes, to deal with unconscious patients and to assist violent injury victims. All these issues are lectured in separate modules: emergency scene management; unconscious patients; violent injuries; and medical emergencies. The basic course lasted for one day and comprised both theoretical, PowerPoint based lectures, and practical sections. Trainees are voluntary and most are already involved in community-based services, bus/taxi drivers, police officers or community leaders.

The course was successful in transmitting to the new EFARs both practical knowledge and confidence in its application. Before training, EFARs averaged 28% in competency; immediately after training they tested positively in 78% of the cases; and four months after training they still averaged 71%. After training, EFAR applicants were more confident in volunteering for helping accident victims and in providing first-aid, prior to arrival of formal prehospital care or transport to hospital. EFARs reported using virtually every skill taught them in the course, and further review showed that they had done so adequately.

According to Sun and Wallis (2011), EFAR training can provide stress relief to the communities, increase the likeliness that community members will cooperate in an emergency, and increase their confidence while helping.

Studies have already demonstrated that first responders can be effective at reducing morbidity and mortality (e.g., Soro and Wayoro, 2017; Jayaraman, *et al.*, 2009; Wisborg, *et al.*, 2008; Tiska, *et al.*, 2004; and Razzak and Kellermann, 2002).

The main requirements for EFAR system sustainability are a stable population from which to recruit community instructors and trainees, a local community organisation to perform day-to-day administration, and an academic or official body to provide accreditation to the training.

To be most effective, the EFAR curriculum should be tailored to local community's expressed needs, and follow the NGO and government care delivery models already well established in the area, namely by liaising with a community adviser, to ensure local appropriateness and adaptation of the system to the area context.

In urbanized areas, access to ambulances which are already enroute but may be delayed by traffic congestion or access difficulties may be a major problem. Even in those cases, highly intense training may be inefficient, due to redundancy with the already existing ambulances and emergency centres.

In rural areas, ambulances are less available, accident scenes are remote (due to larger distances and poor roads) and difficult to locate (lack of physical addresses in remote areas), and emergency incidents are less frequent. In these areas, higher level (advanced) training of each individual EFAR is more important than having a big number of total EFARs.

In those regions where no official EMS is already in place, advanced EFARs may be established with the intention of integrating them into a future ambulance system (Figure 8-2).

EFAR systems are low-cost and passive, and when coordinated provide immediate emergency services in low-resource areas and can be used in a developing region both to lay the foundation for an emergency care system (as a first step) and to support an existing one and its development to maturity. Existence of a community EFAR communications centre contributes to this objective, and also allows close cooperation with local EMTs and paramedics to provide care for emergency patients.

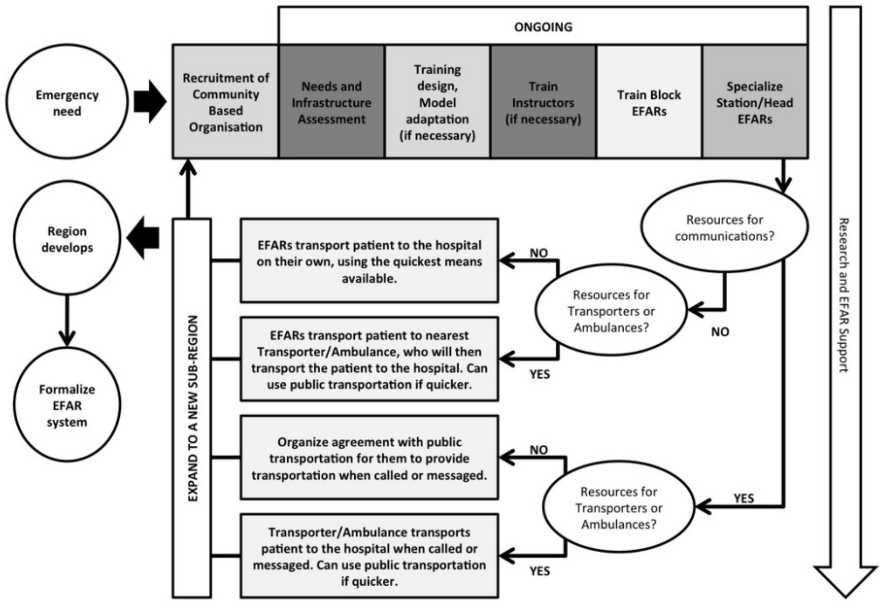

Figure 8-2 Stepwise implementation of the EFAR system (EFAR, 2018)

Further support on implementing and organising this type of system may be found in a dedicated site: http://www.efarsystem.com.

8.2.3 Establishment of appropriate road user insurance schemes to finance rehabilitation services for crash victims

The Kenya National Hospital Insurance Fund (NHIF) is a government insurance scheme established in 1966 as a department under the Ministry of Health. In 1998 NHIF was transformed to a state corporation, aiming at improving effectiveness and efficiency. NHIF's mission is to provide accessible, affordable, sustainable, equitable and quality social health insurance through optimal utilisation of resources; i.e. provide medical insurance cover to all its members and their declared dependants (spouse and children). NHIF membership is open to all Kenyans who have attained the age of 18 years and have a monthly income of more than Ksh 1000 (€8.50); registration is compulsory to those who are in the formal sector (registered workers of registered companies). Approximately 11% of the population in Kenya contributes to the Fund (NHIF, 2018).
NHIF is organised in autonomous branches across the country, each providing NHIF services including payment of benefits to hospitals or members or employers.#
Since June 2017, NHIF members are able to access emergency ambulance services following a partnership between the insurer and the Kenya Red Cross Society

8.2.4 Summary

Most road traffic deaths in Sub-Saharan Africa occur in the pre-hospital phase and the majority of African countries does not have a formal pre-hospital care system. Nevertheless, it is documented that improvements in effective emergency medical services, prehospital triage, transfer criteria, and transfer arrangements between hospitals will contribute to a significant reduction in mortality.

In several African countries the emergency response to accident injuries is faced with specific logistic problems, due to low density of hospitals, long distances to accident scenes, and other land use aspects. Often response is too slow and victims wait too long before help arrives and they are transferred to a proper medical service centre. Furthermore, in general, hospitals are not well co-ordinated, which may result in patients being moved from hospital to hospital.
The selected interventions in this pillar relate to the most pressing needs of providing swift first aid and transport to medical facilities where treatment under proper conditions and supervision may be provided. First aid courses in driver education and Emergency First Aid Responder Systems (EFAR) by lay-persons provide a low-cost system that may be coordinated with EMS, to provide immediate emergency services in low-resource areas. In a developing region they constitute a first step in the foundation for an emergency care system. EFAR systems may also support an existing EMS in its development to maturity.
Appropriate road user insurance is an intervention addressing the problems raised by restrictive hospital admission policies that prevent victims from being admitted to hospitals or force them to receive just rudimentary first aid, unless there is proof of insurance or of an ability to pay the hospital costs.

9 Crosscutting and critical issues affecting road safety intervention effectiveness

9.1 Overview

As mentioned in section 3, integrating road safety interventions in a program based on a rigorous diagnosis, addressing the whole problem, and involving a consistent set of actions on the various components of the traffic system is a key element in a successful combat of road deaths and incapacitating injuries by efficient application of resources. Execution of road safety programs is expected to be according to the principles of realism and opportunity, and to be controlled and directed on an ongoing basis. Therefore, diminishing the burden of road accident disease is best accomplished by implementation of a dedicated road safety policy, which must be adapted to the prevailing economic situation and be in line with current national political priorities and the international setting.

Due to the multidisciplinary nature of the road crash phenomenon, the implementation of road safety policies usually requires an integrated action from several institutional public and private actors, which calls for strong support from political leadership. On specific national contexts, this leadership is important, as improving safety outcomes may involve major changes in the cultural setting towards road safety in general (see Figure 9-1). In fact, in several cases, leadership is crucial and if absent no progress will be achieved; additionally, leadership has to be sustained over time, as the road safety situation improves and problems become smaller, to prevent road safety from losing its priority status.

Figure 9-1 Types of safety culture maturity of an institution or country - adapted from Machata (2016) and Hudson (1999)

Public dissatisfaction with prevailing road safety levels creates a favourable background for initiating a change process, moving from pre-contemplation or contemplation stages to more advanced stages in the process[9]. However, for actual improvements to be achieved, interventions have to be explained to the general public and road users, investments have to be made, enforcement has to be put in place and the merits of the obtained results have to be demonstrated to citizens. All these aspects are better achieved with strong backing from both political leadership and publicly recognisable champions.

Political leadership is also a key aspect to ensure that safety policies take advantage of opportunities for action raised by on-going interventions from other major policies. Synergies with urban renewal of depressed and illegal areas have proved fruitful in European countries, and integration of safety policies with health and education policies are common as well.

Implementation of cost-effective interventions (e.g. international vehicle safety standards) frequently has an initial cost which society will only recover in the long run; most of the gains so obtained are not actual income but savings in future costs. Road safety interventions have immediate and certain disadvantages (e.g. financial costs and behavioural changes) and their benefits are forthcoming and conjectural (sometimes even without an agreed causal mechanism among experts), being therefore difficult to support against competing short-term policies.

An additional issue is that most frequently the rewards from road safety interventions are not perceived as personal gains, even if they are related to both personal and society's risks. Demonstrating interventions effectiveness is a lengthy process, when final outcomes are the selected reference variable, since road accidents are rare statistical events and long periods of time are needed to gather significant numbers of events. For these reasons, it is important that major stakeholders take affirmative action and set examples to the rest of citizens; for instance, a first step for implementing international vehicle standards in a country could include mandating public institutions and facilitating passenger carriers and freight transporters to start requiring their vehicles to comply with those standards.

Disseminating knowledge on interventions expected effectiveness and explaining road safety policies is important to gain public support and acceptability and achieve the desired adherence to attitude and behavioural changes. However, additional preconditions may be needed for implementing the selected interventions, which may be related to different pillars than the one in which a specific intervention fits in.

For instance, model approved and certified speed measuring devices are required for enforcing vehicle speed limits. This means that legislation for model type approval exists, as well as those for setting the proper procedures for certifying approved devices; that a technical certification body is available to check the conformity of each apparatus to standards and to accuracy requirements; and that the police officers are able to operate the distributed apparatus according to good practice rules. Furthermore, drivers must be informed of applicable speed limits, either by general provisions from the Highway Code or from local traffic signs. Similarly, enforcing seat belt use is only possible if vehicle standards require vehicles to be fitted with seat belts, which must conform to specific standards on materials to be used, on anchorage points and on anchorage structures resistance.

[9] According to Prochaska *et al.* (1992), there are five stages in the development of a change process: pre-contemplation, contemplation, preparation, action, and maintenance.

9.2 Synergies

Consideration of possible synergies between road safety interventions is important to enhancing effectiveness and limiting costs of road safety programs.

An interesting example of synergies between infrastructure corrective measures and general education and communication campaigns was implemented in the R300, near Cape Town in the early years of this century (Coetzee, 2010; and Randal, 2013). This set of interventions aimed at reducing pedestrian accidents in the vicinity of a high traffic volume dual carriageway road with average traffic volumes of 70000 vehicles per day.

The road was upgraded to motorway standards, potentially strengthening its barrier effect in the neighbouring communities, a feature that had to be mitigated (Randal, 2013). In addition to pedestrian (children and adults) traffic on the shoulders, there were high numbers of crossings distributed along the road, with the highest pedestrian activity coinciding with the peak periods of morning and afternoon motor traffic. Due to the poor access control, the poor conservation of the sidewalks and the unappealing nature of public transport, only two-thirds of the crossings were made using the existing upper or lower pedestrian bridges and underpasses. In the period from 2002 to 2007, 67 pedestrian fatalities and 81 serious injuries were registered.

To ensure that infrastructure investments would not contribute to an increase in road accident and injury occurrence, a complementary road safety campaign was set-up and cooperation with local communities was strengthened.

An integrated approach was adopted, involving traditional engineering measures and a set of education campaigns.

Three basic principles were followed in the engineering measures: ensuring visibility distances; speed adaptation to the road environment; and separating pedestrians from vehicles.

Narrower traffic lanes were adopted (3.50 m instead of the usual 3.75 m), allowing the building of a 1.5 m wide sidewalk (see Figure 9-2). This layout had the advantage of inducing lower traffic speeds than the normal traffic lane width (Coetzee, 2010). Following a thorough study of pedestrian traffic and walking paths, three new pedestrian overpasses were built, connecting communities located on opposite sides of the road.

Figure 9-2 Provision of sidewalk, to separate pedestrians from high speed motorized traffic (Source: Coetzee, 2010)

The road safety campaign (RSC) was developed at the local level and involved both traditional methods and non-conventional approaches to nudge affected communities to actively take responsibility in the promotion of road safety.

The RSC was designed to raise pedestrians' awareness of road safety, in particular by informing communities about the risks of jay walking and the advantages of using pedestrian viaducts. It was also intended to assisting educators in mainstreaming road safety in school education and to improve cooperation between road safety authorities and schools. This last goal was important to ensure the long term continuity of the intervention's social component.

Each school appointed a road safety educator, in charge of monitoring and evaluating progresses. The RSC comprised several complementary actions:

- A multimedia program and the development of "Streetwise" leaflets (the "experienced / road wise") for all levels of education and its distribution in schools.
- An activity to promote Safe Routes to School, aimed at children of 16 to 17 years.
- Activities aimed at early childhood development centres under the theme "Safe Child".
- A peer education program run by the Red Cross.
- A Pedestrian Visibility theatre project.

The Multimedia Education Program consisted of the elaboration and dissemination of three sets of documents (Basic, Intermediate and Senior), to be used in the classroom (from 6 to 15 years); the program also included a guide for educators, a road education history book and posters.
The "Streetwise" leaflets (Figure 9-3) were based on an original, appealing comic strip story, and included various activities to engage students in the subject of road safety.

Figure 9-3 Examples of "Streetwise" leaflets (Source: Randal, 2013)

The Safe Routes to School project involved students aged 16 to 17. After attending a training session on research methods and modes of presentation of results, students had to identify a serious road safety problem on the routes they routinely use on the way to their school, study it and propose a mitigating solution. Each team had to present their research and build a model, which was evaluated by road engineers (Figure 9-4). In addition to the prizes awarded on a competitive basis, some of the best solutions have been improved and implemented in practice.

With this project it was possible to stimulate interest in the engineering profession, to introduce students to basic research concepts and how to find solutions to problems, to raise the awareness of students to the scope of road safety problems, and to promote teamwork and participatory learning and intervention.

Figure 9-4 Presentation of proposed interventions within the Safe Routes to Scholl project (Source: Randal, 2013)

In addition to ensuring community involvement in road safety intervention, the RSC involved a road safety partnership between the road operator, oil companies, the Provincial Department of Education, the Provincial Government, NGOs linked to road safety, the Police, the Transit Authorities (Provincial and Municipal) and social forums, as well as Community Development technicians.

Following the implementation of the interventions an evaluation procedure was carried out by the road administration. Eight killed pedestrians and 25 seriously injured were registered in the period of 2010 to 2013, comparing with 67 fatalities and 81 serious injuries registered between 2002 and 2007. This corresponds to a reduction of 82% in the number of fatalities and 54% in the number of serious injuries (not adjusted for regression to the mean, AADT developments, and confounding factors).

9.3 Bundles of interventions

In some cases, intervention synergies may be so important that the relevant actions are grouped and preferably taken as a package, rather than pursued individually.

This is the case of interventions aiming at reducing accidents related to excessive speeds. Road safety research shows important relationships between traffic speed and safety outcome rates, in terms of frequency, severity and permanent trauma resulting from accidents, both from the individual point of view (speed of each vehicle) and from a statistical point of view – traffic speed distribution characteristics (Elvik, *et al*, 2009; MASTER, 1998; Greibe *et al*, 1999; Cardoso, 2007; and Cardoso, 2012).

Moderating the magnitude of the risks imposed by each driver on other road users and the difficulty in assessing the prevailing traffic system conditions to choose appropriate speeds are two strong favourable arguments for imposing legal limits on the freedom of driving speed choice. However, setting speed limits is only one side of the equation; to be effective, they have to be accepted by drivers and traffic speed reduced.

Reducing the prevalence of excessive speed does not have an easy solution, since in their normal state drivers choose the speed they prefer and consider safe; excessive speed is seldom considered as such by drivers at the moment of that decision.

Experience has shown that the most efficient way to tackle the problem of excessive speed is to implement an integrated set of complementary interventions, in what is commonly referred to as "speed management". These interventions are multi-disciplinary, addressing issues such as legislation, infrastructure, monitoring, information campaigns and telematics (OECD, 2006).

To be fully effective, speed management requires a functional classification of the road network (hierarchy), where each road segment is assigned a function (mobility, distribution, access or leisure) and a target speed consistent with the roadway design and layout (the infrastructure and the roadside area) in order to facilitate the correct perception of speed by the public, in particular drivers. The speed limits should therefore reflect the road classification, to be credible (and voluntarily accepted); they should also be in line with the traffic management administration' commitments (in terms of safety, mobility, fuel consumption and air pollution) and the levels of quality of operation considered appropriate by citizens (in particular drivers). Thus, roads (and streets) may be engineered to self-enforce speed choice and driver manoeuvers by applying the concepts of self-explaining roads and credible speed limits. Frequent communication campaigns explaining the rationale and motivation for speed limits may change their social acceptability and drivers' sense of responsibility; and enforcement activities contribute to a satisfactory compliance level, which may foster positive social norms towards speed limit compliance. Finally, technology (e.g. Intelligent Speed Adaptation - ISA) may help achieving voluntary or even forced compliance (SUPREME, 2010; and Carsten, 2017).

An example of the efficient synergies between low-cost engineering measures (infrastructure), strict enforcement and information campaigns is described in Cardoso (2012).

In the first half of 1998, three sets of low-cost engineering measures (LECM[10]) were applied by the Portuguese road administration (JAE) in IP5, a major East-West trunk road, between *Albergaria* and *Vilar Formoso*, totalling 170 km. At the time of this intervention, IP5 was a single carriageway two lane road with climbing lanes at selected grades. The road had 3.75 m wide lanes and 2.5 m wide paved shoulders; the design speed was 90 km/h in the first 53 km and 100 km/h in the last 117 km. Average daily traffic volumes (AADT) were very high, between 4400 and 10000 vehicles. Heavy goods vehicle (HGV) traffic was intense, both in absolute numbers and as a percentage of the total number of passing vehicles: between 1700 and 3450 daily HGVs, or 17% to 32% of total AADT.

IP5 safety performance was especially poor: on average, 35 fatalities and 37 serious injuries were registered annually, as a consequence of 508 accidents. Prevailing types of accidents were mainly related to excessive speed and irregular overtaking: head-on collisions and ran-off-road accidents, especially in curves, in the approach to interchanges and in sections with climbing lanes.

[10] Low-cost engineering measures are physical road safety interventions on the infrastructure that have a low capital cost and can be implemented quickly (ETSC, 1996).

One year after the implementation of the LCEM, a communication campaign was initiated and exceptionally intense and severe law enforcement were applied in the IP5; subsequently, after two years this special enforcement was relaxed. The sequential application of these safety interventions and the planned monitoring of resulting developments allowed for the evaluation of their individual impacts through observational before-after studies (Cardoso, 2008; and Cardoso, 2012).

Three sets of LCEM were implemented: improvement of traffic operations on sections with climbing lanes, namely by application of traffic regulations enhancing the number of passing opportunities for cars; increase in visibility conditions and operation predictability for traffic leaving and entering IP5, at interchanges (Figure 9-5); and changes in road environment (carriageway and roadside area) intended to influence driving behaviour.

Figure 9-5 Provision of position marker posts at the road axis on the approach to an interchange (Source: Cardoso, 2012)

This last set of measures comprised several LCEM: measures to improve surface water drainage, traffic sign visibility and overall visibility; mandatory use of day-light running lights in the road section, through the installation of appropriate vertical signs; setting a 90 km/h speed limit on the whole route section; the installation of edge rumble strips along the entire road (and the corresponding warning signs); the installation of new no-passing zones on selected dangerous sites; the repositioning of reflecting road studs at the road axis and at all new no-passing zones; and signing of horizontal curves according to consistency criteria (Cardoso, 2005). The obligation to use day-light running lights (at the time, still not widespread in the Portuguese road network) was intended to improve long distance vehicle conspicuity and to suggest drivers the sense of being on a special road that required extra driving precaution.

Implementation of this engineering intervention took less than six months and its total costs amounted to €740000 (840,000 US dollars, at 1998 prices), less than €4,400 per kilometre.

Six months after the LCEM implementation, a special enforcement campaign started on the IP 5 route, with the motto 'Maximum safety - zero tolerance'. This campaign (MSZT) was accompanied by national safety campaigns and subject to widespread media coverage, including the personal intervention of high ranking government officials.

Characteristics of the enforcement activity were changed in two ways:

- tolerance levels were eliminated (e.g. in the case of prohibited manoeuvres), or reduced to the minimum technically allowed by the measuring devices (radars and alcohol tests);
- the overall activity of the traffic police was increased by more than 75% in the first four weeks of the campaign and by 25% in the following 24 months. The number of police patrols on the road was raised from the original 9 patrols (8 hour shifts) per day, to 16 patrols per day in the first four weeks and to 11, since then, during two years.

A special traffic sign was installed along the IP 5 road, to remind drivers that the road was subject to extraordinary enforcement activity.

Selected driving behaviour variables and accident frequencies were used to evaluate the effects of the safety interventions.

Overall, general driver behaviour became more homogeneous.

Safety impacts were analysed using an observational before-after study, with all other Portuguese Road Network IP category roads as control sections. The expected number of accidents was used as the safety performance variable, and the multivariate regression empirical Bayes method (Hauer, 1997) was used in the analysis. A four year "before" period (1994-97) was considered; the "after" reporting period consisted of years 2001 and 2002. Years 1999 and 2000 were not used because in that period a strong and strict enforcement activity was applied throughout the whole IP5 road, leading to a massive reduction in the annual number of injury accidents and victims. Strict enforcement was abandoned and regular enforcement re-established before the end of 2000.

It was concluded that the number of expected injury accidents was reduced by 12% due to the LCEM, from 428 to 377 injury accidents (also, a reduction of 41% was estimated, as resulting from the compound effect of LCEM and strict enforcement). The annual number of registered fatalities was reduced from 85 to 52, and the annual number of killed and seriously injured victims diminished from 188 to 125 (Cardoso, 2012). Additionally, it was concluded that the suspension of the enforcement campaign was accompanied by a 20% increase in the number of fatalities and a 17% increment in the number of killed and seriously injured victims (18 victims more in three years).

It was recognised that the success of the enforcement campaign was partially due to the fact that no alternative roads existed in the IP5 corridor, for local drivers wishing to escape the enforcement activities.

Traffic on international corridors put an additional dimension to road safety management, due to differences in national legislations, enforcement practices, infrastructure design and maintenance standards, and local traffic habits. Harmonizing these issues is a major diplomatic challenge, as well as communicating the outstanding differences to relevant drivers and transporters and informing these actors on how to comply with them.

10 Concluding remarks

As mentioned in section 3, road safety interventions are actions designed to target consciously chosen safety performance improvement objectives of the road transport system. These actions may be directed to any part of the transport system (people, infrastructures, vehicles and their interaction processes), cover any stage of a crash (pre-collision, collision and post-collision) or be designed to mitigate one of the unsafety phenomenon components, i.e.: exposure, risk and unrecoverable personal injury

To be effective, road safety interventions are selected following an assessment of the safety situation, a diagnosis of the problems to address and a careful collection of alternative sets of available measures. Accurate data is required for carrying out these steps, and general knowledge on safety determinants and the scope of corrective measures. Detailed design and implementation of road safety interventions requires dedicated technical skills and knowledge on the country's legal and political frameworks, its transport system operation (formal standards and informal rules), and the supporting industry for the intervention (e.g. construction companies, media and insurance companies). After implementation, evaluation and assessment of results is needed, to ensure that experience is gained on the specific safety situation in order that future interventions are increasingly tailored to each country's road traffic system.

In this report several interventions were highlighted as good practice potentially relevant for African countries in their quest for improved road safety levels. These interventions were selected on the basis of previous recommendations from the interim review of the African Road Safety Action Plan, from several best practice collections, or because they were reported as proven effective road safety interventions in technical and scientific publications.

A list of the selected case interventions is provided in Table 10-1, with a short description of its main focus, the area where it was successfully applied and a reference to the section or annex where further information is provided.

Table 10-1 Synthesis of sampled good practice road safety interventions in this report

Pillar		Road safety intervention	Area	Reference in text
Road safety management	**Establish and strengthen Lead Agency**	Land Transport Safety Authority	New Zealand	Sect. 4.2.1
		Road safety management in	Great Britain	Sect.4.2.2
		Road safety management in	Sweden	Sect.4.2.3
		Nigerian Federal Road Safety Corps,	Nigeria	Sect.4.2.4
	Improved management of data	National road crash registration (BRON)	Netherlands	Table A5-1 Sect.4.2.6
		Traffic accident databases and information system	in Cameroon	Sect.4.2.7
		Road crash injury data systems,	Victoria State, Australia	Sect.4.2.5
	Develop and strengthen partnership and collaboration	MoU for road safety stakeholders	Zambia	Sect.4.2.9
		Implementation of Deputy Safety Volunteers	Burkina Faso	Table A5-20

Pillar		Road safety intervention	Area	Reference in text
Safer roads and mobility	**Safer road infrastructure for all road users**	Motorway infrastructure safety management on Motorways	Austria	Sect.5.2.1
		Road Safety Audits guidelines	UK	Sect.5.2.3
		The hierarchical mono-functional road network	The Netherlands	Table A5-2 Sect.5.2.6
		Simplified methodology for road safety assessment using automated image analysis of National Highways	Mozambique	Sect.5.2.5
	Capacity building and training of road safety	Education and training of auditors and instructors	Austria	Sect.5.2.2
		Road Safety Master Courses for engineering and economics faculties	European Union ; Belarus	Table A5-3 Sect.5.2.7
		Delft Road Safety Course	The Netherlands	Sect.5.2.8
Safer vehicles		Introduction of EuroNCAP star rating in 1997	UK	Sect.6.2.1
		Implementation of motor vehicle safety regulations as developed by the United Nation's World Forum for the Harmonisation of Vehicle Regulations	World wide	Table A5-6 Sect.6.2.2
		Periodic vehicle inspection	Turkey	Table A5-5 Sect.6.2.3
		ABS and helmets in two-wheeled vehicles	European Union	Sect.6.2.4
		Heavy vehicle overweight control in the Douala-N'Djamena corridor	Cameroun	Sect.6.2.5
Safer road users	**Use of helmets**	Introduction of mandatory helmet use and law enforcement	Vietnam	Table A5-11 Sect.7.2.1
		Mandatory helmet law improvement	Italy	Table A5-9
		Helmet use in Kenya; campaign "No helmet-no ride"	Kenya	Table A5-10
	Use of seatbelts	Enforcement of the law related to mandatory seatbelt use within the front seats in urban areas	Tunisia	Table A5-16 Sect.7.2.2
		Seatbelt legislation and communication campaign "*Por amor*"	Costa Rica	Table A5-7
		Introduction of mandatory helmet use and helmet-use training	Colombia	Table A5-8
		Seatbelt law enforcement	European Union	Table A5-12
	Drink/drug-driving	Reducing BAC limits and increasing penalties on drink-driving - Short-term impact evaluation	Mexico	Table A5-13 Sect.7.2.4
		Communication campaign on drug driving	UK	Table A5-17
	Mobile phone use whilst driving	The 'Speak Out' Publicity Campaign	Norway	Table A5-14 Sect.7.2.6
		Toughening mobile phone penalties	UK	Table A5-18
	Speeding	Impact Evaluation of the National Speed Awareness Course for offenders	UK	Table A5-19 Sect.7.2.3

Pillar		Road safety intervention	Area	Reference in text
	Education and Licencing	Graduated driver licensing system: the effect on motorcycle traffic crash hospitalisations	New Zealand	Table A5-15 Sect.7.2.5
		Communication campaign "Zuska"	Kenya	A5-21
Post-crash response		First Aid courses in driver education	Austria, Bosnia, Estonia, Germany, Hungary, Latvia, Lithuania, Slovakia, Switzerland	Sect.8.2.1
		Emergency First Aid Responder System (EFAR)	South Africa	Table A5-22 Sect.8.2.2
		Establishment of appropriate road user insurance schemes to finance rehabilitation services for crash victims	Kenya, European Union	Sect.8.2.3
Bundles / Combinations		The R300 freeway project for pedestrian road safety improvement near Cape Town	South Africa	Table A5-4 Sect.9.2
		Low cost engineering measures, strict enforcement and information campaigns to improve the safety of a single carriageway interurban trunk road	Portugal	Table A5-23 Sect.9.3

Note: Reference in text contains the related report section or table in Annex 5.

Detailed descriptions of several of these selected interventions are provided in Appendix 5, highlighting their focus, the size of the problem they address, type of expected effects, reported results, costs, acceptance and sustainability. These are issues that will be attended in the following task of this work package, in the transferability audit, which is intended as a procedure for evaluating the prospect that an intervention may be successfully implemented in a certain country or within a given corridor.

It is recommended that the transferability audits to be performed in several African countries are based on selected sets of the measures described in this report, specifically tailored to each country in cooperation with local experts and stakeholders within the scope of the Dialog Platform.

As mentioned at the beginning of the report, no attempt was made to produce a comprehensive list of potential and promising road safety interventions for Africa. Nevertheless, the presented examples will also contribute (and form the basic structure) for selecting appropriate interventions and drafting the five factsheets, for which several themes are being considered: pedestrians; mopeds & motorcycles; safer road infrastructure for all road users; interurban through roads; public transport; safety campaigns; driver training and licensing; and strengthened partnership and collaboration for road safety.

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APPENDICES

Appendix 1: List of Abbreviations

AADT	Average annual daily traffic
ABS	Advanced Braking System
AfDB	African Development Bank
ARSAP	African Road Safety Action Plan
ASR	*Les Ambassadeurs de la Sécurité Routière* (Tunisia)
AU	African Union
AVV	Transport Research Centre of the Ministry of Transport (The Netherlands)
B/C	Benefit-Cost
BAC	Blood Alcohol Concentration
BRON	National Road Crash Registration (The Netherlands)
CEMAC	Economic and Monetary Community of Central Africa
CITA	International Motor Vehicle Inspection Committee
CSIR	Centre for Scientific and Industrial Research (South Africa)
CTL	Centre for Transport and Logistics
CTL	Centro di Ricerca per il Trasporto e la Logistica, Sapienza Universita di Roma
DfT	Department for Transport (Great Britain)
DRSC	Delft Road Safety Course
DUI	Driving Under the Influence
EC	European Commission
ECMT	European Conference of Ministers of Transport
ECTS	European Credit Transfer and Accumulation System
EFAR	Emergency First Aid Responder
EMS	Emergency medical services
ENSTP	Ecole Nationale Supérieure des Travaux Publics (Cameron)
ERSO	European Road Safety Observatory (EU)
ESP	Electronic stability control
EU	European Union
EuroNCAP	European New Car Assessment Programme
EuroRAP	European Road Assessment Programme

FRSC	Federal Road Safety Corps (Nigeria)
FSV	Austrian Research Association for Roads
GDLS	Graduated Driver Licence System
GIS	Geographical Information System
GRSP	Global Road Safety Partnership
ICG	Industry Consultative Group (New Zealand)
IIHS	Insurance Institute for Highway Safety (USA)
IPSOS	International Social Trends Unit (UK)
iRAP	International Road Assessment Programme
ISA	Intelligent speed adaptation
ISO	International Organisation for Standardization
KSI	Killed or Seriously Injured (UK road safety statistics)
LBZ	National Basic Register Hospital Care (The Netherlands)
LMIC	Low and Middle Income Countries
LTSA	Land Transport Safety Authority (New Zealand)
MoU	Memorandum of Understanding
MUARC	Monash University Accident Research Centre
NCAP	New Car Assessment Programme
NCIS	National Coroners' Information System (Victoria, Australia)
NGO	Non-Governmental Organisations
NPRA	Norwegian Public Roads Administration
NRSAG	National Road Safety Advisory Group (New Zealand)
$NRSC_{NZ}$	National Road Safety Committee (New Zealand)
$NRSC_{E}$	National Road Safety Council (Ethiopia)
NRSWG	National Road Safety Working Group (New Zealand)
NTID	National Transport Injury Database (Victoria, Australia)
NWB	National Roads Register (The Netherlands)
OECD	Organisation for Economic Co-operation and Development
ONSP	Observatoire National de Santé Publique of the Ministère Santé Publique (Cameroon)
PIARC	World Road Association
PTI	Periodic Technical Inspection
RCIS	VicRoads' Road Crash Information System
RIA	Road safety impact assessment

RISM	Road Infrastructure Safety Management
ROSPA	Royal Society for the Prevention of Accidents
RSA	Road safety audit
RSI	Road safety inspection
RTSA	Road Transport and Safety Agency (Zambia)
SANRA	Staff Association of the National Roads Authority (Gambia)
SARSAI	'School Area Road Safety Assessment and Improvements' programme (Africa)
SDG	UN Sustainable Development Goals
SIKA	Swedish Institute for Transport and Communications Analysis
SRA	Swedish Road Administration
SSATP	Sub-Saharan African Transport Policy Programme
STAR	Safety Targets and Accident Reduction Steering Group (Great Britain)
SWOV	Institute for Road Safety Research (The Netherlands)
TRL	Transport Research Laboratory (UK)
TTS	Transport Technology and Standards (Great Britain)
UK	United Kingdom
UN	United Nations
UNECA	United Nations Economic Commission for Africa
UNECE	United Nations Economic Commission for Europe
UNRSC	United Nations Road Safety Collaboration
USA	United States of America
VISAR	Victorian Injury Surveillance and Applied Research Program (Victoria, Australia)
WHO	World Health Organisation

Appendix 2: WP4 questionnaire results

Table A2-1 Synthesis Questionnaire answers from WP4 round 1

Western Africa	Northern Africa	Eastern Africa	Central Africa	Southern Africa
Benin	Tunisia	Kenya	Congo	Botswana
Burkina Faso		Malawi		Lesotho
Cameroon		Mauritius		South Africa
Gambia		Tanzania		Swaziland
Guinea				
Mali				
Nigeria				
Senegal				
Sierra Leone				
Togo				

Table A2-2 Questionnaire answers from WP4 round 2 (6th April 2018)

Western Africa	Northern Africa	Eastern Africa	Central Africa	Southern Africa
Benin	Tunisia			Botswana
Burkina Faso	Morocco			
Guinea				
Mali				
Senegal				

Table A2-3, below, shows if there is documented supporting evidence of interventions across the five different pillars, by country.

Table A2-3 Evidence of action across the 5 different pillars by country

Road Safety Management					
Country	WP3 Excel	WP3 D3.1	WP4 (1st)	WP4 (2nd)	Other
Benin		5/7	*	X	
Botswana		6/7	*	X	
Burkina Faso		5/7	*	X	
Cameroon		4/7		X	
Congo		2/7		-	
Gambia		2/7		X	
Guinea Conakry		4/7	-	-	
Kenya		6/7		X	
Lesotho		5/7		-	
Malawi		5/7		-	
Mali		5/7	*	X	
Mauritius		7/7		X	
Morocco		5/7	*	X	
Nigeria		5/7		X	

Senegal		5/7	*	X	
Sierra Leone		4/7		-	
South Africa		7/7		X	
South Sudan		4/7		X	
Swaziland		3/7		X	
Tanzania		1/7		X	
Togo		2/7		X	
Tunisia		4/7	-	X	
Safer Roads and Mobility					
Country	**WP3 Excel**	**WP3 D3.1**	**WP4 (1st)**	**WP4 (2nd)**	**Other**
Benin		4/5	*	X	
Botswana		1/5	*	X	
Burkina Faso		1/5	*	X	
Cameroon		2/5		X	
Congo		2/5		X	
Gambia		1/5		X	
Guinea Conakry		2/5	-	X	
Kenya		2/5		na	
Lesotho		1/5		X	
Malawi		1/5		X	
Mali		3/5	*	X	
Mauritius		3/5		X	
Morocco		5/5	*		
Nigeria		5/5		X	
Senegal		2/5	*	X	
Sierra Leone		1/5		X	
South Africa		4/5		X	
South Sudan		2/5			
Swaziland		2/5		X	
Tanzania		3/5		X	
Togo		1/5		X	
Tunisia		1/5	-	X	
Safer Vehicles					
Country	**WP3 Excel**	**WP3 D3.1**	**WP4 (1st)**	**WP4 (2nd)**	**Other**
Benin		0/7	*	X	
Botswana		0/7	*	X	
Burkina Faso		0/7	*	X	
Cameroon		0/7		X	
Congo		0/7		X	
Gambia		0/7		X	
Guinea Conakry		0/7	-	X	
Kenya		0/7		na	
Lesotho		0/7		X	
Malawi		0/7		X	
Mali		0/7	*	X	
Mauritius		0/7		X	
Morocco		0/7	*	X	
Nigeria		0/7		X	
Senegal		0/7	*	X	

Sierra Leone		0/7		X	
South Africa		4/7		X	
South Sudan		0/7		X	
Swaziland		0/7		X	
Tanzania		0/7		X	
Togo		0/7		X	
Tunisia		0/7	*	X	
Safer Road Users					
Country	**WP3 Excel**	**WP3 D3.1**	**WP4 (1st)**	**WP4 (2nd)**	**Other**
Benin		2,0,1,0,1,0	*	X	X
Botswana	X	4,2,3,1,1,1	*	X	X
Burkina Faso		3,2,1,1,1,1	*	X	
Cameroon	X (inception report from WP5)	2,1,3,1,1,0		X	
Congo	X	2,1,2,1,1,0		X	
Gambia	X	0,1,1,1,1,1		X	
Ghana		4,2,3,1,1,0			X
Guinea Conakry		3,1,2,0,1,1	X	X	
Ivory Coast		3,1,3,1,1,0			X
Kenya		3,2,3,1,0,0		na	
Lesotho		2,1,3,1,0,0		X	
Malawi		4,1,3,1,1,0		X	X
Mali		4,0,3,1,1,1	*	X	X
Mauritius		3,2,3,1,1,0		X	
Morocco		4,1,3,1,1,0		X	
Mozambique		3,2,3,1,1,1			X
Namibia		3,2,3,1,1,1			X
Nigeria		3,1,3,1,1,1		X	
Senegal		1,1,1,1,1,0	*	X	X
Sierra Leone		3,2,3,1,1,1		X	
South Africa		3,2,3,1,1,0		X	X
South Sudan		2,1,2,1,1,0		X	
Swaziland		4,1,3,1,1,0		X	
Tanzania		1,1,3,1,0,0		X	X
Togo		2,2,1,0,1,0		X	
Tunisia		3,1,2,1,1,0	*	X	
Zambia		3,2,2,1,1,1			X
Uganda		2,2,3,1,1,0			X
Post-Crash Response					
Country	**WP3 Excel**	**WP3 D3.1**	**WP4 (1st)**	**WP4 (2nd)**	**Other**
Benin		3/4 ; B	-	X	
Botswana		3/4 ; B	*	X	
Burkina Faso		3/4 ; D	*	X	
Cameroon		4/4 ; A		X	
Congo		2/4 ; A		X	
Gambia		3/4 ; A		X	
Guinea Conakry		2/4 ; A	-	na	
Kenya		2/4 ; A		na	X
Lesotho		3/4 ; 0		X	

Malawi		**3/4 ; 0**		**X**	
Mali		**4/4 ; A**	*	**na**	
Mauritius		**4/4 ; A**		**X**	
Morocco		**3/4 ; D**	*	**X**	
Nigeria		**3/4 ; B**		**X**	
Senegal		**3/4 ; D**	*	**X**	
Sierra Leone		**4/4 ; B**		**X**	
South Africa		**3/4 ; C**		**X**	
South Sudan		**3/4 ; B**		**X**	
Swaziland		**3/4 ; B**		**X**	
Tanzania		**2/4 ; A**		**X**	
Togo		**3/4 ; D**		**X**	
Tunisia		**3/4 ; A**	-	**X**	

Notes:

1. 'N/7' ('N/5' and 'N/4') means that N out of 7 (5 or 4) issues discussed in WP3.1 are fulfilled by a country;
2. 'I,J,K,L,M,N' means that means that 'I' out of 4 issues discussed in 'Use of helmets' are fulfilled; 'J' out of 2 issues discussed in 'Seat belts' are fulfilled; 'K' out of 3 issues discussed in 'Alcohol' are fulfilled; 'L' out of 1 issues discussed in 'speeding' are fulfilled; 'M' out of 1 issues discussed in 'Mobile phones' are fulfilled; and 'N' out of 1 issues discussed in 'Child restraints' are fulfilled; by a country
3. 'A' means less than 11% seriously injured road victims transported by ambulance; 'B' means between 11% and 49% seriously injured road victims transported by ambulance; 'C' means between 49% and 75% seriously injured road victims transported by ambulance; 'D' means more than 75% seriously injured road victims transported by ambulance.
4. '*' implies column filled in WP4 questionnaire but no specific reference given.
5. 'na' means "no answer".
6. 'X' means "Yes"

Appendix 3: General documentation

Table A3-1 Synthesis of evidence on road safety management interventions (International good practices)

Road Safety Management (International good practices)			
	Country	Action	Evidence
Establish/strengthen Lead Agency	**National Highway Traffic Administration,** USA	Standalone lead agency. Promotes education, research, safety standards and enforcement activity .NHTSA also provides grants to State governments so States can conduct effective highway safety programs.	Bliss T., Breen J., World Bank
	Land Transport Safety Authority (LTSA), New Zealand	Stand-alone authority responsible for promoting safety in land transport and managing land transport information and revenue systems. The LTSA established a results management framework for appraising performance and identifying what could be achieved in the medium term. Led the development and delivery of national safety strategies and the work program agreed by the National Road Safety Committee (NSRC), the high-level coordinating body. This strategy includes targets for final and intermediate outcomes and institutional outputs.	
	VicRoads – State of Victoria, Australia	The road authority as lead agency. VicRoads (the Victoria Road Corporation) works very closely in a partnership with the Transport Accident Commission, Victoria Police and the Department of Justice. Road safety is one of four core businesses for VicRoads led by a General Manager, who reports to the Chief Executive. VicRoads has a dedicated Road Safety Department with the aim is to achieve a sustainable reduction in the number and severity of road crashes and the cost of road trauma by delivering road safety programs that target all road users. VicRoads' Road Safety Department leads performance review, target-setting work and road safety strategy development and dedicates a large part of its road safety department to the Strategies and Programs Section. The Victorian	Bliss T., Breen J., World Bank

Road Safety Management (International good practices)			
	Country	Action	Evidence
		government road safety agencies have adopted the Safe System approach to reduce road trauma.	
	Office of Road Safety, State of Western Australia	Lead agency situated within the Premier's Department. The Office of Road Safety (ORS) is an unusual lead agency type, comprising a small road safety dedicated coordinating agency with a stated objective of reducing the number of serious injuries and fatalities on Western Australian roads, but does not have core responsibility for primary service delivery in any road safety or transport-related function. Has responsibility for monitoring road safety performance in Western Australia and for communicating results to the Road Safety Coordination Council. The *Safe System* approach was in 2003.	Bliss T., Breen J., World Bank
	Malaysia	The Ministry of Transport (MoT) is the lead agency for road safety in Malaysia. It oversees the development and regulation of air, land, and sea transport. It sets strategic and policy directions and, through its statutory agencies, carry out operations and regulatory functions relating to transport. In November 2004, a new Road Safety Department (RSD) was established within the Land Transport Division of the Ministry of Transport. Interim quantitative targets have been set for road safety strategies since the 1990s. In-house capacity is established as well as external support for universities and a newly established governmental road safety research organisation.	Bliss T., Breen J., World Bank
	Roads and Vehicles and Standards Directorate, Department for Transport, Great Britain	Lead agency within the government transport ministry. Works to Public Service Agreement targets for road casualty reduction which are the national road safety strategy targets. The DfT's Roads and Vehicle Safety and Standards Directorate has the principal responsibility for the development, delivery and monitoring of the national road safety strategy. The Safety Targets and Accident Reduction Steering (STAR) Group was set up by DfT to provide	Bliss T., Breen J., World Bank

Road Safety Management (International good practices)			
	Country	Action	Evidence
		technical support and advice to ministers on the setting of targets.	
	Netherlands	Lead agency within the government transport ministry. The Ministry of Transport, Public Works and Water Management (MoT) is the lead agency for road safety in The Netherlands. Road safety is one of five areas of responsibility. The Roads and Traffic Safety Department (RTSD) takes the leadership role and has the central responsibility nationally for the development and coordination of road safety targets at national level. The MoT manages the country results focus and ensures that system-wide interventions are agreed and implemented to achieve these by the responsible authorities cross government and wider society. The MoT has established in-house capacity and supports external capacity for appraising performance and identifying what could be achieved in the medium term. The MoT pursues the long term vision of Sustainable Safety (adopted in legislation) and has established road safety outcome targets in its Mobility Policy Document . The MoT has used contractual agreements with its partners to achieve results.	Bliss T., Breen J., World Bank
	Swedish Road Administration, Sweden	The road authority as lead agency. The SRA has the main responsibility in reviewing performance, proposing goals and targets and carrying out intervention in the road network. The SRA developed and leads Vision Zero and is responsible for the achievement of national targets, underpinned by a performance agreement with the Ministry of Industry, Employment and Communications.	Bliss T., Breen J., World Bank
	Poland	Legal responsibility for road safety is mainly within the Ministry of Infrastructure. The Ministry of the Interior also has key responsibilities. The Minister of Infrastructure chairs the National Road Safety Council (NRSC), an inter-ministerial coordinating body, which assists the Council of Ministers on road	Bliss T., Breen J., World Bank

Road Safety Management (International good practices)			
	Country	Action	Evidence
		safety issues. The deputies are undersecretaries of state at the Ministry of Transport and the Ministry of the Interior.	
Improved management of data	**Road crash injury data systems** in Victoria, Australia	Management of crash, exposure and health data by the interaction of the road authority, the road police, the Transport Accident Commission, the Department of Human Services and Monash University Accident Research Centre (MUARC).	Bliss T., Breen J., World Bank
	New Zealand's **Crash Analysis System (CAS**)	The lead agency established a Crash Analysis System (CAS) which manages, analyses and maps road traffic crash and related data. The information provided by the CAS is used to help analyse and determine road safety funding allocations. It is also used in the targeting of road safety programs and the monitoring of their performance. It integrates mapping with other functions and links crash data with road asset management data systems used by the road controlling authorities at the national and local level. The crash data collection is based on the fatal, injury and non-injury crashes reported by the police to the lead agency. Internet access to the full services of the CAS can be provided to authorized users.	Bliss T., Breen J., World Bank
	IRTAD Database	The IRTAD database contains crash and exposure data from 32 countries. It includes safety and traffic data, aggregated by country and year from 1970. All data is collected directly from relevant national data providers in the IRTAD countries. It is provided in a common format, based on definitions developed and agreed by the IRTAD Group.	https://www.itf-oecd.org/IRTAD
	Europe **ERSO** - European Road Safety Observatory	Evidence based approach. Collection of a wide range of information types (data protocols and collection methodologies, national and in-depth accident data, exposure data and safety performance indicators.)	SAFETYNET project
	STATS19 – Great Britain	National police crash reporting system. Police data is forwarded routinely to the Department for Transport and to local	Bliss T., Breen J., World Bank

Road Safety Management (International good practices)			
	Country	Action	Evidence
		authorities. The health sector has a system for road crash injury reporting and linkage studies between health and police data are made from time to time by the lead agency to estimate levels of underreporting in the national police reported database.	
	The Traffic Behaviour Monitoring System, Finland	The main objective is to monitor changes occurring in traffic behaviour. Traffic monitoring data is collected as a collaborative multisectoral efforts. The traffic behaviour measurements included in the system are: speeding, close following, drunk driving, seat belts' use, bicycle helmets' use, use of daytime running lights, indication of directions by vehicles, use of reflectors by pedestrians, and red light compliance by pedestrians. The results of traffic behaviour are reported annually using the same methods and the same measuring points. The methods used are road-side observations and automatic traffic counters.	Bliss T., Breen J., World Bank
	BRON and Correction for underreporting of road traffic fatalities, Netherlands.	Compares three data sources: – crash registration by the police; – court files on unnatural deaths; – files on causes of death from municipal population records.	SUPREME project
	The National Travel Survey (NTS) – Great Britain	Provides information about personal travel within Great Britain and monitors trends in travel behaviour. The NTS is commissioned by the British Ministry of Transport.	SUPREME project
	The Rhône road trauma register - France	Its goal was to estimate the real number of non-fatal casualties and obtain more information about injury severity and long-term impact. The register is based on data from all health care facilities in the Rhone region. For each victim a standard form has to be completed. The register has been 'qualified' by the French National Committee of Registers and is periodically evaluated. Later, registers should be set up in other parts of France as well. The database is protected by	SUPREME project

Road Safety Management (International good practices)			
	Country	**Action**	**Evidence**
		privacy laws, but is made available for research purposes when confidentiality rules are observed. In the Rhone region, 96 first-line hospital services, 160 follow-up services and 11 rehabilitation centres are involved, represented by a central network. Data management is performed by the UMRESTTE Research Department of INRETS. Regular data analysis and research is performed, focussing on specific themes. The themes studied over the last two years include the safety of elderly road users, gender differences in road risk, characteristics of injuries sustained by young road users, pedestrian injuries and the long-term consequences of injuries.	
	The Road Safety Information System - Latvia	The Latvian Road Safety Information System consists of four linked databases with background information, relevant for decisions about road safety: vehicle database, driver database, crash database, traffic law violator database. The databases are mutually linked. For example, the vehicle database can be linked to the crash database by the car licence number; and the driver database can be linked to the violator database or the crash database by the personal identification number. The Road Traffic Safety Directorate in Latvia is responsible for management and maintenance of the four databases. Data are provided by the Road Traffic Safety Directorate, and by the police and insurance companies.	SUPREME project
Develop/Strengthen partnership and collaboration	**New Zealand - National Road Safety Advisory Group** (NRSAG).	Chaired by the lead agency, the NRSAG provides a forum for a wide range of agencies involved in road safety to express their views on road safety issues and to provide a base from which joint projects can be initiated. It comprises members predominantly from the public sector (such as Accident Compensation Corporation (ACC), the Alcohol Advisory Council of New Zealand, the Ministries of Health, Justice, Pacific Island Affairs, Transport and Youth Affairs, the New	Bliss T., Breen J., World Bank

Road Safety Management (International good practices)			
	Country	Action	Evidence
		Zealand School Trustees Association, the New Zealand Automobile).	
	New Zealand's Industry Consultative Group (ICG).	This group was established to provide a forum for the land transport industry to liaise with the lead agency.	Bliss T., Breen J., World Bank
	Victoria's Transport Industry Safety Group, State of Victoria, Australia	Involves the road safety partners, transport industry and unions, the WorkSafe Authority and the State Coroner's Office which focuses upon heavy vehicle related safety issues.	Bliss T., Breen J., World Bank
	The Insurance Institute for Highway Safety (IIHS), US	Non-profit making research and communications organisation funded by motor vehicle insurers. The Institute's research focuses on interventions aimed at all 3 factors in motor vehicle crashes (human, vehicular, and environmental) that can occur.	Bliss T., Breen J., World Bank
	Parliamentary NGO role in seat belt wearing in Great Britain	The UK umbrella organisation, the Parliamentary Advisory Council for Transport Safety, brought together key NGOs such as the Royal Society for the Prevention of Accidents, the British Medical Association and the Automobile Association in an effective coalition in support of compulsory front seat belt use in the 1980s.	Bliss T., Breen J., World Bank
	Sweden Lead agency initiatives to engage the business sector	Helping to establish the European New Car Assessment Programme (Euro NCAP), encouraging the car industry to fast track the fitment of alcohol interlocks, seat belt reminders and electronic stability control systems.	Bliss T., Breen J., World Bank
	Sweden National Road Safety Assembly	Brings together representatives from government agencies, non-governmental organisations and companies affected by road safety issues. Its aim is to inspire and encourage traffic stakeholders to share responsibility for road safety.	

Table A3-2 Synthesis of evidence on road safety management interventions (African good practices)

Road Safety Management (African good practices)			
Establish/strengthen Lead Agency	**Federal Road Safety Corps**, Nigeria	Stand-alone lead agency in Head of State's Department. The FRSC proposes, as part of the coming National Road Safety Strategy to create a high level national council, with a mandate to manage and monitor road safety performance of all stakeholders. It has considerable human, logistical and financial resources, has a professional management, use modern technology in its operations, and is able to show results. The FRSC works in the field of the 5 pillars of the UN Decade of Action for road Safety and of the African Road Safety Action Plan.	Sourced from SSATP
	Ethiopia	A National Road Safety Council (NRSC) was established in 2011 within the Ministry of Transport, to spearhead and facilitate road safety improvements on a federal level. The objective is to develop road traffic safety strategy and coordinate the concerned organs for its implementation. The proposed road safety management framework builds on a review of the functions and powers of the NRSC and of road safety management tasks (results focused approach, coordination, legislation, funding and resource allocation, road safety promotion, monitoring and evaluation, research and development and knowledge transfer). A set of generic road safety interventions is identified as well as typical results and indicators to monitor and evaluate road safety performance in Ethiopia.	Sourced from SSATP
	Road Transport Safety Agency, Zambia	Its operational assignment includes nationwide driver and vehicle examination and licensing, which is carried out by Traffic Inspectors at the regional offices. A National Road Safety Plan is in place until 2013 and RTSA is supporting all stakeholders to promote road safety. RTSA is therefore already recognised as a Lead Agency but need to strengthen its role through	Sourced from SSATP

Road Safety Management (African good practices)			
		implementation and coordination of interventions with other key agencies and stakeholders.	
	National road safety council/committee: Burundi, Burkina Faso, Guinea, Lesotho, Cote d'Ivoire.	---	Sourced from UNECA
	Cameroon	The Ministry of Transport has established a Road Safety Department (RSD) It is charged with several management functions such as control of driving schools and vehicle inspection centres, and road accident sensibilisation and prevention. Further actions will include the development of a new National Road Safety Strategy and Action Plan including all stakeholders, and the identification of policy issues that supports it.	Sourced from SSATP
Improved management of data	Cameroon	Methodological and practical framework for managing the traffic accident data. High quality databases on road safety and centralised and integrated information system to collect, manage and analyse traffic accident data.	Sourced by D4.2
Develop/Strengthen partnership and collaboration	**Zambia Road Safety MoU between RS stakeholders**	Sets to improve coordination among different actors and to promote innovation and the introduction of high impact interventions, bold decisions and actions to proficiently address all aspects of road safety.	Sourced from UNECA
	Namibia Road Safety MoU between the Motor Vehicle Accident (MVA) Fund and National Road Safety Council (NRSC); Namibia	The 2 parties undertake to engage each other in their quest to establish structures for collaboration to promote improved road safety performance in Namibia through jointly identified and mutually agreed road safety interventions and public education campaigns as per the Namibian chapter of the Decade of Action. As part of the MoU, the MVA Fund and NRSC will jointly engage relevant State Owned Enterprises, Government Ministries and private institutions to harmonise efforts and in so doing minimise duplication and fragmentation of road safety interventions.	Sourced from UNECA

Table A3-3 Synthesis of evidence on Safer Roads and Mobility (International good practices)

Safer Roads and Mobility (International good practices)			
	Action/Country	Description	Evidence
Safer road infrastructure for all road users	**EU Directive 96/2008**, Europe	Establishment of different procedures (Road Safety Impact Assessment, Road Safety Audits, Road Safety Inspections, Network Safety Management) in all Member States.	https://ec.europa.eu/transport/sites/transport/files/facts-fundings/evaluations/doc/2014-12-eval-directive-2008-96-ec.pdf
	Infrastructure Safety Management on Austrian Motorways, Austria	All tools of the Directive are applied to the Austrian sections of the Trans-European Road Network (TERN).	IRTAD, Road Infrastructure Safety Management (OECD/ITF)
	Education and training of auditors and instructors, Austria	Road safety auditors and inspectors undergo a joint 5 day course featuring a comprehensive set of road safety issues. The certification requires completion of the above course, a university degree in a relevant field (or adequate alternative education) and several years of work experience in the planning and road safety fields.	IRTAD, Road Infrastructure Safety Management (OECD/ITF)
	Guidelines of Road Safety Audits, UK	Guidelines on RSA procedures during the 4 stages of design and implementation of a new road infrastructure	IRTAD, Road Infrastructure Safety Management (OECD/ITF)
	KiwiRAP – Road Assessment Program, New Zealand's	An extensive Road Assessment Program consists of three protocols: Risk Mapping, Star Rating and Performance Tracking.	IRTAD, Road Infrastructure Safety Management (OECD/ITF)
	The hierarchical mono functional road network, Netherlands	Re-categorization of road network into 3 road categories, each with its own and exclusive function: through roads for long distance travel, access roads for opening up residential areas and rural settlements, and distributor roads connecting the former two road types.	SUPREME project
	Vision Zero, Sweden	The Vision Zero approach aims at a more forgiving road system that takes human fallibility and vulnerability into account: the whole transport system is designed to protect people from death and serious injury. It accepts that	SUPREME project

Safer Roads and Mobility (International good practices)			
	Action/Country	Description	Evidence
		people make mistakes and that they are vulnerable. Those who design the road system and those who use the roads must share responsibility for creating a road system where crash forces do not result in death or serious injury. The Safe System approach implies the safety of all parts of the system have to be improved: roads and roadsides, speed and vehicle construction. The idea is that if one part of the safety system 'fails' (e.g., drivers make a mistake), other parts will still protect the people involved (e.g., more 'forgiving' road infrastructure).	
	Upgrading road network, Slovakia	Slovakia has undertaken to prevent an estimated 355 deaths and serious injuries over the next 20 years on a 327 km sample of motorways and expressways. The total cost of investment was about EUR 40 million. The 77 % of the improved sections are now rated as 3-star, with 1-star sections having disappeared completely. The package of improvements included shoulder rumble strips and barriers with energy absorbing ends.	Safer Roads for All – EU good practice guide
	30 km/h zones, Germany	Legal changes for the application of 30 km/h limits near schools and hospitals.	Safer Roads for All – EU good practice guide
	Measures against tree collisions, France	This pilot project aimed at avoiding tree collisions along a 26.5 km section of the national road RN 134 in the South West of France. The measure consisted of the implementation of 7 800 meters of guardrails, 13 junction and 8 lay-by treatments. Some stretches of the road in question had high risk levels in terms of crashes and severity due to the row of trees along the road side. The problem was to propose and negotiate measures to reduce the number and the severity of the crashes by ensuring the protection of the rows of trees by means of guardrails wherever possible – or otherwise by the felling the trees. The total cost for implementing the	SUPREME project

Safer Roads and Mobility (International good practices)			
	Action/Country	Description	Evidence
		measure against collisions with trees was around EUR 1 million, including management, studies, implementation, and site supervision.. The main benefit of oimplementing the measure consisted of a significant reduction of tree accidents, fatalities and crash severity. The benefits were found to exceed the costs by a factor of 8 to 9.	
	Rumble strips, Sweden	Rumble strips are milled into the asphalt surface of a road shoulder or between lanes in opposite directions in combination with ordinary road markings. Vehicles vibrate and make a noise when passing over them and alert drivers to the potential crash danger changing lanes poses. They help to reduce crashes resulting from lane departure, head-on collisions and off-road crashes Research from different countries has shown that the number of injury crashes can be reduced by over 30% by shoulder rumble strips and by over 10% by centreline rumble strips. Estimations of costs vary largely. Cost-benefit analyses from Norway and USA have estimated that the benefits exceed the costs by factor between 3 and 180.	SUPREME project
	Variable Message Signs, Norway, Sweden, Finland	Adaptation of speed limits and communication of warnings are communicated to drivers via 'Variable Message Signs' (VMS) .It has been observed that warning displays alone do not have much influence on speed behaviour, while speed limits justified by warnings or explanations have significant effects. It is mainly the road authorities at the national and regional level who are responsible for the implementation, operation and maintenance of VMS. Despite methodological weaknesses in many of the evaluation studies for different kinds of VMS there are strong indications that VMS help to reduce injury accidents and harmonise traffic flow. According to evaluations	SUPREME project ROSEBUD

Safer Roads and Mobility (International good practices)			
	Action/Country	Description	Evidence
		carried out in the ROSEBUD project, cost-benefit ratios are between 0.65 and 1.45.	
Capacity building and training	**Road Safety Master Courses for engineering and economics faculties:** EU TEMPUS project Be-Safe, Belarus	Developing of 2 master courses on road safety according to the Bologna Process standard (60 ECTS): one for engineering faculties and one for economic faculties.	Sourced from Deliverable_D6.1_SaferAfrica Be-Safe, Belarusian Road Safety Network, Deliverable 1.3: Curriculum of the 1st level University Master on Road Safety
	The Road Safety Management Master's Degree Program - Renault corporate foundation, France	The purpose is to train a generation of specialized executive managers on the local issues of road safety. The Renault Foundation and the University of Saint Joseph of Beirut (USJ) have designed and proposed a multi-disciplinary, multilingual and multi-national training and research program. The Master's degree program is open to students in the MENA (Middle East and North Africa) region and the Gulf States. It will give students multidisciplinary expertise in the field of road safety management.	Sourced from Deliverable_D6.1_SaferAfrica https://www.fondation.renault.com
	International course in Vision Zero - Swedish Transport Administration, Sweden	The course is targeted for people working in practice with traffic safety issues in various agencies such as government authorities, industry, municipalities, NGOs and academia. It is also highly relevant for experts within UN authorities, development banks, and other international organisations. The aim is to gain a deep understanding of Vision Zero as a policy innovation and how this could affect working methods, as well as how a safe road transport system can be created. Participants will also receive a platform for the understanding of how to continue the work with road safety issues in their respective countries.	Sourced from Deliverable_D6.1_SaferAfrica https://www.trafikverksskolan.se/visionzero
	Delft Road Safety Course, The Netherlands	Focus on postgraduate participants working in the field of road safety. Evidence based and data driven' approach	Sourced from Deliverable_D6.1_SaferAfrica http://delftroadsafetycourses.org/
	Global Road	This 2 weeks training programme aims	https://www.grsproadsafety.

Safer Roads and Mobility (International good practices)			
	Action/Country	Description	Evidence
	Safety Leadership Course, Global Road Safety Parnership	to build leadership capacity to design, advocate for, and implement effective road safety programmes and policies. Each year, the course is offered in a regional location as well as on campus at the JH-IIRU in Baltimore, USA. Participants, primarily drawn from partner organisations from within the Bloomberg Philanthropies Initiative for Global Road Safety (BIGRS), as well as key personnel from government agencies, civil society organisations and Red Cross Red Crescent National Societies who are actively engaged in road safety activities. With a focus on key leadership principles, the course explores topics centred on the five pillars of focus for the Decade of Action for Road Safety, covering topic areas including: • The road safety problem: an overview of the global burden • Road safety risk factors • The role of enforcement in road safety • Post-crash response • Urban design for road safety • Safer vehicles and road safety • Strategic communications and behaviour change campaigns.	org/

Table A3-4 Synthesis of evidence on Safer Roads and Mobility (African good practices)

Safer Roads and Mobility (African good practices)			
	Action/Country	Description	Evidence
	Road safety audits and inspections in Malawi, Zambia.	--	UNECA
	Road Safety Audit, Tanzania	Country requires formal audits for new road construction projects.	Questionnaire for stakeholders
	Simplified methodology on road safety assessment using automated image analysis of National Highways, Mozambique	Methodology based on automated image analysis, to identify critical road sections of the National Highways.	Sourced by CTL
	Traffic calming measures, Ghana	8 traffic calming schemes (mostly narrowing) on accidents prone highways. Effectiveness has been assessed by a before-after study using 3 control sites. Results show a reduction of 11.3 accidents/year and 29.4 fatalities/year.	SSATP https://www.ssatp.org/en/page/safer-roads
	Traffic calming measures, Zambia	Implementation of several traffic calming measures near schools zones by Zambia Road Safety Trust.	Questionnaire for stakeholders
	40-30 km/h schools zones, Namibia	Implementation of 30 km/h in school zones and shopping areas.	Questionnaire for stakeholders
Capacity building and training	**Atelier de formation en sécurité routière et bonnes pratiques dans le transport**, BRSI-cours in Douala, Cameroon	--	Deliverable_D6.1_SaferAfrica
	Scholarship to attend road safety training abroad, South Africa	--	UNECA

Table A3-5 Synthesis of evidence on vehicle safety interventions presented in Elvik et al. *(2009)*

Safer Vehicles			
Country	**Intervention**	**Accident reduction**	**B/C ratio**
Norway USA	Increase tyre tread depth from 1.6 mm to 3 mm	19%	0.3
Germany USA	Antilock braking systems and disc brakes	1%	0.7
Germany USA	High-mounted stop lamps	14% rear end	4.1
Europe, USA Canada Australia Malaysia	Daytime running lights • for cars • for mopeds and motorcycles	6% 7%	2.5 3.8-7.5
Sweden USA	Improving vehicle headlights • halogen lamps • headlamp washer	7% 5%	9.3 1.0
Norway Sweden Germany USA	Reflective materials • Pedestrian • Bicyclist • Number plates in cars • Protective clothing motorcyclists	85% - 3% 33% - injury	5.3
USA	Steering, suspension and vehicle stability	-	-
Europe Australia USA Canada	Bicycle helmets • Children 7-14 years • Adults	64% to -36% (as per type of injury)	2.5 >1
Europe Australia USA	Motorcycle helmets	25% (injuries)	17.2
Europe Australia USA	Seat belts in cars • Car drivers • Front seat passengers • Rear seat passengers	(fatal injury) 50% 45% 25%	31.7 13.3 1.3
Europe Canada, USA	Child restraints	90% to 24%	1.13
GB, USA	Airbags in cars	60% to -8%	-
USA	Seat belts in buses and trucks	-	0.0
Europe, USA	Vehicle crashworthiness • Collapsible steering columns • Laminated front windshields • Head rests • Door protection	Fatalities 24% to 12% 30% to 9% 25% to -12% 21% to 1%	16.7 30.0 1.4 0.9
Europe, USA	Regulating vehicle mass (weight)	-	-

Safer Vehicles			
Country	**Intervention**	**Accident reduction**	**B/C ratio**
	Regulating automobile engine capacity (motor power) and top speed	-	0.3
Europe Australia	Intelligent speed adaptation (ISA)	36 to 10	3.7-16.7
Europe USA Australia	Regulating engine capacity (motor power) of mopeds and motorcycles	-	-
GB	Under-run guards on heavy vehicles	29%	3.9
Sweden, USA	Safety equipment on heavy vehicles • ABS • Elimination of defects in articulated lorries	12% inj; 21% fat 72%	-
USA Australia	Moped and motorcycle equipment	44% to 2%	-
Europe	Bicycle safety equipment • Distance device (side flag) • lights	7 75% to -9%	2.2 0.1
Europe USA	Safety standards for trailers and caravans	-	-
USA	Fire safety standards	-	-
Europe	Hazardous goods regulations (ADR convention)		-
Japan, USA, Europe	Electronic stability control	46%	4.8
USA	Vehicle safety standards	30%	1.9 – 7.2
Europe USA	Periodic motor vehicle inspections	25% to 2%	1.24
Norway	Roadside vehicle inspections	3.4% to 0.7%	4.2
Norway	Garage regulation and inspections	-	-

Table A3-6 Synthesis of evidence on post-crash response interventions described in Elvik et al. (2009)

Safer Vehicles			
Country	**Intervention**	**Accident reduction**	**B/C ratio**
	Emergency medical services		
	Rescue helicopters		
	Automatic crash notification		

Table A3-7 Synthesis of evidence on vehicle safety interventions presented in the SUPREME European project (2007)

Safer Vehicles			
Country	Intervention	Accident reduction	B/C ratio
	Speed Alert (ISA)	20~28% Fatal	2 .0~3.5
	Electronic Stability Program (ESP)	15~20% Fatal	0.43~4.20
	Blind spot vision: Blind spot mirrors Blind spot cameras		 6.3 1.7
	Reverse safety alert		
	Rear view camera		
	Navigation systems		
	Seatbelt reminders		6.0
	Under run protection		
	Yearly inspections		
	Roadside inspections		
	Maintenance programs		
	Daytime running lights (DRL)	5%~15% All	1.2~7.7
	Contour marking		~1.0
	Alcohol Ignition Interlock (alcolok)	10.0% KSI	0.7~4.10
	ABS	8~10% Fatal	1.11~1.39
	Prevention of illegal adaptations to mopeds, helmet use, moped licensing		
	Bicycle Side Reflection	14% All	>10.
	Bicycle Helmet use		2.1~4.1
	Pedestrian reflectors at night-time		
	Seatbelts on coaches,		
	rollover strength buses, ESP		
	EuroNCAP crash test database		1.31 p/star
	Black box: - Journey data recorders - Accident data recorders		 20:1 6:1

Table A3-8 Synthesis of evidence on vehicle safety interventions presented in ROSEBUD European project (2003)

Safer Vehicles			
Country	**Intervention**	**Cost per fatality reduction**	**B/C ratio**
Switzerl.	Prohibition of the use of external two way communication devices in cars and on motorbikes (e.g. mobile phones, internet, paging etc.).		652.0
Sweden Norway	Crash data recorder		1.11-1.50
Switzerl.	Liability and insurance • Increase of the vehicle liability insurance premium for safety relevant violations of traffic regulations • Change from the legal driver-liability to owner-liability (this change ensures that a punishment takes place, even if the owner does not identify the offending driver)		15.0 340
Europe Switzerl. Switzerl. USA	Daytime running lights on cars (DRL) • Mandatory use of DRL in Europe • Campaign and obligatory rule for lights to be on when vehicles are in motion • Obligatory installation of an automatic light switch on device in new vehicles • Require front rear lights to be on when motorcycle is in motion	$1.1k	1.24-1.80 7.7 5.5
USA Sweden Norway Switzerl.	High mounted and multistage stop lamps • Centre High Mounted Stop Lamps in passenger cars and light trucks • Installation of high mounted stop lamps • Installation of multistage stop lamps in vehicles		3.18 3.89-9.07 3.40
Norway Sweden Norway USA	Pedestrian and bicycle visibility enhancement Improving bicycle conspicuousness Use of reflective devices by pedestrians Pedestrian and bicycle visibility enhancement programs	$73k	>1 5.09-7.58
Netherl. Switzerl.	Truck visibility enhancement • Retro-reflecting contour marking on lorries • Enhancing the visibility of heavy trucks		>1 1.7
Norway Switzerl.	Cycle helmets related campaigns and obligations • Mandatory wearing of bicycle helmets • Obligatory rule to wear bicycle helmets		2.7-6.2 4.8
Switzerl. Norway USA	Mandatory rules addressing motorcyclists • Technical speed limitation of motorcycles to 80 km/h • Mandatory wearing of helmets for moped and motorcycle riders • Mandatory motorcycle helmet laws in the USA	$2k/fat	12.0 17.0
Switzerl.	Smart seat belt systems		0.76

Safer Vehicles			
Country	**Intervention**	**Cost per fatality reduction**	**B/C ratio**
	Airbags		
Australia	• Supplementary airbags for front-seat occupants of passenger cars		
	• Airbags		0.58-1.17
Sweden			0.40-0.66
Norway			
	Child restraint system ISO-Fix in cars		
Switzerl.			0.10
USA		$73k	
	Underrun guard rails on trucks		
Norway	• Front, side and rear underrun guard rails on trucks		>1
Norway	• Improving underrun guard rails on trucks		1.18
Switzerl.	• Comprehensive underrun protection devices for trucks		4.10
	Improvement of car front protection to increase the crash-safety of pedestrians and cyclists		
Netherl.	• Improvement of car front design to increase crash-safety of pedestrians and cyclists		3.0
Switzerl.	• Tightening of the law for front protection devices		150
Sweden	• New safety standards for front and bumper		4.66-6.80
Norway			
USA	Head restraints in light trucks	$12.6k per injury	
	Occupant protection measures for buses		
Australia	• Equipping long-distance coaches with occupant protection measures		1.04-1.56
AustraliaEurope	EEVC dynamic frontal offset standard for car crash tests (ECE Regulation 94)		2.96-5.76
AustraliaEurope	New ECE dynamic side-impact standard for cars crash tests (ECE Regulation 95)		1.06
	Intelligent speed adaptation (ISA)		
UK	• Voluntary ISA		5.00
UK	• Mandatory ISA		16.7
Sweden	• Intelligent speed adaptation devices		1.37
Switzerl.	Measures to prevent blind spot accidents with trucks		1.4
	Motor vehicle inspections		
USA	• Compulsory annual motor vehicle inspection in the USA	$20k	
USA	• Periodic inspection of motor vehicle sample focusing on critical components in the USA	$390k	
USA	• Periodic motor vehicle inspection in the USA	$57k	
	Roadside inspections of trucks		
Sweden			1.24
Norway			9.50-10.13

Note: $1k = $1000

Table A3-9 Synthesis of evidence on vehicle safety interventions

Safer Vehicles			
Country		**Intervention**	**Evidence**
Norway, USA		Vehicle safety standards	Elvik, et al. - Handbook of road safety measures
New Zealand, Norway, Sweden, USA		Periodic vehicle inspection	Elvik, et al. - Handbook of road safety measures
Argentina, Brazil, Chile, Mexico		UN standards for vehicles	UN : Global Plan for the Decade of Action for Road Safety TRL: The potential for vehicle safety standards to prevent deaths and injuries in Latin America
Turkey (Denmark, Germany, Greece, Spain, France, Ireland, Italy, Czech Republic, Estonia, Lithuania, Hungary, Slovenia)		Periodical Inspection of vehicles	Project Autofore: http://citainsp.org/wp-content/uploads/2016/01/Autofore_Final_report_without_links.pdf Autofore_WP700 Supreme - Handbook of RSM
UK		Introduction of EuroNCAP star rating in 1997	TRL: The potential for vehicle safety standards to prevent deaths and injuries in Latin America Broughton et al, 2000
		Seat belt reminders	Supreme project - Thematic Report on Vehicles
		ABS in motorcycles	Supreme project - Thematic Report on Vehicles
		Helmet use in motorcycles	Supreme project - Thematic Report on Vehicles
		Bicycle Side Reflection	Supreme project - Thematic Report on Vehicles
Sweden, UK, USA		Under-run guards on heavy vehicles	Elvik, et al. - Handbook of road safety measures
		• Introducing incentives for importation of safer vehicles	Recommendations-mid-term-ARSAP-review WHO (2011). Global Plan for the Decade of Action for Road Safety 2011-2020, World Health Organisation.

Safer Vehicles			
Country		Intervention	Evidence
Kenya		• Mandatory motor vehicle inspection for public service vehicles (this is however not a requirement for privately owned vehicles) • By law, all passengers are obliged to wear their seatbelt in all vehicles in Kenya. This is however very poorly enforced • All motorbikes and their passengers have to wear a helmet and reflector jacket for the duration of the ride. This has not been strictly enforced though. It is further hampered by the flooding of sub-standard helmets in the market that offer little to no protection.	Questionnaire WP4
Tanzania		• By law, vehicles in Tanzania are required to undergo a motor vehicle fire safety inspection. It is however not clear if this is a requirement for all vehicles or only public service vehicles. The motor vehicle fire safety inspection is done on annually.	Questionnaire WP4
		• Regulation on dangerous goods transportation • Incentives for Importation of safer vehicles • Strengthened enforcement of standards • Motor vehicle standards • Mandatory & enforced vehicle inspection	WHO. Summary Recommendations MidTermReview

Table A3-10 Synthesis of evidence on safety interventions directed to road users (Africa)

Safer Road Users			
	Country	Action	Evidence
Educate general public	Benin, Botswana, Côte d'Ivoire, Ghana, Malawi, Mozambique, Namibia, Senegal, Tanzania, and Zambia	Road safety in schools	https://www.childhealthinitiative.org/blog/2017/april/african-schools-safe-infrastructure-campaign-gets-underway http://injuryprevention.bmj.com/content/early/2018/05/19/injuryprev-2018-042786.full
	Botswana	Truck drivers "Fatigue Management and Road Safety"	http://www.swhap.org/news/scania-driver-competition-kenya/
	Burkina Faso[2]	Road safety in schools	Organisme National de Sécurité Routière (ONASER)
	Burkina Faso[2]	Educate rural population	Organisme National de Sécurité Routière (ONASER)

Safer Road Users			
	Country	Action	Evidence
	Cameroon	General campaigns	Capacity Review Inception Report
	Congo	General campaigns	https://monusco.unmissions.org/en/road-safety-campaign-reduce-traffic-accidents-and-improve-image-monusco-drc
	Gambia	UK Partnership with Staff Association of the National Roads Authority	http://thepoint.gm/africa/gambia/article/uk-embassy-funds-road-awareness-project
	Guinea[3]	Road safety awareness - Facebook	https://translate.google.co.uk/translate?hl=en&sl=fr&u=https://b-m.facebook.com/OBSERMU/&prev=search
	Senegal	Using Football stars for promoting RS	http://www.youthforroadsafety.org/news-blog/news-blog-item/t/senegalese_football_stars_support_decade_of_action_for_road_safety
	South Africa	NGO campaigning e.g. Safe Journeys comics for the kids	https://www.shell.com/sustainability/safety/transport-safety/community-road-safety.html
Speeding	Benin[1]	Campaign	Activities in cadre de YELLOW MAY (Global Alliance of NGOs for Road Safety)
	Botswana	Campaign / awareness	https://www.fiafoundation.org/blog/2017/may/auto-clubs-and-ngos-lead-slowdown-advocacy-for-un-week?mode=pad%2Cpad&rnd=130831667410000000%2C130831667410000000
	Burkina Faso[2]	Campaign?	Ministère de Transport
	Cameroon	?	Capacity Review Inception Report
	Congo	Campaign?	https://monusco.unmissions.org/en/road-safety-campaign-reduce-traffic-accidents-and-improve-image-monusco-drc
	Guinea[3]	Campaign?	African day of road safety and World Day of Remembrance (WDR) (obsermu.gn@gmail.com)
Seatbelts	Benin[1]	Campaign	Centre National de Sécurité Routière (CNSR) Annual Plan (PTA) in collaboration with NGOs
	Burkina Faso[2]	Campaign?	Ministère de Transport
	Guinea[3]	Campaign?	African day of road safety and World Day of Remembrance (WDR) (obsermu.gn@gmail.com)

Safer Road Users			
	Country	Action	Evidence
Drink/drug driving	Benin[1]	Campaign	Centre National de Sécurité Routière (CNSR) Annual Plan (PTA) in collaboration with NGOs
	Burkina Faso[2]	Campaign?	Ministere de Transport
	Guinea[3]	Campaign?	African day of road safety and World Day of Remembrance (WDR) (obsermu.gn@gmail.com)
Mobile phone	Benin[1]	Campaign	Centre National de Sécurité Routière (CNSR) Annual Plan (PTA) in collaboration with NGOs
	Burkina Faso[2]	Campaign?	Ministère de Transport
	Guinea[3]	Campaign?	African day of road safety and World Day of Remembrance (WDR) (obsermu.gn@gmail.com)
Helmets	Kenya	Campaign	http://www.who.int/violence_injury_prevention/media/news/2012/02_11/en/ https://www.the-star.co.ke/news/2016/08/24/ntsa-introduce-regulations-for-bodaboda-operators_c1408944
	Benin[1]	Campaign	Centre National de Sécurité Routière (CNSR) Annual Plan (PTA) in collaboration with NGOs
	Guinea[3]	Campaign?	African day of road safety and World Day of Remembrance (WDR) (obsermu.gn@gmail.com)
	Burkina Faso[2], Mali	Promote helmet use among workers – Nestle Commits	https://www.nestle-cwa.com/en/media/pressreleases/nestl-mali-and-its-partners-commit-to-road-safety-for-their-employees
	Uganda	Promote helmet use	https://www.fiafoundation.org/our-work/road-safety-fund/projects/promoting-helmet-vaccines http://www.who.int/roadsafety/events/2012/unrsc_15_appendix_11_greig.pdf http://aip-foundation.org/news/uhvi-project-wraps-up-after-two-successful-years/

1Questionnaire from Tedji Myheournou Huguette
2Questionnaire from Zoreingre Ousamane
3Questionnaire Mamoudou Keita (asked for validation and examples from Thiery)

Table A3-11 Synthesis of evidence on safety interventions directed to road users (Europe)

Safer Road Users				
Topic	**Source**	**Link or equivalent**	**Summary**	**Coding possible?**
Use of helmets				
Appropriate Helmet law	Servadei et al. Effect of Italy's motorcycle helmet law on traumatic brain injuries.	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1731012/pdf/v009p00257.pdf	Study which evaluates the impact of a revised mandatory Italian motorcycle-moped-scooter helmet law on crash brain injuries. A change in the helmet use law in Italy, which made compulsory the "use of an approved helmet …for all motorbike, motorcycle and mopeds drivers, and their passengers, independent of their age", whereas previously, the law "required the use of helmets for all individuals only for motorcycles drivers whereas mopeds drivers had to wear a helmet only when less than 18 years of age". The revised law led to an increase in helmet use for motorcycle and moped users use 19.5% to 97.5% in the Romagna Region (based on survey data). Traumatic Brain Injuries due to motorcycle and moped crashes reduced by 76% after the law was revised (from 7 admissions per 100000 population per year to 2 admissions)	Yes
	Ferrando et al. Impact of a helmet law on two wheel motor vehicle crash mortality in a southern European urban area.	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1730647/pdf/v006p00184.pdf	This study evaluated the effect of a change in the motorcycle helmet law in Spain introduced in 1992 on fatal motorcycle crash injury rates. The change in law extended the compulsory use of motorcycle helmets for occupants of all two wheeled motor vehicles from highways only to urban areas as well. A decrease in motorcycle fatalities of 25% was found in the 3 years after the law was changed.	Yes
Use of seatbelts				

Safer Road Users				
Topic	**Source**	**Link or equivalent**	**Summary**	**Coding possible?**
Compulsory seat belt wearing	EU project GADGET (Guarding Automobile Drivers through Guidance, Education and Technology)	Referenced in the SUPREME final report Part F6 Thematic Report: Enforcement	WP5 of this project dealt with Legal measures including enforcement. Seat belt use was one of four important areas identified in the project. The project identified a number of deficiencies and bottlenecks in the national enforcement systems. Generally it appears that it's an overview of the laws and policing methods across countries and doesn't include an evaluation of effectiveness.	No
	EU project ESCAPE (Enhanced Safety Coming from Appropriate Police Enforcement)	Referenced in the SUPREME final report Part F6 Thematic Report: Enforcement, but report sourced from https://trimis.ec.europa.eu/sites/default/files/project/documents/20040909_144405_72910_escape.pdf	The report contains a section called 'EFFECTS OF TRAFFIC LAW ENFORCEMENT ON DRIVER BEHAVIOUR' which includes a sub-section on seatbelt use, where a study in the USA compared states with primary enforcement laws for seatbelt use and those with secondary enforcement laws, and found seatbelt use rates were higher in states with primary enforcement laws (Campbell, 1988 - https://www.sciencedirect.com/science/article/pii/0022437588900199)	Possible
	EU project PEPPER (Police Enforcement Policy and Programmes on European Roads). Deliverable 9 (Good practice in the selected key areas: Speeding, drink driving and seat belt wearing: Results from meta-analysis)	Referenced in the SUPREME final report Part F6 Thematic Report: Enforcement, but report sourced from http://www.vtt.fi/files/sites/pepper/pepper_d9_wp4.pdf	This report contains a systematic review of evaluation studies on seatbelt use by applying meta-analyses to assess the best estimates of the effects on behaviour (i.e. seatbelt wearing). Overall, the effect of seatbelt enforcement on seatbelt use was a 21% increase during the enforcement periods and 15% increase after the enforcement period (both significant).	Yes

Safer Road Users				
Topic	Source	Link or equivalent	Summary	Coding possible ?
	SUPREME final report Part F6 Thematic Report: Enforcement	https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects_sources/supreme_f6_thematic_report_enforcement.pdf See table on page 21 and Annex 2	In the SUPREME report, evaluation studies are referenced where there was data which showed clear positive effects on behaviour and accidents (1 study related to obligatory wearing of seat belts, education and information campaigns).	Possibly
Drink-driving and driving under the influence of other drugs				
Targets for enforcement of drink driving	EU project GADGET (Guarding Automobile Drivers through Guidance, Education and Technology)	Referenced in the SUPREME final report Part F6 Thematic Report: Enforcement	WP5 of this project dealt with legal measures including enforcement. Alcohol was one of four important areas identified in the project. The project identified a number of deficiencies and bottlenecks in the national enforcement systems. Generally it appears that it's an overview of the laws and policing methods across countries and doesn't include an evaluation of effectiveness.	No
	EU project ESCAPE (Enhanced Safety Coming from Appropriate Police Enforcement)	Referenced in the SUPREME final report Part F6 Thematic Report: Enforcement, but report sourced from https://trimis.ec.europa.eu/sites/default/files/project/documents/20040909_144405_72910_escape.pdf	The report contains a section called 'EFFECTS OF TRAFFIC LAW ENFORCEMENT ON DRIVER BEHAVIOUR' which includes a sub-section on alcohol, including figures for 4 countries across Europe showing the positive effects of introducing and implementing further developments in breath testing on accident numbers (Finland – original report not found; Netherlands - https://www.swov.nl/sites/default/files/publicaties/rapport/d-96-19.pdf ; Sweden and Norway – original report not found).	Possible

Safer Road Users				
Topic	Source	Link or equivalent	Summary	Coding possible ?
	EU project PEPPER (Police Enforcement Policy and Programmes on European Roads). Deliverable 9 (Good practice in the selected key areas: Speeding, drink driving and seat belt wearing: Results from meta-analysis)	Referenced in the SUPREME final report Part F6 Thematic Report: Enforcement, but report sourced from http://www.vtt.fi/files/sites/pepper/pepper_d9_wp4.pdf	This report contains a systematic review of evaluation studies on drink driving by applying meta-analyses to assess the best estimates of the effects on accidents and behaviour. The effect of drink driving enforcement (patrolling) on accidents was an 8% reduction. For DUI checkpoints, it was 15% (both significant).	Yes
	SUPREME final report Part F6 Thematic Report: Enforcement	https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects_sources/supreme_f6_thematic_report_enforcement.pdf See table on page 21 and Annex 2	In the SUPREME report, evaluation studies are referenced where there was data which showed clear positive effects on behaviour and accidents (5 studies related to random breath testing)	Possibly
Rules on Alcohol and other drugs				
Speeding				
Speed limit regulation	EU project GADGET (Guarding Automobile Drivers through Guidance, Education and Technology)	Referenced in the SUPREME final report Part F6 Thematic Report: Enforcement	WP5 of this project dealt with legal measures including enforcement. Speeding was one of four important areas identified in the project. The project identified a number of deficiencies and bottlenecks in the national enforcement systems. Generally it appears that it's an overview of the laws and policing methods across countries and doesn't include an evaluation of effectiveness.	No

Safer Road Users				
Topic	Source	Link or equivalent	Summary	Coding possible ?
	EU project ESCAPE (Enhanced Safety Coming from Appropriate Police Enforcement)	Referenced in the SUPREME final report Part F6 Thematic Report: Enforcement, but report sourced from https://trimis.ec.europa.eu/sites/default/files/project/documents/20040909_144405_72910_escape.pdf	The report contains a section called 'EFFECTS OF TRAFFIC LAW ENFORCEMENT ON DRIVER BEHAVIOUR' which includes a sub-section on speed, which concludes that many reports show a reduction in speeds near speed surveillance sites, but these speeds start increasing again once away from these sites.	No
	EU project PEPPER (Police Enforcement Policy and Programmes on European Roads). Deliverable 9 (Good practice in the selected key areas: Speeding, drink driving and seat belt wearing: Results from meta-analysis)	Referenced in the SUPREME final report Part F6 Thematic Report: Enforcement, but report sourced from http://www.vtt.fi/files/sites/pepper/pepper_d9_wp4.pdf	This report contains a systematic review of evaluation studies on speed by applying meta-analyses to assess the best estimates of the effects on accidents and behaviour. Overall, the effect of speed enforcement on accident was an 18% reduction. For permanent speed cameras only, it was significant at 34%, with the reduction being a non-significant 11% for manual speed enforcement methods.	Yes
	EU ROSEBUD project	Referenced in the SUPREME final report Part F6 Thematic Report: Enforcement, but report sourced from: https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects_sources/rosebud_wp1_report_inventory.pdf	ROSEBUD includes examples of many studies/campaigns where their impacts have been evaluated or estimated (6 evaluated, the rest have been estimated). For speed enforcement, it includes an evaluation of 'randomly scheduled low level police enforcement in Australia' (no.43, page 52)	Possibly
	SUPREME final report Part F6 Thematic Report: Enforcement	https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects_sources/supreme_f6_thematic_report_enforcement.pdf See table on page 21 and Annex 2	In the SUPREME report, evaluation studies are referenced where there was data which showed clear positive effects on behaviour and accidents (8 studies related to fixed speed cameras, mobile speed cameras and section speed control)	Possibly

Safer Road Users				
Topic	**Source**	**Link or equivalent**	**Summary**	**Coding possible?**
Educate general public (road users)				
Education in general	ROSE25 project (Inventory and compiling of a European good practice guide on road safety education targeted at young people)	Good Practice Guide on Road Safety Education https://www.ssatp.org/sites/ssatp/files/pdfs/Topics/RoadSafety/Good_practice_guide_road%2520_safety_education%5B1%5D.pdf	This report mentions and summarises good practice education campaigns but doesn't provide data (possibly in another report from the project but I can't find any others)	No
	SUPREME final report Part F1 Thematic Report: Education and Campaigns	https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects_sources/supreme_f1_thematic_report_education_and_campaigns.pdf	This report mentions campaigns such as: 'Speak Out!' (Norway) which encourages young people who are passengers in cars to speak out if the driver is driving unsafe; 'Goochem the Armadillo' (Netherlands) a public awareness raising campaigns on the use of seatbelts and child restraint systems; 'Bob' (Belgium) an anti-drinking-driving campaign; and 'The Sign of Light' (Latvia) a campaign for the safety of pedestrians walking in the dark. Some basic data to quantify the impact here.	Possibly ?

Safer Road Users				
Topic	**Source**	**Link or equivalent**	**Summary**	**Coding possible?**
Strengthen driver's training, testing and licensing	SUPREME final report Part F2 Thematic Report: Driver Education Training Licence	https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects_sources/supreme_f2_thematic_report_driver_education_training_licensing.pdf	This report investigates a number of measures for potential best practice in the field of driver training, testing and licensing. A total of 27 measures from 16 European countries were submitted for consideration as potential best practice measures, of which none were considered 'best practice' after evaluation, but 3 were considered 'good practice'. These were (i) the Swedish measure of 'lowering the minimum age for learning drive to 16'; (ii) the Danish initial driver training programme and (iii) the Swedish 'Safety Hall' approach. Two of these studies were reported in 'Accident Analysis and Prevention' so it may be possible to obtain more data from these to quantify the impact.	Possibly?
Include RS in school curricula				
Establish/Strengthen RS clubs				
Road safety campaigning	EU ROSEBUD project	Referenced in the SUPREME final report Part F6 Thematic Report: Enforcement, but report sourced from: https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects_sources/rosebud_wp1_report_inventory.pdf	ROSEBUD includes examples of many studies/campaigns where their impacts have been evaluated or estimated (6 evaluated, the rest have been estimated). For campaigning, it includes an evaluation from a 'road safety campaign against drinking and driving in Germany' (no.1, page 24)	Possibly

Safer Road Users				
Topic	Source	Link or equivalent	Summary	Coding possible ?
	EU ROSEBUD project	Referenced in the SUPREME final report Part F6 Thematic Report: Enforcement, but report sourced from: https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects_sources/rosebud_wp1_report_inventory.pdf	ROSEBUD includes examples of many studies/campaigns where their impacts have been evaluated or estimated (6 evaluated, the rest have been estimated). For campaigning, it also includes an evaluation of 'road safety tv advertising supporting increased police enforcement in Australia (no. 62, page 69)	Possibly
	PIARC: Best Practices for Road Safety Campaigns	https://www.piarc.org/ressources/publications/7/18286,2012R28-EN.pdf	THINK campaign, UK Road Safety Campaigns, Page 23 'Road Crew' Campaign, USA, Page 24 (avoiding drink driving)	Possibly
Use of child restraints Campaigns for m/cycle helmet use	EU ROSEBUD project	Referenced in the SUPREME final report Part F6 Thematic Report: Enforcement, but report sourced from: https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects_sources/rosebud_wp1_report_inventory.pdf	ROSEBUD includes examples of many studies/campaigns where their impacts have been evaluated or estimated (6 evaluated, the rest have been estimated). For helmet use, it includes an evaluation from a 'campaign to increase the wearing of cycle helmets in Goteborg…….' (no. 5, page 26)	Possibly

Table A3-12 Synthesis of evidence on post-crash response interventions

Post-Crash Response			
	Country	**Action**	**Evidence**
Improved emergency care	Europe	First Aid courses connected to driver education	Supreme project - Thematic Report: Post Accident Care SafetyCube project
	South Africa, Ghana, Uganda	Emergency First Aid Responder System (EFAR)	http://dx.doi.org/10.1136/emermed-2011-200271 http://dx.doi.org/10.1136/emermed-2011-200619 http://dx.doi.org/10.1016/j.jss.2014.03.029 https://doi.org/10.1016/j.iatssr.2017.01.001
		Emergency medical services (Pre-hospital times; first aid by lay persons; accident scene strategies - advance life support vs basic life support)	Elvik et al. Handbook of RSM
	Europe	Two-tier emergency care system / Mobile Intensive Care Unit	Supreme project - Thematic Report: Post Accident Care
	Europe	Support network for traffic victims	Supreme project - Thematic Report: Post Accident Care
	Europe	Incident management	Supreme project - Thematic Report: Post Accident Care
	Europe	Extraction from vehicle	SafetyCube
	Europe	First aid training	SafetyCube
	Africa	• Getting the injured to quality care • Health-care staff must be trained in emergency care	Who. Road_Safety_in the African Region. 2015
	Kenya	• Emergency access number 999. Since it has not always worked in the past, Kenyans still do not automatically resort to dialling it in the event of emergencies. • The Kenya National Hospital Insurance Fund (NHIF) is the oldest government insurance scheme in Africa. NHIF membership is compulsory for all salaried employees. From June 2017, NHIF members are able to access emergency ambulance services following a partnership between the insurer and the Kenya Red Cross Society	Questionnaire WP4
		Automatic crash notification	Elvik et al. Handbook of RSM

Post-Crash Response			
	Country	Action	Evidence
		Quality improvement (QI) programs as an integral part of well-developed trauma systems.	Juillard C. et al. - Establishing the evidence base for trauma quality improvement: a collaborative WHO-IATSIC review. DOI: 10.1007/s00268-009-9959-8
	Sub-Saharan countries	Transport by ambulance Access to emergency telephone services Emergency training of doctors Emergency training of nurses	Wonmongo Lacina Soro a,, Didier Wayorob. A Bayesian analysis of the impact of post-crash care on road mortality in Sub-Saharan African countries. https://doi.org/10.1016/j.iatssr.2017.01.001
	Latin America city	• Increase in the number of sites of ambulance dispatch from two to four • Introduction of the Prehospital Trauma Life Support (PHTLS) course.	Low-cost improvements in prehospital trauma care in a Latin American city. DOI: 10.1097/00005373-200001000-00020
	Africa	Commercial drivers were trained using a 6-hour basic first aid course	Improvements in prehospital trauma care in an African country with no formal emergency medical services.
	Uganda	Lay First- Responders	First Things First: Effectiveness and Scalability of a Basic Prehospital Trauma Care Program for Lay First-Responders in Kampala, Uganda
	Sierra Leone, Mexico	Emergency medical care	Emergency medical care in developing countries: is it worthwhile?
	Ghana, Cambodja, Iran, Nepal, South Africa, Uganda	Layperson trauma training	Layperson trauma training in low- and middle-income countries: a review
	Uganda	Trauma team training	Trauma team training course: evaluation of Ugandan implementation
	USA	Trauma management	An 8% reduction in mortality for those states with systems for trauma management. In: The effect of organised systems of trauma care on motor vehicle crash mortality.

Appendix 4: Abridged description template for good practice examples of road safety interventions

Benchmarking of Road Safety Good Practice in Africa

Name of your Organisation: ***Les Ambassadeurs de la Sécurité Routière***

Country: __________TUNISIA____________________________________

Please give an example of a good and/or successful Road Safety Campaign/intervention that was/is being implemented in your country

1	Name/description of road safety intervention/campaign	*"Attachez Vous à la Vie…Attachez Votre Ceinture »* « Attach to life…Fasten your Seatbelt »
2	Place of implementation (e.g. Nairobi) Is it an urban, rural or mixed area?	Tunis Urban area
3	Year of implementation (e.g. 2015)	2016
4	Which road users were targeted by the intervention	All category of Road users
5	What was/is the impact of the intervention?	Positive impact! the enforcement of the law related to the mandatory of the seatbelt FOR THE FRONT SEATS IN URBAN AREAS After Hard Work!! Finally, the decree concerning the obligation of wearing the belt in urban areas for passengers in the front and rear seats is finally published and will be applicable from 27 TH of April 201 After Hard Work!! Finally, the decree concerning the obligation of wearing the belt in urban areas for passengers in the front and rear seats is finally published and will be applicable from 27th of April 2017 the decree related to the mandatory of wearing Seatbelt for front passengers was published end enforced on 27 Of April 2018 In just one year from 27 April 2017 To 27 April 2018 we registered: - 635 Traffic Crashes/- 128 Deaths/ - 1031 Injured -8,86% / - 8,81 % / - 9, 45% And we saved many lives and families Thx to this advocacy campaign !!

6	Was/is the intervention sustainable? If yes please state how	Yes it is sustainable because we continue our intervention so that the belt is mandatory to back seats in urban areas and more road users are involved and reinforce our actions and the government has become responsive to our messages and requests
7	Why was the intervention successful?	Because we involved all the stakeholders Ngo's /PUBLIC AND PRIVATE SECTOR
8	If it failed mid-way through, what caused the failure?	
9	Which of the 5 road safety pillars did the intervention address?	Road Safety Behaviour
10	Please attach/provide a link to reports/documentation of the road safety intervention	http://roadsafetyngos.org/sh_team/afef-ben-ghenia-les-ambassadeurs-de-la-securite-routiere-tunisia/ https://www.lecourrierdelatlas.com/tunisie-le-port-de-la-ceinture-de-securite-bientot-obligatoire-en-tunisie--7009 http://www.lepoint.fr/automobile/actualites/en-tunisie-la-ceinture-de-securite-pourrait-devenir-obligatoire-20-12-2016-2091899_683.php http://www.businessnews.com.tn/vers-une-loi-sur-le-port-obligatoire-de-la-ceinture-de-securite,520,69107,3 For All the TV Coverage click: https://www.youtube.com/watch?v=YYYpmnfU_sU https://www.facebook.com/ambassadeurs.securiteroutiere/videos/1131462936959120/ https://www.facebook.com/pg/ambassadeurs.securiteroutiere/videos/?ref=page_internal

Name of your Organisation: Zambia Road Safety Trust

Country: Zambia

Please give an example of a good and/or successful Road Safety Campaign/intervention that was/is being implemented in your country

1	Name/description of road safety intervention/campaign	**Child Road Safety Education & reducing speed in School ZONES in Zambia**
2	Place of implementation (e.g. Nairobi) Is it an urban, rural or mixed area?	Lusaka Urban
3	Year of implementation (e.g. 2015)	2015- 2018
4	Which road users were targeted by the intervention	Child Pedestrians (Vulnerable Road Users)
5	What was/is the impact of the intervention?	A significant 20 percent reduction in Child fatalities and injuries in within a three year campaign – 2015 – 2017.
6	Was/is the intervention sustainable? If yes please state how	Yes, reaching over 70, 000 children, with clear positive results. Implemented speed reduction initiatives at 2 high risk schools. We demonstrated to Government how we can save lives and it works with little resources. Government with other private sector players have continued to support the intervention
7	Why was the intervention successful?	It's visible, evaluated, and demonstrated positive results
8	If it failed mid-way through, what caused the failure?	Nil
9	Which of the 5 road safety pillars did the intervention address?	Safer Road Users
10	Please attach/provide a link to reports/documentation of the road safety intervention	See attachment

Appendix 5: Characteristics template for good practice examples of road safety interventions

Table A5-1 BRON and Correction for underreporting of road traffic fatalities, Netherlands

GENERAL DESCRIPTION										
Designation	BRON and Correction for underreporting of road traffic fatalities, Netherlands									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main	x									
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main							X			
Secondary										
Description	All road traffic crashes in the Netherlands that are recorded by the police in reports or registration sets are included in the national road crash register BRON. The registration is compiled by the Centre for Transport and Navigation (DVS) which is part of the Ministry of Infrastructure and the Environment. BRON contains a large number of characteristics of the crash, drivers and casualties involved. The crash location is linked to the National Roads Register (NWB). Vehicle information is added using the vehicle registration as a basis. BRON contains 90% of fatal crashes. For crashes of lesser severity the registration is less complete. In order to correct for underreporting, comparison or linking with other sources makes it possible to estimate the real numbers of accidents. The estimation of the real number of traffic fatalities is made by the Dutch Central Bureau for Statistics (CBS), comparing three data sources: • crash registration by the police; • court files on unnatural deaths; • files on causes of death from municipal population records. These three data sources are compared by linking date of birth, date of death, type of unnatural death (suicide, traffic crash, etc.), municipality of death, and gender. The data are stored and can be obtained at CBS. Data can be disaggregated to age group, gender, region, modality, day of the week and month. CBS is responsible for overall data management and for collecting and linking the court and municipality data. The Transport Research Centre of the Ministry of Transport (AVV) is responsible for collecting the police records. CBS and AVV work together to arrive at the final database. The reporting rate of the real number of traffic fatalities is very high: 99.4 % (data for 2004). The individual reporting rates were 90 % (police records), 88 % (court data) and 95 % (municipality records). The costs are not exactly known, but assumed to be rather low (a few person months a year), because existing databases can be used (data sources: SUPREME, 2007). Concerning injured road accidents, the Institute for Road Safety Research (SWOV) supplements the BRON data with data from the National Basic Register Hospital Care (LBZ); this allows more reliable information to be produced about the real severity of injuries sustained in traffic crashes. The identification of matching cases is possible by making use of six variables: date/time of crash / hospital admittance, date of birth, gender, region of hospital, severity in police record (killed, not on the spot, hospitalized, A&E treated), external cause of injury in hospital record.									
Duration										

Application	Long lasting
Effects	The reporting rate of the real number of traffic fatalities, based on the combined three data sources, was very high: 99.4 % for 2004. The individual reporting rates were 90 % (police records), 88 % (court data) and 95 % (municipality records)
Scope of application	
Local	
Area wide	
Country	Netherlands
Regional	
Countries with existing experience or practice	
References	SUPREME project
FOCUS	
Types of accident	
All accidents	x
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	
Truck driver	
Motorcyclist	
Cyclist	
Pedestrian	
Novice driver	

Old driver	
Children	
Passenger	
Other	all
Location	
Urban	Not mentioned
Interurban	Not mentioned
Mixed	Not mentioned
Vehicle category	
car	
van	
bus	
truck	
motorcycle	
bicycle	
non-traditional	
other	all
Accident phase (Haddon's)	
Pre-crash	
Crash	
Post-crash	
Direct incidence	
Road crashes	
Driving/road using behaviour	
Active mechanism	
Description	These three data sources are compared by linking date of birth, date of death, type of unnatural death (suicide, traffic crash, etc.), municipality of death, and gender. The data are stored and can be obtained at CBS. Data can be disaggregated to age group, gender, region, modality, day of the week and month.

Incidence of mechanism (ERST)	
Exposure	
Risk	
Severity	
Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	x
% of injury accidents	
% of fatalities	
% of serious injuries	
Comments	
TYPE OF EXPECTED EFFECTS	
Direct effects	
on accidents (total)	x
on injury accidents	
on fatalities	
on serious injuries	
Collateral effects	
Exposure	
Risk	
Severity	
Trauma recovery	
Non-safety related effects	
Related to the UN's sustainable development agenda	Not mentioned
ASSESSED REPORTED RESULTS	

	Estimate	Confidence interval	
on accidents (total)			

on injury accidents on fatalities on serious injuries				
Type of assessment Individual Meta-analysis				
COSTS				
Who bears the cost				
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-			
Infrastructure Maintenance - Labour	-			
Infrastructure Maintenance - Equipment	-			
Administrative				
Social				
Environment	-			
Amount				
Cost-Benefit	The costs are not exactly known, but assumed to be rather low (a few person months a year), because existing databases are used.			
ACCEPTANCE				
Road users (by class) Drivers Passengers				
General public				
Other stakeholders Road administrations (infrastructure)	Transport Research Centre of the Ministry of Transport (AVV)			

Road operators (traffic management)	
Health care institutions & practitioners	
Public administration	
Insurance companies	
Enforcement (Police)	
Enforcement (Judicial system / legal institutions)	
Research / Academia	
Communities	
Drivers' clubs	
Road safety NGO's	
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	
SUSTAINABILITY	
Feasibility	
Pre-conditions	
Requirements	
Factors contributing for effectiveness	
Factors hindering implementation or management	Not mentioned
Potential for combination with other R. S. Interventions	

Table A5-2 The hierarchical mono-functional road network, Netherlands

GENERAL DESCRIPTION										
Designation	The hierarchical mono-functional road network in the Netherlands									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main			x							
Secondary							x			
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing &licensing**	**3 Rehabilitation &diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main					x					
Secondary										
Description	As a first practical result of the Sustainable Safety Vision, all Dutch road authorities re-categorised their roads into one of three road categories, each with its own and exclusive function: through roads for long distance travel, access roads for opening up residential areas and rural settlements, and distributor roads connecting the former two road types. On access roads motorised vehicles and vulnerable road users have to interact; therefore, vehicle speeds must be low: 30 km/h in built-up areas, 60 km/h in rural areas. On through roads, with grade separated intersections and physical separation of opposing traffic streams and no access for slow moving traffic, speed limits are 100 or 120 km/h. On the sections of distributor roads, separated pedestrian and bicycle facilities allow vehicle speeds of 50 km/h in urban areas and 80 km/h in rural areas. At intersections on distributor roads, slow and fast moving traffic have to merge again, so speeds must be reduced, e.g. by a roundabout. Each road category must be clearly recognisable by typical road design characteristics and road markings.									
Duration										
Application	Not mentioned									
Effects	Long lasting									
Scope of application										
Local										
Area wide										
Country	Netherlands									
Regional										
Countries with existing experience or practice										
References	Handbook for measures at the country level Supreme project									

	https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects_sources/supreme-c_en.pdf
FOCUS	
Types of accident	
All accidents	
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	x
Truck driver	x
Motorcyclist	x
Cyclist	x
Pedestrian	x
Novice driver	
Old driver	
Children	
Passenger	
Other	
Location	
Urban	
Interurban	
Mixed	X
Vehicle category	
car	x

van	x
bus	x
truck	x
motorcycle	x
bicycle	
non-traditional	
other	
Accident phase (Haddon's)	
Pre-crash	x
Crash	
Post-crash	
Direct incidence	
Road crashes	x
Driving/road using behaviour	x
Active mechanism	Categorising the road network is a prerequisite for (re)designing roads in such a way that they reflect their function and elicit the desirable traffic behaviour. This increases the consistency and predictability of the road network and thereby reduces possibilities for human error and increases safety.
Description	
Incidence of mechanism (ERST)	
Exposure	
Risk	
Severity	
Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	Not mentioned
% of injury accidents	Not mentioned
% of fatalities	Not mentioned

% of serious injuries	Not mentioned			
Comments				
TYPE OF EXPECTED EFFECTS				
Direct effects				
on accidents (total)	Unknown			
on injury accidents	Unknown			
on fatalities	Unknown			
on serious injuries	Unknown			
Collateral effects				
Exposure				
Risk				
Severity				
Trauma recovery				
Non-safety related effects				
Related to the UN's sustainable development agenda	Not mentioned			
ASSESSED REPORTED RESULTS				
	Estimate	**Confidence interval**		
on accidents (total)				
on injury accidents				
on fatalities				
on serious injuries				
Type of assessment				
Individual				
Meta-analysis				
COSTS				
Who bears the cost	Not mentioned			

Low-cost infrastructure	-
Infrastructure investment - Labour	-
Infrastructure investment - Equipment	-
Infrastructure Maintenance - Labour	-
Infrastructure Maintenance - Equipment	-
Administrative	-
Social	-
Environment	-
Amount	-
Cost-Benefit	
ACCEPTANCE	
Road users (by class)	
Drivers	Not mentioned
Passengers	Not mentioned
General public	
Other stakeholders	
Road administrations (infrastructure)	
Road operators (traffic management)	
Health care institutions & practitioners	
Public administration	
Insurance companies	
Enforcement (Police)	
Enforcement (Judicial system / legal institutions)	
Research / Academia	
Communities	
Drivers' clubs	

Road safety NGO's	
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	Regional road authorities, local road authorities and neighbouring regional road authorities
SUSTAINABILITY	
Feasibility	
Pre-conditions	
Requirements	
Factors contributing for effectiveness	Good social acceptance
Factors hindering implementation or management	Not mentioned
Potential for combination with other R. S. Interventions	

Table A5-3 Be-Safe – Belarusian Road Safety Network

GENERAL DESCRIPTION										
Designation	Be-Safe – Belarusian Road Safety Network									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main	x									
Secondary			x							
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing &licensing**	**3 Rehabilitation &diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main								X		
Secondary										
Description	Developing of 2 master courses on road safety according to the Bologna Process standard (60 ECTS): one for engineering faculties and one for economic faculties.									
Duration										
Application	2014-2017									
Effects	Long lasting									
Scope of application										
Local										
Area wide										
Country	Belarus									
Regional										
Countries with existing experience or practice	Netherlands, Uk, Belgium, France, Sweden and others									
References	Deliverable_D6.1_SaferAfrica Be-Safe, Belarusian Road Safety Network, Deliverable 1.3: Curriculum of the 1st level University Master on Road Safety									
FOCUS										
Types of accident										
All accidents										

Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	
Truck driver	
Motorcyclist	
Cyclist	
Pedestrian	
Novice driver	
Old driver	
Children	
Passenger	
Other	
Location	
Urban	
Interurban	
Mixed	
Vehicle category	
car	
van	
bus	
truck	
motorcycle	

bicycle non-traditional other	
Accident phase (Haddon's) Pre-crash Crash Post-crash	
Direct incidence Road crashes Driving/road using behaviour	
Active mechanism Description	Transferring of EU knowledge based approach on road safety to Belarus by the mean of Local Universities
Incidence of mechanism (ERST) Exposure Risk Severity Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total) % of injury accidents % of fatalities % of serious injuries	
Comments	
TYPE OF EXPECTED EFFECTS	
Direct effects on accidents (total)	

on injury accidents on fatalities on serious injuries				
Collateral effects Exposure Risk Severity Trauma recovery				
Non-safety related effects Related to the UN's sustainable development agenda	Not mentioned			
ASSESSED REPORTED RESULTS				
	Estimate	**Confidence interval**		
on accidents (total) on injury accidents on fatalities on serious injuries				
Type of assessment Individual Meta-analysis				
COSTS				
Who bears the cost	Funded by Tempus Programme of European Commission.			
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-			
Infrastructure Maintenance - Labour	-			
Infrastructure Maintenance - Equipment	-			

Administrative	-
Social	-
Environment	-
Amount	1.200.000 EUR
Cost-Benefit	-
ACCEPTANCE	
Road users (by class)	
Drivers	
Passengers	
General public	
Other stakeholders	
Road administrations (infrastructure)	
Road operators (traffic management)	X
Health care institutions & practitioners	
Public administration	
Insurance companies	
Enforcement (Police)	X
Enforcement (Judicial system / legal institutions)	
Research / Academia	Centro di ricerca per il Trasporto e la Logistica of “Sapienza”, University of Rome, Transport Safety Research Centre from Loughborough University and the National Technical University of Athens, Belarusian National Technical University,Brest State Technica lUniversity,Belarusian State University of TransportBelarusian State University of Economics.
Communities	
Drivers’ clubs	
Road safety NGO’s	
Taxi driver / taxi owner associations	

Driving licence instructors Other	
SUSTAINABILITY	
Feasibility Pre-conditions Requirements	
Factors contributing for effectiveness	Good social acceptance
Factors hindering implementation or management	Not mentioned
Potential for combination with other R. S. Interventions	Increase the knowledge level of the Belarusian .

Table A5-4 Pedestrian road safety on a trunk road

GENERAL DESCRIPTION										
Designation	Pedestrian safety on a trunk road in South Africa									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main			X				X			
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Driver rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main	X				X					X
Secondary										
Description	This set of interventions aimed at reducing pedestrian accidents in the vicinity of a high traffic volume dual carriageway (AADT of 70000 vehicles). The road was upgraded to motorway standards, creating a barrier effect in the neighbouring communities that had to be mitigated [1]. In addition to pedestrian (children and adults) traffic on the shoulders, there were high numbers of crossings, distributed along the road, with the highest pedestrian activity coinciding with the peak periods of morning and afternoon motor traffic. Due to the poor access control, the poor conservation of the sidewalks and the unappealing nature of public transport, only two-thirds of the crossings were made using the existing upper or lower passages. An integrated approach was adopted, involving traditional engineering measures and a set of education campaigns (see accompanying text). • Three basic principles were followed in the engineering measures: guarantee of visibility distance; speed adaptation to the road environment; and separation of pedestrians from vehicles. • Narrower traffic lanes were adopted (3.50 m instead of 3.75m), allowing to build a 1.5 m wide sidewalk. • Three new pedestrian viaducts were built. To ensure that infrastructure investments would not contribute to an increase in road accident and injury occurrence, a complementary road safety campaign was set-up with two objectives: • Raise pedestrians awareness of road safety, in particular by informing communities about the risks of scattered crossings (jay walking) and the advantages of using pedestrian viaducts; • Assist educators in mainstreaming road safety in school education; • Improve cooperation between road safety authorities and schools - to ensure the endurance of the social component of interventions.										
Duration										
Application	2009									
Effects	Long lasting									

Scope of application	
Local	Community in Cape Town, South Africa
Area wide	Expansion is possible
Country	Expansion is possible
Regional	
Countries with existing experience or practice	South Africa
References	Randal, C. (2013). Pedestrian Safety: the R300 Freeway Road Safety Improvement Project, Cape Town, South Africa. Routes/Roads, Issue Number: 360, pp 69/75 Coetzee, J. (2010) Engineering solutions for developing countries. PIARC, Cape Town, South Africa
FOCUS	
Types of accident	
All accidents	-
Frontal collision	-
Lateral collision	-
Rear end collision	-
Ran-off-lane	-
Hit pedestrian	Yes
Hit cyclist	Yes
Other	-
Class of road user	
Car driver	Yes
Truck driver	Yes
Motorcyclist	Yes
Cyclist	Yes
Pedestrian	Yes
Novice driver	-
Old driver	-

Children	Yes
Passenger	-
Other	Yes
Location	
Urban	-
Interurban	Yes
Mixed	Yes
Vehicle category	
car	Yes
van	Yes
bus	Yes
truck	Yes
motorcycle	Yes
bicycle	Yes
non-traditional	Yes
other	All road users
Accident phase (Haddon's)	
Pre-crash	X
Crash	
Post-crash	
Direct incidence	
Road crashes	X
Driving/road using behaviour	X
Active mechanism	

Description	Separation of pedestrians from motorized traffic. Increasing the available permeability of the road/barrier to pedestrian crossings Channelization of pedestrian routes. Raising community awareness to dangers of informal crossings. Involve children and other citizens in the safety process
Incidence of mechanism (ERST)	
Exposure	X
Risk	X
Severity	
Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	
% of injury accidents	
% of fatalities	
% of serious injuries	
Comments	Not clearly stated in the descriptions.
TYPE OF EXPECTED EFFECTS	
Direct effects	
on accidents (total)	YesNo
on injury accidents	No
on fatalities	No
on serious injuries	No
Collateral effects	
Exposure	No
Risk	No
Severity	No
Trauma recovery	No
Non-safety related effects	
Related to the UN's sustainable development agenda	Improvement of pollution – not measured in this study

ASSESSED REPORTED RESULTS				
	Estimate	Confidence interval		
on accidents (total)				
on injury accidents				
on fatalities	82% in the number of pedestrian fatalities			67 fatalities base. (not adjusted for regression to the mean, AADT developments, and confounding factors).
on serious injuries	54% in the number of seriously injured pedestrians			81 serious injuries base. (not adjusted for regression to the mean, AADT developments, and confounding factors).
Type of assessment				
Individual	X			
Meta-analysis				

COSTS	
Who bears the cost	The roads agency Some community work
Low-cost infrastructure	-
Infrastructure investment - Labour	High
Infrastructure investment - Equipment	High
Infrastructure Maintenance - Labour	-
Infrastructure Maintenance - Equipment	-
Administrative	Low Nevertheless, there is high involvement of community leaders and schools, mostly in a voluntary bases
Social	Low
Environment	-
Amount	Unknown
Cost-Benefit	

ACCEPTANCE	
Road users (by class)	
Drivers	Yes
Passengers	Yes
General public	X
Other stakeholders	
Road administrations (infrastructure)	X
Road operators (traffic management)	
Health care institutions & practitioners	X
Public administration	
Insurance companies	N.A.
Enforcement (Police)	Yes
Enforcement (Judicial system / legal institutions)	N.A.
Research / Academia	N.A.
Communities	X
Drivers' clubs	N.A.
Road safety NGO's	N.A.
Taxi driver / taxi owner associations	N.A.
Driving licence instructors	N.A.
Other	N.A.
SUSTAINABILITY	
Feasibility	
Pre-conditions	Community cohesion and community-based services
Requirements	
Factors contributing for effectiveness	The basic EFAR service delivery may be complemented with an additional service layer (advanced EFAR system) with specialized and specially equiped personnel, which can be more sparcely established, with the intention of upgrading them to an ambulance system in the future.

Factors hindering implementation or management	Not mentioned
Potential for combination with other R. S. Interventions	May be combined and expanded by a unique EMS call number and a full EMS service

Table A5-5 Periodical inspection of vehicles in Turkey

GENERAL DESCRIPTION										
Designation	Periodical Inspection of vehicles in Turkey									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main					X					
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main				X						
Secondary						X				
Description	Improving the system of mandatory periodical inspection of vehicles in Turkey									
Duration										
Application	Several years									
Effects	Long lasting									
Scope of application										
Local										
Area wide										
Country	At country level									
Regional										
Countries with existing experience or practice	EU as main reference									
References	Directive 2014/45/EU. – This is the last version about the EU Directive that sets the minimum requirements to put in place by Member States regarding the periodical inspection of vehicles. It defines the category of vehicles to inspect, the frequency and the minimum content of the inspection. Member States may add additional requirements. Project Autofore: http://citainsp.org/wp-content/uploads/2016/01/Autofore_Final_report_without_links.pdf Autore WP700: http://www.ft.dk/samling/20061/almdel/mpu/bilag/290/351924.pdf									
FOCUS										

Types of accident	
All accidents	All accidents – include active and passive safety concepts
Frontal collision	Yes
Lateral collision	Yes
Rear end collision	Yes
Ran-off-lane	Yes
Hit pedestrian	Yes
Hit cyclist	Yes
Other	Yes
Class of road user	
Car driver	Yes
Truck driver	Yes
Motorcyclist	Yes
Cyclist	Yes – indirect
Pedestrian	Yes – indirect
Novice driver	Yes
Old driver	Yes
Children	Yes
Passenger	Yes
Other	Yes
Location	
Urban	Yes
Interurban	Yes
Mixed	Yes
Vehicle category	
Car	Yes
Van	Yes
Bus	Yes

Truck	Yes
Motorcycle	Yes
Bicycle	No
non-traditional	No
Other	No
Accident phase (Haddon's)	
Pre-crash	X
Crash	X
Post-crash	X – i.e. opening of emergency exits of buses
Direct incidence	
Road crashes	X
Driving/road using behaviour	
Active mechanism	
Description	The suitability of vehicles reduces the risk of accidents and their severity.
Incidence of mechanism (ERST)	
Exposure	
Risk	X
Severity	X
Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	-12,4% (102.000 out of 825.561) On average, from 2008 to 2013
% of injury accidents	
% of fatalities	-8,9% (450 out of 5.007) On average, from 2008 to 2013
% of serious injuries	
Comments	The year basis to calculate the reduction of accidents and fatalities is 2007 (Turkish road traffic statistics 2011 ISSN 1300-1175)
TYPE OF EXPECTED EFFECTS	

Direct effects				
on accidents (total)	Yes			
on injury accidents	Yes			
on fatalities	Yes			
on serious injuries	Yes			
Collateral effects				
Exposure				
Risk	Yes			
Severity	Yes			
Trauma recovery				
Non-safety related effects				
Related to the UN's sustainable development agenda	Improvement of pollution – not measured in this study			
ASSESSED REPORTED RESULTS				
	Estimate	**Confidence interval**		
on accidents (total)	612.000 -2.5%			2008 - 2013
on injury accidents	**-2.4%**			
on fatalities	7.200 -2.4%			2008 - 2013
on serious injuries	**-2.4%**			
Type of assessment				
Individual	X			
Meta-analysis				
COSTS				
Who bears the cost	Vehicle owner/user			
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			

Infrastructure investment - Equipment	-
Infrastructure Maintenance - Labour	-
Infrastructure Maintenance - Equipment	-
Administrative	
Social	
Environment	Improvement not measured in the study
Amount	
Cost-Benefit	Average savings of US$ 340 million per year. This figure only takes into account the reduction of accidents considering Turkish cost-unit rate of US$ 3.342,00. The economic impact of the fatalities reduction will be assessed when the cost-unit rate is available.
ACCEPTANCE	
Road users (by class)	
Drivers	Socially accepted
Passengers	Socially accepted
General public	Socially accepted
Other stakeholders	
Road administrations (infrastructure)	N.A.
Road operators (traffic management)	N.A.
Health care institutions & practitioners	N.A.
Public administration	Yes
Insurance companies	N.A.
Enforcement (Police)	Yes
Enforcement (Judicial system / legal institutions)	Yes
Research / Academia	N.A.
Communities	N.A.
Drivers' clubs	N.A.
Road safety NGO's	N.A.

Taxi driver / taxi owner associations	N.A.
Driving licence instructors	N.A.
Other	N.A.
SUSTAINABILITY	
Feasibility	
Pre-conditions	Authorities commitment and skills
Requirements	
Factors contributing for effectiveness	Good social acceptance
Factors hindering implementation or management	Not mentioned. It would be more difficult if the country wouldn't have had requirements for new vehicles
Potential for combination with other R. S. Interventions	Improvement of the vehicle fleet and workshops' quality

Table A5-6 Adoption of UN standards for vehicles

GENERAL DESCRIPTION										
Designation	Implementation of motor vehicle safety regulations as developed by the United Nation's World Forum for the Harmonization of Vehicle Regulations									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main					x					
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main				X						
Secondary						X		X		
Description	Encourage Member States to apply and promulgate motor vehicle Safety regulations as developed by the United Nation's World Forum for the Harmonization of Vehicle Regulations (WP 29).The UN Decade of Action for Road Safety encourages all countries to apply six motor vehicle safety regulations, which are defined as a minimum for today's world markets: 1. Seat belts and anchorages for all seating positions (UN regulations UNR14 and UNR16). 2. Occupant protection in frontal collision (UNR94) 3. Occupant protection in side or lateral collision (UNR95) 4. Pedestrian protection (Global Technical Regulation GTR9) 5. Electronic Stability Control & ABS (ESC) (GTR8)									
Duration										
Application	20 years after legislation (for car complete park renewal)									
Effects	Long lasting									
Scope of application										
Local										
Area wide										
Country	At country level									
Regional										
Countries with existing experience or practice	Generally, EU and USA; UK car fleet used as main reference for estimated effects in Latin America									
References	UN : Global Plan for the Decade of Action for Road Safety									

	TRL: [The potential for vehicle safety standards to prevent deaths and injuries in Latin America]
FOCUS	
Types of accident	
All accidents	All accidents – include active and passive safety concepts
Frontal collision	Yes
Lateral collision	Yes
Rear end collision	Yes
Ran-off-lane	Yes
Hit pedestrian	Yes
Hit cyclist	Yes
Other	Yes
Class of road user	
Car driver	Yes
Truck driver	No
Motorcyclist	No
Cyclist	Yes - indirect
Pedestrian	Yes - indirect
Novice driver	Yes
Old driver	Yes
Children	Yes
Passenger	Yes
Other	Yes
Location	
Urban	Yes
Interurban	Yes
Mixed	Yes
Vehicle category	

car	Yes
van	No
bus	No
truck	No
motorcycle	No
bicycle	No
non-traditional	No
other	All road users (agricultural tractors are included as well in this activity)
Accident phase (Haddon's)	
Pre-crash	X
Crash	X
Post-crash	
Direct incidence	
Road crashes	X
Driving/road using behaviour	
Active mechanism	
Description	Electronic Stability Control (ESC) reduce the probability of accidents; Pedestrian and occupant protection reduce severity of accidents (all other factors constant)
Incidence of mechanism (ERST)	
Exposure	
Risk	X
Severity	X
Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	
% of injury accidents	
% of fatalities	**Car occupants fatalities are**

% of serious injuries	22% of all fatalities, corresponding to 8600 occurrences in Brasil (2006~2010) 50% of all fatalities, corresponding to 2600 occurrences in Argentina (2013) 29% of all fatalities, corresponding to 460 occurrences in Chile (2013) 24% of all fatalities, corresponding to 3950 occurrences in Mexico (2014)			
Comments	GTR9 will have an effect on pedestrian accidents, as well; this depends heavily on the accident site location (urban/rural) and country (impact speed)			
TYPE OF EXPECTED EFFECTS				
Direct effects				
on accidents (total)	Yes			
on injury accidents	Yes			
on fatalities	Yes			
on serious injuries	Yes			
Collateral effects				
Exposure	No			
Risk	Yes			
Severity	Yes			
Trauma recovery				
Non-safety related effects				
Related to the UN's sustainable development agenda				
ASSESSED REPORTED RESULTS				
	Estimate	**Confidence interval**		
on accidents (total)				
on injury accidents				
on fatalities	-6% -11%	-2.4% -4.8%	-7.4% -12.4%	Depending on the scenario (development of transport activity and rate of market penetration) 14,000 to 40,000 car user fatalities could be saved between 2015 and 2030 in Brasil, Argentina, Chile and Mexico
on serious injuries				160,000 to 440,000 killed or seriously injured victims could be saved between 2015 and 2030 in Brasil, Argentina, Chile and Mexico

Type of assessment Individual Meta-analysis	X	Extrapolation based on UK experience and data		
COSTS				
Who bears the cost	Car maker and car owner			
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-			
Infrastructure Maintenance - Labour	-			
Infrastructure Maintenance - Equipment	-			
Administrative				
Social				
Environment	No			
Amount				
Cost-Benefit	Average savings of US$ 64 billion per year, in Argentina, Brasil,Chile and Mexico			
ACCEPTANCE				
Road users (by class)				
Drivers	Socially accepted			
Passengers	Socially accepted			
General public	Socially accepted			
Other stakeholders				
Road administrations (infrastructure)	N.A.			
Road operators (traffic management)	N.A.			
Health care institutions & practitioners	N.A.			
Public administration	Yes			

Insurance companies	Yes
Enforcement (Police)	Yes
Enforcement (Judicial system / legal institutions)	Yes
Research / Academia	N.A.
Communities	N.A.
Drivers' clubs	Yes
Road safety NGO's	N.A.
Taxi driver / taxi owner associations	Yes
Driving licence instructors	N.A.
Other	N.A.
SUSTAINABILITY	
Feasibility	
Pre-conditions	Authorities commitment and skills
Requirements	Legislation Public institution for vehicle standardization and homologation
Factors contributing for effectiveness	Good social acceptance
Factors hindering implementation or management	Not mentioned
Potential for combination with other R. S. Interventions	Improvement of the vehicle fleet and workshops' quality

Table A5-7 Seatbelt legislation in Costa Rica; communication campaign "*Por amor*"

GENERAL DESCRIPTION										
Designation	Costa Rica: seat-belt legislation, awareness raising and enforcement.									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main							X			
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main						X				
Secondary	X									
Description	The Government of Costa Rica led a successful programme (2003-2005) to reintroduce a seat-belt law (including seat-belt legislation, awareness raising and enforcement) after the previous law had not been enforced and then challenged & abolished. It was known as 'Por amor use el cinturón' ('For love use your seat belt'). Intensive publicity campaigns in 2003-2004 (tv, other media, police leaflets…) and in 2005, the law was introduced, including enforcement and penalties, after a short grace period. The aim was to ask the population to 'choose' to wear seatbelts for the sake of their family & friends rather than they 'demand' they wear them.									
Duration										
Application	2003-2005 (law introduced in 2005)									
Effects	The target was to achieve a seat belt wearing rate of 70%, but actually achieved 82% (from 24% before the campaign). There were no more legal challenges to the law, so along with the large increase in wearing rates, it appears the effect is a long-term one.									
Scope of application										
Local										
Area wide										
Country	Costa Rica									
Regional										
Countries with existing experience or practice	**Many**									

References	WHO, (2009). Seat-belts and child restraints: a road safety manual for decision-makers and practitioners. http://www.who.int/roadsafety/publications/Seat-beltsManual_EN.pdf?ua=1 (page 90) Original FIA report not found, but reference to the report were found here: https://www.slideserve.com/heller/seat-belt-interventions-a-role-for-ngos-saul-billingsley-deputy-director-fia-foundation http://toolkit.irap.org/default.asp?page=casestudy&id=6 https://www.slideshare.net/yulyeuni/por-amor-7770531
FOCUS	
Types of accident	
All accidents	X Although effects on accidents were looked at, seatbelt rates were which would have a direct impact on the potential severity of all accident types
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	X All car occupants were included in the law
Truck driver	
Motorcyclist	
Cyclist	
Pedestrian	
Novice driver	
Old driver	
Children	X
Passenger	X
Other	
Location	

Urban	X
Interurban	X
Mixed	X All locations were targeted
Vehicle category	
car	X
van	
bus	
truck	
motorcycle	
bicycle	
non-traditional	
other	
Accident phase (Haddon's)	
Pre-crash	X
Crash	X
Post-crash	
Direct incidence	
Road crashes	
Driving/road using behaviour	X Only looked at seatbelt wearing rates, not crashes, although it would affect the severity of collisions (i.e. reduced severity).
Active mechanism Description	Effects of introducing seatbelt law on wearing rates in car occupants (including publicity campaign) and, once law was introduced, police empowered enforcement and penalties for non-use. Also, political support to pass the law and support the campaign and the police in their enforcement and handing out penalties (fines). Plus NGOs were willing to act as a catalyst for reintroducing the law and supporting the campaign.
Incidence of mechanism (ERST)	
Exposure	X
Risk	
Severity	X Effects on severity not looked at, but increased seatbelt wearing is likely to lead to reduced injury severity when a collision occurs

Trauma recovery				
SIZE OF PROBLEM TACKLED				
% of accidents (total)	?			
% of injury accidents	Road traffic casualties increased by 60.67% over the period 1996-2000			
% of fatalities	?			
% of serious injuries	Serious injury rates increased by 71% between 1996 and 2000			
Comments	The study only looked at seatbelt wearing rates, not injury rates, but these numbers were quoted in the report.			
TYPE OF EXPECTED EFFECTS				
Direct effects				
on accidents (total)	N			
on injury accidents	Expected, but numbers not known			
on fatalities	Expected, but numbers not known			
on serious injuries	Expected, but numbers not known			
Collateral effects				
Exposure	Seatbelt wearing rates increased from 24% to 82% after the campaign and the law was reintroduced and enforcement began.			
Risk	Not mentioned			
Severity	Not reported, but it is expected that injury severities will decrease as seatbelt wearing rates go up.			
Trauma recovery	Not mentioned			
Non-safety related effects				
Related to the UN's sustainable development agenda	Not mentioned			
ASSESSED REPORTED RESULTS				
	Estimate	**Confidence interval**		Seatbelt wearing rates increased from 24% to 82%. No results for accidents or injuries.
on accidents (total)				
on injury accidents				
on fatalities				
on serious injuries				
Type of assessment				

Individual Meta-analysis	X			
COSTS				
Who bears the cost	Government (legislation, enforcement and campaign costs)			
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-			
Infrastructure Maintenance - Labour	-			
Infrastructure Maintenance - Equipment	-			
Administrative	Medium?			
Social	-			
Environment	-			
Amount	Not mentioned			
Cost-Benefit	Not mentioned			
ACCEPTANCE				
Road users (by class)				
Drivers	There was a 58% increase in wearing rates after the law had been introduced and enforcement began (drivers and passengers together)			
Passengers	See above			
General public				
Other stakeholders				
Road administrations (infrastructure)				
Road operators (traffic management)				
Health care institutions & practitioners	? (not directly involved but would have a vested interest as increased seatbelt wearing would lead to decreased serious injury rates)			
Public administration	**X (campaign supported by the government)**			
Insurance companies	X (part of the coalition)			

Enforcement (Police)	X (empowered to enforcement seatbelt wearing)
Enforcement (Judicial system / legal institutions)	X (enforce penalties issued by police)
Research / Academia	
Communities	
Drivers' clubs	X (Automobile club part of the coalition)
Road safety NGO's	X (FIA Foundation & Road Safety Council part of the coalition)
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	**?**
SUSTAINABILITY	
Feasibility	
Pre-conditions	**Support from government and NGOs**
Requirements	**?**
Factors contributing for effectiveness	NGOs will to act as a catalyst, governmental support, the combined approach (introducing the law alongside a publicity campaign asking the public to make the 'right decision' and 'choose' seatbelt wearing for their loved ones leading to social acceptance, police empowered enforcement once law introduced and enforced penalties for non-use).
Factors hindering implementation or management	None mentioned. Only about the previous law, which was abolished because of protests against drivers' 'rights' to choose and also no political support. But the 2003 reintroduced law overcame these issues.
Potential for combination with other R. S. Interventions	Already combines enforcement and education. Possibly also 'driver training, testing & licensing' and maybe 'vehicles' too, to ensure all vehicles are fitted with fully working seatbelts in all seat positions, if not already.

Table A5-8 Introduction of mandatory helmet use in Colombia: helmet-law training

GENERAL DESCRIPTION										
Designation	Effect of introducing a mandatory motorcycle helmet law in Cali, Colombia on motorcycle death rates									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main							X			
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main						X				
Secondary		X								
Description	A study reported in the WHO report (2006) and in the paper Espitia-Hardeman et al (2008) which evaluated the impact of the introduction of a mandatory motorcycle helmet law on motorcycle death rates. This was introduced in 1996 for motorcycle riders and the following year was expanded to include passengers. In 2001, the regulation was also extended to include the requirement for all motorcyclists to wear reflective vests, obligatory attendance at a driving school following a traffic violation, and a weekend ban on motorcyclists.									
Duration										
Application	The rate of motorcyclist deaths per 100000 inhabitants was compared between 1995 and 2001.									
Effects	Rates decreased from 9.7 in 1995 to 2.6 in 2001, with the greatest decrease being after the initial introduction of the law in 1996 (12.3% reduction).									
Scope of application										
Local										
Area wide										
Country										
Regional	City of Cali, Colombia (laws applied here and helmet wearing effects on fatality rates were observed here)									
Countries with existing experience or practice	**Many**									

References	http://www.who.int/roadsafety/projects/manuals/helmet_manual/en/ Chapter 2: How to assess the situation in your country (page 30): http://www.who.int/roadsafety/projects/manuals/helmet_manual/2-How.pdf Espitia-Hardeman et al (2008). Impact of interventions directed towards motorcyclist death prevention in Cali, Colombia: 1993-2001: https://www.researchgate.net/publication/5479630_Impact_of_interventions_directed_toward_motorcyclist_death_prevention_in_Cali_Colombia_1993-2001 or https://scielosp.org/scielo.php?script=sci_arttext&pid=S0036-36342008000700011&lng=en&nrm=iso&tlng=en
FOCUS	
Types of accident	
All accidents	All motorcyclist deaths
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	
Truck driver	
Motorcyclist	Motorcyclist rider and passenger (for helmet use)
Cyclist	
Pedestrian	
Novice driver	
Old driver	
Children	
Passenger	

Other	
Location	
Urban	X
Interurban	X
Mixed	X
Vehicle category	
car	
van	
bus	
truck	
motorcycle	X
bicycle	
non-traditional	
other	
Accident phase (Haddon's)	
Pre-crash	
Crash	X
Post-crash	
Direct incidence	
Road crashes	X
Driving/road using behaviour	
Active mechanism	
Description	The introduction of a mandatory helmet law in 1996 in Cali, Colombia, accompanied by strict enforcement of the law. The helmet law required ALL riders to wear helmets on all roads within the city from 1996 and from 1997, also included passengers. Further regulations were also introduced in 2001 which required the wearing of reflective vests, obligatory attendance at a driving school following a traffic violation, and a weekend ban on motorcyclists.
Incidence of mechanism (ERST)	
Exposure	
Risk	

Severity	X			
Trauma recovery				
SIZE OF PROBLEM TACKLED				
% of accidents (total)	?			
% of injury accidents	?			
% of fatalities	In Cali in 1995, the rate of motorcyclist deaths per 100 000 inhabitants was 9.7. Motorcyclists ranked second in the death rates by motor vehicle between 1993 and 2001 in the city.			
% of serious injuries	?			
Comments				
TYPE OF EXPECTED EFFECTS				
Direct effects				
on accidents (total)	N			
on injury accidents	N			
on fatalities	Y			
on serious injuries	N			
Collateral effects				
Exposure	Not mentioned			
Risk	Not mentioned			
Severity	Motorcyclist deaths reduced from 9.7 per 100000 inhabitants in 1995 to 3.6 in 2001. The greatest reduction was between 1995 and 1996 (12.3%).			
Trauma recovery	Not mentioned			
Non-safety related effects				
Related to the UN's sustainable development agenda	Not mentioned			
ASSESSED REPORTED RESULTS				
	Estimate	**Confidence interval**		There are some statistical results shown for changes in deaths between 1993 and 2001. Four significant results were found, of which two showed a significant reduction in death rates (July 1996-Dec 1999 & Jan Dec – Dec 2001) and two showed a significant increase (May 1994-June 1996 & Jan 2000 – Dec 2000). All with 95% CI.
on accidents (total)				
on injury accidents				

on fatalities on serious injuries	12.3% decrease			
Type of assessment Individual Meta-analysis	X			

COSTS	
Who bears the cost	Government?
Low-cost infrastructure	-
Infrastructure investment - Labour	-
Infrastructure investment - Equipment	-
Infrastructure Maintenance - Labour	-
Infrastructure Maintenance - Equipment	-
Administrative	Low / Medium
Social	-
Environment	-
Amount	Not mentioned
Cost-Benefit	Not mentioned
ACCEPTANCE	
Road users (by class)	
Drivers	Not included
Passengers	Not included
General public	
Other stakeholders	
Road administrations (infrastructure)	

Road operators (traffic management)	
Health care institutions & practitioners	x
Public administration	X
Insurance companies	x
Enforcement (Police)	x
Enforcement (Judicial system / legal institutions)	x
Research / Academia	x
Communities	X
Drivers' clubs	
Road safety NGO's	X
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	**?**
SUSTAINABILITY	
Feasibility	
Pre-conditions	**?**
Requirements	**?**
Factors contributing for effectiveness	(i) Helmet wearing law applied to all motorcyclists and their passengers (ii) additional regulations were introduced in 2001 which also made the wearing of reflective vests compulsory, the ban of motorcyclists at certain weekends and holiday periods and compulsory courses for riders caught with a traffic violation.
Factors hindering implementation or management	It was mentioned that between Jan 200 and Dec 2000, there was a decrease in control by traffic authorities and the average number of deaths per month then increased (3.2 deaths per month). So enforcement of the law is clearly imperative to the success of the law's implementation.
Potential for combination with other R. S. Interventions	Combining with publicity or education, and vehicles (better maintained vehicles alongside helmet use). Also, the quality of post-impact care may also influence death rates.

Table A5-9 Mandatory helmet in Italy: effect of law change in brain injuries

GENERAL DESCRIPTION										
Designation	Effect of Italy's motorcycle helmet law on traumatic brain injuries									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main							X			
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main						X				
Secondary							X			
Description	Study which evaluates the impact of a revised mandatory Italian motorcycle-moped-scooter helmet law on crash brain injuries.									
Duration										
Application	Data collected for study between 1999 and 2001 (30 Mar 1999-29 Mar2000 was pre-law data and 30 Mar 2000 – 29 Mar 2001 was post-law data)									
Effects	Helmet use was found to have increased after the introduction of the revised law and traumatic brain injuries were reduced significantly in motorcycle/moped crashes.									
Scope of application										
Local										
Area wide										
Country	Italy									
Regional	Romagna region, north-eastern Italy (population in 2000 of 983534)									
Countries with existing experience or practice	**? Many**									
References	http://dx.doi.org/10.1136/ip.9.3.257									

FOCUS	
Types of accident	
All accidents	Traumatic brain injuries which were a result of accidents involving a moped irrespective of accident type

Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	
Truck driver	
Motorcyclist	Motorcyclist rider and passenger
Cyclist	
Pedestrian	
Novice driver	
Old driver	
Children	
Passenger	
Other	
Location	
Urban	X
Interurban	X
Mixed	X
Vehicle category	
car	
van	
bus	
truck	
motorcycle	X

bicycle non-traditional other	
Accident phase (Haddon's) Pre-crash Crash Post-crash	 X
Direct incidence Road crashes Driving/road using behaviour	 X
Active mechanism	
Description	A change in the helmet use law in Italy, which made compulsory the "use of an approved helmet . . .for all motorbike, motorcycle and mopeds drivers, and their passengers, independent of their age", whereas previously, the law "required the use of helmets for all individuals only for motorcycles drivers whereas mopeds drivers had to wear a helmet only when less than 18 years of age".
Incidence of mechanism (ERST) Exposure Risk Severity Trauma recovery	 X X
SIZE OF PROBLEM TACKLED	
% of accidents (total)	?
% of injury accidents	?
% of fatalities	More than 1500 deaths mainly related to TBI without crash helmets
% of serious injuries	75000 motorcycle occupant hospital admissions per year
Comments	
TYPE OF EXPECTED EFFECTS	
Direct effects	

on accidents (total)	No
on injury accidents	No
on fatalities	Yes
on serious injuries	Yes
Collateral effects	
Exposure	The revised law led to an increase in helmet use for motorcycle and moped users use 19.5% to 97.5% in the Romagna Region (based on survey data)
Risk	Not mentioned
Severity	Traumatic Brain Injuries due to motorcycle and moped crashes reduced by 76% after the law was revised (from 7 admissions per 100000 population per year to 2 admissions)
Trauma recovery	Not mentioned
Non-safety related effects	
Related to the UN's sustainable development agenda	Not mentioned

ASSESSED REPORTED RESULTS

	Estimate	Confidence interval	
on accidents (total)			
on injury accidents			
on fatalities			
on serious injuries	**-76% (decr.)**		
Type of assessment			
Individual	X		
Meta-analysis			

COSTS

Who bears the cost	Government producing / contracting production of publicity material
Low-cost infrastructure	-
Infrastructure investment - Labour	-
Infrastructure investment - Equipment	-
Infrastructure Maintenance - Labour	-

Infrastructure Maintenance - Equipment	-
Administrative	Low / Medium
Social	-
Environment	-
Amount	Not mentioned
Cost-Benefit	Not mentioned
ACCEPTANCE	
Road users (by class)	
Drivers	Helmet use in riders and passengers together went up from 19.5% to 97.5% after the revised law was implemented.
Passengers	-
General public	
Other stakeholders	
Road administrations (infrastructure)	
Road operators (traffic management)	
Health care institutions & practitioners	x
Public administration	**X?**
Insurance companies	x
Enforcement (Police)	x
Enforcement (Judicial system / legal institutions)	x
Research / Academia	x
Communities	
Drivers' clubs	
Road safety NGO's	X (WHO?)
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	?

SUSTAINABILITY	
Feasibility	
Pre-conditions	?
Requirements	?
Factors contributing for effectiveness	Sufficient enforcement alongside awareness campaign contributed to greater helmet use.
Factors hindering implementation or management	Not mentioned
Potential for combination with other R. S. Interventions	*Already combined with enforcement*

Table A5-10 Helmet use in Kenya; campaign “No helmet-no ride”

GENERAL DESCRIPTION										
Designation	No Helmet, No Ride									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main							X			
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main	X									
Secondary						X				
Description	New national helmet campaign (Ministry of Public Health and Sanitation, Kenya & WHO) aimed at raising the awareness on the consequences of failing to wear a helmet and to help boost helmet use among all motorcycle users (riders and passengers) to save lives and reduce the strain on the national health care system.									
Duration										
Application	Short term roll out – launched 2012									
Effects	Anticipated to be long lasting									
Scope of application										
Local										
Area wide										
Country	Kenya									
Regional										
Countries with existing experience or practice	**? Many**									
References	http://www.who.int/violence_injury_prevention/media/news/2012/02_11/en/									
FOCUS										
Types of accident										

All accidents	All accidents involving a motorcycle irrespective of accident type
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	
Truck driver	
Motorcyclist	Motorcyclist driver and passenger
Cyclist	
Pedestrian	
Novice driver	
Old driver	
Children	
Passenger	
Other	
Location	
Urban	X
Interurban	X
Mixed	X
Vehicle category	
car	
van	
bus	
truck	

motorcycle	X
bicycle	
non-traditional	
other	
Accident phase (Haddon's)	
Pre-crash	
Crash	**X ?**
Post-crash	
Direct incidence	
Road crashes	
Driving/road using behaviour	X
Active mechanism	
Description	Campaign including a series of radio adverts, billboards and posters designed to increase knowledge about the importance of wearing a helmet and change the attitude and behaviour of motorcycle riders and their passengers. Accompanied by stricter enforcement by the police.
Incidence of mechanism (ERST)	
Exposure	
Risk	X
Severity	X
Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	?
% of injury accidents	?
% of fatalities	7% of the 3000 fatalities in Kenya are motorcycle riders
% of serious injuries	?
Comments	Helmets reduce the risk of road traffic related head injury by 70% and deaths by 40% (press release statement, no reference)
TYPE OF EXPECTED EFFECTS	
Direct effects	

on accidents (total)	No			
on injury accidents	Yes			
on fatalities	Yes			
on serious injuries	Yes			
Collateral effects				
Exposure	Not mentioned			
Risk	Not mentioned			
Severity	Mentions helmets reduce head injury by 70% and deaths by 40%			
Trauma recovery	Mentions aim to reduce the strain on the national health care system (implies road ranging including rehabilitation from brain injury?)			
Non-safety related effects				
Related to the UN's sustainable development agenda	Not mentioned			
ASSESSED REPORTED RESULTS				
	Estimate	**Confidence interval**		
on accidents (total)				
on injury accidents				
on fatalities				
on serious injuries				
Type of assessment				
Individual				
Meta-analysis				
COSTS				
Who bears the cost	Government producing / contracting production of publicity material			
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-			
Infrastructure Maintenance - Labour	-			

Infrastructure Maintenance - Equipment	-
Administrative	Low / Medium
Social	-
Environment	-
Amount	Not mentioned
Cost-Benefit	Not mentioned
ACCEPTANCE	
Road users (by class)	
Drivers	-
Passengers	-
General public	
Other stakeholders	
Road administrations (infrastructure)	
Road operators (traffic management)	
Health care institutions & practitioners	
Public administration	**X?**
Insurance companies	
Enforcement (Police)	x
Enforcement (Judicial system / legal institutions)	
Research / Academia	
Communities	
Drivers' clubs	
Road safety NGO's	X (WHO?)
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	**?**

SUSTAINABILITY	
Feasibility	
Pre-conditions	?
Requirements	?
Factors contributing for effectiveness	Sufficient enforcement alongside awareness campaign
Factors hindering implementation or management	Not mentioned
Potential for combination with other R. S. Interventions	Already combined with enforcement

Table A5-11 Helmet law enforcement in Vietnam

GENERAL DESCRIPTION										
Designation	Effect of introducing Vietnam's first mandatory law on helmet use and head injury/fatality rates									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main							X			
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main						X				
Secondary	X									
Description	A study reported in the WHO report (2017) which evaluated the impact of a mandatory law on motorcycle helmet use and helmet wearing rates and head injury/fatality rates.									
Duration										
Application	Helmet wearing rates were collected in the month before the law was introduced (Nov 2007) and then for a month, 6 months after (June 2008). Also, head injury and fatal injury information from hospitals were collected before and after the law was introduced (3 months).									
Effects	Helmet wearing increased from 27% to 99%. The risk of road traffic head injuries and deaths decreased by 16% and 18% respectively.									
Scope of application										
Local										
Area wide										
Country	Vietnam (laws applied nationally and injury information taken from hospitals nationally)									
Regional	Da Nang Province (helmet wearing effects were observed here)									
Countries with existing experience or practice	**Many**									
References	http://dx.doi.org/10.2471/BLT.09.071662. Originally sourced from http://www.who.int/iris/handle/10665/254759 Also http://dx.doi.org/10.1080/17457300.2012.706617 and http://dx.doi.org/10.1080/15389580903497121									
FOCUS										
Types of accident										

All accidents	All road traffic injury patients with head injuries admitted to 20 provincial and central hospitals 3 months before and after the new law came into effect on 15 December 2007
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	
Truck driver	
Motorcyclist	Motorcyclist rider and passenger (for helmet use)
Cyclist	
Pedestrian	
Novice driver	
Old driver	
Children	
Passenger	
Other	All traffic injury patients (for accident monitoring)
Location	
Urban	X
Interurban	X
Mixed	X
Vehicle category	
car	
van	
bus	

truck	
motorcycle	X (for helmet wearing observation study)
bicycle	
non-traditional	
other	
Accident phase (Haddon's)	
Pre-crash	X
Crash	X
Post-crash	
Direct incidence	
Road crashes	X
Driving/road using behaviour	X
Active mechanism	
Description	The introduction of Vietnam's first comprehensive mandatory helmet law in 2007, which included stricter patrolling and penalties. The new helmet law required ALL riders and passengers to wear helmets on ALL roads without exceptions. Subsequent loopholes identified in the law (e.g. the correct & secure fastening of helmets and mandatory helmet wearing for children 6+ & making adults transporting children legally responsible for their helmet wearing) were subsequently resolved (i.e. by introducing penalties for these infringements).
Incidence of mechanism (ERST)	
Exposure	X
Risk	X
Severity	X
Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	?
% of injury accidents	?
% of fatalities	In 2008, 11 243 deaths on the roads, of which an estimated 60% of fatalities occur in motorcycle riders and passengers
% of serious injuries	7771 serious injuries on the roads (no specific % reported from motorcycle occupants)

Comments	‘Various sources suggest official figures may underestimate the number of deaths by more than 30%’. ‘As of January 2009, 27 million vehicles were registered in Viet Nam of which 95% are motorized two-wheelers’.			
TYPE OF EXPECTED EFFECTS				
Direct effects				
on accidents (total)	N			
on injury accidents	Y			
on fatalities	Y			
on serious injuries	Y			
Collateral effects				
Exposure	In Da Nang region, helmet wearing in riders increased from 27% (November 2007) to 99% (June 2008) and 21% to 99% in passengers			
Risk	Not mentioned			
Severity	The risk of road traffic head injuries and deaths decreased by 16% and 18% respectively.			
Trauma recovery	Not mentioned			
Non-safety related effects				
Related to the UN’s sustainable development agenda	Not mentioned			
ASSESSED REPORTED RESULTS				
	Estimate	**Confidence interval**		
on accidents (total)				
on injury accidents				
on fatalities	18% decrease	0.73	0.93	
on serious injuries	16% decrease	0.81	0.87	
Type of assessment				
Individual	X			
Meta-analysis				
COSTS				
Who bears the cost	Government producing / contracting production of publicity material			

Low-cost infrastructure	-
Infrastructure investment - Labour	-
Infrastructure investment - Equipment	-
Infrastructure Maintenance - Labour	-
Infrastructure Maintenance - Equipment	-
Administrative	Low / Medium
Social	-
Environment	-
Amount	Not mentioned
Cost-Benefit	Not mentioned ('one year after the legislation took effect, national police data reported 1557 lives saved and 2495 serious injuries prevented compared to the same time in 2007')
ACCEPTANCE	
Road users (by class)	
Drivers	Helmet wearing in riders increased from 27% (November 2007) to 99% (June 2008)
Passengers	Helmet wearing increased from 21% to 99% in passengers
General public	
Other stakeholders	
Road administrations (infrastructure)	
Road operators (traffic management)	
Health care institutions & practitioners	x
Public administration	X
Insurance companies	x
Enforcement (Police)	x
Enforcement (Judicial system / legal institutions)	x
Research / Academia	x
Communities	X

Drivers' clubs	
Road safety NGO's	X (WHO?)
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	**?**
SUSTAINABILITY	
Feasibility	
Pre-conditions	**?**
Requirements	**?**
Factors contributing for effectiveness	(i) stricter penalties for non-use (10 times higher than previous), (ii) advanced public education and social marketing, (iii) 'Government used the civil service as role models, requiring that all government employees wear helmets three months before the law came into effect' (iv) stringent enforcement from day one of the law being introduced, (v) all roads were included in the law reducing potential for confusion (vi) 'affordable, high-quality, climatically appropriate helmets were readily available to the population'. Also, the Prime Minister issued the legislation and 50000 helmets were distributed to low income families.
Factors hindering implementation or management	Loopholes previously mentioned (i.e. fastening helmets, responsibility of children's helmet use) but were resolved using increased enforcement 1-2 years following the initial law being introduced.
Potential for combination with other R. S. Interventions	Already combines enforcement and education. Possibly also 'driver training, testing & licensing'.

Table A5-12 Seatbelt law enforcement in the EU

<table>
<tr><td colspan="11">GENERAL DESCRIPTION</td></tr>
<tr><td>Designation</td><td colspan="10">Factors affecting the effectiveness of seat belt enforcement: meta-analysis of seat-belt enforcement studies</td></tr>
<tr><td>Road Safety Pillars</td><td colspan="2">1
Management</td><td colspan="2">2
Infrastructure</td><td colspan="2">3
Vehicles</td><td colspan="2">4
Road users</td><td colspan="2">5
Post-crash emergency & recovery</td></tr>
<tr><td>Main
Secondary</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2">X</td><td colspan="2"></td></tr>
<tr><td>Road Safety Intervention Categories (Supreme)</td><td>1
Education & campaigns</td><td>2
Driver training, testing & licensing</td><td>3
Rehabilitation & diagnostics</td><td>4
Vehicles</td><td>5
Infrastructure</td><td>6
Enforcement</td><td>7
Statistics & in-depth analysis</td><td>8
Institutional organisation</td><td>9
Post accident care</td><td>10
Bundles</td></tr>
<tr><td>Main</td><td></td><td></td><td></td><td></td><td></td><td>X</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Secondary</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Description</td><td colspan="10">A study reported in the EU project PEPPER (Erke et al 2009) contains a systematic review of evaluation studies on seatbelt use by applying meta-analyses to assess the best estimates of the effects on behaviour (i.e. seatbelt wearing). Countries included mainly Netherlands & USA, but also Belgium, Australia & Canada (meta-analysis of 17 studies).</td></tr>
<tr><td>Duration</td><td colspan="10"></td></tr>
<tr><td>Application</td><td colspan="10">Seatbelt wearing rates taken from 17 studies ranging in years from 1981to 2006, all with either before-after comparison or before-during comparison. The years the data was collected for each study is not given.</td></tr>
<tr><td>Effects</td><td colspan="10">Overall, the effect of seatbelt enforcement on seatbelt use was a 21% increase during the enforcement periods and 15% increase after the enforcement period (both significant).</td></tr>
<tr><td>Scope of application</td><td colspan="10"></td></tr>
<tr><td>Local</td><td colspan="10"></td></tr>
<tr><td>Area wide</td><td colspan="10"></td></tr>
<tr><td>Country</td><td colspan="10">Netherlands, USA, Belgium, Australia & Canada</td></tr>
<tr><td>Regional</td><td colspan="10"></td></tr>
<tr><td>Countries with existing experience or practice</td><td colspan="10">Many</td></tr>
<tr><td>References</td><td colspan="10">Erke, A.; Goldenbeld, Ch.; Vaa, T. (2009). Good practice in the selected key areas of speeding, drink driving and seat belt wearing; results from meta-analysis: Deliverable 9 of the PEPPER project
http://www.vtt.fi/files/sites/pepper/pepper_d9_wp4.pdf</td></tr>
<tr><td></td><td colspan="10"></td></tr>
</table>

FOCUS	
Types of accident	
All accidents	
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	X
Truck driver	
Motorcyclist	
Cyclist	
Pedestrian	
Novice driver	
Old driver	
Children	X
Passenger	X
Other	
Location	
Urban	
Interurban	
Mixed	X
Vehicle category	
car	X
van	

bus	
truck	
motorcycle	
bicycle	
non-traditional	
other	Vehicle type not clearly specified, but it mentions car drivers in one section of the study.
Accident phase (Haddon's)	
Pre-crash	
Crash	X
Post-crash	
Direct incidence	
Road crashes	
Driving/road using behaviour	X
Active mechanism	Effects of seatbelt law enforcement on wearing rates.
Description	The following types of seatbelt enforcement are included in the studies: Stationary control at the roadside, checkpoints, mostly combined with speed or DUI enforcement Canadian and USA STEP program Combinations of checkpoints and mobile controls Educational enforcement of use of child restrains with leaflets (i.e. publicity) and warnings instead of fines.
Incidence of mechanism (ERST)	
Exposure	X
Risk	
Severity	
Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	?
% of injury accidents	?
% of fatalities	?

% of serious injuries	?			
Comments	The meta-analysis focusses only on seatbelt wearing rates, not accident/injury rates.			
TYPE OF EXPECTED EFFECTS				
Direct effects				
on accidents (total)	N			
on injury accidents	N			
on fatalities	N			
on serious injuries	N			
Collateral effects				
Exposure	There was a 21% increase in wearing rates during the enforcement periods and 15% increase after the enforcement period			
Risk	Not mentioned			
Severity	Not reported, but it is expected that injury severities will decrease as seatbelt wearing rates go up.			
Trauma recovery	Not mentioned			
Non-safety related effects				
Related to the UN's sustainable development agenda	Not mentioned			
ASSESSED REPORTED RESULTS				
	Estimate	**Confidence interval**		
on accidents (total)				21% increase during the enforcement periods (+16, +27, 95% CI) and 15% increase after the enforcement period (+10, +20, 95% CI)
on injury accidents				
on fatalities				
on serious injuries				
Type of assessment				
Individual				
Meta-analysis	X			
COSTS				
Who bears the cost	Government?			

Low-cost infrastructure	-
Infrastructure investment - Labour	-
Infrastructure investment - Equipment	-
Infrastructure Maintenance - Labour	-
Infrastructure Maintenance - Equipment	-
Administrative	Low / Medium
Social	-
Environment	-
Amount	Not mentioned
Cost-Benefit	Not mentioned
ACCEPTANCE	
Road users (by class)	
Drivers	There was a 23% increase in wearing rates during the enforcement periods and 18% increase after the enforcement period
Passengers	For front seat passengers only, there was a 20% increase in wearing rates during the enforcement periods and 17% increase after the enforcement period
General public	
Other stakeholders	
Road administrations (infrastructure)	
Road operators (traffic management)	
Health care institutions & practitioners	x
Public administration	**X**
Insurance companies	x
Enforcement (Police)	x
Enforcement (Judicial system / legal institutions)	x
Research / Academia	x
Communities	X

Drivers' clubs	X
Road safety NGO's	X (WHO?)
Taxi driver / taxi owner associations	X
Driving licence instructors	
Other	**?**
SUSTAINABILITY	
Feasibility	
Pre-conditions	**?**
Requirements	**?**
Factors contributing for effectiveness	The use of publicity alongside enforcement was found to increase effectiveness. Increasing enforcement was found to be more effective than simultaneously increasing and changing enforcement.
Factors hindering implementation or management	This is a meta-analysis of many studies, so factors hindering implementation/management wasn't looked at. However, the results did state that 'local publicity and a publicity campaign increase the effectiveness of seat belt enforcement compared to no publicity or enforcement programmes' so a lack of publicity alongside the enforcement of seatbelt use could hinder implementation.
Potential for combination with other R. S. Interventions	Already combines enforcement and education. Possibly also 'driver training, testing & licensing'.

Table A5-13 Reduction in BAC limits in Mexico

GENERAL DESCRIPTION										
Designation	Effects of reducing BAC limits and increasing penalties on drink-driving in Jalisco, Mexico									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main							X			
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main						X				
Secondary	X									
Description	In 2010, the State of Jalisco, Mexico, amended its drink driving legislation by lowering its own BAC level from 0.15g/dL to 0.05g/dL, in line with international best practice, and also introduced tougher penalties for not abiding by the amended law . It was known as the 'Lifeguard Law' ('Le Salvavidas'). Before the law was introduced, the penalty for being caught driving above the permitted BAC level was a fine of 30 days minimum wage (approximately 133 dollars) and after the amended law, the fine was increased to 150 to 200 days minimum wage (approximately 663-884 dollars) for BAC up to 0.08 and even stricter penalties beyond this level (i.e. removal of vehicle and then at the highest BAC levels, both the vehicle and driver 'are placed at the disposal of the authorities').									
Duration										
Application	1999-2013 (law introduced in 2010)									
Effects	After the law was amended in 2010, a statistically significant reduction in the deaths associated with alcohol was found into 2011 (5.7%, p = 0.018). A significant reduction was also found in the monthly trend of collisions after the law was amended (9.9%, p = 0.023). However, up until December 2011, there were found to be no changes in hospital mortality and discharge rates compared with before introduction of the amended law.									
Scope of application										
Local										
Area wide										
Country										
Regional	Jalisco, Mexico									
Countries with existing experience or practice	**Many**									

References	Gómez-García et al. (2014). Short-term impact of changes in drinking-and-driving legislation in Guadalajara and Zapopan, Jalisco, Mexico http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-311X2014000601281&lng=en&nrm=iso&tlng=en Originally sourced from WHO report 'Save LIVES: a road safety technical package': http://apps.who.int/iris/bitstream/handle/10665/255199/9789241511704-eng.pdf?sequence=1 Page 33 Also: Global Status Report on Road Safety 2015 World Health Organisation: http://www.who.int/violence_injury_prevention/road_safety_status/2015/en/ And the following article: https://www.informador.mx/Jalisco/Rechazan-fracaso-de-ley-salvavidas-ha-contenido-el-numero-de-muertes-dice-Semov-20131022-0188.html
FOCUS	
Types of accident	
All accidents	X
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	X This study looks at the effect on injury rates of all motor vehicle driver/riders and occupants, but the intervention is only aimed at affected the behaviour of drivers/riders of motor vehicles.
Truck driver	X
Motorcyclist	X
Cyclist	
Pedestrian	
Novice driver	
Old driver	

Children	
Passenger	X
Other	
Location	
Urban	
Interurban	
Mixed	X All locations were targeted
Vehicle category	
car	X All motor vehicles
van	X
bus	X
truck	X
motorcycle	X
bicycle	
non-traditional	
other	
Accident phase (Haddon's)	
Pre-crash	X
Crash	X
Post-crash	
Direct incidence	
Road crashes	X
Driving/road using behaviour	
Active mechanism	Effects of amending the drink driving law (i.e. lowering BAC level) and introducing tougher penalties for not following the law, on accident and injury rates in 2010. This was followed in 2013 by additional measures, including random alcohol checks, mandatory payment of fines or 'administrative immutable arrest' from 12-36 hours, driving licence suspension if reoffending occurs within 2 years and a 'hard-hitting' marketing campaign.
Description	

Incidence of mechanism (ERST)	
Exposure	X
Risk	X
Severity	X
Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	Between 1999 and 2011, 10% of drivers were thought to be responsible for crashes on urban & suburban roads were found to have consumed alcohol.
% of injury accidents	?
% of fatalities	14 deaths per 100,000 inhabitants in road traffic collisions in 2011, which is thought to be an underestimation of the problem.
% of serious injuries	
Comments	20% of drivers who underwent an alcohol test were found to be positive for alcohol, with 3% being above allowed limits.
TYPE OF EXPECTED EFFECTS	
Direct effects	
on accidents (total)	A significant reduction was found in the monthly trend of collisions after the law was amended (9.9%, p=0.023)
on injury accidents	Expected, but numbers not known
on fatalities	A statistically significant reduction in the deaths associated with alcohol was found into 2011 (5.7%, p = 0.018)
on serious injuries	Expected, but numbers not known
Collateral effects	
Exposure	Expected, but not reported.
Risk	Expected, but not mentioned.
Severity	A statistically significant reduction in the deaths associated with alcohol was found into 2011 (5.7%, p = 0.018).
Trauma recovery	Not mentioned
Non-safety related effects	
Related to the UN's sustainable development agenda	Not mentioned

ASSESSED REPORTED RESULTS

	Estimate	Confidence interval		
on accidents (total)	-9.9%			p = 0.023

on injury accidents on fatalities on serious injuries	-5.7%			p=0.018
Type of assessment Individual Meta-analysis	X			
COSTS				
Who bears the cost	State of Jalisco Government (legislation, enforcement and campaign costs)			
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-			
Infrastructure Maintenance - Labour	-			
Infrastructure Maintenance - Equipment	-			
Administrative	Medium?			
Social	-			
Environment	-			
Amount	Not mentioned			
Cost-Benefit	Not mentioned			
ACCEPTANCE				
Road users (by class)				
Drivers	The reductions in rates of alcohol-related deaths and accident rates show that drivers must be adhering to the laws more than they used to.			
Passengers	Not applicable			
General public				
Other stakeholders Road administrations (infrastructure)				

Road operators (traffic management)	
Health care institutions & practitioners	? (not directly involved but would have a vested interest as reduced drink driving rates would lead to decreased serious injury rates)
Public administration	**X (campaign supported by the government)**
Insurance companies	
Enforcement (Police)	X (not directly mentioned but would be empowered to enforce drink driving laws and penalties)
Enforcement (Judicial system / legal institutions)	X (not directly mentioned but would enforce penalties issued by police)
Research / Academia	
Communities	
Drivers' clubs	
Road safety NGO's	
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	**?**
SUSTAINABILITY	
Feasibility	
Pre-conditions	**Support from government**
Requirements	**?**
Factors contributing for effectiveness	Amendment of drink-driving law with lower BAC levels (2010). Tougher penalties for drink-driving (e.g. larger fines) (2010). Enforcement through random police checks (2013). A 'hard-hitting' publicity campaign (2013).
Factors hindering implementation or management	The original 2010 amended law (known as the 'Lifeguard Law') was not enforced enough (e.g. random checks, enforced fine payment) and there was only very limited publicity, but these were introduced in 2013 when the' Lifeguard Law' was replaced with the 'Mobility and Transportation Law of the State of Jalisco', which included tougher enforcement and a publicity campaign alongside the changes made in 2010.
Potential for combination with other R. S. Interventions	Already combines enforcement and education. Possibly also 'driver training, testing & licensing'.

Table A5-14 Communication campaign ‘Speak Out’, in Norway

GENERAL DESCRIPTION										
Designation	The ‘Speak Out’ Publicity Campaign, Norway									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main							X			
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main	X									
Secondary						X				
Description	The ‘Speak Out’ campaign was a campaign in Norway which combined education alongside publicity and enforcement. This campaign, which began in 1993 and introduced by the Norweigan government Public Roads Administration (NPRA), encouraged young people who are passengers in cars to speak out if the driver is driving unsafe, and combined education in schools with enforcement (i.e. roadside checks by police).									
Duration										
Application	The campaign began in 1993, but analysis of the effects carried on until 1998.									
Effects	The introduction of the campaign was followed by an overall accident injury reduction of 12% by the 3rd year after campaign introduced for 16-19 year olds.									
Scope of application										
Local										
Area wide										
Country	Norway									
Regional	Sogn og Fjordane (injury rates), Telemark (questionnaire survey)									
Countries with existing experience or practice	**Many (e.g. UK , Australia)**									

References	SUPREME final report Part F1 Thematic Report: Education and Campaigns (2007): https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects_sources/supreme_f1_thematic_report_education_and_campaigns.pdf SUPREME Handbook for Measures at the Country Level (2010): https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects_sources/supreme-c_en.pdf Amundsen et al (1999). Effects of the "Speak out!" road safety campaign on the number of killed or injured road users in Sogn og Fjordane county, Norway. TOI reportv425/1999. https://www.toi.no/getfile.php/133664/Publikasjoner/T%C3%98I%20rapporter/1999/425-1999/sum-425-99.pdf http://roadsafetygb.org.uk/news/campaign-encourages-young-people-to-speak-out-about-unsafe-driving/ http://roadsafety.transport.nsw.gov.au/campaigns/dont_rush/index.html
FOCUS	
Types of accident	
All accidents	X
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	X (16-19 year olds)
Truck driver	
Motorcyclist	
Cyclist	
Pedestrian	
Novice driver	
Old driver	

Children	
Passenger	X (16-19 year olds)
Other	
Location	
Urban	
Interurban	
Mixed	X
Vehicle category	
Car	X
Van	
Bus	
Truck	
Motorcycle	
Bicycle	
non-traditional	
other	
Accident phase (Haddon's)	
Pre-crash	X
Crash	X
Post-crash	
Direct incidence	
Road crashes	X
Driving/road using behaviour	X
Active mechanism	
Description	Effects of the 'Speak Out' campaign in Norway on number or injured and fatal car occupants in the 16-19 year age range.
Incidence of mechanism (ERST)	

Exposure	
Risk	X
Severity	X
Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	?
% of injury accidents	?
% of fatalities	In 2004, 16-19 year old made up approximately 7% of all killed car drivers and passengers in Norway
% of serious injuries	In 2004, 16-19 year olds made up approximately 21% of killed or seriously injured car passengers in Norway
Comments	
TYPE OF EXPECTED EFFECTS	
Direct effects	
on accidents (total)	Not known
on injury accidents	Not known
on fatalities	Not known separately
on serious injuries	In the region of Sogn og Fjordane, there was found to be an overall reduction in injuries and fatalities in accidents of 12% in the 16-19 year age group by the 3rd year after Speak Out was introduced. When looking at just car passengers only, the reduction was 36% by the third year.
Collateral effects	
Exposure	Not reported.
Risk	In a questionnaire survey undertaken in another Norwegian region (Telemark), about 50% of the respondents felt they were more aware of the risks associated with being a car passenger after being exposed to the Speak Out campaign.
Severity	Not reported.
Trauma recovery	Not mentioned.
Non-safety related effects	
Related to the UN's sustainable development agenda	Not mentioned

ASSESSED REPORTED RESULTS

	Estimate	Confidence interval	
on accidents (total)			
on injury accidents			

on fatalities on serious injuries	-12%			Fatalities and personal injuries in 16-19 year old car occupants 3 years after Speak Out was introduced (36% for passengers only, significant to 10%
Type of assessment Individual Meta-analysis	X			
COSTS				
Who bears the cost	The campaign was funded by the Public Roads Administration			
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-			
Infrastructure Maintenance - Labour	-			
Infrastructure Maintenance - Equipment	-			
Administrative	Medium?			
Social	-			
Environment	-			
Amount	2 million NOK			
Cost-Benefit	Cost-benefit ratio ranged from 1.9 (including development costs and taking the lower limit of the confidence interval for the safety effect) to 16.8 (excluding the development costs and taking the best estimate of the effect). Between 1993 and 1998, it is thought the campaign has prevented 30 fatalities or injuries in the 16-19 age range, which equates to approximately 33.6million NOK			
ACCEPTANCE				
Road users (by class) Drivers Passengers	Effects of the campaign on car driver injury rates in the 16-19 year range found that rates were not affected by the campaign, so this is a campaign that only mainly affected the actions of passengers rather than drivers. 50% of questionnaire respondents felt they were more aware of the risks associated with being a car passenger after being exposed to the Speak Out campaign information any many believed they would address risky driving more often and may even find alternative means of transport.			
General public	Not mentioned			
Other stakeholders				

Road administrations (infrastructure)	
Road operators (traffic management)	
Health care institutions & practitioners	? Not directly involved but would have a vested interest as more responsible driving encouraged by passengers speaking out would lead to decreased serious injury rates.
Public administration	X The campaign funded by the Public Roads Administration (government agency)
Insurance companies	
Enforcement (Police)	X The campaign was supported by enforcement carried out by the police and Public Roads Administration, in the form of roadside checks.
Enforcement (Judicial system / legal institutions)	
Research / Academia	
Communities	
Drivers' clubs	
Road safety NGO's	
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	**?**
SUSTAINABILITY	
Feasibility	
Pre-conditions	Support from government, government agencies and police (enforcement)
Requirements	Ensuring that enforcement is carried out, so that those who gain the confidence to speak out know that if their requests to the driver to drive safer are ignored, the driver will be prosecuted for their dangerous driving.
Factors contributing for effectiveness	(i) Support from the government and the campaign being led by a government department; (ii) Intensive publicity and education aimed at 16-19 years in locations such as schools, plus distribution of t-shirts and campaign video to reinforce message that it's ok for passenger to Speak Out if they feel the driver's driving is unsafe; (iii) Targeting passengers in the 16-19 year age range, who will have most influence over the actions of drivers of a similar age, plus who will be most affected by unsafe driving in terms of injury severity; (iv) Using enforcement concurrently with the campaign, in the form of police controls stopping those who are unlikely to be affected by the campaign and not heed their passengers' advice.
Factors hindering implementation or management	None mentioned
Potential for combination with other R. S. Interventions	Already combines 'education' (publicity) with 'enforcement'.

Table A5-15 Graduated driver licensing system in New Zealand

GENERAL DESCRIPTION										
Designation	The effect of the New Zealand graduated driver licensing system on motorcycle traffic crash hospitalisations									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main							X			
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main		X								
Secondary	X									
Description	In New Zealand, a comprehensive Graduated Driver Licencing System (GDLS) was introduced in 1987 for all car drivers and motorcycle riders. The main difference between car and motorcycle riders is that the GDLS system is aimed at the 15 - 24 year age group, whereas the GDLS is aimed at all new motorcycle riders, regardless of their age.									
Duration										
Application	GDLS was introduced in 1987. Analysis of motorcycle crash data was collected from between the years 1978 and 1994 to understand the before/after effects of introducing the GDLS. Similar analysis was also carried out for car drivers.									
Effects	The introduction of the GDLS (law) was found to be closely followed by a significant reduction in motorcycle traffic crash hospitalizations for the 15–19 year age group. This was also the case for car drivers.									
Scope of application										
Local										
Area wide										
Country	New Zealand									
Regional										
Countries with existing experience or practice	**Many (e.g. Australia; British Columbia, Canada; Hong Kong)**									

References	World Health Organisation. (2017). Powered two- and three-wheeler safety: a road safety manual for decision-makers and practitioners (Pg 88) http://apps.who.int/iris/bitstream/10665/254759/1/9789241511926-eng.pdf?ua=1 Reeder et al: An evaluation of the general effect of the New Zealand graduated driver licensing system on motorcycle traffic crash hospitalisations https://www.sciencedirect.com/science/article/pii/S000145759900024X?via%3Dihub https://trl.co.uk/sites/default/files/TRL529.pdf Baughan, CJ,Simpson, HF (2001). Graduated driver licensing - a review of some current systems. Transport Research Laboratory report TRL529
FOCUS	
Types of accident	
All accidents	X
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	X
Truck driver	
Motorcyclist	X
Cyclist	
Pedestrian	
Novice driver	
Old driver	
Children	
Passenger	X
Other	

Location	
Urban	
Interurban	
Mixed	X
Vehicle category	
Car	X
Van	
Bus	
Truck	
Motorcycle	X
Bicycle	
non-traditional	
other	
Accident phase (Haddon's)	
Pre-crash	X
Crash	X
Post-crash	
Direct incidence	
Road crashes	X
Driving/road using behaviour	
Active mechanism	
Description	Effects of the New Zealand graduated driver licensing system on motorcycle traffic crash hospitalisations and car driver hospitalisations.
Incidence of mechanism (ERST)	
Exposure	
Risk	X
Severity	

Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	?
% of injury accidents	25% of hospital admissions were found to be motorcycle riders, although motorcycles only represented 5% of all licenced vehicles and 1.4% of total distances driven on New Zealand's roads
% of fatalities	20% of hospital admissions were found to be motorcycle riders, although motorcycles only represented 5% of all licenced vehicles and 1.4% of total distances driven on New Zealand's roads
% of serious injuries	?
Comments	
TYPE OF EXPECTED EFFECTS	
Direct effects	
on accidents (total)	Not known
on injury accidents	A significant 22% reduction in the amount of motorcycle rider hospital admissions in the 15-19 age group. There were non-significant reductions for the 20-24 age group. Also for car drivers, there was a reduction in injury accident numbers in the 15-19 year age group (23% reduction) and the 20-24 year age group (12%).
on fatalities	Not known
on serious injuries	Expected, but numbers not known
Collateral effects	
Exposure	Not reported.
Risk	Not reported.
Severity	Not reported.
Trauma recovery	Not mentioned.
Non-safety related effects	
Related to the UN's sustainable development agenda	Not mentioned

ASSESSED REPORTED RESULTS

	Estimate	Confidence interval		
on accidents (total)				
on injury accidents	**-22%**	-39%	-1%	15-24 age group
on fatalities				
on serious injuries				

Type of assessment Individual Meta-analysis	 X 			
COSTS				
Who bears the cost	New Zealand government? Although road users will pay to apply for their licences and courses at each stage.			
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-			
Infrastructure Maintenance - Labour	-			
Infrastructure Maintenance - Equipment	-			
Administrative	Medium?			
Social	-			
Environment	-			
Amount	Not reported			
Cost-Benefit	Not reported			
ACCEPTANCE				
Road users (by class)				
Drivers	Not reported.			
Passengers	Not applicable			
General public				
Other stakeholders				
Road administrations (infrastructure)				
Road operators (traffic management)				
Health care institutions & practitioners	? (not directly involved but would have a vested interest as more responsible riding would lead to decreased serious injury rates). The project was also supported by the Health Research Council of New Zealand.			

Public administration	X (GDLS supported by the government). Also, the analysis project was funded by the New Zealand Road Safety Trust and the Land Transport Safety Authority.
Insurance companies	X The project was supported by the Accident Rehabilitation and Compensation Insurance Corporation.
Enforcement (Police)	
Enforcement (Judicial system / legal institutions)	
Research / Academia	
Communities	
Drivers' clubs	
Road safety NGO's	
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	**?**
SUSTAINABILITY	
Feasibility	
Pre-conditions	**Support from government and government agencies**
Requirements	**?**
Factors contributing for effectiveness	(i) The introduction of the system being government-led and nation-wide, and being a legal requirement for all new motorcyclists (and drivers) to have to go through the GDLS process ; (ii) The least experienced riders not being exposed to high risk situations (and their passengers) until the riders have more riding experience and have proven their knowledge and awareness through theoretical and practical testing; (iii) A reduced number of riders in the 15-19 age group being licenced.
Factors hindering implementation or management	Riders' possible noncompliance with GDLS conditions. Also, a perceived lack of effective penalties and low risk of detection of offending.
Potential for combination with other R. S. Interventions	Already combines 'education' and 'driver training, testing & licensing'. Possibly also 'enforcement' if there is evidence of riders not complying the conditions of their licence at each stage of the GDLS.

Table A5-16 Enforcement of seatbelt use in Tunisia

GENERAL DESCRIPTION										
Designation	Tunisia: the enforcement of the law related to the mandatory of the seatbelt for the front seats in urban areas									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main							X			
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main						X				
Secondary	X									
Description	The campaign from Tunisia ("Attachez Vous à la Vie'…Attachez Votre Ceinture " or "Attach to life…Fasten your Seatbelt") involved the enforcement of a mandatory seatbelt law which had not previously been enforced in urban areas. The law began to be enforced in April 2017 for drivers and front seat passengers, and along with publicity campaign, traffic control checkpoints were set up to monitor compliance with the law.									
Duration										
Application	2016-2018									
Effects	The decree related to the mandatory of wearing Seatbelt for front passengers was published end enforced on 27 Of April 2018. In just one year from 27 April 2017 To 27 April 2018, there were registered: - 635 Traffic Crashes, 128 Deaths and 1031 Injured, which were reductions of 8.86%, 8.81 % and 9.45% respectively.									
Scope of application										
Local										
Area wide										
Country										
Regional	Tunis									
Countries with existing experience or practice	**Many**									

References	http://roadsafetyngos.org/sh_team/afef-ben-ghenia-les-ambassadeurs-de-la-securite-routiere-tunisia/ https://www.lecourrierdelatlas.com/tunisie-le-port-de-la-ceinture-de-securite-bientot-obligatoire-en-tunisie--7009 http://www.lepoint.fr/automobile/actualites/en-tunisie-la-ceinture-de-securite-pourrait-devenir-obligatoire-20-12-2016-2091899_683.php http://www.businessnews.com.tn/vers-une-loi-sur-le-port-obligatoire-de-la-ceinture-de-securite,520,69107,3 For All the TV Coverage click: https://www.youtube.com/watch?v=YYYpmnfU_sU https://www.facebook.com/ambassadeurs.securiteroutiere/videos/1131462936959120/ https://www.facebook.com/pg/ambassadeurs.securiteroutiere/videos/?ref=page_internal
FOCUS	
Types of accident	
All accidents	X
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	X According to the information, all road users were targeted, although this would be all road users in a vehicle with seatbelts.
Truck driver	X
Motorcyclist	
Cyclist	
Pedestrian	
Novice driver	X
Old driver	X
Children	X
Passenger	X

Other	
Location	
Urban	X
Interurban	
Mixed	
Vehicle category	
car	X All vehicles with seatbelts?
van	X
bus	X
truck	X
motorcycle	
bicycle	
non-traditional	
other	
Accident phase (Haddon's)	
Pre-crash	X
Crash	X
Post-crash	
Direct incidence	
Road crashes	X
Driving/road using behaviour	X
Active mechanism	Introduction of seatbelt law, along with publicity campaign and enforcement (traffic control checkpoints)
Description	
Incidence of mechanism (ERST)	
Exposure	X
Risk	

Severity	X
Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	Not mentioned
% of injury accidents	Not mentioned
% of fatalities	Tunisia is the country in North Africa most affected by road deaths after Libya, with 24.40 killed per 100,000 inhabitants. 'More than a thousand deaths each year for a population of 11 million inhabitants'.
% of serious injuries	Not mentioned
Comments	
TYPE OF EXPECTED EFFECTS	
Direct effects	
on accidents (total)	Not expected (increased seatbelt use won't necessarily reduce accident numbers, just severity rates). However, a reduction was found (8.86% reduction in the first year)
on injury accidents	Reduction expected, but numbers not known
on fatalities	Reduction of 8.81% in the first year (2017-2018), 35% reduction compared with 2016 and 44% compared with 2013.
on serious injuries	Reduction of 9.45%
Collateral effects	
Exposure	In 89% of cars at traffic control checkpoints in urban areas, drivers and front seat passengers were using seat belts.
Risk	Not mentioned
Severity	Serious injuries were found to decrease by over 9%.
Trauma recovery	Not mentioned
Non-safety related effects	
Related to the UN's sustainable development agenda	Not mentioned
ASSESSED REPORTED RESULTS	

	Estimate	Confidence interval	
on accidents (total)	-8.86%		
on injury accidents			
on fatalities	-8.81%		
on serious injuries	-9.45%		

Type of assessment Individual Meta-analysis	 X 			
COSTS				
Who bears the cost	Government (legislation, enforcement and campaign costs)?			
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-			
Infrastructure Maintenance - Labour	-			
Infrastructure Maintenance - Equipment	-			
Administrative	Medium?			
Social	-			
Environment	-			
Amount	Not mentioned			
Cost-Benefit	Not mentioned			
ACCEPTANCE				
Road users (by class)				
Drivers	In 89% of cars at traffic control checkpoints in urban areas, drivers and front seat passengers were using seat belts			
Passengers	See above			
General public	?			
Other stakeholders				
Road administrations (infrastructure)				
Road operators (traffic management)				
Health care institutions & practitioners	? (not directly involved but would have a vested interest as increased seatbelt wearing would lead to decreased serious injury rates)			
Public administration	**X (campaign supported by the government)**			

Insurance companies	
Enforcement (Police)	X (enforcement of seatbelt wearing)
Enforcement (Judicial system / legal institutions)	?
Research / Academia	
Communities	
Drivers' clubs	
Road safety NGO's	X
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	**Private sector (no further information)**
SUSTAINABILITY	
Feasibility	
Pre-conditions	**Support from government and NGOs/private and public sector**
Requirements	**It is sustainable because the intervention is continuous so that seatbelts are mandatory in the back seats in urban areas and more road users are involved and reinforce the campaign's actions and the government has become responsive to the campaign's messages and requests.**
Factors contributing for effectiveness	Support from NGOs, private and public sectors and governmental support.
Factors hindering implementation or management	None mentioned. Only about the previous law, where fines were not issued systematically and only amounted to 40 Tunisian dinars, or about 16 euros. But the 2007 reintroduced law appears to have overcome this.
Potential for combination with other R. S. Interventions	Already combines enforcement and education. Possibly also 'driver training, testing & licensing' and maybe 'vehicles' too, to ensure all vehicles are fitted with fully working seatbelts in all seat positions, if not already.

Table A5-17 Communication campaign on drug driving in the UK

GENERAL DESCRIPTION										
Designation	'Drug driving…you'd be off your head' publicity campaign, UK									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main							X			
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main	X									
Secondary						X				
Description	This campaign was launched in 2003 to increase awareness of the penalties for people caught driving under the influence of illegal drugs being the same as those for drink-driving.									
Duration										
Application	The campaign began in 2003, but analysis of the effects on drug-related road deaths between 2002 and 2004, plus the effects on attitudes between 2003 and 2005.									
Effects	The introduction of the campaign was followed by an overall accident injury reduction between 2002 and 2004 and increased awareness amongst the 17-25 year age group between 2003 and 2005.									
Scope of application										
Local	Durham									
Area wide										
Country	UK									
Regional	North-East England									
Countries with existing experience or practice	**Only found UK and Australia**									

References	DRUID project: Deliverable 7.1.1: Review of guidelines, booklets, and other resources: state of the art: 'Drug driving…you'd be off your head' publicity campaign (Page 53) https://www.bast.de/Druid/EN/deliverales-list/downloads/Deliverable_7_1_1.pdf?__blob=publicationFile&v=1 Tunbridge, R.J., Keigan, M., James, F.J. (2001). The incidence of drugs and alcohol in road accident fatalities. Published January 2001. TRL report 495. https://trl.co.uk/reports/TRL495?reportid=2650 https://trl.co.uk/reports/TRL495?reportid=2650 http://www.brake.org.uk/notadrop/15-facts-a-resources/facts/482-drug-driving-an-overview
FOCUS	
Types of accident	
All accidents	X
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	X
Truck driver	X
Motorcyclist	X
Cyclist	
Pedestrian	
Novice driver	
Old driver	
Children	
Passenger	
Other	Drivers in the 17-25 age range

Location	
Urban	
Interurban	
Mixed	X
Vehicle category	
Car	X
Van	X
Bus	X
Truck	X
Motorcycle	X
Bicycle	
non-traditional	
other	
Accident phase (Haddon's)	
Pre-crash	X
Crash	X
Post-crash	
Direct incidence	
Road crashes	X
Driving/road using behaviour	X
Active mechanism	
Description	Effects of the drug-driving campaign on drug-related road deaths and awareness of the penalties for drug-driving, particularly among the 17-25 age range.
Incidence of mechanism (ERST)	
Exposure	
Risk	X
Severity	X

Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	?
% of injury accidents	?
% of fatalities	Between Oct 1996 and June 2000, at least one medicinal or illicit drug was detected in 24.1% of 1184 fatal road traffic casualties
% of serious injuries	?
Comments	Data from TRL report 495.
TYPE OF EXPECTED EFFECTS	
Direct effects	
on accidents (total)	Not known
on injury accidents	Not known
on fatalities	Drug related road deaths reduced from 12 in 2002 to 0 in 2004 in the Durham police force area.
on serious injuries	Not known
Collateral effects	
Exposure	Not reported.
Risk	Awareness amongst the 17-25 target group in the Durham police force area rose from nothing when the campaign started in 2003 to over 40% of those surveyed two years later.
Severity	Not reported.
Trauma recovery	Not mentioned.
Non-safety related effects	
Related to the UN's sustainable development agenda	Not mentioned
ASSESSED REPORTED RESULTS	

	Estimate	Confidence interval		
on accidents (total)				
on injury accidents				
on fatalities	-12			From 12 fatalities in 2002 to 0 in 2004.
on serious injuries				
Type of assessment				

Individual Meta-analysis	X			
COSTS				
Who bears the cost	The campaign was funded by UK government agencies (Northumbria police/Local authority road safety officers' association (LARSOA)/Government office for the North East/Cleveland police/Durham constabulary)			
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-			
Infrastructure Maintenance - Labour	-			
Infrastructure Maintenance - Equipment	-			
Administrative	Medium?			
Social	-			
Environment	-			
Amount	?			
Cost-Benefit	No information given			
ACCEPTANCE				
Road users (by class)				
Drivers	Awareness of the penalties involved when drug-driving increased by 40% after the campaign was introduced.			
Passengers	No information given.			
General public	Not mentioned			
Other stakeholders				
Road administrations (infrastructure)				
Road operators (traffic management)				
Health care institutions & practitioners	? Not directly involved but would have a vested interest as less drug driving should lead to decreased serious injury rates.			
Public administration	X Local authority road safety officers' association (LARSOA), Government office for the North East			

Insurance companies	
Enforcement (Police)	X Northumbria police, Cleveland police, Durham constabulary.
Enforcement (Judicial system / legal institutions)	
Research / Academia	
Communities	
Drivers' clubs	
Road safety NGO's	
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	**?**
SUSTAINABILITY	
Feasibility	
Pre-conditions	Support from government, government agencies and police (enforcement)
Requirements	Ensuring that penalties are handed out when drug-driving is detected to act as a deterrent for reoffending and deter other possible first-time offenders
Factors contributing for effectiveness	(i) Support and funding from the government and police forces; (ii) Intensive publicity and education aimed at the 17-25 age group, using posters, written press, radio spots, TV commercials, website; (iii) Targeting drivers in the 17-25 year age range, who are potentially more likely to drug-drive; (iv) Also, surveying the 17-25 target group to increase awareness and knowledge of the penalties of drug-driving and the similarities to the penalties of drink-driving to avoid drug-driving occurring in the first place by improving attitudes.
Factors hindering implementation or management	None mentioned
Potential for combination with other R. S. Interventions	Already combines 'education' (publicity) with 'enforcement'.

Table A5-18 Toughening mobile phone penalties in the UK

GENERAL DESCRIPTION										
Designation	The effects of the introduction of tougher penalties for the use of hand-held mobile phones whilst driving, in the UK									
Road Safety Pillars	**1 Management**		**2 Infrastructure**		**3 Vehicles**		**4 Road users**		**5 Post-crash emergency & recovery**	
Main							X			
Secondary										
Road Safety Intervention Categories (Supreme)	**1 Education & campaigns**	**2 Driver training, testing & licensing**	**3 Rehabilitation & diagnostics**	**4 Vehicles**	**5 Infrastructure**	**6 Enforcement**	**7 Statistics & in-depth analysis**	**8 Institutional organisation**	**9 Post accident care**	**10 Bundles**
Main						X				
Secondary										
Description	In 2003, a ban on hand-held mobile phone use whilst driving was introduced in the UK, as a result of a gradual increase in the number of drivers using mobile phones between 2000 and 2003 (from 1.5% to 2.4%). The penalty for being caught using a mobile phone whilst driving was £30. After an initial decrease in mobile phone use numbers, the numbers started to increase again between 2004 and 2006. So in February 2007, tougher penalties were introduced in the UK for using a hand-held mobile phone while driving (£60 plus 3 penalty points, or £1000 if attendance at court). Later in 2007, a survey was undertaken to see how the new tougher penalties had affected the rates of hand-held mobile phone use whilst driving.									
Duration										
Application	The tougher penalties were introduced in 2007, but rates were compared from 2004-2006 (before increased penalties) and 2007 (after increased penalties).									
Effects	The introduction of the tougher penalties led to a decreased use in hand-held mobile phone use whilst driving.									
Scope of application										
Local										
Area wide										
Country	UK									
Regional	South-East England									
Countries with existing experience or practice	**Only found UK and USA**									

References	TRL leaflets 'Mobile phone use by drivers', 2004-2006 (https://trl.co.uk/sites/default/files/LF2100.pdf) and 2005-2007 (https://trl.co.uk/sites/default/files/LF2103.pdf). Originally sourced from DaCoTA (2012) Car telephone use while driving, Deliverable 4.8b of the EC FP7 project DaCoTA (Page 25) https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/specialist/erso/pdf/safety_issues/hazardous_behaviour/03-car_telephone_use_while_driving_en.pdf

FOCUS	
Types of accident	
All accidents	
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	Didn't look at accidents, only rates of hand-held mobile phone use.
Class of road user	
Car driver	X
Truck driver	X
Motorcyclist	
Cyclist	
Pedestrian	
Novice driver	
Old driver	
Children	
Passenger	
Other	2 categories of 'car drivers' and 'other drivers'
Location	
Urban	

Interurban	
Mixed	X
Vehicle category	
Car	X
Van	X
Bus	X
Truck	X
Motorcycle	
Bicycle	
non-traditional	
other	
Accident phase (Haddon's)	
Pre-crash	X
Crash	X
Post-crash	
Direct incidence	
Road crashes	
Driving/road using behaviour	X
Active mechanism	
Description	Effects of introducing tougher penalties for hands-free mobile phone use whilst driving
Incidence of mechanism (ERST)	
Exposure	
Risk	X
Severity	
Trauma recovery	
SIZE OF PROBLEM TACKLED	

% of accidents (total)	?			
% of injury accidents	?			
% of fatalities	?			
% of serious injuries	?			
Comments	Only mobile phone use rates looked at, not accident rates/severities			
TYPE OF EXPECTED EFFECTS				
Direct effects				
on accidents (total)	Not known			
on injury accidents	Not known			
on fatalities	Not known			
on serious injuries	Not known			
Collateral effects				
Exposure	Not reported.			
Risk	Rate of hand-held mobile phone use reduced by 1.4% for car drivers (1% for hand-held devices, 0.4% for hands-free). For 'other drivers' it was 2.9%.			
Severity	Not reported.			
Trauma recovery	Not mentioned.			
Non-safety related effects				
Related to the UN's sustainable development agenda	Not mentioned			
ASSESSED REPORTED RESULTS				
	Estimate	**Confidence interval**		Incidences of hand-held mobile use whilst driving was reduced by 1.4%. For 'other drivers' it was 2.9%.
on accidents (total)				
on injury accidents				
on fatalities				
on serious injuries				
Type of assessment				
Individual	X			
Meta-analysis				

COSTS				
Who bears the cost	The UK government, but some money will be recouped by drivers being fined for using hand-held mobile phones.			
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-			
Infrastructure Maintenance - Labour	-			
Infrastructure Maintenance - Equipment	-			
Administrative	Medium?			
Social	-			
Environment	-			
Amount	No information given			
Cost-Benefit	No information given			
ACCEPTANCE				
Road users (by class)				
Drivers	Reduced levels of mobile phone use whilst driving shows a level of acceptance from drivers of the increased penalties.			
Passengers	No information given.			
General public	Not mentioned			
Other stakeholders				
Road administrations (infrastructure)				
Road operators (traffic management)				
Health care institutions & practitioners	? Not directly involved but would have a vested interest as less mobile phone use whilst driving should it lead to decreased accident rates involving mobile phone use.			
Public administration	X UK Department for Transport			
Insurance companies				
Enforcement (Police)	X Support to enforce giving out penalties to offenders			

Enforcement (Judicial system / legal institutions)	X Ensuring penalties are carried out (e.g. fines paid, points put on driving licence).
Research / Academia	
Communities	
Drivers' clubs	
Road safety NGO's	
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	**X**
SUSTAINABILITY	
Feasibility	
Pre-conditions	Support from government, government agencies and police (enforcement)
Requirements	Ensuring that penalties are given when hand-held mobile phone use is detected to act as a deterrent for reoffending and deter other possible first-time offenders
Factors contributing for effectiveness	(i) Increasing the penalties (fines and penalty points on driving licence) (ii) Support and funding from the government and police forces; (iii) Publicity (using media) to publicise the increased penalties.
Factors hindering implementation or management	Despite to the electronic devices used to detect the microwave radiation emitted by both hand-held and hands-free mobile phones and combining this with visual observations, the observers may have been unable to detect some phone use and therefore the numbers quoted may be an under-estimation of the actual numbers of hand-held devices being used.
Potential for combination with other R. S. Interventions	Combine with 'education' (publicity) and also 'possibly 'driver training, testing and licencing'.

Table A5-19 Speed aware course for speeding offenders in the UK

<table>
<tr><td colspan="11">GENERAL DESCRIPTION</td></tr>
<tr><td>Designation</td><td colspan="10">Impact Evaluation of the UK National Speed Awareness Course</td></tr>
<tr><td>Road Safety Pillars</td><td colspan="2">1
Management</td><td colspan="2">2
Infrastructure</td><td colspan="2">3
Vehicles</td><td colspan="2">4
Road users</td><td colspan="2">5
Post-crash emergency & recovery</td></tr>
<tr><td>Main
Secondary</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2">X</td><td colspan="2"></td></tr>
<tr><td>Road Safety Intervention Categories (Supreme)</td><td>1
Education & campaigns</td><td>2
Driver training, testing & licensing</td><td>3
Rehabilitation & diagnostics</td><td>4
Vehicles</td><td>5
Infrastructure</td><td>6
Enforcement</td><td>7
Statistics & in-depth analysis</td><td>8
Institutional organisation</td><td>9
Post accident care</td><td>10
Bundles</td></tr>
<tr><td>Main</td><td></td><td></td><td></td><td></td><td></td><td>X</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Secondary</td><td></td><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Description</td><td colspan="10">In the UK, the National Speed Awareness Course (NSAC) is a short retraining course offered by most police forces in England and Wales as an alternative to penalties for low-level speeding offences. A study commissioned by the UK Department for Transport and carried out by Ipsos MORI and the Institute for Transport Studies at the University of Leeds (Ipsos MORI, 2018) was undertaken to evaluate the impact on speed reoffending rates and accident rates of participating on the course compared with accepting the penalties of obtaining points on the driving licence and/or fines.</td></tr>
<tr><td>Duration</td><td colspan="10"></td></tr>
<tr><td>Application</td><td colspan="10">National course introduced in 2007. Analysis undertaken on those taking the course between 2012 and 2017.</td></tr>
<tr><td>Effects</td><td colspan="10">Participation in the course was found to be more effective at reducing speed reoffending than a fine and penalty points, although the effects on injury accident rates was not as clear.</td></tr>
<tr><td>Scope of application</td><td colspan="10"></td></tr>
<tr><td>Local</td><td colspan="10"></td></tr>
<tr><td>Area wide</td><td colspan="10"></td></tr>
<tr><td>Country</td><td colspan="10">UK</td></tr>
<tr><td>Regional</td><td colspan="10"></td></tr>
<tr><td>Countries with existing experience or practice</td><td colspan="10">Many</td></tr>
</table>

References	Ipsos MORI (2018). Impact Evaluation of the National Speed Awareness Course https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/706208/national-speed-awareness-course-evaluation.pdf Also: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/706208/national-speed-awareness-course-evaluation.pdf
FOCUS	
Types of accident	
All accidents	X (also looked at reoffending rates)
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	X.
Truck driver	X
Motorcyclist	X
Cyclist	
Pedestrian	
Novice driver	
Old driver	
Children	
Passenger	
Other	
Location	
Urban	

Interurban	
Mixed	X
Vehicle category	
Car	X All motor vehicles
Van	X
Bus	X
Truck	X
Motorcycle	X
Bicycle	
non-traditional	
other	
Accident phase (Haddon's)	
Pre-crash	X
Crash	X
Post-crash	
Direct incidence	
Road crashes	X
Driving/road using behaviour	X
Active mechanism	Effects of the national speed awareness course on the rate of reoffending as opposed to taking the fine and penalty points instead. Also the effect on the rate of accident involvement.
Description	
Incidence of mechanism (ERST)	
Exposure	X
Risk	X
Severity	
Trauma recovery	

SIZE OF PROBLEM TACKLED	
% of accidents (total)	?
% of injury accidents	In 2015, exceeding the speed limit was reported as a contributory factor in 4.9% (5,272) of reported injury accidents in the UK, and this number has remained stable since 2011. For fatal accidents only, the rate was 15%, which was an increase since 2011 (12.8%)
% of fatalities	For fatal accidents only, the rate was 15% in 2015, which was an increase since 2011 (12.8%).
% of serious injuries	?
Comments	In addition, in 2016, the percentage of cars found exceeding the speed limit on motorways (based on survey results) was found to be 46%, for high speed single carriageways it was 8%, for 30mph roads it was 53% and for 20mph roads it was 81%.
TYPE OF EXPECTED EFFECTS	
Direct effects	
on accidents (total)	216 of the course participants (1.48 collisions per 10000 drivers) between 2012 and 2017 were involved in a collision at some point after the course, compared with 33 of those who did not accept a place on the course (1.72 collisions per 10000 drivers). Not statistically significant.
on injury accidents	Expected, but numbers not known
on fatalities	Not known
on serious injuries	Expected, but numbers not known
Collateral effects	
Exposure	Expected, but not reported.
Risk	Between 2012 and 2017, 13.4% of those who participated on the course were detected reoffending, compared with 15.5% of those who did not accept the course and accepted the fine and penalty points instead.
Severity	Not reported.
Trauma recovery	Not mentioned.
Non-safety related effects	
Related to the UN's sustainable development agenda	Not mentioned

ASSESSED REPORTED RESULTS

	Estimate	Confidence interval		
on accidents (total)	-0.24 per 10000 drivers			
on injury accidents				
on fatalities				
on serious injuries				

Type of assessment				
Individual	X			
Meta-analysis				
COSTS				
Who bears the cost	UK Government initially, although course participants pay for the course instead of a fine			
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-			
Infrastructure Maintenance - Labour	-			
Infrastructure Maintenance - Equipment	-			
Administrative	Medium?			
Social	-			
Environment	-			
Amount	The course costs approximately £100 per participant, depending on which area they are in.			
Cost-Benefit	Cost savings associated with reduced collisions is between £56.66 and £91.33 per participant between 3 and 10 years after attending the course			
ACCEPTANCE				
Road users (by class)				
Drivers	1.4 million drivers accepted a place on the course between 2012 and 2017, compared with 192,000 who did not accept the course offer (from available records), so acceptance was high.			
Passengers	Not applicable			
General public				
Other stakeholders				
Road administrations (infrastructure)				
Road operators (traffic management)				
Health care institutions & practitioners	? (not directly involved but would have a vested interest as reduced speeding rates would lead to decreased serious injury rates)			

Public administration	**X (national course supported by the government)**
Insurance companies	X (not directly mentioned, but related to renewal rates offered to drivers who accepted a place on the course, compared with those who didn't)
Enforcement (Police)	X (nearly all police forces in the UK are empowered to offer the speed awareness course instead of fine and penalty points)
Enforcement (Judicial system / legal institutions)	X (not directly mentioned but would enforce penalties issued by police)
Research / Academia	
Communities	
Drivers' clubs	
Road safety NGO's	
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	**?**
SUSTAINABILITY	
Feasibility	
Pre-conditions	**Support from government and police forces**
Requirements	**?**
Factors contributing for effectiveness	(i) Strong support from national government to implement the course nation-wide across the majority of police forces in England and Wales; (ii) Public awareness and acceptability of the course as an alternative to penalty points and fines, as penalty points in particular can affect insurance policies greater than going on a NASC and some drivers ability to drive for work; (iii) The course content is not looked on as a punishment, but as a way to educate and inform the majority of drivers who have been caught speeding just above the limits to enable them to voluntarily change their driving habits by providing them with the awareness and understanding of the importance of adhering to speed limits.
Factors hindering implementation or management	None mentioned.
Potential for combination with other R. S. Interventions	Already combines enforcement and 'driver training, testing & licensing'. Also 'education'.

Table A5-20 Implementation of Deputy Safety Volunteers in Burkina Faso

<table>
<tr><td colspan="11">GENERAL DESCRIPTION</td></tr>
<tr><td>Designation</td><td colspan="10">Establishment of the VADS- Volontaires Adjoints de Sécurité (Deputy Safety Volunteers)</td></tr>
<tr><td>Road Safety Pillars</td><td colspan="2">1
Management</td><td colspan="2">2
Infrastructure</td><td colspan="2">3
Vehicles</td><td colspan="2">4
Road users</td><td colspan="2">5
Post-crash emergency & recovery</td></tr>
<tr><td>Main
Secondary</td><td colspan="2"></td><td colspan="2">X</td><td colspan="2"></td><td colspan="2">X</td><td colspan="2">X</td></tr>
<tr><td>Road Safety Intervention Categories (Supreme)</td><td>1
Education & campaigns</td><td>2
Driver training, testing & licensing</td><td>3
Rehabilitation & diagnostics</td><td>4
Vehicles</td><td>5
Infrastructure</td><td>6
Enforcement</td><td>7
Statistics & in-depth analysis</td><td>8
Institutional organisation</td><td>9
Post accident care</td><td>10
Bundles</td></tr>
<tr><td>Main
Secondary</td><td>X</td><td></td><td></td><td></td><td>X</td><td>X</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Description</td><td colspan="10">The VADS- Volontaires Adjoints De Sécurité (Deputy Security Volunteers) programme was developed by the Government of Burkina Faso, with the aim of instilling some road safety measures as well as reducing the unemployment rate among the youth in the country. The VADS intervention dealt with vandalization of traffic light installations that often lead to power black outs in certain areas as well.
The main tasks of the VADS are:
✓ to regulate road traffic at the intersections;
✓ to support security policy, especially in the area of community policing;
✓ to assist the national police and the municipal police in various activities such as securing a site identified to host a public event, the establishment or legalization of administrative documents, accident reports, roadside checks, etc.</td></tr>
<tr><td>Duration</td><td colspan="10"></td></tr>
<tr><td>Application</td><td colspan="10">Mandate of 3 years per promotion (1st promotion: 2013-2015 and 2nd promotion: 2017-2019).</td></tr>
<tr><td>Effects</td><td colspan="10">Long lasting</td></tr>
<tr><td>Scope of application</td><td colspan="10"></td></tr>
<tr><td>Local</td><td colspan="10">3000 VADS agents for a 3 year term.</td></tr>
<tr><td>Area wide</td><td colspan="10">VADS are recruited among young women and men aged 18 to 40 years. They are distributed in the 13 regions of the country.</td></tr>
<tr><td>Country</td><td colspan="10">Burkina Faso</td></tr>
<tr><td>Regional</td><td colspan="10"></td></tr>
<tr><td>Countries with existing experience or practice</td><td colspan="10">Burkina Faso</td></tr>
<tr><td>References</td><td colspan="10"></td></tr>
</table>

FOCUS	
Types of accident	
All accidents	X
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	
Truck driver	
Motorcyclist	
Cyclist	
Pedestrian	
Novice driver	
Old driver	
Children	
Passenger	
Other	X All road users
Location	
Urban	X
Interurban	
Mixed	
Vehicle category	
car	

van	
bus	
truck	
motorcycle	
bicycle	
non-traditional	
other	
Accident phase (Haddon's)	
Pre-crash	X
Crash	
Post-crash	X
Direct incidence	
Road crashes	X
Driving/road using behaviour	X
Active mechanism	
Description	VADS agents engaged in the traffic control mission, deploy every day on the arteries of urban centers to regulate the traffic. Their intervention helps to make traffic flow and secure.
Incidence of mechanism (ERST)	
Exposure	X
Risk	X
Severity	
Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	
% of injury accidents	
% of fatalities	
% of serious injuries	

Comments	The Security Observatory of the Ouagadougou Commune (OSCO) is a Technical Service of the General Direction of the Municipal Police. On the basis of statistical data of traffic crashes established by the National Fire Brigade and the General Directorate of the National Police, he draws up annual reports on security in Ouagadougou. According to the 2016 OSCO report, the following information is available: About the number of accidents: ✓ 6845 road accidents compared to 7764 cases in 2015, a decrease of 11.189%; ✓ 7544 victims against 8943 victims in 2015, a decrease of 15.64% in the number of victims in 2016. Among these victims: ✓ 282 lost consciousness compared to 338 in 2015; ✓ 61 died as against 65 for the previous year. Considering the distribution of accidents according to the types of road users, we can see that: - the two wheels generated 6601 accidents, ie 96.43% of the total number of crashes recorded in the municipality; - the two wheels made 7229 victims (4958 men and 2271 women), or 95.82% of the total number of victims of crashes recorded in the municipality; - the two wheels caused the deaths of 53 people (41 men and 12 women), that is 86.88% of all the deceased victims. Considering the distribution of accident victims by age group, sex and the types of véhicule involved, we have: - people between the ages of 16 and 35 are the most affected by road traffic accidents (4623 victims, or 61.27% of the total number of victims) and distributed as follows: - 3071 men, or 40.70% of the total number of accident victims; - 1552 women, or 20.57% of the total number of accident victims. (source : http://news.aouaga.com/h/108281.html)
TYPE OF EXPECTED EFFECTS	
Direct effects	
on accidents (total)	Yes
on injury accidents	Yes
on fatalities	Yes
on serious injuries	Yes
Collateral effects	
Exposure	Yes
Risk	Yes
Severity	Yes
Trauma recovery	
Non-safety related effects	
Related to the UN's sustainable development agenda	The VADS implementation project provides employment and income for three thousand (3,000) young people for three years.
ASSESSED REPORTED RESULTS	

	Estimate	Confidence interval		
on accidents (total) on injury accidents on fatalities on serious injuries	Not mentioned			
Type of assessment Individual Meta-analysis				
COSTS				
Who bears the cost				
Low-cost infrastructure	-			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-			
Infrastructure Maintenance - Labour	-			
Infrastructure Maintenance - Equipment	-			
Administrative	The Government through the National Job Creation Program.			
Social				
Environment				
Amount				
Cost-Benefit				
ACCEPTANCE				
Road users (by class)				
Drivers	Yes			
Passengers	Yes			
General public				

Other stakeholders	
Road administrations (infrastructure)	
Road operators (traffic management)	
Health care institutions & practitioners	
Public administration	
Insurance companies	
Enforcement (Police)	
Enforcement (Judicial system / legal institutions)	
Research / Academia	
Communities	
Drivers' clubs	
Road safety NGO's	
Taxi driver / taxi owner associations	
Driving licence instructors	
Other	X All the population
SUSTAINABILITY	
Feasibility	
Pre-conditions	Political will
Requirements	Youth accession to the project
Factors contributing for effectiveness	Lack of employment for young people
Factors hindering implementation or management	Not mentioned
Potential for combination with other R. S. Interventions	public health, public safety.

Table A5-21 Communication campaign “Zuska” in Kenya

<table>
<tr><td colspan="11">GENERAL DESCRIPTION</td></tr>
<tr><td>Designation</td><td colspan="10">Zusha! Taxi safety campaign</td></tr>
<tr><td>Road Safety Pillars</td><td colspan="2">1
Management</td><td colspan="2">2
Infrastructure</td><td colspan="2">3
Vehicles</td><td colspan="2">4
Road users</td><td colspan="2">5
Post-crash emergency & recovery</td></tr>
<tr><td>Main</td><td colspan="2"></td><td colspan="2">X</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Secondary</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Road Safety Intervention Categories (Supreme)</td><td>1
Education & campaigns</td><td>2
Driver training, testing & licensing</td><td>3
Rehabilitation & diagnostics</td><td>4
Vehicles</td><td>5
Infrastructure</td><td>6
Enforcement</td><td>7
Statistics & in-depth analysis</td><td>8
Institutional organisation</td><td>9
Post accident care</td><td>10
Bundles</td></tr>
<tr><td>Main</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Secondary</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Description</td><td colspan="10">Promoting changes in taxi (matatu) driving behaviour through social pressure from passengers. This was obtained through voluntary application of stickers distributed by insurance companies. Social responsibility was invoked and social norms related to no comment on unsafe driving by passenger of safer speeds and less aggressive driving behaviour were changed.</td></tr>
<tr><td>Duration</td><td colspan="10"></td></tr>
<tr><td>Application</td><td colspan="10">2011-2012</td></tr>
<tr><td>Effects</td><td colspan="10">Long lasting</td></tr>
<tr><td>Scope of application</td><td colspan="10"></td></tr>
<tr><td>Local</td><td colspan="10">Vehicles insured by an insurance company (12000 vehicles out of 20000 officially in operation across the country)</td></tr>
<tr><td>Area wide</td><td colspan="10">7 cities, urban and interurban taxis</td></tr>
<tr><td>Country</td><td colspan="10"></td></tr>
<tr><td>Regional</td><td colspan="10"></td></tr>
<tr><td>Countries with existing experience or practice</td><td colspan="10">Kenya</td></tr>
<tr><td>References</td><td colspan="10">https://doi.org/10.1073/pnas.1422009112</td></tr>
<tr><td></td><td colspan="10"></td></tr>
<tr><td colspan="11">FOCUS</td></tr>
<tr><td>Types of accident</td><td colspan="10"></td></tr>
</table>

All accidents	Speed related and aggressive driving related accidents
Frontal collision	
Lateral collision	
Rear end collision	
Ran-off-lane	
Hit pedestrian	
Hit cyclist	
Other	
Class of road user	
Car driver	Taxi driver
Truck driver	
Motorcyclist	
Cyclist	
Pedestrian	
Novice driver	
Old driver	
Children	
Passenger	
Other	
Location	
Urban	X
Interurban	X
Mixed	
Vehicle category	
car	X
van	X
bus	
truck	

motorcycle bicycle non-traditional other	
Accident phase (Haddon's) Pre-crash Crash Post-crash	 X
Direct incidence Road crashes Driving/road using behaviour	 X
Active mechanism Description	The intervention aimed at directly inform individuals of the feasibility of passengers complaining about driving behaviour and to lower the cost of acting in accordance. More indirectly, the messages could legitimize complaint, allowing riders to confidently challenge the heretofore-unquestioned authority of the driver.
Incidence of mechanism (ERST) Exposure Risk Severity Trauma recovery	 X X
SIZE OF PROBLEM TACKLED	
% of accidents (total) % of injury accidents % of fatalities % of serious injuries	
Comments	Not clearly stated in the description. According to alternative sources, 42% of fatalities were pedestrians and 38% vehicle passengers (Kenya, 1971-1990); 56% of non-fatal traffic injuries were passengers and 17% pedestrians (Eldoret Hospital - http://dx.doi.org/10.1076/icsp.10.1.53.14103).

TYPE OF EXPECTED EFFECTS			
Direct effects			
on accidents (total)	Yes		
on injury accidents	Yes		
on fatalities	Yes		
on serious injuries	Yes		
Collateral effects			
Exposure	Not mentioned		
Risk	Not mentioned		
Severity	Not mentioned		
Trauma recovery	Not mentioned		
Non-safety related effects			
Related to the UN's sustainable development agenda	Not mentioned		
ASSESSED REPORTED RESULTS			
	Estimate	**Confidence interval**	
on accidents (total)	-32%	-20%	-44%
on injury accidents			
on fatalities			
on serious injuries			
Type of assessment			
Individual	X		
Meta-analysis			
COSTS			
Who bears the cost	State/University/Insurance company		
Low-cost infrastructure	-		
Infrastructure investment - Labour	-		
Infrastructure investment - Equipment	-		

Infrastructure Maintenance - Labour	-
Infrastructure Maintenance - Equipment	-
Administrative	Low
Social	
Environment	-
Amount	Total: 100k USD, of which, the lottery accounted to (600 USD/week)
Cost-Benefit	10~45 USD per DALY (Disability-Adjusted Life Year) saved
ACCEPTANCE	
Road users (by class)	
Drivers	Fell over the first 6 months of the campaigns
Passengers	Yes
General public	
Other stakeholders	
Road administrations (infrastructure)	
Road operators (traffic management)	
Health care institutions & practitioners	
Public administration	
Insurance companies	Active cooperation
Enforcement (Police)	
Enforcement (Judicial system / legal institutions)	
Research / Academia	
Communities	
Drivers' clubs	
Road safety NGO's	
Taxi driver / taxi owner associations	X
Driving licence instructors	

Other	
SUSTAINABILITY	
Feasibility	
Pre-conditions	Computerized insurance claim processing; willingness to share claims data
Requirements	Cooperation of taxi drivers & taxi owners
Factors contributing for effectiveness	Lottery among taxis & taxi drivers who kept their stickers
Factors hindering implementation or management	Not mentioned
Potential for combination with other R. S. Interventions	With radio/television campaign (but no measurable effects detected)

Table A5-22 Establishment of an emergency first aid responder system (several countries)

<table>
<tr><th colspan="11">GENERAL DESCRIPTION</th></tr>
<tr><td>Designation</td><td colspan="10">Establishment of an emergency first aid responder system</td></tr>
<tr><td>Road Safety Pillars</td><td colspan="2">1
Management</td><td colspan="2">2
Infrastructure</td><td colspan="2">3
Vehicles</td><td colspan="2">4
Road users</td><td colspan="2">5
Post-crash emergency & recovery</td></tr>
<tr><td>Main</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2">X</td></tr>
<tr><td>Secondary</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Road Safety Intervention Categories (Supreme)</td><td>1
Education & campaigns</td><td>2
Driver training, testing & licensing</td><td>3
Rehabilitation & diagnostics</td><td>4
Vehicles</td><td>5
Infrastructure</td><td>6
Enforcement</td><td>7
Statistics & in-depth analysis</td><td>8
Institutional organisation</td><td>9
Post accident care</td><td>10
Bundles</td></tr>
<tr><td>Main</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>X</td><td></td></tr>
<tr><td>Secondary</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Description</td><td colspan="10">Establishment of an emergency first aid responder system. Lay-persons are trained in basic emergency first aid skills, ensuring they are fit to manage emergency scenes and to provide basic support to accident victims (also of other violent events). Trainees may be volunteers from community members, from special interested road user groups or from especially relevant groups (e.g. drivers, taxi drivers, commercial drivers, community leaders). This is a first step in emergency care systems.</td></tr>
<tr><td>Duration</td><td colspan="10"></td></tr>
<tr><td>Application</td><td colspan="10">2011</td></tr>
<tr><td>Effects</td><td colspan="10">Long lasting</td></tr>
<tr><td>Scope of application</td><td colspan="10"></td></tr>
<tr><td>Local</td><td colspan="10">Community of Menenberg, in Cape Town, South Africa</td></tr>
<tr><td>Area wide</td><td colspan="10">Expansion is possible</td></tr>
<tr><td>Country</td><td colspan="10">Expansion is possible</td></tr>
<tr><td>Regional</td><td colspan="10"></td></tr>
<tr><td>Countries with existing experience or practice</td><td colspan="10">South Africa, Ghana, Uganda, Nepal, Cambodia, Iraq</td></tr>
<tr><td>References</td><td colspan="10">http://dx.doi.org/10.1136/emermed-2011-200271
http://dx.doi.org/10.1136/emermed-2011-200619
http://dx.doi.org/10.1016/j.jss.2014.03.029
https://doi.org/10.1016/j.iatssr.2017.01.001</td></tr>
<tr><td></td><td colspan="10"></td></tr>
</table>

FOCUS	
Types of accident	
All accidents	All accidents – include active and passive safety concepts
Frontal collision	Yes
Lateral collision	Yes
Rear end collision	Yes
Ran-off-lane	Yes
Hit pedestrian	Yes
Hit cyclist	Yes
Other	Yes
Class of road user	
Car driver	Yes
Truck driver	Yes
Motorcyclist	Yes
Cyclist	Yes
Pedestrian	Yes
Novice driver	Yes
Old driver	Yes
Children	Yes
Passenger	Yes
Other	Yes
Location	
Urban	Yes
Interurban	Yes
Mixed	Yes
Vehicle category	
car	Yes
van	Yes

bus	Yes
truck	Yes
motorcycle	Yes
bicycle	Yes
non-traditional	Yes
other	All road users
Accident phase (Haddon's)	
Pre-crash	
Crash	
Post-crash	X
Direct incidence	
Road crashes	
Driving/road using behaviour	
Active mechanism	
Description	The training curriculum was developed to provide practical capabilities enabling trainees to manage emergency scenes, to deal with unconscious patients and to assist violent injury victims. Trainees are voluntary and are involved in community-based services, bus/taxi drivers, police officers or community leaders. Trainees are more confident in volunteering for helping accident victims and in providing first-aid, prior to arrival of formal prehospital care or transport to hospital. This, as a first step in emergency care systems.
Incidence of mechanism (ERST)	
Exposure	
Risk	
Severity	
Trauma recovery	X
SIZE OF PROBLEM TACKLED	
% of accidents (total)	
% of injury accidents	
% of fatalities	

% of serious injuries				
Comments	Not clearly stated in the descriptions. In urban areas where emergency medical systems are available it helps to stabilize the victims until the arrival of ambulances; in rural areas and in urban areas where EMS are not available it helps to prevent needless death and disability while ad hoc transport to hospital is being organised and to prepare minimum care during this transport. Emergency medical care comprises three steps: care in the community; care during transport; and care on arrival at the health facility.			
TYPE OF EXPECTED EFFECTS				
Direct effects				
on accidents (total)	No			
on injury accidents	No			
on fatalities	No			
on serious injuries	No			
Collateral effects				
Exposure	No			
Risk	No			
Severity	No			
Trauma recovery	No			
Non-safety related effects				
Related to the UN's sustainable development agenda	Improvement of pollution – not measured in this study			
ASSESSED REPORTED RESULTS				
	Estimate	**Confidence interval**		
on accidents (total)				
on injury accidents				
on fatalities				
on serious injuries				
Type of assessment				
Individual	X			
Meta-analysis				
COSTS				

Who bears the cost	Community / Health institution / University
Low-cost infrastructure	-
Infrastructure investment - Labour	-
Infrastructure investment - Equipment	-
Infrastructure Maintenance - Labour	-
Infrastructure Maintenance - Equipment	-
Administrative	Low The main requirements to sustain the system are a stable population (from which to recruit community instructors and trainees), a local community organisation (to perform day-to-day administration), and an academic or official body (to provide accreditation to the training).
Social	Low
Environment	Improvement not measured in the study
Amount	One full day instruction, involving PowerPoint presentations and practical sessions.
Cost-Benefit	
ACCEPTANCE	
Road users (by class)	
Drivers	Yes
Passengers	Yes
General public	X
Other stakeholders	
Road administrations (infrastructure)	X
Road operators (traffic management)	
Health care institutions & practitioners	X
Public administration	
Insurance companies	N.A.
Enforcement (Police)	Yes
Enforcement (Judicial system / legal institutions)	N.A.
Research / Academia	N.A.

Communities	X
Drivers' clubs	N.A.
Road safety NGO's	N.A.
Taxi driver / taxi owner associations	N.A.
Driving licence instructors	N.A.
Other	N.A.
SUSTAINABILITY	
Feasibility	
Pre-conditions	Community cohesion and community-based services
Requirements	
Factors contributing for effectiveness	The basic EFAR service delivery may be complemented with an additional service layer (advanced EFAR system) with specialized and specially equiped personnel, which can be more sparcely established, with the intention of upgrading them to an ambulance system in the future.
Factors hindering implementation or management	Not mentioned
Potential for combination with other R. S. Interventions	May be combined and expanded by a unique EMS call number and a full EMS service

Table A5-23 Low cost engineering measures and strict enforcement of traffic rules on a European single carriageway trunk road

<table>
<tr><th colspan="11">GENERAL DESCRIPTION</th></tr>
<tr><td>Designation</td><td colspan="10">Low cost engineering measures and strict enforcement of traffic rules on a trunk road</td></tr>
<tr><td>Road Safety Pillars</td><td colspan="2">1
Management</td><td colspan="2">2
Infrastructure</td><td colspan="2">3
Vehicles</td><td colspan="2">4
Road users</td><td colspan="2">5
Post-crash emergency & recovery</td></tr>
<tr><td>Main</td><td colspan="2"></td><td colspan="2">X</td><td colspan="2"></td><td colspan="2">X</td><td colspan="2"></td></tr>
<tr><td>Secondary</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
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<tr><td>Main</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>X</td></tr>
<tr><td>Secondary</td><td>X</td><td></td><td></td><td></td><td>X</td><td>X</td><td></td><td>X</td><td></td><td></td></tr>
<tr><td>Description</td><td colspan="10">Application of a bundle of interventions on a 170 km long trunk road section (IP5)

Low cost engineering measures comprised the following:
<ol type="a">
changes on road environment (roadway and roadside)
<ol type="i">
Reduce approach speeds to dangerous horizontal curves
Decrease variability in trajectory selection at horizontal curves
Diminish driving workload by installing a standardized dangerous horizontal curve signing and marking system
Higher skidding resistance
Installation of rumble edge lines

Intervention on the approach to interchanges, to improve
<ol type="i">
Installation of central line delineators, to increase visibility of the central reservation
uniformity and predictability of outbound traffic
uniformity and predictability of inbound traffic

Improvements in traffic regulation at climbing lane zones
<ol type="i">
establishment of safer and more frequent overtaking opportunities.

Implementation of daylight running lights on the IP5
Installation of specifically created sign, warning of the special enforcement rules on the IP5 road

Enforcement
<ol type="a">
Police activity increased by 75% in the first four weeks (16 patrols in 170 km) and more than 25% in the succeeding months (11 patrols)
Tolerance levels set at the allowable technological minimum for each class of device

</td></tr>
</table>

	3. Communication campaign a. National campaign on the IP5 road safety issues, on the special rules applying to traffic on that road and for the stricter enforcement being applied on the road. This aawareness campaign was run under the motto “*Maximum Safety – Zero Tolerance” on the IP5* (MSZT).
Duration	
Application	1998 to 2001
Effects	Low cost engineering measures: Long lasting Enforcement: duration of the MSZT campaign and the following year (halo effect)
Scope of application	
Local	X (Note: only in the 170 km IP5 trunk road)
Area wide	-
Country	At country level (Note: the communication campaign was performed nationwide)
Regional	-
Countries with existing experience or practice	Portugal
References	Cardoso, J.L. (2012). The effect of low cost engineering measures and enforcement on driver behaviour and safety on single carriageway interurban trunk roads. In Advances in Human Aspects of Road and Rail (ISBN 9781439871232). Cardoso, J.L. (2007). *Avaliação do impacte sobre segurança no IP5 resultante da aplicação de medidas correctivas da infra-estrutura e de fiscalização intensa. 3º Relatório.* (Assessment of the road safety effects resulting from the application of low cost engioneering measures and strict enforcement on the IP5 trunk road. 3rd Report. – In Portuguese). LNEC, Lisboa. Cardoso, J.L.; Roque, C.A. (2000). Low cost engineering measures and stricter enforcement. A successful combination to improve road safety on a dangerous rural route. Paper presented at the 11th International Conference “Traffic Safety on Three Continents”, Pretoria, South Africa.
FOCUS	
Types of accident	
All accidents	All types of accident on the IP5
Frontal collision	Yes
Lateral collision	Yes
Rear end collision	Yes
Ran-off-lane	Yes
Hit pedestrian	No – not authorized on IP roads
Hit cyclist	No – not authorized on IP roads

Other	Yes
Class of road user	
Car driver	Yes
Truck driver	Yes
Motorcyclist	Yes
Cyclist	No
Pedestrian	No
Novice driver	Yes, but not specifically
Old driver	Yes, but not specifically
Children	Yes, but not specifically
Passenger	Yes, but not specifically
Other	Yes
Location	
Urban	No
Interurban	Yes
Mixed	No
Vehicle category	
car	Yes
van	Yes
bus	Yes
truck	Yes
motorcycle	Yes
bicycle	No
non-traditional	No
other	-
Accident phase (Haddon's)	
Pre-crash	X
Crash	X

Post-crash	-
Direct incidence	
Road crashes	X
Driving/road using behaviour	X
Active mechanism	
Description	Low cost engineering measures: 1. Reduction in speeds on the approach to dangerous horizontal curves 2. Decrease variability in trajectory selection at horizontal curves and interchanges 3. Diminish driving workload on horizontal curves 4. Increase skidding resistance 5. Increase vehicle visibility Awareness campaign and enforcement: 1. Increase traffic rule compliance and reduce speeding and dangerous manoeuvres prevalence 2. Decrease variability in traffic characteristics
Incidence of mechanism (ERST)	
Exposure	
Risk	X
Severity	X
Trauma recovery	
SIZE OF PROBLEM TACKLED	
% of accidents (total)	390 crashes (1994-1997)
% of injury accidents	
% of fatalities	91 fatalities (1994-1997)
% of serious injuries	121 serious injuries (1994-1997)
Comments	
TYPE OF EXPECTED EFFECTS	
Direct effects	
on accidents (total)	Yes
on injury accidents	Yes
on fatalities	Yes

on serious injuries	Yes			
Collateral effects				
Exposure	No			
Risk	Yes			
Severity	Yes			
Trauma recovery				
Non-safety related effects				
Related to the UN's sustainable development agenda				
ASSESSED REPORTED RESULTS				
	Estimate	**Confidence interval**		
on accidents (total)				
on injury accidents	-41%			Observational Before-After Study, with control group. The expected number of accidents and the observed number of fatalities and severe injuries were used as safety performance variables. The multivariate regression empirical Bayes method proposed by Hauer (1998) was used in the analysis of developments in the expected number of accidents.
on fatalities	-75%			
on serious injuries	-65%			
Type of assessment				
Individual	X			
Meta-analysis				
COSTS				
Who bears the cost	Road administration (low cost engineering measures) Police forces (enforcement campaign)			
Low-cost infrastructure	X			
Infrastructure investment - Labour	-			
Infrastructure investment - Equipment	-Total cost: 840,000 US dollars (at 1998 prices); less than 5,000 US dollars per kilometre (Cardoso and Roque, 2000).			
Infrastructure Maintenance - Labour	N.A.			
Infrastructure Maintenance - Equipment	N.A.			
Administrative	N.A.			
Social	N.A.			

Environment	No
Amount	N.A.
Cost-Benefit	N.A.
ACCEPTANCE	
Road users (by class)	
Drivers	Socially accepted, due to seriousness of the traffic safety situation and the perception of universal application
Passengers	Socially accepted
General public	Socially accepted
Other stakeholders	
Road administrations (infrastructure)	Low cost engineering measures of own initiative
Road operators (traffic management)	Yes
Health care institutions & practitioners	N.A.
Public administration	Yes
Insurance companies	Yes
Enforcement (Police)	Yes; but discussion started, on need for reinforcement of means for sustainability of the enforcement campaign
Enforcement (Judicial system / legal institutions)	Yes
Research / Academia	Yes
Communities	N.A.
Drivers' clubs	Yes
Road safety NGO's	Yes
Taxi driver / taxi owner associations	Yes
Driving licence instructors	N.A.
Other	N.A.
SUSTAINABILITY	
Feasibility	
Pre-conditions	Authorities commitment and skills; equipment.

Requirements	Absence of alternative routes for drivers wishing to elude the enforcement campaign
Factors contributing for effectiveness	Good compliance with traffic rules
Factors hindering implementation or management	Diversion of police resources from other roads Alternative routes for drivers wishing to elude the enforcement campaign
Potential for combination with other R. S. Interventions	