

IMPLEMENTATION OF THE SAFE SYSTEM APPROACH IN SOUTH AFRICA: OVERVIEW OF THE LIMPOPO ROAD SAFETY PROGRAMME

K VENTER*, J JAMES, F AHMED, N GREYLING, S MAVUSO, C MALAN, M ROMIJN, C HARDING and R BAKER

CSIR Smart Mobility Cluster, Building 2, Impact Catalyst, Building 22, Meiring Naude Road, Brummeria; Tel: 082 821 6474; *Email: Kventer@csir.co.za

ABSTRACT

In line with the Sustainable Development Goals 2030 road safety has been prioritized as a key public health priority. Aligned with South African national development goals (NDP 2030) and the fact that the South Africa Government recognizes road safety and the consequences of the road safety scourge as public health and socio-economic development challenge across South Africa, and across communities.

In 2018 a South African mining community and health assessment determined that road safety needs to be a key health and safety priority. In support a baseline Limpopo Province road safety analysis conducted in 2021 indicted the need to cater for the most vulnerable in society (and with that broader than the usual vulnerable road user, but also aimed at socio-economic vulnerability) which puts road safety in the mainstream of development activities and the road safety agenda will need to aspire to achieving more.

In response to address the road safety problems in the province, a targeted programme was developed. The Limpopo Road Safety Programme is premised on the Safe Systems Approach which at the heart of both the First and the Second United Nations Decade of Action and Global Road Safety Plans, as well as the National Road Safety Strategy 2030. The Limpopo Road Safety Programme aim to implement road safety actions and interventions in a targeted manner. The Limpopo Road Safety programme is a three-year initiative developed and implemented by the Impact Catalyst and is set to through public and private partnerships support communities in reducing the number of deaths and injuries from road traffic accidents (Sustainable Development Goal 3.6). This commitment is deliberately ambitious and aligned to improve people's lives. The programme is rooted in successful public and private partnerships and the coordination of targeted interventions and actions aimed at reducing the carnage on Limpopo roads.

This research paper provides an overview of the the Limpopo Road Safety programme which through the execution of thirteen targeted Safe System projects aims to improve road safety in the Limpopo Province by strengthening the various pillars of the Safe System Approach in support of road safety improvements.

1. INTRODUCTION

1.1 Prioritizing Road Safety in Developing Countries

Despite acknowledgement that globally road safety injuries are a major public health problem, little attention has been given to this problem in Africa. This is mainly because there seems to be a lack of interest from the appropriate stakeholders and road traffic injuries must compete with other more pressing (prioritised) health problems such as for example Tuberculosis, HIV/AIDS, and Malaria (Forjuoh, 2002). A concern is that even in countries where national action plan/programmes exist, the plans/programmes are not translated into achievable and measurable targets for all road safety stakeholders (Bekefi, 2007). The result is that road safety does not feature high on developing countries' agendas because most government agencies in developing countries do not prioritize road safety and as a result the design and implementation of preventative road safety programmes seem to suffer.

The Global Road Safety Partnership (GRSP) highlights that governments of developing countries find it challenging to share and implement road safety policy lessons, technologies and institutional innovations that underpin the success of developed countries (Bekefi, 2007). Weak institutional leadership, relationships between stakeholders and uneven distribution of funding complicate matters even more (Vogel, 2015). Further labouring road safety efforts is a lack of sufficient financial and human resources to achieve the targets (Small et al., 2014).

Although there are advances in terms of improving road safety, a specific road safety policy framework is lacking or is not implemented. There is thus a need for a defined road safety policy, as well as a road safety strategy and road safety action plan/s that prioritise road safety activities in the short-, medium- and long term and should be targeted and measurable (Adolehoume, 2017).

1.2 Global Best Practices

The Vision Zero policy of Sweden as well as the Sustainable Road Safety Strategy of the Netherlands are radical and innovative policies used to underpin the design of the United Nations Decade of Action (UNDoA). The Safe System Approach (SSA) forms the basis of the UNDoA and encourages a holistic view of all factors in road safety as well as a better understanding of the interaction of the elements (road users, roads and roadsides, vehicles, and travel speeds). It represents a change in thinking from treating road injury factors as inherent factors to the road transport system (i.e., there will always be a risk) to recognizing that humans are vulnerable and cannot withstand the kinetic energy that is transferred to the human body in the event of a collision.

Countries making progress towards the UNDoA goals, aiming for a zero-fatality rate, have a sound scientific base upon which they build their strategies and targeted road safety programmes (Belin, 2012; Wegman et al., 2015). The success factors for these countries include political leadership and research that inform the development of policies (Belin, 2012). These countries seeing success in the reduction of fatal crashes and serious injuries have long-term political commitment and political will to bring about change.

Evidence based research informs the actions and interventions that are successfully being implemented in countries making progress towards reaching the UNDoA goals through

implementation SSA (Johannson, 2009; Schemers et al., 2010; Schulze et al., 2010). Road safety research in Africa is, however, scarce and indications are that even in African countries where road safety research is undertaken, it is inconsistent with the magnitude of the problem and more research is needed to pinpoint contributory factors to road traffic accidents in order to develop strategies, policies and procedures that will address the road safety problem (Lagarde, 2007). Research is considered fundamental to identify, analyse and explain the road safety problems (Adolehoume, 2017).

In October of 2021, the Second Global Plan for the Decade of Action for Road Safety 2021-2030 was published by the World Health Organization (WHO), following Resolution 74/299 adopted by the UN General Assembly on August 31, 2020. This Second Global Plan describes what is needed to achieve the target of reducing road traffic deaths and injuries by at least 50% during the 2021 - 2030 period. The Plan calls on governments and partners to implement an integrated Safe System approach to achieve this ambitious target through a series of Recommended Actions and Requirements for Action. Additional recommended actions include considerations regarding multimodal transport and land-use planning, safe road infrastructure, vehicle safety, safe road use and post-crash response. In line with ISO 39001 the requirements for road safety action revolves around institutional management functions that include sustained funding for road safety interventions, appropriate legal frameworks that include strategies for speed management, capacity development, ensuring a gender perspective in transport planning, as well as the adaptation of innovative technologies to implement the SSA.

Recognising the principle of shared responsibility for road safety, the second Global Plan recognises that though governmental agencies have the primary responsibility to design a safe road transport system and implement a road safety action plan, the role and influence of other actors are increasingly recognized as an important part of the Safe System. The 2021 - 2030 Global Plan for road safety action highlights the role of private sector along with civil society, academia, and other non-state actors to collaborate to best address road safety from various angles. The Global Plan highlights the importance of public and private organizations adopting road safety practices as part of their contributions to the SDGs, together with endorsement, leadership and purchasing power.

1.3 National Road Safety Strategy 2030

As a signatory to the UNDoA, South Africa has pledged to half road traffic crashes by 2030 from the 2010 baseline. In 2010 the country recorded 10 837 fatal crashes in which 13 967 people lost their lives. To achieve a systematic reduction in road traffic deaths, the South African Department of Transport (DoT) published the revised National Road Safety Strategy (NRSS) 2016-2030.

The NRSS 2016-2030 was developed and designed according to the principles of the SSA and aims to address the South African road safety scourge by prioritising road safety interventions to ensure appropriate allocation of scarce resources and funds for the design and implementation of actions and strategies to address the dire road safety situation in South Africa (Department of Transport, 2015). The NRSS 2030 target, to half road traffic deaths by 2030 is in line with the South African National Development Plan 2030 (NDP), which highlight road traffic crashes as a public health problem, setting a target to “reduce injury, accidents and violence by 50% from 2010 levels” (NRSS, 2015-2030, 2015:14).

2. LIMPOPO ROAD SAFETY PROGRAMME

2.1 Background

Limpopo Province is home to approximately 5.9 million people, which constitutes 10% of the South African population. Limpopo consists of five district municipalities with the Vhembe District Municipality being the district with the largest share of households in the province. Limpopo Province has a large rural component and the National Household Travel Survey (NHTS) 2020 highlighted the long distances that learners and adults, especially females must travel to reach places of work. The 2011 Statistics South Africa Limpopo Burden of Disease profile highlighted that on a district level, especially females (age 14 to 65) are prone to be involved in fatal crashes. Indications are that in terms of road safety Limpopo has a higher average of road related deaths per 100 000 population than the rest of South Africa national average which was 24.9, while Limpopo deaths fluctuated between 26 and increasing to 29.5, between 2015 and 2017.

In 2018, a health study led by the London School of Hygiene and Tropical Medicine in partnership with the consultancy Research and Training for Health and Development (RTHD) determined that road safety needs to be a key health and safety priority for mining houses. The baseline Limpopo Province road safety analysis that was conducted for the project in 2021 highlighted the need to cater for the most vulnerable in society (and with that broader than the usual vulnerable road user, but also aimed at socio-economic and gender vulnerability) which puts road safety in the mainstream of development activities and requires the road safety agenda to aspire to achieving more. The spatial dimensions of the province will also have implications for deployment of post-crash assistance and emergency trauma care as well as for planning of safe infrastructure, for non-motorised transport (NMT), given that two thirds of crashes and fatalities occur with pedestrians.

2.2 Public Private Partnerships in Support of Road Safety Efforts

2.2.1 Response to the Limpopo Road Safety Situation

In 2021, the Impact Catalyst responded to a call for proposals to address road safety in the Limpopo province. The Impact Catalyst is an initiative founded by Anglo American, Exxaro, Council for Scientific and Industrial Research (CSIR), Industrial Development Corporation (IDC) of South Africa and World Vision International, to deliver socio economic change on a regional scale.

The Impact Catalyst aspires to establish inclusive, collaborative, cross-sectoral platforms, initiatives, and partnerships to achieve systemic socio- economic impact through public private partnerships. Initiatives are designed to leverage collaboration for road safety promotion, and are cross sectoral and selected for impact beyond the scale of individual participants.

The Limpopo Road Safety Programme utilises international and local specialists to deliver the projects over a three-year duration – 2022 to 2024. The programme will also aim to build capacity to ensure that the programme continues in Limpopo beyond 2025. The Limpopo Road Safety Programme is premised on the Safe Systems Approach as well as the National Road Safety Strategy 2030 and directly supports four of the five initial SSA pillars. The programme will be rolled out over a period of three years in thirteen Safe System focused projects.

The Programme is supported by a Technical Steering Committee, comprising of local as well as international road safety experts that provide guidance regarding the way forward. To monitor the success of the programme over the short-, medium-, and long-term, a Theory of Change evaluation strategy was prepared with input from both local and international partners.

2.2.2 Partners and Stakeholders

Pillar 1 of the UNDoA (Road Safety Management or Institutional Management) provides a set of principles that set out requirements of shared responsibility, coordination and planning, adequate allocation of resources and compliance with existing policies and legislation; as well as the setting of realistic targets. Road safety management needs to include the participation of governmental and organizational bodies in the provision of road safety strategies such as agreed targets and goals to be achieved, proposal of actions, regulation of vehicle safety standards, road design standards, and the organisation of a road crash database (Small, 2014).

Firstly, this is no easy task as the fragmentation in the South African road and traffic management domain continues to persist, resulting in the hindering of the execution of these institutional management functions (Labuschagne, 2016).

All governmental departments have a stake in the promotion of safe and efficient transport, facilitated through proper infrastructure as well as competent users of the road and traffic system. Public entities responsible for road safety are defined as “actors that at all geographical levels, operate within the government hierarchy in which one can identify the pilot-sectors for road safety, which participate in the design and structuring of the road and transport system and make it work (road infrastructure, urban planning, transport management, vehicle and traffic regulations, safety laws, enforcement and justice, civil protection) as well as sectors that contribute to road safety by raising awareness, developing a safety culture, providing knowledge or otherwise providing smoother functioning of the existing road and transport system: public education, road-user information, public health, emergency rescue systems, research, professional education and training” (Mulrad, 2016).

Private sector partners participate in the road safety effort representing components of the transport system with economic or humanitarian interests in road safety improvement. Active participation of non-governmental organizations and other private actors may work through direct involvement in policy formulation, implementation and evaluation, and/or through sponsoring specific interventions (Mulrad, 2016).

Road safety as a shared responsibility, influences several economic and social matters (including local and cross-border activities, tourism, economic development, and social wellness). Key prerequisites for implementation of road safety are an enabling regulatory and policy framework, and the capacity of the implementing agencies to act. At the heart of the Limpopo Road Safety Programme lies the opportunity to establish partnerships between government and private sector institutions to address road safety in the province in a sustainable manner.

Footwork has been done to establish partnerships between the programme, international road safety organisations (Global Road Safety Partnership, International Road Assessment Programme, International Red Cross), private sector (e.g. mining houses and agricultural

industry), as well as national entities (Department of Transport, Road Traffic Management Corporation, South African National Roads Agency Limited) and provincial government departments, including the Office of the Premier, Roads Agency Limpopo which a subsidiary of the Department of Roads and Public Works, Community Safety, Education and Health. The establishment of these partnerships remain work in progress.

2.3 Targeted Approach to Address Road Safety

The Global Plan for the UNDoA sets out five pillars according to which countries can align their safety interventions. These pillars are: Road Safety (Institutional) Management, Safer Roads and Mobility, Safer Vehicles, Safer Road Users and Post-Crash Response. The Safe System Approach is structured around sustainable maintenance of safe speeds, safe road use, safe vehicles, safe roads and roadsides; and more recently an inclusive view of modal integration and land use management.

2.3.1 Projects Supporting Institutional Road Safety Management

The first three Limpopo Road Safety Programme projects support road safety from an institutional management point and requires provincial and private sector collaboration to coordinate efforts to prepare a provincial road safety strategy to develop provincial capacity to implement the Safe System Approach; as well as the development of a road traffic and safety data management platform that can be used for informed decision-making.

2.3.1.1 Provincial Road Safety Strategy

At regional levels there is a need to internalise the UNDoA goals and objectives (Oviedo-Trespalacios & Haworth, 2015). The success of the NRSS strategy is dependent on effective leadership and governance to oversee completion of implementation. A review of previous South African strategies indicate that a lack of leadership contributed to failed implementation thereof (Wegman et al., 2013). The expectation would be that all nine provinces in South Africa would prepare dedicated road safety strategies, in line with the overarching national strategy.

A provincial road safety strategy (either supporting the development of existing initiatives or the preparation of a new road safety strategy) is essential to guide long-term road safety intervention and to support positive road safety change in the province. Long-term goals can only be achieved by addressing the systemic issues, namely provision of safe infrastructure for all road users, ensuring safe public transport, and planning land use with safety in mind. In addition, considerations in terms of lower speed that reduces the risk and severity of injury and is key to the Safe System Approach.

2.3.1.2 Road and Traffic Data Platform

An important aspect of achieving road safety results, is to have good crash and supporting data to understand and monitor the situation (Labuschagne, 2016) Road safety priorities are identified by collecting the relevant data which is then considered in terms of current requirements, societal trends and future needs. Data provides direction in terms of topics for consideration and each topic is then described in terms of its challenges, scope and expected impact of the research and the expected actions associated with the research. As elsewhere in middle income countries, road traffic data that is needed to assess the state of road safety in African countries are often not available, incomplete or not reported (Sinclair, 2011; Mynhardt et al., 2015).

Road traffic data (outcomes and indicators) is essential to inform the development of a targeted road safety strategy for the province as well as to measure impact and progress towards a reduction in crashes and fatalities. A lack of data makes it difficult to conduct a detailed analysis for the Limpopo province e.g., to understand the distribution of fatal crashes on a geographical basis and to identify specific hotspots.

The Limpopo Road Safety Programme therefore supports the development of a road and traffic data platform which will in future facilitate informed decision-making and prioritisation of road safety interventions and responses in support of improving road safety at a systems level.

2.3.1.3 Safe System Implementation Capacity Development for Public Officials

Although the SSA has been adopted by South Africa, implementation thereof remains slow. The third institutional management project focus on Safe System capacity development for public officials. Road safety is a cross-cutting issue, (as is other themes, e.g., environment) and the focus is on the specific skills needed for the career, rather than the management and implementation of a complex system. This project targets professionals, practitioners and officials within the provincial road safety system that should receive training as part of their career preparation.

2.3.2 *Projects Supporting Safer Roads and Infrastructure*

Pillar 2 of the SSA highlights that as a shared responsibility road designers (authorities) have a duty to design a road and road environment that is inherently safe and forgiving. The SSA highlights the additional focus on safe speeds which incorporates the principle that humans are frail and that the human body cannot withstand the kinetic energy that is transferred if a collision occurs without being killed or seriously injured. Four of the thirteen projects, have safer infrastructure at their core.

2.3.2.1 Limpopo Road Safety Assessments

Roads Agency Limpopo (RAL) is responsible for over 19,000 km of Limpopo provincial roads. Out of this number, about 7,000 km is tarred and 14,000 km is gravel or dirt. Global Road Safety Performance Target 4 states that “By 2030, more than 75% of travel on existing roads is on roads that meet technical standards for all road users that consider road safety. As a rough estimate, 75 % of travel may occur on 10% of a network. This equates to about 1,900 km of the RAL network (and less if it is assumed that most travel occurs on the paved network).

The South African Road Safety Assessment Methods of 2022 (SARSAM, 2022) is part of the Technical Recommendations for Highways (TRH) compiled and currently under review of the Committee of Transport Officials (COTO). These guidelines reflect the Safe System principles and consists of three volumes which deals with Road Network Screening, Road Safety Inspections and Road Safety Audits. The guidelines are currently used to pilot local road safety assessment methods in addition to the international road assessment programme (iRAP); to be rolled out within Limpopo Province with the RAL in 2023/2024.

The iRAP methodology was developed to accelerate the implementation of safe infrastructure globally. The methodology is internationally recognized and offers evidence-based approaches to guide planning, design, investment and policy setting. The methodology has been used in more than 100 countries to assess more than 2 million km of roads and designs

and supports the UNDoA and the Global Road Safety Performance Targets. A pilot assessment of up to 2000 km of the paved RAL network will provide an opportunity to apply the methodology to a range of local contexts (including rural and village/town/city roads); build local capacity; inform safety treatments for roads that are likely to account for a significant percentage of travel and serious crashes; and to provide a foundation for local strategy and target setting.

To ensure that these processes are sustainable, local practitioners will be trained and accredited to conduct these assessments.

2.3.2.2 Innovation for Road Safety Assessments

The purpose of this project is to explore the use of 4IR technologies in the automation of the collection and analysis of infrastructure assessment methodologies. The AiRAP initiative was conceived by iRAP in 2019 to address the automation of road infrastructure assessments and help improve access to, and application of, existing and emerging data sources globally. AiRAP refers to 'accelerated and intelligent' capture of road safety-related data using automatic, repeatable, and scalable methods.

In the context of Limpopo, potential sources of data may include, for example, information contained in the RAL Road Asset database, advance driver assistance system (ADAS) data collected by private sector vehicles, and satellite imagery.

2.3.2.3 Small and Medium Enterprise (SMME) Development Project

A micro enterprise business and implementation plan are being developed to support the set-up of micro enterprises that will be able to support maintenance of infrastructure in the province in a sustainable manner. This project includes a pilot project to demonstrate the business case which will enable SMMEs to obtain funding towards sustainable implementation and upscaling to several micro enterprises that will be determined during this project.

2.3.2.4 Star Ratings for Roads and Infrastructure Around Schools

Star Rating for Schools (SR4S) is an evidence-based tool for measuring, mapping, managing, and communicating the risk children are exposed to on a journey to school (iRAP, 2021). It supports the implementation of interventions that save lives and prevent serious injuries and is key to meeting SDG 3.6 that focuses on addressing road safety risks in child and adolescent pedestrians. The Star Rating for Schools provide a methodology for assessing safety in respect to infrastructure around schools; providing a star rating according to which authorities can in future prioritise and address infrastructure concerns that impact specifically non-motorised transport around schools.

The SR4S component is part of the safer schools and community projects and will be implemented in 60 Limpopo schools alongside the VIA program, through a SR4S Lead Partner to lead the on-the-ground activities. This project will be executed in collaboration with iRAP international as well as RAL and local engineering practitioners, whom will be trained to implement the methodology in and around Limpopo schools.

2.3.3 Projects Supporting Safer Road Users and Communities

2.3.3.1 Safer Road Users and Communities

Safe road user behaviour and a reduction in road traffic fatalities depend not only on knowledge and skills but also on community support, perception of vulnerability and risk, social norms and models, engineering measures and law enforcement. A key component is increasing awareness of road safety risk factors and prevention measures through education and behaviour change communication which is an adjunct to other measures, rather than a stand-alone solution.

Road safety education interventions should ideally be paired with enhanced law enforcement campaigns as evidence suggests this combination of interventions is most effective, impactful and sustainable. This project will train and equip designated community-based workers in the implementation and management of publicity and awareness campaigns to be delivered in support of enhanced police enforcement programs targeting unsafe behaviours.

2.3.3.2 VIA Programme

Limpopo has 4 239 schools located in towns and in rural areas. The Safe to School - Safe to Home (STS-STH) is designed as one of the most comprehensive child road safety around schools' initiatives of its kind anywhere in the world. The programme takes account of the most recent evidence on effective road safety interventions relating to child safety in the school road environment. VIA programme incorporates assessment of road risks, the installation of effective local traffic engineering improvements, extensive road safety education involving all the community, together with enhanced enforcement of behaviours that either cause or worsen road trauma for children. The programme includes the use of the iRAP 'Star Ratings for Schools' methodology.

2.3.4 Projects Supporting Post-Crash Care

The World Rescue Organisation (WRO) methodology is considered a good practice with emergency responders tasked with responding to and dealing with post-crash incidents. The WRO does this in three ways, namely through the delivery of direct and bespoke training provision, development of skills and knowledge and the provision of supporting educational materials.

The aim of the project would be to improve the capability of emergency responders when dealing with post-crash incidents and where necessary, the capacity within the post-crash system within a particular country. This phase of the project will be implemented towards the end of 2023 and will focus on upskilling existing provincial emergency medical personnel and to assist the province with critical resource management.

3. CONCLUSION

The Limpopo Road Safety Programme is an ambitious undertaking. The Programme is resource intensive but aims to bring about change by linking and mobilising road safety actors that previously operated in silos. The programme enables inter-sectoral discussion and aim to improve decision-making coordination at the operational level which needs to include both private stakeholders and government, facilitating the dialogue regarding road safety actions and interventions.

Public and private partnerships are a key element that needs to drive this programme beyond 2025. To achieve this horizontal and vertical alignment of not only government departments but private sector as well, there is a need for a champion in the province to drive this integration process and to ensure that the programme is sustainable. Although the different government departments are responsible for the implementation of interventions that can address road safety, the partnerships with private sector will assist with the streamlining of activities as well as potentially sustaining road safety interventions with dedicated funding streams.

The Theory of Change monitoring and evaluation framework that was prepared at the inception of the programme will assist with assessing the success of the three-year programme, including the allocation of resources. However, the true success will be measured in terms of the sustainability of the programme, continuing beyond the three-year implementation period. Real road safety change and a reduction of fatal crashes and fatalities in the province will only be seen and evaluated against the NRSS 2023.

4. REFERENCES

Adolehoume, AP. 2017. Interview by Handicap International: Ethics and Influence. *5 Questions to Dr. Amakoé Adoléhoumé on Road Safety in Africa*.

Bekefi, T. 2007. *The Global Road Safety Partnership and Multisectoral collaboration*. Harvard University, School of Government.

Belin, M, Tillgren, P & Vedung, E. 2012. Vision Zero – a road safety policy innovation. *International Journal of Injury Control and Safety Promotion*, 19(2):171-179.

Buttler, I. 2014. Safe System Approach - the expectations and challenges. *Fit to drive 8th international Traffic Expert Congress*. Warsaw: Motor Transport Institute, pp. 1-21.

Department of Transport. 2015. *National Road Safety Strategy 2030*. Pretoria: Road Traffic Management Corporation.

Forjuoh, SN, Zwi, AB & Mock, CN. 2002. "Injury control in Africa: Getting governments to do more." *Tropical Medicine and International Health*, 3(5):349-356.

International Road Assessment Programme. 2021. *Star Ratings for Schools*. Accessed 24 February 2023. Available at: <https://irap.org/project/star-rating-for-schools>.

Johannson, R. 2009. "Vision Zero – Implementing a policy for traffic safety". *Safety Science* 47(6):826-832.

Labuschagne, FJJ & Venter, K. 2016. 'Results focus': Ready to launch? *Southern African Transport Conference*. ICC, Pretoria, 1-10.

Lagarde, E. 2007. "Road Traffic Injury Is an Escalating Burden in Africa and Deserves Proportionate Research Efforts". *PLoS Med* 4(6):170-180. Available at: <https://doi.org/10.1371/journal.pmed.0040170>.

Mulrad, N. 2016. "Road Safety Management from National to Local". In *Transportation planning and traffic safety - making cities, roads and vehicles safer* (Tiwari, G and Mohan, D editors), CRC Press Taylor and Francis, pp 301-316.

Mynhardt, CD, De Vries, I & Pretorius, H. 2015. "Combating road traffic crime: the need for establishing a valid National Road Traffic Safety Databank (NRTSD) in South Africa." *Acta Criminologica: Southern African Journal of Criminology*.

Oviedo-Trespalacios, O & Haworth, N. 2015. "Developing a new index for comparing road safety maturity: Case study of the ASEAN Community." *Australian Road Safety Conference*. Gold Coast, Australia, 1-10.

Road Traffic Management Corporation. 2022. South African Road Safety Assessment Methods. Available at:

<https://www.rtmc.co.za/index.php/publications/reports/research-development-reports>.

Sinclair, M. 2011. Road Traffic Injury Data in South Africa: An Assessment of the National Road Collision Databse. *30th Southern African Transport Conference*. Pretoria, 262-274.

Small, M & Runji, J. 2014. *Managing road safety in Africa: A framework for national leading agencies*. Working Paper 101, Washington D.C.: SSATP Africa Transport Policy Programme.

Statistics South Africa. 2021. National Household Travel Survey. Available at:

<https://www.statssa.gov.za/publications/P0320/P03202020.pdf>

Vogel, T, Reinharz, D, Gripenberg, M & Barennes, H. 2015. "An organizational analysis of road traffic crash prevention to explain the difficulties of a national program in a low income country." *BMC Research Notes*, 8:486.

Wegman, F & Hagenzieker, M. 2010. "Editorial safety science special issue road safety management", *Safety Science*, 48(9):1081-1084.

Wegman, F, Berg, H, Cameron, I, Thompson, C, Siegrist, S & Weijermars, W. 2015. "Evidence-based and data-driven road safety management." *International Assostion of Traffic Safety Sciences*, 39:19-25.

Wegman, F, Schemers, G & Van Schagen, I. 2013a. *National Road Safety Strategy for South Africa*. Leidschendam, The Netherlands: SWOV Institute for Road Safety Research.