Motorcycle Safety in Africa

AFRICAN DEVELOPMENT BANK GROUP

Global Road Safety Facility

Title of the Study	Motorcycle Safety in Africa
Report Authors	Antonino Tripodi (FRED Engineering) and Govert Schermers (SWOV – Institute for Road Safety Research)
Task Team Leaders	Girma Berhanu BEZABEH (African Development Bank) and Noor Ibrahim MOHAMED (Global Road Safety Facility – GRSF-World Bank)
Division Manager	Jean Kizito KABANGUKA and Lydie EHOUMAN
Report Version	Final
Published Date	April 2022

Citation

Please cite the report as follows: Girma Berhanu BEZABEH, Noor Ibrahim MOHAMED, Antonino Tripodi and Govert Schermers. 2022. Motorcycle Safety in Africa. Abidjan, Côte d'Ivoire : African Development Bank.

Executive Summary

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In developing countries with inadequate public transport and road infrastructure, motorcycles present a fast, cheap, and efficient transport alternative. Motorcycles are widely used in many African countries for personal and public transport, as well as for service delivery. In some African countries, motorised two- and three-wheelers constitute the largest proportion of the motorised vehicle population. However, despite their benefits, motorcycles expose their riders and passengers to a high risk of serious injury or death in the event of crashes. Motorcycle safety is therefore a significant problem in Africa. On average, 22.5% of road traffic deaths in 2016 involved riders/passengers of two- and three-wheelers, according to the last data published by World Health Organisation (WHO, 2018).

This research study presents comprehensive **strategic recommendations on how to improve motorcycle safety in Africa.** The study will serve as policy advice and technical assistance to the Bank's regional member countries (RMCs). The study focuses on motorcycle safety conditions in Cameroon, Burkina Faso, Rwanda, and Uganda, where the use of motorcycles for daily activities is reputedly high. Recommendations are predicated on an examination of the major causes of motorcycle crashes and injuries, as well as an extensive body of knowledge from various sources, notably:

- international literature and good practices on motorcycle safety;
- assessment of motorcycle crashes, regulations, risk exposure data, risk indicators in African countries (with more detailed analysis of Burkina Faso, Cameroon, Rwanda, and Uganda); and
- consultations with stakeholders.

The review of international literature helped identify global interventions and practices that could be adapted to the African context. Figure 1 (below) outlines the key factors that determine motorcycle safety.

Figure 1: Key determinants of motorcycle safety

VEHICLE SAFETY	ROAD USERS	ROAD INFRASTRUCTURE	POLICIES	REGULATION AND ENFORCEMENT
• Motorcycle technical aspects and their certification • Motorcycle design (e.g. use of safety cells) • Lighting technology • Motorcycle airbags • Protective frames • Braking devices (e.g. ABS) • Helmet quality • Conspicuity measures (e.g. use of headlights at all time, retroreflective jacket)	• Training to increase competence and experience levels • Sensitisation measures (e.g. on helmet use) • Age limitations according to motorcycle engine power • Safety riding education activities • Prevention of impaired riding • Motorcycle education and training programmes	• Exclusive motorcycle lanes • Traffic control interventions • Roadside barriers adapted to motorcycles • Road surface and road marking to reduce skidding • Incorporation of self-explanatory and forgiving roads in road design standards	• Universal helmet law • Mandatory rider education programmes • Motorcycle Safety Strategies and Plans • National Road Safety Agenda	• Motorcycle enforcement strategies • Anti-tampering measures • Regulations on motorcycle and helmet standards, minimum riding age, motorcycle technical inspections,etc.

It is worth mentioning that some international practices are unsuitable for African countries. Most require adaptation to local conditions, but some (e.g., highly technological systems) are not yet suitable to motorcycle safety issues in Africa. A transferability audit has been conducted to identify main the challenges of the adaptation of practices to African realities.

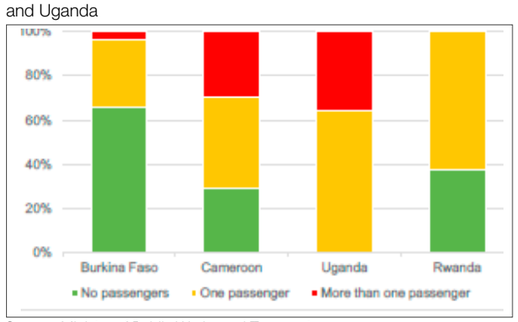
The assessment of motorcycle safety conditions highlighted the main causes of motorcycle crashes and injuries in Africa.

In 2016, about 10 million motorcycles were registered in Africa, representing approximately 20% of the world's registered motorcycles (around 53 million in total). The five African countries with higher percentage of registered motorcycles (Burkina Faso, Rwanda, Tanzania, Uganda and Togo) are all classified as low-income countries. The five countries' Gross National Income (GNI) per capita is under USD 1,000.

In 2016, Africa recorded approximately 73,400 road traffic deaths, about 23 percent of that on motorcycles. However, some countries recorded much higher percentages. An example is Togo, with 72% of deaths on motorcycles.

Helmet use is one of the main issues in Africa. The reported rate of helmet use ranges from 6% in Mali to 95% in Eritrea. Compared to riders, the helmet wearing rate of passengers is much lower.

Figure 2: – Comparison of Burkina Faso, Cameroon, Rwanda and Uganda



Source: Ministry of Public Works and Transports

The analysis of data from Burkina Faso, Cameroon, Rwanda and Uganda (Figure 2) and consultations with stakeholders, revealed other contributing factors, as well as differences among African countries.

For instance, in Cameroon and Uganda, a large number of motorcycles are overloaded. In Burkina Faso, motorcycles are mostly used for private purposes, so that they generally carry one or two persons. In Rwanda, even though moto-taxis are the primary means of transport, no motorcycle carries more than one passenger. The main causes of crashes and of injuries identified from studies conducted in Burkina Faso, Cameroon, Rwanda and Uganda, are as follows:

- **Low quality of road infrastructure**, due to the absence of design standards or unsuitability to motorcycle safety conditions, and a limited awareness of motorcycle safety facilities.
- **Lack of motorcycle quality**, due to the absence of motorcycle roadworthiness standards and laws on mandatory technical inspections, as well as lack of spare parts, and absence of fleet controls.
- **Unlicenced and inexperienced licensed riders**, due to unwillingness to undertake training or obtain a licence, poverty, lack of awareness of the importance of riding training and education, and inadequate enforcement.
- **Unsafe moto-taxi services**, due to unregulated and unchecked practices, informal management of activities, non-accreditation, and long working hours. Rwanda has implemented effective measures to regulate these services.
- **Alcohol and drugs**, due to low awareness of the risks of riding under the influence of alcohol or drugs (especially by moto-taxi operators, to stay awake for long periods); inadequate enforcement.
- **Speeding**, due to the absence of road infrastructure adapted to motorcycles, low awareness about the risks of speeding, the desire of moto-taxi operators to increase their number of trips; inadequate enforcement.
- **Motorcycle overloading**, due to the desire to increase the number of passengers to make the trip profitable (for moto-taxi services); inadequate enforcement.
- **Non-use of helmets**, due to the absence of regulations, low awareness of safety risks, low availability and high cost of good quality helmets, unsuitability of helmets to weather conditions, and inadequate enforcement. Rwanda stands out in its implementation of effective measures to ensure/enforce the use of helmets.
- **Absence of helmet quality standards**, due to absence of law and regulation, lack of implementation of rules from regulatory authorities, importation of non-standardised helmets.
- **Non-use of protective gear**, due to lack of regulations, difficulties in finding cheap protective, lack of awareness about benefits of the use of protective gear.

It is noteworthy that Rwanda has implemented effective solutions to regulate moto-taxi services and to enforce compliance with the rules. The motorcycle safety situation in Rwanda remains challenging, but practices such as Traffic Police enforcement, sensitisation by moto-taxi associations, Government support to moto-taxi operators through clear and fair regulations, can be used as reference for other African countries.

To improve motorcycle safety, various interventions can be implemented to address the direct causes of motorcycle crashes and injuries.

Developing a **strategic framework** to guide the implementation and monitoring of interventions would facilitate the improvement of motorcycle safety. The framework should especially deal with policy formulation, the development of legal, institutional and human capacity, the formulation of safety standards, motorcycle safety education and public awareness campaigns, the implementation of road safety interventions, and the strengthening of enforcement.

Regulation of the moto-taxi sector is also recommended (especially based on solutions adopted in Rwanda, e.g., the use of e-services for the registration of moto-taxi associations and riders, and for the promotion of road safety practices). In several African countries, the moto-taxi is often the main transport option in cities and rural areas. Despite their importance, motorcycles are almost completely unregulated and unmonitored. Creating official moto-taxi associations, with clearly defined governing regulations, and recognising them as professional services, should be considered a priority.

Road safety infrastructure plays an important role in motorcycle safety. This provides main recommendations for safety infrastructure are as follows: the revision of existing road design standards and guidelines, and the implementation of interventions like separate lanes dedicated for motorcycle use, advanced stop lines for motorcycles, and speed calming measures.

Safety standards for motorcycles should be updated or created, taking into consideration reliable verification of imported vehicles, and avoiding the assembly of motorcycles in unofficial facilities. The implementation of a mandatory periodic technical inspection of motorcycles is also highly recommended (both in authorized facilities and through roadside tests).

Standards of helmets must be meticulously implemented, to avoid the importation of substandard helmets, which offer little protection. The certification of helmets to ensure their suitability to local weather conditions should be prioritised.

Training and licencing are crucial because they can reduce the risky behaviours prevalent among of riders. Attention should also be given to the age limits for riders, as well as age-appropriate licencing to the motorcycle engine power. Governments should consider incentives to promote training and education for riders.

The introduction of age limits for passengers is also important because of the high vulnerability of children. Riders should be barred from taking passengers under the age of twelve (12).

The development of integrated road safety education programmes, sensitisation activities, learning practices, code of behaviours, and communications on motorcycle safety is highly recommended. Topics covered during **communication and awareness** should include helmet use, speeding, alcohol and drugs, and overloading.

Enforcement can save lives in the short-term. Governments should develop a clear **enforcement strategy** focused on key motorcycle collision causation factors, and a nationally agreed approach to enforcement.

Interventions should be implemented to ensure the strict enforcement of the following rules: helmet use, compliance with helmet standards, validity of technical inspections and quality of motorcycles, validity of riding licences, observance of speed limits, non-consumption of alcohol and drugs, and loading limits.

To ensure its effectiveness and acceptance, enforcement should be accompanied by a comprehensive communication strategy and adequate resources and funding.

Emergency management and first aid training. This crucial measure might involve training medical personnel in the correct way of removing helmets from the heads of riders and passengers involved in crashes.

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List of abbreviations and acronyms

AADT	Annual Average Daily Traffic
ACEM	Association des Constructeurs Européens de Motocycles
AfCAP	Africa Community Access Partnership
AfDB	African Development Bank
AIP	Asia Injury Prevention Foundation
AHO	Automatic Headlamp-On
ABS	Anti-lock Brakes System
BAC	Blood Alcohol Concentration
BNSP	Brigade Nationale de Sapeurs Pompiers (Burkina Faso)
BRT	Bus Rapid Transit
CBS	Combined Braking System
DoT	United States Department of Transports
FEMA	Federation of European Motorcyclists' Associations
FGSV	Forschungsgesellschaft für Straßen- und Verkehrswesen
FMVSS	Federal Motor Vehicle Safety Standard
GDP	Gross Domestic Product
GNI	Gross National Income
GRSF	Global Road Safety Facility
IMMA	International Motorcycle Manufacturers Association
iRAP	International Road Assessment Programme
ITF	International Transport Forum
MAIDS	Motorcycle Accidents In Depth Study
MKP	Motorcycle's Killing Potential
ONASER	Office National de la Sécurité Routière (Burkina Faso)
PPM	Problem Priority Matrix
PTW	Powered Two-Wheeler
RTDA	Rwanda Transport Development Agency
RTI	Road Traffic Injury
RURA	Rwanda Utilities Regulatory Authority
SPI	Safety Performance Indicator
SSATP	Sub-Saharan African Transport Policy Program
UNaSEV	National Unit for Road Safety of Uruguay
UNECA	United Nations Economic Commission for Africa
UNECE	United Nations Economic Commission for Europe
UNRA	Uganda National Road Authority
USD	United States Dollar
VKP	Vehicle's Killing Potential
VRU	Vulnerable Road User
WB	World Bank
WHO	World Health Organisation

Acknowledgments

The "Motorcycle Safety in Africa" Study is financed by the World Bank's Global Road Safety Facility (GRSF). The Study was undertaken by FRED Engineering in joint venture with SWOV – Institute for Road Safety Research. The main authors of the Report are Antonino Tripodi and Govert Schermers. The study was initiated and led by Girma Berhanu BEZABEH (Chief Road Safety Specialist). The service contract was managed in the World Bank by Noor Ibrahim MOHAMED.

The study was validated by the Internal Working Group of the Infrastructure and Urban Development Department with the participation of the staff of GRSF. The peer reviewers of the study were: Augustin Karanga, Chief Transport Economist (RDGC4); Richard Malinga, Principal Transport Engineer (RDS0), and Monjurul Hoque Mohammod Arif Uddin; Transport Specialist (GRSF, external reviewer).

The Study is the result of lessons learnt from research and consultations with stakeholders in Burkina Faso, Cameroon, Uganda and Rwanda. The authors wish to acknowledge and thank the following stakeholders for their valuable inputs provided in these countries.

BURKINA FASO		
Police Nationale	Alexandre Nongnyaghma	Officer, Statistical Services
Office National de Sécurité Routière Ministry of Transport	Dramane Gamane	Project Manager
Police Municipale de Ouagadougou	Adama Pamtaba	Chief of Communication Services
Gendarmerie Nationale	Rodrigue Adoua	Officer criminal and statistical analysis
NGO Humanité & Inclusion	Casimir Sanon	Road safety expert
CAMEROON		
Police Nationale	Bernard Ananfa	Head, Research and Statistics services
National Statistics Institute	Vincent Ledoux Essambe Bome Abanda Ambroise	Project Manager Head of Division
Ministry of Transport	Divine Mbamome	Director of Road Transport
Ministry of Public Works	Aboubakar Dadje Nazole	Project Manager
Ministry of Public Health	Olive Nicole Ngaba	Project Manager
National School for Public Works	Prof. Jean François Wounba	Road Safety expert
UGANDA		
Kampala Capital City Authority	Jacob Byamukama	Deputy Director Infrastructure
Ministry of Works and Transport	Winstone Katushabe	Commissioner, Transport & safety Regulations
Wakiso District	Samuel Mwesigwa	District Engineer
Uganda National Roads Authority	Isaac Menya	Manager, Networking Planning
National Road Safety Council	Ronald Amanyire	Secretary to the Council
Uganda National Bureau of Statistics	Paul Okudi	Senior officer, Directorate of Infrastructure
Freelance consultant	Barbara Mwanje	Road Safety expert
RWANDA		
Ministry of Infrastructure	Patricie Uwase	Permanent Secretary
Ministry of Infrastructure	Alfred Byiringiro	Transport Division Manager
Ministry of Infrastructure	François Zirikana	Project Manager
Rwanda Utilities Regulatory Authority	Deo Muvunyi	Project Manager
Rwanda Transport Development Authority	Hadeline Verjus	Project Manager
Freelance consultant	Anselme Ahimana	Traffic Police expert

1. Introduction

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1.1 Background

The number of powered two-wheelers (PTWs), which include motorcycles, scooters and mopeds,[1] has been constantly increasing worldwide.

In developing countries, with relatively poorly developed public transport and road infrastructure, motorcycles are fast, cheap, and efficient alternatives to walking and cycling. For many commuters, motorcycles are the only affordable or practical means of mobility. In many developing countries, motorcycles also serve as taxis.

However, despite the mobility benefits they offer, given the number of vehicle-kilometres they travel daily, motorcycles expose the riders and their passengers to significant risks of serious injury or death in the event of crashes.

Motorbike crashes are frequently linked to failures of perception and loss of control. The most frequent fatal motorcycle crashes are collisions at intersections, commonly involving problems of perception and poor judgement by both motor vehicle drivers and motorcycle riders. Single-vehicle motorcycle crashes are also common, mainly because of the two-wheeler's problem of maintaining balance on poor road surfaces and bad weather conditions, and in attempts to avert collision with objects on the road. Speeding, reckless driving and driving under the influence of alcohol or drugs are critical factors in the occurrence and severity of motorcycle crashes, just as for other road users.

Motorcycles are also widely used in many African countries for personal and public transport, as well as for service delivery. Although many African countries have large populations of cars and other four-wheel motor vehicles, motorcycles have a significant and growing share of the motorised vehicle population in many of these countries. In some African countries, motorised two- and three-wheelers constitute the highest percentage of motorised vehicles. In Burkina Faso, for instance, they represent 85% of the total number of registered vehicles[2].

Motorcycles' road safety is a significant problem in Africa, as illustrated by figures provided by the World Health Organisation (WHO, 2018). The data includes the percentage of drivers/passengers of two- or three-wheelers deaths in road traffic crashes in 22 (out of 54) African countries. On average, 22.5% of road traffic deaths in 2016 were drivers/passengers of two- or three-wheelers. Based on WHO estimates of road fatalities, 22,700 motorcyclists were killed in road traffic crashes in the 22 African countries for which data were available. Extrapolating that to all African countries, an estimate of some 55,700 motorcyclists' fatalities can be derived.

This information suggests that several factors are influencing motorcycle safety conditions in Africa. Motorcycle safety in Africa is therefore an urgent (and growing) problem that needs to be addressed through a better understanding of the characteristics of the phenomenon and the differences among countries, and through the identification of adaptable recommendations for interventions.

[1] Scooters are two-wheeled vehicle with a step-through chassis and footrest platform. Mopeds are engines without footrest platform, having engine smaller than 50cc. Motorcycles have engine higher than 50cc.

[2] African Road Safety Observatory developed by the SaferAfrica project. http://www.africanroadsafetyobservatory.org/

1.2 Research objectives

Road safety is one of the priority cross-cutting areas the African Development Bank's (AfDB) transport sector operations. In line with this, AfDB decided to undertake a research project to assess the severity and trend of motorcycle crashes and identify causes and countermeasures.

This study's main objective was to develop a set of comprehensive **recommendations for motorcycle safety in Africa.** They aim to inform regional member countries on policy advice and technical assistance.

To develop the recommendations, the study:

- assessed the best international practices on motorcycle safety;
- collated available data and information on motorcycle safety in the continent; and
- investigated motorcycle safety in selected Africa countries.

The study focused especially on four African countries (Cameroon, Burkina Faso, Rwanda and Uganda) where the use of motorcycles for daily activities is reputedly high. These countries also represent three geographic regions of the continent, namely Central, Western and Eastern Africa. Rwanda was considered especially interesting to include in the study because the regulation of moto-taxi services has produced positive results that could be replicated in other African countries.

The research activities included:

- reviewing international good practices on motorcycle safety and selection of transferable good practices to African conditions;
- Investigating motorcycle crash fatalities and injuries, with a view to:
    - assessing motorcycle safety for all African countries;
    - performing detailed investigation of motorcycle crash fatalities and injuries from selected countries (Cameroon, Burkina Faso, Rwanda and Uganda);
    - assessing policies, regulations and current practices related to motorcycle safety;
    - collating available data from stakeholders and official sources (national authorities); and
    - assembling and analysing the data to assess the severity, trends, and characteristics of motorcycle crashes;
- identifying the main causes of motorcycle crashes and injuries; and
- defining strategic recommendations for countermeasure interventions corresponding to the identified causes of motorcycle crashes and injuries.

1.3 Limitations

The study team has reviewed international literature and assessed motorcycle safety in Africa based on available resources. The continental assessment, however, is limited in terms of available published reports and data. It is worth noting the limitation of road crash reporting in general, and the scarcity of available of disaggregated motorcycle crash data in Africa.

The study was first designed, besides having continental assessment, to undertake detailed investigation at least in five representative African countries where motorcycle is widely used in the continent. However, the coverage was constrained to three countries namely Burkina Faso, Cameroon and Uganda due to limitation of funding. This was however, expanded to include Rwanda after the comment from the validation workshop to capture lessons learnt that Rwanda has on enforcement for smooth operation of motorcycle taxi.

Furthermore, the data shortage in the study countries has also constrained the investigation of different aspects of motorcycle safety in the continent including comparison of motorcycle crashes between rural and urban roads.

2. Review of International Practices

2. Review of international practices

A review of international practices dealing with motorcycle safety has been conducted as a starting point of the research. The information collected was useful to perform road safety analysis, identify motorcycle crash causes, identify specific conditions applying to African countries, and to define recommendations for future improvements.

2.1 International motorcycle safety examples

In most OECD countries, the motorcycle fleet increased much faster than the passenger car fleet between 2001 and 2010. The trend of increase is also confirmed for the years after 2010. However, in Europe, motorcycle ownership varies between southern Europe (Greece, Spain, and Italy, accounted for around 11.9 million motorcycles in 2018) and northern Europe, which had just around 9.4 million motorcycles in 2018). Nevertheless, motorcycles are an accepted and frequently used mode of transportation, because of the high affordability, and they are a growing and important part of the transport system (OECD/ITF, 2015).

Despite the growth trends and the mobility benefits, motorcycles are more vulnerable than four-wheeled vehicles. In OECD countries, PTW riders represent 17% of total fatalities on average, while PTWs account for about 8% of the motorised vehicle fleet. PTW fatalities often comprise a much higher proportion of total fatalities in low- or middle-income countries (OECD/ITF, 2015).

The review of international practices led to a list of around 50 documents (see Annex 1), providing useful information on road safety challenges and on potential interventions that could be adapted to African countries.

Table 1 summarises the main international practices adopted to improve motorcycle safety identified from the literature review. The following paragraphs provide details of international practices, along with the sources of the international examples.

Among these sources, the “International Good Practice Guide for Motorcyclists. Road Safety Measures” (Ferrer & Rubino, 2017) is especially relevant, since it provides references to motorcycle safety good practices in developing countries (particularly in Latin America).

Table 1 – Summary of international practices

Topic	Intervention/ Practice	Impact	International examples
VEHICLES / SAFETY STANDARDS	Use of headlight during daytime and night-time	**Reducing crash numbers by improving PTWs visibility**	Evidence of the effectiveness of the measure in a lot of international research, including studies from: • University of Iowa (USA). • North Dakota State University (USA). • Transport Research Laboratory (UK). Cited also in “International Good Practice Guide for Motorcyclists: Road Safety Measures”.
	Vehicle lighting technology and mandatory retroreflective equipment		• Paraguay and Colombia: mandatory use of retroreflective vest or jacket during night-time (Ley 769 2002. “Código de Tránsito”, art. 94). • UN Regulation No. 22: mandatory retroreflective area on every helmet (2002). • Cited also in “International Good Practice Guide for Motorcyclists: Road Safety Measures”.
	Provide heavy vehicles with wide-angle and close-proximity mirrors		• European Union: Directive 2007/38/EC. • New York City: Cross Over Mirrors for Trucks. New Legislation goes into effect (2012). • Cited also in International Good Practice Guide for Motorcyclists: Road Safety Measures”.

Table 1 – Summary of international practices

	Braking system: mandatory ABS/ CBS	**Reducing number of crashes and mitigating severity of consequences**	• European Union: Regulation (EU) No 168/2013 15/01/2013. • ABS/CBS regulations in Brazil, India, Japan, Taiwan. • Cited also in "International Good Practice Guide for Motorcyclists: Road Safety Measures".
	Motorcycle with safety cell	**Reducing the severity of crashes**	Currently implemented by main manufacturers. They are mainly sold in Europe.
	PTWs airbags		Honda Research: demonstrated the main benefits of PTWs airbags
	PTWs with protective frames		Currently implemented by main manufacturers.
	Helmet standards		Most common safety standard required internationally: • DoT • ECE 22.05 Latin America standards cited in International Good Practice Guide for Motorcyclists. Road Safety Measures.
Road user	Mandatory use of helmets	**Reducing the severity of crashes**	Most countries have set of mandatory helmet law.
	Mandatory use of protective clothing		• Costa Rica government promoted the usage of protective clothing through sensitisation campaigns. • France: mandatory use of CE certified gloves (November 2016). • Belgium: mandatory use of protective clothing (September 2011).
	Training and education of motorcyclists and drivers	**Reducing crash numbers due to improper behavior or lack of experience**	• Spain and Ontario: Graduated Licencing System. • UK: BikeSafe initiative run by police forces. • Austria: experimental workshops potential riders aged 15 and 16. • Indonesia: Safety Riding Education for School and Public campaign. • India: training for traffic police officers. • Spain: Voluntary Safe Training. • Malaysia: training for commuters. Also cited in "International Good Practice Guide for Motorcyclists: Road Safety Measures".
	Prevent riding under impairment through sensitisation campaigns, education at school, rider training, driver training, stronger enforcement		• MMA recommendations to reduce human errors and support to the governments to prevent impaired riding. • USA: information / education campaigns. • India: Safe Rider Program. • UK: campaign THINK! Also cited in International Good Practice Guide for Motorcyclists. Road Safety Measures
	Measures to improve child safety	**Reducing crash numbers and mitigating severity of consequences**	WHO Regional Office for South-East Asia proposals defining Maximum Safety and Minimum Acceptable Safety for children. "International Good Practice Guide for Motorcyclists. Road Safety Measures" provides references on helmet for children, awareness campaigns, recommendations on children transportation.
	Motorcycle taxi: regulate and monitor this form of transport	**Reducing crash numbers due to improper behaviours**	• Rwanda: SafeMotos application. • Colombia: integration of moto-taxi services with public transport as alternative to feeder services. • Brazil: regulation certifying associations and establishing minimum training. Also cited in "International Good Practice Guide for Motorcyclists: Road Safety Measures".

Table 1 – Summary of international practices

Road infrastructure	Enhance road infrastructure design, maintenance and layout	**Reducing crash numbers and mitigating severity of consequences**	SaferAfrica[4] – good practice factsheet on PTWs (2018)
	Traffic calming interventions		
	Inclusion of motorcycles in road infrastructure policies		Internationally, maintenance of roads and infrastructure must be a priority for authorities
	Introduction of self-explaining and forgiving roads		Recommendations from the research report "Improving Safety for Motorcycle, Scooter and Moped Riders" (2015). Examples cited in "International Good Practice Guide for Motorcyclists: Road Safety Measures".
	Roadside and crash barriers interventions	**Reducing the severity of crashes**	Some recommended design solutions to reduce injuries and fatalities caused by direct impact of the rider's body against the barrier. Examples cited in "International Good Practice Guide for Motorcyclists: Road Safety Measures".
	Exclusive motorcycle lanes	**Reducing crash number by reducing interactions between motorcyclists and other road users**	• Malaysia: first motorcycle lane on Federal Highway 2. • Cali (Colombia) and São Paulo (Brazil). Cited also in "International Good Practice Guide for Motorcyclists: Road Safety Measures".
	Advanced stop line/box at signalised intersections		Barcelona (Spain): advanced stop line to mitigate the problem of black spots. Cited also in "International Good Practice Guide for Motorcyclists: Road Safety Measures".
	Road surface conditions: avoid extensive repair work using a plain bitumen surface and sealing patches	**Reducing crash numbers by limiting skidding or loss of grip**	Recommendations on type of road surface and its maintenance. Examples provided in "International Good Practice Guide for Motorcyclists: Road Safety Measures".
	Use of road markings limiting skidding		Recommendations on marking characteristics. Recommendations provided in "International Good Practice Guide for Motorcyclists: Road Safety Measures".
	Motorcycle shelter station	**Reducing crash numbers**	Malaysia experience
	In roadworks zones: signs specifically directed to motorcyclists		Australia: Infrastructure Improvements to Reduce Motorcycle Casualities, Austroads (2016)

[4] Adopted from Qatar Highway Design Manual 2015 (QHDM)

Table 1 – Summary of international practices

Policies	Universal helmet law	**Reducing the severity of crashes**	Most countries have set of mandatory helmet law. • USA experience.
	Mandatory rider education program	**Reducing the number and severity of crashes due to improper behaviours or lack of experience**	• Philippines: Call to Action towards Unity, Safety and Equality. • Malaysia: measures to increase the number of trained riders. • Canada: encouraging riders to attend voluntary courses. Examples provided in "International Good Practice Guide for Motorcyclists: Road Safety Measures".
	Motorcycle safety strategies and plans	**Reducing the number of crashes and mitigating severity of consequences**	• Sweden: Motorcycle Safety Strategy (2010). • New South Wales (Australia): Motorcycle Safety Strategy (2012-2021). • Victoria (Australia): Road Safety and Transport Strategic Action Plan for PTWs (2009-2013). • Argentina: Metropolitan Road Safety Plan for Motorcycles. • Costa Rica: National Plan for motorcycles road safety (2015-2020). • Colombia: District motorcycle road safety plan (2017-2027). Cited also in "International Good Practice Guide for Motorcyclists: Road Safety Measures".
	National Road Safety Agenda	**Halve the number of fatalities by 2021 by intervening on the main road safety issues**	Thailand: National Road Safety Agenda (2011-2021).
Laws/Regulations and enforcement	Motorcycle enforcement programmes	**Reducing the number and severity of crashes due to improper behaviours**	• USA: law enforcement (to spot impaired motorcycle riders, promote training and education, prevent illegal behaviours, spot noncompliant helmet use). • UK: Motorcycle Enforcement Strategy (Association of Chief Police Officers, 2006). Examples provided in "International Good Practice Guide for Motorcyclists: Road Safety Measures".
		Reducing crash numbers due to improper behaviours	• EU: Directive 97/24/EC. • Madrid (Spain): anti-tempering campaign.
		Reducing the number of crashes and mitigating severity of consequences	Uruguay experience.

Vehicles / Safety standards

Most of the world's **motorcycle safety standards** focus mainly on technical aspects such as frame and suspension alterations, engine replacements and modifications, steering gear, handlebars, rear-view mirrors, seats, wheels and tyres, headlights, indicators, chain/belt guards, etc.

The United States' Federal Motor Vehicle Safety Standards (FMVSS) issues a Code of Federal Regulations which govern the sale, operation, and maintenance of motorcycles in the country[5]. Manufacturers and operators/riders of motorcycles must comply with these regulations. Under the regulations, it is forbidden to make any changes or modifications that are not compliant with the set standards.

Regulations apply to motorcycles, mopeds or motorised cycles, including three-wheeled vehicles. They cover:

- brake hoses;
- lamps, reflective devices, and associated equipment;
- rear-view mirrors;
- motorcycle brake fluids;
- new pneumatic tyres for vehicles other than passenger cars;
- tyres and rims for vehicles other than passenger cars.
- motorcycle brake system;
- motorcycle controls and displays; and`
- glazing materials.

The European Union (EU) has extensive regulations governing the sale, use, and operation of motorcycles. These include the "Regulations for Performance and Safety Standards of Motor Vehicle and Vehicle Parts and Regulation (EU) No. 168/2013 of the European Parliament and of the Council of 15 January 2013 on the approval and market surveillance of two- or three-wheel vehicles and quadricycles"[6].

These regulations stipulate the type-approval system[7] for two- and three-wheel vehicles and specify their manufacturing and safety requirements. There are also regulations governing the sale of use of parts and accessories. The authorities deregister motorcycles that fail to meet these requirements are and/or impose significant fines on their owners.

The United Nations Economic Commission for Europe (UNECE) sets down uniform regulations for vehicle standards and includes requirements for all types of motorcycles. The Consolidated Resolution on the Construction of Vehicles (R.E.3) ECE/TRANS/WP.29/78/Rev.5 replaces TRANS/WP.29/78/Rev.4 and contains the amendments adopted by the World Forum for Harmonization of Vehicle Regulations (WP.29) at its 172nd session (ECE/TRANS/WP.29/2017/46).

The interaction between motorcycles and heavier vehicles in a mixed environment is often reported as a risk factor for riders. Positive interventions in vehicle operation include the following:

- Use of headlights by day and night to improve PTW visibility (PTW riders' daytime use of headlights has lowered the overall crash rate by 10 percent in Europe). International studies confirm that the use of headlights by PTW riders improves their visibility. A study8 conducted in the University of Iowa, using a driving simulator, indicated the positive impacts of daytime headlights. These finding is corroborated by another by the North Dakota State University, "Motorcycles: crash trends and interventions", and the "Literature review of interventions to improve the conspicuity and help avoid looked but failed to see accidents" by the United Kingdom's Transport Research Laboratory (TRL).

The use of headlights in daytime and night-time driving has been mandatory in Malaysia since 1992. In the three years following the implementation of this new regulation, the number of crashes related to a lack of visibility dropped by 29% (Ferrer & Rubino, 2017).

In Latin America, some countries and cities, notably, Brazil, Colombia, and the Argentinian capital Buenos Aires, have included in their national or local laws and regulations the obligation to use daytime running lights (Ferrer & Rubino, 2017).

The effectiveness of this measure in Africa should be monitored and verified. Since daylight is generally brighter in Africa than in Europe, different effects could be expected.

[5] National Highway Traffic Safety Administration (NHTSA). Requirements for Motorcycle Manufacturers. https://www.nhtsa.gov/DOT/NHTSA/Rulemaking/Articles/Associated%20Files/mcpkg002.pdf
[6] Official Journal of the European Union, 2013. Regulation (EU) No 168/2013 of the European Parliament and of the Council of 15 January 2013. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R0168&from=EN
[7] Type-approval system refers to the minimum set of regulatory, technical and safety requirements
[8] "Motorcycle Conspicuity – What Factors Have the Greatest Impact".

- **Motorcycle with safety cells** for occupants offers increased protection against collisions and falls and reduce the effects of crashes (Figure 1). A design with a high-rising frame, shoulder bars, and windshield can reduce the impact power on the driver in case of collision. Policy interventions for importing such type of motorcycles could be considered.

Primary safety also refers to functions such as vehicle stability, braking, traction control, ergonomics, and chassis designs that enhance the rider's control of the vehicle.

Figure 1 – Example of PTW with safety cell

The report, "Motorcycle safety: a scoping study" (Elliott et al., 2003), provides useful references on some vehicle safety systems, such as:

- **Vehicle lighting technology** improving rider's vision, visibility, and the lighting signature of PTWs. Aiming to support headlamp-on policies, some manufacturers also developed the Automatic Headlamp-On (AHO) feature on PTWs. The AHO system automatically turns on the headlamps when the engine is started.
- **PTWs airbags** present another potential solution. Studies show that most motorcycle crashes resulting in fatal and serious head and chest injuries of the riders/passengers occur in head-on collisions vehicles travelling at a speed of 25km/h or lower. Hence, the airbag system performance is tailored for impacts of head-on motorcycle collisions with stationary and slow-moving vehicles.

PTWs AIRBAGS

A Honda Research study of airbags mounted in a large touring motorcycle demonstrated that the main benefits and risks were to the head and neck.

For the head, the injury benefits were much larger than the injury risks; whereas for the neck, the injury risks were greater – although overall there was still a net benefit. The results indicated that the injury benefits were very much greater than the injury risks.

Source: Iijima et al., 1998

- **PTW protective frames** can be constructed with the following safety features:
  - aluminium safety frame with integrated protective roll bars;
  - three points lap and diagonal seat belts;
  - safety seat to prevent 'submarining'[9] ;
  - side bars in the shoulder area to prevent sideways slip and intrusion;
  - deformable impact-absorbing front element; and
  - tempered safety glass windshield.
- Braking, particularly in an emergency, is one of the motorcycle rider's most difficult challenges. Errors in braking can result in skidding. At least two technical solutions have been identified to mitigate this issue: Anti-lock Braking Systems (ABS) and Combined Braking System (CBS). Anti-lock Braking Systems (ABS) are designed to prevent the wheels from locking and thus provide motorcyclists with the confidence to use the brakes up to the limit of the friction available, without falling to the ground. ABS also reduce stopping distance in wet and icy conditions. The Combined Braking System (CBS) is a system for linking front and rear brakes. Through this system, the rider's action of depressing one of the brake levers engages both front and rear brakes. This system helps preventing the propensity of many learner riders to not use the front brakes as a matter of course.

[9] The term "submarining" describes what could happen in a head-on collision when the lower part of the body is pushed deep into the seat cushion and slips beneath the lap belt.

ANTI-LOCK BRAKING SYSTEMS - ABS

The German Insurance Association GDV has estimated ABS to be beneficial in 55% of PTW crashes in terms of reducing crash numbers and mitigating severity of consequences.

In 2004, ACEM signed the European Road Safety Charter binding itself to offer at least 50% of PTW street models with advanced braking systems as an option by 2010.

In June 2008, 35% of the European PTW offer was already available with an advanced braking system, which translated into 35% actual penetration in terms of PTW sales.

The use of ABS on all new motorcycles with an engine displacement of more than 124 cm3 has been mandatory in the EU since 2016. Motorcycles with displacements of between 51 cm3 and 124 cm3 must be fitted with at least the Combined Braking System.[10]

These manufacturing and safety requirements were introduced after the evaluation of many studies, chief among them the United Kingdom's Transport Research Laboratory's (TRL) 2009 study, "Evaluating the Impact of possible new measures concerning motorcycles safety". According to the TRL study, 5,168 lives would have been saved in ten year if all the motorcycles had had ABS, and 4,801 lives would have been saved over the same period if the vehicles with an engine displacement up to 124 cm^3 had had CBS and all with an engine displacement of more than 124 cm^3 had had ABS.

Other countries, notably, Brazil, India, Japan and Taiwan, have regulations mandating the use these these braking systems (Ferrer & Rubino, 2017).

It is worth mentioning that the application of these measures in African countries could be hampered by socio-economic factors (such as the high cost of technologies, limited technical skills for maintenance, and poor road conditions).

- **Manufacturing and safety standards extend to helmets.** Helmets standards incorporates a comprehensive evaluation of the safety features, including adequate shock absorption, minimised rotation in a crash and secure and well-fitting chin guards. Helmet shells and liners should be well padded to provide maximum shock absorption at lower, more common, impact speeds, where the benefit of wearing a helmet is most pronounced. UN Regulation ECE 22 guide manufacturers on how to produce and test effective motorcycle crash helmets.

Motorcycle helmets that have attained certain requirements for sale in the market are subjected to laboratory tests to measure their impact absorption capacities. The effectiveness of the retention system that keeps the helmet secure on the head, as well as accessories such as helmet visor, is also tested.

While helmet safety tests measure the performance and impact absorption capacities of the helmets, the methods of testing and the standard requirements vary from country to country. In some countries, helmet safety standards compliance is overseen and monitored by government agencies. In other countries, compliance is left up to the motorcycle helmet manufacturer or the distributor of the item.

The main helmet standards are described in following paragraphs:

US Federal Motor Vehicle Safety Standards

All motorcycle helmets sold in the USA must be certified by the Department of Transport (DoT). The Federal Motor Vehicle Safety Standards (FMVSS) provides the requirements for DoT certification of all motorcycle helmets sold in the United States.[11]

FMVSS 218 sets standards in three areas of helmet performance: i) impact reduction (absorption), ii) penetration resistance, and iii) retention system effectiveness.

The standard requires peripheral vision to be not less than 105° from the helmet midline. Projections from the helmet's surface (snaps, rivets, etc.) may not exceed 5 mm. The impact test measures acceleration of a head form inside the helmet when it is dropped from a fixed height onto a spherical and flat-surfaced anvil. The standard stipulates a peak acceleration energy of 400 G. The penetration test involves dropping a piercing test striker onto the helmet from a fixed height. The striker must not penetrate deep enough to pierce the head form. The retention system test involves placing the helmet's retention straps under load in tension.

SNELL Standards

The SNELL Memorial Foundation is a non-profit organization founded with the aim of achieving a higher safety standard for helmets. SNELL is known for making very high demands on the safety of the helmets tested. While it can be considered as an indicator, it is not mandatory on public roads.

[10] "Regulation (EU) No 168/2013 of the European Parliament and of the Council of 15 January 2013 on the approval and market surveillance of two- or three-wheel vehicles and quadricycles".

[11] "Federal Motor Vehicle Safety Standards; Motorcycle Helmets; A Proposed Rule by the National Highway Traffic Safety Administration on 05/21/2015. https://www.federalregister.gov/documents/2015/05/21/2015-11756/federal-motor-vehicle-safety-standards-motorcycle-helmets

SHARP Standards

SHARP is a British government programme that tests motorcycle helmets, rating them with stars, from 1 to 5 — 1 star being the lowest score/rating, and 5 the highest.

Economic Community of Europe Standards

The Economic Community of Europe (ECE) is the common motorcycle helmet safety standard internationally. The ECE 22.05[12] is required by over 50 countries across the world. Compliance with the ECE 22.05[12] standard is assured through a compulsory sample testing of every batch of helmets before they leave the factory.

The ECE and DoT standards are similar in several ways. For example, they both require peripheral vision through an arc of 105° from the helmet midline.

Impact absorption testing involves a drop test from a fixed height on a steel anvil with a head form fitted inside to measure the energy transmitted. The stipulated peak acceleration energy at the head form is 275 G. Impact absorption and rotational forces are also tested at points where any surfaces or parts project from the shell of the helmet. The retention system is tested with a free-fall drop test of a 10 kg weight from a height of 0.75 m attached to the fastened chin strap. No more than 35 mm displacement of the attachment point is allowed. The chin strap buckle system is also tested for slippage under load, and the strap material itself is tested for abrasion resistance and tension failure load (which cannot be less than 3 kN). There are also tests for ease of release and durability of quick-release buckle systems.

There are some areas where the DoT and ECE standards differ. For example, in ECE standards the surface of the helmet is tested for abrasion resistance, but in this test, the performance standard requires the helmet surface either to shear away or to allow the test surface to slip past the helmet. Projections from the helmet (snaps, rivets, etc.) may not exceed 2 mm.

Another test assesses the rigidity of the shell of the helmet by measuring the deformation of the helmet shell when more load is applied progressively up to 630 N.

In addition to these areas, ECE 22.05 includes performance for the visor on a helmet if it is an integral part of the helmet. DoT sets standards for visors and other eye-protection gear in a separate standard referred to as the Vehicle Equipment Safety Commission (VESC) Regulation VESC 8 — Minimum Requirements for Motorcyclists' Eye protection. The ECE standards do not include a test for penetration resistance.

The ECE standard includes requirements for retroreflective materials in specific member countries.

The ECE standard uses codes to indicate the type or configuration of helmet to which the approval applies: "J" for a helmet without a lower face cover, "P" for a helmet with a protective lower face cover, and "NP" for a helmet with a non-protective lower face cover (identified as ECE 22.05J, ECE 22.05P and ECE 22.05NP, respectively).

The ECE approval is the most accepted standard worldwide and is used in over 50 countries.

Although it is considered one of the strictest inspections in the world, the ECE standard has some loopholes. For instance, the penetration test is missing in the latest version of the ECE test. The penetration test examines the extent to which the outer shell of the motorcycle helmet is pierced when it falls on a sharp object (such as, for example, a motorcycle footstep or the bar of a fence).

Another criticism is that a helmet is always tested for an impact in the same place on the outer shell. A helmet manufacturer could therefore reinforce a helmet in exactly those places, so that the helmet is approved earlier. In addition, helmet manufacturers have different philosophies on safety. For example, one manufacturer could swear by an outer shell that deforms and thus distributes the impact of a crash, while another could be convinced of a super hard and rigid outer shell and a soft inner shell that functions internally as a kind of crumple zone.

Despite these weaknesses, ECE standard can be considered as a guarantee for a minimum safety level.

Malaysia's standard MS1-1:2011[13] is another example of good motorcyclist helmets safety standards.

Table 2 below provides list of helmet standards.

[12] UNITED NATIONS; Uniform Provisions Concerning the Approval of Protective Helmets and their Visors for Drivers and Passengers of Motorcycles and Mopeds. E/ECE/324 Rev.1/Add.21/Rev.4 E/ECE/TRANS/505 24 September 2002. http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/r022r4e.pdf

[13] Malaysian Standard (MS) Related to Automotive...http://www.data.gov.my/data/en_US/dataset/malaysian- standards-ms-related-to-automotive/resource/ed8a13c1-6dd1-4fba-881b-c14c6a030362

Table 2 – Examples of helmet safety standards

Country	Safety Standard
USA	DoT
European	ECE 22.05
Brazil	NBR 7471
Taiwan	CNS
Australia	AS 1698-2006
Japan	SG or JIS
New Zealand	NZ 5430
Korea	KS G 7001
Malaysia	SIRIM
USA	DoT
European	ECE 22.05
Brazil	NBR 7471
Taiwan	CNS
Australia	AS 1698-2006
Japan	SG or JIS
New Zealand	NZ 5430
Korea	KS G 7001
Malaysia	SIRIM
Thailand	TIS
India	IS 4151
Singapore	PSB
Canada	CSA CAN3-D230-M85

Motorcycles are often associated with conspicuity challenges. The Committee on Motorcycles and Mopeds[14] of the Transportation Research Board explains that various crash studies provide ample evidence that motorcyclists are not easily seen by drivers of other vehicles, particularly heavy traffic and bad weather.

In roughly half of the cases in which motor-vehicle drivers failed to detect a motorcycle in time to avoid a crash, something interfered with the driver's line of sight within the vehicle, part of the landscape or in passing traffic

Extensive experimental work involving both drivers and pedestrians suggests that the following measures, singly or in combination, can increase the daytime detectability of a motorcyclist by 10% to 20%:

- A large headlamp of at least 40-watt power.
- A pair of daytime headlamps.
- A retroreflective jacket or waistcoat.

Figure 2 shows an example of retroreflective jacket used while riding[15].

United Nations legislation "ECE 22 - Uniform provisions concerning the approval of protective helmets and their visors for drivers and passengers of motorcycles and mopeds (2002)" states that every helmet must have a retroreflective area of at least 18 cm^2.

Vehicles' blind spots constitute a major conspicuity challenge. Blind spots are those areas near the vehicle that the driver cannot see with normal mirrors. The issue is particularly relevant for heavy vehicles, because their spots are broad and are responsible for many crashes involving pedestrians, cyclists and motorcyclists. These

Figure 2 – Example of retroreflective jacket

crashes are often related to a change of direction at crossings, junctions or roundabouts when drivers fail to detect other road users in the blind spots.

The Directive 2007/38/EC of the European Parliament requires that all heavy goods vehicles be equipped with wide-angle and close-proximity mirrors on the passenger side, with a combination of fields of vision covering no less than 95% of the field vision at ground level (Figure 3).

In New York City, it is mandatory to equip school buses and trucks with convex mirrors that allow the driver to see the vulnerable road users in the vehicle's immediate vicinity[16].

Figure 3 – Wide - angle and close - proximity mirrors

[14] Transportation Research Board: Motorcycles and Mopeds, 30th of April 2021; http://www.trb.org/ANF30/ANF30.aspx

[15] The Highway Code: Rules for motorcyclists (83 to 88); Rules for motorcyclists, including helmets, carrying passengers, daylight riding and riding in the dark. https://www.gov.uk/guidance/the-highway-code/rules-for-motorcyclists-83-to-88

Road users

When dealing with safer road users, the "Good Practice Factsheet on Powered Two Wheelers" (SaferAfrica, 2018) recommends interventions in education, law enforcement, and driver education to safeguard road users. as the topics include:

Helmet use: According to Elvik et al. (2009), using helmets reduces the number of head injuries among moped riders and motorcyclists by around 44%. The effect is larger for the most serious injuries. In the United States, introducing mandatory wearing of helmets in late 60s reduced the number of injured moped riders and motorcyclists by around 25%.

In 2000, Italy adopted a comprehensive law aimed at reducing the effects of motorcycle crashes, requiring the use of helmets for all motorcycle and moped drivers and their passengers, irrespective of age[17]. A study carried out to assess the impact of the new law revealed:

- a considerable rise in helmet-wearing rates across the country, by up to 95% in some regions,
- no decrease in the number of two-wheeled motorized vehicles in use throughout the country,
- a 66% decrease in admissions of traumatic brain injury for motorcycle and moped crashes,
- a 31% decrease in traumatic brain injury admissions to neurosurgical hospital units,

a fall, to almost zero, in the number of blunt impact head injuries (epidural haematomas) among injured moped riders admitted to hospital.

In Vietnam, the introduction of mandatory helmet law and its enforcement led to an increase in use from 46% in 2012 to 70% in 2015. In one of the country's provinces, the increase was 99% up from 27%. Within three months of the enactment of the law, hospitals reported a decrease in road traffic head injuries and deaths of 16% and 18%, respectively. The Asia Injury Prevention Foundation (AIP) estimates that, since the introduction of the helmet law, around 15,000 lives have been saved (Passmore et al., 2010).

- **The non-use of protective clothing** by PTW users is another important factor influencing the severity of injuries. This problem is mainly due to the lack of adequate information about the effectiveness of clothing such as boots, gloves, jackets, and long trousers. Moreover, the use of protective clothing is problematic in countries with predominantly hot weather. In these countries, materials that minimise the heat-related stress should be used.

An Australian study, "Effectiveness of motorcycle protective clothing: Riders' health outcomes in the six months following a crash" (de Rome et al., 2011), explains the effects of the non-use of protective clothing by learner riders. A sample of 212 adult motorcyclists were recruited for the study, following presentations to hospitals or crash repair services in Australia between June 2008 and July 2009. Data were obtained from interview subjects and medical records at baseline, then by mailed survey at two- and six-months post-crash periods. The outcome was that, compared to unprotected riders, riders in full protection gear (jacket and pants) and in partial gear (jacket) had fewer days in hospital and reported less pain immediately after the crash. By six months, all protected riders were more likely to recover fully and return to work than unprotected riders.

Many countries promoted the usage of protective clothing through communication and sensitisation campaigns. In Costa Rica, the government approved the "National Road Safety Plan for motorcyclists 2015-2020", which deals with the main issues on motorcycle safety: protective clothing, alcohol consumption, helmet use, speeding, transporting of children, and compliance with the signs. Within the framework of this plan, various communication and information campaigns were carried out (Ferrer & Rubino, 2017).

In France, the use of CE certified gloves has been mandatory for motorcyclists and their passengers since November 2016. Violators of the law incur penalties[18].

In Belgium, since September 2011, motorcyclists and passengers have been required to wear protective clothing: gloves, jacket with long sleeves, trousers, and ankle-length boots[19].

[16]"Cross Over Mirrors for Trucks. New Legislation goes into effect: New York City" – see Ferrer & Rubino, 2017.
[17]Helmets: a road safety manual: Why are helmets needed? Online on the 1st of May 2021; https://www.who.int/roadsafety/projects/manuals/helmet_manual/1-Why.pdf
[18] Decree No. 2016-1232 of September 19, 2016 regarding the requirement to wear gloves for motorcycle, motor tricycle, motor quadricycle or moped drivers and passengers; Online on the 1st of May 2021: https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000033131556?r=kktmTGoQqW
[19]Motorcycle touring and motorcycle news; online on the 1st of May 2021: https://touron2wheels.wordpress.com/2016/06/17/wearing-of-protective-clothing-in-belgium-required-by-law/

GRADUATED LICENCING SYSTEM - SPAIN

In Spain, the access to motorcycles with high performance is based on a model considering the progressivity according to age and experience of the rider. This progression postulates that the performance of a vehicle develops in parallel with the experience of its driver.

In 2009, the progressivity according to age an experience was regulated: A new kind of "intermediate" licence between the A1 and A licences, called A2, was introduced. The new A2 licence allows persons being older than 18 year to drive motorcycles up to 400cc. Hence, to be able to access the A licence, it is indispensable to have held the A2 for at least two years.

Source: Atos Consulting. Strategic Road Safety Plan for Motorcycles and Mopeds on line on May 25 2021: http://www.svmc.se/upload/SMC%20centralt/Dokument/rapporter/PTW-Road-Safety-Plan-Draft-English.pdf

- Crash risk is relative to the rider's age and level of experience. Both young and older riders present higher risk of injury. For young riders, the risk is principally related to lack of experience and propensity for risky behaviour (involving very high speeds, lane splitting or filtering, competing, etc.). For older riders, the risks relate to physical fragility and limited riding practice, leading to an increase in the number and severity of crashes.

Mullin et al. (2000) examined the associations between age, experience, and motorcycle injury in New Zealand. They identified a strong and consistent correlation between the rider's age and level of risk of moderate to fatal injury. They found out that the risk of riders older than 25 was more than 50% lower than that of riders aged between 15 and 19. They noted that people with more than five years of riding experience were less crash-prone than people with two years of riding experience.

Sexton et al. (2004) investigated the relationship between age and crash involvement in the UK. They found that riders aged between 16 and 20 years have a higher likelihood of being involved in crashes than riders aged between 21 and 25, and an even higher likelihood than riders aged 40 and above. Rider experience was also found to be a key crash predictor.

Human factors are recognised as the most critical for motorcycle crashes. Behavioural changes should be at the forefront of all activities and initiatives. The "Motorcycle Accidents In-Depth Study" (MAIDS)[20] identified human error as the primary cause of crashes (87.9% of all crashes, as against 7.7% attributable to poor infrastructure).

Training and education should be emphasized not only for motorcycle users, but also for other road users who may be involved in or responsible for motorcycle crashes. The most common cause of crashes involving motorcycles is perception failure by other drivers. The training and education of learners and experienced riders can be expanded to include critical skills like hazard perception and vehicle control.

Post-crash care education is needed to minimise the risk of serious injury and death. The WHO offers two PTW-specific inventions: on-site helmet removal and on-site application of a cervical collar brace to the injured individuals (WHO, 2017).

Uruguay launched in 2017 a «Comprehensive Emergency Care System» led by the National Road Safety Unit and the Ministry of Health, so that the country has both public and private hospital logistics, and pre-hospital care with land-based mobile emergency units (Ferrer & Rubino, 2017).

Various examples of training and education methods exist internationally. Good practices can be found in Deliverable 28 of the 2BESAFE project, "Powered Two Wheelers - Safety Measures: Guidelines, Recommendations and Research Priorities" (Winkelbauer et al., 2012). Below are the examples of good practices.

- The Ontario's Graduated Licencing System: a two-step licencing process taking at least 20 months to complete, during which some restrictions on riders are gradually removed (for instance, riding only during daylight hours, or not carrying passengers).
- Probationary licence for learner riders, and extension of the probationary period from one to two years. Probational riders who commit traffic offences must undergo additional theoretical or practical education.
- Multiphase education for learner riders, including several training modules after the driving test.
- Rider training provided by the police. In the UK, BikeSafe is an initiative run by police officers working together with the motorcycling community. They offer test rides and rider skills workshops, including theory sessions.

[20] MAIDS: In-Depth Investigation of Motorcycle Accidents; Online on the 1st of May 2021: http://www.maids-study.eu/

- In Austria, practical workshops are offered to active and potential moped riders aged between 15 and 16. Beside technical rider training, the adolescents were instructed on defence driving and on preventing crashes. The you people also received training on first aid, and traffic laws.

Prevention of impaired riding is also a important. Riding without a motorcycle licence and riding under the influence of alcohol or drugs both constitute impaired riding.

Riders under the influence of alcohol constituted 27%

SAFETY RIDING EDUCATION (SCHOOL/ PUBLIC) - INDONESIA

PTW manufacturers conduct regular activities across the country to educate the public on rider safety, including well-attended exhibition events, which can also be also to encourage PTW check-ups before riding.

The industry's Safety Riding Education for School and Public campaign has gained momentum, becoming a well-known activity across the country. At exhibitions and other events, pre-delivery safety advice leaflets with guidance on the conduct of pre-ride check-ups are distributed.

Results achieved:

1.200,000 leaflets distributed; and
2.1,250 events on safety, including check-ups, with 145,490 participants in 2017.

Source: IMMA (2019). "Safer motorcycling: The Global Motorcycle Industry's Approach to Road Safety".

of the riders involved in the 5,075 fatal motorcycles crashes recorded in the United States in 2012. That means more than one quarter of the fatal motorcycle crashes are linked to drink-riding.

Moreover, almost one quarter of motorcycle riders involved in fatal crashes in 2011 were riding with invalid licences.

It will take the combination of education and enforcement to reduce impaired riding. The International Motorcycle Manufacturers Association (IMMA) urges governments to introduce combined education and enforcement campaigns on drink-riding and riding without a proper licence.

Most information and education campaigns adopted in the United States focus on[21]:

- conspicuity and/or motorist awareness;
- motorcycle safety education programmes in schools; and
- motorcycle-specific crash investigation training.

The IMMA also recommends to the following error reduction measures:

- Rider training should be affordable, accessible, and effective. In particular:
  - Initial rider training for learners, prior to licencing, should be encouraged.
  - Resources and infrastructure should be allocated for systematic motorcycle training and education.
  - Minimum standards and certification of training and trainers should be established. Training should be designed to improve motorcycle safety by setting rider's hazard awareness and perception at the core of the training curriculum.
  - Voluntary post-licence training should be promoted.
- Education of drivers for a better understanding and perception of riders:
  - Targeted components on drivers' interaction with and perception of riders should be a mandatory part of the training curriculum and licencing assessments of other vehicle drivers.
  - Training drivers on impaired riding (drinking and riding, tampering, riding without a proper licence) to foster understanding and attitude change.
  - Extensive sensitisation campaigns to highlight the dangers of impaired riding, along with appropriate and consistent enforcement.

Moreover, the usage rate of safety helmets should be accompanied with a mix of stronger enforcement and Sensitisation campaigns.

Table 3 summarises some other motorcycle education and training programmes undertaken in the world.

[21]DHHS - U.S. Department of Health and Human Services (2010). "Motorcycle Safety"

SAFE RIDER PROGRAM - INDIA

The Society of Indian Automobile Manufacturers (SIAM) has partnered with stakeholders in safety and environment to set up the Society for Automotive Fitness & Environment (SAFE), supporting road safety awareness programmes across India.

The industry has established free safety training for first-time riders by professional instructors, with courses tailored to the specific needs of target audiences. They are conducted with a high degree of interaction and participation and tackle all levels of literacy and understanding in all major Indian languages.

An essential part of the programme emphasizes the vulnerability and limitations of a rider, as PTWs account for nearly 30% of road fatalities in India. Riding assessment, demonstration, rides, and feedback are all optional parts of the training program. The courses include pre- and post-course written tests and, if desired, an on-the-road ride assessment.

Results achieved:

- In the absence of two-wheeler training institutes, SIAM members are voluntarily providing the Safe Riders training to learner riders.
- Many of India's leading companies, several diplomatic missions and a variety of organisations ranging from NGOs to Government departments use these programmes to train their personnel in road safety and have reported a significant improvement in their safety records.

Source:IMMA (2019). "Safer Motorcycling: The Global Motorcycle Industry's Approach to Road Safety".

Table 3 – Examples of motorcycle education and training programmes

EDUCATION & TRAINING	AIM
Voluntary Safe Training Spain	To provide high quality voluntary training, four courses are offered: Kids/ Schools, Scooter 125, Beginners/Re-entry, and Advanced/ Professional. 91% of all participants consider that they have increased their riding skills/safety level. It should be noted that other research indicates that the perception of increased riding skills/safety level is a negative outcome of any training course because it increases overestimation of riding skill and risk-taking behaviour. See Ferrer & Rubino (2017) for more details.
Training for traffic police officers India	To increase safer riding for traffic police members by offering inspirational courses.
Training for commuters Malaysia	To engage employers to improve the safety of their employees. Studies revealed that for employees' riders, 88% of the crashes took place while traveling to work (52% - on the way to work and 36% on the way back).

Source: http://www.saferafrica.eu/media/1959/sa-ntua-wp4-d43.pdf

In the SWOV report[22], (Boele and Craen, 2014) focused on the evaluation of training course for motorcyclists. Specifically, the Institute evaluated the "'Risk' advanced training course of the Royal Dutch Motorcyclists Association.".

The 'Risk' training is both theoretical and practical. It aims at timely perception and recognition of traffic hazards and adaptation of riding behaviour to deal with these risks. The training covers the key areas of conspicuity, speed, glance behaviour, risk perception, and risk acceptance. An important aim of the training is to prevent participants from feeling that they are automatically safer riders after the training, but rather to remain aware of the (overt and covert) traffic risks.

[22]Boele and Craen, 2014; Evaluation advanced training course for motorcyclists. SWOV Institute for Road Safety Research.

The training takes one day and has a maximum number of nine participants who are guided by three certified 'advanced training' instructors. The morning section is dedicated to risk awareness, followed by a motorcycle ride in traffic. After the theoretical part in the afternoon, the motorcycle ride in traffic focuses on the choices and execution of riding behaviour.

Results from a two-year evaluation indicate that the 'Risk' training has a positive effect on motorcyclists' safe riding behaviour and hazard perception in the short-term (the first few months after training). Even in the long term (one year to eighteen months after training), 'Risk' trained motorcyclists showed safer traffic behaviour than a control group without 'Risk' training.

In their report for the European project "PROMISING" Noordzij et al. (2001) provide valuable insights into the challenge of motorcycle safety. The report notes that the structure of motorcycles, as single track vehicles without a bodywork, make them difficult for riders to control when cornering or braking, and even more so in emergency situations. The control of motorcycles in all conditions requires special training and experience. The single-track character also implies that riders have more difficulty coping with uneven road surfaces and obstacles. The small frontal area contributes to the problems of the perception of motorcycles by other road users.

The small size of a motorcycle and its low weight in relation to their engine performance provide opportunities to their riders for behaviour which is different from car drivers. They can overtake where cars cannot, and they can accelerate faster than many cars. Other road users may not expect this behaviour, and riders who behave in this manner will have to realise this and learn the reactions (if any) of road users.

All this explains why age and experience are important for safe motorcycling. Motivations and riding styles also play important roles. Most riders will enjoy the direct sensation of speed (offered by the absence of a bodywork) and the control of the vehicle with the whole body. Other riders seize every opportunity to accelerate, overtake and speed. These behaviours, particularly attractive to young riders, are dangerous because of the small safety margins and the reactions (if any) by other road users.

Training and experience will improve motorcycle riders' ability to operate in all kinds of conditions, including imperfect road surfaces and obstacles on the road, and to recognise dangerous situations in which other road users may not react adequately to their presence.

Research on motorcycle rider training provides no clear answer to such obvious questions as the following:

- What should a learner rider learn as a minimum to be able to safely ride a motorcycle?
- How can this skill be learned effectively and efficiently, in how much time and in which sequence?
- In what way is learning to ride a moped different from learning to ride a motorcycle, or is learning to ride a low performance motorcycle different from learning to ride a high performance one?

In fact, there is little evidence that motorcycle training programmes contribute to riders' safety. For that reason, there is a need to do more and better research into the training of moped riders and motorcyclists.

However, safe motorcycling requires both theoretical and practical training. The development of new simulation techniques offers new opportunities for training programmes.

Child safety is another important safety aspect, especially in low-income countries (Ferrer & Rubino, 2017). Children traveling on motorcycles are more likely than adults to suffer serious consequences in a crash, as their brains and skulls are more vulnerable. The WHO Regional Office for South-East Asia (SEARO) has published a study on children on motorcycles, with recommendations to the authorities to define two different levels of safety: Maximum Safety and Minimum Acceptable Safety. Three age groups were targeted, with different proposals for each (see Table 4).

Table 4 – Recommendation to improve child safety on motorcycles

Age	Maximum Safety	Minimum Acceptable Safety
0-1 year	Infants are not allowed on motorcycles.	Promote the production, importation, and use of tricycles, with room for passengers and a child restraint system. From nine months of age, infants must wear an approved helmet appropriate to their size.
1-5 years	Children are not allowed on motorcycles.	Children should wear all possible protective equipment. Promote the production and use of tricycles for the transportation of children, with room for passengers and a child restraint system.
5-15 years	Do not allow children under the age of 15 to ride. Do not allow children whose feet do not reach the footrest to travel by motorcycle. Passengers must wear all possible protective equipment (helmet, trousers, boots). To transport children under the age of twelve, motorcyclists should undergo an additional test related to the transportation of children.	Children whose feet do not reach the footrests must be carried on motorcycles with suitable seats. Passengers must wear all possible protective equipment (helmet, trousers, boots).

Source: WHO Regional Office for South-East Asia

Motorcycle taxi is a popular form of public transport in developing countries. These taxi services get people to their destinations faster and at lower costs than traditional forms of public transport. However, owing to fierce competition and low profit margins, motorcycles are rarely in good condition, and their operation increases pollution and traffic hazards. The need to provide more services to get better income forces commercial motorcyclists to increase speeds take higher risks. For these reasons, authorities are reluctant to include this form of public transport in mobility plans, and tend to discourage, ban and combat motorcycle taxis, with little success.

A good way to resolve this problem is to regulate and monitor the operation of motorcycle taxis. A centralised organization is needed to generate conditions that facilitate official state regulation and monitoring of this transport system and to detect outlaws. An effective international example has been implemented in Colombia, where the Metroinsú company, which provides public transport in the city of Monteria, has created a free sub-system to complement its bus network (Ferrer & Rubino, 2017). The initiative provides lower cost public transport to marginalised communities in certain suburban neighbourhoods by deploying motorcycle taxis as an integrated part of the public transport system. Motorcycle taxi riders receive training for eight weeks. By setting the maximum speed of motorcycle at 15 km/h and keeping them from the main routes, the authorities reduce crash risks and traffic congestion. The motorcycle taxis are equipped with GPS, GPRS and card readers for real-time tracking.

Rwanda uses "SafeMotos", a mobile phone application that rates riders from one to five stars based on their way of driving, to reduce the risks associated with the motorcycle taxi transport system. A motorcyclist's rating is based on user reports and data collected directly from the motorcyclist's mobile phone, via GPS, accelerometer and gyroscope. The app records the rider's speed, type of braking and other habits. By encouraging riders to travel safely, the SafeMotos app prevents road crashes and provides steady employment.

Road infrastructure

Infrastructure is by far one of the most important problems for motorcycle safety. Poor conditions of many roads and the fact that motorcycles are often ignored by transport plans are the primary reasons for this condition. Satisfactory maintenance of roads and infrastructure should be a priority for authorities.

The good practice factsheet on PTWs issued by SaferAfrica (2018) indicates specific elements of **roadway design** that could be improved, namely:

- **Exclusive motorcycle** lanes to separate motorcycles from larger vehicles. The possibility of collision or motorcycle drivers' injury can be lowered by reducing the interaction between motorcycles and heavier vehicles. This measure is particularly useful when the percentage of motorcycles is greater than 20-30% of all vehicles.

EXCLUSIVE MOTORCYCLE LANE MALAYSIA

Malaysia built the world's first exclusive motorcycle lane on Federal Highway 2 in the 1970s as part of a World Bank project.

A review of the lanes found that there had been a 39% reduction in motorcycle crashes because of fewer conflicts between motorcycles and other vehicles, also a lower speed differential between vehicles. Several other Malaysian highways now have motorcycle lanes.

Malaysia has also made extensive use of inclusive motorcycle lanes. They are built along Federal trunk roads where access to and from the lanes is not monitored.

Researchers found a reduction in motorcycle crashes on roads where inclusive lanes are installed. However, there seems to be an increase in crashes involving pedestrians where pedestrian traffic is prevalent. This may be due to the increased overall width of the road. Features like pedestrian refuges would reduce such crashes.

Source: Road Safety toolkit: Online on 3rd May 2021: http://toolkit.irap.org/default.asp?page=casestudy&id=4

- Motorcyclists are mainly vulnerable to skidding crashes on curves, slip roads and roundabouts. Hence, an improved road infrastructure design, maintenance and layout is needed.

- **Traffic calming interventions** and lowered speed limits can give a positive effect on crashes. Nevertheless, these interventions should be designed to reflect motorcyclists' needs and their capacity to navigate them securely (speed bumps - Figure 4 - and other vertical objects constitute hazard for motorcycles in zones of curvy trajectories).

Figure 4 – Example of speed bumps

Infrastructure is by far one of the most important factors for motorcycle safety. Poor road surface conditions and the exclusion of motorcycles in transport plans are the primary reasons for unsafe conditions. Authorities should make regular maintenance of roads and infrastructure a priority.

Roadside barriers were found to present an increased danger to riders, causing serious lower extremity and spinal injuries, as well as serious head injuries (Elliot et al., 2003). An analysis of motorcycle crashes involving barriers revealed that 15% of all fatalities are caused by direct impact of the rider's body against the barrier. Domhan (1987) found that, among 50 motorcycle riders who collided with barriers, three were killed, 31 were seriously injured and 16 were slightly injured.

There are several different barrier designs, but they were made and tested for four-wheel vehicles. This means that potential problems for two-wheel riders may not be identified.

A typical scenario for a motorcycle crash is the rider's loss of control in a corner due to inappropriate speed or sudden braking manoeuvres. Because of this, guardrails create additional risk to riders, if they fall off their machine and slide towards the guardrail. Collision with one of the posts frequently results in severe consequences for riders. Possible ways of reducing this risk are:

- the removal of the guardrail;
- mounting of protectors around the posts;
- replacement of the guardrail with concrete barrier;
- and installation of under-ride protection (Figure 5).

Figure 5 – Example of under-ride protection

On the roadside, a **clear zone** without dangerous hazards should be guaranteed. To make the roads, motorcycle-friendly, essential features that constitute hazards (e.g. signage, guide posts, light poles) should be set back as far as practicable from the road shoulder. Other hazards that do not provide a benefit to a road user with regard to enhancing the readability of the road or network (e.g. statues, water meters, utility poles) should not be in the clear zone, particularly on the outsides of curves or on the shoulder of a straight when the formation is narrow (Milling et al., 2016).

According to the AusRAP model,[23] crash severity for motorcyclists is 90% lower when an object or hazard is placed 10 or more metres from the road edge, compared to less than one (1) metre. The crash severity is 20% lower when the distance is between 1 and 5 metres, and 65% lower when the distance is 5 to 10 metres.

Road surface may present hazard to motorcyclists (for instance, slippery surfaces, repaired patches, longitudinal parallel grooves and drain covers). Moreover, excessive bitumen can create instability due to denivelation. Hence, extensive repair work using a plain bitumen surface should be avoided and patch seals should be as small as possible.

In 2007, the Council of Barcelona took stock of the motorcycle black spots in the city, by analysing manoeuvres and behaviours associated with the most frequent crashes (Ferrer & Rubino, 2017)[24]. The main findings were that:

- intersections are high-risk spots for motorcycles;
- one of the most common and dangerous practices of motorcyclists is to move between vehicles to be in the front of the queue at traffic lights, often occupying pedestrian crossings; and
- the most severe conflicts occurred near intersections, when motorcycles attempted to drive straight, and 4-wheeled vehicles attempted to turn.

The main solution adopted to solve these issues was the introduction of the advanced stop line at intersections.

Advanced stop line/box are road markings at signalised intersections allowing motorcycles a head start when the traffic signal changes from red to green (Figure 6 – Ferrer & Rubino, 2017). This measure consists in separating the movements of motorcycles from other vehicles by establishing an exclusive area for motorcycles located between 4-wheeled vehicles and pedestrian crossings. The advanced stop line reduces interactions and conflicts between motorcycles and pedestrians, and between motorcycles and 4-wheeled vehicles.

Figure 6 – Example of advanced stop line

[23] Rating Australia's National Network for Risk. Online available on 31st of May 2021. http://ausrap.aaa.asn.au/

[24] https://issuu.com/buenaspracticasmotos/docs/d_1_avaluacio_zam_2015_v2

Motorcycle shelter stations, connected to motorcycle dedicated lanes, are areas that provide protection for motorcyclists against heavy rain (Ferrer & Rubino, 2017). Many motorcycle shelters are located below overhead bridges, but sometimes special booths are placed in the actual motorcycle lanes. This facility is used along the highways and rural roads in Malaysia to prevent the large number of severe crashes that occur when motorcyclists seek shelter under bridges or in tunnels, to put on rain clothes or to wait for conditions to improve. Poor visibility and poor grip often contribute to these crashes. In Malaysia, it was found that motorcyclists welcomed the initiative and used the facilities correctly.

In cities with a large number of motorcycles, parking becomes a primary issue. Motorcycles invade public space, especially pedestrian facilities such as sidewalks, which increase the risk exposure for this category of road users. For this reason, the provision and regulation of the **motorcycle parking** must be an essential activity.

In case of roadworks that pose a risk to motorcyclists and cyclists, such as milling and repaving, the use of well illuminated **signs specifically directed at them,** as well as the illumination of the hazardous area can be an effective measure (Figure 7 - Ferrer & Rubino, 2017).

Figure 7 – Example of motorcycle signs

Road markings can considerably improve the riding dynamics of motorcycles, depending on the quality of the markings and the weather conditions (Ferrer & Rubino, 2017). Poorly designed or located markings can cause "crabbing" whereby the motorcycle longitudinal axis is at an angle to the direction of travel. The loss of tyre grip because of surface water is a major problem for motorcycle riders.

Surface water may be retained by profiled markings, initiating loss of adhesion. In conjunction with air resistance, this may cause the front wheel to rise, resulting in a loss of friction between the front tyre and the road.

Possible solutions could be:

- create zones without marking (line marking can be interrupted in specific zones) to decrease the risk of skidding in wet conditions;
- keep profiled markings at a maximum of seven millimetres above the road surface; and
- position metal road studs with unequal gaps to prevent motorcycles from weaving.

Crash barriers pose serious threats to two-wheeled riders. A study of motorcycle crashes with safety barriers in Australia and New Zealand (Grzebieta et al., 2010) found that more fatalities resulted from collisions with steel barrier posts than with a concrete or wire rope safety barrier. Most barriers installed on curved roads, where most of the motorcycle crashes occur, are of a traditional W-beam design. Typically, manufacturers' specifications restrict the installation of wire rope safety barriers on small radius curves (less than 200 m).

Possible and effective ways of reducing motorcycle casualties at crash barriers are:

- demolishing unnecessary crash barriers;
- using sigma posts instead of the standard IPE-100 posts; and
- covering posts with impact-absorbing protectors.

Winkelbauer et al. (2012) also provides helpful guidance on possible good practices for safer roads for motorcycles, namely:

- inclusion of motorcycles in road infrastructure policies;
- enhancement and maintenance of road surface conditions (comprising avoidance of poor-quality road building causing rapid deterioration);
- regular road safety audits to evaluate safety levels of both existing and new road infrastructure projects;
- quality standards for unsealed roads;
- standards for marking or signing road hazards, at illumination of dangerous hazards at night;
- safe and motorcycle-friendly roadside barriers;
- advanced stop lines at traffic lights for riders; and
- remedial action on black spots, with special attention to intersection design and traffic signs dedicated to warning riders at places of recurring crashes.

The research report, "Improving Safety for Motorcycle, Scooter and Moped Riders" (OECD/ITF, 2015) provides recommendations on the improvement of safety conditions for motorcycling. Below are the highlights of the report's recommendations:

- Implementing a Safe System approach that meets the safety needs of PTWs.

  The main technical challenge of including motorcycle users in the Safe System is providing protection from physical harm at the speeds at which collisions with other vehicles or fixed objects are likely. While this could be solved by ensuring lower travel speeds of motorcycles, it could also lead to a different challenge: ensuring that measures taken to improve motorcycle safety are supported both by the broader community and by riders.

  This leads to the question as to whether the conventional Safe System approach should be modified by recognising that, in the short to medium term, riding will remain an inherently risky activity and that measures should be taken to reduce risk. This may result in strategies that focus more on avoiding crashes rather than mitigating their effects.

  While a Safe System approach is adaptable to all countries, whatever their level of development and safety performance, it must acknowledge that the huge difference in the use of motorcycles in different parts of the world. A tailored approach is therefore required to tailor the solutions to local realities.
- Reducing crash risk for motorcycles by introducing self-explaining and forgiving roads.
  Concerning this last aspect, OECD/ITF (2015) states that:

  "infrastructure should be improved with the development of self-explaining roads which guide drivers and riders to adopt appropriate speed behaviour along with traffic calming measures and motorcycle friendly infrastructure ("forgiving" roads). Engineers, road designers and providers, local authorities, road safety auditors and inspectors should be trained to consider motorcycles in the design, construction, maintenance, and operation of roads, and be provided with the necessary risk assessment tools to make the right decisions".

Policies

Several documents support the assumption that motorcycles deserve appropriate recognition in transport and road use policy and planning. Ignoring motorcycles in transport policy has added negative consequence of increasing the existing vulnerabilities of motorcycle users on the road (RoSPA, 2006; IMMA, 2015).

There are numerous existing policies targeting the improvement of motorcycle safety. The most important traffic policy is the universal helmet law (requiring riders of all ages to use a helmet) and the mandatory rider education programme (for all or some riders). The two policies are intended to increase motorcycle safety by directly impacting the behaviour of motorcycle operators. Universal helmet laws have significantly lowered fatalities injury severity and medical cost around the world (French et al., 2009).

Table 5 summarises some of the motorcycle policies and strategies undertaken in the world.

Table 5 – Synthesis of motorcycle policies and strategies

Table 5 – Synthesis of motorcycles policies and strategies

POLICY	AIM
Motorcycle Safety Strategy Sweden	Halve the number of rider fatalities and reduce the number of rider injuries by 40% between 2010 and 2020.
Call to Action towards Unity, Safety and Equality Philippines	Follow "Helmet On, Headlight On" (H20) Programme - increasing awareness on the advantages of switching headlight on and proper wearing of standard helmets.
National Road Safety Agenda (2011-2021) Thailand	Halve the number of road fatalities in Thailand by 2021. The agenda includes eight main areas: 1. Helmet use 2. Riding/driving under the influence of alcohol 3. Reduction of "risky" road areas 4. Speed limit violation 5. Vehicle standards 6. Training of drivers and riders 7. Emergency assistance 8. Road infrastructure management system
Increased number of trained riders Malaysia	Providing more affordable training options and reduced licence fees to riders in difficult economic situation in the aim of encouraging riders to undergo training and obtain riding licences.
Encouraging riders to attend voluntary training courses Canada	The incentives offered by many insurance companies have contributed to attracting a huge number of learner riders. Approximately 85% of new riders take a riding training course to get their licence in Canada.
Motorcycle Safety Strategy, 2012-2021 New South Wales (Australia)	The safety strategy focuses on initiatives such as: • developing targeted communication campaigns to address motorcycle crash risks; • furthering our research and understanding of motorcycle crash risks; • improving road environment safety features for motorcyclists; and • investigating safety equipment and gear.
Road Safety and Transport Strategic Action Plan for PTWs, 2009–2013 Victoria (Australia)	The plan targets four areas for action, namely: • increasing knowledge and understanding of motorcycle riding and crashes; • ensuring appropriate recognition of motorcycles in transport policy and planning in Victoria; • improving rider awareness, skills and knowledge. • encouraging greater use of safer motorcycles and scooters, equipment, and protective clothing by riders.
Metropolitan Road Safety Plan for Motorcycles Buenos Aires (Argentina)	The plan identifies various safety actions, namely: • communication campaigns aimed at motorcyclists and citizens to raise awareness on the risks that bikers take; • establishment of a motorcycle sector worktable by each competent authority at which the actors involved in the problem will be periodically convened; and • establishment of local road safety observatories.
National plan for motorcycles road safety, 2015-2020 Costa Rica	The plan provides strategic guidance on: • training; • enforcement; • egulations; • vehicles; • road infrastructure; • motorcycles used for work purpose; • post-crash care; • road traffic crash data; and • awareness campaigns.
District motorcycle road safety plan, 2017-2027 Bogotá (Colombia)	The plan's strategy comprises the set of actions required in Bogotá to achieve the objectives of reducing road crashes. These are: • the institutionalisation and management of road safety; • safe infrastructure; • comprehensive initiatives for road actors, communication, and road culture; • road safety, technology, and vehicle inspections; and • timely attention, and follow-up of victims.

Source: Elliott M.A. et al. (2003)

Laws/regulations and enforcement

The assessment of the implications for motorcyclist safety of recent repeals of universal helmet laws in six US states in 2007 demonstrated the importance of regulations and enforcement on helmet use (Houston & Richardson, 2007). On average, when compared to states without mandatory helmet laws, universal helmet laws were associated with an 11.1% reduction in motorcyclist fatality rates. In states in which repeals of universal coverage have been recently instituted, the motorcyclist fatality rate increased by an average of 12.2% over the rate expected had universal coverage been maintained. States that repealed universal coverage compromised motorcyclists' safety

In the United States, law enforcement programmes are used to reinforce the messages from public information and education campaigns through sanctions and penalties imposed on motorists and motorcycle riders who violate State traffic laws.

The American law enforcement programmes incorporate:

- spotting impaired motorcycle riders and enforcing relevant laws;
- promoting motorcycle training and education;
- enforcing laws related to illegal motorcycle riders; and
- spotting noncompliant helmet use and enforcing compliance.

In the United States, penalties violations of motorcycle licencing and/or learners permit requirements include fines and/or court fees, suspension of licences, 15 to 180 days), demerit points and mandatory attendance of a rider training course, and imprisonment (15 to 180 days.

Another dimension of enforcement is training of Police officers provision of equipment for the detection of infringement of traffic laws (speed camera for speeding, breathalysers for alcohol, etc.), organisation of enforcement strategies, and incentives to Police officers (to reduce corrupt practices).

Anti-tampering mechanisms may be used to verify safety standards of motorcycles. This measure involves the institution and effective enforcement use of a combination of anti-tampering regulations to minimise after-sale PTW tampering. The issue of after-sale tampering with motorcycles is regarded as a serious problem in some EU states.

The addition of performance-enhancing items or tampering with equipment designed to restrict power output can compromise the safe operation of motorcycles. PTW engine driveline tampering (to increase performance above legal limits) is a major concern in several European countries. Anti-tampering measures for motorcycles are outlined in Chapter 7 of the European Parliament Directive 97/24/EC.

ANTI-TAMPERING CAMPAIGN
MADRID (SPAIN)

In Madrid, a campaign has been developed as a countermeasure to this practice of illegal moped and motorcycle tuning.

Mobile speed cameras and dynamometers have been supplied to law enforcement units to allow them to carry out campaigns that monitor compliance with technical requirements for two-wheeled motor vehicles.

The aim of this initiative was to combat motorcycle and moped tuning to increase power and speed.

Source: http://www.madrid.es/

A demerit points system is a penalty system that adds penalty points to the driving record of a PTW riders and other motorists for each traffic offence they commit. In some countries (Spain, for example), the demerit points system has reduced the number of crashes, especially among moped riders on urban roads (Novoa et al., 2010). It is worth mentioning that this research indicates that the positive effect has a maximum duration of about 1.5 years. A meta-analysis of twenty-four effect measurements of general demerit points systems in European and non-European countries shows a decline in the number of crashes, road deaths and serious road injuries of between 15 and 20%. However, after less than 1.5 years on average, the effect had disappeared again. The explanation probably is that the required level of enforcement cannot be permanently realised (Castillo-Manzano et al., 2012).

Improper maintenance of motorcycles can be a primary contributing factor in crashes. Paine's (1994) study, "Literature and Research Review", estimated that vehicle defects caused or contributed to at least 12% of crashes in Australia. The European Motorcycle Accident In-Depth Study (MAIDS)[25] pointed out that while only 0.3% of crashes are directly caused by a technical failure, technical failure contributed to more than 5% of crashes. Through technical inspections, national and regional authorities can check vehicles' mechanical condition and conformity to safety and emission regulations. Although some countries have laws mandating technical vehicle inspections, compliance is often insufficient.

Uruguay is one of the countries where technical motorcycle inspection is mandatory, but its implementation has been limited by the lack of regulation (Ferrer & Rubino, 2017). In 2014, the country's National Unit for Road Safety (UNaSEV) carried out voluntary technical inspections on motorcycles, with material incentives for participants. The scheme drew over a thousand motorcyclists and offered UNaSEV data on the condition of the vehicle fleet. A third of motorcycles passed the inspection without defects.

A staggering 39% of the motorcycles had serious technical defects. Another important finding had to do with the age of the motorcycles: most of the motorcycles developed technical problems after two years of operation. The data helped UNaSEV to strengthen and enforce the regulation of technical vehicle inspections.

Motorcycle safety interventions

"Powered Two Wheelers - Safety Measures" (Winkelbauer et al., 2012), the Project 2BESAFE report, revealed the availability of numerous interventions to improve motorcycle safety and decrease the risk of crash and injury (Table 6). The interventions are categorised by topic:

- road infrastructure (including pavement and intersections);
- vehicle safety equipment (comprising passive and active safety);
- visibility;
- protective equipment;
- licencing, and basic and post-licence training;
- traffic law and enforcement;
- awareness campaigns; and
- data collection.

The impact of each intervention, based on several parameters (size of the problem, safety impact, acceptance, sustainability, etc.), was rated from 1 (low impact) to 5 (high impact). Table 6 provides the descriptions and ratings of the motorcycle safety interventions listed in the report.

[25] MIDS: In-Depth Investigation of Motorcycle Accidents. Online on 26th of May 2021. http://www.maids-study.eu/index.php?error=hastolog

Table 6 – Motorcycle safety interventions

ROAD SAFETY INTERVENTION	TYPE OF INTERVENTION	SHORT DESCRIPTION	IMPACTS		
			SAFETY IMPACT	TOTAL IMPACT	EXAMPLE
Road Safety Audit	Road Infrastructure	Discover possibilities of optimising road design in the planning phase to improve road safety.	5	5	Some EU projects like Ripcord-Iserest or Pilot4Safety [26] demonstrate positive effects.[27]
Road Safety Inspection		Efficient assessment of the standard of an existing road network, taking into consideration hazards, environmental risk factors and roadside features.	5	5	Poor quality (alignment and road surface) is the cause of around 15% of PTW crashes. Some EU projects like Ripcord-Iserest or Pilot4Safety demonstrate positive effects.
Black Spot Management		Reduction and prevention of crashes with low-cost engineering enhancements by treating crash clusters at special sites.	5	5	In Australia, based on the first 50 treated blackspot sites of Victoria's motorcycle blackspot program, 37% rider casualty crashes were reduced (Dale, 2006).
Speed limit signposting at dangerous spots at curves		Reduction of PTW crashes on curves and corners, by introducing signposts. Cheap and easy procedure for implementation.	4	4	In Germany, FGSV's motorcycle guideline, "Merkblatt zur Verbesserung der Verkehrssicherheit auf Motorradstrecken", shows that motorcycle crashes at curves can be reduced with the implementation of this measure. [28]
Installation of rumble strips		Efficient on straight stretches followed by sharp curves. This measure helps increasing riders' awareness at curves and reducing PTW crashes at curves due to speed.	3	3	The TRL study showed a reduction of the 85th percentile speed (about 6%) with the implementation of rumble strips, as well as the reduction of motorcycle crashes by 28% and the decrease of crash injuries by 35% (Webster et al., 1993).
Enhanced lane separation by floor markings		This measure increases the distance between drivers and riders in corners, decreasing the chances of head-on collision.	4	3	-
Elimination of visual barriers at curves to improve visibility		Visual barriers reduce visibility and increase motorcycle crashes at curves.	5	4	FGSV's motorcycle guideline, "Merkblatt zur Verbesserung der Verkehrssicherheit auf Motorradstrecken", shows that motorcycle crashes at curves can be reduced with the implementation of this measure.
Elimination of dangerous obstacles in bends		Fixed obstacles too close to the road causes major crashes, especially for motorcycle riders.	5	5	Suggested by FGSV's motorcycle guideline, "Merkblatt zur Verbesserung der Verkehrssicherheit auf Motorradstrecken".
Under-ride barriers for guardrails		Guardrails absorb crash impact but do not protect motorcyclists from falling. Moreover, motorcyclists sliding under the guardrail is one of the causes of fatal crashes.	5	4	-
Guideposts made of flexible material		This measure enhances passive safety. It reduces severe crashes of motorcycles with fixed obstacles. Cost-effective method	4	4	Recommended by ADAC and DVR in "Motorrad fahren – auf sicherer Straße!". The MAIDS study, the EU project RISER and the ERA-NET project provide evidence of this measure's success.
Speed limits at hazardous sections of the road		This measure reduces PTW riders' risk of losing control. Installed at curves.	4	3	Suggested by FGSV's motorcycle guideline, together with radar/laser monitoring.
Separate PTW lanes		This measure avoids conflicts between motorcycles and other (larger) vehicles.	3	2	Motorcycle crash reduction in Malaysia by 39%, upon the implementation of this measure.[29]
Advanced stop lines for PTWs		This measure prevents queue with other vehicles near intersections and enhances PTW mobility.	1	3	This measure is described in "ACEM Guidelines for PTW-safer Road Design in Europe".[30]
Skid resistance concerning magnitude and consistency		This measure reduces motorcycle skidding in slippery and wet roads.	5	4	Recommended by the Institute of Highway Engineers in "IHIE Guidelines for Motorcycling".[31]
Road surface testing		Increase of PTW safety by testing road characteristics, to improve the interaction between road surface and PTW tyres	4	4	Studies attribute 3-10% of road crashes to poor quality of road surface.[32]
Improvement of the transversal slope (crossfall) at curves		Tyre and road surface contact pressure is decreased with negative crossfall. Transversal slope in curves reduces PTW crashes.	4	3	FGSV's motorcycle guideline shows that motorcycle crashes at curves can be reduced with the implementation of this measure.
Improvement of pavement friction on new asphalt surfaces		This intervention reduces PTW crashes caused by low skid resistance. Useful especially for single PTW crashes.	4	3	Suggested by PANK RY, Finland, in Finnish Asphalt Specification 2008.[33]
Reduction of debris on roadway and roadside		Debris can deflect PTW wheels, leading to loss of control.	4	4	According to the MAIDS (2009) temporary obstruction of the roadway (including gravel, sand, and diesel and oil spills) is a contributing or precipitating factor in 3.8% of the crash cases surveyed.[34]

[26] RIPCORD-ISEREST: Road Infrastructure Safety Protection. Online on 26th May 2021. https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects/ripcord-iserest.pdf

[27] https://ec.europa.eu/transport/road_safety/sites/roadsafety/files/pdf/projects/pilot4safety.pdf

[28] Pilot4Safety: Pilot project for common EU Curriculum for Road Safety experts: training and application on Secondary Road. Online on 26th May 2021. https://www.passco.de/fileadmin/contents/news/2007/10/10_motorradfahrerschutz.pdf

[29] Road Safety Toolkit: Online on 26th May 2021. http://toolkit.irap.org/default.asp?page=casestudy&id=4

[30] ACEM: The Motorcycle Industry in Europe. Guidelines for PTW-safer road design in Europe. A handbook that describes the specific needs of riders. Online on 26th May 2021. https://acem.eu/policy-areas/safety/guidelines-for-ptw-safer-road-design-in-europe

[31] Institute of Highway Engineers: Guidelines for Motorcycling. Online on 26th May 2021. http://www.motorcycleguidelines.org.uk/

[32] EU 7th Framework Program: Powered Two Wheelers - Safety Measures: Guidelines, Recommendations and Research Priorities. Online on 26th May 2021. http://www.2besafe.eu/sites/default/files/deliverables/2BES_D28_GuidelinesPolicyRecommendationsAndFurtherResearchPriorities.pdf

[33] Experience of Finnish system (PANK) for quality verification by using GPR. Online available on 26th of May 2021. http://www.metodgruppen.nu/getfile.ashx?cid=1062963&cc=3&refid=7

[34] MIDS: In-Depth Investigation of Motorcycle Accidents: Online on 26th of May 2021. http://www.maids-study.eu/

ROAD SAFETY INTERVENTION	TYPE OF INTERVENTION	SHORT DESCRIPTION	IMPACTS		
			SAFETY IMPACT	TOTAL IMPACT	EXAMPLE
Braking requirements	Vehicle	Crash avoidance with minimum braking standards.	5	4	Research projects a 30% drop in casualties (Elvik et al., 2009).
ABS and other advanced braking systems		Assistance is required for PTW riders to distribute brake forces correctly.	5	5	European Commission's policy claims that ABS increase PTW safety. The German Insurance Association GDV estimates that ABS reduce PTW crashes by 55%.
Automatic Stability Control (ASC)		Same as ABS, but for longitudinal acceleration.	5	4	Dynamic stability control reduces crashes by an estimated 10%, according a 2010 Swedish Transport Administration research.
Protective cages		The protective cage's high-rising frame provide protection to riders and passengers during crashes, especially head-on collisions.	2	1	BMW C1 is an example of a scooter with protective cage.[35]
Assessment methods for secondary safety systems		All passive safety components can be increased.	4	4	ISO Standard 13232 "Motorcycles – Test and analysis procedures for research evaluation of rider crash protective devices fitted to motorcycles".
Motorcycle airbags		Motorcycle airbags absorb crash impact. A major problem is the high cost of motorcycles with airbags.	3	3	Results of the motorcycle design with airbags by DEKRA Automobil GmbH from Stuttgart, Germany, shows reduction in the severity of injuries.
Rear-view mirrors		This intervention guarantees a clear rear vision, thereby reducing the number of crashes.	3	4	This measure is stipulated in the European Parliament Directive 97/24/EC.[36]
Tyres and wheels specifications		Wrong PTW tyre pressure can result in motorcycle crashes.	2	3	The European Parliament Directive 97/24/EC defines tyre specifications
Measuring methods tyre rolling conditions for new tyres under loaded conditions		It is a trustworthy method of measuring the circumference of an efficient tyre, facilitating the accurate function of safety systems.	3	4	This measure is described in "BS AU 50-1.6.8 – DIN" guideline from the German Federal Highway Research Institute.
Mandatory use of headlights	Visibility	This intervention guarantees a clear visibility to other drivers. Use of headlights all time.	5	5	Use of headlights by motorcyclists in daytime reduces collisions 30 to 40% according to PROMISING project (Noordzij et al., 2001).
Lighting and light-signalling devices type approval		This measure reduces crashes caused by the absence of conspicuity.	2	3	This measure is stipulated in the European Parliament Directive 97/24/EC.
Automatic headlamps on (AHO)		This intervention guarantees a clear visibility to other drivers. Automatic headlights at all times (during daylight too) makes other drivers more conscious of PTW riders.	4	5	Adoption of the Automatic Headlamps On (AHO) requirement for all motorcycles, scooters and mopeds by the European Motorcycle Manufacturers Association (ACEM) in 2001.
Guidelines to improve rider conspicuity during daylight riding		This intervention guarantees a clear visibility to other drivers during day. The measure requires the use of reflective (coloured or fluorescent) high visibility clothing and helmet to reduce PTW crashes	4	4	-
Guidelines to improve rider conspicuity during night-time riding		This intervention guarantees a clear visibility to other drivers in the dark. The measure requires the use of reflective (coloured or fluorescent) high visibility clothing and helmet to reduce PTW crashes	5	5	-
Motorcycle helmets standards	Protective equipment	The main aim is to protect the rider's head during crash	3	4	The most known international standard for helmet safety is the Economic Community of Europe (ECE) 22.05 (Motorcycle Standard). Risk of casualties and severe injuries can be reduced by 70% and 40% respectively by wearing motorcycle helmet correctly.
Obligatory use of helmets by PTW riders and passengers		Riders and passengers should wear helmets (fastened securely) for their safety. Helmets absorb collision impact, protecting riders' and passengers' heads in a crash.	4	5	Regulation 270 of the Australian Road Rules mandates the use of an approved motorcycle helmet securely fitted and fastened on the rider's and passenger's head.
Standards for eye protection		Goggles can keep riders' eyes safe from flying objects and particles.	3	4	Required and tested by the European Standard EN 1939.
Impact protectors for motorcyclists		This measure minimises the level of PTW injury. Back and legs protectors are the two most important equipment.	3	3	Shoulder protector (EN 1621-1) and back protector (EN 1621-2) are the two European motorcyclists' standards.
Airbag jacket		This measure minimises rider's injury severity. Same function as motorcycle airbag.	3	2	-
Neck braces		Placed on a motorcyclist's shoulder to limit head movement during crash.	1	1	-

[35] WIKIPEDIA; BMW C1. Online on 26th of May 2021. https://it.wikipedia.org/wiki/BMW_C1
[36] EUR-Lex: Access to European Union Law. Online available on 26th of May 2021. https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A31997L0024

Legal regulations to obtain PTW riding licence	**Licencing, training**	This measure comprises regulations for different classes of licence. Moreover, criteria to obtain minimum skills for a safe operation of a motorcycle on roads.	5	4	The Austrian driving law FSG containing regulations for all classes of licence: description of the theoretical and practical exam, as well as the consequences of disobedience of traffic rules.
Initial rider training		This measure implies that new riders learn basic traffic strategies, interact with other road users, and learn how to control their motorcycle while accelerating, cornering, and braking.	5	4	Project co-funded by the EU [37]
Multiphase education		This measure includes numerous training sessions for learner riders: the aim is to continue their driving trainings harmoniously.	3	3	Multiphase driving system implemented in Austria in 2007 reduced crashes around 30%.[38]
Trainings for riders provided by the Police		Cooperation between police and private motorcyclists and improvement of motorcyclists' theoretical and technical skills.	4	3	Austria: on-road training.[39]
Workshops for young moped riders		The workshops' purpose is to reduce PTW crashes by using practical training to correct riders' behaviour in traffic.	5	5	KFV workshops for teenagers to avoid dangerous situations. The evaluation was positive.
Practical training for PTW learner riders		This measure aims to decrease road crashes by improving danger and risk recognition, and curtailing risky behaviours.	5	4	Safety training in Germany teaching motorcycle riders physical balance, braking, swerving appropriately, cornering and anticipation of dangerous situations.
Deceleration tester		With a measuring system, riders can learn how to brake their motorcycles in urgent situations.	5	4	KFV tests motorcycle riders on correct and effective braking.[40]
Framework for motorcycle law: road traffic law	**Traffic law and enforcement**	Rules on road infrastructure, vehicles, and road users (helmet use, licence, non-use of drugs/alcohol). A framework for motorcycle law protects PTW.	3	3	-
Targeted enforcement strategies		This enforcement measure includes factors contributing to PTW crashes. To achieve success, the enforcement must be implemented as part of the national enforcement strategy	2	2	European Commission's policy up to 2020 (EC, 2010).
Periodical technical inspections		Mandatory PTW inspection (roadworthiness, and PTW vehicle tampering).	2	1	Lack of proper motorcycle maintenance constitutes a factor of PTW crashes by 5% based on the MAIDS report.
Events promoting motorcycle safety		The campaign's aim is to gather riders for practical training on riding skills and guidance on «riding safely».	3	3	"German Safety Tour" workshops providing theoretical and practical trainings to riders.[41]
Educational brochures		The measure offers advice on how to handle risky circumstances.	2	2	Cartoon called "Lucky 13" launched by ACEM (2010).
Shocking films about motorcycle safety		This measure raises awareness through films by making viewers- targeted audience reflect about their behaviour (speeding/drinking and driving/driving without helmet).	1	1	The motorcycle safety campaign on the importance of protective clothes for PTW, launched by the Transport Accident Commission, in Australia in 2008.[42]
Community collaboration to raise motorcycle safety	**Awareness campaigns**	Campaigns and workshops interacting with motorcycle groups and clubs.	2	2	In Gloucestershire, Travel Plans are supported by the coordinator of Motorcycle Safety for the employees who travel to work by motorcycle.[43]
Integrated programmes on road safety education		This programme is to teach proper behaviour and trainings to children from early stages.	5	5	"Traffic – Competence – Motivation" programme implemented by The Norwegian Council for Road Safety.[44]
Programmes increasing awareness on safety helmet use		Raise awareness on the correct use of the helmet and its importance in the reduction of PTW crashes.	4	4	"Wear & Lock" campaign launched by ACEM to persuade PTW riders to wear helmet constantly, lock the chinstrap, use the appropriate size and helmets conform to ECE standard (ACEM, 2008).
Peer activities preventing drink-riding		These activities raise riders' awareness of problems associated with drink-riding(single vehicle crashes from loss of control/running off the road) and present tools to prevent riders from drink-riding.	5	4	"Riders Helping Riders" campaign organised by NHTSA (McKnight & Becker, 2006).
Other road users' responsibility to riders		Through awareness campaigns, car drivers be taught to understand and respect motorcyclists on the road.	5	5	«THINK!» campaign's purpose in England is to reduce motorcyclists' deaths by humanising them in the eyes of other vehicle drivers.[45]
Motorcycle issues in emergency and first aid trainings	**Post-Crash Care**	Training of medical personnel on the correct and safe way to remove PTW riders' (and passengers') helmets after a crash.	3	5	The US Transportation Department (DoT, 2001) calls attention to the persisting lack of first aid for motorcyclists.
Helmet removal devise		The device to remove helmets during PTW crashes facilitates the rescue and emergency treatment of motorcyclists, reducing the severity of injuries.	3	4	Adopted by "Shock Doctor" where first aiders use helmet removal devices.[46]
Data collection improvement	**Data Collection**	This measure targets better data collection for a clearer understanding of the growth of PTWs and its related characteristics.	5	5	One of the objectives of the Road Safety Action Plan of the Australian state of Victoria is to improve the quality of PTW data collection to guide the development of relevant and more effective countermeasures.[47]
In-depth analysis of motorcycle crashes		This measure's objective is to fully reconstruct PTW crashes, identifying all the factors to unravel the causes of collisions.	5	5	The most comprehensive PTW crash data in Europe is MAIDS (Motorcycle Accidents In-Depth Study).

[37] Initial Riding Training: Online available on 26th of May 2021. http://www.initialridertraining.eu/
[38] http://www.kfv.at/department-transport-mobility/safety-measures-in-austria/multi-phase-driving-licence/
[39] http://www.landespressedienst.steiermark.at/cms/beitrag/10550614/374565/
[40] http://www.kfv.at/kuratorium-fuer-verkehrssicherheit/landesstellen/steiermark/aktionen/erlebnisworkshop-sicherauf-zwei-raedern/
[41] http://www.german-safety-tour.de/2010/
[42] Transport Accident Commission (TAC: Road Safety. Online available on 26th of May 2021. http://www.tacsafety.com.au/jsp/content/NavigationController.do?areaID=13&tierID=2&navID=6F2BE05C7F00000100498EF248E878CB&navLink=null&pageID=1899
[43] MSF: Motorcycle Awareness month. Online available on 26th of May 2021. http://www.msf-usa.org/imsc/proceedings/a-Lambert-CycleSafeTamingTheRoadSafetyRally.pdf
[44] http://ec.europa.eu/transport/rose25/index_en.htm
[45] http://www.dft.gov.uk/topics/road-safety/think/
[46] http://www.ejectsafety.com/home.html
[47] https://www.vicroads.vic.gov.au/Home/Moreinfoandservices/MotorcyclesVictoriasRoadSafetyAndTransportStrategicActionPlanForPoweredTwoWheelers.htm

2.2 Transferability Audit

2.2.1 Transferability Audit methodology

A Transferability Audit has been applied to the main international practices found from the review of literature, with the aim of understanding the level of challenge of the implementation of the measures in African countries, and the key factors that influence these challenges.

Within the context of this research study, transferability refers to the prospects of the successful implementation in the African context, a road safety intervention developed and deployed in other contexts.

The underlying concept of transferability is that an intervention that has been successfully used in one context may be less successful when used in another context because of differences in social, economic, and institutional character.

The methodology adopted to assess the transferability of motorcycle safety interventions in Africa is derived from the European Commission project, SaferAfrica, and especially from the Deliverable 7.2 of the project[48].

The following six factors were used in the assessment of the road safety interventions:

- **Society:** People Environment.
- **Institution:** Availability of regulation Political commitment.
- **Economy:** Design, implementation, and maintenance costs affordability/Technical skill availability.

Scores for each factor are provided according to the respondent's expertise on the context where the measures should be designed and implemented. Scores range from 1 (highly challenging/not important) to 5 (not challenging/highly important).

A questionnaire was prepared (see Annex 2) and sent to road safety stakeholders in almost all African countries. The motorcycle safety interventions have been divided according to the following categories:

- Road infrastructure.
- Vehicles.
- Visibility.
- Protective equipment.
- Licencing, training.
- Traffic law and enforcement.
- Awareness campaigns.
- Post-crash care.
- Data collection.

Details of the methodology are provided in Annex2.

2.2.2 Transferability Audit results

Few African stakeholders have filled in the Transferability Audit matrix. Results are available for Botswana, Mali, Tunisia, Kenya, and Ethiopia. Burkina Faso, Cameroon, Uganda have not been considered for this analysis since more focused analysis and stakeholders' consultations have been performed.

An analysis of the results by components and factors (scores per columns - Table 7), produced similar results for Botswana, Mali, Kenya and Ethiopia, while generally Tunisian factors are consistently less challenging.

In Ethiopia, the institutional components are considered high-medium challenging. The country scored high in regulation (4.00) and political commitment (3.87). The other components (society and economy) are considered medium challenging.

In Tunisia, all the scores are below 2.00, which means that all the components and factors are not considered very challenging.

In Mali, the scores are almost all around 3.00 (medium challenging) except for the environmental factors, which are considered low-medium challenging.

In Kenya, the scores are close to or slightly above 3.00. All components and factors are considered medium challenging.

In Botswana, most of the components and factors are considered medium challenging. The cost affordability is close to 4.00 and can thus be considered not challenging.

Details of transferability audit results are provided in Annex 2.

Table 7 – Transferability Audit results by component and factor

	SOCIETY		ECONOMY		INSTITUTION	
	People	Environment	Regulation	Political commitment	Costs affordability	Technical skills
Ethiopia	3.25	2.99	4.00	3.87	3.20	2.69
Tunisia	1.81	1.30	1.74	1.81	1.92	1.53
Mali	3.04	1.91	2.83	3.07	3.04	2.90
Kenya	3.06	3.28	3.30	2.98	3.30	3.14
Botswana	3.17	3.20	3.13	3.10	3.80	3.31

[48]http://www.saferafrica.eu/media/2013/saferafrica_-_d72_-_final-1.pdf

3. Motorcycle safety conditions in Africa

3. Motorcycle safety conditions in Africa

The assessment of motorcycle safety conditions in Africa was based on data from multiple sources. The Assessment begins with a general overview of road safety conditions in all African countries.

The data identified for all African countries provided a generic picture of motorcycle safety situation on the continent. However, the following key questions remain unanswered:

- What are the trends of motorcycle registration in African countries?
- How is motorcycle use distributed within a country (for example, in urban and rural area)?
- What is the reliability of motorcycle registries?
- How much are motorcycles used (distance travelled, etc.)?
- What are the purposes of motorcycle trips (for example, taxi services)?
- What are the main factors contributing to motorcycle crashes?
- How safe are motorcycles and helmets compared to international standards?

Road safety data for all African countries were gathered using various sources of information, with special focus on road traffic crashes involving motorcycles. Sources of information refer to international organisations (WHO, etc.), national institutions (such as statistical offices, traffic police repositories, ministries), and literature review (mainly of good practices).

The Global Health Observatory data repository (WHO, 2018) appeared to be the most complete source of information, even if not much detailed. Data from national institutions were not available for all African countries. Moreover, the level of detail varied greatly from country to country.

It is worth mentioning that the reliability of some of the data was undermined, notably by differences in road safety definitions, underreporting issues, lack of information.

Notwithstanding, these analyses provide a preliminary overview of motorcycle safety conditions in Africa.

WHO data

A first set of data was retrieved from the WHO's Global Health Observatory data repository. These data are not complete for all the African countries. However, they provide an overview of Africa's road safety challenges and a means of comparison and classification of the countries and regions.

The data assessed related to the:

- number of registered vehicles;
- number of road traffic deaths reported;
- estimated number of road traffic deaths;
- estimated road traffic death rate (per 100,000 population);
- distribution of road traffic deaths by type of road user; and
- motorcycle helmet wearing rate.

Vehicle registration

Based on 2016 data from WHO, 42 out of the 54 African countries reported data on the number of vehicles registered. Twenty-nine (29) countries provided data segregated by type of vehicle (Figure 8). Twelve (12) countries provided no information on the number of registered vehicles.

In 2016, African countries registered about 10 million motorcycles, representing around 20% of the world's registered motorcycles (around 53 million).

The percentage of motorcycles compared to the total registered vehicles varies greatly among the countries. Referring to the 29 countries which provided data by type of vehicle, the percentage goes from almost 0% to nearly 85% (Figure 8).

Figure 8 – Registered PTWs per country
Grey colours: no data available

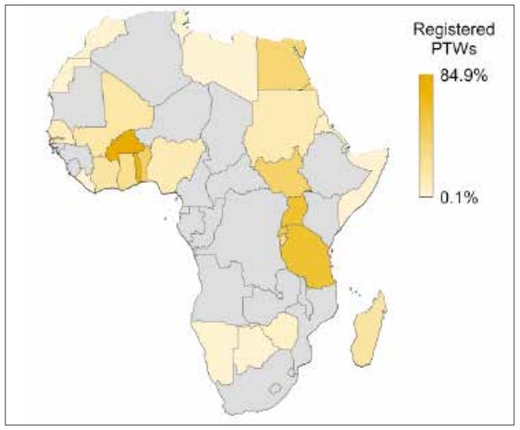
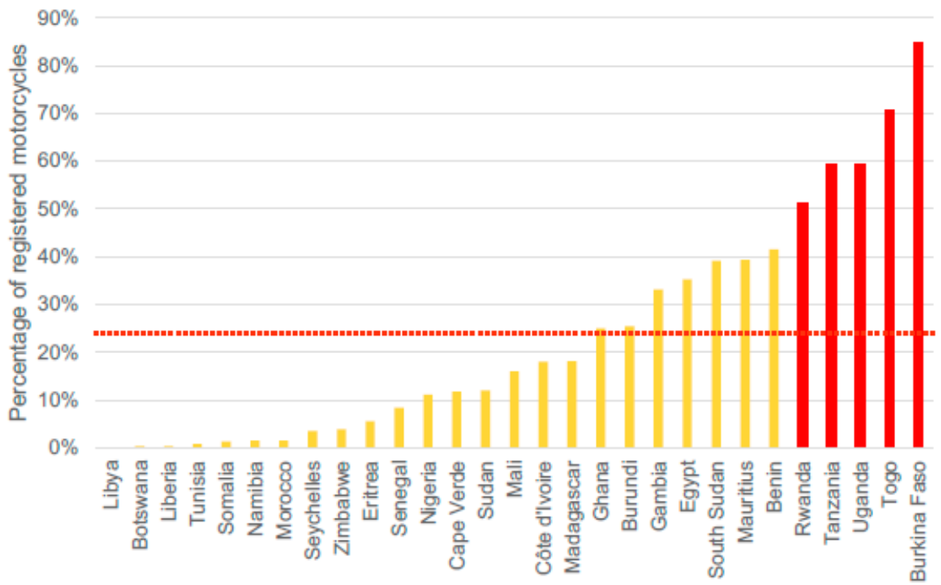


Figure 9 – Percentage of registered motorcycles in African countries



Source: WHO

The reliability of these data is difficult to ascertain since it greatly depends on the socio-economic conditions of each country and of their processes in place for vehicle registration.

Out of the 29 countries:

- 11 have less than 10% of registered motorcycles;
- seven have between 10% and 25%;
- six countries have between 25% and 50%; and
- five countries have higher than 50%.

The five countries with higher percentage of registered motorcycles (Rwanda, Tanzania, Uganda, Togo, and Burkina Faso) are all classified as low-income countries. All five have a Gross National Income (GNI) per capita lower than USD 1,000. They are among the 15 countries with lower GNI in Africa. It is also worth mentioning that only six countries (out of the 15 with lower GNI in Africa) have a share of registered motorcycles lower than 20%. These considerations are not intended as a proof of statistical correlation between the share of motorcycles and country income. However, the correlation between the use of motorcycles and poverty is established in the literature (Bishop et al., 2018).

Road traffic crashes

Based on the WHO's 2016 data, 49 out of the 54 African countries reported data on road traffic crashes (Figure 10). Twenty-four (24) countries provided data segregated by type of vehicle. However, only 21 provided percentages of road traffic deaths by motorcycle.

In 2016, African countries reported about 73,400 road traffic deaths. However, the WHO estimated a much higher figure: about 288,500 deaths, corresponding to 26.7 deaths per population of 100,000.

It is difficult to determine whether the WHO estimate is correct, compared to the reported values. However, there is no doubt that most of Africa's road traffic crashes are unreported.

When dealing with the estimated death rate (number of road traffic deaths per population of 100,000), the data show that only four countries have a rate lower than 20, while 34 countries have a rate ranging from 20 and 30, and 11 countries have a rate higher than 30 (Figure 11).

Figure 10 – Death rate per country
Grey colours: no data available

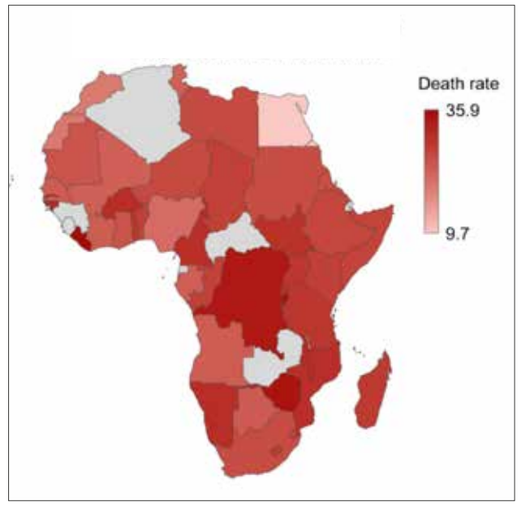
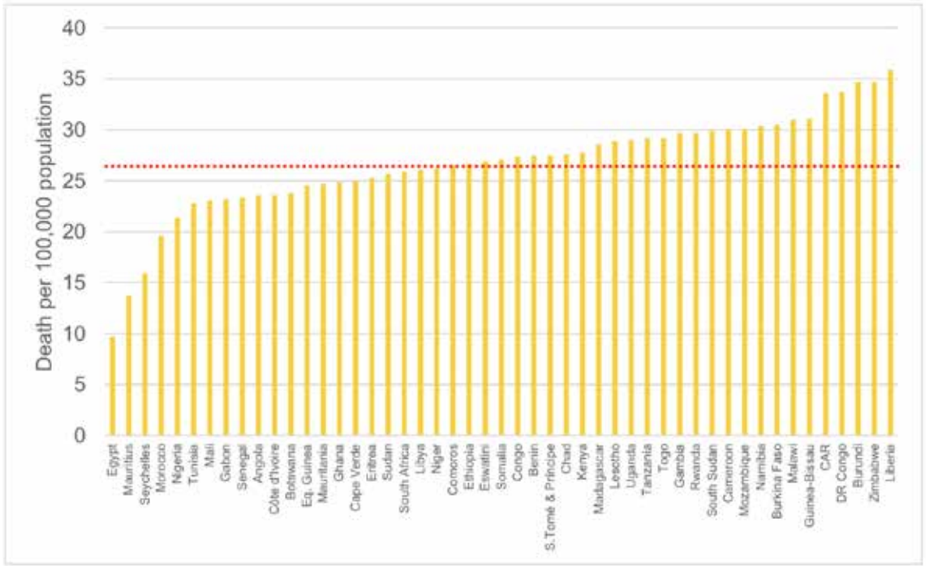


Figure 11 – Estimated rate of road traffic deaths per 100,000 population Source: WHO



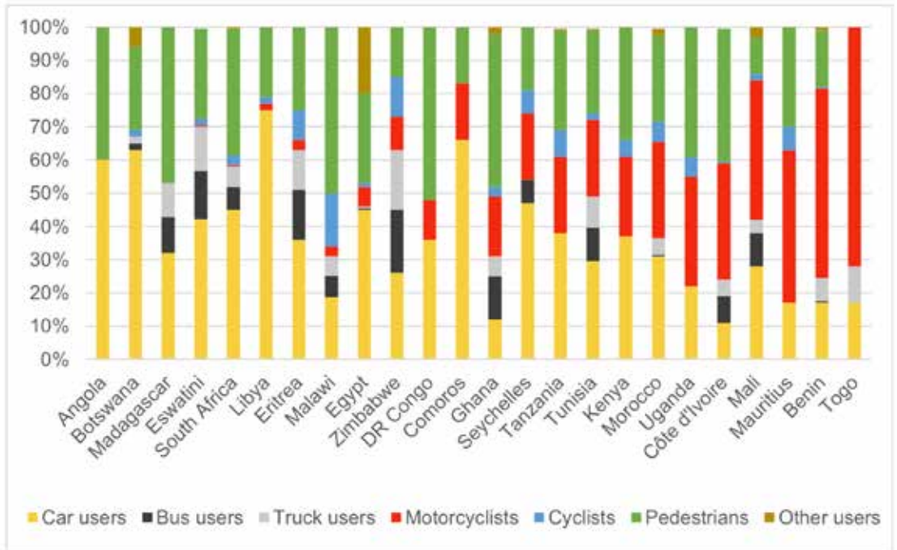
Source: WHO

The 24 countries that reported data on the percentage of deaths by type of road user show a fragmented situation (Figure 12). The data are ordered from the lower to the higher percentage of deaths on motorcycles.

On average, for these 24 countries, the percentage of deaths on motorcycles is about 23%. However, some countries recorded much higher percentages (Togo, for instance, with 72% of deaths on motorcycles). Six countries have percentage of deaths on motorcycles lower than 10%, nine recorded between 10% and 30% and six (Benin, Côte d'Ivoire, Mali, Mauritius, Uganda and Togo) recorded higher than 30%.

Togo is a unique case in that no pedestrian deaths in road crashes are reported by Police authorities. This is likely to be due to issues in data collection and classification (i.e., not considering crashes with pedestrians as road crashes).

Figure 12 – Reported percentage of deaths by type of road user



Source: WHO

Based on the WHO's 2016 data, 15 African countries provided information on road traffic deaths, percentage of deaths on motorcycles and number of registered motorcycles (Figure 13). For these countries, the Vehicle's Killing Potential (VKP) of motorcycles has been calculated (Figure 14). Four countries (Mali, Togo, Morocco, and Tunisia) have a very high VKP for motorcycles (higher than 30 deaths per 1,000 motorcycles).

It would be interesting to assess the ratio between motorcycles deaths and the number of kilometres travelled by motorcycles. However, these data are not available.

Figure 13 – Death per 1,000 PTWs
Grey colours: no data available

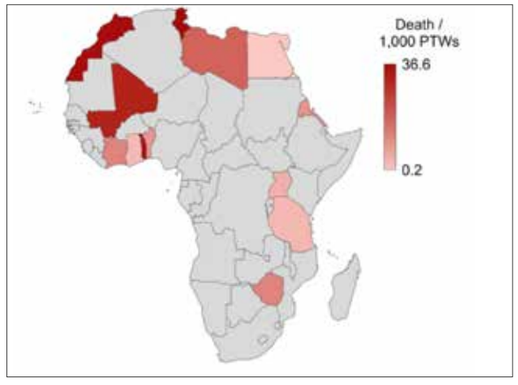
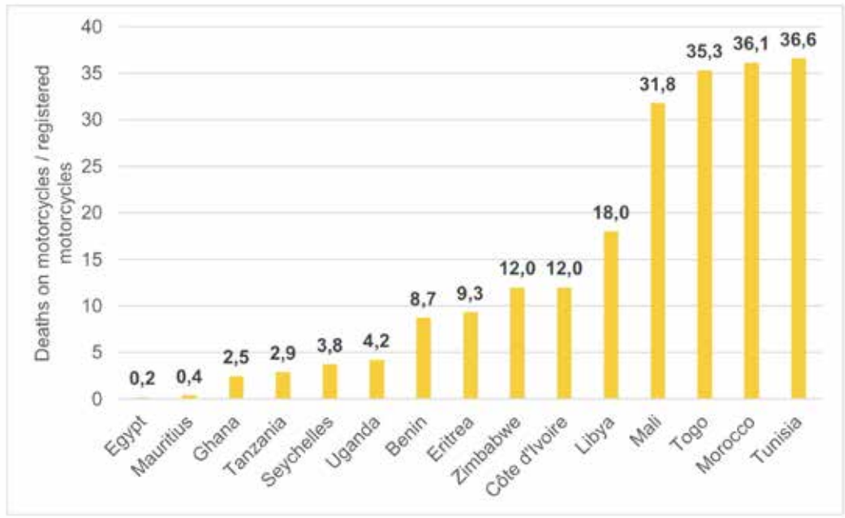


Figure 14 – Deaths on motorcycles per 1,000 registered motorcycles



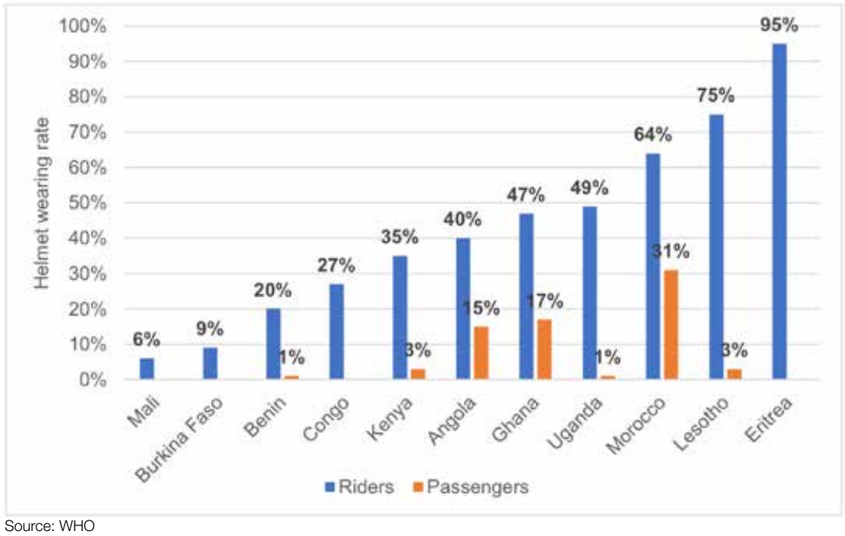
Source: WHO

Risk Indicators

Little information is available on the measurement of riding risks indicators in African countries. Some data about the percentage of helmet wearing by riders and passengers are available from the WHO. However, only 11 out of the 54 African countries reported a helmet wearing rate for riders; only seven reported the rate for passengers. The reliability of these data is also limited.

The reported helmet wearing rate ranges from 6% in Mali to 95% in Eritrea (Figure 12). It is important to note that, compared to riders, the helmet wearing rate of passengers is quite low. In the best case (Morocco), it reaches 31% (less than half the riders wearing rate in that country).

Figure 15 – Helmet wearing rate for riders and passengers



Source: WHO

National data

In addition to information collected from international sources (such as the WHO), data collection on all African countries was conducted to gather as much information as possible on motorcycle safety from national authorities (e.g., government Ministries, and statistical institutes). The research was hampered by the non-availability of data, information, and other essential details in national repositories. Also, road traffic crash data collection practices differ from country to country, so that the level of details was not homogeneous. Furthermore, the information published in official records are not always complete and reliable. The most complete information remains WHO data.

The data collection from Ministries, Statistics Institutes, etc. from single African country provided partial information. Out of 51 African countries (the exceptions are Burkina Faso, Cameroon and Uganda on which specific data collection have been performed), data were found on 24 countries (some without motorcycle crash data).

The data identified lack of uniformity, due to different practices applied for road traffic crash data collection and reporting. The reliability of the data is also unknown due to a likely high proportion of underreporting.

For the 24 countries on which data were collected, the number of crashes and casualties are reported in Table 8. Figure 13 shows the fatality rate based on the reported number of road traffic crash fatalities. Even if these data provide a general overview of road safety challenges, their reliability is hard to determine. For instance, Morocco (with a population of 35.6 million) recorded around 89,000 crashes, while Nigeria (population: around 181 million) recorded only 24,954 crashes. Various factors can explain this difference - different protocols for data collection, different definitions, different reference year for data, etc. For instance, looking at Table 8, it seems that in Nigeria, crashes involving slight injuries are not considered.

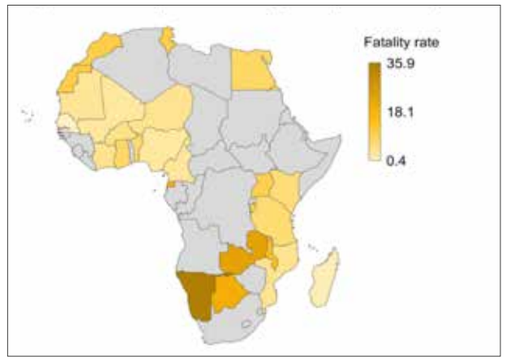
Little is known about the countries' data collection methodologies and definitions adopted for crashes, fatalities, injuries, etc. Comparisons between countries using these data could thus be misleading. Some comparisons are possible when it comes to fatalities, which are generally less influenced by underreporting. For this reason, the data have been analysed per single country without further comparisons. Only the 11 countries with available data on motorcycle crashes are reported.

Table 8 – Road traffic crashes for single African countries

Country	Year	Crashes	Killed	Seriously Injured	Slightly injured
Benin	2012	5,740	658	2,297	2,898
Botswana	2018	17,341	462	1,099	4,682
Burundi	2017	3,145	910	4,320	
Egypt	2013	15,578	6,700	22,397	
Equatorial Guinea	2017	3,731	252	821	807
Gambia	2015	729	87	89	37
Ghana	2016	8,651	2,084	10,438	
Côte d'Ivoire	2016	10,178	991	9,457	8,651
Kenya	2018	5,144	3,153	4,672	5,028
Madagascar	2017	10,000	255	2,963	
Malawi	2017	N/A	2,472	1,380	4,504
Mali	2016	5,532	541	2,252	4,772
Mauritania	2013	653	130	1,097	
Mauritius	2016	29,277	144	512	3,206
Morocco	2017	89,375	3,726	10,492	119,519
Mozambique	2018	1,553	1,164	1,192	1,511
Namibia	2013	3,484	789	5,845	
Niger	2017	5,912	869	3,375	6,095
Nigeria	2015	24,954	5,042	10,257	
Rwanda	2018	5,611	N/A	N/A	N/A
Senegal	2016	579	55	876	
Tanzania	2016	10,297	3,381	9,549	
Tunisia	2018	5,884	1,205	8,876	
Zambia	2017	30,163	4,006	N/A	N/A

N/A = information not available
Source: *Ministries, Statistics Institutes, etc. from individual countries listed*

Figure 16 – Reported fatality rate per country



Source: Ministries, Statistics Institutes, etc. from individual countries listed

Relevant analysis for individual countries is reported below. The complete analysis for individual countries is reported in Annex 3.

The data from Benin show that young riders (up to 30 years old) are more involved in road traffic crashes compared to other age groups. This trend is different from that of drivers.

Data from Ghana (Figure 15) show that motorcycles have more chances than cars to be involved in fatal crashes.

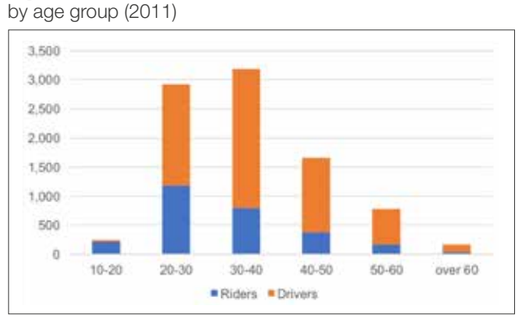
In Côte d'Ivoire, motorcyclists represent around 22% of road fatalities relate to motorcyclists, while car drivers and passengers represent nearly 28% (Figure 19). However, motorcycles are involved in 13.6% of crashes, while cars are involved in 65.4% of crashes. This is indicative of the higher vulnerability of motorcyclists.

In Mali, around 78% of road traffic crashes occur with motorcycles (Figure 20), even if the number of registered motorcycles in the country is less than 20% of the total registered vehicles.

Motorcycle riders constitute most of the casualties in road traffic crashesin Mauritius (Figure 18).

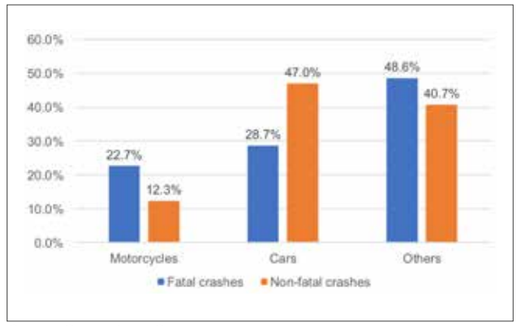
In Tunisia, riders are involved in 21% of all road traffic crashes (Figure 19).

Figure 17 – Drivers and riders involved in crashes in Benin by age group (2011)



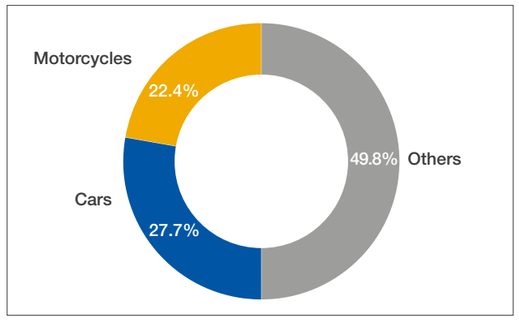
Source: Ministry of Public Works and Transports

Figure 18 – Percentage of crashes by severity and type of vehicle in Ghana (2016)



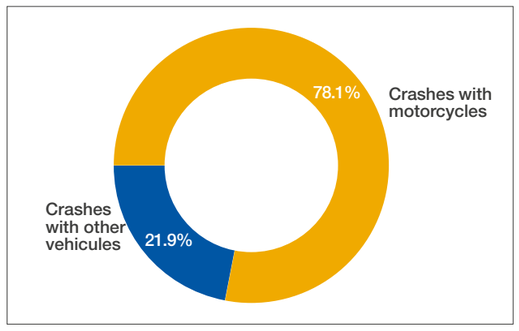
Source: Ghana Police Service

Figure 19 – Fatalities by type of vehicle in Cote d'Ivoire (2016)



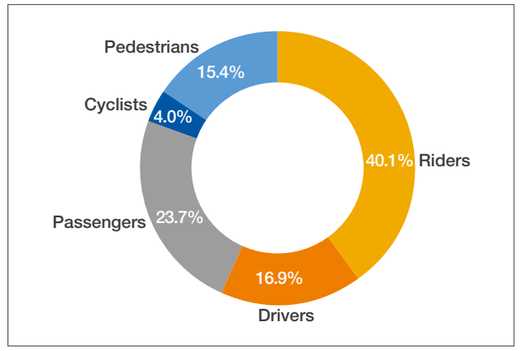
Source: National Road Safety Observatory

Figure 20 – Percentage of crashes by type of vehicle in Mali (2016)



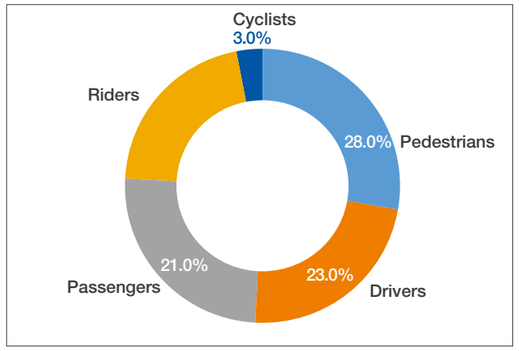
Source: National Institute of Statistics

Figure 21 – Casualties by road user in Mauritius (2016)



Source: Statistics Mauritius

Figure 22 – Percentage of crashes by road user in Tunisia (2014)



Source: Direction Générale de la Garde Nationale

Road safety in Africa from literature review

The "Thematic Factsheet on Vehicles", issued in 2019 in the framework of the SaferAfrica project, provides some information on the Vehicle's Killing Potential [49] (VKP) for Burkina Faso, Cameroon, and Uganda (Table 9). Among the three countries selected, Cameroon has the highest vehicle's killing potential (9.32), closely followed by Uganda (7.55). These high VKP figures are mainly attributable to a relatively low number of registered vehicles, compared to road fatalities estimates. As mentioned previously, the unreliability of vehicle registration data (especially motorcycle registration) could be a weakness.

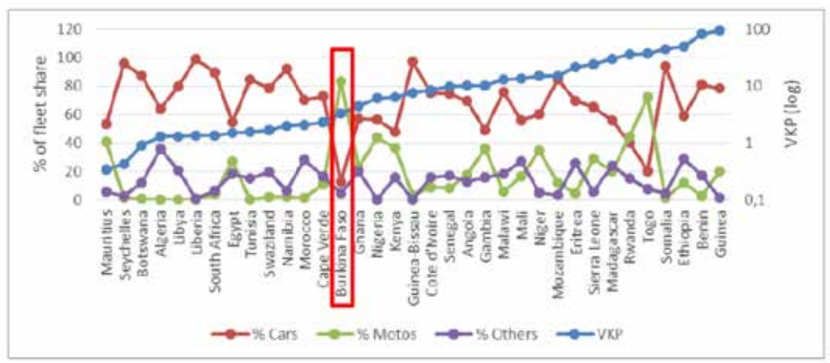
The analysis of the relationship between VKP and the vehicles' share of the fleet was conducted as part of the SaferAfrica project. For some countries (such as Burkina Faso), the VKP seems related to a high percentage of motorcycles (Figure 20). However, for most countries, this relationship is not always clear.

Table 9 – Vehicle's Killing Potential in the three selected countries (2016)

Country	Population	Road traffic deaths	Registered vehicles	Vehicle by population (1,000)	VKP
Burkina Faso	18,646,432	5,686	2,106,292	112.96	2.70
Cameroon	23,439,188	7,066	758,145	32.35	9.32
Uganda	41,487,964	12,036	1,594,962	38.44	7.55

Data sources: SaferAfrica project, WHO, Global Status Report on Road Safety 2018

Figure 23 – Relationship between VKP and vehicles' share of the fleet in some African countries



Source: WHO

[49] VKP is defined as the number of fatalities per 1,000 vehicles each year.

According to the "Good Practice Factsheet on Powered Two Wheelers", issued in 2018 in the framework of the SaferAfrica project, two- and three-wheeled vehicles represent 22.5% of all registered motorised vehicles in Africa. About 7% of all road traffic deaths in Africa are PTWs. The rate is considerably higher in some of the countries.

However, these data are quite different from the OECD figures, which suggest a relatively low reliability of data on registered vehicles. It is worth mentioning that such information is not available for all African countries. Compared to the high percentage of motorcycles, the share of road traffic deaths for this transport mode seems to be low. This could suggest a major underrepresentation in the crash data.

According to SafeAfrica's [50]Deliverable 4.3, "Data analysis and identification of risk factors", the use of helmets in African countries is highly variable.

The best performing countries in the reporting of helmet wearing rates were Eritrea (95% for riders and passengers), Seychelles (90% for riders and passengers), Egypt (84% for riders), Mauritius (80% for riders and passengers) and. Among the countries with low helmet wearing rates are Mali (18%), Benin (15%), Namibia (12%), D.R. of Congo (10%), Burkina Faso (9%), and Togo (5% to 10%).

The significant differences between riders' and passengers' helmet wearing rates are noteworthy. These differences are most pronounced in Egypt (84% for riders as against 21% for passengers), Morocco (43% for riders as against 8% for passengers) and Uganda (49% for riders as against 1% for passengers).

Uganda conducted a campaign entitled "helmet vaccines" (UHVI) to encourage moto-taxi (Boda-Boda) riders to use helmets.

Oluwadiya et al. (2009) assessed motorcycle crash site characteristics in Nigeria based on about 363 motorcycle road traffic injury (RTI) patients collected in three tertiary hospitals in the country's southwest. The study found that 80% of motorcycle injuries occurred in urban locations. The respective percentages for rural and highway road traffic injuries were 13% and 7.6%.

Chalyað et al. (2010) analysed motorcycle injuries in Tanzania. According to the research, young adult males are more likely to be injured. Businessmen and students are the largest groups of motorcycle injury victims. Limb and head injuries are the most common types of injuries, and they often result in prolonged hospitalisation and death. The study recommended the following safety measures:

- use of protective gear (helmet, eye and face protection, long pants, gloves, boots and a durable long-sleeved jacket);
- restriction of alcohol consumption before operating a motorcycle;
- strict enforcement of traffic laws and regulations;
- keeping headlights on at all the times (day and night),
- training courses for motorcycle riders before issuance of a driving licence.

In 2011, the Africa Transport Policy Programme (SSATP)[51] conducted a study on the "emerging role of motorcycles in African cities", with a special focus on Douala, Lagos and Kampala. Using the three cities as models, the study traced the origin and growth of **motorcycle taxis** in Africa to the **collapse of state bus transport services** and the **deregulation of the market** leading to a growth in informal operators.

The exponential growth in the number of motorcycles taxis is not the result of a strategic plan to address the mobility needs, but rather an indigenous response to growing unmet demand and a commercial opportunity. Estimates of financial viability suggest large profit margins, and a huge income stream that is mostly unaccounted for and untaxed. There is no enforcement or monitoring of fares by government; the fares are arbitrarily set by the operators. These operators pass all increases in operating costs (fuel, lubricants, etc.) on to passengers in fare hikes plus an often-confiscatory profit margin. The transport unions exercise limited control, but in the interest of the operators, not the passengers.

In principle, all commercial motorcycles should be registered under the Road Traffic Rule and Regulations, and operators should possess a driving licence and a roadworthiness certificate, and should use and provide passengers safety helmets. However, in practice, many operators fail to comply with the legislation. For instance, over 50% of the motorcyclists in Lagos were estimated to be operating without a valid licence. In Douala, the municipality do not regulate moto-taxis' access to urban transport infrastructure, and operating licences are

[50] http://www.saferafrica.eu/media/1959/sa-ntua-wp4-d43.pdf.

[51] Ajay Kumar, April 2011. SSATP Discussion Paper No. 13 Urban Transport Series. Understanding the emerging role of motorcycles in African cities A political economy perspective. https://www.ssatp.org/sites/ssatp/files/publications/SSATP-DiscussionPapers/DP13-Role-Motorcycles.pdf

granted by the central government; motorcycles only need to be registered when above 125cc. Moreover, only 18% of moto-taxi drivers acknowledge having a driving licence. It is often easier and cheaper to obtain a forged certificate of roadworthiness than to pass a test with a vehicle in good condition. Similarly, driver licencing systems are not secure, and it is possible to obtain fraudulent documents.

The literature on motorcycling in Africa highlights the main contributing factors to motorcycle crashes and proposes several suggestions. Motorcycles in Africa are perceived as a transport service filling a mobility gap, and they are used for commercial purposes: passengers or/and goods transport, especially in rural areas (Bishop et al., 2018).

It appears that non poor people use motorcycles as their main mode of transportation, and they therefore use motorcycles more frequently than poor people. (Kumar, 2011). In Uganda, most of the injured in motorcycle crashes are businessmen and students commuting to their workplaces/schools by motorcycle.

It is reported that crashes mostly occur during the day, in busy traffic, and the most common injuries are head and musculoskeletal (extremities) injuries (Chalyað et al., 2010). The following are the causes of crashes and injuries mostly cited in the literature:

- riders' behaviour (human error is the main cause of motorcycle crashes in Africa): non-use of helmet, untrained and unlicenced riders, over speeding, overloading, lack of riding skills, and alcohol and drug use;
- ignorance and disregard of traffic laws.
- poor and limited quality of riders' training and low levels of licencing;
- lack of safety education and awareness;
- rider fatigue;
- poor quality of roads (e.g., inaccessible motorcycle paths, increase in motorcycle use);
- poor design of intersections (spacing and turning);
- poor post-crash care, and non-existent insurance;
- lack of monitoring in case of small motorcycles;
- inadequacy of regulations and enforcement laws (for helmet use/motorcycle overloading/riding age limit);
- absence of transport system policy despite the predominance of motorcycle as a mode of transportation (Jones et al., 2014).

4. Motorcycle Safety Conditions in Selected Countries

4. Motorcycle safety conditions in selected countries

More detailed data collection and analysis were conducted in the selected four countries with high levels of motorcycle use: Burkina Faso, Cameroon, Rwanda and Uganda (Figure 24). These countries are also representative of three regions (Central, West and East Africa). The data collected was complemented with field surveys on risk factors for motorcycles. Consultations with stakeholders' consultations helped to validate the findings and identify specific needs.

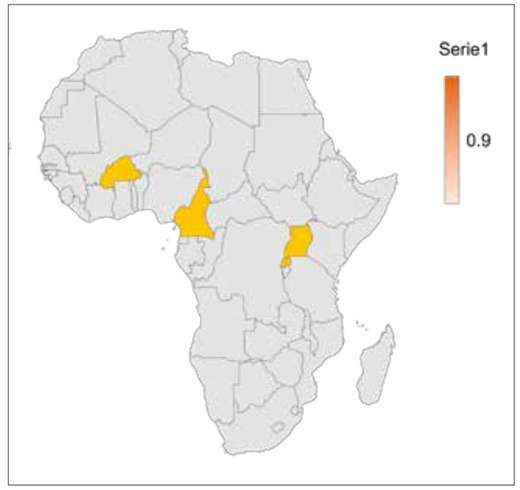
The information collected on the four countries aided the identification of the causes of motorcycle crashes and injury and the formulation of strategic recommendations.

The assessment of motorcycle safety in the four countries was based on data and information collected from official sources, as well as through data collection on the field.

The information collected was categorised as follows:

- Road traffic crash data.
- Economy indicators.
- Risk exposure data.
- Road safety legislation and standards.
- Safety Performance Indicators (SPIs) and Risk Indicators.

Figure 24 – Four selected countries



Data and information collected on the four countries are reported in Annex 4.

The public authorities contacted for data and information in Burkina Faso, Cameroon, Rwanda, and Uganda are listed in Table 10.

Table 10 – Data requested from stakeholders

STAKEHOLDER	DATA / INFORMATION
Burkina Faso	
National Road Safety Office	Road traffic crash variables Road safety legislation and standards
Ministry of Transport	Economy indicators Risk exposure data (vehicle fleet, vehicle-km, traffic volume) SPIs and risk indicators
Ministry of Infrastructure	Risk exposure data (road data)
Gendarmerie Nationale	Road traffic crash variables SPIs and risk indicators (Police checks)
Police Nationale	Road traffic crash variables SPIs and risk indicators (Police checks)
Sapeurs-pompiers	Road traffic crash variables

Cameroon	
Ministry of Transport	Risk exposure data (vehicle fleet, vehicle-km, traffic volume) SPIs and risk indicators Road safety legislation and standards
Ministry of Public Works	Risk exposure data (road data)
Gendarmerie Nationale	Road traffic crash variables
Police Nationale	Road traffic crash variables
National Institute of Statistics	Economy indicators
Rwanda	
Ministry of Infrastructure	SPIs and risk indicators Road safety legislation and standards
Traffic Police	Road traffic crash variables
National Institute of Statistics	Economy indicators
Rwanda Transport Development Agency	Risk exposure data (road data)
Rwanda Utilities Regulatory Authority	Road safety legislation and standards
Uganda	
Ministry of Works and Transport	Risk exposure data (vehicle fleet, vehicle-km, traffic volume) SPIs and risk indicators Road safety legislation and standards
Uganda National Roads Authority	Risk exposure data (road data)
National Road Safety Council	Road traffic crash variables
Uganda Police	Road traffic crash variables
Uganda Bureau of Statistics	Economy indicators

The data on road traffic crashes were limited. In Burkina Faso and Uganda, precompiled statistics were available from official sources, but some details about contributing factors were missing. The data provided by authorities in Cameroon and Rwanda were more complete, even if not comprehensive.

It is worth mentioning that the quality of road traffic crash data is also affected by the reliability of the countries' data collection process.

Most of the existing road safety legislations and standards in the four countries were analysed. Challenges concerning road design standards were found in Cameroon and Burkina Faso. Cameroon, Rwanda and Uganda have no available information on motorcycle standards. None of these three countries organises regular education programmes.

Considering the available data and the possible challenges of data reliability and completeness, additional field data collection was deemed necessary for a better and fuller insight. The field data were collected from visual observation on various types of roads, mainly during peak time. This exercise cannot be intended as a survey performed according to standard protocols or having a clear statistical reliability. The field data complement the information collected from official sources and provides an overview of the main road safety issues. Information from field data collection was also used during stakeholders' consultations to facilitate the discussion and to confirm or revise crash and injury risks.

Below are the data collected during the -field research in the four countries:

- Counting of vehicles (by type) in both directions of traffic, for at least one hour.
- Estimated quality of motorcycles, from a minimum sample of 100 motorcycles.
- Vehicles' estimated age, from a minimum sample of 100 motorcycles.
- Helmet use (riders and passengers), from a minimum sample of 100 motorcycles.
- Use of chin strap (riders and passengers), from a minimum sample of 100 motorcycles.
- Type of helmet, from a minimum sample of 100 motorcycles (full, half or open face).
- Estimated quality of helmet, from a minimum sample of 100 motorcycles (good/fair/bad).
- Use of protective clothing, from a minimum sample of 100 motorcycles.
- Number of passengers on a motorcycle, from a minimum sample 100 motorcycles.

Vehicle count | Quality of motorcycles
Vehicle age | Helmet use
Use of helmet chin strap | Type of helmet
Quality of helmet | Protective clothing use
Number of passengers | Phone use while riding

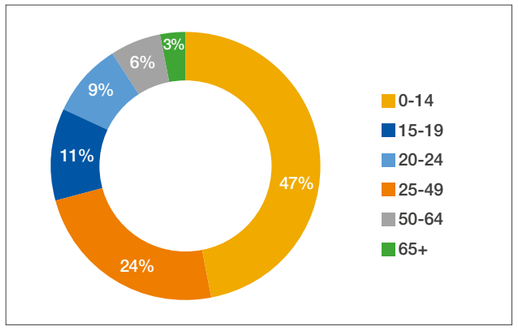
4.1 Motorcycle safety in Burkina Faso

Socio-economic indicators

Burkina Faso's population has been on a steady 3% annual increase for several years. In 2018, the population was around 20.24 million.

A large part of the population is young - around 47% under the age of 15 (Figure 25). This could explain their higher representation in motorcycle crash casualties, due to the vulnerability of children. People aged between 25 to 49 make up about 25% of the population. Conversely, the older population is significantly smaller - around 9% of the population are over 50 years old, and around 3% are over 65 years old.

Figure 25 – Share of population by age group in Burkina Faso (2018)



Source: National Institute of Statistics and Demography

The population growth rate only partially reflects the increasing trends of road traffic crashes and fatalities (Figure 26). The crash rate (i.e., number of crashes per 10,000 people) has increased by about 150% from 2009 to 2018, indicating a worsening of road safety in the country. This could be attributable to multiple factors, chief among them the growth of motorisation and expansion of the road network, and lack of road maintenance.

Surprisingly, the injury rate (number of injuries per 10,000 people) decreased by 28% over the same period. The fatality rate (the number of fatalities per 100,000 people) remained almost constant from 2009 to 2018. Again, various factors might have influenced the trend. The factors include better hospitals and emergency care centres, drop of registration of seriously injured, better quality of roads and vehicles, implementation of road safety policies, and higher road users' awareness towards road safety.

It is worth noting that the level of underreporting differs according to the type of information assessed. Generally, underreporting increases as severity of crashes decreases (that is to say that the information on number of fatalities are generally more accurate than those on number of injuries and of crashes). This could explain the different trends identified in Figure 26.

Figure 26 – Trends of crashes and casualties' rates in Burkina Faso (2009-2018)

Source: Office National de la Sécurité Routière (ONASER)

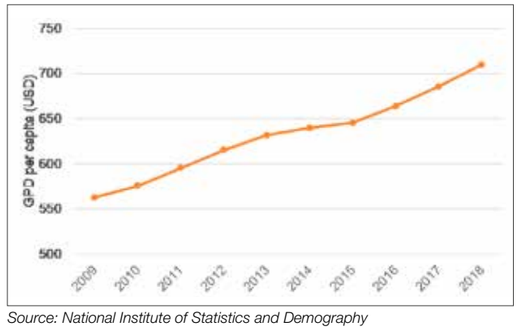
Burkina Faso's economic trend is on the rise (Figure 27). The Gross Domestic Product (GDP) per capita has increased significantly (around 26%) from 2009 to 2018, reaching around 710 USD.

Despite the strong GDP increase, the relationship between the economic and road traffic crash trends shows relative stability (Figure 28). The economic growth does not translate to a decrease in the number of traffic fatalities, as it could be expected in the long-term development of traffic fatalities in the model described by Oppe in 1991 (Elvik et al., 2004). This is not surprising. Burkina Faso has not yet attained stability in the level of motorisation (which usually leads to a decrease in the number of fatalities). Emerging African economies experiencing big increases in traffic usually have inadequate traffic systems (which lead to increasing number of fatalities).

Figure 24 does not show a clear trend. For instance, GDPs per capita lower than USD 575 and higher than USD 630 USD are correlated with similar fatality rates.

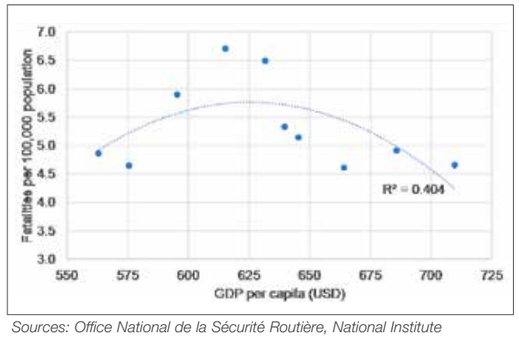
It is worth mentioning that these considerations are strongly influenced by the reliability (under-reporting) of recorded crash data. For instance, WHO (2018) has estimated around 6.5 times more road traffic fatalities than those recorded by African countries.

Figure 27 – Trend of GDP per capita in Burkina Faso (2019-2018)



Source: National Institute of Statistics and Demography

Figure 28 – Relationship between GDP per capita and fatality rate in Burkina Faso (2009-2018)



Sources: Office National de la Sécurité Routière, National Institute of Statistics and Demography

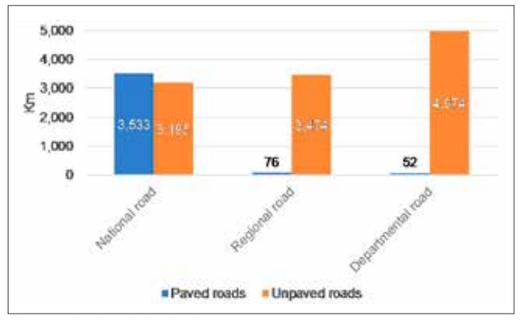
Risk exposure data

In 2016, Burkina Faso's entire road network was around 61,400 km. Only 25% of the network is classified. Most of the roads are also not paved (around 76% of all the classified roads). Moreover, 2% regional roads and 1% of county roads are paved. National roads fare better, with around 52% of the classified roads paved (Figure 29).

It is noteworthy that these lengths of road do not include all urban roads . They refer to rural areas and to portions of classified roads crossing urban areas.

Clearly, the high percentage of unpaved roads can be considered as a risk factor for road users, in that they increase the probability of single vehicle crashes. This can be especially true for motorcycles, considering the chances of falling. Usually, unpaved roads rapidly deteriorate due to adverse weather conditions and vehicular traffic.

Figure 29 – Length of classified roads by type and surface in Burkina Faso (2016)



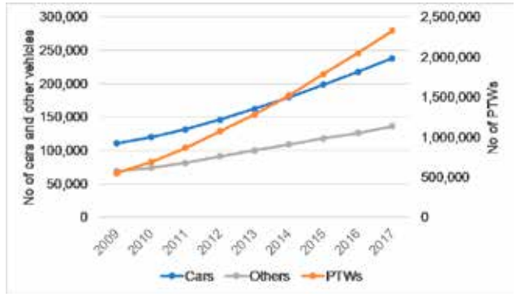
Source: Ministry of Infrastructure

The data collected on the number of vehicles in Burkina Faso show a very high concentration of motorcycles compared to other vehicles. The trend of registered vehicles in the country (Figure 30) shows a significant increase in the number of motorcycles from 2009 to 2017 (they increased about 4.2 times in nine years). This growth trend is significantly higher than that of other registered vehicles (growing around twice in the same period).

More than 2.3 million motorcycles were registered in 2017, compared to around 238,000 cars and 136,000 other vehicles. This means that around 85% of registered vehicles are motorcycles.

Generally, the motorisation growth rate corresponds with a country's positive economic trend.

Figure 30 – Trend of registered vehicles in Burkina Faso (2009-2017)

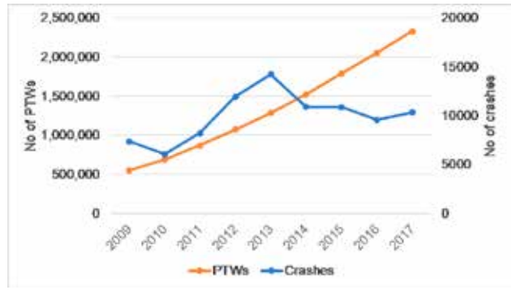


Source: Office National de la Sécurité Routière (ONASER)

A comparison of motorcycle registration and motorcycle crash trends highlighted a change in 2013 (Figure 31). The number of registered motorcycles and motorcycle crashes increased untill 2013, but the number of motorcycle crashes decreased from 204 to 2017. This reflects the relationship between economic trend and fatality rate trend described in Figure 28, as well as the significant reduction in motorcycle crashes and fatalities from 2014 to 2017 (Figure 36).

A comparison of the number of motorcyclists fatalities and the number of registered motorcycles (that is, the Motorcycle's Killing Potential - MKP) shows a decreasing trend of motorcycle crashes (it decreased by around 4 times from 2009 to 2017 - Figure 32).

Figure 31 – Trend of registered PTWs and crashes with PTWs in Burkina Faso (2009-2017)



Source: Office National de la Sécurité Routière / National Institute of Statistics and Demography

Figure 32 – Motorcycle's Killing Potential in Burkina Faso (2009-2017)

Source: Office National de la Sécurité Routière / National Institute of Statistics and Demography

Road traffic crashes

The road traffic crash data recorded by Burkina Faso's police forces (Gendarmerie Nationale and Police Nationale) show a trend of increase in the number of crashes from 2009 to 2018 (Figure 33). In 2018, the number of crashes was about twice as high as in 2009. This could be attributed to multiple factors, including improvements of data collection methods.

A significant increase in the number of crashes was recorded between 2010 and 2013, followed by an almost constant trend until 2016.

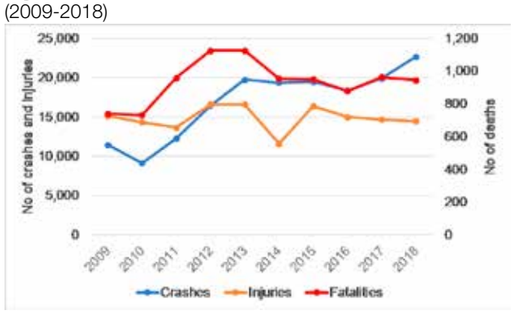
The number of road traffic casualties was stable during the same period. The number of injuries slightly decreased by around 4% from 2009 to 2018. Conversely, the number of fatalities increased with about 27%, with a peak of 1,125 deaths in 2012 and in 2013.

It is important to note that the number of injuries and fatalities remained the same in 2012 and 2013. This is problematic from a statistical point of view and is likely related to errors in the recorded data.

Fatalities and injuries show a different trend. Except for an important decrease in 2014, the number of injuries remained almost constant from 2009 to 2015. However, the number of fatalities increased significantly between 2010 and 2012, and decreased steadily from 2014.

From 2016 to 2018, the number of road traffic crashes increased, while the number of injuries slightly decreased. The number of fatalities increased from 2016 to 2017 and slightly decreased in 2018. These different trends could be to the result of various improvements, such as better post-crash treatments, improved vehicle conditions, etc.

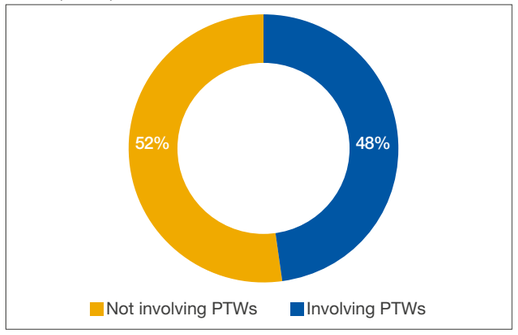
Figure 33 – Trend of crashes and casualties in Burkina Faso (2009-2018)



Source: Office National de la Sécurité Routière (ONASER)

The number of road traffic crashes involving at least one motorcycle is very high. In 2017, around 52% of crashes involved a motorcycle (Figure 34). This could be the result of the high number of registered motorcycles in the country, compared to other vehicles.

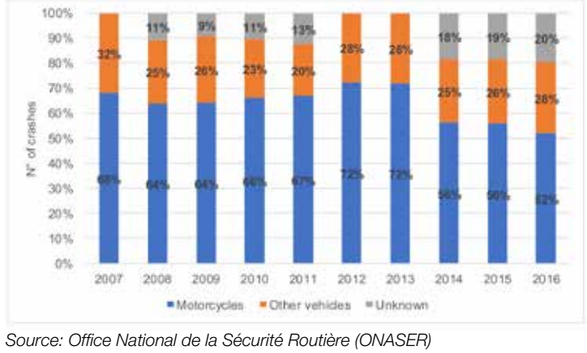
Figure 34 – Involvement of PTWs in crashes in Burkina Faso (2016)



Source: Office National de la Sécurité Routière (ONASER)

The percentage of motorcycles involved in road traffic crashes has remained significant, ranging from 52% in 2016 to 72% in 2012 and 2013 (Figure 31). The percentage of motorcycles involved in crashes has increased by about 132% from 2007 to 2016 (from about 4,100 to about 9,600).

Figure 35 – Trend of number of crashes by type of vehicles in Burkina Faso (2007-2016)



Source: Office National de la Sécurité Routière (ONASER)

The increase in the number of fatalities shows a prevalence of rider/passenger deaths in road crashes compared to other road users (Figure 36). However, the proportion of motorcycle-related fatalities increased from 2009 to 2017. During the last four reported years (2014 to 2017), the proportion has been closer to that of other vehicles. A reduction in the number of motorcycle fatalities was recorded, while the fatalities of other vehicles increased.

Possible factors influencing this change in trends could be the improved quality of motorcycles, as well as an increased use of other vehicles. Information collected during the consultations with stakeholders confirmed that, due to economic growth and import of cheaper motorcycles, replacements of these vehicles occur more often, leading to better quality. At the same time, stakeholders noted that cheaper motorcycles (imported from China) were of lower quality than those imported from Japan, for example.

The positive trend from 2014 to 2017 could also be related to a policy change in 2012, disallowing the use of motorcycles as moto-taxi in the two Burkina Faso's two major cities, Ouagadougou and Bobo Dioulasso. [52]

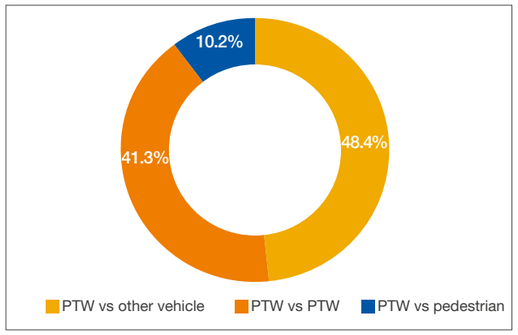
Figure 36 – Trend of fatalities by type of vehicles in Burkina Faso (2009-2017)

Source: Office National de la Sécurité Routière (ONASER)

[52] DECRET N° 2012-559/PRES/PM/MTPEN/MEF/MICA/MATDS/MID of 05 July 2012

An analysis of PTWs' involvement in traffic conflicts in Burkina Faso (Figure 37), shows a predominance of PTW crashes with other vehicles. Around 48% of the motorcycle conflicts occurred with four-wheels vehicles, while around 41% occurred with another motorcycle. This could be related to the mixture of vehicle type (huge numbers of motorcycles mingling with other vehicles). The relatively high percentage of conflicts among motorcycles is also predictable, considering the predominant use of motorcycles as a means of transportation. Conversely, the conflicts between motorcycles and pedestrians are relatively low (around 10% of all crashes).

Figure 37 – PTWs and traffic conflicts in Burkina Faso (2016)



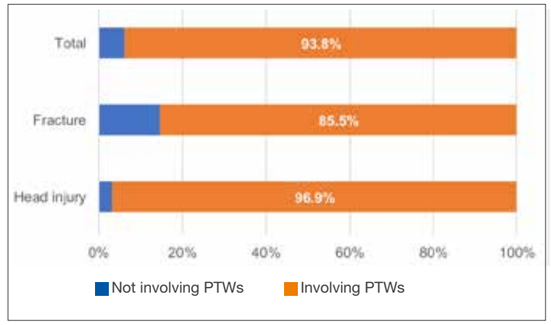
Source: Office National de la Sécurité Routière (ONASER)

The overwhelming number of road traffic crashes involving motorcycles has a strong correlation with the severity of injuries, given the greater vulnerability of riders and passengers compared to the drivers/passengers of other vehicles. According to 2018 data from the national fire brigade (in charge of emergency services), around 94% of all crash injuries were sustained by motorcycle users (Figure 38).

An examination of injury types[53] shows that motorcyclists sustain head injuries in 97% of crash cases, and lower back fractures in 85% of the cases. Motorcyclists clearly have much higher prospects of head injury than other road users because of the absence of a rigid structure around the rider, as is the case with cars. However, the very high percentage of head injuries could be related to a low use of helmet. This risk factor has been further assessed through on-the-field surveys (see discussion on "SPIs and risk indicators" in subsequent sections).

[53] The following type of injuries are considered: head injury (including head fractures) and body fracture (any broken bone except for head).

Figure 38 – Motorcycles involvement by type of injury in Burkina Faso (2018)



Source: Brigade Nationale de Sapeurs-Pompiers (BNSP

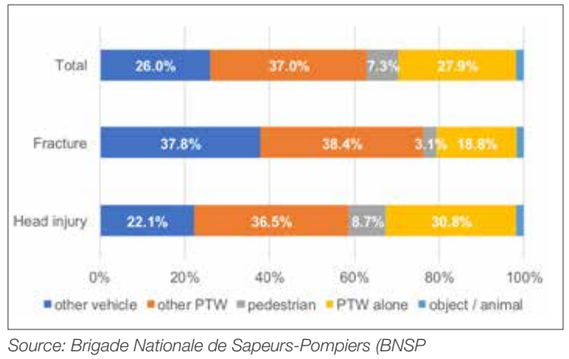
The national fire brigade also collects information on the type of conflicts that result in the injury of road users.

Conflicts between one or more motorcycles are prevalent (Figure 39). They represent approximately 65% of the conflicts involving motorcycles — 37% of the conflicts occur between two or more motorcycles, and around 28% of conflicts involve only one motorcycle. Conflicts between motorcycles and other vehicles represent around 26% of all motorcycles' conflicts. Conflicts with pedestrians are much lower (around 7%).

Head injuries (generally linked to non-use of helmet) are common in conflicts between motorcycles (36% of the cases) and in crashes of lone motorcycles (31%).

It is interesting to note that the crash of a lone motorcycle is more likely to cause a head injury than a fracture to another part of the body. Conversely, a conflict between a motorcycle and another type of vehicle has a higher chance of causing body fractures rather than head injuries.

Figure 39 – PTWs conflict types by type of injury in Burkina Faso (2018)

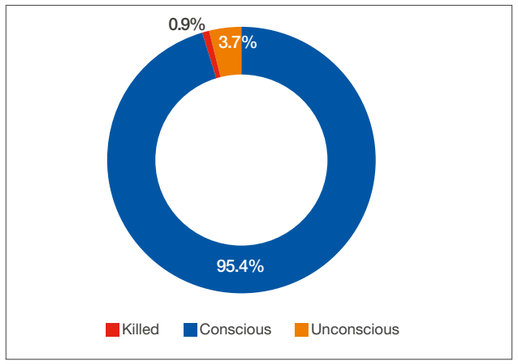


Source: Brigade Nationale de Sapeurs-Pompiers (BNSP

The national fire brigade finds most road crashes victims in a conscious state (Figure 40). This is an indication that most road crashes result in light injuries (for example, minor fractures). Around 3.7% of road crash victims were unconscious, and around 1% were dead. The levels of severity are likely to be associated with head injuries, rather than other consequences.

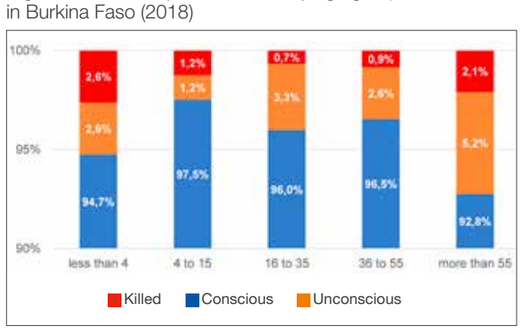
The vulnerability of road users is obviously related to age. Indeed, the percentages of serious road crash injuries (resulting in unconsciousness or death) are higher for children and the elderly (Figure 41). Around 5.2% of children and around 7.3% of people above the age of 55 involved in road traffic crashes were found unconscious or dead. Moreover, these vulnerable groups are more likely than other road users to die in a road crash.

Figure 40 – Severity of casualties in Burkina Faso (2018)



Source: Brigade Nationale de Sapeurs-Pompiers (BNSP

Figure 41 – Severity of casualties by age group in Burkina Faso (2018)



Source: Brigade Nationale de Sapeurs-Pompiers (BNSP

Road safety legislation and standards

Various laws and standards in place in Burkina Faso have a potential impact on road safety (Table 11). The respect and enforcement of traffic rules will reduce the risk of road traffic crashes.

The mere existence of legislation and standards does not guarantee their effectiveness. On the one hand, the specific contents of legislation and standards should be assessed and updated (to align with international good practices). On the other hand, it would be useful to assess the level of enforcement of legislation and standards, as a measure of their effectiveness. Precise information on the number of fines per type of traffic offence are not easily available. However, it was clear from the consultations with stakeholders that the level of enforcement of legislation and standards are lower in Burkina Faso than in European countries.

Table 11 – Road safety legislation and standards in Burkina Faso

TOPIC	LEGISLATION / STANDARD	YEAR OF ISSUE	VALUE / COMMENT
Speed	Max limit on urban roads	2003	50 km/h
	Max limit on rural roads	2003	90 km/h
	Max limit on national roads	-	Nil
Mobile phone	Hand-held prohibited	2003	Yes
	Hands-free prohibited	2003	No
Alcohol	BAC limit (blood alcohol level)	2017	0.5 g/ml
	BAC limit (breath alcohol level)	-	Not available
	BAC limit for learner drivers	2017	0.2 g/ml
Driving licence	Threshold for drivers	2018	18 years old
	Threshold for riders	2018	14 years old
	Mandatory licence for riders	2016	Yes
	Mandatory training for riders	2016	Yes
	Training theoretical and practical	2016	Yes
	Minimum hours of practical training	-	No
Education	School programmes	-	No specific programmes
	Programmes for motorcyclists	-	No specific programmes
Technical inspections	Mandatory for cars	2010	Yes
	Mandatory for motorcycles	2012	Yes
	Existence of standards for motorcycles	2012	Yes
Awareness campaigns	Specific for motorcycles	2013-2019	Yes
Helmet	Existence of helmet law	2003	Yes
	Law requires helmet fastening	2006	Yes
	Law refers to helmet standards	2006	Yes
	Law applies to riders and passengers	2003	Yes
	Law applies to all type of roads	2003	Yes
	Law applies to all engines	2003	Yes
	Restriction for child passengers	2003	Not allowed under 5 years old

SPIs and risk indicators

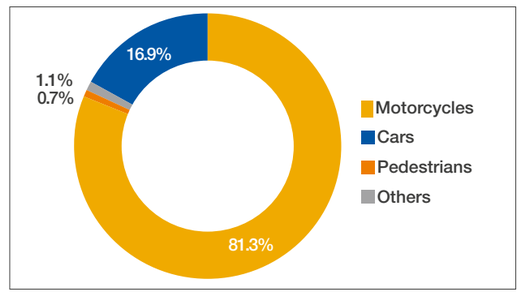
Despite the large number of motorcycles, their technical inspection is limited compared to other types of motor vehicles. Motorcycles constituted only 5.3% of the approximately 283,500 technical inspections performed in 2016.

Field surveys were used to fill the gaps in official data on risk indicators.

Details of the surveys conducted in Burkina Faso are reported in Annex 5.

Vehicles were counted on one arterial and one local urban road during peak and off-peak hours. The counting confirms a large presence of motorcycles in Burkina Faso (Figure 42). Around 81% of the vehicles counted were motorcycles. Cars represent around 17% of all vehicles. There was a relatively low number of pedestrians on those roads.

Figure 42 – Share of vehicles and pedestrians in Burkina Faso



Around 57% of motorcycles recorded were judged by observers to be of medium or low quality (Figure 43). Even if this indicator is relatively subjective, it seems there could be a risk factor associated with the quality of vehicles. This is also confirmed by the estimated age of recorded motorcycles (Figure 44). From observation, around 61% of the motorcycles were at least five-year-old.

Figure 43 – Estimated motorcycle quality in Burkina Faso

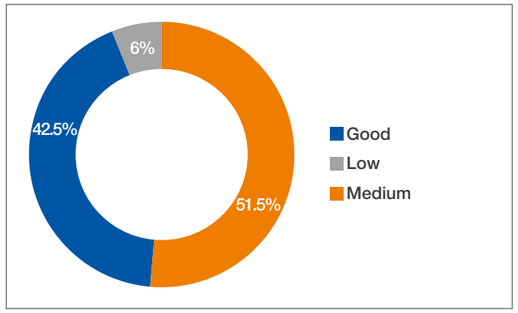
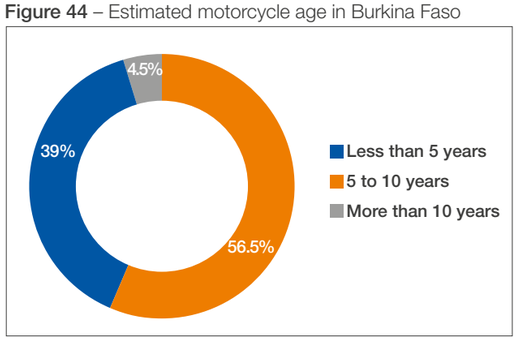


Figure 44 – Estimated motorcycle age in Burkina Faso



A serious risk factor is represented by the very low rate of helmet use (Figure 45). Around 91% of the riders and 99% of the passengers were not wearing a helmet. This explains the high rate of head injuries in motorcycles crashes (see Figure 38).

On a positive note, most of the motorcycle users who put on helmets used the chin strap but this is not representative of willingness to use it because of the low number of motorcyclists wearing helmets). Moreover, around 84% of the helmet used were "full face", that is closed and protecting all the head (Figure 46). Generally, the helmet quality is estimated as good (around 76% - Figure 43). It is worth mentioning that that the helmet quality has been recorded subjectively by observation. The reliability of this information is thus only indicative.

Unfortunately, these positive aspects apply to very few cases; they have probably no influence on motorcyclists' safety in Burkina Faso.

Figure 45 – Helmet use by riders and passengers in Burkina Faso

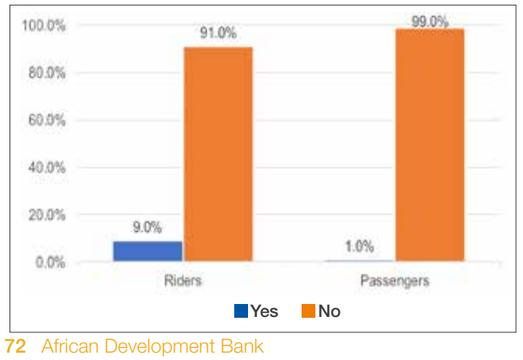


Figure 46 – Helmet type used in Burkina Faso

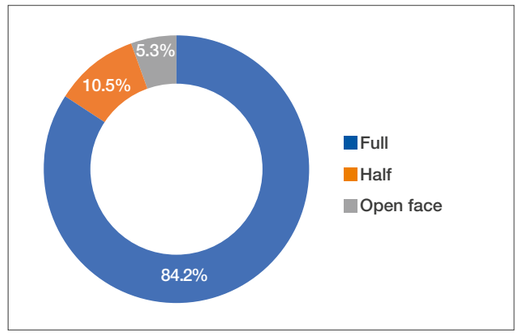
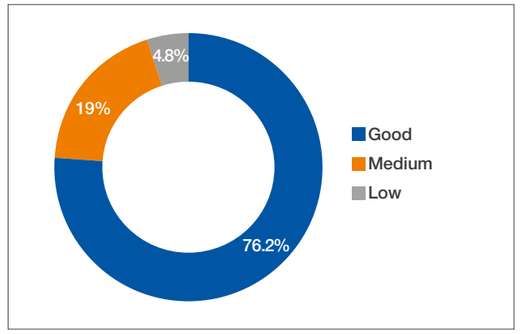
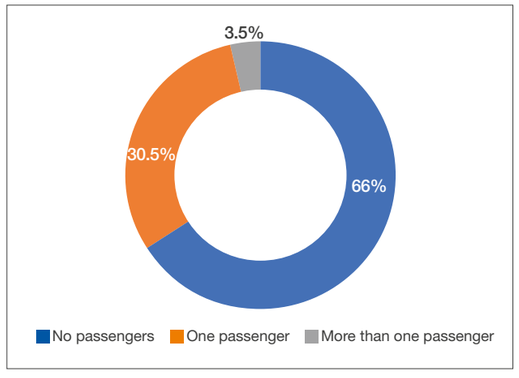


Figure 47 – Subjective quality of helmet recorded in Burkina Faso



Unlike many African countries, the average number of passengers on motorcycles is relatively low (around 34%). Around 66% of motorcycles were recorded with no passengers (Figure 48). It is likely that motorcycles in Burkina Faso are mainly used as single mean of transport and few as "moto-taxi" (since these services are banned in the two main cities). It is noted that around 30% of motorcycles had one passenger and around 3.5% at least two passengers.

Figure 48 – Number of passengers per motorcycle in Burkina Faso



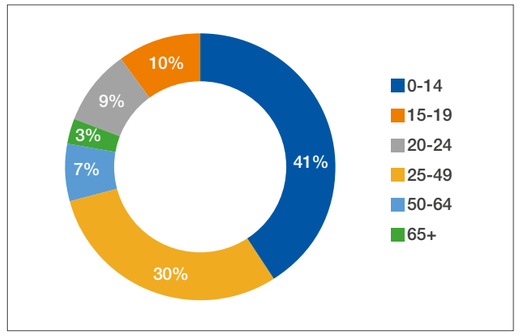
4.2 Motorcycle safety in Cameroon

Socio-economic indicators

Cameroon's population rose to around 24.8 million in 2018, following a sustained average annual growth rate of 2.7%.

The largest part of the population is under 14 years old (41%), followed by people aged between 25 and 49 (Figure 49). People aged 65 and above represent just around 3% of the population. The high number of children in the country could be a risk factor related to their high vulnerability.

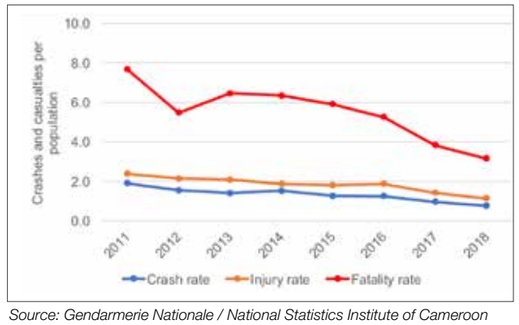
Figure 49 – Share of population by age group in Cameroon (2018)



Source: National Statistics Institute of Cameroon

Crash and casualty rates[54] (the number of crashes, injuries and fatalities relative to the population) have dropped by 52% to 59% from 2011 to 2018 (Figure 50). Still, little is known about the reliability of the official road traffic crash data. It is worth mentioning, for instance, that WHO estimated fatalities (7,066) for 2016 is more than 3.7 times the Cameroon's official fatality figure (1.879) in.

Figure 50 – Trends of crash and casualty rates in Cameroon (2011-2018)



Source: Gendarmerie Nationale / National Statistics Institute of Cameroon

[54] Crash rate is the number of crashes per 10,000 people.
Injury rate is the number of injuries per 10,000 people.
Fatality rate is the number of fatalities per 100,000 people.

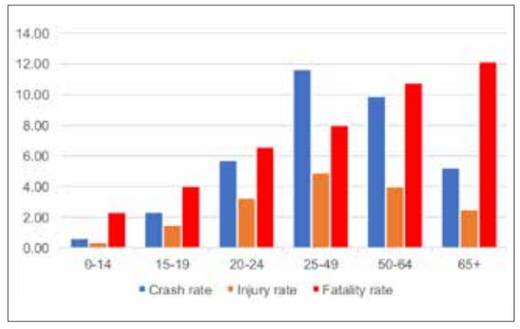
Crash and casualty rates change quite significantly according to road users' ages (Figure 51).

Crash rates are higher for persons aged between 20 and 64 (usually the most active road users). This is quite normal for the 25-49 age group, which represents a large portion of the population. On the contrary, the rates are particularly high for the 20-24 and 50-64 age bands because their share in total population is relatively low. Thus, they are more exposed to crashes than other groups.

A similar trend emerges in injury rates. People aged between 20 and 64 are more exposed to injuries, probably due to their higher chances of involvement in crashes.

The situation changes when dealing with fatality rates. The higher the road users' ages, the higher the ratio of the number of deaths to the population. Usually, people aged over 65 years old), who represent only 3% of the total population, have a higher fatality rate. Their probability of death in road crashes is extremely high.

Figure 51 – Crash and casualty rates by age group in Cameroon (2018)



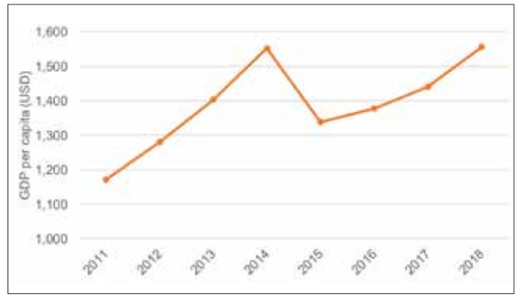
Source: Gendarmerie Nationale / National Statistics Institute of Cameroon

From 2011 to 2018, the growth of the Cameroonian economy was almost constant, except for a decrease in 2015 (Figure 52). On average, the GDP per capita has increased by around 4% per year. The relationship between economic and road traffic crash trends seems to confirm the trend of decreases in crashes (Figure 53). The economic growth has induced a decrease of road fatalities.

The relationship between GDP and fatality rate in Cameroon is clear, compared to Burkina Faso, where a clear trend cannot be identified (Figure 28).

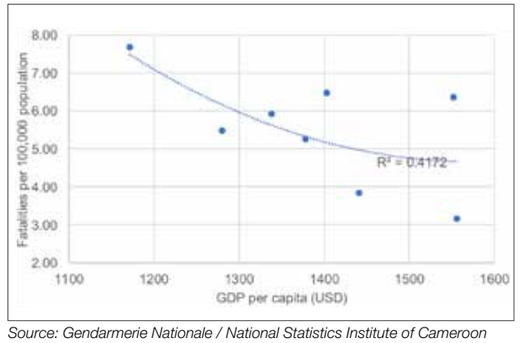
Despite the decreasing trend of crashes and fatality rates identified in Cameroon, there are also some contradicting figures. For instance, for high GDPs in 2014 and 2018, two different fatality rates have been recorded (around 6.3 and 3.0 fatalities per 100,000 people). Like for other African countries, these results could be strongly influenced by the reliability of crash data recorded.

Figure 52 – Trend of GDP per capita in Cameroon (2011-2018)



Source: National Statistics Institute of Cameroon

Figure 53 – Relationship between GDP per capita and fatality rate in Cameroon (2011-2018)



Source: Gendarmerie Nationale / National Statistics Institute of Cameroon

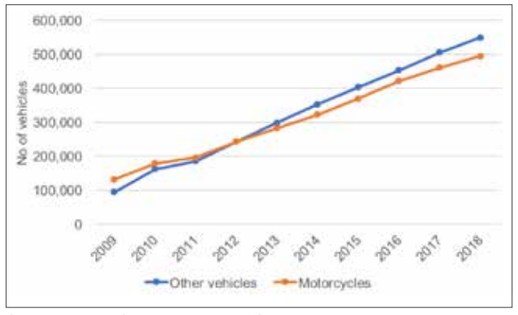
Risk exposure data

According to a 2015 Ministry of Public Works report, Cameroon has approximately 121,424 km of roads, of which 21,973 km are on the main network (national roads), and nearly 100,241 km are on the rural network. Around 72% of the main network are unpaved. However, a plan for asphalting roads has been in place for some years.

The road infrastructure is riddled with problems (inadequate signage and marking, cracks, potholes, absence of sidewalks and bicycle paths, etc.). Among the network's major shortcomings, is the proportion of roads in good condition (only 26%). The poor condition of Cameroonian roads is largely attributable to an absence of an institutional framework, lack of maintenance, overloaded vehicles, and the presence of obstacles and broken-down vehicles.

Data on registered vehicles in Cameroon confirm a high presence of motorcycles, compared to other vehicles (Figure 54). The trend has been continuously increasing over the years, in line with the country's economic growth. However, in the number of registered vehicles, motorcycles are close to other vehicles. In 2018, the number of motorcycles in the country's motor vehicle fleet reached 500,000.

Figure 54 – Trend of registered vehicles in Cameroon (2009-2018)



Source: National Statistics Institute of Cameroon

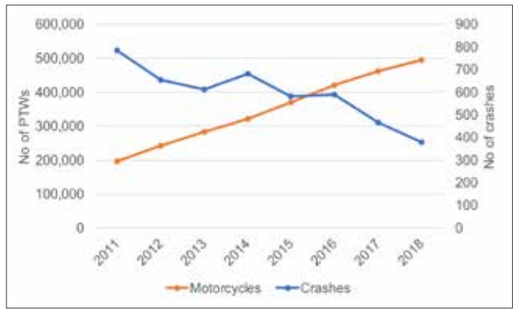
The trends of registered motorcycles and of crashes involving motorcycles are relatively constant. While the number of registered vehicles is constantly growing, the number of crashes is decreasing (Figure 55). This pattern could be linked to factors, ranging from better vehicles and roads, to a high level of underreporting.

Despite the general trend, a relatively constant evolution is noted between 2013 and 2016. The number of crashes involving motorcycles dropped significantly between 2016 and 2018 (following the trend of other vehicles).

The Motorcycle's Killing Potential (MKP), that is the number of motorcyclists fatalities compared to the number of registered motorcycles, decreased by around 80% from 2011 to 2018 (see Figure 56).

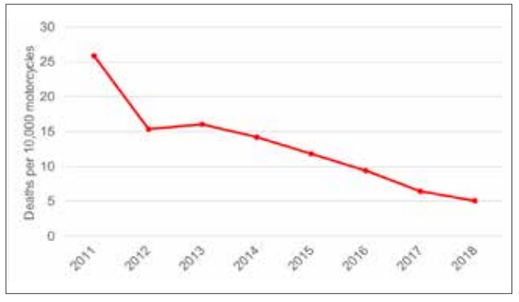
It is worth mentioning that these considerations are strongly influence by the reliability of recorded data.

Figure 55 – Trend of registered PTWs and PTWs crashes in Cameroon (2011-2018)



Source: National Statistics Institute of Cameroon

Figure 56 – Motorcycle's Killing Potential in Cameroon (2011-2018)



Source: Based on data provided by Gendarmerie Nationale and the National Statistics Institute of Cameroon

Available statistics on professional licences issued for public transport services indicate that approximately 40% of the licences issued are for passenger transportation in urban and semi-urban areas, and about 49% for goods transportation (trucks allowed over 3.5 tons in payload).

Very few licences are issued for "moto-taxi" services. On average, around 155 moto-taxi licences were issued from 2007 to 2013. These figures are unlikely to correspond to the real situation in the country because the real number of "moto-taxi" is believed to be much higher (due to unregistered and unregulated moto-taxis).

There is limited official data on traffic flows. The National Statistics Institute of Cameroon provides some generic data for a period covering 2007 to 2013. For all kind of roads, the Institute's data refer to around 4,350 vehicles per day. Data on motorcycle traffic are missing.

Road traffic crashes

According to the data from Cameroon's Gendarmerie Nationale (National paramilitary police), the number of road crashes has been on a decrease since 2011 (Figure 57). The trend is especially significant for fatal crashes (decrease by around 61%), even if mainly due to changes from 2011 to 2012.

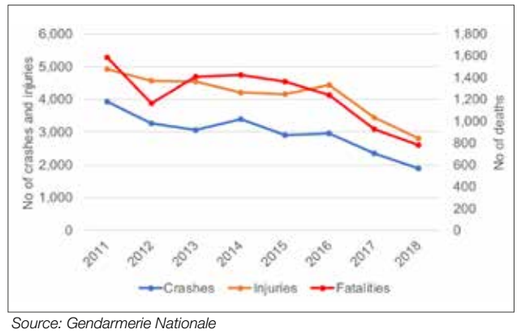
Road traffic injuries and fatalities also decreased significantly from 2011 to 2018 (Figure 58), by about 52% and 43%, respectively.

The trend of decreases in road crashes and casualties could be related to general improvements of road safety conditions (notably, better roads, safer vehicles and greater road users' awareness). The possibility of a high rate of underreporting of crash data can also not be ruled out. The situation of data collection should significantly improve with more available data thanks to the implementation of new national road traffic crash database (even if it yet to be fully operational).

Figure 57 – Trend of crashes in Cameroon (2011-2018)

Source: Gendarmerie Nationale

Figure 58 – Trend of crashes and casualties in Cameroon (2011-2018)



Source: Gendarmerie Nationale

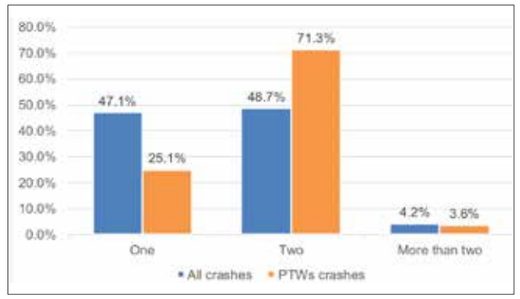
Fewer motorcycles were involved in single-vehicle road crashes than other vehicles (Figure 59). Around 47% of all single-vehicle crashes (including motorcycles) were recorded. Around 75% of crashes involving a motorcycle are collisions with other vehicles.

Considering the share of crashes by vehicle type, most of the motorcycle collisions tend to involve other types of vehicle. The high vulnerability of motorcycles would increase the severity of such crashes.

Data on collision types support these figures (Figure 60). Single vehicle collisions represent only 7% of all road collisions, compared to pedestrian collisions (around 19%).

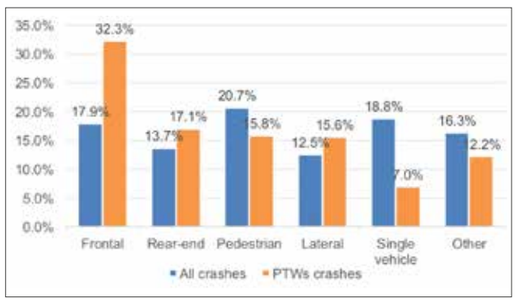
Data on collision types also show that motorcycles are mostly affected by frontal crashes (around 32% of collisions). Rear-end and lateral crashes are also significant, as well as crashes with pedestrians.

Figure 59 – Number of vehicles involved in crashes in Cameroon (2018)



Source: Gendarmerie Nationale

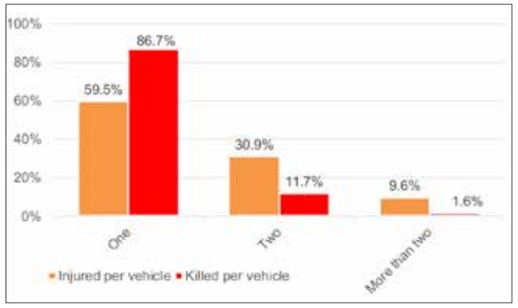
Figure 60 – Crashes by collision type in Cameroon (2018)



Source: Gendarmerie Nationale

The severity of motorcycle crashes is also clear from Figure 61. Around 87% of fatal motorcycle crashes have one casualty, usually the motorcyclist. About 40% of motorcycle crashes result in the injury of at least two people.

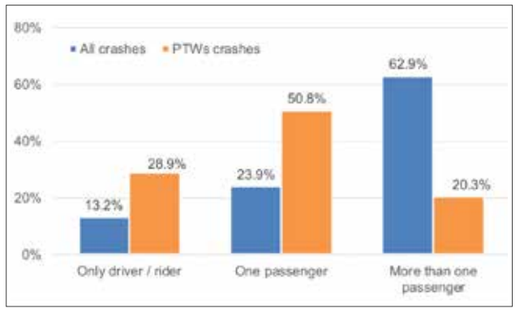
Figure 61 – Casualties per motorcycle crashes in Cameroon (2018)



Source: Gendarmerie Nationale

Relatively few road crashes involve only the drivers or riders (Figure 62). Around 87% of all crashes involved at least one passenger in addition to the driver or rider. This percentage is lower when dealing only with motorcycle crashes (around 71%), but still significant. Most motorcycle crashes involved one passenger, in addition to the rider. However, the percentage of crashes involving more than one passenger is not negligible (around 20%). This factor is probably attributable to the negligible number of vehicles travelling without passengers.

Figure 62 – Road users involved in crashes in Cameroon (2018)

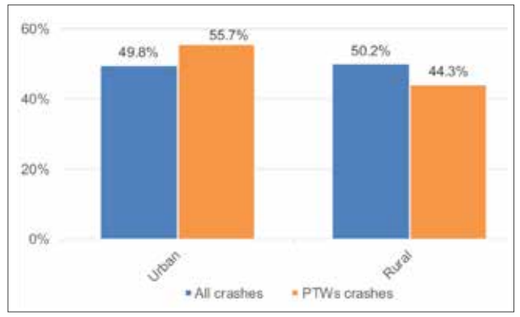


Source: Gendarmerie Nationale

Motorcycle crashes have a higher chance of occurring in urban roads (around 56%) than in rural roads (Figure 63). This is understandable because motorcycles are mostly used for commuting in cities, rather than for longer trips. The share is different when considering all road crashes.

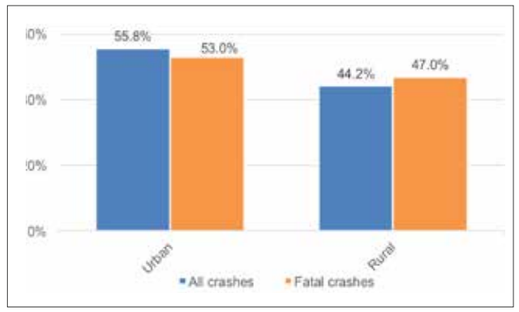
When looking at the difference between A comparison of fatal crashes with fatal crashes involving PTWs highlights distinctions between urban and rural environments (Figure 64). The percentage of fatal crashes increases in rural areas, compared to all type of crashes. On the contrary, it decreases in urban areas. This seems to confirm an influence of speed on the severity of crashes (rural areas have higher speed limits than urban areas).

Figure 63 – Crashes by location in Cameroon (2018)



Source: Gendarmerie Nationale

Figure 64 – PTWs crashes and fatal crashes by location in Cameroon (2018)

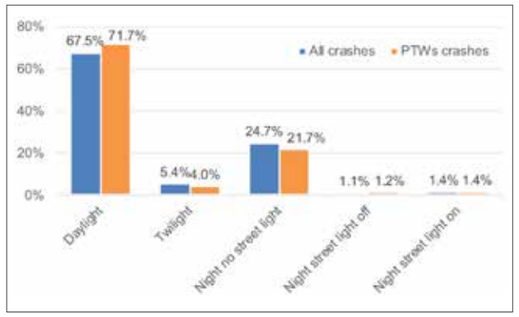


Source: Gendarmerie Nationale

Most of road crashes (including motorcycle crashes) occurred during daytime (see Figure 65). A risk factor seems to be related to roads with no streetlights. Around 22% of motorcycle crashes occurred at night, because of poor or no street illumination.

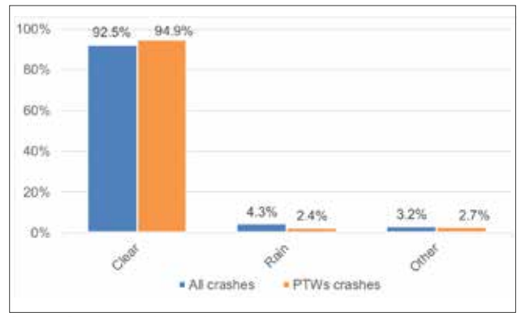
Weather conditions have relatively little influence on road crashes (Figure 66). The prevalence of motorcycle crashes occurred between 4.00 p.m. and 80.00 p.m. (around 37% of crashes) can be safely attributed to the higher traffic concentration in that period (Figure 67).

Figure 65 – Crashes by light conditions in Cameroon (2018)



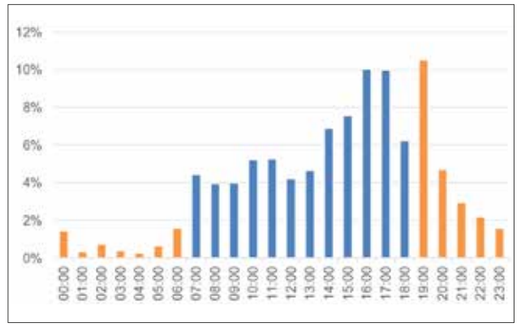
Source: Gendarmerie Nationale

Figure 66 – Crashes by weather conditions in Cameroon (2018)



Source: Gendarmerie Nationale

Figure 67 – Time of motorcycle crashes in Cameroon (2018)



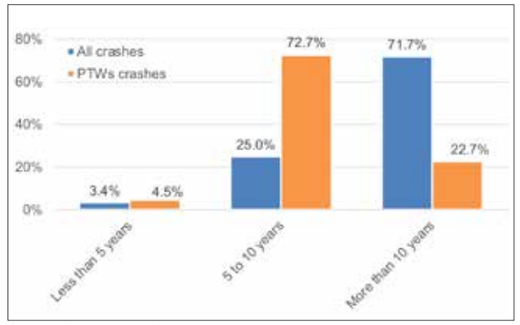
Source: Gendarmerie Nationale

The poor condition of vehicles could be a risk factor for road crashes. Few of the vehicles involved in crashes were recent models (that is, registered within five years). Old vehicles (more than ten years from the first registration) constituted about 72% of all vehicles involved in crashes (Figure 68).

A significant risk factor could be inadequate technical inspection of motorcycles. Around 55% of motorcycles involved in crashes were not compliant with technical verifications (Figure 69). This is especially problematic considering that other vehicles are almost always compliant with technical verifications.

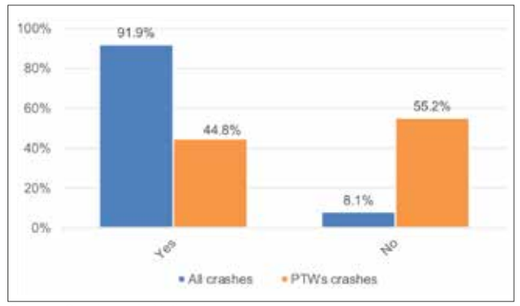
Another significant difference between PTWs and other vehicles was insurance. The percentage of insured motorcycles involved in crashes is lower than that of all vehicles involved in crashes. Under 16% of motorcycles involved in crashes had valid insurance (Figure 70).

Figure 68 – First registration of vehicle involved in crashes in Cameroon (2018)



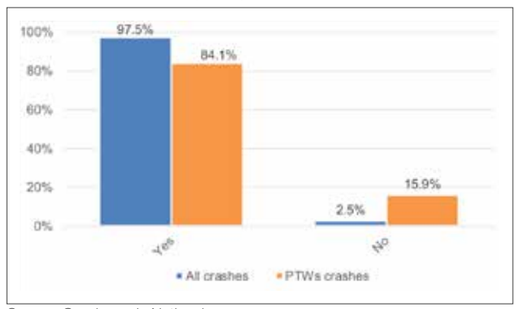
Source: Gendarmerie Nationale

Figure 69 – Validity of technical visit of vehicle involved in crashes in Cameroon (2018)



Source: Gendarmerie Nationale

Figure 70 – Validity of insurance of vehicle involved in crashes in Cameroon (2018)

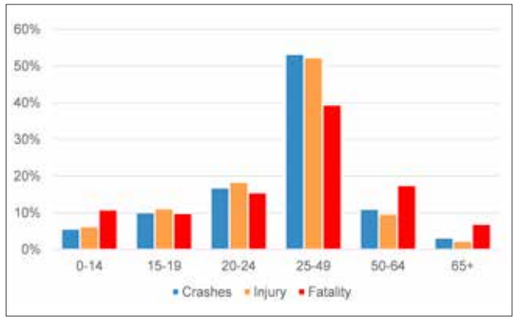


Source: Gendarmerie Nationale

More than half of the motorcyclists involved in crashes are aged between 25 and 49 (Figure 71). This is clearly the age group most exposed to motorcycle crashes. However, the severity of crashes is higher for children aged under 15 years and adults above 64 years of age. For these groups, the percentage of fatalities is higher compared to injuries and crashes. The two groups are more vulnerable to crashes than other road users because of their fragility.

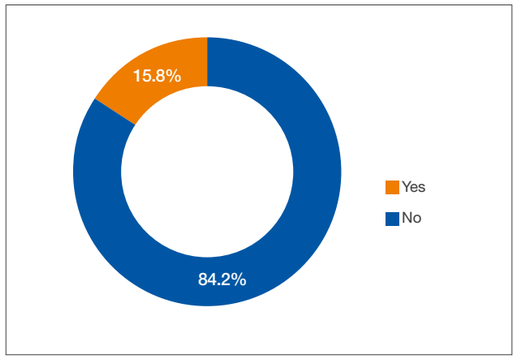
A serious risk factor is the low rate of helmet use. Only 16% of motorcyclists involved in road crashes were wearing a helmet (Figure 72).

Figure 71 –Crashes and casualties by age group of motorcyclists in Cameroon (2018)



Source: Gendarmerie Nationale

Figure 72 – Helmet wearing rate of motorcyclists involved in crashes in Cameroon (2018)



Road safety legislation and standards

Various laws and standards in place in Cameroon have a potential impact on road safety (Table 12). It is worth mentioning that the respect and enforcement of traffic rules are the crucial to the reduction of the risks of road crashes. The mere existence of legislation and standards does not guarantee their effectiveness. Information collected during the consultations with stakeholders consultations highlighted partial implementation and limited enforcement of laws and standards

Table 12 – Road safety legislation and standards in Cameroon

TOPIC	LEGISLATION / STANDARD	YEAR OF ISSUE	VALUE / COMMENT
Speed	Max limit on urban roads	2001	60 km/h
	Max limit on rural roads	2001	110 km/h
	Max limit on national roads	2001	110 km/h
Mobile phone	Hand-held prohibited	2001	Yes
	Hands-free prohibited	2001	Yes
Alcohol	BAC limit (blood alcohol level)	2001	0.8 g/ml
	BAC limit (breath alcohol level)	-	Not available
	BAC limit for learner drivers	-	Not available
Driving licence	Threshold for drivers	2001	18 years old
	Threshold for riders	2001	16 years old
	Mandatory licence for riders	-	Yes
	Mandatory training for riders	-	Yes
	Training theoretical and practical	-	Yes
	Minimum hours of practical training	-	Not available
Education	School programmes	-	No specific programmes
	Programmes for motorcyclists	-	No specific programmes
Technical inspections	Mandatory for cars	1979	Yes
	Mandatory for motorcycles	-	No
	Existence of standards for motorcycles	-	No
Awareness campaigns	Specific for motorcycles	-	Yes
Helmet	Existence of helmet law	-	Yes
	Law requires helmet fastening	-	No
	Law refers to helmet standards	-	No
	Law applies to riders and passengers	-	Yes
	Law applies to all type of roads	-	Yes
	Law applies to all engines	-	Yes
	Restriction for child passengers	-	Not allowed under 5 years old

SPIs and risk indicators

As previously mentioned, the total absence of technical inspections on motorcycles is a serious risk factor. Currently, no standards are available, and verifications are not mandatory.

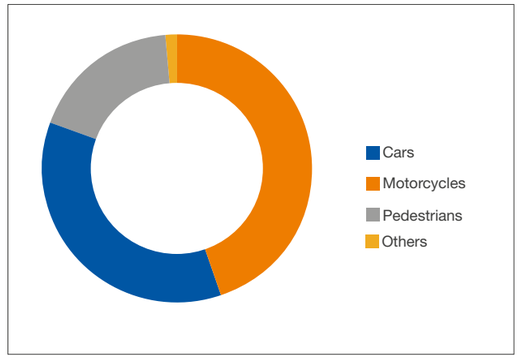
Information on risk indicators has also been collected by performing on-field surveys concerning the topics listed on the right boxes.

Details of the surveys conducted in Cameroon are reported in Annex 6.

Vehicles were counted on one arterial and one local road during peak and off-peak hours. The count confirms the large heavy number of motorcycles on Cameroonian roads (Figure 73). Nearly 45% of the vehicles counted during the surveys were motorcycles, followed by cars (36%). Around 18% of road users were pedestrians. Other types of road users are negligible.

The large number of motorcycles and other vehicles could be a risk factor due to the mixture of different types and sizes of vehicles. In this context, motorcyclists (and pedestrians) are clearly the most vulnerable road users.

Figure 73 – Share of vehicles and pedestrians in Cameroon



Source: Gendarmerie Nationale

Most of the motorcycles recorded in the survey were estimated to be of good quality (around 87% - Figure 74). Even if this indicator is subjective, there appears to no specific risk factor associated with the quality of vehicles. This is also confirmed by the estimated age of motorcycles (Figure 75). Around 98% of the motorcycles were estimated to be at least five years old.

Figure 74 – Estimated motorcycle quality in Cameroon

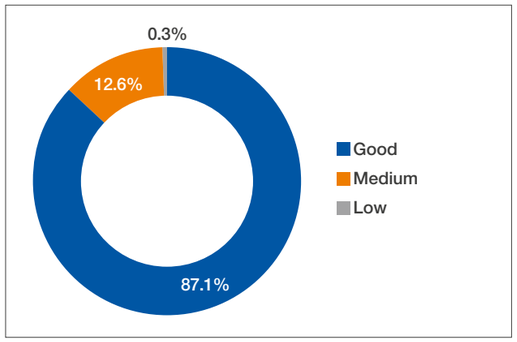
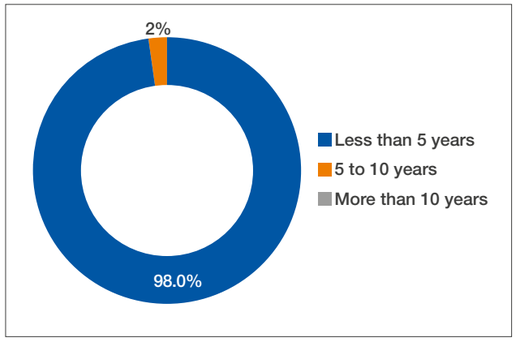


Figure 75 – Estimated motorcycle age in Cameroon



The low rate of helmet use is a serious risk factor (Figure 76). Around 83% of the recorded riders were not wearing a helmet, and not a single passenger was wearing one.

In addition, no rider or passenger was using the chin strap. Around 85% of the helmet used were “open face” (the less safe type), which constitutes an additional risk factor (Figure 77). The helmet quality has been estimated “good” in around 96% of the cases (Figure 78). It is worth mentioning that the helmet quality has been recorded subjectively by observation. The reliability of this information is thus only indicative.

Figure 76 – Helmet use by riders and passengers in Cameroon

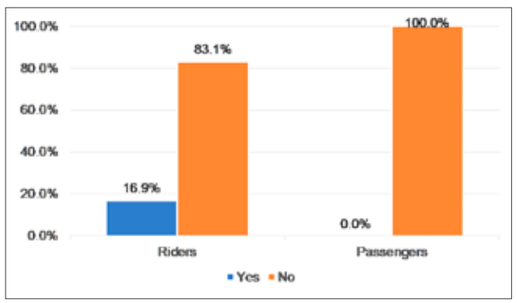


Figure 77 – Helmet type used in Cameroon

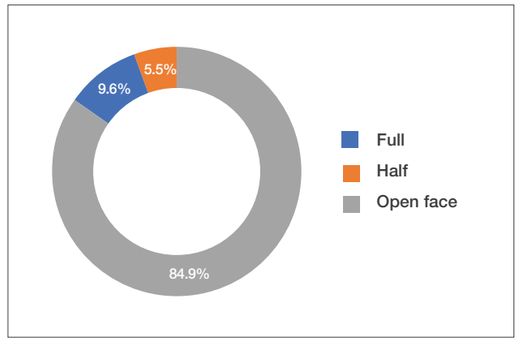
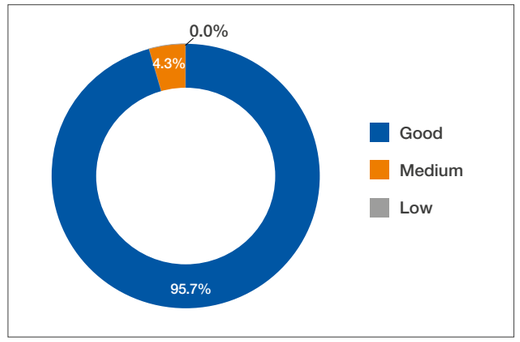
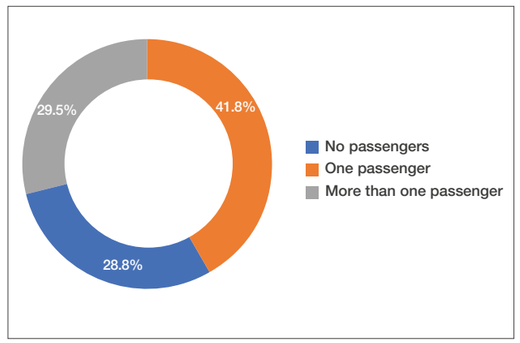


Figure 78 – Subjective quality oh helmet recorded in Cameroon



Just under 29% of motorcycles have no passengers and nearly 30% carry more than one passenger. (Figure 79). Around 42% of motorcycles have one passenger. These figures could be related to a high use of motorcycles as “moto-taxi”.

Figure 79 – Number of passengers per motorcycle in Cameroon



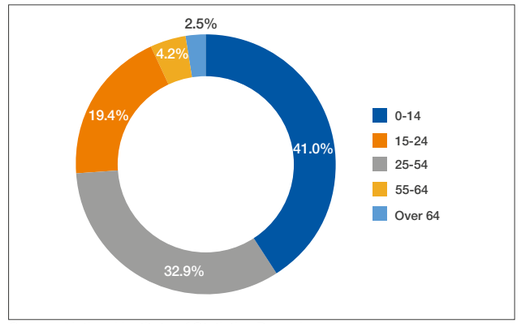
4.3 Motorcycle safety in Rwanda

Socio-economic indicators

Rwanda has recorded a steady annual population growth rate of 2.6% over recent years. In 2019, the population was around 12.6 million. Around 83.5% of the population lives in rural areas.

A significant proportion of the population is young — people under the age of 15 constitute around 41% of the population (Figure 80). Around 20% of the population is aged between 25 to 54. Conversely, the older population is relatively small. People aged 55 to 64 constitute 6.7% of the population, and those above 65, only 2.5%.

Figure 80 – Share of population by age group in Rwanda (2019)



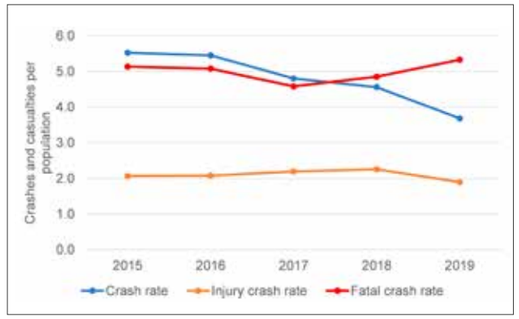
Source: National Institute of Statistics Rwanda

Figure 81 shows the trend of crash and injury rates from 2015 to 2019. In this period, the crash rate (number of crashes per 10,000 people) has decreased by around 33%, showing a general improvement of road safety in the country. It is worth mentioning that a crash is the composition of various types of events: fatal crash, serious injury crash, slight injury crash, as well as property damage only crash. The improvement can thus be linked to factors influencing one of these events, and possibly underreporting of some of these events. Precise and reliable data on crash severity levels are unavailable in Rwanda. However, it is likely that official data on fatal and serious injury crashes are more reliable than slight injury and damage-only crashes.

The injury crash rate (crash injuries per 10,000 people) shows a more stable trend from 2015 to 2019. It increased slightly from 2.0 to 2.2 in 2018 and then decreased to 1.9 in 2019. It is worth mentioning that this rate refers to both serious and slight injuries, having usually different levels of underreporting.

The fatal crash rate (fatal crashes per 10,000 people) increased by around 3.8% from 2015 to 2019. However, while the fatal crash rate decreased from five crashes per 10,000 people in the initial period (2015 to 2017), it jumped by about 16% from 2017 to 2019. The worsening of road safety situation could be influenced by several factors, notably, economic growth, increased motorisation, large number of motorcycles, etc.

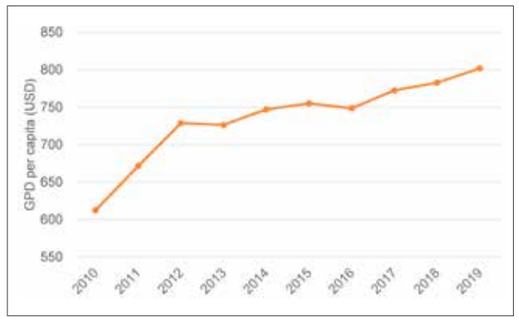
Figure 81 – Trends of crash and casualty rates in Rwanda (2015-2019)



Source: Traffic Police Rwanda / National Institute of Statistics Rwanda

Between 2010 and 2019, the Rwandan economy recorded significant growth (Figure 82). The GDP per capita has increased by around 25%, reaching about 800 USD/capita.

Figure 82 – Trend of GDP per capita in Rwanda (2010-2019)



Source: National Institute of Statistics Rwanda

Risk exposure data

Owing to the unavailability of complete data, the exact extent of the Rwandan road network remains unknown. As of 2019 Rwanda had a total road network of around 14,000 consisting of National roads, Districts roads (Class 1 & 2), feeder roads and unclassified roads.

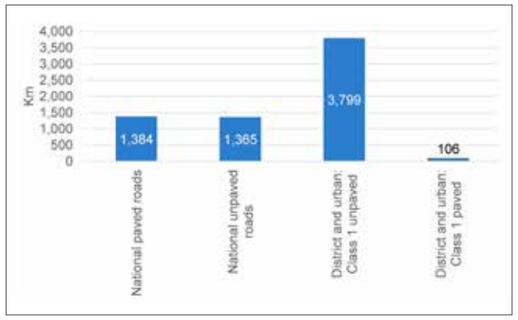
In 2019, the country had 1,973 km of paved roads, according to official data from Rwanda Transport Development Agency (RTDA) indicated. A road condition survey carried in 2019 showed that 96.5% of national paved roads and 73% of national unpaved roads were in good condition.

In 2018, Rwanda had 1,384 km of national paved roads and 1,365 km of national unpaved roads (Figure 83). Since 2010, the length of national paved roads has increased by around 15%, while that of unpaved national roads decreased of around 17.5%. Class 1 district roads are mostly unpaved (3,799 km, as against 106 km paved). The length of class 1 district roads has increased significantly from 2010 to 2018.

Considering only national and Class 1 district roads, it appears that around 77.5% of them are still unpaved. Class 2 district roads, feeder roads and unclassified roads are mostly unpaved. In 2018, Rwanda had 2,522 km of feeder roads.

Precise information on road length for other type of roads and in urban area is not available.

Figure 83 – Length of classified roads by type in Rwanda (2019)

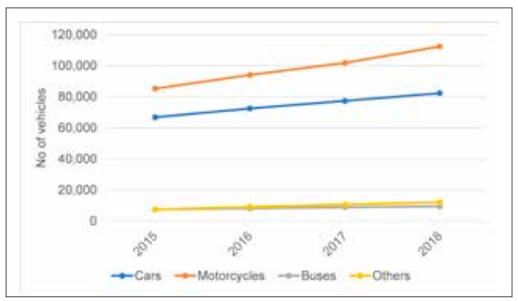


Source: Rwanda Transport Development Agency

Data on registered vehicles in Rwanda confirm a higher population of motorcycles compared to other vehicle types. The trend of registered vehicles in the country (Figure 84) shows an almost constant increase between 2015 and 2018. Around 3,900 cars and 6,800 motorcycles are registered in Rwanda yearly.

In 2018, the total number of registered motorcycles was around 112,000, compared to around 104,000 other vehicles.

Figure 84 – Trend of vehicles by type in Rwanda (2015-2018)

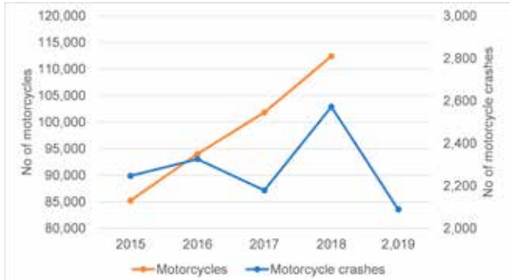


Source: National Institute of Statistics Rwanda

A comparison of the number of registered motorcycles and the number of crashes involving motorcycles from 2015 to 2018 shows a different trend (Figure 85). The number of registered motorcycles increased by around 32%; the number of crashes involving motorcycles increased by 14.5%. However, the big increase in the number of crashes involving motorcycles seems to be related mainly to worsening road safety conditions in 2018. If 2018 is excluded, the number of motorcycle crashes shows a decreasing trend (-7% from 2015 to 2019). However, the real possibility of the data for 2017 and 2019 being underreported makes it hard to ascertain the decreasing trend of motorcycle crashes. The number of motorcycle crashes increased by around 3.5% from 2015 to 2016 and decreased by around 6% from 2016 to 2017. In 2018, motorcycle crashes increased by around 18% compared to 2017. In 2019, they decreased by around 19%, 1% lower than 2018.

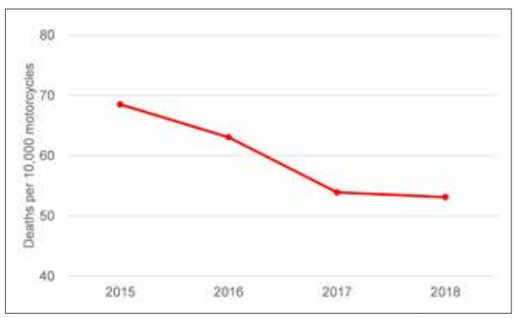
The number of motorcyclists fatalities compared to the number of registered motorcycles (that is the Motorcycle's Killing Potential or MKP) shows a decreasing trend (it decreased by around 22% from 2015 to 2018 - Figure 86).

Figure 85 – Trend of registered PTWs and crashes with PTWs in Rwanda (2015-2018)



Source: Traffic Police Rwanda / National Institute of Statistics Rwanda

Figure 82 – Motorcycle's Killing Potential in Rwanda (2013-2018)



Based on data from Uganda Police and the Uganda Bureau of Statistics

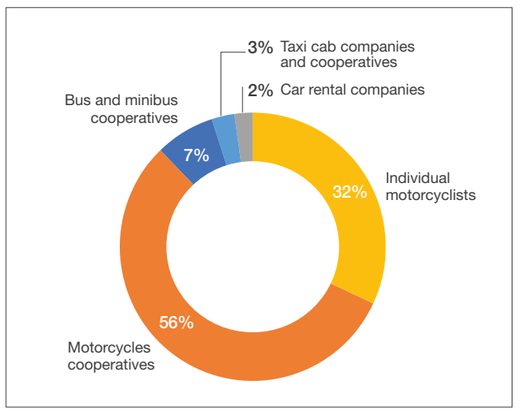
Regulation No. 008/trans/rt/rura/2018 of 21/12/2018, which governs motorcycle public transport services, stipulates that only holders of an operator's licence issued by the Regulatory Authority (RURA can operate a motorcycle for public transport service. Statistics on the number of licenced transport of persons operators show a prevalence of motorcycle cooperatives and of individual motorcyclists, together representing around 88% of the total licenced operators (Figure 87).

Data for the second quarter of 2019 reveal the existence of:

- 2,948 bus and minibus cooperatives.
- 21,578 motorcycle cooperatives.
- 12,502 individual motorcyclists.
- 731 car rental companies.
- 1,052 taxicab companies and cooperatives.

In the first and second quarters of 2019, the number of motorcycle cooperatives dropped by around 28%, but individual licenced motorcyclists increased by 140%. Possible explanations for this development include a relaxation in the law allowing individual operators as opposed to operators belonging to a co-operative, greater financial benefits and lower costs of individually operated moto-taxis or even lower attention to road safety. The Rwandan stakeholders attribute the change in the first and second quarters of 2019 mainly to motorcycle associations' internal budgetary constraints, which are perceived negatively by riders.

Figure 87 – Share of fleets for licenced transport of persons operators in Rwanda (Q2 2019)



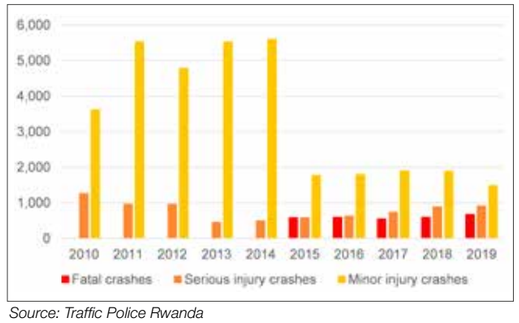
Source: National Institute of Statistics Rwanda

In the second quarter of 2019, 69 licenced driving schools were active in Rwanda. It is interesting to note that the total fleet of vehicles used by these driving schools comprised 308 cars and 735 motorcycles. This can be considered a positive aspect of motorcyclists' training (especially considering that, like other motorists, motorcyclists must obtain their driving licences through driving schools).

Road traffic crashes

Figure 88 shows a relatively consistent trend of both fatal and minor injury crashes between 2015 and 2019. Fatal crashes increased by around 15% from 2015 to 2019 (no data on fatal crashes are available before 2015). Serious injury crashes decreased by around 28% from 2010 to 2019. However, they increased by around 3% from 2018 to 2019. Minor injury crashes decreased by about 59% from 2010 to 2019. This drastic reduction could be the result of a lower registration of minor injury crashes. The short-term trend is also positive, with around 21% less minor injury crashes in 2019, compared to 2018.

Figure 88 –Road crash trend in Rwanda (2010-2019)



Source: Traffic Police Rwanda

Motorcycles are the vehicles mostly involved in road crashes in 2019 (Figure 89). This reflects the numerical superiority of motorcycles in Rwanda. There are more registered motorcycles than any other vehicles.

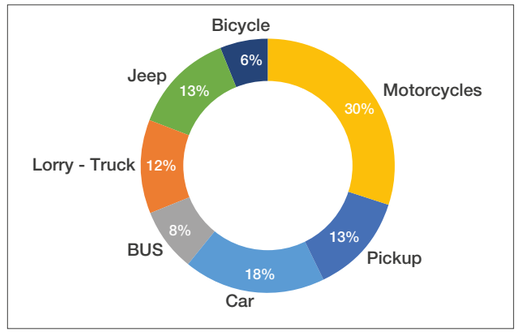
The road crash trend from 2010 to 2019, reveals a significant increase of motorcycle crashes from 2014 (Figure 90).

A similar increase of number of cases was reported for other vehicles in 2014. This could be due to an improvement of crash registration system from that year (even if no precise information on this is available). However, motorcycles seem to have worse road safety conditions than other vehicles.

From 2010 to 2019, motorcycle crashes increased by around 35%, while crashes involving other vehicles decreased by around 24%. Even if considering the period from 2014 to 2019 (after the likely improvement of crash recording), safety conditions of other vehicles improved (around 36% fewer crashes), while the motorcycles' remained almost constant (around 0.5% fewer crashes).

Generally, these figures confirm the serious road safety issues associated with motorcycles, due to their heavy presence on Rwandan roads.

Figure 89 – Vehicle involved in crashes in Rwanda (2019)



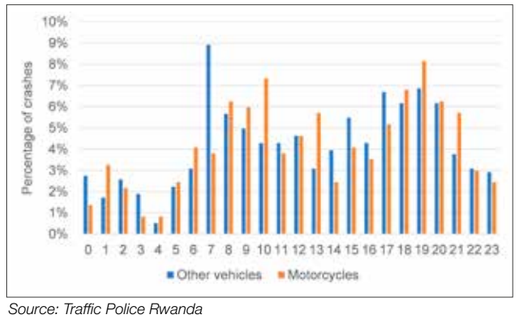
Source: Traffic Police Rwanda

Figure 90 – Trend of motorcycles and other vehicles involved in crashes in Rwanda (2010-2019)

Source: Traffic Police Rwanda

A comparison of crashes involving motorcycles and those involving other vehicles by time of day reveals similar trends (Figure 91). Some differences appear in specific times, such as 7:00 to 8:00 (low motorcycle crash percentage), 10:00 to 11:00 (high motorcycle crash percentage).

Figure 91 – Crashes by time of day in Rwanda (2019)

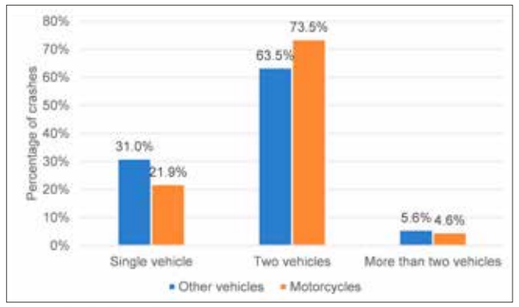


Source: Traffic Police Rwanda

Most of Rwanda's road crashes involve two vehicles (Figure 92). Relatively few involve more than two vehicles. Single vehicle crashes are not uncommon.

Differences appear when looking at crashes involving motorcycles. The rate of single vehicle crashes are lower for motorcycles (21.9%) than other vehicles ((around 31%). Conversely, motorcycles are mostly involved in two-vehicle crashes (around 73.5% of motorcycle crashes). This is probably attributable to the higher vulnerability of motorcycles compared to 4-wheeled vehicles.

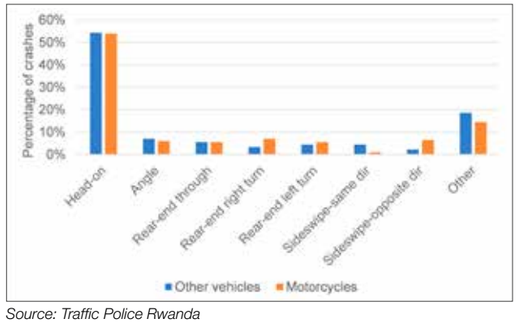
Figure 92 – Crashes by number of vehicles involved in Rwanda (2019)



Source: Traffic Police Rwanda

An analysis of crashes by type does not reveal significant differences between crashes involving motorcycles and those involving other vehicles. Figure 93 shows that in both cases 55% of crashes are head-on.

Figure 93 – Crashes by type in Rwanda (2019)

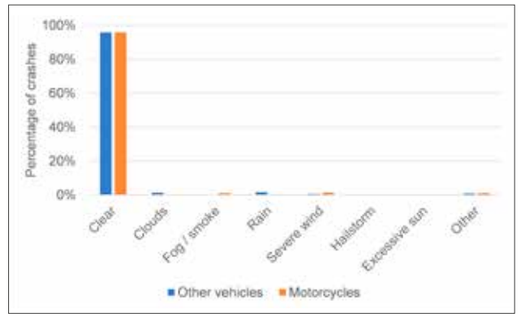


Source: Traffic Police Rwanda

Most of crashes occur in good weather conditions. In clear weather, motorcycles and other vehicle vehicles record about the same percentage of crashes (Figure 94).

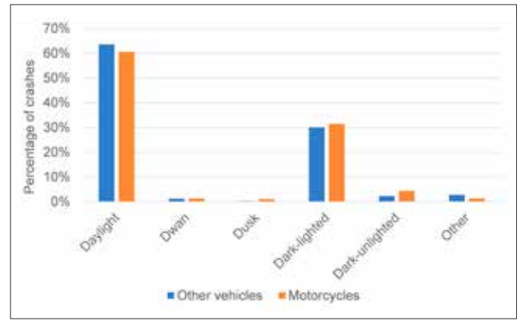
No important differences are also noticed for crashes by light conditions (Figure 95). Around 60% of crashes occur during daylight, while around 30% occur during night-time with presence of lighting.

Figure 94 – Crashes by weather conditions in Rwanda (2019)



Source: Traffic Police Rwanda

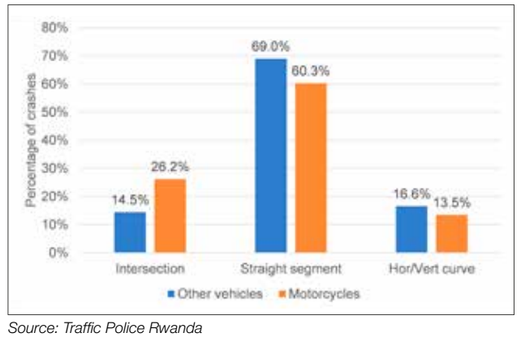
Figure 95 – Crashes by light conditions in Rwanda (2019)



Source: Traffic Police Rwanda

Most crashes occur along straight roads. There are fewer crashes at intersections (16.5%) and curves (13.5%). The situation is slightly different when looking at crashes involving motorcycles (Figure 96). In this case, crashes at intersections are around 26%, compared to 14.5% for other vehicles. Motorcycle crashes along straight roads are around 60%, compared to 69% for other vehicles. Indeed, intersections are usually more dangerous for motorcycles than for other vehicles. These figures could also be related to the failure to consider motorcycles when designing intersections.

Figure 96 – Crashes by location in Rwanda (2019)



Source: Traffic Police Rwanda

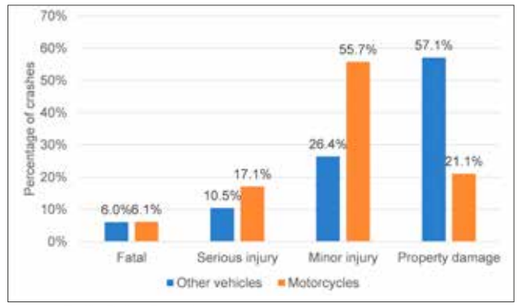
Figure 97 shows the percentage of crashes by severity. Fatal crashes represent around 6% of all crashes.

Crashes with serious and minor injuries are higher for motorcycles than other vehicles (around 17% and 56% and 17%, respectively). This difference is attributable to the higher vulnerability of motorcycles and the higher likelihood of motorcycle passengers of being injured in the case of a crash.

Conversely, only 21% of motorcycle crashes result in property damage, compared to 57% for the crashes of other vehicles.

It is worth mentioning that these data can be influenced by different levels of underreporting, especially crashes resulting in property damage.

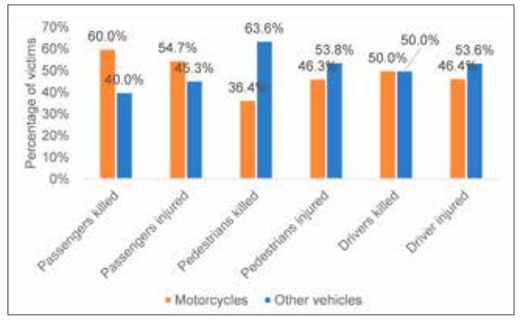
Figure 97 – Crashes by severity in Rwanda (2019)



Source: Traffic Police Rwanda

Crashes with motorcycles lead to the injuries and deaths of drivers/riders, passengers and road users (Figure 98). A staggering 60% of people killed in crashes involving motorcycles are motorcycle passengers, who also constitute 55% of the injured. For drivers, crashes with other type of vehicles are slightly more dangerous (half of drivers are killed and around 46% are injured in crashes with motorcycles). Crashes with motorcycles are less dangerous than other vehicles for pedestrians. These results could be misleading because the country has no data on the exposure of these road user categories.

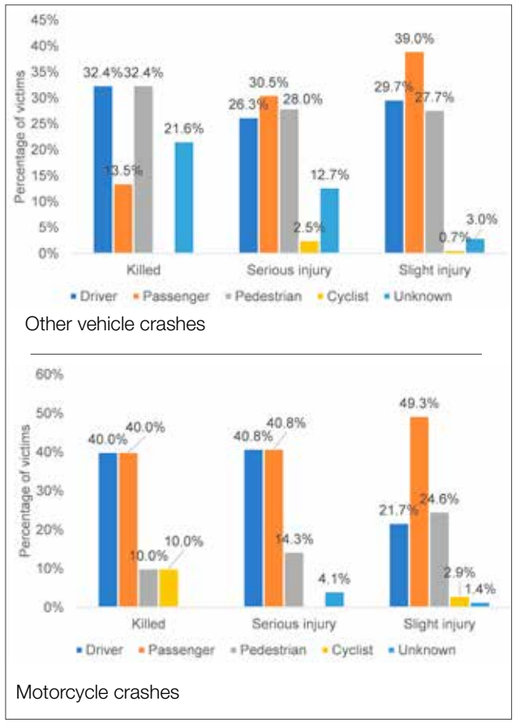
Figure 98 – Victims by type of road user in Rwanda (2019)



Source: Traffic Police Rwanda

Crashes with motorcycles increase the severity of crashes (Figure 99). The likelihood of the death or injury of riders and passengers is higher in crashes with motorcycles than in crashes with other vehicles. The severity of injuries of motorcycle riders is by far higher than drivers of other vehicles. However, slight injuries of motorcycle passengers are higher compared to the passengers of other vehicles. This is a clear indication of higher vulnerability of the motorcycles.

Figure 99 – Crash severity by type of user in Rwanda (2019)

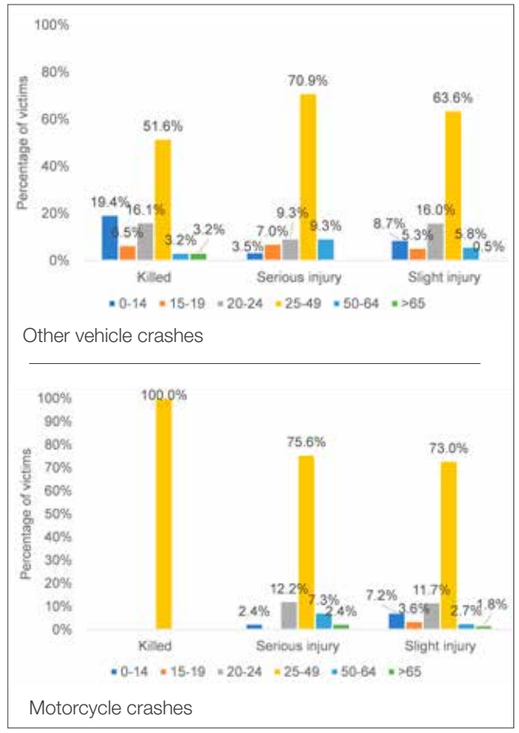


Source: Traffic Police Rwanda

Most crash victims are aged between 25 and 49. This applies to crashes involving both motorcycles and other vehicles (Figure 100). This is probably because people in this age bracket make the higher number of road trips. Moreover, it is likely that most of riders belong to this age group. IN Rwanda, people must be aged 15 and above to ride a motorcycle. For motorcycles caring passengers, the rider's minimum age is 17.

By gender, males constitute the majority of crash victims (Figure 101). The percentage of males killed or seriously injured in motorcycles crashes is higher than in other vehicles crashes. This can be attributed to the prevalence of male riders. Strangely, there is no record of female motorcycle users killed in road crashes. This could be due to women's low level of use of motorcycles (as riders and passengers). However, precise information was unavailable.

Figure 100 – Crash severity by age in Rwanda (2019)



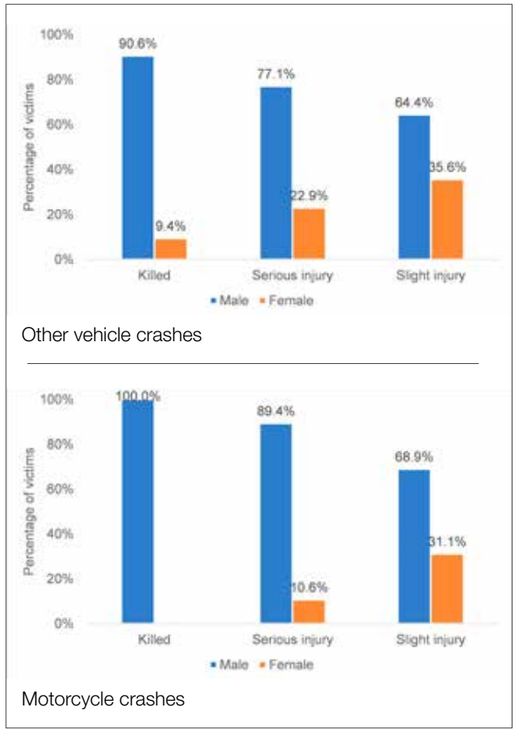
Source: Traffic Police Rwanda

Data from Rwanda's Department of Traffic Control & Road identify road users' bad behaviours, notably speeding and driving, as the primary causes of crashes in 2019 (Figure 102). Other causes, mostly related to mechanical failures, road conditions or weather conditions, are negligible.

Compared to 2010, the causes of road crashes in 2019 have changed. Crashes resulting from speeding and drink-driving have increased by around 23%, but those resulting from drink-driving have reduced by around 10%. This reduction could be linked with higher level of enforcement and sensitisation activities promoted by the Highway Police Rwanda.

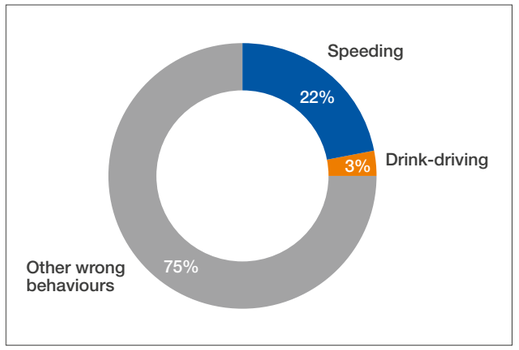
Crashes associated with mechanical failures have reduced by around 10% (confirming the opinion of Rwanda stakeholders on good quality of vehicles). The reverse was the case for crashes caused by poor road conditions; they increased by around 33% from 2010 to 2019.

Figure 101 – Crash severity by gender in Rwanda (2019)



Source: Traffic Police Rwanda

Figure 102 – Road crashes by reported cause in Rwanda (2019)



Source: Traffic Police Rwanda

Road safety legislation and standards

Various laws and standards introduced in Rwanda have the potential of improving road safety (Table 13). Enforcement is crucial to the reduction of the risks of road crashes. According to stakeholders consulted, the current Police enforcement system in Rwanda is effective, especially when considering helmet wearing.

Table 13 – Road safety legislation and standards in Rwanda

TOPIC	LEGISLATION / STANDARD	YEAR OF ISSUE	VALUE / COMMENT
Speed	Max limit on urban roads	2003	60 km/h (40 km/h for public transport vehicles)
	Max limit on rural roads	2003	80 km/h (60 km/h for public transport vehicles)
	Max limit on national roads	2003	80 km/h (60 km/h for public transport vehicles)
Mobile phone	Hand-held prohibited	-	Yes
	Hands-free prohibited	-	No
Alcohol	BAC limit (blood alcohol level)	-	0.8 g/ml
	BAC limit (breath alcohol level)	-	0.8 g/ml
	BAC limit for learner drivers	-	-
Driving licence	Threshold for drivers	2003	18 years old
	Threshold for riders	2003	15 years old (if carry of other person: 17 years old)
	Mandatory licence for riders	2003	Yes
	Mandatory training for riders	2003	Yes
	Training theoretical and practical	2003	Yes
	Minimum hours of practical training	-	-
Education	School programmes	-	No specific programmes
	Programmes for motorcyclists	-	No specific programmes
Technical inspections	Mandatory for cars	2003	Yes
	Mandatory for motorcycles	-	No
	Existence of standards for motorcycles	2016	Yes
Awareness campaigns	Specific for motorcycles	-	Yes
Helmet	Existence of helmet law	2003	Yes
	Law requires helmet fastening	2003	Yes
	Law refers to helmet standards	-	No
	Law applies to riders and passengers	2003	Yes
	Law applies to all type of roads	2003	Yes
	Law applies to all engines	2003	Yes
	Restriction for child passengers	-	Prohibited for children under 7 years old

SPIs and risk indicators

Motorcycles (especially moto-taxi services) are the main means of transportation in Rwanda. Stakeholders consulted for this study indicated that the quality of motorcycles is generally good (because of moto-taxi riders' willingness to maintain their vehicles in good quality). However, there is no provision for technical inspection of motorcycles.

The unavailability of precise official data on risk indicators necessitated the conduct of field surveys (similarly to those conducted on the other countries under research).

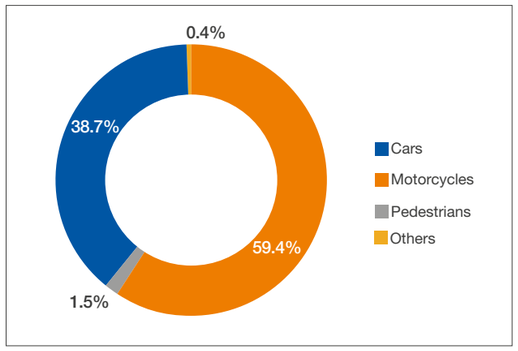
The results of the surveys conducted in Rwanda are reported in Annex 7.

A key part of the survey was a mall-scale vehicle count. on two urban roads (main and local) in peak and off-peak traffic.

The counting confirms the large presence of motorcycles in Rwanda (Figure 103). Around 59% of the vehicles counted during the surveys were motorcycles, followed by cars (39%). It is interesting to note that relatively few pedestrians were counted on that roads (1.5%) and that other types of vehicles represent a small portion of the total.

An analysis of road crashes shows that the high presence of motorcycles and other vehicles is a risk factor due to the mixture of different types of vehicles (of various shapes and sizes). Clearly, in this case, motorcyclists are the most vulnerable road users.

Figure 103 – Share of vehicles and pedestrians in Rwanda



Most motorcycles observed on the roads were estimated to be of good quality (confirming the opinions of stakeholders consulted as part of the study). A total of 10.5% of motorcycles were estimated to be of medium or poor quality (Figure 104). The quality of vehicles was also confirmed by the estimated age of recorded motorcycles (Figure 105). The estimated ages of 74.5% of the motorcycles were five years and above.

Figure 104 – Share of vehicles and pedestrians in Rwanda

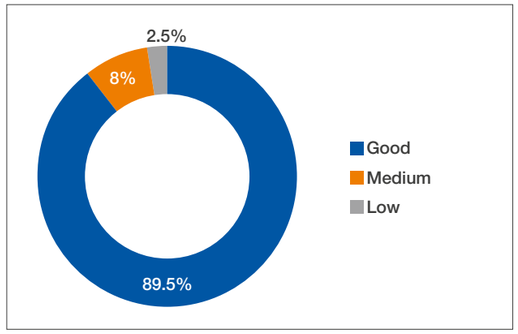
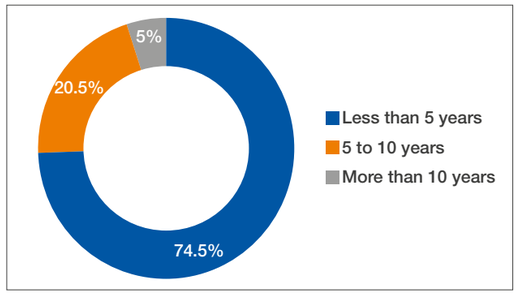


Figure 105 – Estimated motorcycle age in Rwanda

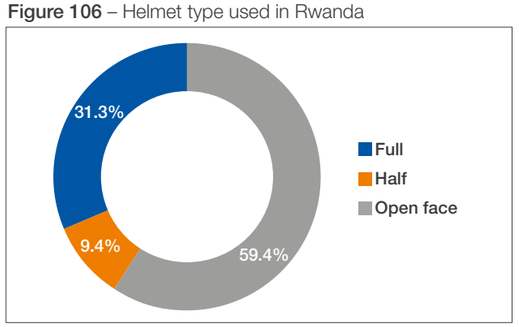


The use of helmets by both riders and passengers is very high in Rwanda. All riders and passengers of motorcycles observed were wearing helmets, with chin straps. This confirms the high level of attention given to safety by moto-taxi associations, as well as the effectiveness of police enforcement.

A little over 31% of the helmet used are "full face" (the safer type). This could be a risk factor. Nearly 60% of the helmets used are "open face" (Figure 106). The extensive use of this type of helmet is due to weather conditions (very warm), but also to the COVID pandemic (a Government decree suggest not using different type of helmets due to sanitary conditions).

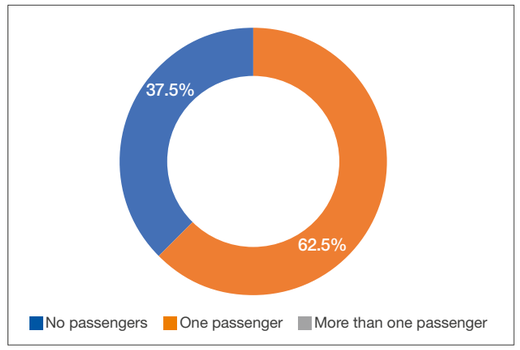
The helmet quality for all riders and passengers was estimated to be "good". It is important to stress that the helmet quality has been recorded subjectively by observation. The reliability of this information is therefore only indicative.

Figure 106 – Helmet type used in Rwanda



The average number of passengers on motorcycles is around 0.6 passengers. The country's traffic law limits the number of motorcycle passengers to one. Police enforcement of the law is deemed to be effective. Around 62% of motorcycles have one passenger on board — and obvious reflection of the large number of moto-taxis (Figure 107).

Figure 107 – Number of passengers per motorcycle in Rwanda



Road safety practices

As seen from previous sections, road crashes remain a serious problem in Rwanda. However, some of the positive actions initiated by the government — notably, regulation of moto-taxi services, accompanied by Sensitisation activities and Traffic Police enforcement — are progressively producing results.

Like many African countries, particularly in Central and West Africa, the moto-taxi is the predominant mode of public transportation in Rwanda. However, compared to other African countries, this sector is highly organised. The operation of public transport motorcycles is governed by precise rules, which are generally well enforced.

Regulation No. 008/trans/rt/rura/2018 of 21/12/2018, which governs motorcycle public transport services, stipulates that only holders of an operator's licence issued by the Regulatory Authority (RURA) can operate a motorcycle for public transport services.

The existence of this regulation helped to improve safety conditions of motorcyclists, particularly the basic safety features associated with obtaining a licence, as well as:

- wearing helmets;
- making helmets available to passengers;
- carrying only one passenger;
- wearing reflective jackets (mandatory for riders);
- properly maintaining the motorcycle (even though technical inspections are not mandatory;
- respecting traffic rules; and
- using a smart meter (a device that calculates passenger fares based on a combination of distance and waiting time) if operating in Kigali.

Most of these basic safety features are applied by motorcycle users and enforced by Police.

These practices are the result of the government's political will to ensure motorcycle safety. In 2006, the government banned moto-taxi because the riders did not belong to cooperatives. After this action and the reorganisation of the moto-taxi sector, the government re-opened the services with success.

The regulation for moto-taxi services was accompanied by actions focusing on:

- sensitisation on the value of motorcycle cooperative membership;
- education (especially for learner riders) on traffic laws, road safety, customer service, riding technique and basic repairs; and
- enforcement of road safety practices by cooperatives and the Highway Police.

Currently, several moto-taxi riders belong to a cooperative and hold an operating licence issued by RURA. Affiliation with a cooperative is not mandatory and could be reducing, as evidenced by the significant increase in the number of single licences from the first quarter 2019 to second quarter 2019 (more recent data were unavailable).

In 2015, the Government introduced a regulation governing passenger transportation. The regulation, No. 007/TRANS/RT/RURA/2015, includes provisions for moto-taxi services and was integrated into Regulation No. 008/trans/rt/rura/2018 of 21/12/2018 (a regulatory framework dealing specifically with motorcycle passenger transportation across Rwanda).

The regulation applies to all individual operators, companies or cooperatives carrying operating or intending to operate passenger road transportation services using motorcycles in Rwanda. The Regulation's main stipulations are that:

- no person can operate motorcycle for public transport service without an operation's licence issued by RURA (through an online application);
- two categories of authorisations can be issued: cooperative authorisation or individual authorisation;
- all motorcycles must have a valid commercial insurance;
- motorcycle Intelligent Connected Fare Meter (smart meters) must be used; and
- operators must:
  - transport no more than one (1) passenger at a time,
  - be neatly dressed (and keep the motorcycle clean),
  - park and operate in area designated by competent authority, o have two helmets (one for rider and one for passenger),
  - always wear a reflective jacket, and
  - not carry oversized luggage.
- RURA can conduct physical inspections (announced or unannounced) of these facilities.

In 2019, Rwanda had some 70 registered cooperatives operating around 34,000 motorcyclists.

Cooperatives ensure that all their riders respect of safety rules, such as wearing helmets and providing them to passengers, carrying only one passenger, wearing reflective jackets, respecting speed limits, etc.

They also conduct training and sensitisation exercises. These practices are combined with strict enforcement by Highway Police. Field surveys and consultations with stakeholders confirmed effective police enforcement of the rules (on helmet use, wearing of reflective jacket by riders, cleanliness of motorcycles, and limitation to one passenger) and a near-total compliance by riders.

However, the stakeholders noted that speeding and drink riding remained challenges.

The modernisation of the moto-taxi sector is ongoing. Currently, passengers can use "Uber-like" applications to book services and to track riders.

In 2020, RURA issued a new regulation on the use of smart meters in motorcycle transport services, stipulating that:

- from August 2020, only moto-taxis with smart meters are permitted to operate in the city of Kigali;
- moto-taxi riders operating in provinces can temporarily continue to operate without smart meters, but are required to adhere to cashless payment methods;
- passengers in Kigali are required to use only moto-taxis with smart meters, and adhere to cashless payment methods (based on meter readings); and
- moto-taxi riders should operate their motorcycles responsibly, for their and their passengers' safety.

Projects are being designed to equip motorcycles with tracking devices, to further ensure respects of rules.

The regulation of the industry in Rwanda is making moto-taxi service highly profitable. Most of the riders own the motorcycle (mostly imported cheaply from India).

The Rwandan government is also promoting the use of technologies supporting delivery of moto-taxi services and, in turn, increasing road safety. For instance, applications for on demand services (Uber-like systems) are being used in Rwanda. Companies like "CanGO" and "SAFIRIDE" developed smartphone applications for the booking of moto-taxi rides. These services bolster road safety. Indeed, these booking services allow the users to be sure to select authorised services and riders attentive to safety features. Such services weed out illegal services and unreliable riders (thanks to the possibility for users to leave feedback on services received). Moreover, some of these companies can organise training for riders.

Technological developments being discussed at government level include the possibility of mounting tracking devices on motorcycles to track riders' behaviours on the road.

The Rwandan Government is also actively in promoting training and education in road safety. The traffic police organises occasional communication and sensitisation sessions on road safety. In May 2019, the government organised a weekly campaign under the theme "Leadership for Road Safety", in the framework of the 5th UN Global Road Safety Week. Other road safety initiatives include technical inspection of four-wheel vehicles, construction of roads and installation of traffic signs.

Despite the existence of regulations for motorcycle services, many riders are still operating moto-taxi services without an official licence. Stakeholders consulted as part of this study estimated that up to 45% or riders operate without licences. However, according to Rwandan stakeholders, the number of illegal services is reducing almost constantly year by year. According

to stakeholders, stopping illegal services is challenging because it is impossible to stop and check all riders, especially in the provinces.

Aspects that still require attention include the unreliability of crash data collected on paper and not encoded in a database.[55]

Rwanda has not appointed a lead agency for road safety; the road safety management function is the responsibility of the national ministry. The government established a National Road Safety Committee to co-ordinate road safety management across all tiers of government and with all stakeholders. The committee falls under the responsibility of the Rwanda Transport Development Authority (RTDA) and involves all major stakeholders (such as the police, and government Ministries). The committee meets monthly and issues action plans for the implementation of road safety policy. Action plans set targets, which are monitored and reported quarterly. According to stakeholders, penalties are foreseen for non- achievement of set targets, but the policing of targets will call on resources needed to implement future actions.

Consultations with stakeholders from the Ministry of Infrastructure, RURA, and RTDA revealed the following additional details.

The government has set standards for vehicles (including motorcycles from 2016) and is currently developing standards for helmets. are in place in the country, there are currently no standards for helmets to ensure protection for motorcycle riders and passengers.

Stakeholders rate the quality of motorcycles as generally good, especially because riders are encouraged to maintain them properly. However, periodic technical inspections of motorcycles are not compulsory (as is the case for other vehicles), and there is no clear vehicle scrapping policy. The absence of mandatory inspections and a vehicle scrapping policy accounts for the operation of many unroadworthy motorcycles, which pose significant road safety risks.

The Rwandan approach to road safety is primarily the regulation of operations. The government has in place adequate regulations on the licencing of public transport services, vehicle and driver requirements, conditions of operation, etc. Some challenges persist in the areas of monitoring and enforcing of regulation compliance of the huge number of motorcycles on Rwandan roads. With the support of moto-taxi associations, the Highway Police is effectively enforcing rules such as helmet use and the single passenger limit. However, motorcycles' standards and roadworthiness are not monitored and enforced because of the absence of regulation on periodic technical inspections).

Private and commercial vehicles have different speed limits for rural and urban roads.

- On rural roads, the speed limit is 80 km/h for private vehicles and 60 km/h for commercial vehicles (including moto-taxis).
- On urban roads, the speed limit is 50 km/h for private vehicles and 40 km/h for commercial vehicles (including moto-taxis).

These additional safeguards are crucial, given the large number of commercial vehicles. It is important to note that the degree of compliance and levels of speed enforcement are unclear. A further problem is that the road infrastructure design makes no allowance for motorcycles/moto-taxis. All roads in Rwanda are single carriageway, with relatively low design and operating speeds. Conspicuously absent are dedicated lanes for motorcycles, advanced stop line at intersections and other related features.

According to the stakeholders consulted during this study, the Rwanda government's response to the increase in crash risks related to the use of motorcycles is to gradually phase out moto-taxis and replace them with other more effective and safer forms of public transportation (buses, for example). No precise plan is available. However, in the future, motorcycles could operate only in suburbs, and not in city centres. A transition to more environmentally friendly electric motorcycles is also being considered. Although there are no indications that it intends to completely phase out motorised 3-wheelers, the Rwanda government does not encourage their operation, especially because of their negative impact on congestion.

[55] The crash data analysis in Rwanda is based on a sample of data forms received by Traffic Police and coded by the Consultant.

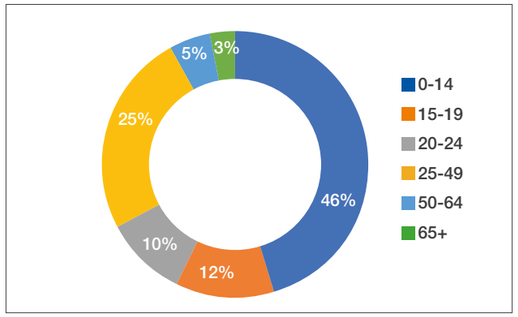
4.4 Motorcycle safety in Uganda

Socio-economic indicators

Uganda has recorded a steady annual population growth of 2.5% for several years. In 2018, the population was around 39 million.

A large part of the population is young; children under the age of 15 make up 46% of the population. A quarter of the population is aged 25-49. By contrast, the aged population is low — (people aged 50-64 constitute 5% and people above the of 65 represent 3% (Figure 108).

Figure 108 – Share of population by age group in Uganda (2018)



Source: Uganda Bureau of Statistics

The decrease crash and injury rates,[56] by about 45% between 2009 to 2018, shows a general improvement of road safety in the country (Figure 109).

It should be noted, however, that there are various types of crashes: fatal crash, serious injury crash, light injury crash, as well as crashes that result only in property damage. The improvement can thus be linked to factors influencing one type of crash, or to the underreporting of some of these events.

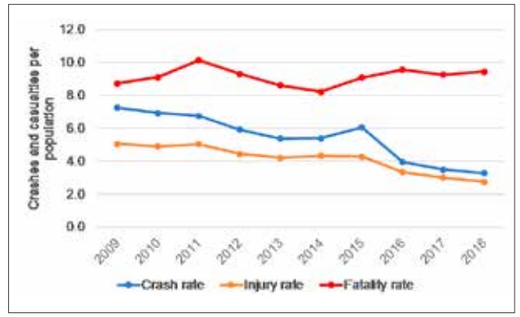
Similarly, the injury rate has also decreased of around 45%. In this case also, the information refers both to slight and serious injuries, having different levels of underreporting.

The reverse was the case for fatality rates, which increased by about 8% from 2009 to 2018. While the higher value of fatality rate was reached in 2011, followed by decrease until 2014, since 2014, the trend since 2014 has been a constant increase. Factors that could be responsible for negative trend include, economic growth leading to an increase in motorisation, as well as a better road network.

[56] Crash rate is the number of crashes per 10,000 people.
Injury rate is the number of injuries per 10,000 people.
Fatality rate is the number of fatalities per 100,000 people.

Disparities in crash, injury and fatality rates may be traceable to varying levels of underreporting. Generally, the authorities report almost all fatalities but leave out crashes with minor or no injuries.

Figure 109 – Trends of crash and casualty rates in Uganda (2009-2018)



Source: Uganda Police / Uganda Bureau of Statistics

The Ugandan economy recorded significant growth between 2009 and 2018 (Figure 110). Even if with some fluctuations, the GDP per capita has increased by around 25%, reaching about USD 725.

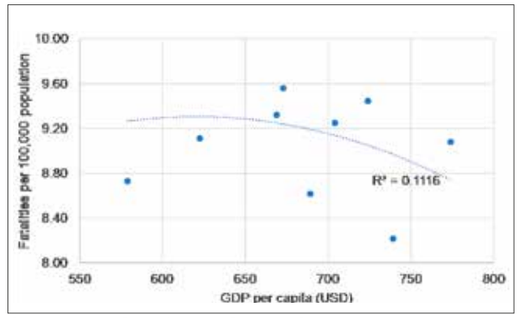
The relationship between the economic growth and road crash trends is relatively stable (Figure 111). The economic growth seems to lead to a decrease of road fatalities. These results are influenced by the unreliability of official crash data because of underreporting). For instance, WHO (2018) estimated around 3.4 times more road traffic fatalities than those recorded by the Ugandan government.

As in the case of Burkina Faso (Figure 28), a clear trend cannot be identified. Some contradicting correlations between GDP and fatality rate can be identified. Similar GDP values are associated with different fatality rates.

Figure 110 – Trend of GDP per capita in Uganda (2009-2018)

Source: Uganda Bureau of Statistics

Figure 111 – Relationship between GDP per capita and fatality rate in Uganda (2009-2018)



Source: Uganda Police / Uganda Bureau of Statistics

Risk exposure data

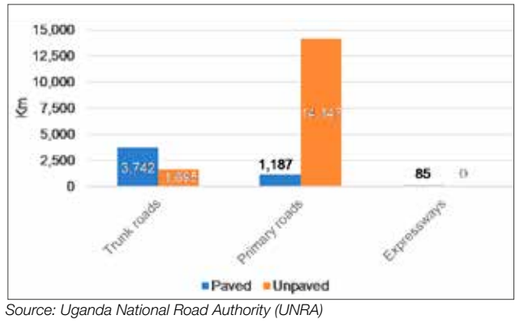
The data on Uganda's road network are incomplete. In 2013, the government reported a total length of around 74,000 km of national, district, community, and urban roads. However, the length of the district roads appears to be overstated, possibly doubled.

According to the official data from Uganda National Road Authority (UNRA), the classified road network in rural areas was 20,856 km long in 2018 (Figure 112). Most of the network is composed of primary roads (around 73% of the total network), followed by trunk roads (around 26%). There are also two expressways. Precise information on the total length of urban roads is unavailable.

Around 75% of unclassified roads are unpaved. The majority of paved network consists of trunk roads; few primary roads are paved (only 8% of the total primary roads).

The high percentage of unpaved roads is a risk factor for road users. Unpaved roads increase the probability of single vehicle crashes, especially by motorcycles. Usually, unpaved roads rapidly deteriorate due to adverse weather conditions or even just because of vehicular traffic.

Figure 112 – Length of classified roads by type and surface in Uganda (2018)

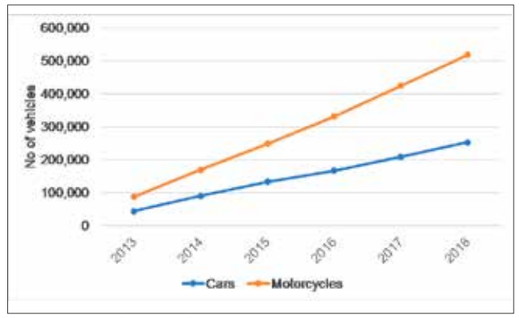


Source: Uganda National Road Authority (UNRA)

The data collected on the number of vehicles in Uganda confirm the higher presence of motorcycles than other vehicles. The number of registered vehicles increased significantly from 2013 to 2018 (Figure 113). Every year, around 50,000 cars are registered in Uganda, compared to around 103,000 motorcycles.

In 2018, the number of registered motorcycles was around 520,000, compared to around 253,000 cars. Despite these numbers, the Uganda Revenue Authority estimates that another 500,000 vehicles are not registered in the system, leading the total number to more than 1.2 million vehicles.

Figure 113 – Trend of registered motorcycles and cars in Uganda (2013-2018)

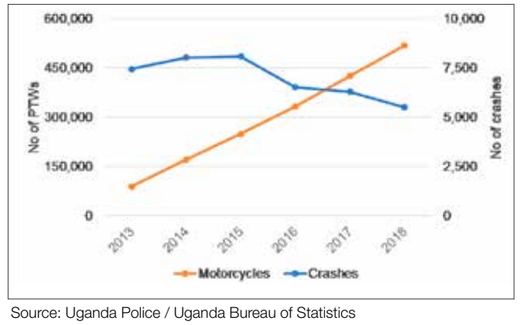


Source: Uganda Bureau of Statistics

A comparison of the rates of motorcycle registration and crashes involving motorcycles shows a change in trend in 2015 (Figure 114). Until 2013, both the number of registered motorcycles and of the number of motorcycle crashes were on the increase. From 2016 to 2018, the number of motorcycle crashes dropped. This pattern could be related to either road safety improvements (better roads, improvements in vehicle quality, measures to increase helmet wearing, etc.) or lack of reliable registration of crashes.

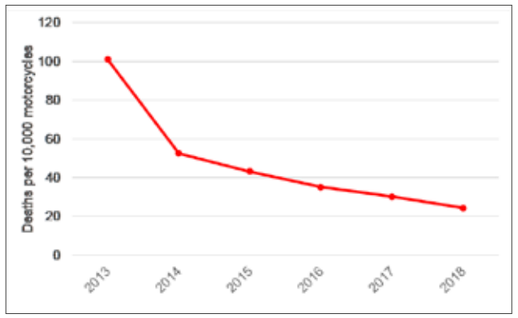
The number of motorcyclists fatalities compared to the number of registered motorcycles (that is, the Motorcycle's Killing Potential or MKP) shows a decrease by around 76% from 2013 to 2018 – (Figure 115).

Figure 114 – Trend of registered PTWs and crashes with PTWs in Uganda (2013-2018)



Source: Uganda Police / Uganda Bureau of Statistics

Figure 115 – Motorcycle's Killing Potential in Uganda (2013-2018)



Source: Elaboration of data provided by Uganda Police / Uganda Bureau of Statistics

Statistics on licenced public vehicles show a prevalence of "public service vehicles operators" (representing 69% of the total licenced commercial vehicles), following by "Boda-Boda" (moto-taxi), which represents around 20% of the total.

Below is the tally of licenced commercial vehicles in 2019:

- 13,714 commuter taxis (the most used means of transport);
- 7,493 Boda-Boda (a small number compared to registered motorcycles, because very few riders bother to get this licence);
- 1,283 medium-sized buses; and
- 947 buses.

It is worth mentioning that the licences issued to Boda-Boda had the strongest increase from 2013 to 2017 (220% in five years). Commercial vehicle operators increased only by 11%.

The number of riders tested for license in 2018 stood at only 2% of the number of registered motorcycles in the country. However, these tests are conducted by police as a prerequisite to applying for a driving permit.

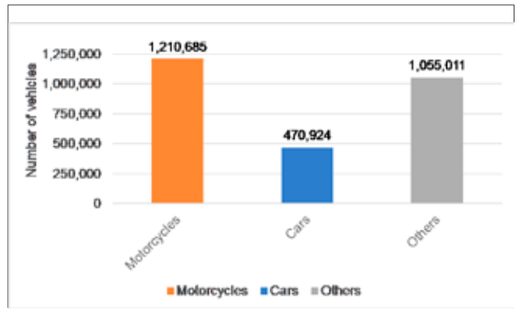
A study conducted at Mulago National Referral Hospital in Kampala indicated that the treatment of motorcycle crash victims claimed 62.5% of the hospital's annual surgery budget.

Motorcycles are clearly the most used means of transportation in Uganda. Traffic surveys conducted on almost all the classified roads in 2018 showed that motorcycles represent around 44% of the Annual Average Daily Traffic (AADT) (Figure 116).

Motorcycles' domination of the road traffic is directly linked safety conditions. Indeed, the fatality rate of motorcycles (ratio between fatalities and amount of traffic) is higher than that of other vehicles. In 2018, the fatality rate of motorcycles was around 104 deaths per 100,000 motorcycles. That of other vehicles was on average around 66 deaths per 100,000 vehicles.

These figures underscore the high vulnerability motorcyclists are. The number of motorcyclists' deaths in road crashes is higher than the deaths of users of other vehicles (Figure 123).

Figure 116 – AADT by mean of transport in Uganda (2018)



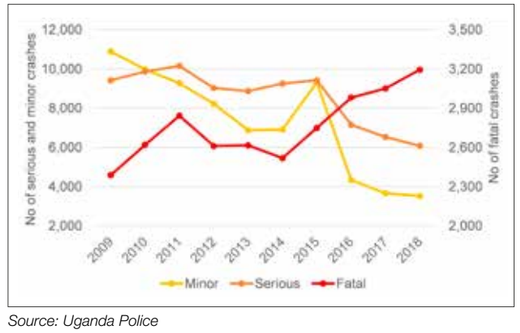
Source: Uganda Police / Uganda Bureau of Statistics

Road traffic crashes

The Uganda Police road traffic data show a decrease in the number of crashes from 2009 to 2018 (Figure 117). The number of crashes in 2018 was around 43% lower than in 2009. This general road safety improvement is mainly due to a decrease in the number of injury crashes (possibly linked to the underreporting of crashes). Over the same period, fatal crashes increased by around 34%.

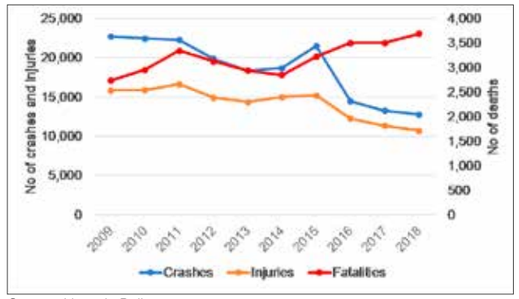
Casualty rates followed a similar trend (Figure 118). While the number of injuries has decreased of around 32% from 2009 to 2018, the number of road crash casualties increased by about 34%. The trend of increase is fatalities has remained almost the same since 2014.

Figure 117 – Trend of crashes in Uganda (2009-2018)



Source: Uganda Police

Figure 118 – Trend of crashes and casualties in Uganda (2009-2018)

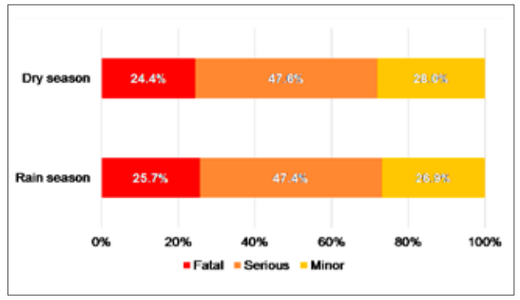


Source: Uganda Police

Most African countries have two main seasons: dry and rainy seasons. The percentages of fatal, serious, and minor crashes during the dry and rain season are almost identical (Figure 119).

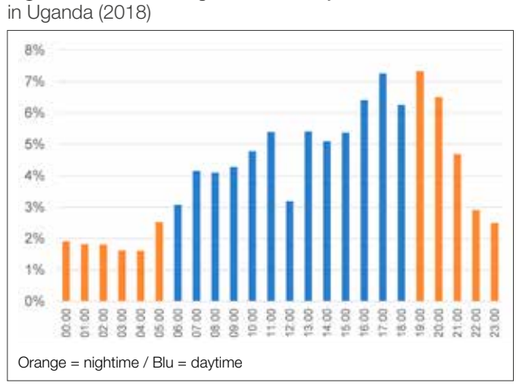
The time of the day is a stronger factor. Around two thirds of crashes occur during the daytime and the highest percentages of crashes occur between 16:00 and 21:00 (Figure 120). This is probably due to a high concentration of traffic during this period.

Figure 119 – Crashes by season in Uganda (2018)



Source: Uganda Police

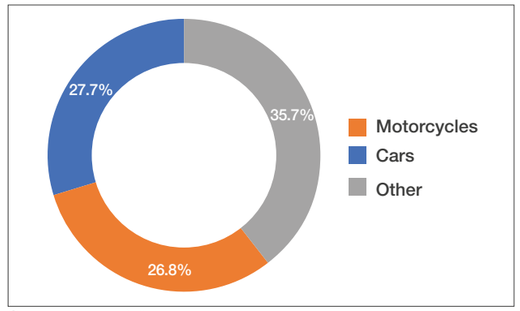
Figure 120 – Percentage of crashes by hour in Uganda (2018)



Source: Uganda Police

In 2018, around 27% of vehicles involved in road crashes were motorcycles — cars represented around 28%, and other vehicles (trucks, buses, and similar) constituted about 36%. (Figure 121). This could indicate that most of the conflicts occur between motorcycles and other vehicles, with limited cases of single motorcycle crash or collision by two motorcycles.

Figure 121 – Share of vehicles involved in crashes in Uganda (2018)



Source: Uganda Police

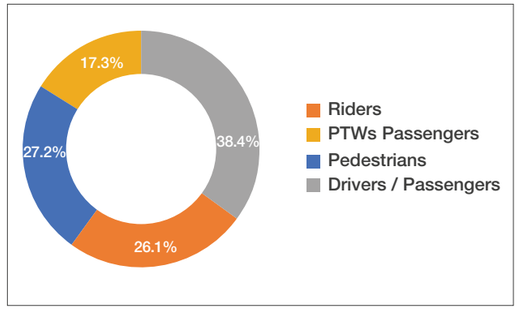
The data on casualties by type of road user highlight the vulnerability of pedestrians and motorcyclists (Figure 122). In 2018, around 43% of casualties were riders or passengers (with a prevalence of riders as casualties). Pedestrians constituted around 27% of the total casualties.

The casualties' severity level varies according to the type of road user (Figure 123). It is not surprising that the higher percentage of fatalities is related to pedestrians (around 38.5% of all fatalities), followed by riders and passengers (around 34% of fatalities together). The higher the vulnerability, the higher the risk of being killed.

Conversely, around 41% of the injured were riders and passengers; around 20% were pedestrians. This significant difference between fatalities and injuries can be due to various factors, such as the high presence of motorcycles creating a kind of "critical mass effect".

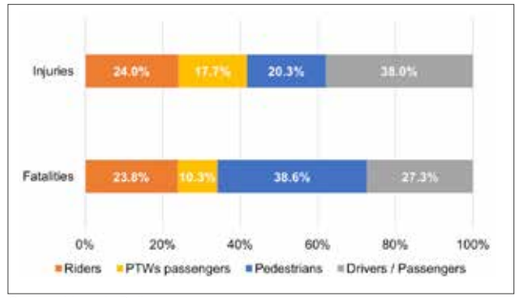
According to the 2018 Police Report, moto-taxi riders are second to pedestrians in fatalities by road user groups. However, adding rider and passengers, motorcyclist fatalities are very close to that of pedestrians (34.1% compared to 38.6%). Even then, injured moto-taxi riders and passengers are the highest group on the injury scale (Figure 123).

Figure 122 – Share of casualties by road user type in Uganda (2018)



Source: Uganda Police

Figure 123 – Share of fatalities and injuries by road user type in Uganda (2018)

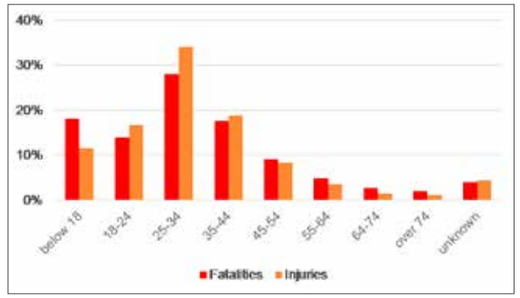


Source: Uganda Police

An examination of crash victims by age group highlights the influence of vulnerability on the number of fatalities and severity of injuries (Figure 124). Most of the people killed in road crashes in 2018 were aged between 25 to 34. This is to be expected because people of this age group are the most active road users.

The reverse is the case for younger travellers — their fatality rates are significantly higher than injury rates. People aged between18 and 44 are more likely to be injured than killed in road crashes. The situation is the reverse for all people aged less than 18 and aged more than 55 (the most vulnerable ones).

Figure 124 – Share of fatalities and injuries by age group in Uganda (2018)



Source: Uganda Police

According to the data provided by the Uganda Police, at least 92% of casualties recorded in 2018 were associated with road users' behaviours (careless driving, over speeding, abuse of alcohol, etc.). Only 2.7% of crashes are attributed to mechanical issues (Table 14).

These data are open to question because they are largely generic and indicate single causes of crashes. Road crashes are always the results of a combination of factors (related to road infrastructure, vehicle conditions, road users' behaviours, environment, etc.).

Table 14 – Recorded cause of casualties in Uganda (2018)

Recorded cause of casualties	Percentage (%)
Careless driving	80.2%
Over speeding	2.5%
Over loading	1.2%
Alcohol abuse	0.9%
Careless pedestrian	7.6%
Fall from vehicle	0.9%
Mechanical issues	2.7%
Other	4.0%

Road safety legislation and standards

Uganda has a variety of road safety laws and standards (Table 15).

However, an assessment of the country's road safety data and consultations with stakeholders revealed inadequate enforcement of the laws and standards, especially those related to motorcycles (for instance, helmet use, technical inspections, overloading).

Table 15 – Road safety legislation and standards in Uganda

TOPIC	LEGISLATION / STANDARD	YEAR OF ISSUE	VALUE / COMMENT
Speed	Max limit on urban roads	2018	50 km/h
	Max limit on rural roads	2018	80 km/h
	Max limit on national roads	2018	100 km/h
Mobile phone	Hand-held prohibited	2014	Yes
	Hands-free prohibited	2014	No
Alcohol	BAC limit (blood alcohol level)	2004	0.8 g/ml
	BAC limit (breath alcohol level)	2004	0.35 g/ml
	BAC limit for learner drivers	-	Not available
Driving licence	Threshold for drivers	2018	18 years old
	Threshold for riders	2018	18 years old
	Mandatory licence for riders	2016	Yes
	Mandatory training for riders	2016	Yes
	Training theoretical and practical	2016	Yes
	Minimum hours of practical training	-	60 hours
Education	School programmes	-	No specific programmes
	Motorcyclists programmes	-	No specific programmes
Technical inspections	Mandatory for cars	2016	Yes
	Mandatory for motorcycles	2016	No
	Existence of standards for motorcycles	2012	No
Awareness campaigns	Specific for motorcycles	-	Yes (yearly)
Helmet	Existence of helmet law	2003	Yes
	Law requires helmet fastening	2006	No
	Law refers to helmet standards	2006	no
	Law applies to riders and passengers	2003	Yes
	Law applies to all type of roads	2003	Yes
	Law applies to all engines	2003	Yes
	Restriction for child passengers	2003	No

SPIs and risk indicators

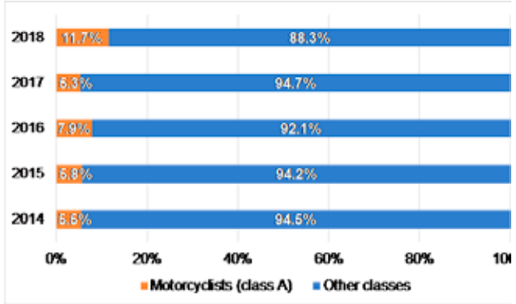
Despite the large number of motorcycles on Ugandan roads, there is no mandatory technical inspection. The reported average age of motorcycles is one year, which is impressive if compared to other vehicles (around 15 years). However, it appears that most of the motorcycles sold in Uganda were imported from China and India and have a low service life (three years on average), which significantly impacts their quality.

In 2018, 87,455 learner drivers were tested for driving competence at the various testing centres throughout the country. Cars and dual-purpose vehicles (Class B) had a higher number of learner drivers tested than motorcycles (Class A).

The number of learner riders was significantly higher in 2018 than in previous years. There were around 2.5 more learner riders in 2018 than in 2014 (Figure 125). This increase could be due to various factors, such as the increase of Boda-Boda services in the country.

However, if the number of registered motorcycles registered is considered, the number of learner riders seems to be quite low, compared to other vehicles. There could be a risk factor associated with low or missing riding training.

Figure 125 – Drivers tested per class of driving permit in Uganda (2014-2018)



Source: Uganda Police

Enforcement

In 2018, Uganda Police issued more than 199,000 infringement tickets, of which around 86% where paid (totalling USD 4 million).

Table 16 lists the common traffic offences recorded by Uganda Police (the data refer to all vehicles at one check point). In 2018, the top three offences were:

- careless driving (around 12,000 offenders);
- mechanical faults (around 10,000 offenders); and
- speeding (around 8,000 offenders).

These three categories represent around 64% of all offenders.

Offences specific to motorcycles were riding without permit (1,343 offenders) and failing to wear a helmet (1,220 offenders).

Together motorcycle riders represent only 5.4% of all offenders but could be associated with more severe crashes than other categories (e.g. drivers of cars). Most of the offences reported by Uganda Police include those committed by motorcycles. Indeed, considering the huge number of motorcycles on the roads, it is likely that riders are involved in much higher percentage of offences than only 5.4%.

Some stakeholders consulted for this study pointed out that police rarely check motorcycle speeds and riders' BAC level.

Table 16 – Common traffic offences in Uganda at one check point (2018)

OFFENCES	NO. OF OFFENDERS
Driving a motor vehicle without a valid driving licence	2,630
Riding a motorcycle without permit	1,037
Default mechanical conditions	10,005
Careless driving	11,989
Dangerous loading	996
Driving a vehicle without insurance	2,264
Breach of operators' licence	1,790
Unauthorised passenger	1,540
Obscured (defaced) number plate	554
Speeding	7,995
Driving a motor vehicle without reflectors	1,164
Not wearing a safety belt	1,529
Interfering with safe driving	631
Using a hand-held mobile phone	141
Drunk driving	161
Passenger riding	306
Obstruction	567
Carrying excess passengers	572
Not wearing a crush helmet	1,220
Failing to give right way	15
Total	**47,106**

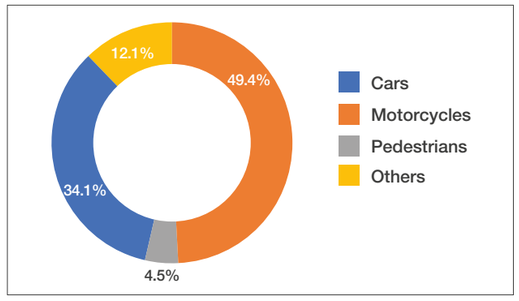
In addition to the above-described data, other risk indicators were obtained through field surveys. Details of the surveys conducted in Uganda are reported in Annex 8.

Vehicles were counted on six urban roads (arterial and local) during peak and off-peak hours.

The counting confirmed the heavy presence of motorcycles on Ugandan roads (Figure 126). Around 49% of the vehicles were motorcycles. Cars represented 34%, and other types of vehicles around 12%. Pedestrians represented just 4.5%.

The interaction of motorcycles and other vehicles of different shapes and sizes could be a risk factor. In this case, motorcyclists are clearly the most vulnerable road users.

Figure 126 – Share of vehicles and pedestrians in Uganda



Around 75% of recorded motorcycles were estimated to be of medium or poor quality (Figure 127). Even if that assessment is relatively subjective, it highlights a possible risk factor associated with the quality of vehicles. This is also confirmed by the estimated age of recorded motorcycles — about 79% were five years and above (Figure 128).

These findings, associated with the low level of technical verifications of motorcycles, could be directly related to severe risk factors.

Figure 127 – Estimated motorcycle quality in Uganda

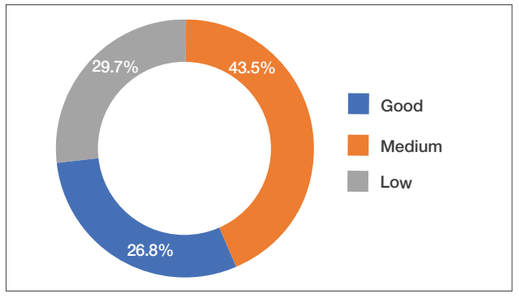
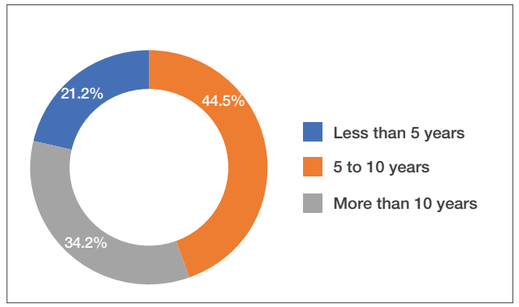


Figure 128 – Estimated motorcycle age in Uganda



The low rate of helmet use is a serious risk factor (Figure 129). Around 58% of the riders and a meagre 2.4% of passengers wore helmets.

To make matters worse, around 58% of riders and almost all the passengers wore their helmets incorrectly, and few riders or passengers used the chin strap (Figure 130).

Around half of the helmets used are “full face” (the safer type) (Figure 131). Overall, 49% of the helmets appeared to be of good quality (Figure 132). It is important to note that the assessment of the helmet quality was based on observation. The reliability of this information is thus only indicative. Despite this, there is significant room for improvement in helmet quality.

Figure 129 – Helmet use by riders and passengers in Uganda

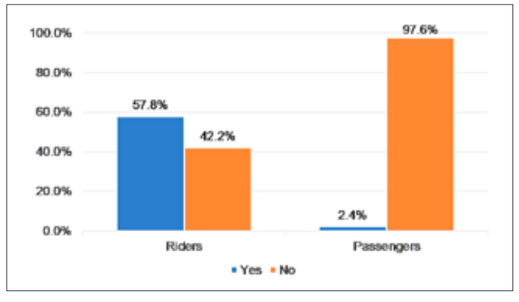


Figure 130 – Use of helmet chin strap by riders and passengers in Uganda

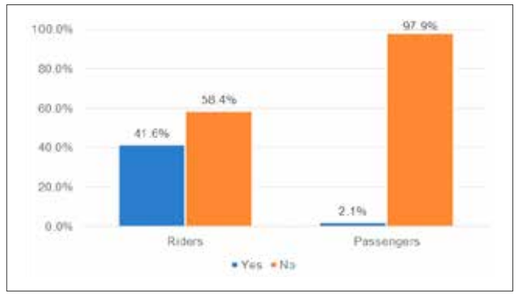


Figure 131 – Helmet type used in Uganda

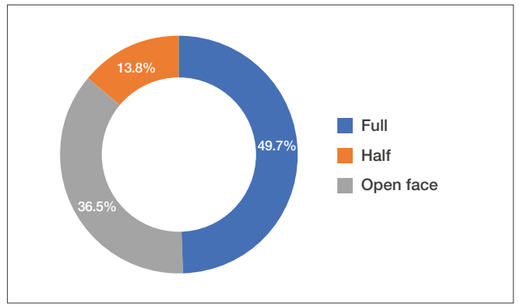
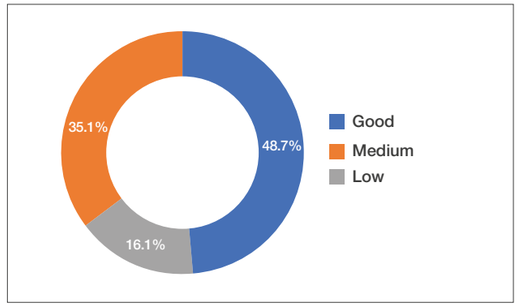


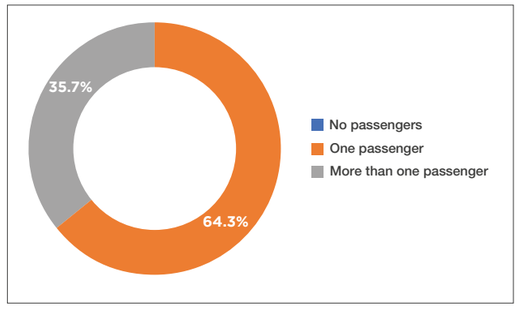
Figure 132 – Subjective quality of helmet recorded in Uganda



The average number of passengers on motorcycles is considerable. The average passenger load of each motorcycle is 1.4. This means that almost every motorcycle on the road carries a passenger. Moreover, about 36% of motorcycles carry more than one passenger (Figure 133).

These figures confirm the high use of motorcycles as “moto-taxi” (Boda-Boda). However, the high percentage of travel with more than one passenger, combined with the almost complete non-use of helmet by passengers, presents an extremely high risk of severe road crashes.

Figure 133 – Number of passengers per motorcycle in Uganda



4.5 Consultations with stakeholders

Consultations with stakeholders complemented data gathering and analysis by validating the findings and identifying specific factors contributing to motorcycle safety challenges.

Representatives from the institutions listed below were asked to comment on the data obtained from a variety of sources, provide their opinions on the main causes of crashes and injuries and recommend ways of improving motorcycle safety in their country. The stakeholders’ names and positions are listed in Annex 9.

BURKINA FASO

- National Road Safety Office
- National Police
- Municipal Police of Ouagadougou
- National Gendarmerie
- Humanité & Inclusion (NGO)

CAMEROON

- National Police
- National Statistics Institute
- Ministry of Public Works
- Ministry of Public Health
- Ministry of Transports

RWANDA

- Ministry of Infrastructure
- Rwanda Transport Development Authority
- Rwanda Utilities Regulatory Authority

UGANDA

- Kampala Capital City Authority
- Wakiso District
- Uganda National Roads Authority
- National Road Safety Council
- Uganda National Bureau of Statistics

The consultations focused on various topics related to motorcycle use (the use of protective equipment, motorcycles' roadworthiness, riders' experience, road infrastructure quality, etc.). The four countries share some common aspects and challenges.

In all four countries, the high use of motorcycles is strongly linked to **socio-economic and cultural aspects**. Economic growth over the years has made motorcycles increasingly accessible to citizens. However, the big increase of motorcycles has not always been followed by improvements in regulations and in their application.

Regulations and laws similar to those of European countries are in place in the four countries. However, in some of these countries, most of the laws and standards are neither implemented nor enforced. This is the case for:

- **Helmet use** by both riders and passengers in Burkina Faso, Cameroon, and Uganda. The limited helmet use in these countries are attributable to various factors, including old habits, lack of awareness on helmet benefits, high cost of good quality helmets, limited availability of good quality helmets in the market, lack of enforcement, weather conditions. In contrast, Rwandan riders and passengers almost always use helmets. This is due to the existence of regulation for motorcycle public transport services prescribing use of helmet, accompanied by monitoring by moto-taxi associations and reliable Traffic Police enforcement.
- **Motorcycle overloading**, especially in countries like Cameroon and Uganda. In these countries, motorcycles are mainly used for moto-taxi services. However, fare conditions are not regulated, and riders tend to carry as many passengers as possible to make more money. In Contrast, Rwanda has clear regulations on passenger fares and payment modalities (encouraging electronic payments). Under these conditions, moto-taxi services are profitable and fully recognised vocations, and riders are motivated to respect basic rules (including the one-passenger limit).
- In Burkina Faso, Cameroon and Uganda, very few motorcyclists possess the **rider licence** (therefore, there is a high level of inexperience and lack of knowledge of traffic rules). Motorcycles are often operated by young riders without proper training. This is not the case in Rwanda, where a rider licence is mandatory for the operation of moto-taxi services.
- **Low quality of motorcycles** due to little maintenance, almost complete absence of technical inspections, rapid deterioration of motorcycles (they are often used for long periods and on poor quality roads). Most of the new motorcycles are imported from China or India due to a lower purchase cost. However, most of the stakeholders from Burkina Faso, Cameroon and Uganda observed that these motorcycles have a shorter lifetime compared to others the Japanese ones or deteriorate faster. In Rwanda, motorcycles are generally well maintained by their owners. This is due to existence of moto-taxi associations that encourage riders to take care of their vehicle. However, it is to note that periodic technical inspections of motorcycles are not mandatory in Rwanda.
- **Moto-taxi services are mostly unregulated** in Burkina Faso, Cameroon and Uganda. Most moto-taxi riders have no riding or professional licence. They are not registered and, therefore, their operations are unmonitored. It is quite common that moto-taxi riders are not the owners of the motorcycle. They generally rent it in exchange of a fixed amount to be paid to the owner daily. This was mentioned as one of the reasons riders work for long periods and take more than one passenger at a time. This leads to fatigue, aggressive behaviour and infringement of traffic rules. In Rwanda, the Government regulates moto-taxi services. Introduction of clear rules and promotion of moto-taxi associations is leading to a gradual phasing-out of illegal services, and is producing positive impacts on road safety (for example, the use of helmets and reflective jackets by almost all the riders) The regulations introduced in 2015 are regularly updated.

In some cases, stakeholders also consider that regulations are not updated.

The consensus of all stakeholders is that a motorcycle is often the **only alternative** to walking. For this reason, some stakeholders were reluctant to support the idea of limiting the use of motorcycles. This situation is generated by a mix of aspects:

- **Road quality** is generally so poor that only motorcycles can access some roads or tracks. This occurs in both rural and urban areas. This also explains the extensive use of motorcycles as a means of transportation. Road infrastructure development is one of the main ongoing activities in Africa. However, most road designs leave out motorcycle facilities.
- Despite a general economic growth in the countries, relatively few persons can afford the cost of a car. For the poor in Cameroon and Uganda, a common way of earning an income is starting an informal moto-taxi service. Moto-taxi operators are better off in Rwanda where riders earn sufficient incomes, based on clear fare schemes promoted by the government.
- **Public transport** services are absent or of poor quality in the four countries assessed. Services like Matatus[57] in Uganda, operated by private owners, are less attractive for passengers than the moto-taxi because they are generally crowded, and the trips take longer. Moreover, these services are also generally informal and unregulated. Plans to develop public transport services (BRT, for instance) exist in Uganda and in Rwanda.
- **Moto-taxi services** are generally used by all population, including children going to school. In Cameroon and Uganda, it is quite common for parents to assign to the same rider their children's daily commute to school. This is not the case in Rwanda, where it is prohibited to get children under seven years old as passengers. Moto-taxi services in Rwanda are mostly used by adults.

Riders' bad behaviours — especially **speeding** (also related to generally young age of riders), **drink riding** and **drugs use** — were among the risk factors stressed by stakeholders consulted on this study. In Cameroon the behaviours are linked to the pressures of working for long periods, staying awake during the night, keeping a certain level of aggressivity.

There are some differences between the assessed countries.

In Burkina Faso, moto-taxi services are rare, mainly people's preference for ownership of a personal means of transportation. The government has also forbidden moto-taxi services (only powered three-wheelers can be used for taxi services). On the contrary, in Rwanda, Uganda and Cameroon, motorcycles are almost exclusively used for taxi services (very little for personal use).

In Burkina Faso, Cameroon and Uganda, there is a general lack of awareness about road traffic risks and about the importance of road safety measures and road regulations. Stakeholders identified sensitisation as a crucial aspect, to be implemented before any other action. In Rwanda, sensitisation activities are often promoted by moto-taxi associations and the Highway Police.

It is worth mentioning that there is no clear evidence from the literature about the effectiveness of sensitisation.

However, the stakeholders highlighted the importance of a correct communication approach, especially when dealing with moto-taxi riders. Approaching them through groups and associations (to which they usually belong formally or informally) is crucial. In Rwanda, moto-taxi associations are active in promoting road safety culture and in explaining the importance of rules like helmet wearing, safe behaviours, etc. In addition, moto-taxi associations monitor compliance of rules by associated riders.

Clearly, rules against incorrect behaviours (helmet, speeding, alcohol, drugs, motorcycle quality, licencing) are difficult to enforce. There is a general lack of political willing to introduce measures that could be perceived as repressive (and risk triggering a public outcry, if not riots). Despite difficulties, Rwanda is a good example of success in this regard. For instance, enforcement on helmet use and overloading is effective in Rwanda.

When dealing with moto-taxi services, it is important to **reform and organise the sector** through the creation of associations of services. Rwanda is probably the best example concerning moto-taxi sector organisation in Africa, where proper road safety measures are implemented related to this and regulations are enforced to bring positive safety behaviour.

[57] Privately owned minibuses

4.6 Major causes of motorcycle crashes and injuries

Analysis of motorcycle safety conditions and consultations with stakeholders in Burkina Faso, Cameroon, Rwanda and Uganda revealed the main causes of crashes and injuries in these countries.

Some of the risk indicators assessed refer mainly to the risk of severe injuries, rather than the risk of crashes. This is the case, for the low helmet use identified in Burkina Faso, Cameroon and Uganda. The failure to use a helmet does not necessarily increase the crash risk. On the contrary, it will certainly increase the risk of severe (head) injury.

The identified causes of crashes and injuries are listed in Figure 134. They are described through factsheets including information on:

- Challenges (issues identified, and references to international literature).
- Underlying factors, explaining aspects identified in the selected countries, leading to the challenge.
- Information on the relationship of the challenge with:
  - Number of crash number and/or severity and outcomes of crashes, accompanied by a symbol (the colour of the symbol has no specific meaning).
  - Country of reference and evaluation of the scale of the challenge in each country. This information is given by coloured images of the countries (see figure below for the colours meaning).

Figure 134 – Main motorcycle crash and injury causes

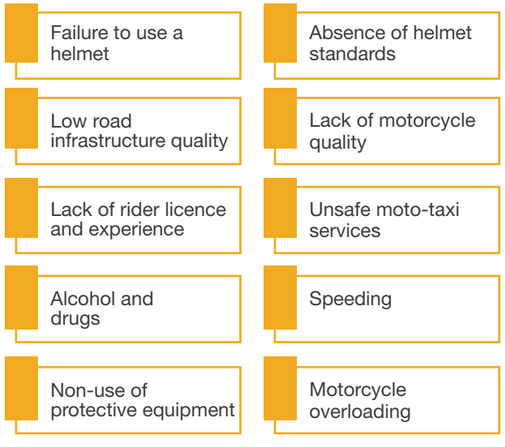


Figure 135 – Colours used as evaluation scale of challenges

GREEN	YELLOW	RED
Challenge is not present	Challenge is medium or improving	Challenge is high or persisting

- References to international literature.

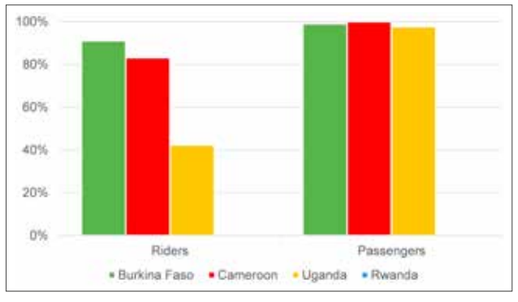
4.6.1 Lack of helmet use

Challenge

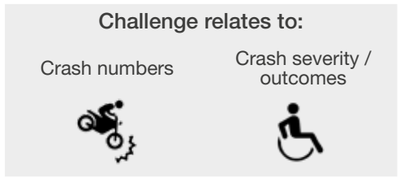
Surveys conducted in the four countries revealed very limited helmet use in Burkina Faso, Cameroon and Uganda. In Rwanda, almost all motorcycle riders and passengers wear helmets.

In Burkina Faso, Cameroon and Uganda, almost no passengers wear helmets. In Burkina Faso and Cameroon riders hardly wear helmets. The situation is slightly better in Uganda, where data collected showed that around 58% of riders wear helmets (Figure 136).

Figure 136 – Percentage of no helmet wearing in Burkina Faso, Cameroon, Rwanda, Uganda



There is a strong link between the use of personal safety equipment and the level of road crash injury. A review of 61 international studies shows that wearing a motorcycle helmet reduces the risk of a fatal motorcycle crash by approximately 42% (Elvik et al., 2009), and the risk of severe head injury by about 69% (Liu et al., 2008).



Underlying factors

Failure to wear a helmet is not related to the absence of regulations. The four selected countries all have a law for mandatory helmet use, but the rules in Uganda and Cameroon are silent on helmet fastening. On the contrary, various factors were found to contribute to this challenge.

A first aspect, often reported by stakeholders in Burkina Faso, Cameroon and Uganda, relates to a lack of knowledge and awareness. Failure to wear a helmet has been a common habit for decades, and motorcycle users simply do not know why it is important to wear it. In turn, this is also related to lack of training, poverty, and illiteracy.

Another contributing factor is the unavailability and high cost of good quality helmets. Stakeholders explained that motorcycle users did not know where to buy a good quality helmet) and that such helmets were too costly for the generally poor riders (especially moto-taxi riders). In some cases, unconventional helmets are improvised to avoid police checks.

In Burkina Faso, helmets are by law sold together with the motorcycle. However, this has not increased the helmet wearing rate (partially because helmets sold with motorcycles are perceived to be of low quality).

Helmets are also considered by riders and passengers to be uncomfortable, hot, and restrictive (impairing hearing and vision). The shareholders noted that the imported helmets were not suited to African weather conditions. To address this problem, a Ugandan moto-taxi association is using Vietnamese-manufactured specifically designed for the tropics. A pilot project funded by United Nations is also in place in Jamaica and Tanzania to test new types of helmets.

There are challenges specific to the use of motorcycles for taxi services. Health conditions are considered a challenge for moto-taxi passengers, having to wear the same helmet used by other persons. In Uganda, some moto-taxi riders provide disposable head covers to passengers (Bishop et al., 2018). In Rwanda, most riders provide both helmets and disposable head covers to passengers.

In addition, moto-taxi riders often work for other persons owning the motorcycle, and often not providing them with any safety equipment (including helmets).

All these factors are amplified by little or no police enforcement in Burkina Faso, Cameroon and Uganda. The lack of action is attributable to the reticence of politicians to go against motorcycle users. Some years ago, in 2005, attempts to enforce helmet wearing in Burkina Faso turned into riots, and the government backed off. Shareholders mentioned a certain degree of police corruption (limiting the number of fines issued) as a factor limiting helmet use. On the contrary, helmet enforcement by Highway Police and by moto-taxi associations appears to be very effective in Rwanda.

4.6.2 Absence of helmet standards

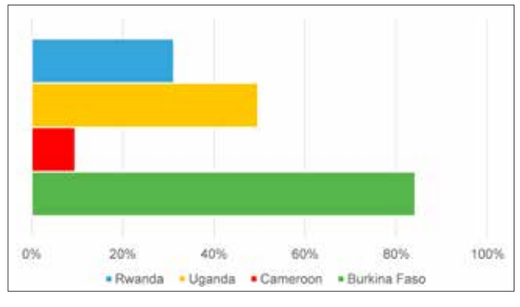
Challenge

Surveys conducted in the four countries identified weaknesses in the helmet standards. Considering that in Burkina Faso, Cameroon and Uganda helmet use is limited, the effect of the type of helmet is negligible in that countries. However, an evaluation of helmet types can be useful for future actions. In Rwanda, this challenge is relevant since use of helmet is very high.

It appears that the use of “full face” helmets (the safest type) ranges from around 9% in Cameroon to around 84% in Burkina Faso. Rwanda’s rate is around 31%and Uganda’s is around 50% (Figure 137).

Studies show that a “full face” helmet with a fixed jaw guard considerably reduces the risk of chin and facial injury (Oxley et al., 2013). Different helmet types offer

Figure 137 – Percentage of full-face helmet used in Burkina Faso, Cameroon, Rwanda, Uganda



varying levels of protection (see examples in Annex 10), with half-head helmets providing the least protection from head injuries (IMMA, 2019). Wearing a loosely fastened or loosely fitting helmet may compromise any potential protection.

The helmet quality recorded during the field surveys was considered good (100% of the helmets in Rwanda, 96% in Cameroon, 76% in Burkina Faso and 49% in Uganda). It is worth mentioning that this assessment of helmet quality is highly subjective (based on limited observations in the field).

The data revealed the absence of a law on helmet standards (including their homologation) in Cameroon, Rwanda and Uganda.

In Burkina Faso, a law exists, but it lacks important elements such as post-crash verifications of helmets' compliance to standards. In addition, there is no organisation responsible for regulating the import of helmets and for checking compliance with standards before they are sold. This leads to uncertainties concerning adequacy of helmets

Challenge relates to:

Crash severity / outcomes

Challenge identified in:

BFA CMR UGA RWD

Underlying factors

Challenges are helmet standards and quality are directly linked to the dismal level of helmet use. The importance of wearing a good quality helmet is simply not understood by most motorcycle users, owing to very limited knowledge and information.

The first factor influencing helmet standards is the absence of law and regulation, as is the case in Cameroon, Rwanda and Uganda. In Cameroon and Uganda, stakeholders suggested the conduct of helmet homologation through already existing structures and bodies. However, there is a gap in the current legislation leading to the import of equipment with almost no control. The absence of law also makes it impossible to enforce the use of a specific type of helmet.

The situation is slightly different in Burkina Faso. The country has laws to regulate standards and an agency responsible for vehicle and helmet homologation.

Most of the stakeholders mentioned the need for good quality and standardised helmets, adapted as much as possible to African weather conditions. Some stakeholders advocated for a more coherent promotion of the use of "half" helmet type. Others suggested the local manufacture of helmets for better monitoring of standards compliance and reduction in cost price. Ugandan stakeholders noted the existence of a local company capable of producing quality and suitable helmets.

4.6.3 Low quality of road infrastructure

Challenge

Road infrastructure quality is associated with both the number and outcome/severity of road crashes. In fact, the whole idea of self-explaining and forgiving roads is based on the concept of preventing crashes and, where they cannot be prevented, providing an environment that will minimise the effects of crashes (reduce the severity of injuries, etc.).

The quality of road infrastructure is related to the combination of road features that provide optimal safety for all road users. For instance, creating a separate motorcycle lane, providing a good road surface, and removing hazards/obstacles closer than 5 m (for 60 km/h roads) from the road edge, should make roads sufficiently safe for motorcycles (Folla et al., 2018).

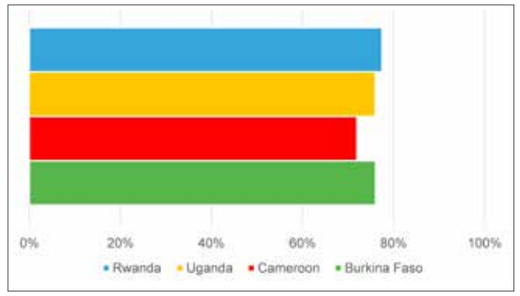
Speed reduction devices (traffic calming measures) should be considered when designing an infrastructure, with an objective to guarantee the safety of all users, especially motorcyclists.

Some "speed inhibitors" (like rumble strips, avoidance of loss of grip, avoidance of big change in vertical alignment) are safe for motorcyclists. The use of different colours is another way of indicating speed limits. The correct location of these devices, on difficult road sections (instead of speed reduction devices) such as a curve or a series of curves, is also important. By installing rumble strips, the number of collisions in curves due to speeding can be reduced. (Winkelbauer et al., 2012).

Road quality can be assessed, for instance, by verifying the combination of its features, performing road safety inspections, or using road safety assessment techniques, by assigning a star rating (see iRAP methodology – www.irap.org).

Road infrastructure in Burkina Faso, Cameroon, Rwanda and Uganda are generally in poor condition. Up to 78% of roads outside the built-up area are unpaved (Figure 138). Moreover, facilities for motorcycles (like dedicated lanes) are absent both in rural and urban environments, resulting in mixed traffic with large differences in speed and mass between road user groups. In Cameroon, a high portion of motorcycle crashes occur at night, on roads with no lighting.

Figure 138 – Percentage of unpaved roads in Burkina Faso, Cameroon, Rwanda, Uganda



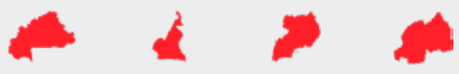
Road type, geometric design, traffic control, lighting conditions, network structure, urban planning, and maintenance are some of the most critical factors affecting road safety outcomes. Countries with more paved roads have substantially lower fatality rates (Elvik et al., 2009). It is worth mentioning that almost all African countries are implementing programmes for road improvement.

Challenge relates to:

Crash numbers Crash severity / outcomes

Challenge identified in:

BFA CMR UGA RWD



Underlying factors

While the quality of road infrastructure in Africa is generally low, ongoing development are being implemented in most African countries. Construction of new roads or improvements of existing ones are in place, but they are still far from meeting all the needs.

Even in urban areas, tracks or informal roads proliferate, most accessible only by motorcycles (which also makes this mode of transportation almost essential).

Factors influencing road quality are poor planning, low and outdated design standards (not catering well for safety or for all road users), low skills in road design, etc. There is also a lack of funding for road construction and maintenance (despite the rapid deterioration of roads).

The analysis of the data collected in Burkina Faso, Cameroon, Rwanda, and Uganda revealed a lack of awareness about dedicated road features for motorcycles. The stakeholders expressed divergent opinions about the possibility of implementing specific facilities for motorcycles.

For instance, stakeholders in Burkina Faso and in Rwanda considered as a possibility the inclusion of motorcycle lanes in the design of roads. Stakeholders in Cameroon did not consider the feature relevant (mainly because they consider that road is not the main cause of motorcycle crashes). For the Ugandan stakeholders, motorcycle lanes are potentially useful but not easy to implement because of limited political will.

The possibility of implementing motorcycle lanes on existing roads in urban areas is generally considered challenging due to often limited carriageway width, especially in peripheries. Some stakeholders raised doubts about motorcyclists' willingness to use only the dedicated lanes, especially when several other motorcycles are using the same lane. Enforcing the respect of this rule would be very challenging.

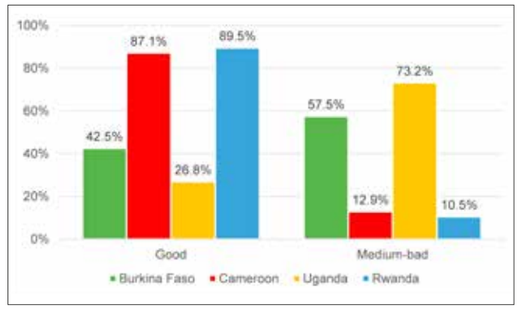
4.6.4 Poor motorcycle quality

Challenge

Consultations with stakeholders in Burkina Faso, Cameroon, and Uganda highlighted a challenge related to the quality of motorcycles.

In Burkina Faso, more than half the motorcycles are judged to be of medium-low quality, and around 61% are more than five (5) years old. In Cameroon, only 4.5% of motorcycles involved in crashes were less than five (5) years old. Around 55% of motorcycles involved in crashes in Cameroon had not undergone any technical inspections. In Uganda, around 73% of motorcycles are medium-low quality, and around 79% are more than 5 years old (Figure 139). Moreover, Cameroon and Uganda have neither precise standards nor mandatory technical inspections for motorcycles.

Figure 139 – Estimated motorcycle quality in Burkina Faso, Cameroon, Rwanda, Uganda



The case in Rwanda is somewhat different. Rwanda has standards for motorcycles. However, periodic technical inspections are not mandatory, nor are they performed as a matter of course. Stakeholders consulted in Rwanda pointed out that moto-taxi riders pay much attention to the quality of their motorcycles (largely because of moto-taxi associations' sensitisation efforts).

Vehicles degrade over time because of wear and tear, breakdowns, crashes, modifications, and tampering. The challenge is to reasonably maintain vehicles throughout their serviceable life to provide optimal safety and performance. That means that the safety features of vehicles should be maintained and regularly checked during their life and following special events, such as modifications, re-builds or after crashes (Directive 16/2009/UEMOA). In addition to periodic testing, regular spot checks by Police are important to avoid problems and frauds during periodic inspections.

Studies on vehicles (including motorcycles) involved in crashes have shown that technical defects contributed to between 3% and 19% of crashes. Empirical evidence from Germany shows that technical defects contribute to around 10% of crashes (European Commission, 2012).

MAIDS (the most comprehensive in-depth data currently available for motorcycle crashes in Europe) also confirmed that lack of proper vehicle maintenance (associated with technical defects) is a contributing factor in motorcycle crashes (5% of all PTW contributing factors).[58]

This figure is likely to be higher in African countries where quality of motorcycles is likely to be lower than in European countries (Folla et al. 2018).

Challenge relates to:

Crash numbers

Crash severity / outcomes

Challenge identified in:

BFA

CMR

UGA

RWD

[58] MAIDS, "Motorcycle Accidents In-Depth Study", http://www.maids-study.eu/.

Underlying factors

The main factors undermining motorcycle quality are:

- missing national standards for motorcycle roadworthiness, regulatory agency, and qualified personnel to administer periodic testing;
- absence of laws mandating technical inspections;
- poor supply of qualified motorcycle mechanics and well-equipped garages;
- lack of correct and high-quality spare parts; and
- lack of fleet controls (periodical, unannounced checks after modification or crash).

Stakeholders consulted in Burkina Faso, Cameroon, Rwanda and Uganda generally confirmed these factors. However, the following aspects are also considered to be important.

Most of the motorcycles in these countries are imported from India and China. Stakeholders noted that these are cheaper and of lower quality than motorcycles manufactured in Japan,. and they deteriorate rapidly; their average lifetime is two to three years.

It is worth mentioning that the verdict on the quality of motorcycles imported from India and China is based on stakeholders' judgement. On the one hand, these motorcycles' standards[59] have not been found to be very different from other international standards. On the other hand, there is hardly any verification of compliance to standards (homologation process) at the motorcycles' arrival in the countries. Disparities between declared and actual standards cannot be eliminated. Another reason these motorcycles are of lower quality is that most are imported as parts and assembled in local (unofficial) garages.

These factors are also connected to government interventions that led to the distortion of the market. For instance, in 1991, the Government of Uganda relaxed the law banning the importation of motorcycles older than five years. Liberalisation measures have led to an increase in the importation of used vehicles, many in poor condition (Kumar, 2011).

The rapid deterioration is also associated with lack of maintenance by motorcyclists, especially in Cameroon and Uganda, where moto-taxi services are prevalent. The case is different in Rwanda; riders are encouraged to maintain their vehicles in good condition. In some countries, moto-taxi riders are not the owners of the motorcycles, and so they pay little or no attention to the maintenance or quality of the vehicle. Moreover, motorcycle riders operate long hours, and consider maintenance a waste of time (and money).

In the four countries, periodic technical inspections are generally not mandatory and there is very low awareness by motorcycle users (or owners) of their importance. It is rare that a motorcycle is periodically inspected on a voluntary basis. Some stakeholders also highlighted that the cost for technical inspections is an additional barrier.

The quality standards of motorcycles are almost completely unchecked. Stakeholders from Burkina Faso, Cameroon, and Uganda observed that many of the motorcycles on the roads are unregistered and, in some cases, could not be homologated. While the common of the importation of motorcycles in parts for local assembly might reduce the cost price, it contributes to non-registration of motorcycles and the low level of controls (homologation, etc.).

4.6.5 Lack of rider licence and experience

Challenge

Level of experience and age are associated with crash risks.

Obtaining a motorcycle licence is mandatory in Burkina Faso, Cameroon, Rwanda and Uganda. In all four countries, completion of both theoretical and practical training is part of the licencing system. However, the countries have different licensing practices. For instance, only Uganda sets a minimum number of practical training lessons. The minimum age for a rider licence also varies. In Burkina Faso, 14 is the minimum age for riding light motorcycles (cylinder capacity not exceeding 125 cm3), and 16 is the minimum age for more powerful motorcycles. In Rwanda, the minimum age for motorcycles is 15, but a rider must be 17 or older to carry a passenger (which includes operating moto-taxi services).In Cameroon, the minimum age for any type of motorcycle is 16. In Uganda, the minimum age for any type of motorcycle is 18.

Despite the existence of regulations, the number of licenced riders is quite low in Burkina Faso, Cameroon and Uganda.

In Uganda, for instance, one of the main offences enforced by the police is riding without licence (next to failure to use a helmet).

[59] China National Standards. Online available on 31st of May 2021. http://www.gbstandards.org/index/Standards_Search.asp?word=Motorcycles

According to stakeholders interviewed for this study few motorcyclists in Cameroon and Burkina Faso hold a rider licence. The opposite is the case in Rwanda, where the moto-taxi regulation is enforced directly by moto-taxi associations themselves.

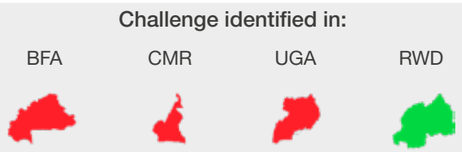
Both young and older riders face a higher risk of injury. For young riders, the risk is predominantly associated with lack of experience and greater propensity for risky behaviours. For older riders, the susceptibility to higher risk of (severe) injury is associated with physical fragility and reduced riding practice (SaferAfrica project, 2018).

Challenge relates to:

Crash numbers | Crash severity / outcomes

Challenge identified in:

BFA | CMR | UGA | RWD



Underlying factors

Low rider experience in African countries is related to the low willingness to get a training or a licence. Most riders are simply not aware of the importance of training. Moreover, there is a generally low level of enforcement (especially when it comes to moto-taxi riders).

There is a correlation between a lack of awareness and the social conditions of users. In countries where moto-taxi services are prevalent tend to have a high proportion of poor and illiterate riders with little or no knowledge of traffic rules. Most of these riders (including the young) learn from others how to ride, but with no information on road behaviour or traffic risks, conditions and rules.

The cost of obtaining a rider licence is generally not considered a barrier, even for poor persons. Riders are simply not interested in obtaining one. Stakeholders mentioned a lack of proper information and of training adapted to motorcyclists. For instance, the availability of riding schools dedicated to motorcycles is considered potentially useful.

It is worth mentioning that the existence of regulation governing motorcycle public transport services in Rwanda is leading to a constant increase in the number of moto-taxi riders with a riding licence (mandatory to be authorised) and at least basic training.

4.6.6 Unsafe moto-taxi services

Challenge

In Cameroon, Rwanda and Uganda, there is a high number of motorcycle taxis (called Boda-Boda in Uganda). According to the principal licencing officer in Uganda's Ministry of Works and Transport, more than a million Boda-Bodas operate in Uganda, more than half of them unregistered. Official licences for these services have increased in the recent years (around 2.5 more from 2014 to 2018).

Precise figures are not available for Cameroon. However, according to stakeholders, almost all motorcycles are used as moto-taxi, especially in small and big cities, suburban areas and in the country's northwest, close to the border with Nigeria.

In Rwanda also, motorcycles are almost exclusively used for professional services.

The presence of moto-taxi in Burkina Faso is much more limited. Moto-taxi services have been prohibited by Government (taxi services can be made by motorised three-wheelers but are anyway limited). Moto-taxi exists in some areas of the country (for example, close to the borders).
The public perception of motorcycle taxi riders has been tainted by reckless driving that leads to crashes, and a strong link between motorcycles and crime.

Attempts to regulate the sector have been unsuccessful in Uganda. Anecdotally, this is in part due to the link between moto-taxi associations and politics. For example, measures taken to mandate moto-taxi riders to carry two helmets and reflective jackets were reversed in the face of opposition from riders and motorcycle owners. The government is now reluctant to challenge the associations (Bishop et al., 2018).

A similar perspective has been given by Cameroonian stakeholders share the same view, saying politicians are reluctant to challenge moto-taxi riders and the informal associations through which they are organised.

However, the Rwandan government succeeded in regulating moto-taxi sector and in promoting good road safety practices. Moto-taxi associations actively monitor the riders and promote positive behaviours, such as helmet wearing, avoiding overloading (for instance, through sensitisation activities). It is noteworthy that enforcement of regulations by the Highway Police contributes to road safety conditions for riders, including moto-taxi operators not affiliated with an association.

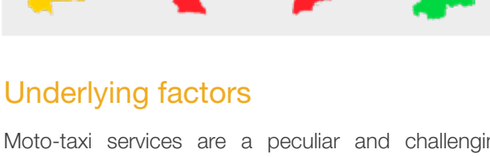
Despite the challenges facing the sector, moto-taxi services remain an important means of transportation. Often, they are the only means of motorised transportation, especially in rural areas and for some urban areas not properly connected with roads. Moto-taxi services are considered an important part of the national economy and are also useful in emergencies.

Challenge relates to:

Crash numbers | Crash severity / outcomes

Challenge identified in:

BFA | CMR | UGA | RWD



Underlying factors

Moto-taxi services are a peculiar and challenging sector in several African countries. Because of their high concentration on roads and their shape and size, motorcycles are frequently involved in road crashes.

Moto-taxi services are often unregulated and unmonitored. Exceptions are Rwanda and, to some extent, Uganda where official associations have been set up. These associations facilitate adherence to some safety rules. In Cameroon, similar associations are unofficial. They exist mainly to guarantee eventual economic support to riders, when needed. However, these unofficial associations in Cameroon are not particularly attentive to safety challenges.

In some countries, moto-taxi riders do not own the motorcycle they use. They pay the owners a fixed daily amount and keep whatever is left of the day's earning (sometimes, nothing). This pushes the riders to work as much as possible and for long periods. This situation has a strong influence on motorcycle safety. Stakeholders identified this arrangement as the main factor influencing overloading, speeding, abuse of alcohol and even drugs to stay awake (especially in Cameroon). In Rwanda, on the contrary, most riders own the motorcycles they use for moto-taxi services, so this challenge does not emerge.

In Burkina Faso, Cameroon and Uganda, moto-taxi riders are generally the poor, young and unemployed. For them, things like helmet use, training, licencing and motorcycle maintenance, are unwarranted costs. In Rwanda, moto-taxi riders enjoy better economic conditions due to clear fare schemes regulated by the Government.

In Burkina Faso, Cameroon and Uganda), where the sector is largely unregulated (e.g. riders' working conditions are unfavourable — they have low incomes, and no social security, insurance or similar. Motorcycle owners are not very attentive to the working conditions of riders. For instance, they rarely provide them with helmets. In addition, in these three Countries. Because of their social conditions in the three countries, moto-taxi riders are very sensitive to any change that could limit their activity. Consequently, enforcement of rules in this sector is complicated, some stakeholders argued.

Some attempts to regulate the sector are ongoing in Uganda, through the establishment of associations to promote the use of safety equipment.

Rwanda has been successful in regulating the sector and can be considered an example of good practice.

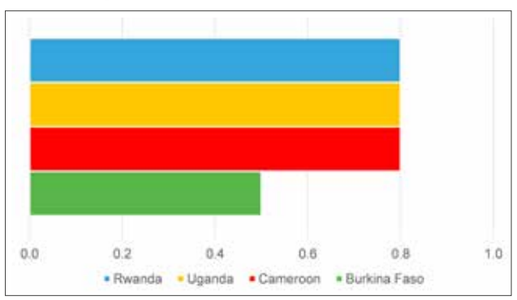
4.6.7 Alcohol and drugs

Challenge

Drink driving/riding is internationally recognised as a major road safety risk. Many studies have reported on how alcohol and drugs impair driving/riding performance. Several studies have examined the relationship between alcohol impairment and road crashes (Elvik et al., 2009).

This challenge is not highly reported in Police records of Burkina Faso, Cameroon, Rwanda, and Uganda. Regulations currently in place do not appear sufficient (Figure 140). BAC levels prescribed by law in Cameroon, Rwanda and Uganda are higher than other countries' (0.8 g/ml compared to 0.5 g/ml). Moreover, there is no differentiation between categories of road users (age groups or road user categories at higher risk of being involved or exposed to crash and injury risks). In Burkina Faso, the laws are comparable to most countries' (BAC level equal to 0.5 g/ml; 0.2 g/ml for young and learner drivers).

Figure 140 – BAC levels (g/ml) in Burkina Faso, Cameroon, Rwanda, Uganda



Stakeholders noted that the use of alcohol is widespread among riders, especially the younger ones. In Cameroon, a high consumption of drugs by moto-taxi riders (aimed at increasing attention and emboldening for risk-taking) has been reported.

It is worth mentioning that this risk extends to all road users. However, considering that in the four countries, statistics show a greater vulnerability of young motorcyclists (higher chances of being killed compared to other age groups), high BAC levels could escalate crash risks.

Challenge relates to:

Crash numbers | Crash severity / outcomes

Challenge identified in:

BFA | CMR | UGA | RWD

Underlying factors

There is a clear correlation between drink-riding phenomenon and a low awareness of the risks of riding under the influence of alcohol. As for other factors (helmet wearing, training, vehicle maintenance, etc.), motorcycle users do not consider the risks of drink-riding and often do not have sufficient information to guide them.

Just like the other major safety risks, drink-riding is hardly ever enforced. In this case, the problem is the police don't have breathalysers, so they cannot test riders' BAC levels. The same applies to drug use by riders; police forces have no drug-testing.

Drug use by moto-taxi riders, reported by Cameroonian stakeholders, is a serious issue, which significantly increases the risk of motorcycle crashes and injuries. The drug used is usually a painkiller (tramadol), but engenders high-risk behaviours (such as filtering, speeding). It is very cheap (around EUR 0.04 per pill) and is purchased in the black market. This phenomenon has been reported in newspapers[60] and is the subject of political deliberation.

4.6.8 Speeding

Challenge

In Uganda and Rwanda, speeding is one of the top three offences reported by police for all type of vehicles. In Cameroon and Rwanda, the maximum speed in urban areas is 60 km/h (the same for several African countries, according to WHO data). In Rwanda, city speed limits are reduced to 20 km/h for public transport services.

Precise data on speed limits are not available in Cameroon, Rwanda and Burkina Faso. However, the number of speed violations is quite high, compared to other traffic offences.

WHO considers urban speed limits of 50 km/h and under to be best practice and the most likely to reduce road traffic casualties.[61]

According to the Safe System approach,[62] speed limits should not exceed:

- 1.30 km/h in roads where pedestrians and cyclists can cross the path of cars and other vehicles.
- 2.50 km/h in locations where vehicles can meet at right angles.
- 3.70 km/h in locations where vehicles can have a head-on collision.

High speeds and great variations in speed increase the probability of crashes and serious injuries because the demands on the road user's observation and reactions increase, and because braking distance increases proportionally with the speed (Elvik et al., 2009).

[60] Motorcycle taxi in Yaoundé, Cameroon in October 2018. (MARCO LONGARI / AFP). Online on 31st of May 2021. https://www.francetvinfo.fr/monde/afrique/societe-africaine/cameroun-des-morts-subites-et-des-motards-qui-planent-quand-l-addiction-au-tramadol-vire-au-cauchemar_3624565.html

[61] Facts: Road Safety - Speed. Online on 31st of May 2021. https://www.who.int/violence_injury_prevention/publications/road_traffic/world_report/speed_en.pdf

[62] International Transport forum. TOWARDS ZERO Ambitious Road Safety Targets and the Safe System Approach. OECD 2008, Online on 31st of May 2021. https://www.itf-oecd.org/sites/default/files/docs/08towardszeroe.pdf

Challenge relates to:

Crash numbers | Crash severity / outcomes

Challenge identified in:

BFA | CMR | UGA | RWD

Underlying factors

Stakeholders consulted in Burkina Faso, Cameroon, Rwanda and Uganda consider excessive speed of motorcycles as a major road safety risk. Young people and moto-taxi riders are more prone have a general tendency to speed, both in urban and rural areas.

Stakeholders attributed inappropriate speed limits to poor road infrastructure. Generally, the road infrastructure features are not perceived by drivers as an important factor, compared to the lack of riders' discipline.

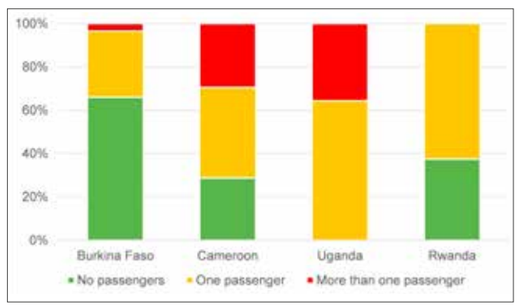
4.6.9 Motorcycle overloading

Challenge

Motorcycle overloading is prevalent in Cameroon and Uganda. In Cameroon, around 30% of motorcycles carry two or more passengers. In Uganda, no motorcycles were found without passengers. Around 36% of motorcycles carry at least two passengers.

The situation is different in Burkina Faso, where more than 60% of motorcycles carried no passengers on board (Figure 141). In Burkina Faso, motorcycles are mostly used for private purposes.

Figure 141 – Motorcycle overloading in Burkina Faso, Cameroon, Rwanda, Uganda



In Rwanda, overloading is not an issue. The country has and effectively enforces regulations governing motorcycle public transport services, which limits the number of motorcycle passengers to one.

In addition to making motorcycles harder to monitor (resulting in crashes), multiple passengers increase the severity of crashes in that more people get injured or killed.

Challenge relates to:

Crash numbers | Crash severity / outcomes

Challenge identified in:

BFA | CMR | UGA | RWD

Underlying factors

Motorcycle overloading is mainly associated with moto-taxi services. Overlading is prevalent in Uganda, Rwanda and Cameroon where motorcycles are primarily used for commercial transportation, overloading.

In the two countries, moto-taxi operators frequently carry more than one passenger to maximise the gain — almost all riders must pay a fixed daily amount to the motorcycle owner. A moto-taxi is generally cheap, so riders take on extra passengers to increase to make the service profitable.

In some countries (e.g. Cameroon, Uganda), motorcycles are used to carry goods (along with passengers in many cases). Police enforcement of overloading is almost inexistent in Uganda and Cameroon. For example Rwanda, has and effectively enforces regulations forbidding overloading of motorcycles and covering both passengers and goods.

4.6.10 Non-use of protective equipment

Challenge

Surveys conducted in Burkina Faso, Cameroon, and Uganda showed that almost no motorcycle user (riders or passengers) use protective equipment. In Rwanda, the use of protective equipment is limited to reflective jackets by riders.

Various types of protective equipment can be used to reduce the impact of crashes on riders and passengers (Winkelbauer et al., 2012).

Eye protectors like glasses, goggles, shields, or visors can reduce the occurrence, severity and impacts of motorcycle crashes, especially those resulting from flying pebbles. These protective devices must be clean, well fitted and without scratches).

Protective gloves can reduce the impact and severity of crash they protect riders against serious hand injuries in crashes.

Impact protectors are part of protective clothing and can minimise riders' and passengers' injuries in crashs. The two most important impact protectors are for the back and the legs.

The use of protective clothing with retroreflective materials also improves motorcyclists' conspicuity, thus reducing the number of crashes. In Rwanda, moto-taxi riders regularly wear retroreflective jackets. In Uganda, riders belonging to moto-taxi associations wear retroreflective jackets (useful also in marking them out as members of the association).

An analysis of data from MAIDS showed that heavy protective gear was effective in preventing or mitigating injuries in 93% of all cases; light and medium weight protective gear was 73% effective (McCarthy et al., 2007).

Challenge relates to:

Crash numbers

Crash severity / outcomes

Challenge identified in:

BFA

CMR

UGA

RWD

Underlying factors

The main factors behind non-use of protective gear are:

- the absence of specific regulations or laws prescribing or recommending their use;
- difficulties in finding such equipment for purchase, especially at affordable prices;
- lack of awareness and information about the importance of protective equipment; and
- weather conditions limiting their use (Protective boots, for instance, are unsuitable for hot weather, and costly – so motorcyclists use the cheaper and more convenient flip flops, which offer no protection in a crash).

5. Recommendations for Motorcycle Safety Improvement

5. Recommendations for motorcycle safety improvement

This study's recommendations for the improvement of motorcycle safety are based on the assessment of major causes of motorcycles' road crashes and injuries.

These strategic recommendations serve as policy advice and technical assistance to decision makers, as well as guidance on the implementation of interventions to mitigate motorcycle crashes in African countries.

Motorcycle safety interventions are directly connected to the review of best practices and to the results of assessments of motorcycle safety in Africa (using the data and main issues identified in Burkina Faso, Uganda, Rwanda, and Cameroon). Consultations with stakeholders served the important purposes of ensuring that the recommendations are applicable and responsive to African countries' needs, as well as their peculiarities, notably their traffic conditions, institutional structures and technical capacities.

These strategic recommendations should constitute the main framework for the development of future road safety interventions. Below are the key recommendations.

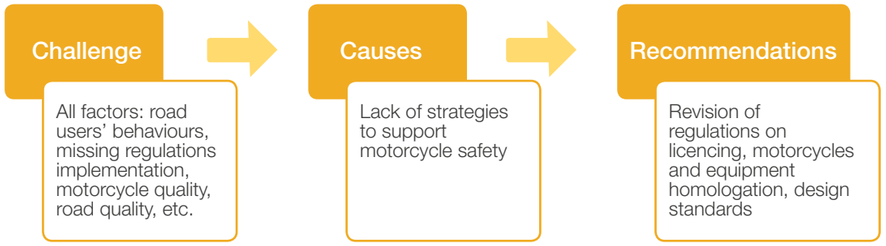
1. Recognise motorcycles as a distinct mode of transport in all transport planning and road safety programmes.
2. Introduce legislations on motorcycle safety standard requirements mandating periodical technical inspections, rider training and licencing, and the use of helmet and protective equipment.
3. Initiate safety education and public campaign to improve motorcycle riders' behaviour in traffic and to foster the adoption of a low-risk attitude to motorcycle riding.
4. Incorporate motorcycle safety into road planning, design and maintenance, as well as traffic management.
5. Introduce programmes for increased motorcyclists' awareness, acceptance, and usage of appropriate personal safety equipment, as well as good quality motorcycles.
6. Enhance the enforcement of motorcycle safety laws and requirements, and improved understanding, consultation and communication between government agencies and the motorcycling community.
7. Improve the public image of motorcyclists by increasing their safety conditions.

Most of the actions recommended above would work better in combination with the others. A typical example is the enforcement of helmet use, which usually gets high benefits from tailored communication campaigns. A list of other potential motorcycle safety interventions is also available in Table 6, which lists examples identified from international literature.

The insights obtained from stakeholders was complemented by the outcomes of the transferability audit of the applicability of interventions to African countries (see Chapter 2.2). The audit covers six categories of challenges, namely:

- user acceptance (Would the targeted users accept this intervention?);
- conditions of the environment (changes in the local environment to accommodate the measure?);
- political commitment (Is there any political impediments to the implementation of this intervention?).
- regulatory framework (Is it necessary to introduce or revise laws or standards for the implementation of the measure?);
- technical skills (Are skills to implement the measure available?); and
- affordability (Are the essential financial resources available for the implementation of the measure).

5.1. Developing motorcycle safety strategy



Motorcycles are important transport means for most African countries since they are often the only mobility alternative. This is true for Cameroon, Rwanda and Uganda where moto-taxi services are prevalent as for Burkina Faso where motorcycles primarily are used for private transportation. Specific support measures focusing on motorcycle safety should be implemented.

A strategic framework (national motorcycle road safety plans and guidelines, for instance) for the implementation and monitoring of the interventions would facilitate the improvement of motorcycle safety.

The framework should clearly identify the main motorcycle safety issues, specify objectives and targets and describe the interventions to be implemented to reach the targets. The development of such a framework at regional level would ensure a better harmonisation of interventions among countries, and is therefore strongly recommended. A national framework is the minimum recommended.

The interventions proposed in the plans and guidelines should focus on specific motorcycle safety issues and be accompanied by implementation timelines and estimated costs.

The strategic framework should specifically deal with the following aspects:

GOOD PRACTICE

COSTA RICA: NATIONAL PLAN FOR MOTORCYCLES ROAD SAFETY (2015-2020).

The plan has been prepared with the aim of implementing a participative and multi-sectorial process to reduce the increasing trend of fatality rate and to promote a safe mobility of motorcyclists interacting with other road users.

The plan especially focuses on creating an organisational structure to implement and monitor motorcycle safety interventions recommended for Costa Rica.

The plan provides strategic recommendations and actions on various topics, such as awareness campaigns, training, enforcement, regulations, vehicles, road infrastructure, etc. Each action is then described and accompanied by indicators, activities to be implemented immediately, references from literature, etc.

While the plan preparation has been coordinated by the Costa Rica National Council for Road Safety (COSEVI), it has been participated by several national stakeholders, including motorcycling sector, institutions, and private firms.

Source: Consejo Nacional de Seguridad Vial Direccion de Proytectos : PNSVMoto-CR 2015-2020. 2015. Online in 31st of May 2021. plan motos final (ucr.ac.cr).

- **Policy formulation on the mainstreaming of motorcycle safety.**

  Motorcycles should be integrated into transport policies and initiatives aimed at creating a safer environment for road users and addressing vulnerabilities of two-wheeler users. Policies should promote the development of dedicated motorcycle facilities (such as parking facilities, dedicated lanes, removal of safety hazards, support training programmes) and the education of all road users on motorcycling safety.

  Countries with significant numbers of motorcycle users should direct safety policy development at further enabling sustainable motorcycle use. The objective should be to maximise road safety, while recognising that motorcycles remain vitally important in terms of affordability, mobility, the economy and the environment.

  Transport policies should incorporate clear road safety improvement goals and the steps to those goals (i.e., the "result focus" for institutional management).

- **Development of legal, institutional, and human capacity.**

  The policy formulation should be sustained with adequate legal and institutional frameworks, as well as by adequate human skills. A reliable road safety management system can contribute significantly to the improvement of road safety conditions. It is worth mentioning that road safety management is not limited to motorcycle safety. However, emphasising the importance of motorcycle safety through adequate institutional management functions is recommended.

  The development of legal, institutional and human capacity should be based on internationally recognised approaches, such as GRSF guidelines (Bliss & Breen, 2009).

  Institutional management functions, to be delivered by Government institutions, include developing appropriate coordination mechanisms for institutions and stakeholders involved (including identifying a Lead Agency), setting up appropriate legal instruments to specify responsibilities of institutions and their interventions, allocating sufficient and sustainable (technical and financial) resources needed for the implementation of road safety interventions, and emphasising the importance of road safety through road safety communication and promotion of actions.

- **Development of shared responsibilities**

  The development of the strategic framework for motorcycle safety should be led by a permanent working group in collaboration with relevant road safety stakeholders (Ministries, private sector, associations, NGOs and others).

  The working group's main role would be the inter-institutional strengthening of the entities responsible for road safety at the national and district levels. of the group's activities will include:

  - update of the process for obtaining driving licences for motorcyclists;
  - development and implementation of measures to regulate and support safety of moto-taxi users;
  - review of the process for homologation of helmets;
  - strengthening of the regulation and monitoring of the transportation of passengers (including children) on motorcycles;
  - development of solutions for improved enforcement,
  - exploring possible incentives for the use of protective equipment and for motorcycle safety actions (training, sensitisation, etc.); and
  - review of the processes of information gathering and processing and analysis of data on road crashes of motorcyclists.

  The working group has a strategic role of providing decision-makers with concrete outputs and guidance on the implementation of measures to improve road safety. The group should act as "lobbyist" to push the decision-makers to implement interventions. Moreover, it should establish a cooperative framework involving all the stakeholders, to ensure a wide acceptance of the interventions and to facilitate implementation.

- **Development of safety standards and requirements for critical factors.**

  The assessments conducted in Burkina Faso, Cameroon, Rwanda and Uganda highlighted deficiencies in regulations, standards and technical skills. These deficiencies were most pronounced in motorcycle safety aspects, such as road design standards, vehicle technical inspection, motorcycles and helmets standards, training and licencing of riders, moto-taxi services, motorcycle loading, etc.

The strategic framework should include actions aimed at developing new regulations or updating the existing ones. These actions include identifying institutions responsible for each aspect (for example, the authority in charge of transport policies dealing with vehicle inspections), agreeing on the technical features to be adopted, defining the legal, financial, and technical requirements for the implementation, setting the timelines for the implementation, and instituting measures to ensure adequate enforcement.

- **Development of motorcycle safety education and public awareness.**

  As part of the strategic framework, it is crucial to develop a culture oriented to motorcycle safety education. This involves developing motorcyclists' riding skills (through training and licencing) and a safe transport environment that accords motorcycles due recognition as part of the system, and ensures the safety of motorcycle riders and passengers and all other road users.

  One of the main strategic objectives, at country and regional level, should be to improve other road users' awareness of riders. Greater emphasis should be placed on the training of operators of all vehicle types to raise awareness on the effect of their road behaviour on other road users.

  Road safety campaigns can improve the safety of motorcyclists. Riders' attitudes and the perception of riders by other road users are the targets of most campaigns. Accordingly, education and publicity campaigns should be tailored to specific target groups (private riders, moto-tax riders, etc.).

  Specific aspects to be considered for the development of public awareness campaigns include creating a coordinated approach involving as many stakeholders as possible, focusing the campaign on providing solutions, targeting the right media, using appropriate and popular messages. For instance, particular emphasis should be put on recalling that motorcycles are smaller in size, therefore harder to spot in the traffic, and that their speeds are difficult to judge.

  In this context, it is also recommended that the strategic framework is accompanied with guidelines **(codes of conduct)** explaining to motorcyclists and other users the risks of road safety, and correct behaviours.

- Implementation of road safety interventions.

  The strategic framework should describe motorcycle safety interventions to be implemented at country level.

  The interventions should address the planning, design and operation of safe road networks, the conditions under which vehicles and road users can safely use it, and the safe recovery and rehabilitation of crash victims.

  The implementation of interventions should be driven by the institutional framework, including the lead agency, coordination mechanisms, legal instruments, resources, communication and promotion, as well as appropriate monitoring and evaluation mechanisms for the assessment of the impacts of interventions.

- **Strengthening of enforcement**

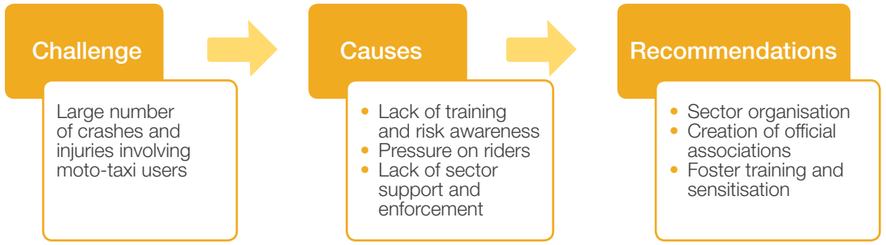
  The development of regulations, standards, and interventions does not guarantee their effective implementation. The enforcement of interventions must be strengthened to ensure the short-term improvement of road safety conditions.

  To achieve this, the enforcement measures should be integrated into the strategic framework. Motorcyclists must recognise their responsibilities, such as riding sensibly and safely within the law, showing respect to other road users, riding without the impairment of alcohol or drugs, etc.

  Police forces adopt inconsistent strategies when dealing with motorcyclists and often do not sufficiently enforce safety regulations helmet use, for instance). This can result in a lack of focus on key safety issues. Strategies which focus enforcement activities on key causes of motorcycle collision should be worked out. A national approach to enforcement should be introduced, with the aim of reducing the cases of serious injury and death among this vulnerable group of road users.

  A good example of enforcement is Rwanda, where the police has succeeded in ensuring good safety practices (such as helmet use and the one-passenger limit, etc.).

5.2. Regulation of moto-taxi sector



In Cameroon, Rwanda, Uganda and many other African countries, motorcycles are used primarily for moto-taxi service. Few African countries (like Burkina Faso) ban moto-taxis (but allow such services to be made by powered three-wheelers).

The presence of moto-taxi is important for most African countries, since it is often the main transportation option in cities and rural areas. Despite their strategic importance, moto-taxi services are in most countries almost completely unregulated and unmonitored.

The growth of the moto-taxi sector is related to an increasing but unmet demand for public transportation and represents a business opportunity. Estimates of financial viability suggest a substantial profit, mostly unaccounted for and untaxed. There are no standard fares set or enforced by government. Operators charge arbitrary fares, passing operating costs (fuel, lubricants, etc.) on to passengers in the form of higher fares plus an exorbitant profit.

Any action or plan dealing with moto-taxi services should be developed in close cooperation with relevant stakeholders (riders, associations, NGOs, etc.). Governments could consider the extension/replication of programmes like Uganda's "Safe Boda Boda" and practices effectively implemented in Rwanda notably, the regulations governing motorcycle public transport services. Rwanda's road safety rules for motorcycles incorporate:

- mandatory helmet use by riders and passengers;
- one-passenger limit;
- riders' use of reflective jackets adherence to speed limits;
- and training and sensitisation of riders.

It is crucial to **regulate the moto-taxi sector** at country level.

GOOD PRACTICE

RWANDA. STRATEGIES TO REGULATE MOTO-TAXI SERVICES.

Government of Rwanda has put in place regulations and practices to ensure moto-taxi services are operated safely and officially.
Specific laws have been implemented making mandatory for riders willing to operate moto-taxi service to belong to an official cooperative. In 2019, there were 71 cooperatives registered in the country, accounting for around 21,600 motorcyclists. Individual authorised motorcyclists were around 12,500 (i.e. around 36% of professional riders were not members of an association).

Cooperatives and motorcyclists can request a licence to the regulatory authority (RURA). Issuing of licences is facilitated thanks to online application services.

Cooperatives ensure respect of safety rules by all their riders, such as wearing helmet and providing it to passengers, avoiding loading more than one passenger, wearing reflective jackets, respecting speed limits, etc. They also provide training and awareness raising.

These practices are coupled with strong enforcement by National Police.
The process of modernisation of moto-taxi sector is ongoing. Currently "uber-like" applications can be used to book services and to track riders.
Projects are also under design to equip motorcycles with tracking devices, to further ensure respects of rules.

Source: stakeholders' consultations

Governments should **support the creation of official moto-taxi associations**, possibly by banning single moto-taxi riders or unofficial employment by motorcycle owners. This would have a twofold objective: effective monitoring of the sector's development (since all associations and riders would be registered) and recognition of the professional role of moto-taxi riders (thereby tackling unemployment and poverty).

As a first step, **appropriate regulations** should be introduced to facilitate the transition from informal practices to organised public services. This can be done in a variety of ways, notably by:

- developing incentive mechanisms to foster the affiliation of riders to official associations especially those offering benefits such as guaranteed fixed salaries and social security entitlements).
- offering associations incentives (such as lower taxation, equipment, training, and support on how to set up the association) to support the sector's development.
- giving the associations clear and uniform rules, such as:
  - providing professional rider licence (in conjunction with the municipality council);
  - training riders on how to ride and abide road traffic rules;
  - developing sensitisation activities (periodic messages and information, explanations of risks and the importance of safety equipment, etc.);
  - providing riders with safety equipment (helmet, retroreflective jacket, etc.);
  - using technology for riders tracking;
  - eventually providing equipment for passengers (also considering hygiene aspects); and
  - periodically verifying the motorcycles' roadworthiness.
- creating at the municipal level centralised repositories of data on moto-taxi associations and registered riders (as is the case with conventional four-wheeled taxis); and
- banning informal employment (private owners renting the motorcycle to riders).

The associations should have clear code of conduct, which on spells out misconducts (for instance related to causing crashes, speeding, riding under the influence of alcohol or drugs, etc.). The code should include clauses banning Riders who breach the code of conduct. The moto-taxi associations should also act as guarantor for riders' compliance with **safety rules**, for example, by:

- accepting only licenced riders as members (or supporting riders in obtaining a licence);
- assigning riders good quality and uniquely homologated motorcycles;
- providing motorcycles that are recognisable (distinct colour, stamps, etc.);
- ensuring periodic technical inspections of motorcycles; and
- verifying riders' compliance with standard safety rules (use of helmet, adherence to load and passenger limits, non-use of alcohol or drugs, respect of working periods, etc.).

Trip costs and riders' salaries should be clearly outlined, to keep riders from working excessive hours, speeding, etc.

In setting the fares, the associations should balance the users' ability and willingness to pay with the association's and rider's financial benefits.
The transition to "professionalism" of moto-taxi riders could be undermined by inadequate remuneration. This could also be worsened by improper taxation. Government should consider incentives such as tax rebates.

The government should explore the possibility of harmonising budgetary aspects at regional level to reduce illegal moto-taxi services in border areas.

The **use of helmet by moto-taxi passengers** is an important safety factor. Most moto-taxi riders do not provide a helmet to their passenger for a variety of reasons (chief among them, the unavailability of an extra helmet, and passengers' reluctance to use the same helmets worn by others). I in Rwanda, however, riders always provide their passengers with helmets.

One way of fostering passengers' use of helmets could be transferring the helmet responsibility from riders to passengers. By doing this, the rider could eventually refuse a passenger not willing to use a helmet. Alternatively, the police could enforce helmet use by both riders and the passengers.

5.3. Road infrastructure safety

5.3.1 Road design standards

Most African countries are currently building or updating road infrastructure. However, few road design standards and guidelines include specific features for motorcycle safety (dedicated motorcycle lanes, speed limits tailored for motorcycles, etc.).

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Road not designed for motorcycles • Low road maintenance	• Fewer crashes • Reduced crash severity / outcomes	• Affordability • Technical skills

It is recommended that governments revise the existing road design standards and guidelines (or develop new ones that meet the standards and guidelines) to reflect the growing presence of motorcycles and their specific characteristics and needs.

Most of the existing standards in Africa are foreign (AASHTO, French standards, etc.) and are not tailored to local conditions. Generally, design standards do not specifically consider motorcycles as reference vehicle for design characteristics, particularly not as a vehicle for public transportation.
Road design guidelines should reflect all the road infrastructure characteristics taking into consideration the Safe System approach, as well as the safety needs of motorcycles, and other vehicles and road users) The following road design guidelines, such as the one developed in South-East Asia, with careful attention to motorcycle features, could be used as reference:

- Malaysian Public Works Department (2015). **"Guidelines for Motorcycle Facilities**: NTJ 33/2015 JKR 20401-0063-15".
- Malaysian Public Works Department (2018). **"Geometric Guideline for Exclusive Motorcycle** Lane: ATJ 35/2018".

As far as possible, the development of regional guidelines should be promoted to ensure the harmonisation of road characteristics across the country.

The standards for roads should also include systemic road safety audits and inspections focused on motorcycle safety. Audits and inspections are an integrated process that incorporates safety of all road users, especially motorcycle riders and passengers as well. Reference can be made, for instance, to AfDB road safety audit manuals.[63]

Similarly, plans and tailored methodologies should be developed for systematic assessment of risks and identification of black spots in road infrastructure, accompanied by investment plans that focus on motorcycle safety. A systematic road infrastructure risk assessment can help guarantee adequate road standards. International methodologies incorporate network-wide road safety assessments. Reference can be made, for instance, to consolidated risk assessment methodologies like star rating for motorcycles from iRAP.[64]

[63] African Development Bank, 2015.Road Safety Manuals For Africa - New Roads and Schemes: Road Safety Audit. https://www.afdb.org/en/documents/document/road-safety-manuals-for-africa-new-roads-and-schemes-road-safety-audit-51937
[64] Decade of Actions for Road Safety: 2021-2030. A world free of high-risk roads. https://www.irap.org/

5.3.2 Separate lanes

Provision of separate lanes on roads with a large number of motorcycles can reduce potential conflicts with larger and heavier vehicles. The separation of motorcycles from the other road users, especially from heavy vehicles, can reduce motorcycle crashes.

Such facilities should be provided for all two-wheeled vehicles. Motorcycle speed limits should be introduced on such roads to reduce risky behaviours.

Riders may not accept this measure if motorcycles are confined to the separate lanes. This can be especially an issue in areas with high percentages of motorcycles and heavy traffic.

Motorcycle lanes can be installed on the existing road (usually located on the outside of the main carriageway for each direction of traffic). They should be separated from other lanes by bollards or similar features, and exclusive to motorcycles. Motorcycle lanes separated from the rest of the road by painted lines could be less effective and more easily used by other vehicles.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Mixture of road users	• Fewer crashes	• Regulatory framework • Political commitment • Environment change • Affordability • Technical skills

If inclusive motorcycle lanes re-join the main carriageway at intersections, crashes can occur. Critical issues to be considered include right or left turns on the road, which require rules on the management of motorcycles' interactions with other road users.

On new rural roads, for instance, exclusive motorcycle lanes should be considered. They require a carriageway completely separated from the road used by other vehicles, to minimise crashes at intersections.

One challenge could be the acceptance of dedicated lanes by other road users. A strong political commitment is therefore required to support this intervention.

Other challenges are related to the limited "right of way" of most of the roads because of the increased need for land acquisition and road maintenance.

5.3.3 Advanced stop lines for motorcycles

This measure involves the design of two distinct stop lines at a signal-controlled junction. The upstream one being for all vehicles and the downstream one only for motorcycles (or eventually bicycles). This allows motorcycles to bypass queued cars at the intersection and to queue up ahead of them.

Motorcycles have usually higher accelerations and therefore move quicker and at faster speeds from a stationary position than other vehicles. Denying them the head start provided by an advanced stop-line creates more interactions and potential conflicts with other vehicles.

GOOD PRACTICE

BARCELONA (SPAIN): ADVANCED STOP LINE TO MITIGATE THE PROBLEM OF BLACK SPOTS.

In Barcelona, Advanced Stop Lines (ASL) for motorcycles were implemented since 2009.

This separation allows motorcycles to manoeuvre more safely with reduced conflict with other traffic. In Barcelona, the 'bike box' is available to all two-wheelers and is indicated with a yellow hatched marking.

Source: European Safer Urban Motorcycling: BP2: Highway Features and Policy. Online on 31st of May 2021. http://motorcycleguidelines.org.uk/wp-content/uploads/2013/08/BP2-002-Advanced-Stop-Line-Trials-v3.pdf

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Mixture of road users	• Fewer crashes	• Regulatory framework • Political commitment • Environment change • User acceptance

The implementation of the measure should be possible at all signal-controlled intersections, especially where the traffic is dense, and the composition of motorcycles is high (which is the case in most African countries).

Pedestrian crossings must be placed downstream of the motorcycle stop-line. Since motorcycles could not formally queue downstream, there are potential conflicts with pedestrians. The measure should be accompanied with a permission for motorcycle to filter at low speeds through traffic.

Motorcycle waiting areas have been officially deployed in advance of the stop line at signalised intersections in developing countries like Taiwan, Malaysia and Indonesia.

5.3.4 Traffic calming measures

Traffic calming measures can be very effective in reducing the number of injury collisions, especially in residential areas.

These measures can be effective also for motorcyclists. However, it is important to pay attention to potential unintended effects linked to design, materials and maintenance.

Traffic calming measures can be either physical or visual (informational), or both. The choice depends on the objectives of the traffic calming scheme and the level of speed reduction considered appropriate.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Speeding	• Fewer crashes • Reduced crash severity / outcomes	• Regulatory framework • Environment change • User acceptance • Technical skills

The choice of type of physical measures is normally influenced by such factors as collision records, traffic volume, pedestrian activity, target speed, sensitivity of the local environment, views of local residents, and the budget.

Examples of traffic calming measures are:

- vertical traffic calming, such as speed humps and cushions (not to be located in an area where a motorcyclist will need to brake or change direction).
- non-vertical speed reducing feature such as mini roundabout.
- horizontal schemes, such as chicanes, islands, or refuges.

Figure 142 – Example of speed cushions

Many motorcyclists support the use of speed cushions (Figure 142), which give the option of riding between the speed cushions rather than over them (the act of aligning a motorcycle to pass through a small gap between speed cushions brings about a natural reduction in speed).

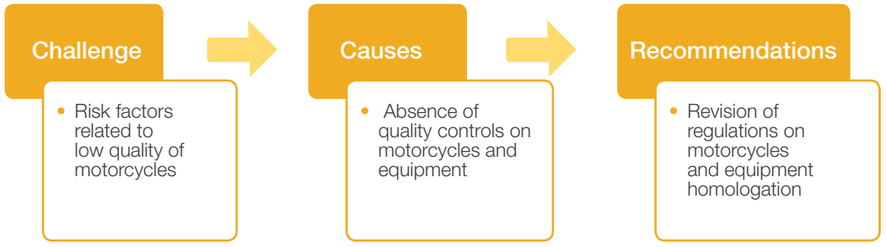
Rumble strips are also useful for motorcycles, provided they have adequate skid resistance. They are located away from the final braking area on the approach to a hazard, and have no vertical face greater than 6 mm. There is some evidence to suggest that rumble strips should not be used on bends with a radius of less than 1,000 metres because of possible danger to motorcyclists.

Useful publications in this area include "Home Zone: Design Guidelines" (IHIE, 2002) and the Traffic Advisory Leaflet 01/07 "Traffic Calming" (DfT, 2007).

It is worth noting that poorly maintained traffic calming devices can be a hazard to road users, but the consequences are often most severe for motorcyclists. Important aspects to ensure good quality traffic calming are:

- replacement of parts using non-original materials, thereby creating inconsistent road surfaces.
- uneven wear on vertical measures leading to unexpected depressions.
- road markings that fall below acceptable standards for retro-reflectivity and skid resistance, or that fade away completely.

5.4 Motorcycle safety standards



5.5.1 Standards and homologation of motorcycles

A revision of standards and homologation of motorcycles is recommended. On the one hand, most of the motorcycles currently sold have been described as low in quality and safety standard, resulting in a short service life (despite their relatively robust and powerful engines). On the other hand, several motorcycles are imported as parts and assembled in garages without the usual checks for completely or partially constructed vehicles. These vehicles are not often registered and homologated and can pose a danger to riders and other road users.

While assembling motorcycles locally can reduce the purchase price, it should only be allowed at authorised assembly facilities where the vehicle can pass through a process of verification of safety compliance, registration, and homologation. The authorities should impound motorcycles operated on public roads without the required assembly certification and registration plates.

Second-hand motorcycles imported from abroad should be checked (by recognised authorities or in authorized workshops before they are allowed to operate in the country. Verification of compliance with safety standards is highly recommended for spare parts and for assembled new motorcycles, upon their entry into the country. This can be done, for instance, by a random sampling of imported motorcycles and spare parts to ensure compliance with quality and safety standards.

A focus on type approval is recommended as a way of ensuring that all vehicles of a certain group or category comply to the minimum design and safety standards. Type approval offers a clear legal framework covering the technical requirements for the construction, safety and environmental performance of vehicles manufactured locally or imported for use on public roads.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Low motorcycle quality	• Fewer crashes • Reduced crash severity / outcomes	• Regulatory framework • Political commitment • Affordability • Technical skills

Compliance with these rules provides customers with products they can rely on and keeps non-compliant vehicles out of the market. The possibility of banning any motorcycle allowing more than one passenger or having an engine power incompatible with its weight should be explored and translated into revised standards.

The implementation of a sound type approval procedure is difficult because it requires a highly qualified staff and a relatively large investment in testing equipment. The authorities need to develop legal and administrative procedures with corruption prevention mechanisms, to reduce non-compliance with rules.

5.4.2 Motorcycle technical inspections

Periodic technical inspections of motorcycles at an authorised testing centre should be mandatory. Such inspections will increase motorcycle safety and improve the technical state of the motorcycle fleet.

In the process of testing a motorcycle's roadworthiness, illegal tampering can be uncovered.

The discovery of faults during technical inspections will reduce the number of motorcycle crashes caused by technical defects.

This measure should go hand in hand with random roadworthy spot checks on the road. This will discourage motorcycle owners from cheating the system, bribing officials, etc.

Penalties for operation of an unroadworthy vehicle may include impounding the unroadworthy vehicle or giving the owner one week to take the vehicle to a roadworthy testing centre). Moto-taxi operators or associations should have more stringent rules. Riding permits should be subject to roadworthy conditions.

GOOD PRACTICE

MOTORCYCLE TECHNICAL INSPECTIONS IN URUGUAY

Uruguay is one of the countries with mandatory motorbike technical inspections, but compliance has been delayed by the absence of regulation.
In 2014, the National Unit for Road Safety carried out voluntary technical inspections on compliance of motorcycles, with material incentives for participants. More than a thousand inspections were recorded.

The records show that 75% of the motorcycles had between 110 and 150 cm3 of displacement. Almost 63% of the motorcycles were less than five years old and only 11% were more than ten years old. One in three motorcycles passed the inspection without defects. Almost 54% had serious or very serious defects. The very serious constituted 39%.

The greatest number of defects was in the lighting system and the electrical installation, followed by the condition of the tyres.

Moreover, the study showed that most motorcycles developed effects after two years of operation.

Source: Ferrer A., Rubino J. (2017). "Guía de Buenas Prácticas Internacionales para Motociclistas : Medidas de Seguridad Vial". Banco de Desarrollo de América Latina (CAF).

In Europe, it is accepted that «dangerous machinery» has to be maintained and properly inspected to remain technically fit through its lifetime. The results of the study indicated a different situation in Africa. In Uganda, for example, technical inspections are no longer mandatory.

Figure 143 – Example of a mobile technical inspection

To support this measure, the following actions are recommended:

- Raising awareness on the importance of well fitted motorcycle.
- Promoting periodic inspections (every year or every six months) and offering incentives (cost reduction, benefits).
- Enforcing missed inspections, from the registry motorcycles. To facilitate the enforcement, a sticker should be given to motorcycles that pass the inspection.
- Banning motorcycles that are too old (e.g. more than 15 years) or that failed technical inspection.

Many countries and regions have regulations on the nature and timing of periodic inspections. These rules proved to be effective but could need to be amended to include motorcycles.

However, periodic technical inspection requires a large well-educated staff and huge investment in vehicle testing infrastructure.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Low motorcycle quality	• Fewer crashes	• User acceptance • Affordability • Technical skills • Regulatory framework • Political commitment

The effectiveness of this measure is strongly related to enforcement. It is crucial that the authorities impose fines on riders/owners who fail to present their motorcycles for any of the mandatory periodic inspections. Similarly, motorcycles that fail technical inspections should be barred from the roads.

A strong political commitment to the correct implementation of this measure is crucial.

The lack of precise data on technical failure as a risk factor might limit the acceptance of regular motorcycle inspection.

5.4.3 Standards for helmets

Helmet standards and homologation is a relevant topic since there is a general lack of regulations for this equipment. Poor quality is often the excuse for the failure to use helmets. The promotion of helmets of certified quality can be challenging in Africa, mainly because of the high cost involved. Moreover, not all the conventional helmets (the full helmets used in Europe, for example) are suitable for African weather conditions. A significant problem, in countries where moto-taxi is prevalent, is hygiene (particularly for passengers).

Standards for helmets specifically designed for use in tropical weather should be developed (taking advantage of pilot activities in countries like Uganda). The standards should clearly define the safety features of helmets and their homologation procedures to ensure compliance with agreed safety levels.

There are numerous standards for motorcycle helmets in the market. These safety standards are enforced by governments to protect motorcycle riders.

Motorcycle helmets sold in the market are subject to laboratory tests measuring a helmet's ability to absorb impact. The effectiveness of the retention system that keeps the helmet on the head and accessories such as helmet visors is also tested.

The most used motorcycle helmet safety standard internationally is the ECE 22.05 (required by over 50 countries). One of the advantages of this standard is the requirement for mandatory testing of each batch of helmets before release to the public. This means that the compliance with the ECE 22.05 standard is assured before the helmets leave the factory.

An uncertified helmet is unlikely to offer any protection to the wearer in the event of a crash.

Helmets should also be checked at the periodic motorcycle inspection and certified as safe/not damaged.

Standards should be implemented by an obligation to the manufacturers and dealers. To ensure the effectiveness of this intervention, government should introduce a ban on the sale and use of all non-certified helmets (for instance, those without ECE 22.05 or equivalent certification). This ban could be implemented gradually, for instance, phased over five years.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Low motorcycle quality	• Reduced crash severity / outcomes	• User acceptance • Technical skills • Regulatory framework • Political commitment

Governments should promote measures, such as the removal of taxes or offer of subsidies for imported standardised helmets, to support the distribution of helmets that meet the standards,

Campaigns should support the implementation of the measure, to raise acceptance. Enforcement of the measure is highly recommended (that is, after verifying that helmets used comply with standards).

5.4.4 Use of protective clothing

Protective clothes alleviate the effects of falls and collisions, as well as shield riders from the wind, rain and cold.

Among the standardised clothing offering protection to motorcycle users are protective riding gear/suits, goggles and helmet visors, gloves, impact protectors, and riding boots.

Some clothes can also include retroreflective strips to improve visibility in the dark (they reflect light from the headlamps of other vehicles, making a rider visible from a longer distance).

Improving motorcyclists' conspicuity with high-visibility equipment and active/reflective lighting is mostly beneficial in low light conditions, especially at night.

Conspicuity, however, is not a matter of lighting, but of contrast. High contrast makes a rider more visible and recognisable to other road users. Ample background light, sunshine, a bright environment and high-visibility equipment with a strong yellow colour and white reflective stripes can reduce the wearer's conspicuity, thereby increasing the risk of crash.

It is important that protective clothes comply with standards, ensuring basic safety protections.

GOOD PRACTICE

FRANCE: MANDATORY USE OF CE CERTIFIED GLOVES (NOVEMBER 2016).

To travel in France with a 2- or 3-wheeler (motorcycle, scooter, etc.) or a motor quadricycle (quad), several items of equipment necessary for the safety of passengers or other road users are mandatory: helmet, gloves, vest, headlights, etc.

The absence of this equipment constitutes an offence and results in a fine. Some personal protective equipment is not mandatory but recommended: jacket, pants, shoes, airbag, etc.

Source: Mandatory accessories for a 2 or 3 wheels with motor (motorcycle, scooter ...). Online on 31st of May 2021. https://www.service-public.fr/particuliers/vosdroits/F34168#:~:text=Le%20port%20de%20gants%20est,amende%20forfaitaire%20de%2068%20%E2%82%AC

There are two issues to consider in standardisation. First, there should be a harmonised definition of the term «protective». Second, users need to be aware of the level of protection to expect from a given product.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Lack of motorcyclists protection • Low motorcyclists conspicuity	• Reduced crash severity / outcomes	• User acceptance • Technical skills • Regulatory framework • Political commitment • Affordability

The implementation of this measure can be challenging in African countries because of the following factors:

- difficult climatic conditions;
- difficulties in finding standardised equipment (especially in rural areas); and
- high cost (depending on the type of clothing).

Awareness campaigns can help increase the use of high-visibility equipment.

To be made mandatory for all motorcycle users, the measure may need to be subsidised. Alternatively, it could be regulated for moto-taxi riders, so that it is a quality requirement to become a moto-taxi operator.

5.4.5 Mandatory use of headlights at all times

This measure is aimed at making motorcycle riders more visible to other road users, and to help reduce collisions.

By using their headlights at all times, day and night, motorcycle riders increase their conspicuity and reduce the prospects of a collision.

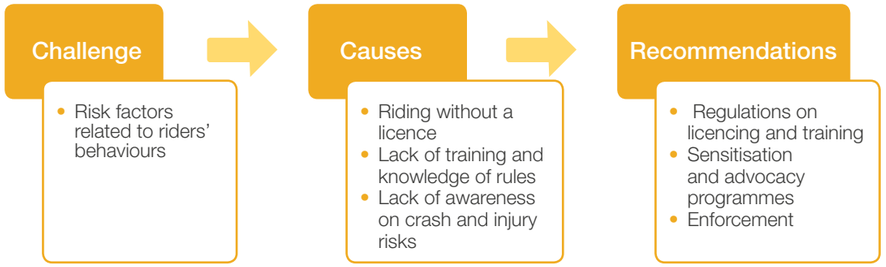
However, as other road vehicles increasingly use running lights during the daytime, there could be a reduced impact of motorcycles' use of headlights for conspicuity.

Another aspect to be considered is that riders are particularly resistant to instructions on to ride or the operation of their motorcycles. The riders' resistance notwithstanding, the implementation of this measure requires the introduction of a regulation empowering police to enforce the use of headlights by motorcyclists.

Several countries have made the use of headlights at all times mandatory. Furthermore, several models of motorcycles already are fitted with devices that prevent switching off the headlights (only dazzling can be activated or disactivated).

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Low motorcycle conspicuity	• Fewer crashes	• Regulation • User acceptance

5.5 Motorcyclists' safety



5.5.1 Integrated training and licencing

Most African countries have regulations for rider licencing. However, according to the information collected in Burkina Faso, Cameroon, and Uganda, few riders are in possession of a valid drivers' licence. The main reasons are the cost of the licence, and inadequate monitoring and enforcement. In Rwanda, most riders have a riding licence, which qualifies them for the operation of professional moto-taxi services.

Governments should increase awareness of the importance of the riding licence and facilitate access to training schools. Government should explore the use of incentives (such as slashing the cost of the Category A licence) to motivate riders to obtain the licence. This measure should be accompanied by Police enforcement to ensure effective implementation.

Governments should set a minimum age for a riding licence and the maximum engine power of motorcycles young and learner riders may operate (below 50cc recommended). Riders should be licenced to ride a motorcycle with a bigger engine only after the age of 18 and/or after at least one year of riding experience. This practice is already in place in some African countries (for example, Burkina Faso).

With the implementation of the Third Driving Licence Directive in Europe in 2013, learner riders must undergo the following curriculum: AM licence at age 14-16, A1 licence at age 16-18, A2 licence at age 18-20, and A licence at age 20-24[65].

In the mid-term, the development of training centres tailored on motorcycles should be promoted, for instance, to facilitate obtaining a licence, or to teach specifically how to ride motorcycles and what risks riders can face. Training centres should also facilitate teaching of illiterate persons (for instance, on how to recognise a signal).

Integrated training programmes should be developed and implemented involving various stakeholders' platforms (secondary schools, driving centres, riders' associations, and others).

GOOD PRACTICE

MALAYSIA: TRAINING FOR COMMUTERS.

A Malaysian programme to fight the rapid growth in commuting crashes has been rewarded as international good practice.

In Malaysia, the number of commuting crashes increased significantly from 2008 to 2017. To fight this, a program was launched aiming to facilitate employers' implementation of commuting safety measures at the workplace. It also encourages close cooperation between strategic partners and stakeholders for better road safety.

In one year, more than 800 training sessions were organised and 10,000 motorcyclists successfully trained. This resulted in improved riding behaviour in terms of using personal protection such as helmets and protective vests.

Source: Vision Zero: Combating Commuting Accidents In Malaysia. Online on 31st of May 2021. http://visionzero.global/vision-zero-combating-commuting-accidents-malaysia

[65]AM = motorcycle with cylinder capacity not exceeding 50 cm^3.
A1 = motorcycle with cylinder capacity not exceeding 125 cm^3.
A2 = motorcycle of a power not exceeding 35 kilowatts and with a power/weight ratio not exceeding 0.2 kilowatts per kilogram.
A = Any motorcycle not in category A1/A2.

Supporting and enforcing the licencing system is highly recommended to strongly reduce the number of unlicenced riders. Specific attention should be given to learner riders, as well as to youngers.

Currently, riders are not willing to get a riding licence due to general habits, the cost of a licence considered too high, and lack of enforcement of existing regulations. The following actions would motivate riders to obtain the licence:

- Reducing costs of the riding (Category A) licence (motorcycle with no power limitation).
- Offering the riding training for reasonable fee or, if possible, free (even for a limited period).
- Developing training courses on road safety and traffic rules for students (including assessing the possibility of adding these courses as part of school curricula).
- Developing sensitisation and enforcement plans focused on the rider licence.
- Creating specialised centres on motorcycle riding.
- Fostering training activities through moto-taxi or rider associations.
- Making mandatory components, such as the interaction drivers/riders and perception of riders, part of the training curriculum and licencing assessments of other vehicle drivers.
- Training drivers on impaired riding, to change their attitudes to drinking and riding, tampering, riding without a proper licence).

Minimum standards and certification of training and trainers should be established. Training should be designed to improve motorcycle safety by placing hazard awareness and perception at the core of the riders' training curriculum.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Incorrect / risky behaviours	• Fewer crashes • Reduced crash severity / outcomes	• Technical skills • Regulatory framework • Political commitment • Affordability

Introducing post-licencing training practices (eventually voluntary) should also be investigated. This can be accomplished through mandatory licencing recalls and/or through voluntary activities (workshops, community events, school programmes, etc.).

It is also important to maintain and regularly update a riders' registry, which should be linked with law enforcement databases (so that, for instance, road users with repeated wrong behaviours can be prosecuted or eventually banned).

5.5.2 Learner and beginner rider training

Analysis of data in Burkina Faso, Cameroon, and Uganda revealed that a high proportion of motorcycle crashes involved learner riders. This can be attributed to the different of training received by learner riders, and in many cases, a complete absence of training before obtaining a licence.

Below are the key aspects of basic training can make the learner rider capable of safely operating a motorcycle in normal traffic conditions on public roads:

- learning and understanding the intentions of laws and regulations on road safety;
- learning basic traffic strategies (interaction with other road users, correct and safe speed, lane positioning, visual directional control, active hazard search, perception, and anticipation); and
- earning precise and effective machine control skills, enabling the rider to be in control of the motorcycle when accelerating, cornering, and braking.

A sound basic training needs a lot of complementary measures like relevant training infrastructure, competent trainers, an extensive knowledge base and the administrative infrastructure for certification of training institutes and trainers.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Incorrect / risky behaviours	• Fewer crashes • Reduced crash severity / outcomes	• User acceptance • Technical skills • Regulatory framework • Political commitment • Affordability

The training should also reflect the minimum age for obtaining a motorcycle licence (16 for engine capacity under 50cc, and 18 for 50cc and above). A learner/beginner licence should apply for two years. They would have to redo the training and repeat the test for the licence if they incur a fine or get involved in a crash during the two-year period. Examples of such limitations for learner riders (also called riding bans for learner motorcyclists) exist in Ontario (Canada), Victoria (Australia) and Great Britain (Noordzij et al., 2001).

5.5.3 Age limitation for passengers

There is a minimum age for motorcycle passengers.

The Czech Republic implemented a Guideline in 2000 (Act on the road traffic No. 361/2000 - G2 -Article 7) urging riders not to take persons under the age of 12 as passengers[66]. The Portuguese Highway Code (national guideline implemented in 2005) sets the minimum age of passengers at seven (7).[67] In Austria, the minimum age for pillion passengers on motorcycles is 12.[68]Riding as a passenger on a motorcycle demands certain physical and cognitive abilities. Children under a certain age might not have the physical strength to react properly in specific situations, for example, in braking situations. There is a risk of falling off the motorcycle. The insufficient cognitive abilities increase the danger of a false reaction, which is dangerous for the rider and the passenger.

The use of moto-taxis to transport children to school featured prominently in the consultations with reported during the stakeholders in Burkina Faso, Cameroon and Uganda, for instance. In Rwanda, this challenge did not emerge because children under the age of seven (7) are not allowed as motorcycle passengers. Moreover, police enforcement of this rule is effective in Rwanda.

To be successful, this measure requires a combination of regulation, communication and enforcement.

Road users are likely to resist the regulation because in many African countries, the motorcycle is the only travel option for families, including children. Governments should promote alternative means of transportation (like BRT being developed in Kampala).

Enforcement of this intervention could also be hampered by the difficulty in verifying children's ages — many citizens do not carry identification documents.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Motorcycle overloading • Users' vulnerability	• Fewer crashes • Reduced crash severity / outcomes	• User acceptance • Regulatory framework • Political commitment

It should also be noted that having reached a certain age does not guarantee that one possesses the necessary level of physical and cognitive abilities to react properly in specific situations. Restricting according to the age could not completely solve the problem.

5.5.4 Integrated road safety education programme

The right attitudes towards correct behaviours in traffic are important. Attitudes are formed early in life and therefore children should be taught about traffic behaviour early in life.

Using an integrated long-term approach of teaching safe behaviours should get the problem at the root.

It may be assumed that the impact of educational measures goes far beyond just influencing children's road crash involvement. Familiarity with safe behaviour and safety attitudes during childhood is likely to create an effect that remains for the whole life of an individual.

Stakeholders consulted for this study identified this measure as a potential solution by stakeholders consulted.

The implementation of integrated road safety education requires comprehensive planning and capacity building, as well as political will, and the involvement of different ministries.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Incorrect / risky behaviours	• Fewer crashes • Reduced crash severity / outcomes	• Technical skills • Regulatory framework • Political commitment

[66]Global Regulation: The Amendment To The Law On Road Traffic. Online on 31st of May 2021. Machine Translation of «The Amendment To The Law On Road Traffic» (Czech Republic) (global-regulation.com)
[67]http://www.prp.pt/informacao/actualidades/act_00107.asp
[68]Bundesrecht konsolidiert: Gesamte Rechtsvorschrift für Kraftfahrgesetz 1967, Fassung vom 31.05.2021. Online on 31st of May 2021. http://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10011384

This measure is directed at road safety in general, not just motorcycle safety. However, considering the dimension of motorcycling in African countries, education programme could focus a lot more on motorcycle safety aspects (especially from the behavioural point of view).

5.5.5 Workshops for young riders

Although young riders fulfil the physical requirements for riding in traffic, immaturity and showy behaviour escalate the safety risks. Adolescents especially often misjudge critical situations. Stakeholders consulted on the study highlighted this challenge.

Young riders' attitude can be positively influenced by rider training, first-aid skills, and theoretical knowledge.

Workshops for young riders can include technical training, avoidance of critical situations, crash prevention, first-aid, and traffic rules and laws.

The workshops' curriculum and activities can be promoted in collaboration with motorcycle associations.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Incorrect / risky behaviours	• Fewer crashes	• Technical skills • Affordability

Implementation challenges could be related to costs and facilities, as well as the development of programmes.

Issues mainly involve the context of the workshop. It should address the "issues" that make young riders more prone to risk-taking and road crashes.

Awareness can be raised through schools, training schools, the licencing authority and the media.

5.5.6 Group work and problem-based learning

The main ideas for group work are to give participants a realistic picture of motorcycling risks and propose risk-reduction actions and attitudes.

The instructor or group leader/facilitator has a practical role, which may include providing data of motorcycle crashes. The group work could be the theoretical part of a one- or two-day riding course, including field training, and basic manoeuvres for dangerous situations.

This measure is deemed to only affect the behaviour of a small proportion of riders, especially because participation is voluntary.

The measure could specifically target regular offenders, who may have to undergo the group training before being allowed to ride again. In this case, the measure should be accompanied by effective enforcement, including suspension of licences.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Incorrect / risky behaviours	• Fewer crashes	• Technical skills • Affordability

5.5.7 Code of conduct for riders

To ensure that riders strive for safer behaviour and better interaction with other road users, guidelines can be issued, as part of the training curriculum, with the aim of improving motorcyclists' road behaviour. In addition to the traffic code, these guidelines may cover specific aspects of riding and behaviour.

While the highway (traffic) code is a law (usually enforced by the authorities), the guidelines are tools to increase awareness of road risks. Thus, they should be prepared according to communication practices.

Codes of behaviour that educate riders about risks and hazards, including specific characteristics of the local climate and infrastructure that could affect riding, can be deployed in support of wider safety initiatives.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Incorrect / risky behaviours	• Fewer crashes	• Technical skills

This measure should be implemented with the guidance/collaboration of the motorcycling community, to ensure that the guidelines fit motorcyclists' in safety needs as well as other interests, and that the measures are understood and widely accepted.

5.5.8 Community collaboration

This measure involves the organization of events, workshops or campaigns targeting the improvement of motorcycle road safety.

The sharpening of rider risk anticipation and perception, and the improvement of their riding skills, could result in the reduction in the number and the severity of motorcycle crashes.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Incorrect / risky behaviours	• Fewer crashes • Reduced crash severity / outcomes	• Affordability • Technical skills

Community collaboration may be considered a holistic approach to the achievement of sustainable effects by using a combination of channels to get the message through. Hence, this measure may be particularly useful for messages that are difficult to communicate through other channels.

Community collaboration could be promoted via motorcycle associations, where they exist.

There are no specific barriers for implementing this measure.

5.5.9 Sensitisation on helmet use

It will the collaboration of political leaders, local authorities and agencies, NGOs, the private sector, and community leaders to increase awareness on the proper use of crash helmets, especially in rural areas.

Coordinated activities such as talks, seminars and advocacy campaigns can be used to draw the attention and sustain the interest of the targeted group.

The main impacts of the sensitisation will be improved rider and passenger safety. However, increased awareness does not necessarily translate into fewer injuries and fatalities.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Incorrect / risky behaviours	• Reduced crash severity / outcomes	• Affordability • Technical skills

In countries where moto-taxi services are prevalent, this measure should focus on commuters using moto-taxi services. The sensitisation should cover both helmet wearing and safety standards, and include hygiene, the correct way of wearing helmets, etc. The messages of the sensitisation programme should be clear and free of scientific jargon.

5.5.10 Promotion of protective gear

Exposure to weather conditions, including, wind, rain and heat can also affect rider and passenger well-being and concentration. Furthermore, dehydration, overheating, and hypothermia can compromise a rider's judgment, decrease vision and impair coordination. Safety is the main reason to wear protective clothes, but comfort is also important.

Riders should be persuaded to wear protective gear to shield themselves from the elements and reduce the impact of falls from the motorcycle.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Incorrect / risky behaviours	• Reduced crash severity /outcomes	• Affordability • Technical skills

Wearing protective clothing can make the difference between an uncomfortable slide and severe injury requiring months of rehabilitation. Therefore, governments should develop public information and education resources for the instruction of motorcyclists on the benefits of helmets and protective gear.

To ensure a successful implementation, the costs and timelines of such programmes would need to be well defined. Cost is probably the main barrier. Sponsors providing clothing, subsidies should be explored as supportive interventions.

Evaluation, essential for the measure of the programme's effectiveness, is an additional cost.

5.5.11 Sensitisation on motorcycle safety

Several crashes involving motorcycles are linked to lack of riding experience, insufficient knowledge of traffic rules, and risky behaviours (speeding, overloading, abuse of alcohol, non-respect of signals, etc.). The analysis of data and consultations with stakeholders in Burkina Faso, Uganda, and Cameroon revealed that few motorcyclists hold a rider licence or received proper training.

A sensitisation campaign is highly recommended. The campaigns programme should be developed prior to other interventions. A key part of the campaign is clearly explaining to users why some interventions are essential. This is especially relevant to enforcement measures.

Good sensitisation practices can be found in Africa. For instance, the Rwanda Traffic Police and moto-taxi associations conduct periodic sensitisation and training activities. In Uganda, some moto-taxi cooperatives deliver sensitisation programmes.

Sensitisation programmes should be developed for motorcyclists and other road users, and should cover the main risk factors, notably:

- poor quality motorcycles;
- risky behaviours (speeding, drink-riding, overloading); and
- the invisibility of motorcycles to other motorists.

The actions should focus on improving motorcyclists' understanding and handling of road hazard risks (crash incidence, injuries, black spots, traffic situations, etc.).

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Incorrect / risky behaviours	• Fewer crashes • Reduced crash severity /outcomes	• Affordability • Technical skills

Behavioural experts should be engaged to develop effective road safety messages and strategies tailored to motorcyclists and other road users, by category. The sensitisation programme should be set up at national level. Below are examples of communication approaches for different user categories.

- General population should be approached through radio, television, social media, schools. The use of "national road safety champions" (popular persons like sportsmen, singers, etc.) would help increase users' interest in the message.
- Motorcycle associations should be approached through workshops and train-the-trainer activities.
- Moto-taxi riders should be approached through their associations, which can tailor the message to the riders' level of knowledge and understanding.

Road safety advocacy[69] is also deemed necessary to inform and influence changes to policies, legislation and structures by targeting decision-makers invested with the power to make the requested change. For instance, the Global Road Safety Partnership (GRSP) has developed specific tools to support road safety advocacy that could be used as references[70].

5.5.12 Sensitisation on drink-riding

The implementation of specific actions to prevent drink-riding is recommended. Approaches to prevent drinking and riding have been proposed (McKnight & Becker, 2006 McKnight & Becker (2006) that present three important aspects of drink-riding prevention that could be communicated to riders. They are:

- the extent of the drinking and riding problem;
- the need for riders to intervene in their peers' drink-riding behaviour; and
- "tools" that riders can use to help prevent their peers from drink-riding.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Drink-riding	• Fewer crashes	• Technical skills • Affordability

Sensitisation by peers can significantly reduce the rate of drink-riding among riders.

Critical issues to be considered when implementing the measure would be the characteristics of the riders. Sensitisation on such measures could be done through media, by word of mouth and a well-designed communication strategy. Different motivational approaches should be considered. For example, the message should highlight the consequences of drink-riding — crashes, injuries, even death.

Given the wide-ranging implications of the problem to society, it is highly recommended that riders be approached through associations, communities, influential groups.

[69] A set of targeted and appropriate actions directed at decision-makers and key influencers in support of a specific policy issue
[70] Global Road safety Partnership: Advocacy tool. Online on 31st of May 2021. https://www.grsproadsafety.org/resources/advocacy-tools/

5.5.13 Motorcycle overloading

The data analysis and consultations with stakeholders in Burkina Faso, Cameroon and Uganda highlighted motorcycles' excess load (goods and passengers) as a serious safety risk. The problem was not identified in Rwanda where existing regulations on motorcycle public transport services limit the number of passengers to one and prohibit oversized luggage. These rules are effectively enforced by the Traffic Police.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Drink-riding	• Fewer crashes	• Technical skills • Affordability

To eliminate overloading, governments should:

- develop specific sensitisation campaigns to explain risks associated with overloading and carrying multiple passengers;
- educate riders (especially moto-taxi operators) on the risks of overloading.
- promote correct moto-taxi fares and salaries for moto-taxi operators, to reduce the temptation of carrying multiple passengers; and
- adequately enforce overloading, including sharing the responsibility between riders, passengers, and owners of motorcycles (especially those operating unofficial moto-taxi services).

5.5.14 Training and testing of unlicenced riders

The central goal of a motorcycle licencing system is to ensure that individuals have the necessary skills and knowledge to operate a motorcycle safely. The objectives of the licencing system are to:

- motivate intending motorcycle operators to acquire the knowledge and skills necessary to ride safely;
- encourage all riders to obey and follow the rules of the road;
- encourage beginning riders to gain experience in a low-risk environment;
- ensure that new riders attain an appropriate level of knowledge and skill before receiving full riding privileges; and
- encourage strict enforcement and heavier penalties for untrained and unlicenced riders.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Incorrect / risky behaviours	• Fewer crashes • Reduced crash severity /outcomes	• Technical skills • Regulatory framework • Affordability

In addition to ensuring that new riders get a training and a licence before they start operating a motorcycle, government should address the specific challenge related to unlicenced riders currently involved in the transport system.

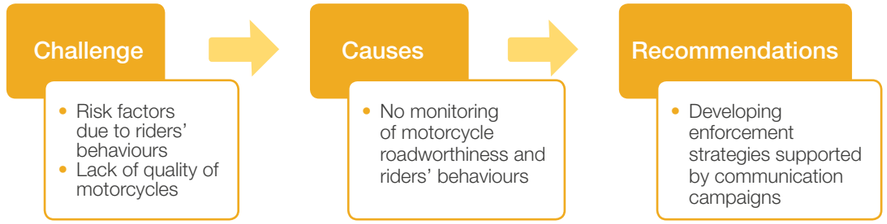
The information collected in Burkina Faso, Cameroon, and Uganda showed that few riders have a riding licence or have been appropriately trained to operate in the transport system. Most riders merely learn how to control a motorcycle, without any training on traffic rules and safety aspects.

Motorcycle licencing requirements drastically reduce the system's overall effectiveness (Hanchulak & Robinson, 2009). Without proper enforcement of licencing, agencies cannot ensure that riders possess adequate knowledge and skills to operate safely on the road.

Reaching the motorcyclist population must be a priority for licencing administrators. To train and test unlicenced riders, the following actions should be implemented:

- **Stakeholders' cooperation.** Licencing authorities should work cooperatively with all stakeholders involved in road safety and motorcycle operation (moto-taxi associations, communities, etc.) to develop strategies for training and testing riders. Specific actions to convince riders to get a training can be promoted through associations, NGOs and local communities.
- **Communicating** to riders the importance and impact of safety measures is also important. It is vital to explain why training is important, how to obtain a licence, and what benefits can be obtained. Approaching riders appropriately and using adequate language must be considered as a priority. For instance, it could be necessary to identify training methods suitable for explanation of traffic rules to people with limited literacy.
- **Consistent enforcement** combined with public education campaigns can be powerful incentives for motorcycle riders to become fully licenced.
- **Expanded testing locations and hours.** Government should consider increasing the number of testing locations and extending testing hours for motorcycle licences, to give riders more time and flexibility for training. By creating more training opportunities for riders (for example evenings and weekends), agencies can facilitate riders' in compliance with licencing requirements.

5.6 Enforcement strategy



Recognising the strategic role of enforcement as a driver to road safety improvement is one of the main aspects to be dealt with. If accompanied by a clear communication strategy, enforcement is probably the more effective measure in the short term. Enforcement should incorporate efforts to eliminate corruption.

To achieve success, enforcement should target specific factors contributing to motorcycle crashes and should be integrated to a national enforcement strategy.

Governments should develop a clear **enforcement strategy** that focuses on key causes of motorcycle collisions, and introduce a nationally agreed approach to enforcement. The strategy should include clear goals (that is, the specific risk factors to be dealt with) and adequate resources.

Police enforcement is based on the principle that people try to avoid penalties. [71]A related, and crucial, principle is the subjective chance of apprehension — people's belief that there is a high chance of getting caught and penalised when they violate a rule. The subjective chance of apprehension is influenced by the actual level of enforcement (that is, the objective chance of apprehension). It is also affected by how much people see or hear about police enforcement. Therefore, the subjective chance of apprehension can be increased by:

- applying both visible and covert enforcement activities.
- publicising specific enforcement activities (in national or regional media), to explain to users is the rationale and importance activities; and
- giving feedback on the results of enforcement activities in national or regional media and other information channels. The enforcement strategy should be accompanied by precise performance indicators (for example, the percentage of reduction of the number of motorcyclists not using the helmet over three years).

GOOD PRACTICE

UK: MOTORCYCLE ENFORCEMENT STRATEGY (ASSOCIATION OF CHIEF POLICE OFFICERS, 2006).

The strategy has been developed in 2006 by the Association of Chief Police Officers with the aim of:

- introducing clear guidelines,
- alleviating animosity between the Police and motorcycle groups,
- encouraging an environment of cooperation and partnership, working together to achieve a safer road environment for all.

Amongst others, the core themes were exceeding speed limits, careless or dangerous riding and noncompliance with road signs.
As a result of this strategy, the UK casualty rate for riders has fallen during the three years after its implementation.

Source: http://irsa-association.org/wp-content/motorcycle_enforcement_strategy_website.pdf

Enforcement should be gradual, to reduce resistances from users. Moreover, strong political will is needed to deal with the issues. To be successful, it is recommended that the enforcement strategy is accompanied by measures supporting the motorcycle sector and by sensitisation campaigns.

The enforcement strategy should also address police lack of breathalysers, drug test, speed cameras, etc. A plan to get resources for their deployment should be developed.

To be effective, enforcement should target specific factors contributing to motorcycle crashes and the enforcement measures should be integrated into a national enforcement strategy.

[71]European Commission: Mobility and Transport. Online on 31st of May 2021. https://ec.europa.eu/transport/road_safety/specialist/knowledge/speed/speed_limits/speed_enforcement_en

Governments should develop strategies that focus on enforcement activities that address the key causes of motorcycle collisions. A nationally agreed approach to enforcement should be introduced, with the aim of reducing the cases of serious injury and death.

Based to the assessment made in Burkina Faso, Cameroon, Rwanda and Uganda, enforcement is especially recommended for the following safety measures:

1. Helmet wearing

This enforcement measure involves the verification of riders' and passengers' use of helmet.

The imposition of severe penalties, including the confiscation of motorcycles, is highly recommended for riding without a helmet.

The responsibility for a passenger's failure to wear a helmet should be placed both on the passenger and the rider.

For moto-taxi services, the responsibility for wearing the helmet should be placed on the owner of the motorcycle or on the association to which the rider belongs.

Rwanda is successfully enforcing the wearing of helmets. Field surveys conducted in Rwanda confirmed that all riders or passengers wore helmets. The Traffic Police has been effective in systematically stopping riders and passengers not complying with the rules, which led to almost complete compliance of rules.

2. Compliance with helmet standards

The primary goal of a motorcycle helmet is to protect the rider's head during impact, thus preventing or reducing head injury or saving the rider's life. The standards for motorcycle helmets ensure that the helmets sufficiently protect the wearer in the event of a collision.

Motorcycle helmets sold in the countries should have met certain requirements and should be subject to laboratory tests (measuring the helmet's ability to absorb impact). The effectiveness of the retention system that keeps the helmet on the head and accessories, such as helmet visors, must also be tested.

To enforce compliance with helmet standards, the government should:

- verify compliance with the country's entry requirements for helmets, through a national homologation authority.

Figure 144 – Example of a mobile technical inspection

- ensure that all helmets have a visible stamp indicating the standard to which they refer (Figure 144); and
- ensure that the enforcement legislation includes rules for verification of compliance and adequate fines.

3. Validity of technical inspections and quality of motorcycles

Provided that technical inspections are mandatory, motorcycles should be tested periodically by an authorised company. Following the technical inspection, the authorised company should issue a certificate confirming the validity of the inspection and certifying the safe condition of the motorcycle.
To ensure the quality and integrity of technical inspections, the transport authority should monitor the activities of technicians. This includes reviewing issued certificates, verification of facilities, conducting audits, etc.

During road checks, police officers should request to see the riders' certificates of technical inspection and verify their validity. These checks would typically cover the functioning of brakes, headlights and tyres, and the motorcycle's overall condition.

3. Validity of riding licences

This enforcement measure entails the verification of the validity of the riding licence, as well as its correspondence with the type of motorcycle used. This measure is directly connected with riders' compliance with training and licencing regulations. The imposition of severe penalties, including the confiscation of motorcycles, is highly recommended for riding without a valid licence.

4. Speeding.

The enforcement of speed limits is only effective if the offenders pay the fines for the infringements. In countries that apply a penalty point system, penalty points are assigned for the most severe speed violations in addition to a monetary fine. If a speed violation exceeds a certain threshold, the driving licence can be suspended for a stipulated period. In some countries, drivers are required to attend a driver improvement course after a serious speed limit violation.

There are numerous tools and methods for automatic and non-automatic speed enforcement. With non-automatic speed enforcement, a speed violation is detected, and the violator is immediately stopped by a police officer who can either issue the driver a warning or fine. With automatic speed enforcement, a speed camera records the licence plate number of a speed-violating vehicle, and the system generates a speeding ticket, which is mailed to the driver.

Tools and methods typically used for non-automatic speed enforcement are:

- Spot checks: radar or laser gun equipment alongside the road (visible or hidden).
- Conspicuous or inconspicuous police cars.

Tools and methods for automatic speed enforcement are:

- Spot checks: fixed or mobile speed cameras.
- Trajectory or section control (control between two points).

Use of automatic speed enforcement tools is more complicated in the short-term, since it entails higher resources and, in some cases, a revision of the legal system in a particular country (for instance concerning liability and privacy legislation related to the identification of the licence plate holder).

Experience shows that a speed camera enforcement programme requires good national and local partnerships working to clear and transparent rules, to ensure public acceptability. Achieving compliance requires legislation that enables vehicle owners to be liable for the offences.

Governments should put emphasis on allocation of resources for the purchase and maintenance of speed-monitoring equipment and for skills acquisition. This should be done as part of the national strategy for road safety.

- **Riding under the influence of alcohol and drugs**

Enforcement of riding under the influence of alcohol and drugs is as important as the enforcement of speeding and other risk factors.

The introduction of a BAC reading of zero for motorcycle riders is highly recommended as a measure to prevent alcohol-linked road casualties.

For instance, the EU has recently set a target to reduce deaths and serious injuries on the road by half by 2030. A quarter of the 25,000 EU road deaths each year are likely to be linked to alcohol, according to European Commission estimates. Therefore, significant progress has been recorded in the tackling drink driving.

- **Similarly, zero-tolerance on drug use by riders must be implemented.**

To ensure compliance with regulations (in addition to the accepted BAC level or on zero tolerance), police officers should be equipped with devices for testing alcohol (portable breathalysers) and portable saliva drug test for drug use (Figure 145).

The imposition of severe penalties, including the imposition of motorcycles and a mandatory attendance of a training course prior to the recovery of the rider/operation licence, is highly recommended for motorcyclists riding under the influence of alcohol or drugs.

Figure 145 – Examples of breathalyser and drug test devices

- Motorcycle overloading

  The enforcement of overloading is aimed at ensuring the stability of motorcycles and, consequently, the reduction of crash risks.

  Police should impose severe penalties, including the i motorcyclists carrying more than one passenger or oversize goods.

  It is also preferable that children are not carried on motorcycles unless they are above 12 years old. This can be achieved through the implementation of suitable regulation.

  It is highly recommended to impose severe consequences to riders overloading the motorcycle, including motorcycle confiscation.

  Rwanda is successfully enforcing the overloading of motorcycle taxis.

- **Other risky behaviours such as cutting in and out of traffic, failure to signal, loading/ unloading passengers in non-designated areas, not wearing reflective vests, etc.**

Enforcement is unpopular and can be resisted by road users. A strong political commitment is crucial for successful enforcement.

A specific topic related to enforcement is addressing **corruption practices** that undermine the effectiveness of enforcement strategies.

Case studies and literature reveal that there is no "one size fits all" solution to police-related corruption. Rather, any measures must take into consideration the country's political, economic, and social environment and address the root causes of corruption, rather than adopting a symptomatic approach (Lee-Jones, 2018). For example, in Singapore and Georgia, low salaries and poor working conditions for members of the police force were identified as a cause of corruption among lower-level officers.

A national strategy to address this issue should be developed. Different actions can be taken to curbing corruption, including sensitisation of police officers and civil society, salary increase, result-based incentives, promotion of meritocracy, quality control of personnel, and independent oversight of the police.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• Incorrect / risky behaviours	• Fewer crashes • Reduced crash severity /outcomes	• Affordability • Political commitment • Regulatory framework

5.7 Motorcycle issues in emergency and first aid training

This measure involves adequate training of medical personnel on riders' needs in crash scenes, such as the correct way to remove helmets.

It is important that the emergency medical personnel are prepared for the specific needs of motorcyclists involved in crashes.

The training can also be extended to the public (as a voluntary course) but made mandatory for moto-taxi riders.

Since the injuries are generally severe, a different response protocol to crashes involving motorcycles could be introduced, for instance, by making sure that there is a first-aid provider on site, and trauma specialist at hand at medical facilities.

A potential challenge could be the additional contents of the training, which should be based on the poor or inadequate treatment of riders at the crash scene, in the ambulance or at the hospital.

In addition, it crucial that such first aid information is provided to riders so that they also know how to react after a crash, what to do about their and their passengers' injuries.

Information about the training could be disseminated to at places of work, training schools, or through the traditional and social media.

Prior to implementation, harmonised and scientifically approved methods of the management of injured riders (helmet removal, for example) must be agreed upon.

RISK FACTOR	EXPECTED IMPACTS	MAIN CHALLENGES
• All risks	• Reduced crash severity / outcomes	• Affordability • Technical skills • Regulatory framework

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Annexes

Annex 1 - Literature on motorcycle safety

	Title	Location	Year	Type
1	Enhancing understanding on safe motorcycle and three-wheeler use for rural transportation	Africa	2018	Report from project “Enhancing understanding on safe motorcycle and three-wheeler use for rural transport” (AfCAP).
2	Motorcycle Injuries as an Emerging Public Health Problem in Mwanza City, North-Western Tanzania	Tanzania	2010	Paper (Tanzania Journal of Health Research).
3	Motorcycle safety: a scoping study	Great Britain	2003	Report (Transport Research Laboratory – TRL).
4	Motorcycling Safety Policy Paper	Great Britain	2006	Report (Royal Society for the Prevention of Accidents).
5	Motorcycle Safety	US	2010	Presentation (U.S. Department of Health and Human Services).
6	Traffic problems in Southeast Asia featuring the case of Cambodia's traffic accidents involving motorcycles	Cambodia	2018	Paper (International Association of Traffic and Safety Sciences).
7	Motorcycle Safety and the Repeal of Universal Helmet Laws	US	2007	Paper (American Journal of Public Health).
8	Motorcycle Safety	US	n/a	Paper (Transportation Research Board - A3B14: Committee on Motorcycles and Mopeds).
9	Motorcycle Safety and Accidents in Europe	Europe	n/a	Report (Federation of European Motorcyclists' Associations).
10	Public Policies and Motorcycle Safety	Miami	2009	Paper (University of Miami).
11	Motorcycle Crash Causation Study	US	2019	Report (Federal Highway Administration).
12	Fatal Two-Vehicle Motorcycle Crashes	US	2007	Report (U.S. Department of Transportation - NHTSA).
13	Integration of needs of moped and motorcycle riders into safety measures	Europe	2001	Report (SWOV for EC research project PROMISING).
14	A Global Approach for Safer Motorcycling	Global	2015	Report (International Motorcycle Manufacturers Association).
15	Motorcycle parts and aftermarket industry regional value chain in Southern Africa	South Africa	2019	Paper (United Nation University WIDER).
16	Understanding the emerging role of motorcycles in African cities	Africa	2011	Report (SSATP).
17	Safer Motorcycling	Global	2019	Report (International Motorcycle Manufacturers Association)
18	Traffic Safety Facts	US	2013	Factsheet (U.S. Department of Transportation - NHTSA).
19	A comparative study on machine learning based algorithms for prediction of motorcycle crash severity	Ghana	2019	Paper (open access: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0214966).
20	Impact of Motorcycle Defects on Motorcycle Safety in Thailand	Thailand	2014	Paper (Journal of Society for Transportation and Traffic Studies).
21	Rural Transport Health and Safety in Sub-Saharan Africa	Africa	2014	Report (African Community Access Programme - AfCAP).
22	Examine Factors Associated with Motorcycle Injury and Fatality	China	2014	Paper (Applied Mechanics and Materials).
23	Common motorcycle crash causes	Great Britain	2017	Report (Royal Society for the Prevention of Accidents).

24	The need for building role models for motorcycle riders' education in the kingdom of Cambodia	Cambodia	2018	Paper (International Association of Traffic and Safety Sciences).
25	Determinants of certified motorcycle helmet use among postal delivery riders at rural areas in Peninsular Malaysia	Malaysia	2018	Paper (International Association of Traffic and Safety Sciences).
26	Evaluation of State Motorcycle Safety Programmes	US	2010	Report (U.S. Department of Transportation - NHTSA).
27	Opportunities for Safety Improvements in Motorcycle Crashes in the United States	US	2007	Report (National Crash Analysis Centre, The George Washington University).
28	Motorcycle and moped helmets	Netherlands	2010	Factsheet (SWOV).
29	Evaluation advanced training course for motorcyclists/ Motorcyclists ride safer after training	Netherlands	2014	Report (SWOV).
30	Category A1 (to 125cc) of the new motorcycle driving licence	Netherlands	2010	Factsheet (SWOV).
31	Fatal and serious road crashes involving motorcyclists	Australia	2008	Report (Department of Infrastructure, Transport, Regional Development and Local Government).
32	NSW Motorcycle Safety Strategy 2012 – 2021	New South Wales	n/a	Report (Transport for NSW).
33	Powered Two Wheelers - Safety Measures	General	2012	Report (from Project 2BESAFE (European Commission).
34	Power Two Wheelers 2018	Europe	2018	Report (European Road Safety Observatory).
35	Addressing Urban PTW Accidents	Europe	2018	Report (from project “eSUM” (European Commission).
36	Powered two wheelers (PTWs)	Africa	2018	Factsheet (the SaferAfrica project, European Commission).
37	Vehicles	Africa	2019	Factsheet (from theSaferAfrica project, European Commission).
38	Data Analysis and Identification of Risk Factors	Africa	2018	Report (from the SaferAfrica project, European Commission.)
39	Improving Safety for Motorcycle, Scooter and Moped Riders	General	2015	Report (IRTAD).
40	Injury Analysis of Powered Two-Wheeler versus Other-Vehicle Urban Accidents	Florence	2016	Conference paper (International Research Council on the Biomechanics of Injury).
41	Victoria’s Road Safety and Transport Strategic Action Plan for Powered Two Wheelers 2009–2013	Victoria	2008	Report (Victorian Government).
42	Plan Metropolitano de Seguridad Vial para Motociclistas	Buenos Aires	n/a	Report (Buenos Aires Ciudad).
43	Plan Nacional de Seguridad Vial para Motociclistas	Costa Rica	2014	Report (Consejo Nacional de Seguridad Vial).
44	Plan de Seguridad Vial del Motociclistas	Bogotá, Columbia.	2016	Report (Secretaria Distrital de Movilidad).
45	Capacity Review Reports	Burkina Faso Cameroon Kenya South Africa Tunisia	2018	Reports (five deliverables from the SaferAfrica project, European Commission).
46	Powered Two Wheelers	Europe	2009	Report (from the SafetyNet project, European Commission).
47	Motorcycles & Mopeds	Europe	2011	Report (from the DaCoTA EU Road Safety Project, European Commission).
48	International Good Practice Guide for Motorcyclists: Road Safety Measures	Latin America	2017	Guidelines on motorcycle safety measures accompanied by good practices.

n/a = not available

Annex 2 – Transferability audit details

Transferability Audit methodology

Within the context of this research study, transferability refers to the extent a road safety intervention developed and deployed in one context, can be applied to another context. The “context” can be a country or a region, infrastructure characteristics such as road type, age, gender and nationality of the targeted road user, legal and organisational structure, government policy, etc.

The underlying concept of transferability is that an intervention that has been successfully used in one context may be less successful in another context because of differences in social, economic, and institutional characteristics.

For a road safety intervention developed somewhere to be successfully adopted in an African country, the specific local context needs to be assessed and a judgement made about what specific elements of the intervention can be transferred without modifications and what needs adaptation.

The method used to assess the transferability of motorcycle safety interventions in Africa is derived from the European Commission’s SaferAfrica project, especially from the Deliverable 7.2 of the project.[72]Within SaferAfrica, a set of road safety good practices was assessed to determine their potential for adaptation to five African countries.

The tool to analyse transferability is a Problem Priority Matrix (PPM) where:

- rows represent motorcycle road safety interventions;
- columns represent three “road safety factors” (Society, Economy, and Institution).

Relationships between rows and columns are scored and weighted by African stakeholders, to determine the motorcycle safety interventions would best address safety issues at country level in Africa.

The Problem Priority Matrix is a tool commonly used in project management to prioritise activities. It can help an organization to make decisions by narrowing options down by systematically comparing choices through several (weighted) criteria that are important to the organization.

It is used, for instance, to rank problems according to their urgency and the potential impact that an unresolved problem might have on an organization.

Within the research study, a Problem Priority Matrix was used to assess the applicability and process of transferring foreign motorcycle safety interventions to an African country.

The basic task is to assess whether a given intervention may be perceived as a problem within one (or more) of the assessment area(s) provided by the road safety space (i.e. Society, Economy and Institution) as research layers which describe the receptor context.

To this end, six factors related to the three road safety domains are used, namely:

- **Society:** People/Environment.
- **Institution:** Availability of regulation/Political commitment.
- **Economy:** Design, implementation, affordability of maintenance costs and the availability of technical skills.

Possible questions raised by each factor can be used to assess the applicability of an intervention (Table 17).

[72] http://www.saferafrica.eu/media/2013/saferafrica_-_d72_-_final-1.pdf

Table 17 – Questions addressing transferability

Domain	Factor	Assessment questions
Society	People	Would the public and the targeted population accept this intervention? Does any aspect of the intervention go against local social norms? Is it ethically acceptable? Can the contents of the intervention be tailored to suit the local culture? Does the target population in the local setting have a sufficient educational level to comprehend the contents of the intervention? Is the target population aware of the road safety problem?
	Environment	Is it possible to change the present environment to accommodate the proposed practice?
Institution	Availability of regulation	Is there relevant legislation (standards, laws, etc.) to facilitate the transferability of the intervention?
	Political commitment	Does the political environment allow this intervention to be implemented? Is there any political barrier to implementing this intervention?
Economy	Affordability (of the design, implementation, maintenance)	Are the essential economic resources for the implementation of this intervention available in the local setting?
	Availability of technical skills	Is the provider of the intervention in the local setting sufficiently skilled to deliver this intervention?

To fill the Problem Priority Matrix, for each practice, the stakeholders faced the question: *Would this safety practice be a problem for the following factor?*

To answer, they need to provide a score and a weight for each criterion of the road safety space according to their expertise. Then, the total scores will be the sums of multiplications of scores and weights in rows and columns.

Scores to be assigned to an intervention depend on the level of difficulty in transferring/adapting it to the receptor context. The more challenging the transfer/adaptation, the higher the score on the Likert scale.[73]

It is assumed that measures with similar level of challenge might differ in the level of importance attributed by policy makers/stakeholders to each criterion for a specific measure. For instance, environment suitability might be critical for the successful implementation of a roundabout but not for an educational measure.

Weights are to be assigned according to the importance of criteria to the successful implementation of the intervention. For instance, the weights can show if a factor is more important than another in the specific receptor context (for example, are factors related to people more important than those related to the availability of technical skill?).

Scores and weights are to be provided according to the respondent's expertise on the context where the measures should be designed and implemented. The score and weights ranged from 1 (highly challenging/not important) to 5 (not challenging/highly important).

The final scores are calculated per rows and columns as the sum of multiplications by scores and weights.

As a result, the lowest are the total scores for each row, the least challenging being the interventions to be implemented. The lowest are the total scores for each column, the least affected being the related road safety components (society/institution/economy). The results can also be used to identify the factors to be improved to facilitate the transferability.

To put in practice the concepts described above, a questionnaire was prepared (see section "Transferability Audit questionnaire" below) and sent to road safety stakeholders in almost all the African countries. The motorcycle safety interventions (see Table 6 for details) were classed by category, as follows:
Road infrastructure.

- Vehicles.
- Visibility.
- Protective equipment.
- Licencing, training.
- Traffic Law and Enforcement.
- Awareness campaigns.
- Post-crash care.
- Data collection.

[73] A scale commonly used in research questionnaires to rank the respondent's level of agreement or disagreement to a topic or situation.

Transferability Audit results

Few African stakeholders filled in the Transferability Audit matrix. Results are available for Botswana, Mali, Tunisia, Kenya, and Ethiopia. Burkina Faso, Cameroon, Uganda ere been considered for this analysis since more focused analysis and consultations with stakeholders have been performed. The consultations with stakeholders were also used to assess the transferability of potential interventions in these three countries.

When looking at the results by components and factors (scores per columns - Table 18), similar results are found for Botswana, Mali, Kenya and Ethiopia, while generally Tunisian factors remain less challenging.

In Ethiopia, the institutional components are considered high-medium challenging. High scores were given both to regulation (4.00) and to political commitment (3.87).

The other components (society and economy) are considered medium challenging. In Tunisia, all the scores are below 2.00, which means that all the components and factors are not considered very challenging. In Mali, the scores are almost all around 3.00 (medium challenging) except for the environmental factors, which are rated low-medium challenging.

In Kenya, the scores are all slightly under or above 3.00. All components and factors are rated medium challenging. In Botswana, most of the components and factors are rated medium challenging. The affordability is close to 4.00 and can thus be considered highly challenging.

Table 18 – Transferability Audit results by component and factor

	SOCIETY		INSTITUTION		ECONOMY	
	People	Environment	Regulation	Political commitment	Costs affordability	Technical skills
Ethiopia	3.25	2.99	4.00	3.87	3.20	2.69
Tunisia	1.81	1.30	1.74	1.81	1.92	1.53
Mali	3.04	1.91	2.83	3.07	3.04	2.90
Kenya	3.06	3.28	3.30	2.98	3.30	3.14
Botswana	3.17	3.20	3.13	3.10	3.80	3.31

When looking at the scores under intervention, differences emerge in these five countries (see Table 19 to Table 27). The highest scores (at least 3.70) are highlighted in bold in the tables.

The scores should not be used to compare transferability potential in different contexts (countries). The scores obtained for each road safety intervention are linked to local characteristics and skills that have an influence on score variations. Despite this, variations in scores can be used to identify countries in which road safety interventions can be more easily implemented and where more challenges need to be address for its implementation.

The road infrastructure interventions are never considered too challenging in Tunisia and Mali.
Six (6) out of 18 road infrastructure interventions in the five countries assessed (Table 19) are rated as not too challenging. The six interventions are:

- installation of rumble strips;
- enhanced lane separation by floor markings;
- elimination of sight barriers in curves and improvement of sight;
- elimination of dangerous obstacles in bends;
- speed limit at hazardous sites; and
- reduction of debris on roadways and roadsides.

Table 19 – Transferability Audit results by Infrastructure intervention

Road safety intervention	Ethiopia	Tunisia	Mali	Kenya	Botswana
Road Safety Audit	3.18	2.05	1.91	**4.00**	3.05
Road Safety Inspection	**3.81**	1.96	1.91	**4.00**	**4.28**
Black Spot Management	3.20	1.70	2.56	3.83	**4.48**
Speed limit signposting at dangerous spots in curves	3.58	1.18	2.95	3.17	**3.80**
Installation of rumble strips	2.77	1.55	2.50	3.17	3.00
Enhanced lane separation by floor markings	3.33	1.38	2.44	3.50	3.53
Elimination of sight barriers in curves and improvement of sight	2.46	1.61	2.36	3.17	2.74
Elimination of dangerous obstacles in bends	2.45	1.61	2.95	2.83	1.33
Under-ride barriers for guardrails	**4.10**	1.74	2.71	3.33	1.89
Guideposts made of flexible material	2.74	1.74	2.00	**4.00**	2.71
Speed limit at hazardous sites	3.00	1.74	2.55	3.00	2.00
Separate PTW lanes	3.25	1.74	1.94	**3.83**	2.95
Advanced stop lines for PTWs	3.15	1.83	3.48	**4.00**	1.85
Skid resistance concerning magnitude and consistency	3.29	1.74	3.13	**3.83**	1.00
Road surface testing	**3.86**	1.77	3.13	3.50	1.17
Improvement of transversal slopes (crossfalls) in curves	**3.70**	1.22	1.88	**4.17**	1.56
Improvement of pavement friction on new asphalt surfaces	3.00	1.22	1.88	**4.00**	1.63
Reduction of debris on roadway and roadside	3.13	1.73	2.91	2.50	1.00

Implementation of vehicle safety interventions is mostly considered challenging. Out of nine interventions, two seem feasible, with no big challenges: assessment methods for secondary safety systems and tyres and wheels specifications. It is also worth mentioning that medium-high challenges are mentioned in Ethiopia and Kenya, but not in the three other countries (Table 20).

Table 20 – Transferability Audit results by Vehicle intervention

Road safety intervention	Ethiopia	Tunisia	Mali	Kenya	Botswana
Braking requirements	**4.08**	2.09	3.21	3.00	3.14
ABS and other advanced braking systems	**3.70**	2.19	3.32	**4.17**	3.00
Automatic Stability Control (ASC)	3.37	2.54	3.52	**4.50**	2.25
Protective cages	3.37	2.36	3.68	**4.17**	3.41
Assessment methods for secondary safety systems	2.86	1.73	3.48	3.00	2.88
Motorcycle airbags	3.48	2.36	3.31	**4.67**	3.13
Rear-view mirrors	**3.90**	2.18	3.06	3.17	2.80
Tyres and wheels specifications	3.20	2.18	3.67	2.50	1.46
Measuring methods tyre rolling conditions for new tyres under loaded conditions	**4.20**	2.19	2.65	2.33	1.00

Implementation of visibility interventions are generally not very challenging. Few challenges are mentioned only in Ethiopia and Mali for automatic headlamps, and guidelines to improve rider conspicuity during daylight riding. However, even for these interventions, the average score is not very high (Table 21).

Table 21 – Transferability Audit results by Visibility intervention

Road safety intervention	Ethiopia	Tunisia	Mali	Kenya	Botswana
Mandatory use of headlights	3.26	1.53	2.67	2.50	2.50
Lighting and light-signalling devices type approval	3.00	1.73	2.13	2.83	2.83
Automatic headlamps on	**3.72**	1.87	2.13	2.50	2.50
Guidelines to improve rider conspicuity during daylight riding	3.05	1.76	**3.87**	2.67	2.67
Guidelines to improve rider conspicuity during night-time riding	2.67	1.76	3.65	2.67	2.67

The use of protective equipment by motorcyclists is considered challenging in all countries except Tunisia. Only the "obligatory helmet use by PTW riders and passengers" intervention is judged easy to implement (Table 22).

Table 22 – Transferability Audit results by Equipment intervention

Road safety intervention	Ethiopia	Tunisia	Mali	Kenya	Botswana
Motorcycle helmets standards	**4.00**	1.61	3.55	3.00	**3.85**
Obligatory helmet usage by PTW riders and passengers	2.00	1.76	3.63	2.67	2.38
Standards for eye protection	**5.00**	1.76	2.37	3.17	2.84
Impact protectors for motorcyclists	**4.00**	1.88	**3.72**	3.00	2.57
Airbag jacket	**4.00**	1.88	**4.24**	**4.17**	1.78
Neck braces	3.00	1.88	**4.10**	**4.00**	1.00

Licencing interventions are considered relatively easy to implement. In few cases (only in Ethiopia and Botswana), challenges are mentioned (among them, the setting up of legal regulations to obtain PTW riding licences, and initial rider training and multiphase education). The other four interventions are less challenging (Table 23).

Table 23 – Transferability Audit results by Licencing intervention

Road safety intervention	Ethiopia	Tunisia	Mali	Kenya	Botswana
Legal regulations to obtain PTW riding licence	**3.73**	1.59	2.60	3.00	2.00
Initial rider training	2.95	1.75	2.80	2.83	**4.00**
Multiphase education	**3.70**	1.73	2.91	2.83	3.67
Training workshops for riders provided by the police	3.32	2.00	3.35	2.83	3.00
Workshop for young moped riders	3.00	1.52	2.32	2.83	2.00
Practical training for PTW learner riders	3.25	1.52	2.32	2.80	3.00
Deceleration tester	2.75	1.52	3.35	3.00	2.00

In four countries, legislation interventions are not considered challenging to implement. However, in Botswana, two out of three interventions are judged extremely challenging: creation of a framework for motorcycle law and the setting up of periodical technical inspections). However, the implementation of targeted enforcement strategies is considered easy to implement in all the countries assessed (Table 24).

Table 24 – Transferability Audit results by Legislation intervention

Road safety intervention	Ethiopia	Tunisia	Mali	Kenya	Botswana
Framework for motorcycle law: road traffic law	3.40	1.74	3.13	3.00	**5.00**
Targeted enforcement strategies	2.75	1.74	3.43	3.00	3.33
Periodical technical inspections	3.37	1.76	3.52	3.17	**5.00**

The implementation of sensitisation interventions is not considered very challenging in Tunisia, Mali, and Kenya. Ethiopia encounters minor challenges in two interventions (integrated programmes for road safety education and programmes increasing awareness on the use safety helmet).In Botswana, half of the assessed interventions are considered challenging to implement (Table 25).

Table 25 – Transferability Audit results by Awareness intervention

Road safety intervention	Ethiopia	Tunisia	Mali	Kenya	Botswana
Events promoting motorcycle safety	3.40	1.00	2.16	2.67	**4.00**
Educational brochures	3.00	1.00	2.68	2.67	**5.00**
Shocking films about motorcycle safety	3.12	1.00	2.38	1.91	2.00
Community collaboration to raise motorcycle safety	3.00	1.00	2.05	2.67	**4.00**
Integrated programmes on road safety education	**3.71**	1.00	2.17	2.67	3.00
Programmes increasing awareness on the use safety helmet	**3.76**	1.00	2.37	2.67	2.93
Peer activities on the prevention of drink-riding	3.21	1.00	2.44	2.67	2.38
Other road users' responsibility to riders	3.24	1.00	2.88	2.67	**3.70**

Implementation of post-crash interventions are not considered very challenging in Tunisia, Mali and Kenya. Significant challenges are mentioned in Botswana concerning first aid training and in Ethiopia concerning the implementation of helmet removal system (Table 26).

Table 26 – Transferability Audit results by Post-crash intervention

Road safety intervention	Ethiopia	Tunisia	Mali	Kenya	Botswana
Motorcycle issues in emergency and first aid training	3.48	1.73	2.38	2.67	**4.09**
Helmet removal system	**4.00**	1.73	2.52	2.67	2.82

Implementation of data collection interventions — especially improvements of current procedures and implementation of in-depth analysis — could be highly challenging especially in Ethiopia and Botswana (Table 27).

Table 27 – Transferability Audit results by Data collection intervention

Road safety intervention	Ethiopia	Tunisia	Mali	Kenya	Botswana
Data collection improvement	**4.04**	1.59	2.53	3.00	**5.00**
Motorcycle crashes in-depth analysis	**4.00**	1.59	2.79	3.00	**5.00**

Transferability Audit questionnaire

Road infrastructure

ROAD SAFETY INTERVENTION	SHORT DESCRIPTION	SOCIETY				INSTITUITION				ECONOMY			
		People		Environment		Regulation		Political Committment		Costs Affordability		Technical skills	
		W	S	W	S	W	S	W	S	W	S	W	S
Road Safety Audit	Discover possibilities to optimize road design in order to improve road safety already during the planning phase												
Road Safety Inspection	Assessment of the road standard of an existing road network taking into consideration hazards, environmental risk factors and roadside features												
Black Spot Management	Reduction and prevention of crashes with low-cost engineering enhancements by treating crash clusters at special sites												
Speed limits' signposting at dangerous spots in curves	Reduction of PTW crashes on curves and corners by implementing signposts.												
Installation of rumble strips	Used on straight stretches followed by sharp curves.												
Enhanced lane separation by floor markings	This measure increases the distance between drivers and riders in corners, decreasing the head-on collision type												
Sight barriers' elimination in curves and improvement of sight	Sight Barriers generate poor visibility, hence increase in motorcycle crashes at curves												
Dangerous obstacles' elimination in bends	Fixed obstacles too close to the road causes major crashes especially for motorcycle riders												
Under-ride barriers for guardrails	Guardrails absorb crash energy, but don't protect motorcycles in case of falling. Moreover, motorcyclists' sliding under the guardrail is one of the major fatal crashes												
Guideposts made of flexible material	This measure enhances passive safety. It reduces severe crashes of motorcycles with fixed obstacles.												
Speed limit at hazardous sites	This measure reduces PTW's losing control risk. Installed at curves.												
Separate PTW lanes	This measure avoids conflicts between motorcycles and other (larger) vehicles												
Advanced stop lines for PTWs	This measure prevents queue with other vehicles near intersections and enhance PTW mobility												
Skid resistance concerning magnitude and consistency	Motorcycles sliding is caused from slippery and wet roads												
Road surface testing	Increase of PTW safety by testing road characteristics since interaction between road surface and PTW wheels is important												
Transversal slope (crossfall)'s improvement in curves	Tire and road surface contact pressure is decreased with negative crossfall. Transversal slope in curves reduces PTW crashes												
Pavement friction's improvement on new asphalt surfaces	This intervention reduces PTW crashes caused by low skid resistance. Useful especially for single PTW crashes.												
Roadway debris' reduction on roadway and roadside	PTW wheels can be deflected due to debris in case of struck, leading to loss of control												

Vehicles

ROAD SAFETY INTERVENTION	SHORT DESCRIPTION	SOCIETY				INSTITUTION				ECONOMY			
		People		Environment		Regulation		Political Committment		Costs Affordability		Technical skills	
		W	S	W	S	W	S	W	S	W	S	W	S
Road SaBraking requirements	Crash avoidance with minimum braking standards												
ABS and other advanced braking systems	Assistance is required for PTW riders to distribute brake forces correctly.												
Automatic Stability Control (ASC)	Same as ABS but for longitudinal acceleration												
Protective cages	It provides protection to riders' and passengers with its high-rising frame during crashes especially for head-on crashes												
Assessment methods for secondary safety systems	All passive safety components can be increased												
Motorcycle airbags	Motorcycle airbags absorb crash energy. As a major problem, motorcycles with airbags are very expensive												
Rear-view mirrors	This intervention guarantees a clear vision backward, hence reduces number of crashes												
Tires and wheels specifications	Wrong PTW tire pressure can be the cause of motorcycle crashes												
Measuring methods tire rolling conditions for new tires under loaded conditions	It is a trustworthy method to measure the circumference of an efficient tire, facilitating the precise function of safety systems.												

Visibility

ROAD SAFETY INTERVENTION	SHORT DESCRIPTION	SOCIETY				INSTITUTION				ECONOMY			
		People		Environment		Regulation		Political Committment		Costs Affordability		Technical skills	
		W	S	W	S	W	S	W	S	W	S	W	S
Mandatory use of headlights	This intervention guarantees a clear visibility to other drivers. Use of headlights all time												
Lighting and light-signaling devices type approval	This measure reduces crashes caused by the absence of conspicuity.												
Automatic headlamps on (AHA)	This intervention guarantees a clear visibility to other drivers. Automatic headlights all time (during daylight too) obliges other drivers to be more cautious regarding PTW riders												
Guidelines to improve rider conspicuity during daylight riding	This intervention guarantees a clear visibility to other drivers during day. This measure requires the use of reflective (colored or fluorescent)/ high visibility clothing and helmet to reduce PTW crashes												
Guidelines to improve rider conspicuity during night-time riding	This intervention guarantees a clear visibility to other drivers in the dark. This measure requires the use of reflective (colored or fluorescent)/ high visibility clothing and helmet to reduce PTW crashes												

Protective equipment

ROAD SAFETY INTERVENTION	SHORT DESCRIPTION	SOCIETY				INSTITUTION				ECONOMY			
		People		Environment		Regulation		Political Committment		Costs Affordability		Technical skills	
		W	S	W	S	W	S	W	S	W	S	W	S
Motorcycle helmets standards	The main aim is to protect rider's head during crash												
Obligatory helmet usage by PTW riders and passengers	Riders and passengers should wear helmets (fastened securely) for their safety. Helmets absorb collision's energy protecting riders and passengers head during a shock.												
Standards for eye protection	Goggles can prevent particles hitting riders' eyes												
Impact protectors for motorcyclists	This measure minimizes the level of PTW injury. Back and legs protectors are the two most important equipment												
Airbag jacket	This measure minimizes rider's injury severity. Same function as motorcycle airbag												
Neck braces	Placed on motorcyclist's shoulder to limit head movement during crash												
Legal regulations to obtain PTW riding license	This measure comprises regulations for different classes of licenses based on different access. Moreover, criteria to obtain minimum skills to safely operate a motorcycle on roads												

Licencing, training

ROAD SAFETY INTERVENTION	SHORT DESCRIPTION	SOCIETY				INSTITUTION				ECONOMY			
		People		Environment		Regulation		Political Committment		Costs Affordability		Technical skills	
		W	S	W	S	W	S	W	S	W	S	W	S
Legal regulations to obtain PTW riding license	This measure comprises regulations for different classes of licenses based on different access. Moreover, criteria to obtain minimum skills to safely operate a motorcycle on roads												
Initial rider training	This measure aims that new riders learn basic traffic strategies, interact with other road users and learn how to control their motorcycle in terms of accelerating, cornering and braking												
Multiphase education	This measure includes numerous training sessions for novice riders: the aim is to continue their driving trainings harmoniously												
Trainings for riders provided by the Police	Cooperation between police and private motorcyclists and improvement of motorcyclists theoretical and technical skills												
Young moped riders' workshops	The purpose of this kind of workshop is to correct riders' behavior in traffic and give practical trainings in the aim of reducing PTW crashes												
Practical training for novice PTW riders	This measure aims to improve danger and risk recognition, and lower behaviors taking risk, hence decrease road crashes												
Deceleration tester	With a measuring system, riders can learn how to brake their motorcycles in urgent situations												

Traffic Law and Enforcement

ROAD SAFETY INTERVENTION	SHORT DESCRIPTION	SOCIETY				INSTITUTION				ECONOMY			
		People		Environment		Regulation		Political Committment		Costs Affordability		Technical skills	
		W	S	W	S	W	S	W	S	W	S	W	S
Framework for motorcycle law: road traffic law	Rules concerning road infrastructure, vehicle and road users (helmet use, license, non-use of drugs/alcohol). A framework for motorcycle law protects PTW.												
Targeted enforcement strategies	This enforcement measure includes factors contributing PTW crashes. For achievement, this enforcement must be implemented in the enforcement national strategy												
Periodical technical inspections	Mandatory PTW inspection (the roadworthiness and tampering of PTW)												

Awareness campaigns

ROAD SAFETY INTERVENTION	SHORT DESCRIPTION	SOCIETY				INSTITUTION				ECONOMY			
		People		Environment		Regulation		Political Committment		Costs Affordability		Technical skills	
		W	S	W	S	W	S	W	S	W	S	W	S
Events promoting motorcycle safety	Campaigns in the aim of gathering riders, explaining riding safety and providing practical trainings												
Educational brochures	The purpose of this measure is to focus on the risky circumstances and to give advices												
Shocking films about motorcycle safety	This measure's objective is raising awareness through films by making viewers- targeted audience reflect about their behavior (speeding/ drinking and driving/driving without helmet...)												
Community collaboration to raise motorcycle safety	Compaigns and workshops interacting with motorcycle parties and clubs												
Integrated programs about road safety	This program is to teach proper behavior and trainings to children from early stages												
Programs increasing awareness to use safety helmet	Raise awareness about using helmet correctly ans its importance in reducing PTW crashes												
Peer activities preverting drink riding	It aims to provide riders awareness from drinking and driving problems (single vehicule crashes fromm losing control/running off the road) and presents tods to prevent riders from drinking and driving												
Other road users' responsibility to riders	awareness campaigns can be hold involving car drivers to think more the bahavior of motorcycle riders												

Post-crash care

ROAD SAFETY INTERVENTION	SHORT DESCRIPTION	SOCIETY				INSTITUTION				ECONOMY			
		People		Environment		Regulation		Political Committment		Costs Affordability		Costs Affordability	
		W	S	W	S	W	S	W	S	W	S	W	S
Motorcycle issues in emergency and first aid trainings	Medical personnel trainings for the need of PTW riders to remove properly helmets in case of crash												
Helmet removal system	The device to remove helmet while PTW crashes occur enhances the rescue of motorcyclists and emergency treatment, reducing the severity of injuries												

Data collection

ROAD SAFETY INTERVENTION	SHORT DESCRIPTION	SOCIETY				INSTITUTION				ECONOMY			
		People		Environment		Regulation		Political Committment		Costs Affordability		Costs Affordability	
		W	S	W	S	W	S	W	S	W	S	W	S
Data collection improvement	This measure aims to collect data in a better way in order to understand the growth of PTW and its related characteristics												
Motorcycle crashes in-depth analysis	The objective is to fully reconstruct the PTW crashes, identifying all the factors in order to be capable to explain the causes of collisions												

Annex 3 – Road traffic crash analysis per countries

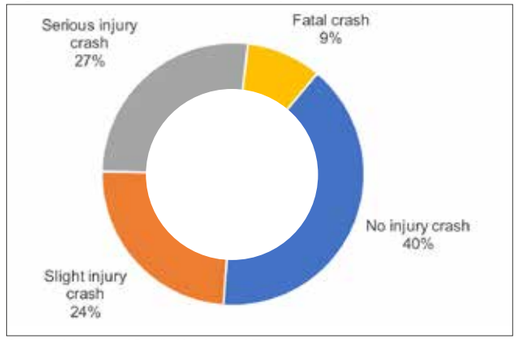
Benin

In 2012, around 5,700 road crashes were recorded in Benin. Around 9% of them resulted in at least one death, and around 27% resulted in at least one serious injury (Figure 146).

These crashes involved 8,845 vehicles. Around 31% of them were motorcycles and around 47% were cars (Figure 147). In 2011, the riders killed or injured in road crashes represented around 31% of the total. Around 4% were riders of moto-taxi, while around 27% were riders of "normal moto" (Figure 148).

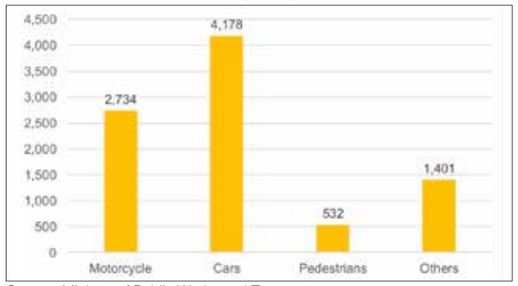
Figure 149 provides a clear overview of the age groups mostly killed or injured in road crashes. Most of the victims were drivers and riders aged between 30 and 40. However, most of them are drivers of a four-wheeled vehicle. Most of the riders killed or injured in road crashes are aged between 20 and 30. It is also important to note that the vast majority of persons killed or injured, aged between 10 and 20 years old, are riders. This could be due to a higher vulnerability of riders in this age bracket.

Figure 146 – Share of crashes by type in Benin (2012)



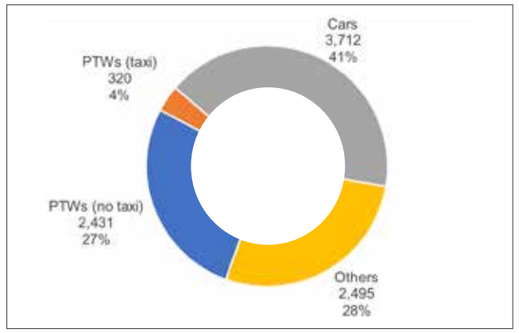
Source: Ministry of Public Works and Transports

Table 147 – Number of vehicles and pedestrians involved in crashes in Benin (2012)



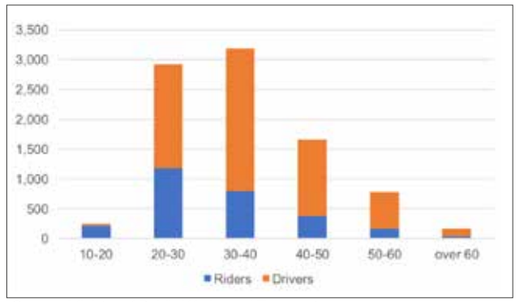
Source: Ministry of Public Works and Transports

Figure 148 – Drivers and riders involved in crashes in Benin (2011)



Source: Ministry of Public Works and Transports

Table 149 – Drivers and riders involved in crashes in Benin by age group (2011)



Source: Ministry of Public Works and Transports

Botswana

From 2009 to 2018, the number of road crashes in Botswana has decreased of about 13%, while the number of persons killed and injured has decreased by about 22%. This is quite a good result if compared to the population growth (around 30% in the same period).

These positive trends, depicted in Figure 150, show the evolution of crash and casualty rates74 from 2009 to 2018.

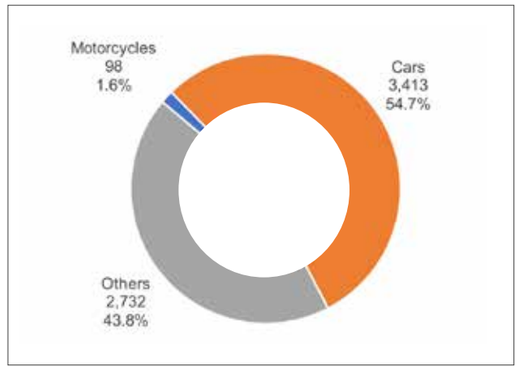
The involvement of motorcycles in road crashes in Botswana is relatively low. In 2018, around 1.5% of persons killed or injured were motorcycle riders or passengers (Figure 151).

The mostly recorded causes of crashes in 2018, were driver's carelessness (around 55% of casualties) and driver's loss of control (around 20.5% of casualties). No specific causes were associated with motorcycles

Table 150 – Trends of crash and casualty rates in Botswana (2009 to 2018)

Source: Statistics Botswana

Figure 151 – Casualties by type vehicle in Botswana (2018)



Source: Statistics Botswana

Ghana

In 2016, Ghana recorded around 8,650 road accidents involving around 14,000 vehicles and causing 2,084 deaths and 10,438 injuries (Figure 152).

Motorcycles are not the vehicles most involved in crashes. However, a significant difference appears between fatal and non-fatal crashes. While the percentage of fatal crashes involving cars is lower than that of non-fatal crashes, the situation is the opposite for motorcycles (Figure 153). This is quite normal considering the high vulnerability of motorcyclists.

Data on fatalities per road user showed a similar result. Motorcyclists (riders and passengers) accounted for 21% of fatalities in 2016, while car drivers and passengers accounted for around 11% of fatalities (Figure 154). That said, the majority of persons killed in road accidents in Ghana are pedestrians (39.5%).

Table 152 – Percentage of crashes by severity and type of vehicle in Ghana (2016)

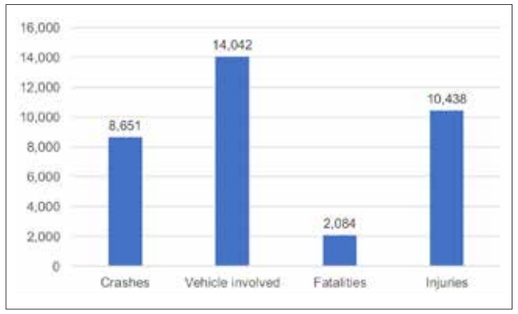
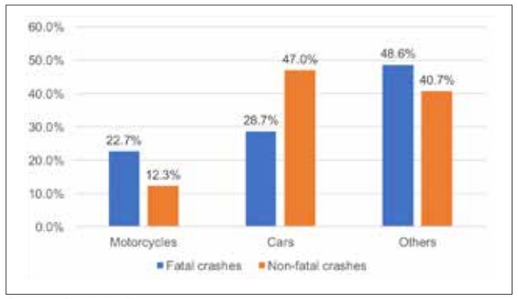
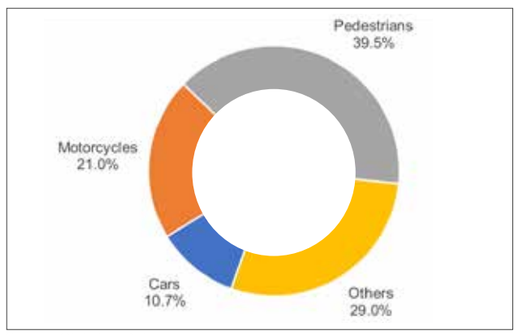


Table 153 – Percentage of crashes by severity and type of vehicle in Ghana (2016)



Source: Statistics Botswana

Figure 154 – Fatalities by road user in Ghana (2016)



Source: Statistics Botswana

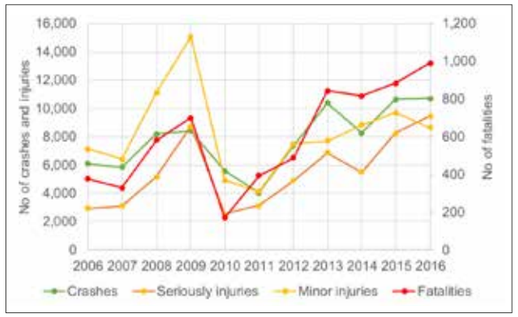
[74] Crash rate = no of crashes/population * 1,000.
Injury rate = no of injured/ population * 10,000.
Fatality rate = no of deaths/population * 100,000.

Cote d'Ivoire

In 2016, Cote d'Ivoire recorded around 10,720 road accidents resulting in 991 deaths, around 9,460 serious injuries and around 8,650 minor injuries. The trend of road accidents and of casualties has been increasing significantly since 2010: around 76% for crashes and around 165% for fatalities (Figure 155). Moreover, this rate of increase is greater than the population growth.

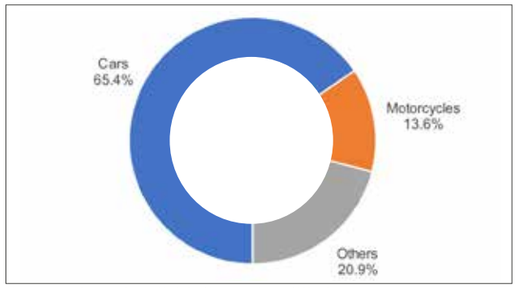
In 2016, around 65% of crashes involved cars, and 13.6% involved motorcycles (Figure 156). However, as shown in Figure 157, fatalities associated with cars are much lower (around 28%) than those associated with motorcycles (22.4%). Motorcycles are clearly more vulnerable than other means of transportation.

Table 155 – Trend of crashes and casualties in Cote d'Ivoire (2006-2016)



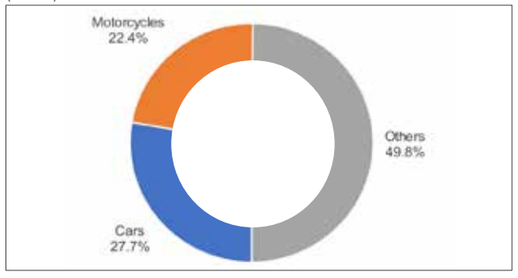
Source: National Road Safety Observatory (OSER)

Figure 156 – Crashes by type of vehicle in Cote d'Ivoire (2016)



Source: National Road Safety Observatory (OSER)

Figure 157 – Fatalities by type of vehicle in Cote d'Ivoire (2016)



Source: National Road Safety Observatory (OSER)

Kenya

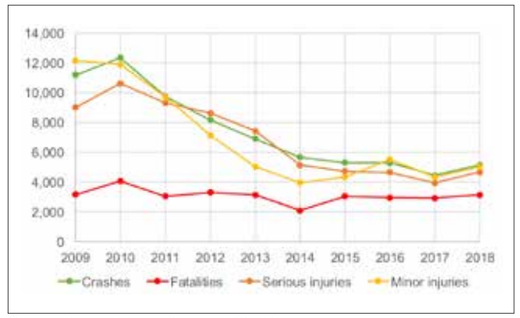
The number of road traffic crashes and injuries in Kenya has significantly decreased from 2009 to 2018 (Figure 158). This decreasing trend is even more positive considering that the population is growing of around 2.3% every year.

The number of fatalities on the contrary has remained rather stable during the same period. However, the population growing leads to a decreasing trend of fatality rate.

The number of registered motorcycles in Kenya is rather high (Figure 159). Motorcycles constitute around 45.6% of all registered vehicles (while cars are around 32% of the total). Despite this high percentage, motorcycles were involved in around 14% of road crashes in 2018. This difference could be related to low use of motorcycles or to issues with the data recording.

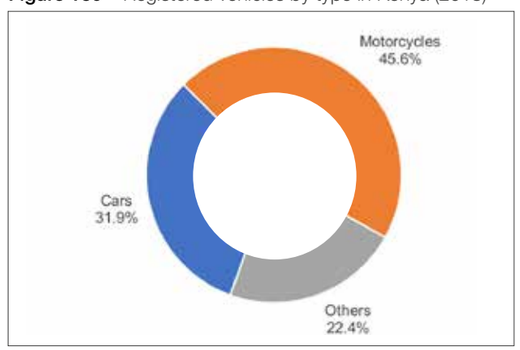
It is also interesting to note that drivers and riders have been found to be the primarily responsible for road crashes in Kenya. Around 59% of crashed were caused by drivers and riders. No information is available concerning the crashes caused uniquely by riders.

Table 158 – Trend of crashes and casualties in Kenya (2009-2018)



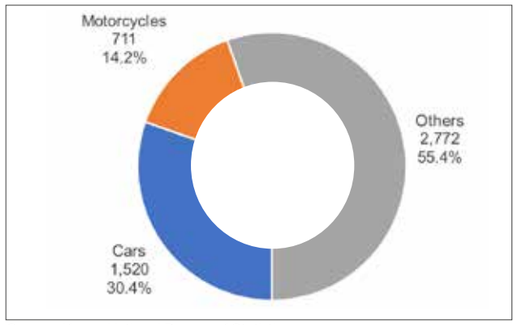
Source: Kenya National Bureau of Statistics

Figure 159 – Registered vehicles by type in Kenya (2018)



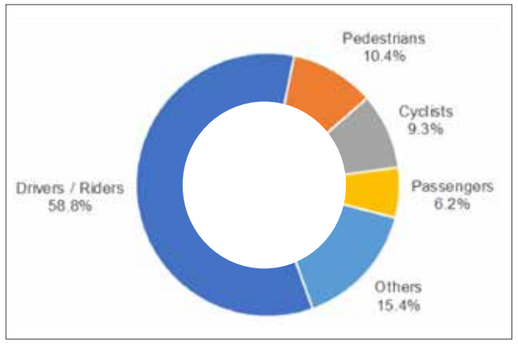
Source: Kenya National Bureau of Statistics

Figure 160 – Vehicles involved in crashes in Kenya (2018)



Source: Kenya National Bureau of Statistics

Table 161 – Road users primarily responsible for crashes in Kenya (2018)



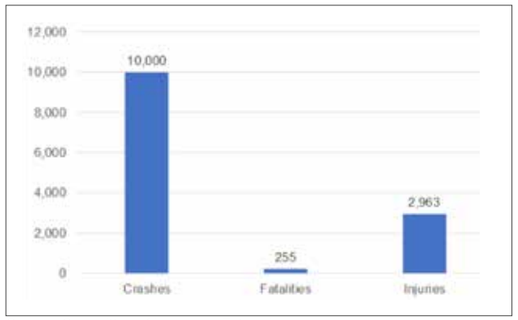
Source: Kenya National Bureau of Statistics

Madagascar

In 2017, Madagascar recorded 10,000 road crashes resulting in 255 deaths and 2,963 injuries (Figure 162). Compared to 2013, the number of crashes has increased by around 5%, while fatalities and injuries increased by 46% and 12%, respectively.

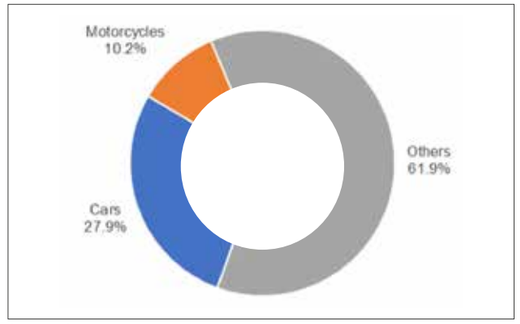
Just about 10% of the crashes involved motorcycles. Most crashes involved other means of transportation, notably moto-taxi, taxis and small trucks. (Figure 163).

Table 162 – Number of crashes and casualties in Madagascar (2017)



Source: Committee of Insurance Enterprises

Figure 163 – Crashes by type of vehicles in Madagascar (2017)



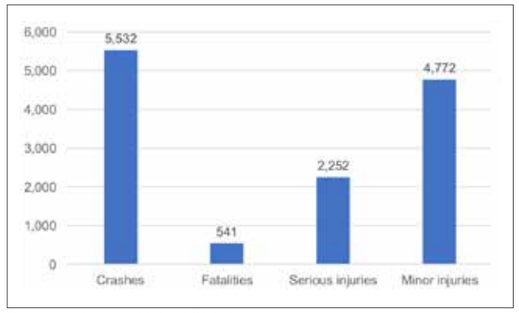
Source: Committee of Insurance Enterprises

Mali

In 2016, Mali recorded around 5,500 road crashes resulting in 541 deaths, around 2,250 serious injuries and around 4,770 minor injuries (Figure 164). A decrease in the number of crashes and casualties were recorded from 2012 to 2016.

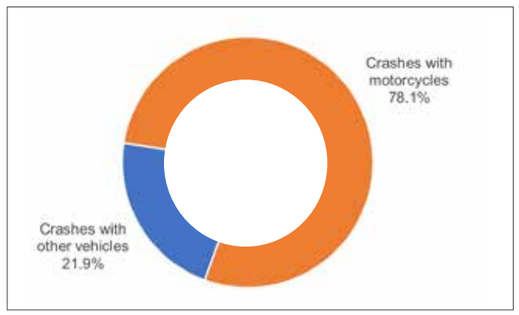
Information on registered vehicles and motorcycles was not available. However, motorcycles are clearly highly exposed to road crashes. In fact, around 78% of crashes involved motorcycles (Figure 165).

Table 164 – Number of crashes and casualties in Mali (2016)



Source: National Institute of Statistics

Figure 165 – Percentage of crashes by type of vehicle in Mali (2016)



Source: National Institute of Statistics

Mauritius

In 2016, Mauritius recorded around 29,300 road crashes involving around 57,300 vehicles and causing 144 deaths, 512 serious injuries and around 3,200 minor injuries (Figure 166).

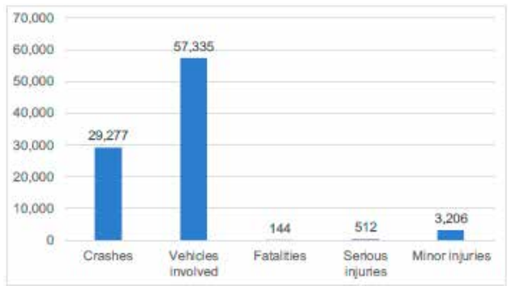
Between 2007 and 2016, the number of road crashes increased significantly (by around 43%), and the crash rate rose to around 38%. On the contrary, the number of persons killed and seriously injured remained almost constant. A small reduction in fatality rate was recorded.

In 2016, 82,746 (or 16.3%) of the 507,676 vehicles registered in Mauritius were motorcycles. Around 40% of the vehicles were cars (including taxis).

Despite the relatively low percentage of motorcycles registered in the country, they were involved in many road crashes. Around 38% of vehicles involved in crashes were motorcycles (Figure 167). This clearly explains the higher vulnerability of motorcycles compared to other vehicles.

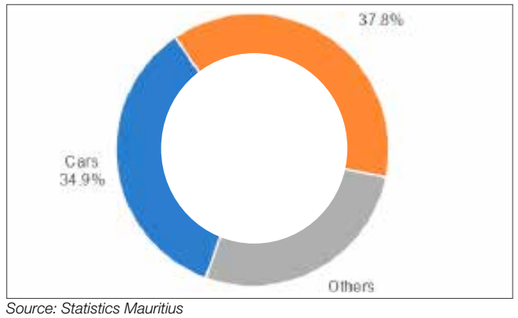
A similar situation appears when looking at the casualties (Figure 168) and at the fatalities (Figure 169) by type of road user. In 2016, around 40% of the total casualties were motorcycle riders, and around 45% of persons killed in road crashes were riders or passengers. Considering the relatively low number of registered motorcycles in Mauritius, this means motorcycles have more than five times the Vehicle's Killing Potential of cars.

Figure 166 – Number of crashes, vehicles involved and casualties in Mauritius (2016)



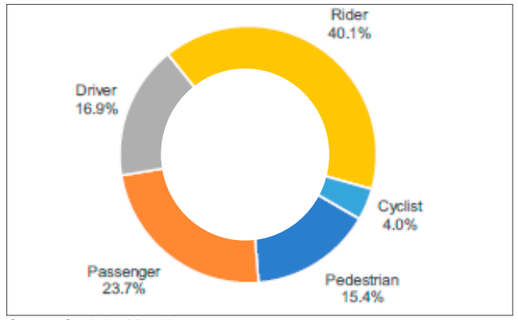
Source: Statistics Mauritius

Figure 167 – Vehicles involved in crashes by type in Mauritius (2016)



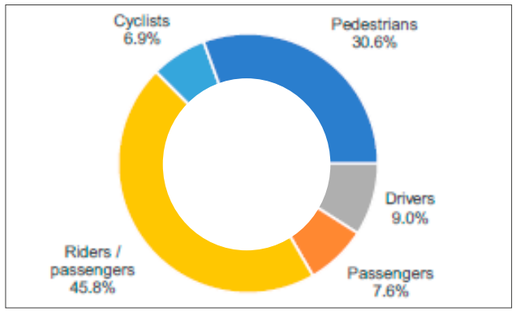
Source: Statistics Mauritius

Figure 168 – Casualties by road user in Mauritius (2016)



Source: Statistics Mauritius

Figure 169 – Fatalities by road user in Mauritius (2016)



Source: Statistics Mauritius

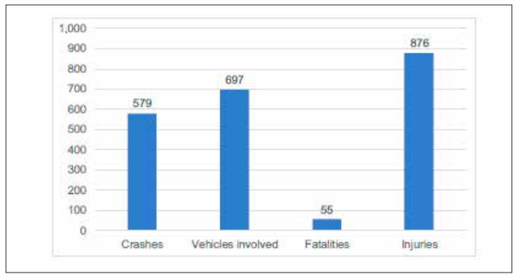
Senegal

In 2016, Senegal recorded 579 road crashes involving 697 vehicles and resulting in 55 fatalities and 876 injuries (Figure 170).

Considering Senegal's population of around 15 million in 2016, these figures appear to be extremely low. The data, however, differ from WHO figures, which put the number of fatalities at 604. The reliability of Senegal's official data is therefore doubtful.

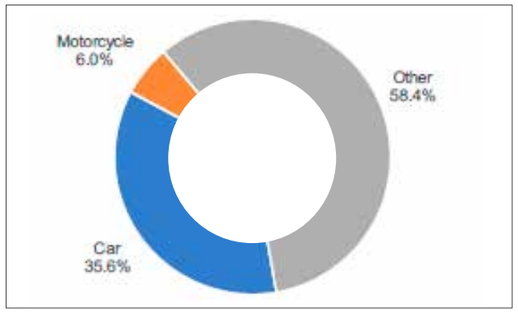
The motorcycles registered in Senegal account for about 8% of the total number of registered vehicles. This is consistent with the percentage of motorcycles involved in road crashes, which is 6% (Figure 171).

Figure 170 – Number of crashes, vehicles involved and casualties in Senegal (2016)



Source: National Agency for Statistics and Demography

Figure 171 – Percentage of crashes by type of vehicle in Mali (2016)



Source: National Agency for Statistics and Demography

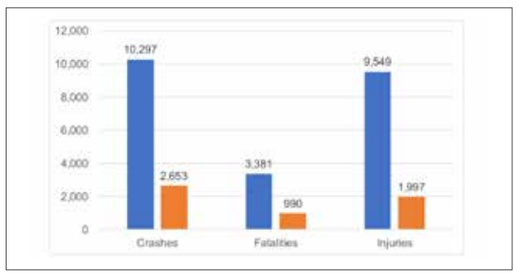
Tanzania

In 2016, Tanzania recorded around 10,300 road crashes resulting in 3,381 fatalities and 9,549 injuries (Figure 172). Road crashes involving motorcycles represent around 26% of the total, while around 29% of fatalities are linked to motorcycles. These figures are relatively positive considering that around 59% of the registered vehicles in the country are motorcycles.

However, 27.6% of the crashes were fatal and 41.6% resulted in injuries. (Figure 173).

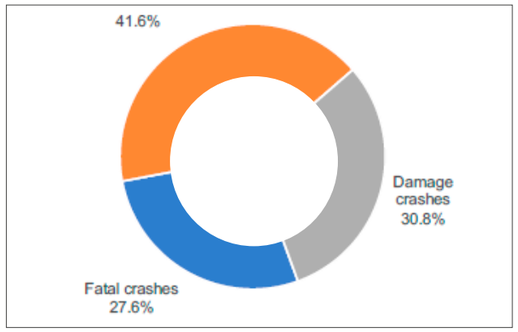
Human factor is the predominant cause of the crashes reported by the police. Moreover, 22.6% of these human factors are associated with "careless motorcyclists".

Figure 172 – Number of crashes and casualties in Tanzania (2016)



Source: Tanzania Police Force

Figure 173 – Percentage of crashes by severity in Tanzania (2016)



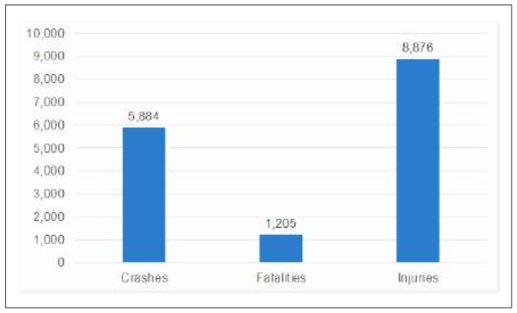
Source: Tanzania Police Force

Tunisia

In 2018, Tunisia recorded 5,884 road crashes resulting 1,205 deaths and 8,876 injuries (Figure 174). Generally, the number of crashes and casualties has been on a steady decrease since 2005.

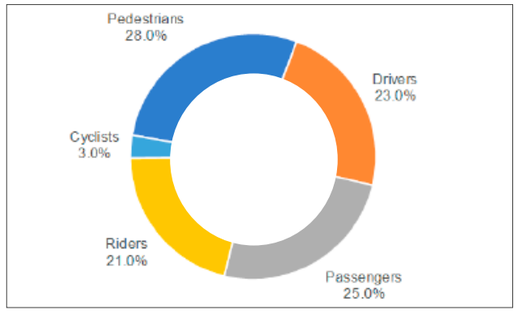
Little information is available on crashes by type of vehicle. In 2014, around 21% of crashes involved motorcycle riders (Figure 175). Similar percentages were recorded for vehicle drivers, pedestrians and passengers. It should be noted that in this case, passengers refer to all type of vehicles (including motorcycles).

Figure 174 – Number of crashes and casualties in Tunisia (2018)



Source: Direction Générale de la Garde Nationale

Figure 175 – Percentage of crashes by type of vehicle in Tunisia (2014)



Source: Direction Générale de la Garde Nationale

Annex 4 – Set of variables and data requested in the selected countries

Road crash data

Road crash data refer to single cases recorded by the police, according to their standard procedures. As far as possible, crash data were collected for the last 10 years.

CRASH VARIABLES	ROAD VARIABLES	VEHICLE-RELATED VARIABLES (FOR EACH VEHICLE INVOLVED	PERSON-RELATED VARIABLES (FOR ROAD USER INVOLVED)
• Date • Time • Location (urban/ non urban) • Region • Crash type • Impact type • Weather conditions • Light conditions • Reported crash cause	• Road type • Presence of obstacle • Crash occured at junction	• Vehicle type • Vehicle manoeuvre	• Linked vehicle • Age • Gender • Road user type • Injury severity • Use of seatbelt / helmet • Use of alcohol • Use of drugs • Pedestrian manoeuvre

Economy indicators

Indicator	Level of detail	Source
Population	By Region Total for country By age	National Statistics Institute
Gross Domestic Product (GDP)	GDP per capita	National Statistics Institute

Risk exposure data

Indicator	Level of detail	Source
Vehicle fleet	Number of registered vehicles by type of vehicle (motorcycles, passengers' cars, others)	Transport Ministry National Road Safety Agency
Road length	Total By type of road (motorway, rural, urban) By type of road surface (paved, non-paved)	Transport Ministry National Road Safety Agency
Vehicle km of travel	By type of vehicle (motorcycles, passengers' cars, others)	Transport Ministry National Road Safety Agency
Traffic volume	On major roads	Transport Ministry National Road Safety Agency

Road safety legislation and standards

Group	Indicator	Level of detail	Source
Roads	National speed limit law	By type of road (motorway, rural, urban)	Transport Ministry National Road Safety Agency
	Road design standards	By type of road (motorway, rural, urban) By type of vehicle (e.g. specific provisions for PTWs)	Transport Ministry National Road Agency
Users	National helmet law	Standards set out (fastening, type of users, type of helmet)	Transport Ministry National Road Safety Agency
	Mobile phone use while driving / riding	Application of law	Transport Ministry National Road Safety Agency
	National drink-driving law	Limits and application	Transport Ministry National Road Safety Agency
	Driving / riding law	Licence thresholds Training standards Licences issued and renewed	Transport Ministry National Road Safety Agency
	Education programmes	By school type By road user type	Transport Ministry National Road Safety Agency
	Awareness campaigns	By type of vehicle	Transport Ministry National Road Safety Agency
Vehicles	Law on vehicle technical inspection	By type of vehicle	Transport Ministry National Road Safety Agency
	Standards for motorcycles	-	Transport Ministry National Road Safety Agency

Annex 5 – Surveys in Burkina Faso

Road sections observed:

- Avenue de la Dignité (Ouagadougou):
  - Single carriageway.
  - Bi-directional.
  - One lane per direction.
  - Survey date: 16/01/2020
  - Survey time: from 7 a.m. to 9 a.m.
- Boulevard Tensoba Benda (Ouagadougou):
  - Double carriageway.
  - Bi-directional.
  - Two lanes per direction.
  - Survey date: 14/01/2020
  - Survey time: from 7 a.m. to 9 a.m.

Traffic counts				
Type of vehicle	Avenue de la Dignité		Boulevard Tensoba Benda	
	Direction south-north	Direction north-south	Direction west-east	Direction east-west
Motorcycles	4,364	857	4,398	975
Cars	910	166	940	186
Other vehicles	28	11	52	48
Pedestrians	24	29	13	20

In this study, cars refer to all four-wheeled motor vehicles designed for transport of persons (including taxi). Other vehicles refer to heavy vehicles (for good transportation), buses, mini-buses, ambulance, etc.

	Helmet quality	
	Avenue de la Dignité	Boulevard Tensoba Benda
Good	43	42
Medium	49	55
Open face	9	3

	Motorcycle age	
	Avenue de la Dignité	Boulevard Tensoba Benda
Less than 5 years	43	35
5 to 10 years	49	65
More than 10 years	9	0

	Helmet use	
	Avenue de la Dignité	Boulevard Tensoba Benda
RIDERS		
Yes	4	14
No	96	86
PASSENGERS		
Yes	1	99
No	1	99

	Chin strap use	
	Avenue de la Dignité	Boulevard Tensoba Benda
RIDERS		
Yes	4	13
No	0	1
PASSENGERS		
Yes	1	0
No	1	0

	Helmet type	
	Avenue de la Dignité	Boulevard Tensoba Benda
Full face	4	12
Half face	0	2
Open face	1	0

	Helmet quality	
	Avenue de la Dignité	Boulevard Tensoba Benda
Good	5	11
Medium	0	4
Open face	1	0

	Use of protective clothes	
	Avenue de la Dignité	Boulevard Tensoba Benda
Yes	0	0
No	100	100

	Use of mobile phone	
	Avenue de la Dignité	Boulevard Tensoba Benda
Yes	0	0
No	100	100

	Number of passengers	
	Avenue de la Dignité	Boulevard Tensoba Benda
No passengers	59	73
One passenger	35	26
More than one passenger	6	7

Annex 6 – Surveys in Cameroon

Road sections observed:

- Carrefour Obili – Carrefour Biyem Assi (Yaoundé):
  - Single carriageway.
  - Bi-directional.
  - One lane per direction.
  - Survey date: 20/01/2020
  - Survey time: from 4 p.m. to 5 p.m.
- Rue de Melen (Yaoundé):
  - Double carriageway.
  - Bi-directional.
  - 18.Two lanes per direction.
  - 19.Survey date: 17/01/2020
  - 20.Survey time: from 4 p.m. to 5 p.m.

Traffic counts				
Type of vehicle	Obili – Biyem Assi		Rue de Melen	
	Direction A	Direction B	Direction A	Direction B
Motorcycles	621	680	971	1,126
Cars	940	1,119	354	300
Other vehicles	25	26	26	12
Pedestrians	-	-	954	409

For the purpose of this study, cars were considered all four-wheeled motor vehicles designed for transport of persons (including taxi). Other vehicles refer to heavy vehicles (for good transportation), buses, mini-buses, ambulance, etc.

	Motorcycle quality	
	Obili – Biyem Assi	Rue de Melen
Good	167	178
Medium	28	22
Open face	1	0

	Motorcycle age	
	Obili – Biyem Assi	Rue de Melen
Less than 5 years	199	193
5 to 10 years	1	7
More than 10 years	0	0

	Helmet use	
	Obili – Biyem Assi	Rue de Melen
RIDERS		
Yes	41	20
No	120	180
PASSENGERS		
Yes	0	158
No	0	119

	Chin strap use	
	Obili – Biyem Assi	Rue de Melen
RIDERS		
Yes	1	0
No	40	20
PASSENGERS		
Yes	0	0
No	0	0

	Helmet type	
	Obili – Biyem Assi	Rue de Melen
Full face	1	6
Half face	2	2
Open face	39	23

	Helmet quality	
	Obili – Biyem Assi	Rue de Melen
Good	39	27
Medium	2	1
Open face	0	0

	Use of protective clothes	
	Obili – Biyem Assi	Rue de Melen
Yes	0	0
No	161	200

	Use of mobile phone	
	Obili – Biyem Assi	Rue de Melen
Yes	0	0
No	161	200

	Number of passengers	
	Obili – Biyem Assi	Rue de Melen
No passengers	42	73
One passenger	102	65
More than one passenger	56	62

Annex 7 – Surveys in Rwanda

Road sections observed:

- KG201 road (Kigali):
  - Single carriageway.
  - Bi-directional.
  - One lane per direction.
  - Survey date: 23/10/2020
  - Survey time: from 7 a.m. to 9 a.m.
- KN5 road (Kigali):
  - Double carriageway.
  - Bi-directional.
  - One lane per direction.
  - Survey date: 23/10/2020
  - Survey time: from 7 a.m. to 9 a.m.

Cars were considered all four-wheeled motor vehicles designed for transport of persons (including taxi). Other vehicles refer to heavy vehicles (for good transportation), buses, mini-buses, ambulance, etc.

Traffic counts				
Type of vehicle	KG201		KN5	
	Direction A	Direction B	Direction A	Direction B
Motorcycles	150	150	875	883
Cars	125	120	550	508
Other vehicles	0	0	8	5
Pedestrians	17	13	12	10

	Motorcycle quality
	All roads
Good	176
Medium	16
Bad	5

	Motorcycle quality
	All roads
Less than 5 years	149
5 to 10 years	41
More than 10 years	10

	Helmet use
	All roads
RIDERS	
Yes	200
No	0
PASSENGERS	
Yes	200
No	125

	Chin strap use
	All roads
RIDERS	
Yes	200
No	0
PASSENGERS	
Yes	125
No	0

	Helmet type
	All roads
Full face	101
Half face	30
Open face	193

	Helmet quality
	All roads
Good	200
Medium	0
Bad	0

	Use of protective clothes
	All roads
Yes	13
No	187

	Use of mobile phone
	All roads
Yes	6
No	194

	Number of passengers
	All roads
No passengers	75
One passenger	125
More than one passenger	0

Annex 8 – Surveys in Uganda

Road sections observed:

- Ggaba road (Kampala):
  - Single carriageway.
  - Bi-directional.
  - One lane per direction.
  - Survey date: 22/01/2020
  - Survey time: from 7 a.m. to 9 a.m.
- Busabaala road (Kampala):
  - Single carriageway.
  - Bi-directional.
  - One lane per direction.
  - Survey date: 23/01/2020
  - Survey time: from 7 a.m. to 9 a.m.
- Jinja Highway (Kampala):
  - Double carriageway.
  - Bi-directional.
  - Two lanes per direction.
  - Survey date: 24/01/2020
  - Survey time: from 7 a.m. to 9 a.m.
- Kitezi road (Kampala):
  - Single carriageway.
  - Bi-directional.
  - One lane per direction.
  - Survey date: 23/01/2020
  - Survey time: from 7 a.m. to 9 a.m.
- Masaka Highway (Kampala):
  - Single carriageway.
  - Bi-directional.
  - One lane per direction.
  - Survey date: 24/01/2020
  - Survey time: from 7 a.m. to 9 a.m.

Traffic counts				
Type of vehicle	Ggaba road		Busabaala road	
	Direction A	Direction B	Direction A	Direction B
Motorcycles	205	536	229	340
Cars	190	312	285	179
Other vehicles	40	79	47	42
Pedestrians	32	14	183	211

In this study, cars refer to all four-wheeled motor vehicles designed for transport of persons (including taxi). Other vehicles refer to heavy vehicles (for good transportation), buses, mini-buses, ambulance, etc.

Traffic counts				
Type of vehicle	Jinja Highway		Kitezi road	
	Direction A	Direction B	Direction A	Direction B
Motorcycles	621	391	470	138
Cars	456	284	335	65
Other vehicles	263	187	42	11
Pedestrians	26	15	3	0

Traffic counts		
Type of vehicle	Masaka Highway	
	Direction A	Direction B
Motorcycles	750	592
Cars	496	388
Other vehicles	147	184
Pedestrians	13	2

	Helmet quality
	All roads
Good	200
Medium	0
Bad	0

	Helmet quality
	All roads
Less than 5 years	126
5 to 10 years	264
More than 10 years	203

	Helmet use
	All roads
RIDERS	
Yes	339
No	248
PASSENGERS	
Yes	13
No	527

	Chin strap use
	All roads
RIDERS	
Yes	198
No	278
PASSENGERS	
Yes	7
No	6

	Helmet type
	All roads
Full face	158
Half face	44
Open face	116

	Helmet quality
	All roads
Good	172
Medium	124
Bad	57

	Use of protective clothes
	All roads
Yes	71
No	516

	Use of mobile phone
	All roads
Yes	0
No	587

	Number of passengers
	All roads
No passengers	0
One passenger	386
More than one passenger	214

Annex 9 – Contacts of stakeholders consulted

BURKINA FASO		
Institution	Name	Contact
National Road Safety Office	Dramane Gamane	g.dramane@yahoo.fr
National Police	Alexandre Nongnyaghma	alexandrenonguierma@gmail.com
Municipal Police of Ouagadougou	Adama Pamtaba	
National Gendarmerie	Rodrigue Adoua	adouarodrigue@yahoo.fr
Humanité & Inclusion (NGO)	Casimir Sanon	casimirsanon@yahoo.fr

CAMEROON		
Institution	Name	Contact
Police Nationale	Bernard Ananfa	btapieak@yahoo.fr
National Statistics Institute	Vincent Ledoux Essambe Bome Abanda Ambroise	essambebvl@yahoo.fr abanda_ambroise@yahoo.org
Ministry of Transports	Divine Mbamome	hisgracepchs@yahoo.com
Ministry of Public Works	Aboubakar Dadje Nazole	moussadjafarou01@gmail.com
Ministry of Public Health	Olive Nicole Ngaba	ngabaolivenicole@yahoo.fr

UGANDA		
Institution	Name	Contact
Kampala Capital City Authority	Jacob Byamukama	jbyamukama@kcca.go.ug
Ministry of Works and Transport	Winstone Katushabe	katushabew@gmail.com
Wakiso District	Samuel Mwesigwa	dsmwesigwa@yahoo.co.uk
Uganda National Roads Authority	Isaac Menya	Isaac.Menya@unra.go.ug
National Road Safety Council	Ronald Amanyire	amronaldo77@gmail.com
Uganda National Bureau of Statistics	Paul Okudi	paul.okudi@ubos.org

RWANDA		
Institution	Name	Contact
Ministry of Infrastructure	Patricie Uwase	patricie.uwase@mininfra.gov.rw
Ministry of Infrastructure	Alfred Byiringiro	alfred.byiringiro@mininfra.gov.rw
Ministry of Infrastructure	François Zirikana	zirifra95@gmail.com
Rwanda Utilities Regulatory Authority	Deo Muvunyi	deo.muvunyi@rura.rw

Annex 10 – Examples of helmet types

Full face

A full-face helmet covers the entire head and has a rear that covers the base of the skull, and a protective section over the front of the chin. Such helmets have an open cut-out in a band across the eyes and nose, and often include a clear or tinted transparent plastic face shield, known as a visor, that generally swivels up and down to allow access to the face. Many full-face helmets include vents to increase the airflow to the rider.

Half helmet

The half helmet has essentially the same front design as an open face helmet but without a bowl-shaped lowered rear. The half helmet provides a minimum coverage. Some Motorcycle Safety Foundations currently prohibit the use of half helmets because of their inferiority to other helmet styles.

Open face

The open face or "three-quarters" helmet covers the ears, the cheeks and the back of the head, but lacks the lower chin bar of the full-face helmet. Many offer snap-on visors that may be used by the rider to reduce sunlight glare. An open face helmet provides the same rear protection as a full-face helmet, but little protection to the face, even from non-crash events.

AFRICAN DEVELOPMENT BANK GROUP

Infrastructure and Urban Development
Department
African Development Bank
CCIA, Avenue Jean Paul II, Plateau
01 BP 1387 Abidjan 01
www.afdb.org