MOTORCYCLES IN LATIN AMERICA

Current and recommended best practices for the protection of its users

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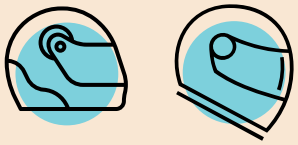

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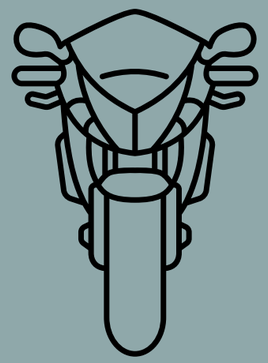
TABLE OF CONTENTS



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INDEX OF ILLUSTRATIONS

INDEX OF TABLES

ACRONYMS

ABS
Anti-lock brakes (for its acronym in English)

ADL
Automatic Daytime Running Lights (ADL)

AIS
Abbreviated Injury Scale (Abbreviated Injury Scale)

ANDI
National Businessmen's Association of Colombia

ANSV
National Road Safety Agency (Colombia)

ANTSV
National Traffic and Road Safety Agency (Paraguay)

CAF
Development Bank for Latin America

CBS
Combined Brake System (Combination Braking System)

CONASET
National Traffic Safety Commission (Chile)

COSEVI
Road Safety Council (Costa Rica)

DNII
National Directorate of Internal Revenue (Dominican Republic)

DOT
Department of Transportation (United States)

EMCDDA
European Monitoring Centre for Drugs and Drug Addiction

EMMA
European Motorcycle Manufacturers' Association (European Motorcycle Manufacturers' Association)

EN
European Standards (German acronym)

EPP
Personal Protective Equipment

EPRV
Road Risk Perception Survey (Colombia)

FEMA
Federation of European Motorcyclists' Associations (FEMEA)

FGR
Gonzalo Rodriguez Foundation

FIA
International Automobile Federation

GLS
Graduated Licensing System (Graded Licensing System)

IDB
Inter-American Development Bank

IDU
Urban Development Institute (Colombia)

INTRANT
National Institute of Transit and Land Transportation (Dominican Republic)

ITF
International Transport Forum

MTAI
Mandatory Vehicle Insurance

MTOP
Ministry of Transportation and Public Works (Uruguay)

NEA
Northeastern Argentina

NHTSA
National Highway Traffic Safety Administration

NWA
Northwest Argentina

NTSB
National Transportation Safety Board (United States)

OECD
Organization for Economic Cooperation and Development

PAHO
Pan American Health Organization

PSPTA
Public Service as Payment for Traffic Crashes (Ecuador)

SDG
Sustainable Development Goals

SNTR
Single National Traffic Registry (Colombia)

UN
United Nations (UN)

UNASEV
National Road Safety Unit (Uruguay)

UNECE
United Nations Economic Commission for Europe

UV
Ultraviolet

VTV
Vehicle Technical Verification

WHO
World Health Organization

INTRODUCTION

The World Health Organization (WHO) states in its publication "Global Road Status Report on Road Safety, 2018" that approximately 1.35 million people died in the world due to traffic crashes during 2016. This represents one death every 24 seconds due to road crashes. For this reason, it is the eighth leading cause of death worldwide for people of all ages, and in the range from 5 to 29 years old, road crashes represent the first cause of death.

24

seconds is the amount of time -on average- between deaths due to traffic.

Vulnerable traffic users (a group that includes motorcyclists, cyclists, and pedestrians), in turn, account for 54% of the total number of deaths mentioned above. Users (driver or passenger) of motorcycles, scooters, mopeds account for 28% of the total number of deaths, which means a figure of approximately 378,000 fatalities per year.

Latin American countries are no exception to the problem of high road crash rates, and in many countries in the region, the number of motorcycle users killed far exceeds the world average, reaching 50% in some cases, as is the case in Colombia and Uruguay in 2021. The growing presence of motorcycles as a vulnerability factor on Latin American roads requires evidence-based regulations. The Inter-American Development Bank's Vision 2025, entitled "Reinvesting in the Americas, a Decade of Opportunities", aims to help boost the region's recovery from the crisis caused by the Covid-19 pandemic. In this regard, collective action is needed to build, among other needs, stronger and healthier societies. The reduction of traffic-related mortality is therefore imperative to contribute to the achievement of these objectives.

In turn, the United Nations has declared the period 2021-2030 as the Second Decade of Action for Road Safety, whose central objective is to reduce road traffic deaths and injuries by at least 50%. Within this framework, the World Health Organization and the United Nations Regional Commissions for Road Safety have published the Global Plan: Decade of Action for Road Safety 2021-2030 to achieve the target set for the decade, encouraging governments to work under the Safe System approach.

This monograph aims to foster policy dialogue to improve motorcycle user safety in the region, examining best practices in all areas and outlining policy recommendations for Latin American and Caribbean countries. It seeks to update the region's motorcycle issues, regulatory realities and best practices in the areas of licensing, motorcycle infrastructure, policy planning, mandatory insurance, reflective devices, vehicle safety and speed management. This is an expansion of the motorcycle issues addressed in the Flagship Report "Road Safety in Latin America and the Caribbean, after a decade of action and perspectives for safer mobility", which is expected to be launched by the Inter-American Development Bank in early 2022.

Within the interventions and good practices covered in this publication, the section on helmets and safety equipment for motorcyclists is developed in detail, not only with the intention that its operation be clearly understood, but also with the purpose of deriving from this understanding the need to require the use of certified or homologated equipment under technical standards.

28%

of deaths in traffic crashes are related to the usage of Powered Two Wheelers.

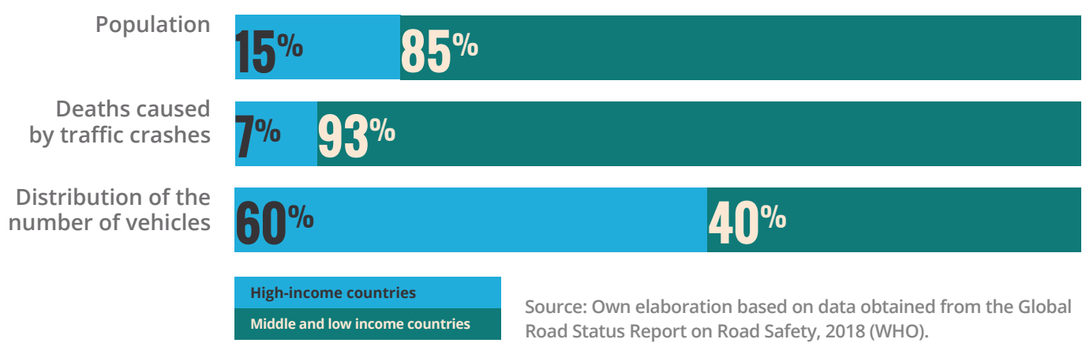
CONTEXT

The Crash Rate in the Americas and the World Region

Traffic crashes with high mortality rates are much more evident in low- and middle-income countries (OMS, 2018). Eighty five percent of the world's population is concentrated in these countries, where 60% of the world's vehicles are located, and 93% of the victims' deaths are due to a road crash.

Graph 1 shows that no direct proportionality can be established between countries' motorization and mortality rates (OMS, 2018). That is, high income countries, although they have 4 out of 10 of all the vehicles, they have only 7% of deaths world-wide.

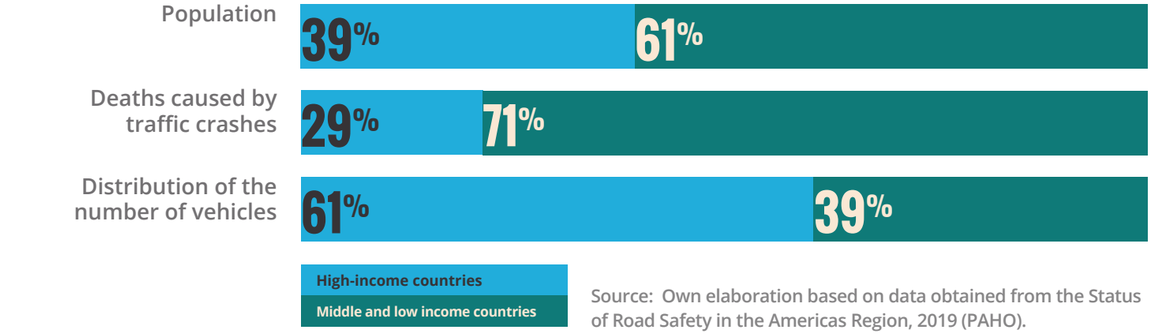
GRAPH 1 - DISTRIBUTION OF ROAD TRAFFIC CRASHES WORLDWIDE



Source: Own elaboration based on data obtained from the Global Road Status Report on Road Safety, 2018 (WHO).

The American continent is no stranger to the problem of mortality due to road crashes. (OPS, 2019). This region is heterogeneous in many aspects, among which are the socioeconomic factors of its inhabitants. The latter has an impact on the composition of the vehicle type in the different regions and, therefore, the crash rate of the different road users, which can be seen in Graph 3.

GRAPH 2 - DISTRIBUTION OF ROAD TRAFFIC CRASHES IN THE AMERICAS



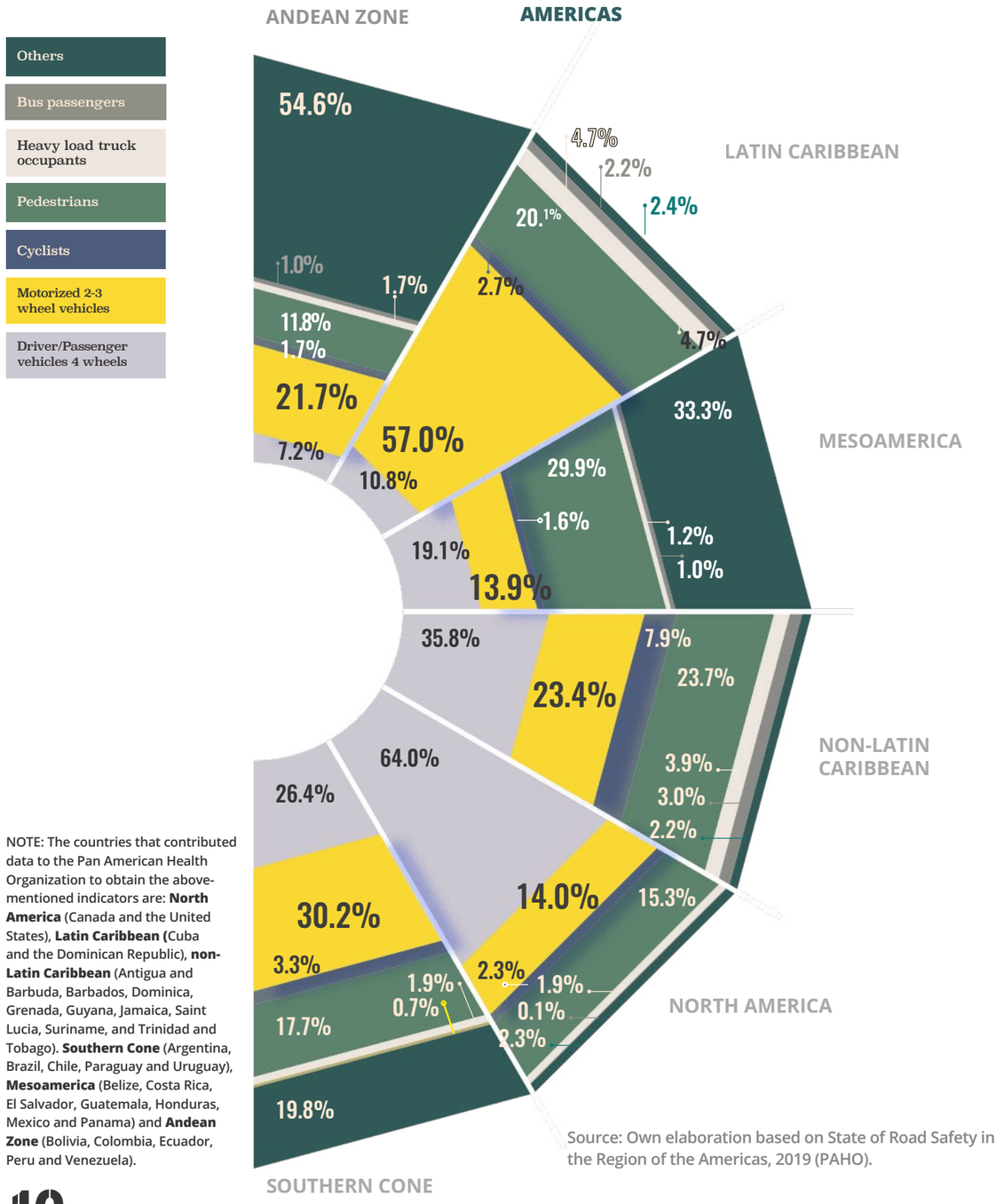
Source: Own elaboration based on data obtained from the Status of Road Safety in the Americas Region, 2019 (PAHO).

Graph 2 shows that, in the region, low- and middle-income countries concentrate the highest number of deaths due to road crashes, as is the case at the global level. However, in this case, the distribution of the number of vehicles is such that high-income countries have the highest motorization rate (number of vehicles in relation to the number of inhabitants). This allows to notice at the global level that no direct proportionality can be established between the motorization rate of the countries and their mortality rates.

Graph 3 shows that, depending on the sub-region, the share of motorcycle users in the number of deaths due to traffic crashes varies considerably, and in the Latin Caribbean (Cuba and the Dominican Republic) it is double the world trend which stands at 28%.

CONTEXT

GRAPH 3: REPRESENTATION OF THE DIFFERENT ROAD USERS IN MORTALITY IN EACH OF THE REGIONS THAT MAKE UP THE REGION OF THE AMERICAS



NOTE: The countries that contributed data to the Pan American Health Organization to obtain the above-mentioned indicators are: **North America** (Canada and the United States), **Latin Caribbean (**Cuba and the Dominican Republic), **non-Latin Caribbean** (Antigua and Barbuda, Barbados, Dominica, Grenada, Guyana, Jamaica, Saint Lucia, Suriname, and Trinidad and Tobago). **Southern Cone** (Argentina, Brazil, Chile, Paraguay and Uruguay), **Mesoamerica** (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico and Panama) and **Andean Zone** (Bolivia, Colombia, Ecuador, Peru and Venezuela).

Source: Own elaboration based on State of Road Safety in the Region of the Americas, 2019 (PAHO).

Effects on Road Safety during the first year of the SARS-CoV-2 pandemic.

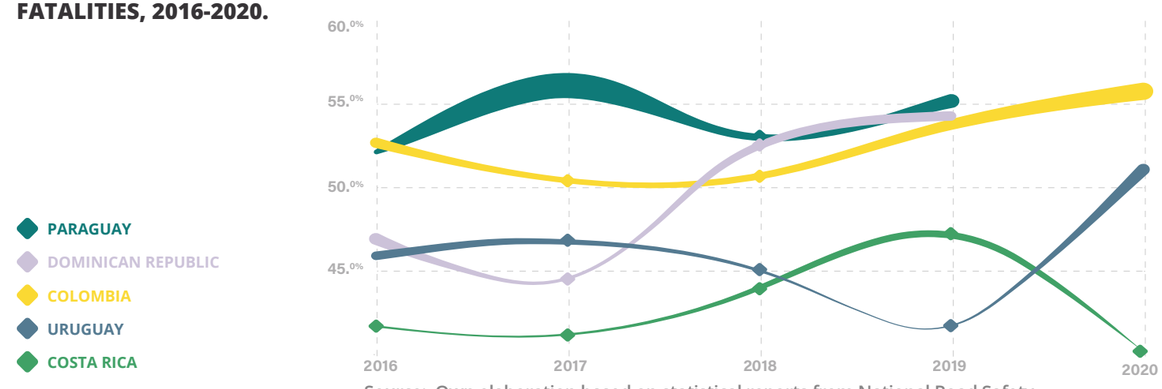
In 2020, the world context changed due to the health emergency resulting from the SARS-CoV-2 pandemic. Each government implemented a set of measures to minimize the circulation of the virus and avoid contagion.

While there were containment measures, there was a decrease in the mobility of people around the world and, in turn in many countries, a decrease in reported traffic fatalities, which meant that some nations temporarily achieved target 3.6 of the Sustainable Development Goals (SDGs): halve the number of road deaths and injuries by 2020. (Todt, 2020).

This is considered a positive consequence within the global crisis, because in many countries, fewer people were killed in traffic crashes, and in some countries, the reduction in the number of fatalities was not the same as the reduction in mobility, the latter being higher. In addition, while there were confinement measures, the average speed of traffic crashes increased due to fewer people being on the road.

Graph 4 shows the evolution of the percentage of motorcyclists killed since 2016 for some Latin American countries for the year the information on which the data in Graph 3 was reported. Here it can be observed, not only that the motorcycle crash rate continued to be a problem after 2016, but also that during 2020, except in Costa Rica, of the countries whose information is presented, the percentage of motorcyclist fatalities presented an increase, especially in Uruguay, where there was a significant inter-annual increase 2019-2020.

GRAPH 4 - PERCENTAGE SHARE OF MOTORCYCLISTS IN TOTAL FATALITIES, 2016-2020.

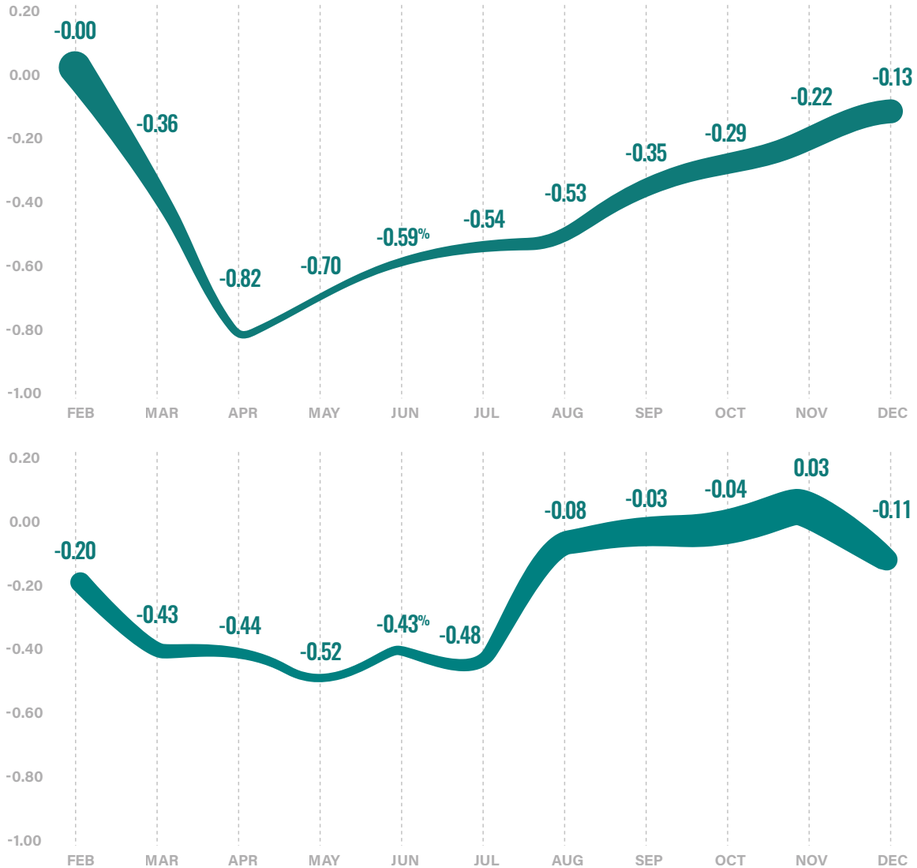


Source: Own elaboration based on statistical reports from National Road Safety Agencies of Colombia, Costa Rica, Paraguay, Dominican Republic, and Uruguay.

CONTEXT

According to the WAZE platform, there was a decrease of up to 82% in the mobility of its users, compared to February 2020. For example, in the case of Bogota, Colombia, on average, between March and December there was a 45% drop in vehicle-km. According to data from the National Road Safety Agency, Bogota recorded 402 fatalities in 2020, a reduction of 20.3% compared to 2019. The reduction in fatalities from March to December 2020 compared to the average of the previous three years was 26.3%. That is, the reduction in fatalities was less than the reduction in mobility. The lower activity reduced congestion and allowed higher speeds on the roads, which eventually resulted in a higher proportion of fatalities.

GRAPHICS 5 Y 6 - CHANGE IN ACTIVITY AND REDUCTION OF FATALITIES IN 2020 IN BOGOTA



Sources: Own elaboration with data from (Waze, n.d.) and (ANSV, n.d.)

For this city, 2020 is the first year in the historical series in which the proportion of motorcycle user fatalities exceeds the proportion of pedestrian fatalities in the total. Motorcycle use increased, especially for distribution and home delivery activities.

TABLE 1: FATALITIES DUE TO ROAD CRASHES IN BOGOTÁ, ACCORDING TO ROAD USER

	2019		2020	
Pedestrian	246	47%	145	36%
Motorcycle User	167	32%	147	37%
Bicycle User	66	13%	72	18%
Individual Vehicle User	19	4%	14	3%
Public Transportation User	12	2%	7	2%
Other/no information	11	2%	17	4%

Source: Own elaboration with data (ANSV, n.d.)

In the context of the pandemic, there is a decrease in the rates of use of public transportation services, in a percentage between 60% and 85%. This not only means a financial difficulty for the companies that provide this service, but also directly affects the middle and lower classes, as well as urban mobility in general (IDB, 2020). The lack of trust in the public transportation system has caused those who have the means to change to a private transportation system, despite the negative repercussions caused in large cities (Heavy traffic conditions, pollution, and traffic crashes, among others).

CONTEXT

Increase in the use of motorcycles in the region

As cities continue to grow, a problem arises in the supply and quality of public transport, which in many cases fails to maintain frequencies needed or routes that minimize transfers, with low fares and competitive travel times with respect to other travel options. (Rodríguez, et al., 2015), Motorcycles are presented as an affordable transport option.

This type of vehicle is used for different purposes, depending on the geographical area observed; in those countries considered high-income they are usually for recreational purposes, while in countries where incomes are low and middle-income, motorcycles are usually used for commercial purposes, as goods delivery vehicles and in some countries as cabs (OMS, 2017). This also gives motorcycles a key role in society, in the sense that, in many cases, they represent a source of income for the rider-owner. (Rodríguez, et al., 2015).

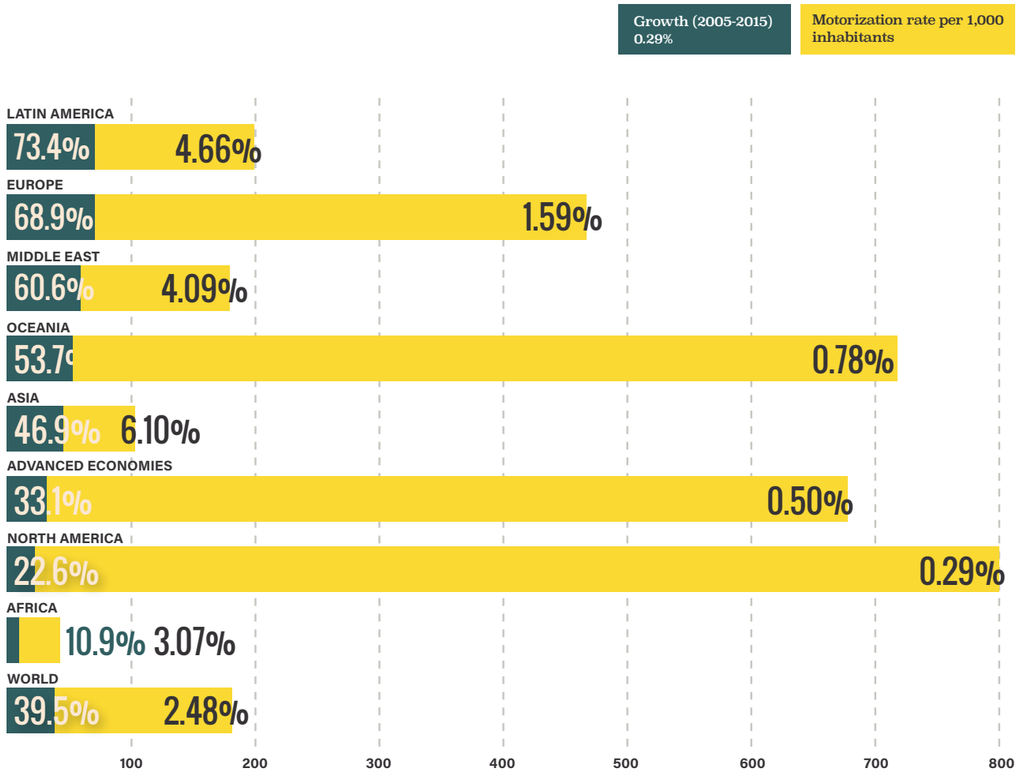
A clear difference in how motorcycles are utilized in different regions can be observed through their sales. For example, those of large displacement are sold more in North America than in Asia. It is also observed that most of the two- and three-wheeled vehicles registered in the world are found in low- and middle-income countries. (OMS, 2017) According to a measurement carried out in 2013, 88% of these vehicles were circulating in the countries[1].

The motorization rate in Latin American and Caribbean countries, 201 vehicles per 100,000 inhabitants as of 2015, although lower than that of the United States and Europe (with 471 and 805 vehicles per 1,000 inhabitants), has expanded rapidly. That is, while the expansion of the vehicle rate in advanced countries was 0.5% per year -from 2005 to 2015- that of Latin America and the Caribbean was 4.7%. This has an impact on the use of public transport services, which went from accounting for 50.5% of total trips in the 1990s to 35.5% in the 2010s. (BID, 2020).

The number of registered two- and three-wheeled vehicles increased by 23%, an incredibly steep rate. Comparing this indicator with the 8% increase in registered automobiles contributes to the enormity of the growth of the motorcycle vehicle fleet (OPS, 2019).

[1] Although there are no updated statistics to date on the distribution of motorcycles worldwide, some data illustrates the high presence of motorcycles in Latin America. In Colombia, for example, according to data from the Registro Único Nacional de Tránsito (RUNT) during the first semester of 2021, 73% of all registered vehicles were motorcycles (RUNT, 2021). Similarly, according to data from the National Directorate of Internal Taxes (DNII, 2021) of the Dominican Republic, 55.7% of all vehicles registered in that country as of December 2020 were motorcycles. In the southern part of the continent, in the Oriental Republic of Uruguay, for example, data from the Ministry of Transport and Public Works (MTOP, n.d.) show that motorcycles represent 51% of the vehicle fleet.

GRAPH 7- MOTORIZATION RATE BY REGIONS, AND ITS GROWTH IN THE 2005-2015 DECADE



Source: Own elaboration based on (BID, 2020)

There are several factors that contribute to increased motorcycle acquisition, for example, financing facilities for low-cost motorcycles. Other contributing factors are rising income levels, lower manufacturing costs, increasing cost of public transportation, convenience and ease of parking, lower fuel consumption, and ease of maintenance (OPS, 2019). Another reason why motorcycles are a popular vehicle in the region is the agility it provides, even in congested traffic conditions, a situation that is common in large Latin American cities.

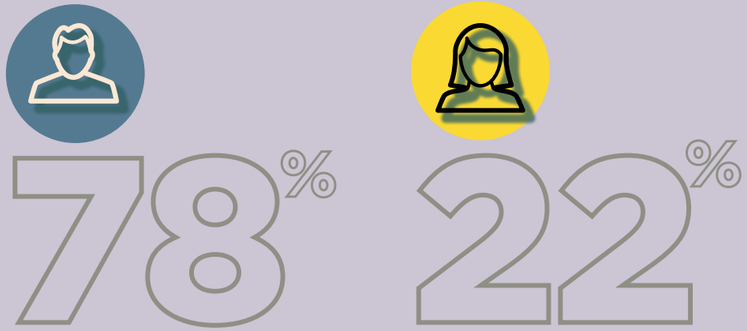
The demand for courier, cab, or home delivery services aboard motorcycles, exhibits a growing trend, as it is a service that citizens prefer due to low fares and shorter travel time in relation to other modes of transportation. In addition, many types of unofficial jobs, make it possible for workers to continue to receive state subsidies, which increases the profitability of the work, which in some cases exceeds the minimum wage. At the same time, people who use their motorcycles as a means of work tend to have low levels of education and income, which is a barrier to access employment with better working conditions. (OMS, 2017). The need for motorcycles to be used in the commercial workforce should be considered more seriously under adequate labor regulations so that they will transform and formalize this type of activity, thus improving the quality-of-life standards for people who today provide a service without decent conditions. This will not only contribute positively to the fulfillment of SDG 8, Decent Work and Economic Growth, but will also have a positive impact on road safety.

CONTEXT

Women on motorcycles in Latin America

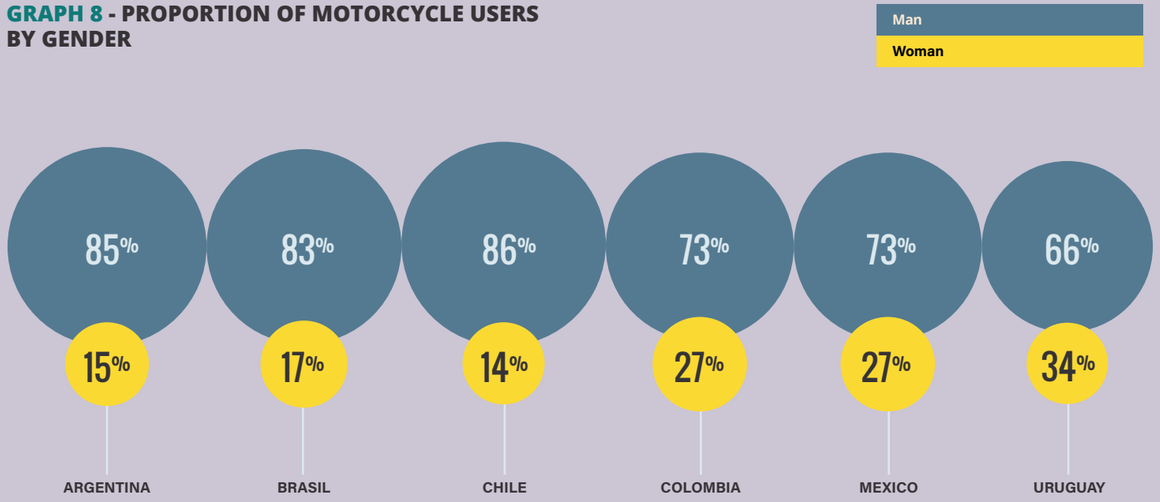
Motorcycle use is inextricably associated with gender, being a means of transportation predominantly used by men. Thus, the results of the Latin American Mobility Survey indicate that 78% of motorcycle users are men, compared to 22% of women.

PROPORTION OF MOTORCYCLE USERS BY GENDER



However, this proportion of users, according to gender, tends to vary significantly depending on the country, as shown in Graph 8. Chile, with 14% of female users, is the least diverse of the countries for which data could be obtained, while Uruguay leads in the number of women traveling by motorcycle with 34%. Despite these figures, studies suggest that motorcycle use by women in the region has progressively increased. In Chile, (CONASET, 2011) the number of female users reached 7% in 2010, and according to Transport Gender Lab's own calculations with the Mobility Surveys, there was an increase in female motorcycle users up to 14% in 2012. This behavior is mainly attributed to the deficiencies in public transport and guarantees a fast, comfortable, and safe trip by motorcycle. (CONASET, 2011).

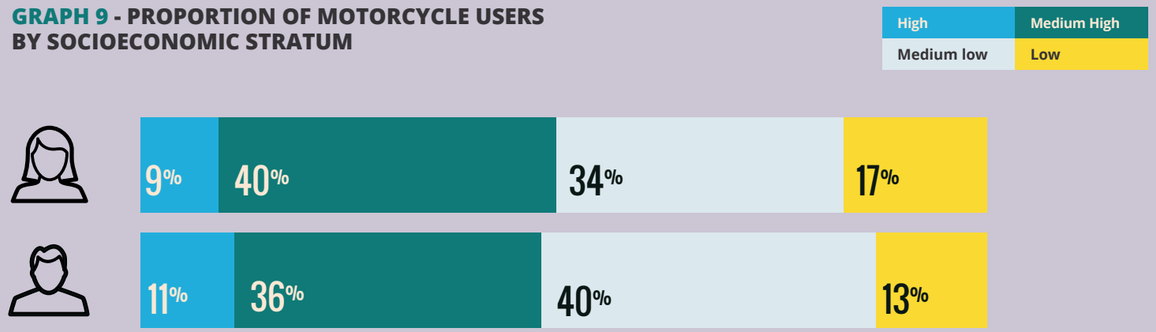
GRAPH 8 - PROPORTION OF MOTORCYCLE USERS BY GENDER



Source: Own elaboration with information from mobility surveys for Buenos Aires 2009-2010 (Argentina), Sao Paulo 2017 (Brazil), Santiago 2012 (Chile), Bogota 2019 (Colombia), Mexico City 2017 (Mexico) and Montevideo 2016 (Uruguay).

Motorcycles are a means of transportation used mainly within the middle socioeconomic strata for both men and women, as shown in Graph 9. In this sense, women in the upper middle stratum are the largest user group with 40% of the sample, while men predominate in the lower middle stratum. However, motorcycle use by stratum varies significantly among countries. Uruguay and Chile stand out with 45% and 39% of women users in the upper middle strata, respectively. Likewise, in the lower middle stratum, Mexico and Colombia have a higher proportion of female users, with 69% and 52% of women who travel by motorcycle, respectively.

GRAPH 9 - PROPORTION OF MOTORCYCLE USERS BY SOCIOECONOMIC STRATUM



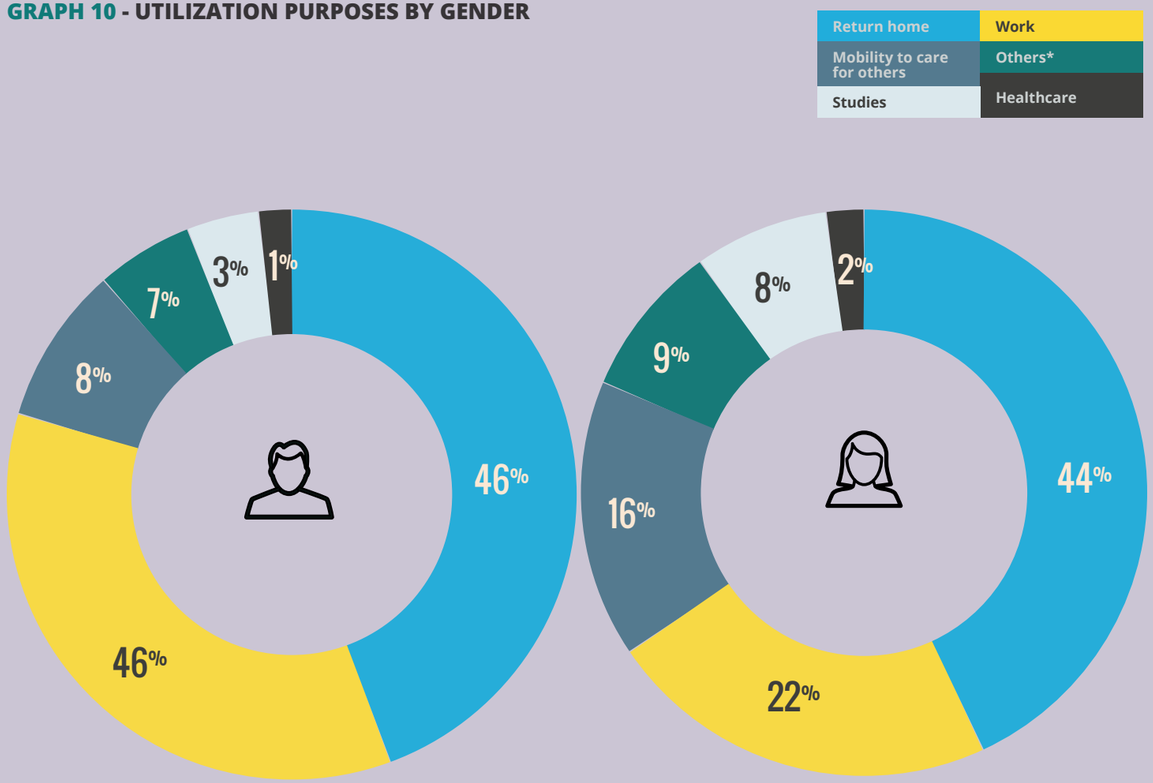
Source: Own elaboration with information from mobility surveys for Buenos Aires 2009-2010 (Argentina), Sao Paulo 2017 (Brazil), Santiago 2012 (Chile), Bogota 2019 (Colombia), Mexico City 2017 (Mexico) and Montevideo 2016 (Uruguay).

CONTEXT

Women on motorcycles in Latin America

Graph 10 shows the utilization purposes of motorcycles. For men and women, the main reason for using the motorcycle for a trip is to return home 46% and 44% of the time, respectively. In addition, both use it repeatedly for commuting to work, although there are greater differences between men and women. Thirty-five percent of men's motorcycle trips are work-related, compared to 22 percent of women's trips.

GRAPH 10 - UTILIZATION PURPOSES BY GENDER



Source: Own elaboration with information from mobility surveys for Buenos Aires 2009-2010 (Argentina), Sao Paulo 2017 (Brazil), Santiago 2012 (Chile), Bogota 2019 (Colombia), Mexico City 2017 (Mexico) and Montevideo 2016 (Uruguay).

***Following the definition of (Madariaga, 2009) care mobility includes within the category mobility for the care of others: shopping, visiting relatives, moving, or accompanying dependent members of the household (children, adolescents, elderly) and paying for services and formalities.**

In respect as to who the driver-passenger is, women tend more often to be passengers. In Mexico, women were passengers in 51% of trips, while men were in 5% of the cases. In view of this, as pointed out by (Buscher, 2015)in Mexico, because of their predominant role as passengers, women tend to face the same risks as male drivers, although with less control of the situation since they are passengers. The lower rate of driving may be linked to the availability of licenses in Argentina, Chile, and Colombia. On the other hand, evidence from Global South suggests that in 66% of motorcycle trips, women use this means of transport accompanied by at least three people, as opposed to men, who use it with only one person at a time. (Oyesiku & Odufuwa, 2002) Therefore, the use of motorcycles by women may be associated with family or shared use, for which the vehicle was not designed.

51%

of the trips have women as passengers

66%

of the trips in which women are riders, have at least three passengers

In terms of road crashes, the lower occurrence by women seems to be directly proportional to the use of motorcycles. Thus, 22% of road crashes involving motorcycles in Ibagué, Colombia during 2008 and 2012, were of women (Cabezas, et al., 2014). Similarly, in Brazil, the study by Oliveira, et al. 2020, indicates that only 27.2% of women were admitted to the hospital for a motorcycle incident. However, official data on traffic crashes and fatalities are usually not reported under a gender approach, including "neutral" users without identification of their sex or gender. Therefore, it is difficult to know the current situation at the regional level. Studies have found a low acceptability of the use of motorcycle safety equipment by women, especially helmets. (Kudebong, et al., 2011). In addition, for pregnant women, the use of motorcycles may be risky and contraindicated.

CONTEXT

The vulnerability of the motorcycle user

Motorcyclists and their passengers belong to the group of vulnerable road users (OMS, 2018). When a motorcycle user is involved in a crash, the injuries sustained are likely to be multiple. Head injuries, particularly common in head-on crashes, are the most frequent in fatal crashes and are present in about half of all fatal crashes. (Mau-Roung Lin, et al, 2008).

Due to under-reporting or under-recording, there is significant under-reporting of crashes involving motorcycles, especially those that did not involve serious injuries, or those that did not involve other vehicles.

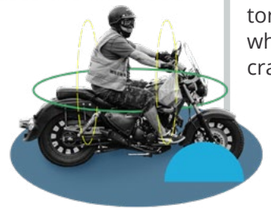
The second most common type of injury, after head injuries, is chest and abdominal injuries. Injuries to the lower extremities, although commonly suffered in traffic crashes, are not those that cause the death of the person who suffers them.

The World Health Organization publication, "Safety of two- and three-wheeled vehicles" (2017), mentions three groups of risk factors to which motorcyclists are exposed: those related to the vehicle, to the user and to the road environment.

Vehicle-related risk factors

LACK OF STRUCTURAL PROTECTION

The motorcycle does not have a passenger compartment with an enveloping bodywork that has the capacity to absorb energy in the event of an impact. In the event of a crash, the motorcyclist is exposed to greater deceleration, which increases the likelihood of serious or fatal injuries.



STABILITY

Maintaining stability on board a motorcycle is not a trivial matter. Keeping the motorcycle stable requires both the speed at which the motorcycle travels and the condition of the road, as well as the motorcyclist's riding skills. In this sense, because stability depends on several factors, the risk of losing control of the motorcycle is greater than that of losing control of a car, which increases the likelihood of being involved in a crash.

User-related risk factors

LACK OF VISIBILITY

One of the most important factors in crashes involving motorcycles is the situation where the driver of a vehicle has made a maneuver without realizing that a motorcyclist was around. Because of their smaller size and rapid acceleration, motorcycles often cannot be seen in time to avoid a collision. The more visible motorcycles are, the less likely they are to be involved in traffic crashes.

In this sense, just as the use of safety helmets is an indispensable practice for motorcyclists to remain safe, so is the use of retro-reflective materials on clothing and on the vehicle.

RIDER AGE AND EXPERIENCE

Young and older riders are at greater risk of injury. In young people, this risk is increased because they are more prone to engage in risky behaviors, in addition to the lack of experience in riding a motorcycle. On the other hand, when it comes to older people, risk increases due to physical fragility and the decrease in regular driving practice causing the ability to react quickly to the command of the motorcycle lessening year by year.

THE PURPOSES OF MOTORCYCLE UTILIZATION

Usually, in countries considered high-income, motorcycles are used for recreational purposes, while in low- and middle-income countries, motorcycles are usually used for commercial purposes. When a motorcycle is used for commercial purposes, it is more likely that its driver, due to the type of use, tends to drive recklessly (speeding, not respecting traffic signs, etc.) and that the condition of the vehicle is not optimal. This increases the likelihood of being involved in a traffic crash.

User-related risk factors

THE NON-USE OF PERSONAL PROTECTIVE EQUIPMENT

It is important to highlight that, although the safety helmet is the protective equipment par excellence, not all serious injuries occur at head level, which is why motorcycle users must use additional elements to guarantee their protection and safety in the event of a road crash, such as gloves, appropriate footwear and clothing made of materials that resist friction.

Non-use of safety helmets, for example, is an important factor affecting the risk of head injury and death, or serious side effects following a traffic crash. Head and neck injuries are among the leading causes of death and causing the most serious injury and disability among motorcycle users. When the head hits the pavement or the ground, the brain, not rigidly attached to the skull, tends to impact the hard surface. The helmet's job is to decrease the force and speed of the skull upon impact with the surface and therefore increase chances of survival because it is a physical barrier against the impacting object.

SPEED

As with all vehicles, speeding is a dangerous practice aboard a motorcycle. It is important to remember that the energy due to movement (kinetic energy) is proportional to the speed the motorcycle is moving. The consequence is in the event of a crash, injuries may be more serious because the brake system was not correctly used. In the same sense, the higher the speed, the shorter the reaction time needed to make decisions and avoid crashes, and the greater the distance required to stop the vehicle.

BRAKING ERRORS

Properly braking a motorcycle differs from braking a car. Motorcycles have independent brakes on both wheels. Each of these brakes has different braking capacity and both must be activated so as not to lose control of the motorcycle at any time. It is common that the rider does not use the full braking capacity of the motorcycle (usually the front brake tends not to be used), which affects the distance the motorcycle needs to stop. In addition, if the motorcyclist does not properly master braking techniques, he/she is more likely to lose control of the motorcycle and be involved in a traffic crash.

RECKLESS DRIVING

Reckless driving is defined as fast acceleration, higher speeds, driving between lanes, "zigzagging" between vehicles, overtaking the right and driving with more than one passenger. All these behaviors increase the risk of injury and death in traffic crashes.

NON-USE OF LIGHTS IN DAYTIME DRIVING

In motorcycle collisions, two-thirds of the cars involved in the collision reported not seeing the motorcycle or seeing it too late. (Mau-Roung Lin, et al, 2008) The use of low beams during the day is one way to be seen by motorists.

ALCOHOL AND DRUG USE

In the Latin American and Caribbean region, (Cherpitel, et al., 2021) found that the risk of being injured in a traffic crash was five times higher in those people who reported having consumed alcohol at some point during the six hours prior to the road incident, compared to those who did not consume alcohol during that time period. This risk is even higher when alcohol consumption is combined with cannabis use.

The same study also states that the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) has assigned levels of risk of being seriously injured or killed in a road traffic crash:

Slightly increased: cannabis or alcohol up to 0.05 mg%.

Moderately increased: cocaine, opiates, benzodiazepines, or alcohol between 0.05 and 0.08 mg%.

Highly increased: amphetamines, combination of drugs, or alcohol in a concentration higher than 0.08 mg%.

The International Transport Forum, moreover, states that, in reference to the prevalence of different types of drugs used by injured drivers in OECD member countries, the proportion of drug-using drivers is higher among motorcycle drivers than car drivers (ITF, 2015).

Risk factors related to the road environment

PAVEMENT CONDITIONS

Pavement conditions have a direct influence on the motorcycle's grip of the pavement: the worse the conditions, the more likely it is that the motorcycle will not be able to generate adequate friction to maintain stability, which happens, for example, on rainy days when the road is wet, which increases the risk of loss of control and subsequent crash. Another important factor in crashes is those caused by falls into a pothole or, on the contrary, by abrupt maneuvers made to avoid hitting a pothole or some imperfection in the road.

ROAD INFRASTRUCTURE DESIGN

Infrastructure design can affect the likelihood and/or severity of a motorcycle crash. Motorcyclists are particularly vulnerable to collisions on curves, bends, driveways, and traffic circles. This is primarily due to changes in acceleration or when vehicle stability is at stake. Intersections and traffic circles are often the scene of motorcycle crashes due to failure to respect the right-of-way, increased approach speed and failure to obey traffic signs.

MIXED TRAFFIC

Driving in mixed traffic significantly increases the likelihood of motorcycle crashes. Increased traffic volume on large and small roadways, as well as at intersections, increases the exposure of motorcycles to other vehicles traveling at different speeds, thus increasing the likelihood of a crash.

ROADSIDE HAZARDS

These can be fixed objects such as trees, vertical signs, or rail guards, as well as moving objects such as parked cars. All these roadside objects pose a risk to motorcycle riders. This is mainly because all objects are designed with the safety of cars and their occupants in mind rather than that of motorcyclists

Protocol of safe practices for workers who use motorcycles as a work tool.

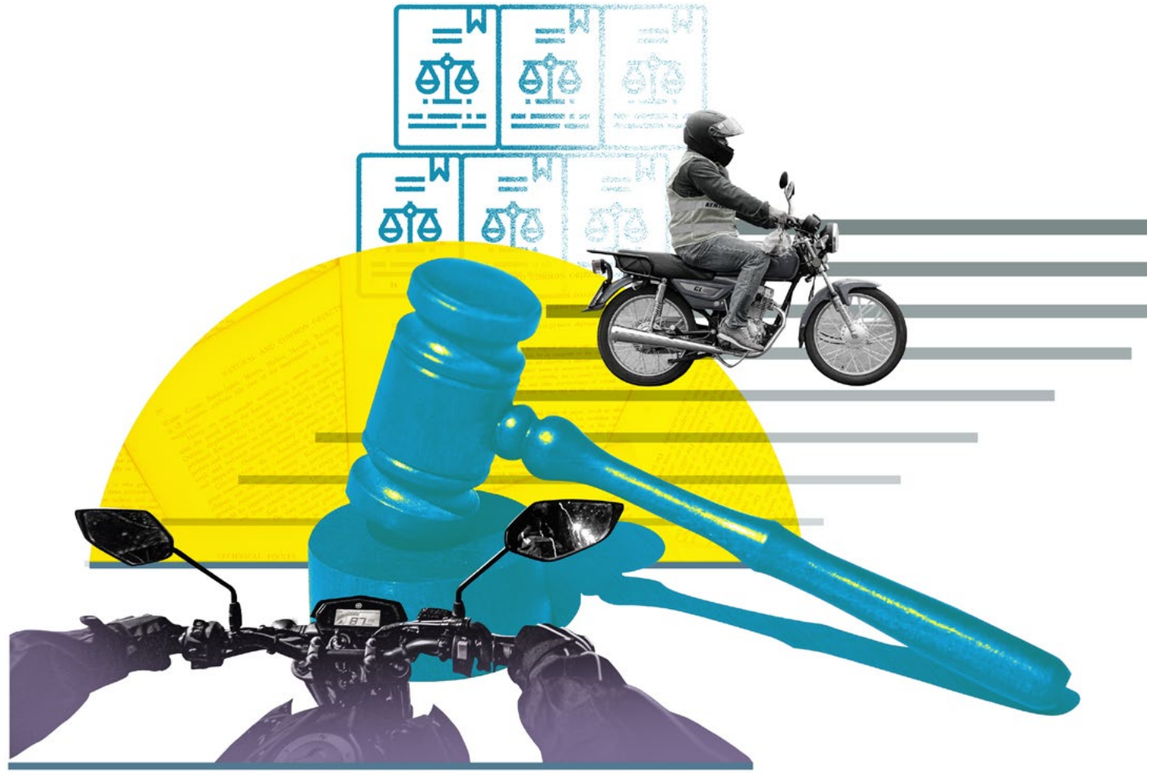
The use of motorcycles for work purposes generates vulnerability for those who carry out such activities. This vulnerability, in addition to being generated using this vehicle, is due to the risk exposure of those who drive the motorcycle, due to the large amount of time that the worker drives the vehicle.

The Colombian Ministry of Labor created the Protocol of safe practices for workers who use motorcycles as a work tool. The main objective of this document is to reduce the risk of road crashes due to the use of motorcycles in the workplace.

In turn, the protocol has been implemented with the following specific objectives:

1. **Determination of actions to be developed from the Occupational Health and Safety Management System to control the risk of road crashes among motorcycle drivers who are part of the country's labor force.**
2. **Determine preventive actions for the safe operation of motorcycles in Colombia in the workplace.**
3. **Reference the suggested active safety standards for motorcycles promoted in Colombia.**
4. **Establish minimum requirements for hiring motorcycle drivers in compliance with current legal regulations and establish guidelines for the implementation of strategies that lead to a correct selection process.**
5. **Reference and analyze international best practices for safe work on motorcycles.**
6. **Consolidate proposed characteristics for Personal Protective Equipment (PPE) to be used by motorcycle drivers.**

The Ministry of Labor intends to provide public and private companies with easy-to-apply tools to promote control actions that will lead to a reduction in the number of labor incidents involving motorcycles.



Legislative Framework in the Region

The research documented in the bibliography of this paper shows the status of different countries in the region and their ranking in terms of motorcycle safety.

The aspects mentioned are part of the good practices recommended in Section 3 of this document, practices that address motorcyclist safety from aspects related to vehicle safety, infrastructure interventions and personal care of the user, in addition to the legislative aspects necessary to have an appropriate legal framework.

Regional Legislative News

Regarding the legislation on safety helmets

With respect to the information contained in Table 2, the following groups can be established:

Group C1

Countries where the legislative framework for safety helmets is complete.

This group is composed of: Argentina, Brazil, Chile, Colombia, Ecuador, Honduras, Jamaica, Paraguay, Suriname, and Uruguay.

The recommendation for this group of countries is to generate a process of continuous improvement so that the legislation is adequately updated, especially regarding technical standards. Its development requires constant monitoring.

In turn, as mentioned above, it is important that legislation in addition to already existing rules, and complied by citizens, requires an adequate level of enforcement.

Group C2

Countries where the legislative framework exists, with opportunities for improvement in a specific aspect (within those mentioned).

This group is composed of: Barbados, Bolivia, Costa Rica, El Salvador , Dominican Republic and Trinidad and Tobago.

The recommendation for this group of countries is aimed at the improvement of legislation, covering the necessary points to reach the recommended good practice. The necessary enforcing should also be carried out to achieve an adequate level of use of this road safety device (the goal of 100% use should be set).

Group C3

Countries where the legislative framework exists, with opportunities for improvement in two specific areas (within those mentioned).

This group is composed of: Belize, Guatemala, Panama, and Peru.

The recommendation for this group of countries is aimed at the improvement of legislation, covering the necessary points to reach the recommended good practice. The necessary enforcement should also be carried out to achieve an adequate level of use of this road safety device (the goal of 100% use should be set).

Group C4

Countries where there is no law in force regarding the use of safety helmets.

This group is composed of Guyana and Mexico. The recommendation is to address the issue with the objective of regulating the use of helmets for motorcycle and moped users, following the best practices in the matter and examples of countries that have achieved a correct implementation of this type of law.

TABLE 2: LEGISLATION REGARDING MOTORCYCLE SAFETY HELMETS

Yes	Helmet Use Law				
	Does it exist?	Applies to Adult and Passenger?	All Roads?	Helmet fastened?	Specific Standard?
Argentina	Yes	Yes	Yes	Yes	Yes
Bahamas	-	-	-	-	-
Barbados	Yes	Yes	Yes	No	Yes
Belice	Yes	Yes	No	Yes	No
Bolivia	Yes	Yes	Yes	No	Yes
Brasil	Yes	Yes	Yes	Yes	Yes
Chile	Yes	Yes	Yes	Yes	Yes
Colombia	Yes	Yes	Yes	No	Yes
Costa Rica	Yes	Yes	Yes	No	Yes
Ecuador	Yes	Yes	Yes	Yes	Yes
El Salvador	Yes	Yes	Yes	Yes	No
Guatemala	Yes	Yes	Yes	No	No
Guyana	No	-	-	-	-
Haiti	-	-	-	-	-
Honduras	Yes	Yes	Yes	Yes	Yes
Jamaica	Yes	Yes	Yes	Yes	Yes
Mexico	No	-	-	-	-
Nicaragua	-	-	-	-	-
Panama	Si	Yes	Yes	No	No
Paraguay	Yes	Yes	Yes	Yes	Yes
Peru	Yes	Yes	Yes	No	No
Dominican Republic	Yes	Yes	Yes	No	Yes
Suriname	Yes	Yes	Yes	Yes	Yes
Trinidad and Tobago	Yes	Yes	Yes	No	Yes
Uruguay	Yes	Yes	Yes	Si	Yes

The entry "-" means that the data is not available in the literature.

Source: Own elaboration based on data from (OMS, 2018)

Regional Legislative News

Regarding Anti-lock Braking System Legislation (ABS)

Brazil is the country in the region that has made it mandatory for all motorcycles of 300 cubic centimeters or more to be equipped with ABS brakes. However, it must be considered that small engine motorcycles are used in the region, which is why this type of measures should cover all motorcycle sizes and types. For example, through a risk perception survey in Argentina, implemented by the Fundación Gonzalo Rodríguez, it was established that only 5.6% of the motorcyclists surveyed drove a vehicle of 250 cubic centimeters or more.

In the European Union, all vehicles with a cylinder capacity of more than 125 cubic centimeters are mandatorily equipped with this braking technology to reduce the number of fatalities by 40%. For motorcycles with a smaller cylinder capacity, the manufacturer may or may not equip ABS, but it is mandatory for the motorcycle to be equipped with CBS technology.

In the United States, the National Transportation Safety Board (NTSB) sent the National Highway Traffic Safety Administration (NHTSA) in 2018, by unanimous vote of its board of directors, a formal recommendation that all motorcycles be equipped with ABS technology.

Bearing in mind that all countries in the region should strive to have a safer braking system, the idea is to urge the incorporation regulations that require new motorcycles to have the ABS technology braking system.

Regarding daytime use of front lights

Currently, according to the Benchmarking report on road safety in Latin America, the legislative reality regarding the use of headlights during the day can be observed in some Latin American countries. At the same time, information about the mandatory use of the "Automatic Headlamp On" (AHO) device is shown.

TABLE 3: LEGISLATION ON THE USE OF HEADLIGHTS AND THE AHO DEVICE

Country	Mandatory headlight on (even during the day)	Automatic front light on
Argentina	Yes, only on national roads	Yes, for all models marketed from 2012 onwards.
Brasil	Yes	Yes
Chile	Yes	Yes, for motorcycles registered after 2001.
Colombia	Yes	No
Costa Rica	Yes	No
Ecuador	Yes	No
Mexico	Yes, only on federal highways	No
Paraguay	Yes	No
Uruguay	Yes	No

Source: Own elaboration based on the study: Benchmarking road safety in Latin America. (OCDE/FIT, 2017)

Licensing requirements

Licensing information by country is available and can be seen below as to the different requirements for the issuance of licenses in Latin American countries. Some of the data has changed in respect to the date from which the study was conducted and has been adapted to the present day. (OCDE/FIT, 2017)

TABLE 4: REQUIREMENTS FOR OBTAINING A MOTORCYCLE LICENSE IN DIFFERENT LATIN AMERICAN COUNTRIES

Country	Minimum age to drive a moped/ scooter	Minimum age to ride a motorcycle (years)	Mandatory pre-training	Theoretical exam	Practical exam	Comments
Argentina	16 years old	Up to 150cc: 18 years old 150cc to 300cc: 20 and 2 years of seniority in previous category. Over 300cc: 22 and 2 years of seniority in previous category.	Yes: 5 hours of theoretical training	✓	✓	For mopeds, prior consent of an adult is required, who will be responsible for any damage caused by the young driver.
Brasil	18 years old	18 years old	Moped: 20 hours of theory and 10 hours of practice. Motorcycle: 45 hours of theory and 10 hours of practice.	✓	✓	
Chile	18 years old	18 years old	✗	✓	✓	
Colombia	16 years old	16 years old	Up to 125cc: 25 hours of theory and 11 hours of practice.	✓	✗	
Costa Rica	No minimum	Up to 125cc: 16 years old Over 125cc: 18 years old	✗	✓	✓	No specific license for driving motorcycles, same license as for driving a car.
Ecuador	17 years old	17 years old	10 hours of theory, 10 hours of practice, 1 hour of mechanical	✓	✓	
Mexico	No minimum	18 years old	✗	✗	✗	
Paraguay	18 years old	18 years old	✗	✓	✓	
Uruguay	16 years old	Up to 200cc: 18 Over 200cc: 21	Up 200cc: 18	✓	✓	

Source: Own elaboration based on the study: Benchmarking road safety in Latin America. (OCDE/FIT, 2017)

GOOD PRACTICES

This chapter presents a set of good practices aimed at improving motorcyclist road safety. The sections are not intended to be extensive in terms of experiences, but rather to gather a group of experiences that can serve as examples for current realities.

Table 5 shows the focus or dimension which good practices are to be developed are based on, as well as a brief notion of the subject matter.

TABLE 5 - SET OF TOPICS ADDRESSED BY THE GOOD PRACTICES COVERED IN THIS CHAPTER

Focus	Subject of work
Driver and passenger 	• Minimum age to ride a motorcycle, depending on engine power and riding ability. • Mandatory training for the granting of motorcycle licenses, starting with a basic category and increasing according to years of experience. • Personal safety elements for driver and passenger.
Vehicle 	• Allow only the sale of approved vehicles. • ABS braking device. • Day and night lights. • Mandatory MOT on vehicles. • Mandatory insurance.
Infraestructure 	• Surface condition. • Demarcation and visibility. • Speed management. • Exclusive lanes for motorcyclists • Side barriers adapted for motorcycles.

Strategic Planning

The rapid growth of motorcycles in the region, especially the concentration of its use in cities and the increase in crashes with victims justifies concentrating efforts on improving road safety for motorcyclists from the public policies that are developed in terms of mobility at both national and local levels.

The Development Bank for Latin America (CAF) generated a methodology for developing road safety plans (CAF, 2013) with a goal of providing a useful and simple to implement tool that would make it easier for policy makers and technicians at the municipal level to approach problems and solutions for motorcycle safety. The methodology included new intervention strategies and proposals developing road safety plans. One aspect to be highlighted is the approach to involve all active participation of all users who have an incidence or some degree of responsibility in motorcyclist road safety.

Strategic Planning

TABLE 6 - LIST OF POTENTIAL ACTING BODIES TO BE CONSIDERED FOR THE CONSTRUCTION OF A ROAD SAFETY PLAN FOR MOTORCYCLISTS OF A ROAD SAFETY PLAN FOR MOTORCYCLISTS

Manufacturers	Vendors	Workshops	Insurance companies
Vehicles	City motorcycle	Small workshops	Companies
Components	Sport motorcycle	Specialized	Consortiums
Helmets	Equipment	Technical inspections	
Equipment			

Other users	Bike organizations	Professional Motorcycle Organizations	Media outlets
Pedestrians	Motorcyclist associations	Courier	Specialized magazines
Cyclists	Unions	Delivery service	Press
Car drivers	Sports federations	Motorcycle taxi	Audio-visual media
Transporters		Others: doctors, mechanics	

Health system	Trainers/Educators	Public administrators	Regulatory agencies and Police
Medical emergencies	Driving schools	National admin	Local transit police
Hospitals	Specialized schools	Regional admin	Labor inspectors
Rehab	Educational centers	City councils	Transport inspectors
		Areas of: Industry, transit, transport, health, infrastructure	Prosecutor's office
		education	

SOURCE: OWN ELABORATION BASED ON (CAF, 2013)

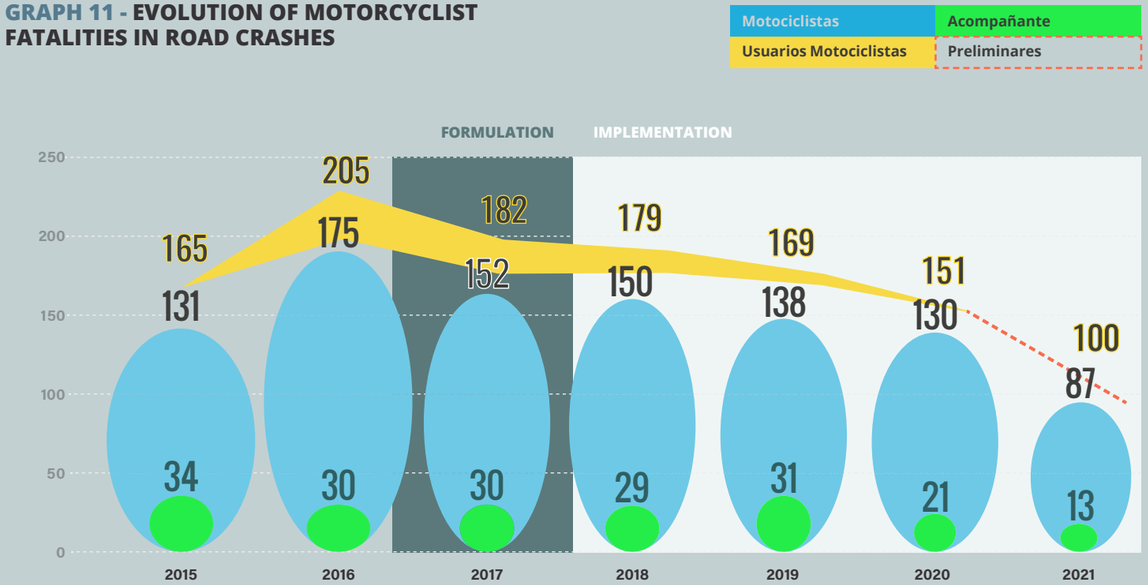
This methodology has been applied in several countries in the region. Two cases are presented below.

Good practices for motorcyclists in the city of Bogota

Working for the protection of the most vulnerable users in Bogota has been a priority for the district, which has been developing actions at the level of planning, inter-institutional articulation, control, cultural behaviors, among others. As part of this effort in April 2016, diagnostics, surveys, and workshops were conducted, among others, aimed at obtaining material for the development of the District Road Safety Plan for Motorcyclists, adopted from the publication of District Decree 813 of 2017. Thus, Bogota became the first city in Colombia and one of the first in Latin America to draw up a roadmap between 2017 and 2026 to reduce the road crash rate of this road user.

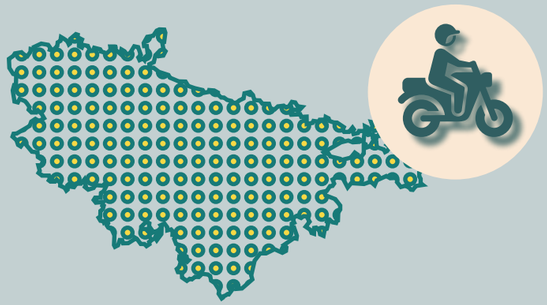
The plan includes 35 specific actions to mitigate road crashes among motorcyclists. Since the beginning of its implementation in January 2018, progress has been made in 28 of these, which have been possible considering an articulation between key public and private users with interests in the sector. As of June 30, 2021, there is a 40% implementation progress, based on the planning indicators available to the entity; additionally, as shown in the following graph, since its implementation, a 14% reduction in deaths due to road crashes involving motorcyclists has been achieved.

GRAPH 11 - EVOLUTION OF MOTORCYCLIST FATALITIES IN ROAD CRASHES



Source: Own elaboration based on data provided by the Secretaría Distrital de Movilidad, Bogota.

Good practices for motorcyclists in the city of Bogota



220

gaps that have caused crashes reported to the IDU (Jan/2019 - Jul/2021)

3.800

assistants in 17 local days of Road Safety

9.000

beneficiaries through 17 participant organizations

763

motorcyclists trained together with the Health Secretariat

To follow up on priority issues and improve strategies, intersectoral coordination has been fundamental for this purpose. Since 2020, joint work efforts have been strengthened and resumed with district and national entities, assemblers, motorcyclist training companies, personal protection equipment suppliers, motorcyclist clubs and associations, among others.

Based on the topics discussed at these roundtables, new projects have taken place, such as the development of the Methodological Guide for traffic and transport control procedures, an application to report potholes on the roads, where more than 220 that had caused crashes, were reported to the Urban Development Institute -IDU (Jan/2019 - Jul/2021), and the review of local regulations that stablished measures for motorcyclists. Other strategic actions have taking place such as the institutionalization of the month of road crash prevention for motorcycles, which in the 2021 version impacted more than 145 thousand motorcyclists both virtual and in person, road safety campaigns on Bogota's districts with more than 3,800 attendees (17 campaigns since 2018), on-road road safety campaigns that have reached more than 30,000 motorcyclists (Jan/2018 - Jul/2021), a free theoretical and practical driving course that have trained nearly 4,000 motorcyclists (Oct/2018 - Jul/2021), a yearly road safety contest where companies postulate their good practices for motorcyclist, which in its first 2 editions has had the participation of 17 organizations where more than 9,000 collaborators have benefited (2019 and 2020), a free online road safety course for motorcyclist that already has nearly 15,000 registered motorcyclists (Oct/2020 - Jul/2021), "un pedido por la vida" campaign that has trained more than 1,500 motorcyclists that work on delivery (Oct/2020 - Jul/2021), and First Responder Workshops that have been developed with the Secretary of Health, in which 763 motorcyclists have been trained on road emergencies while being assisted by health care services (Mar/2019 - Jul/2021).

National strategic road safety plan for motorcycles - Dominican Republic

Dominican Republic is one of the countries with the highest number of motorcyclists than any other type of vehicle. The number has been rising steadily since 2007 and in 2017 reached 54.6%, which confirms that 59% of motorcycles are for commercial purposes while the remaining 41% are for private purposes.

The high rate of motorcycle use in this country is also reflected in the traffic-related mortality figures, where motorcycle users account for more than 50% of the fatalities.

The Instituto Nacional de Tránsito y Transporte Terrestre (INTRANT) has set up a plan aimed at reducing traffic fatalities, especially those related to the use of motorcycles and mopeds. Currently, the mortality rate in the Dominican Republic is 29 deaths per 100,000 inhabitants.

The plan's implementation seeks to reduce motorcyclist fatalities by 20% through seven specific objectives determined in working tables along with the stakeholders involved. These are (INTRANT, 2019):

1. **Identification and control of the causes that result in the crash rate of motorcycle users, as well as those who interact with it.**
2. **Defy positive causes in reducing crashes that were brought about by a human factor (road safety education, road safety training and driver's licenses).**
3. **Determine how and why vehicle crashes occur when caused by a vehicle factor and how to reduce them.**
4. **Determine what caused vehicle crash reduction when previously caused by an infrastructure factor.**
5. **Review of regulatory factors that regulate motorcycles circulation. Once weak points have been identified, proceed to improve them.**
6. **Strengthening the acquisition, maintenance, and promotion of safe road behaviors among motorcyclists and eradicating risky behaviors as a preventive measure for traffic crashes.**
7. **Training and road user education as a preventive measure for road safety.**

Licenses

Paragraph 27 of resolution A/RES/74/299, issued by the United Nations General Assembly in August, 2020 “Encourages members to develop and implement comprehensive motorcycle laws and policies, including training, driver licensing, vehicle registration, working conditions and the use by motorcyclists themselves of helmets and personal protective equipment.

within the framework of existing international standards, working conditions, in the face of the disproportionately high and increasing number of deaths and injuries worldwide involving the use of motorcycles, particularly in developing countries.”

The recently published Guide for Road Safety Interventions: Evidence of What Works and What Does Not Work (Turner, et al., 2021) highlights systems in which new drivers must receive practical training, which includes several hours of on-street driving, obtain good results, and other factors that increase driver safety. Mention is made of the Gradual Licensing System (GLS), which combines supervised on-road training with a gradual approach to driving, in which certain aspects such as the types of vehicles that can be driven, alcohol tolerance or the number of passengers is restricted from the beginning of the learning stage. This is supported by the evidence that drivers are 3 to 4 times more likely to be in a crash during the first year of driving, which is due to the lack of skill and experience when facing different traffic situations. Additionally, it is also confirmed that cognitive maturity plays a fundamental role in this aspect.

Specifically, regarding motorcycle and moped riding, the Benchmarking Road Safety for Latin America report (OCDE/FIT, 2017) indicates that, to improve the safety of motorcyclists, it is vital that there is an improvement in their training and education for licensing. In order to ride a motorcycle safely, it is necessary to possess skills that can only be acquired through technical training. In this regard, if we consider current practices such as in Europe and Australia, where mandatory training is theoretical and practical, not only seeking to know how to perform maneuvers but, above all, focused on safety and defensive driving.

The same assessment is also reported in the publication Motorcycle Safety in Africa (Tripodi, et al., 2020) which indicates that the training of applicants to obtain a license to drive 2-wheeled vehicles can reduce risky behaviors, especially for novice drivers who, due to their age (+16 in many countries/cities), tend to have more reckless driving behaviors. Therefore, the recommendation for governments is to consider this factor, as well as vehicle power, when issuing licenses.

For many years in many countries, the power and displacement of vehicles has been a determining factor for the issuance of licenses to novice drivers. However, the inclusion of age and experience as part of the requirements has given way to the gradual system (ITF , 2015).

Graduated licensing system

The publication produced for the third Global Road Safety Conference, Saving Lives Beyond 2020: The Next Steps, notes that gradual licensing for different vehicle powers has proven to be an effective action to control driver risk exposure, which (Seguí Gómez, et al., 2020) points out that the gradual introduction of licensing for different vehicle powers has proven to be an effective action to control the risk exposure of younger drivers and to make their training easier.

As the name implies, these systems allow new drivers to acquire skills and experience gradually, going through different stages until a full license is obtained. Namely: restricted license, provisional license, and full license. At each stage, the driver’s knowledge is tested, and restrictions are eliminated, such as: age, vehicle cylinder capacity, authorization to transport passengers, night driving, among others. (ITF , 2015).

While this is a system that is proving successful, it is important to note that some countries do not accept it because the restrictions can be difficult to enforce, which may encourage younger people to drive without legal authorization.

Obtaining a license

Prior initial training is essential in the licensing system, and can take three forms: mandatory, voluntary, and one that includes both.

In Canada and the United States, for example, training is mostly voluntary. At the end of the course, participants are tested to determine what they have learned. In Europe, pre-training includes theoretical and practical training courses, with a knowledge test having to be completed to obtain a license (ITF, 2015).

An example of a system with mandatory training is that of Argentina, where applicants must have a certain number of hours of training to be qualified to take a theoretical and practical exam to obtain a license.

Driver's license applicants must comply with certain requirements that are imposed at the national, provincial, or municipal level, depending on the country. These include minimum age, qualifying medical examination, theoretical knowledge, and practical skills. Although the forms of evaluation vary around the world, it is essential to have this instance to ensure that all minimum requirements are met. Once qualified by age and medical examination, the applicant must take a theoretical knowledge test on the corresponding regulations and laws. Then, he/she must pass the practical part of the test to evaluate his/her technical driving skills. To evaluate these skills, the examiner must have subject knowledge and experience.

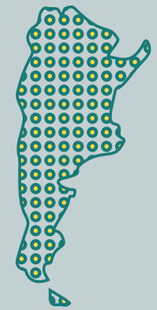
Training of instructors and examiners

This aspect is very important, since instructors and examiners' knowledge and experience is a determining factor in the training of applicants and whether they obtain their license.

The International Transport Forum (ITF) states that, minimally, trainers should have a thorough knowledge of the training they provide, as well as of driving and pedagogy for training. In this regard, it is relevant that trainers be trained in such a way that they can provide the correct information to trainees in a clear manner and meet the objectives outlined for each training plan. The trainer's competence and attitude towards road safety are fundamental. There should be minimum competence requirements for instructors based on the training they provide. The requirements could relate to the instructors' own driving competence and their pedagogical competence, e.g., training competence. (ITF, 2015).

Train the Trainers Course for Safe Motorcycle Riding - Argentina

In Argentina, as in other Latin American countries, motorcyclists represent a high percentage of annual fatalities. In 2020, 44% of those killed in traffic crashes were motorcyclists (ANSV, 2021). Territorially, statistics show that the regions of Northeastern Argentina (NEA) and Northwestern Argentina (NOA) register the highest crash rates, with some provinces exceeding 65% of motorcyclists in the total number of fatalities.



Fundación Gonzalo Rodríguez is working together with the National Road Safety Agency to intensively Train the trainers of Municipal License Issuing Centers (mainly in the NEA and NOA) on issues related to Motorcyclist Safety in Argentina.

Through training of trainers, the aim is to improve the process of obtaining the National Driver's License A.1 (for motorcycles and mopeds), generating safer users and fewer deaths in this group of vulnerable traffic users.

The topics addressed in the Train the Trainers Course for Safe Motorcycle Riding are:

Global, regional, and national road safety status, with emphasis on motorcyclists.

Role of the motorcycle in society.

Work strategies to improve the teaching aspect.

Working paradigms for a correct approach to work on the subject.

Technical aspects inherent to the motorcycle.

Motorcycle driving

The number of licenses issued by trained instructors, from September 2019 (when the first edition was held) until the end of 2020 were 165,000, we can observe the multiplier effect that the training of trainers has.

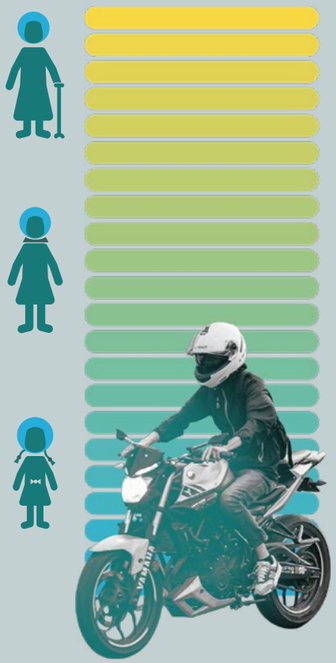
By mid 2021, through 3 face-to-face editions and 8 virtual editions, this program has reached more than 400 trainers from more than 150 municipalities in 17 provinces - out of the 23 provinces in Argentina.

Some of the municipalities have adopted the materials supplied by the Foundation to carry out their theoretical training, and some, such as Oberá (Misiones) have made it mandatory to generate specific theoretical spaces where applicants for the Class A1 National License can learn about the dangers faced by motorcyclists, something promoted by both the Fundación Gonzalo Rodríguez and the National Road Safety Agency.

Post-licensing training

The objectives of this type of training, which is not mandatory, are to deepen basic knowledge required for the initial obtaining of a license, or to update the skills of a driver who, for example, spent a long time without driving. Although this type of training is promoted by different organizations, it is not clear whether it is effective in preventing crashes or the severity of their consequences. Since this type of training is voluntary, there are not many evaluation studies, but research indicates that, if they are not clearly aimed at road safety, they might even imply a higher risk for the driver, as he/she might be overconfident, without having really improved his/her prevention skills. (ITF , 2015).

Age of passengers



Children are vulnerable road users and, as such, need adult protection to be moved safely.

It is important to mention that children's brains and skulls are still developing until they are about 20 years old. In addition, neck muscles are weaker than those of adults, and ligaments can stretch more. Children's vertebral joints do not restrict forward motion as much as in adults, and their spinal columns also have more cartilage and less bone (UN, 2016).

If we add to this the fact that transportation on motorcycles is inherently riskier than in cars, the initial recommendation that emerges in many publications, especially from the Expert Group, is that children should preferably not be transported on two-wheeled vehicles. And, if there are no other options available for transporting them, ensure that they ride with safety helmets, at lower speeds or route restrictions (Seguí Gómez, et al., 2020).

It is common knowledge that the reality in Latin America, Asia and Africa shows that the transportation of children in this type of vehicle is more common than desired. (FGR, 2017) provides data, for Latin America, about this reality.

Because this is such a controversial issue, which goes far beyond just the issue of transportation, and requiring a complex approach in resolving it, many countries have decided to take data such as age, height or reach to the footboard to determine when someone can be a motorcycle passenger, without there being an international consensus on the matter.

Ibero-American Charter on Driver's Licenses

In June 2009, within the framework of the IX Ibero-American Meeting of Traffic and Road Safety Officers, held in Santiago de Chile, Latin American countries signed the "Ibero-American Charter on Driver's Licenses" (E.I, 2009). It establishes the minimum requirements for training and evaluation of knowledge and skills to obtain a license. The goal is to improve the licensing systems, detailing the theoretical and practical contents required in the exams. (Ferrer & Rubino, 2017). In addition, this document aims to homogenize the processes and procedures to be carried out in the different signatory countries.

The Ibero-American Charter proposes that applicants for a motorcycle license must take a theoretical exam in which they can demonstrate their knowledge of traffic rules and signals, two-wheeled vehicle driving techniques, and road safety questions.

Safety Helmets

Head and neck injuries are the leading cause of death and serious injuries among drivers and passengers of motorcycles and mopeds (between 75% and 88% of deaths occur for this reason). It should also be considered that the social costs of these injuries are high, both for the survivors, their families, and the communities in general.

These injuries require specialized and/or long-term care, generating much higher medical costs than those caused by any other type of injury (OPS, 2008).

It is considered that -between 2008 and 2020- had properly approved safety helmets been used, 1.4 million traffic fatalities could have been avoided (UN, 2016).

The use of safety helmets is therefore an imperative behavior. The correct use of said helmets increases the chances of surviving a traffic crash by 42% while it also increases the capacity of not suffering serious injuries by 69%.

Safety Helmet Operating Principle

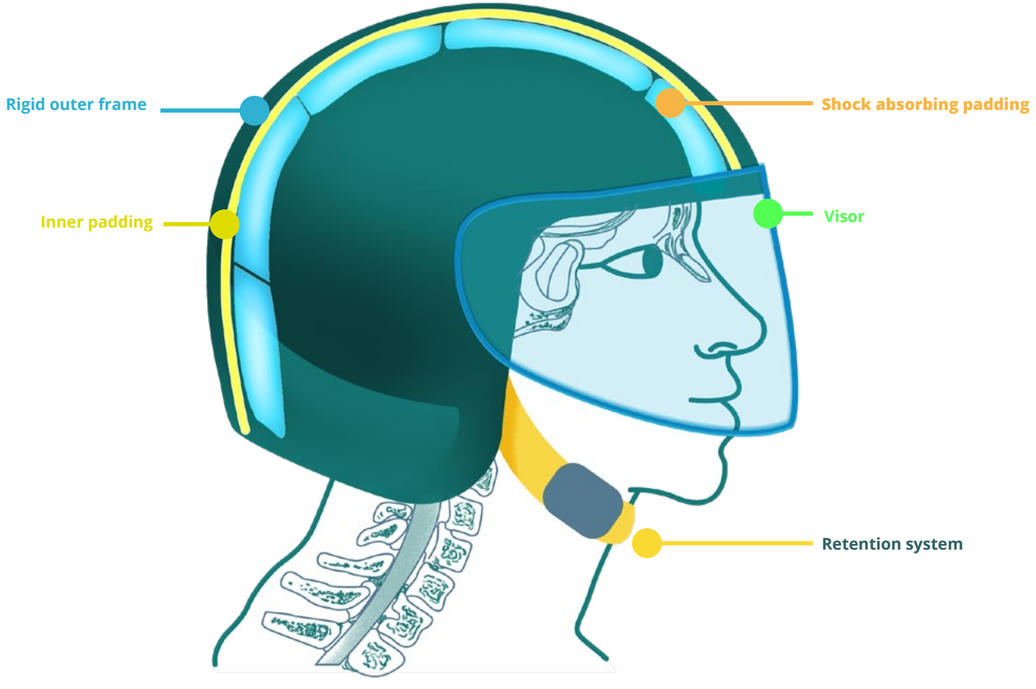
According to data from the Pan American Health Organization, the correct functioning of the safety helmet aims to (OPS, 2008):

Reduce the deceleration of the skull, and therefore of the brain, due to the action of its cushioning padding, in conjunction with the external rigid shell.

Disperse the impact force, enlarging the impact surface, reducing localized stresses.

Physically separate the skull from the impacted objects.

ILLUSTRATION 1 - SAFETY HELMET COMPONENTS

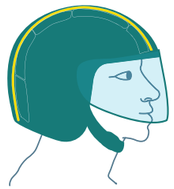


Source: Own elaboration based on (Pan American Health Organization, 2008).

Illustration 1 shows the main components of a safety helmet, each of which is designed to fulfill specific functions:

FRAME

It is the part of the hull that gives it structural shape, and acts as the first rigid barrier against the impacted object. It acts to distribute the impact force, maximizing the force action surface, and provides protection against possible penetration of sharp objects.



CUSHIONING PADDING

(or shock absorbing padding)

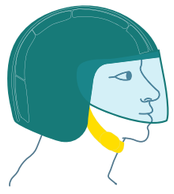
Its purpose is to reduce the deceleration of the head impact, to prevent the brain, due to inertia, from colliding with the structure of the skull.

The cushioning filler is 3 to 4 centimeters in thickness which is less than the minimum established above and may not provide adequate protection.

COMFORT PADDING

(or inner foam)

It is the part of the helmet that is in contact with the user's head. It is manufactured with fabrics that allow the user to feel comfortable. It also helps the helmet fit correctly to the head.



RETENTION SYSTEM

It is the mechanism that keeps the helmet on the head during a collision, whereby the action of inertia the helmet tends to come out of place. It consists of straps, anchorages and fastening mechanisms, or buckling, specifically designed to withstand the stresses in case of a collision.

VISOR

Just as it must be resistant to the impact of objects, it must ensure the correct visibility of the helmet wearer. Both in terms of transparency and in terms of not obstructing the field of vision.

Important information for the correct operation of the safety helmet:

The helmet must always be worn fastened to the head. The retention system is responsible for preventing the helmet from coming off the user in the event of a collision. Studies show that in cases where the helmet was not correctly fastened, the motorcyclist lost it during a collision in 96% of the cases (Fundación Mapfre, 2021).

The use of light-colored helmets increases the ability to be seen by other road users, thus decreasing the risk of collision by approximately 24% (OPS, 2008).

It is important to note that the safety helmet, to protect the head, undergoes permanent deformations in its structure. These permanent deformations (better known as “plastic deformations”) can occur both at the level of the shell and at the level of the shock-absorbing padding. The consequence of the above is that these deformations are not always easily identified. It is therefore important that helmets are not reused after having been involved in a crash.

In turn, like any other garment, helmets have a specific size. To know the right helmet size, the user’s cranial perimeter must be known by checking it above the ears and eyebrows. The way you measure may allow some tolerance, try on the tightest size as well as the loosest. If you prefer a snugger fit, refer to the tighter size, otherwise to a looser size. If you are unsure, use a tighter size. The comfort padding will give way with use. Safety helmets are for personal use. Their inner padding is designed to conform to the shape of the wearer’s head to maximize protection.

The materials of which helmets are made, especially plastics, have an expiration period from the moment the helmet starts to be used. Due to the passage of time and the action of UV radiation, hull materials gradually lose their mechanical properties. It is difficult to determine the expiration date but also considering the rapid development of this equipment to improve protection levels, it is advisable to replace the helmet after three or four years from the beginning of its use.

The safety helmet must be approved under a standard accepted in the country where it is used. The importance of this aspect is covered later in this chapter.

96%

of the situations in which the motorcyclist was involved in a crash with the helmet unfastened, ended with it deploying from the head

24%

is the reduction of collision risk if a clear-color rigid outer frame is used

Types of safety helmets

There are more than one type of safety helmet for motorcyclists on the market. Regardless of this, the following aspects should be considered (OPS, 2008):

- The materials used should not degrade over time or by exposure to weather conditions. They should not be toxic or cause allergic reactions.
- Technical standards establish the minimum safety specifications that a helmet must meet.

In addition to safety helmets designed specifically for sports activities, a distinction can essentially be made between four different types of helmets, with different degrees of protection.

FULL FACE HELMETS (P/NP)

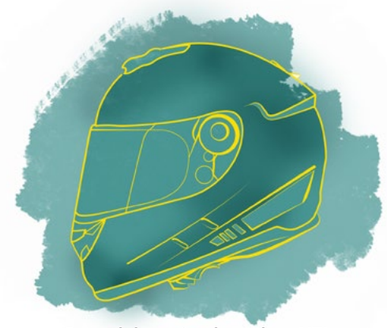
In addition to providing protection against impacts to the head, they also provide protection to the user’s face. It consists of a bar that passes over the chin and jaw area, above which there is an opening that gives the rider (and/or passenger) the necessary visibility in compliance with technical standards.

These hulls can be distinguished with the letters “P” or “NP” depending on the following characteristics:

P: Protector, chin guard (or jaw cover) tested and approved as a full-face helmet.

NP: No protector, chin guard (or jaw cover) not tested and/or approved as a full-face helmet.

ILLUSTRATION 2 - FULL FACE HELMET

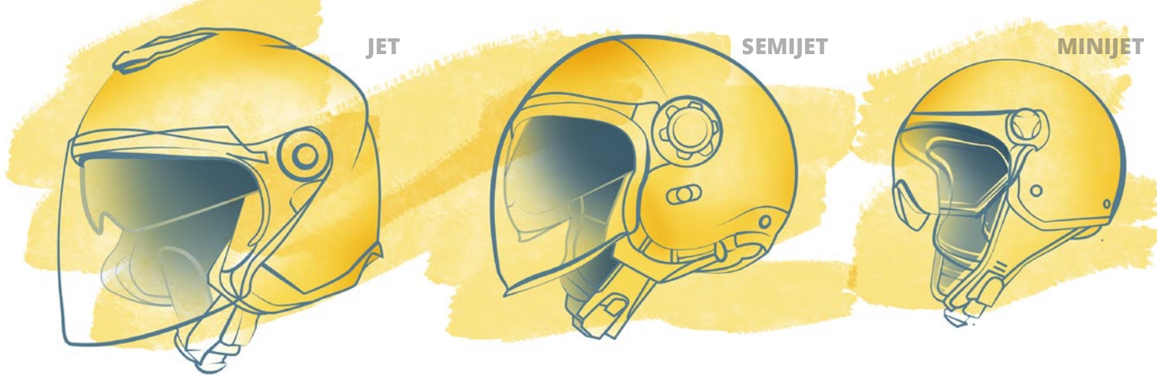


Source: Own elaboration based on NZI Helmets.

OPEN HULLS (J: “JET”)

They provide protection against impacts but offer limited protection to the user’s jaw, chin, and face. They are available with and without a visor, and in the latter case they must be used with goggles to protect the motorcycle user’s eyesight.

ILLUSTRATION 3 - OPEN FACE HELMET

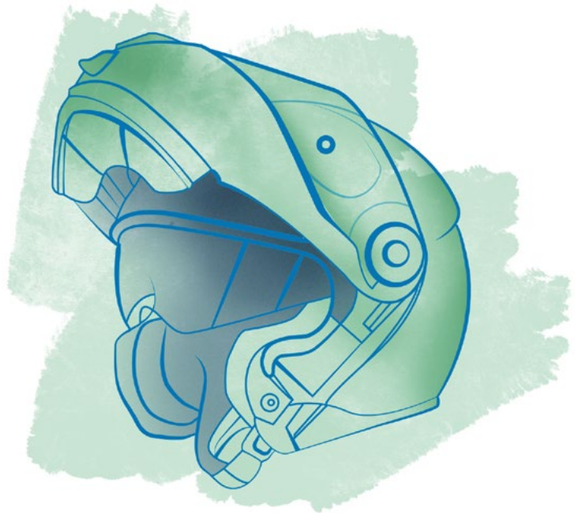


Source: Own elaboration based on NZI Helmets.

FLIP-UP HELMETS

In this type of helmet, the visor and chin guard can be opened to leave the face uncovered. For driving, the chin guard should be folded down to offer greater protection and to prevent the wind from destabilizing the driver.

ILLUSTRATION 4 - FLIP-UP HELMET



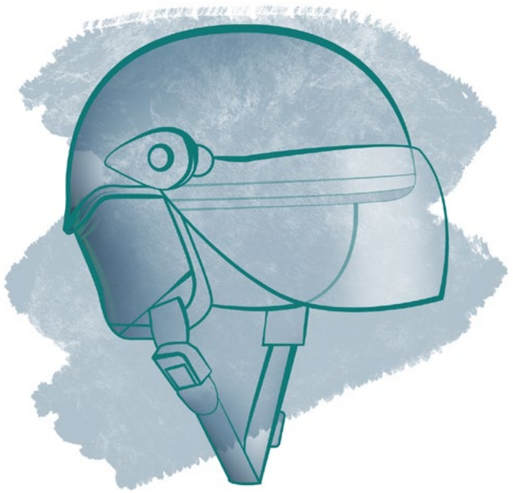
Source: Own elaboration based on NZI Helmets.

TROPICAL HELMETS

Designed specifically for South and Southeast Asian countries with extremely humid and hot climates. They are helmets with ventilation holes that maximize air circulation to reduce heat. They are lightweight and are usually made of PVC.

These helmets arose, as an initiative of the countries, because, due to the nature of the climate (among other factors), the population was reluctant to use helmets of classic design.

ILLUSTRATION 5 - TROPICAL HELMET



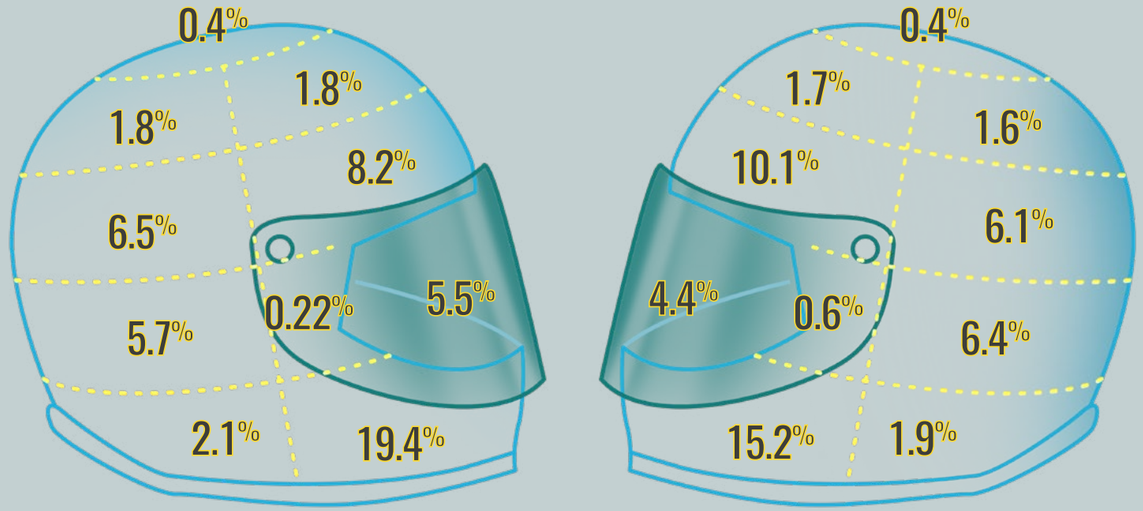
Source: Own elaboration based on NZI Helmets.

What type of helmet provides the best protection?

In the study "Motorcycle Crash Cause Factors and Identification of Countermeasures Volume 1: Technical Report" conducted by H. H. Hurt, the percentage of impacts received by each area of the helmet was determined, as shown in the following image.

The study shows that an open face helmet because it does not cover the face, chin, and jaw of the user, does not cover 45% of the impacts that the motorcyclist may receive, in this sense, the full-face helmet is the safest option.

ILUSTRATION 6 - PERCENTAGE OF IMPACTS ACCORDING TO HELMET AREA



Source: Own elaboration based on (H.H. Hurt, 1981).

Why are helmets not usually used?

(OPS, 2008) y (UN, 2016) address the different reasons that lead many people not to use safety helmets:

- **Negative peer pressure.** Non-use of safety equipment due to peer pressure is a common occurrence among young drivers. In many cases, those who use this type of equipment are ridiculed.
- **The belief that it is only necessary for long trips.**
- The price of helmets is **considered high.**
- **Discomfort and heat sensation,** especially in tropical climate regions.
- It cannot be worn over any other traditional, religious, or fashionable headwear.
- **They become an uncomfortable object** when they are not being used.
- Belief that the use of helmets **generates neck or spinal cord injuries.**
- Belief that vision and hearing are impaired.
- Approved helmets have the same level of protection as any other helmet.

As can be seen, several of the reasons are based on beliefs and not on objective data. It is therefore necessary to properly inform motorcycle users about the advantages of using a safety helmet.

Some of the measures recommended to counteract negative ideas are:

1- Improvement of the public image of the helmet.

2- Search for solutions to the problem of helmet discomfort when not in use (storage under the seat or "parking" for helmets).

3- Education of motorcycle users through awareness campaigns, to demystify erroneous beliefs.

4- Stimulate the sale of the motorcycle together with an approved helmet, so that the cost of the latter is an assumed cost in the purchase.

5- Legislation on the mandatory use of safety helmets.

6- Companies should encourage employees to increase their reliability to the use of approved helmets.

The case of Vietnam and its increase in the rate of safety helmet use

The helmet usage rate was between

6% and 10%

in the first stage
After the law implementation, the usage rate was

90%

Since the 1990s, motorcycles have dominated the streets of Vietnam, in many cases being the primary means of family transportation. The country's rapid period of motorization has been a key factor in the high mortality and injury rates on its roads.

In the first stage of motorization, the percentage of helmet use in Vietnam was low (between 6% and 10%). This was due to a lack of knowledge on the part of motorcycle users about the importance of helmet use and its principal operation. In addition, due to the country's climatic conditions, helmets were not a comfortable option for users.

It is also worth noting, in this first stage, the low access of the population to good quality safety helmets, with the corresponding homologations.

On December 15, 2007, the universal safety helmet law came into effect. For the first time in Vietnam, motorcycle drivers and passengers must wear helmets to ride on all streets and roads in the country. In four major cities (Hanoi, Danang, Can Tho and Ho Chi Minh City), helmet use increased from the above-mentioned percentages to over 90%.

The tropical helmet, specially designed for the Vietnamese climate, was also developed to reduce resistance to use due to discomfort.

During 2008, the country experienced a 24% decrease in road traffic injuries and a 12% decrease in road traffic fatalities.

(AIP, 2017)

Approval under technical standards

A technical standard is a document approved by a recognized body, which establishes technical specifications that must be complied with for certain products, processes, or services. It is of great importance that the safety helmet is approved under a technical standard, because in this way, a set of processes and test procedures will certify that it complies with the functions for which it was designed.

The affordability of approved helmets is a major issue. Motorcycle users need to have easy access to a product that provides adequate safety in terms of head protection.

In low- and middle-income countries, the purchase of helmets whose level of protection is adequate has a cost-benefit ratio of 2.2 to 1. That is, the benefits of purchasing these helmets outweigh the costs of not doing so by a factor of 2.2. (UN, 2016).

On the other hand, in this same group of countries, the cost-benefit ratio of purchasing helmets that are not certified under technical standards is 1 to 1. This means that, in addition to providing a false sense of security, the use of non-approved helmets does not provide benefits for society, i.e., the benefits of purchasing them are equal to the costs of not doing so.

Homologated and Affordable Helmets for Latin America - FIA Foundation

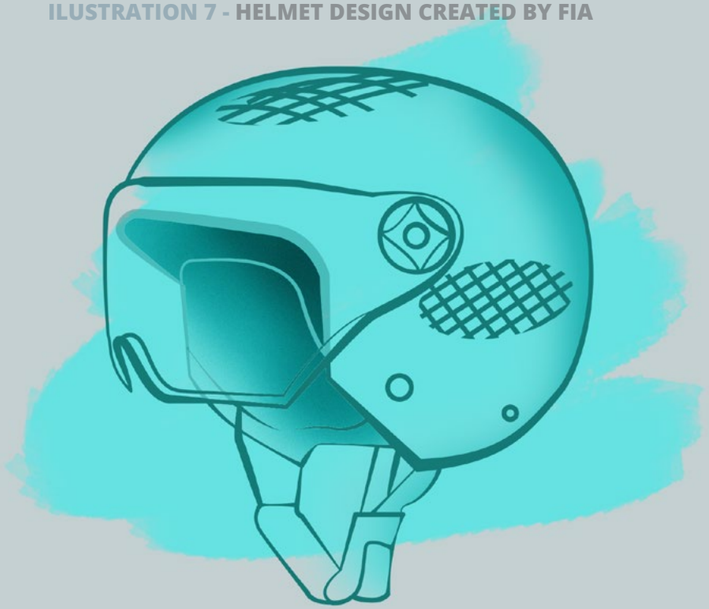
The Fédération International de l'Automobile (FIA) has set itself the challenge of creating a safety helmet, homologated to UNECE R22 standards, with the following characteristics:

The helmet must be SAFE.
With the objective of protecting motorcyclists, with an internationally recognized homologation.

The helmet must be ECONOMICALLY cost effective.
The aim is to make helmets accessible to all motorcyclists in low- and middle-income countries, discouraging the use of unsafe helmets because of economic reasons.

The helmet must be COMFORTABLE.
Discomfort should not be a barrier when using a safety helmet, in that sense, the design of the helmet has been designed so that factors such as heat or humidity do not negatively affect the user of the helmet in question.

ILUSTRATION 7 - **HELMET DESIGN CREATED BY FIA**



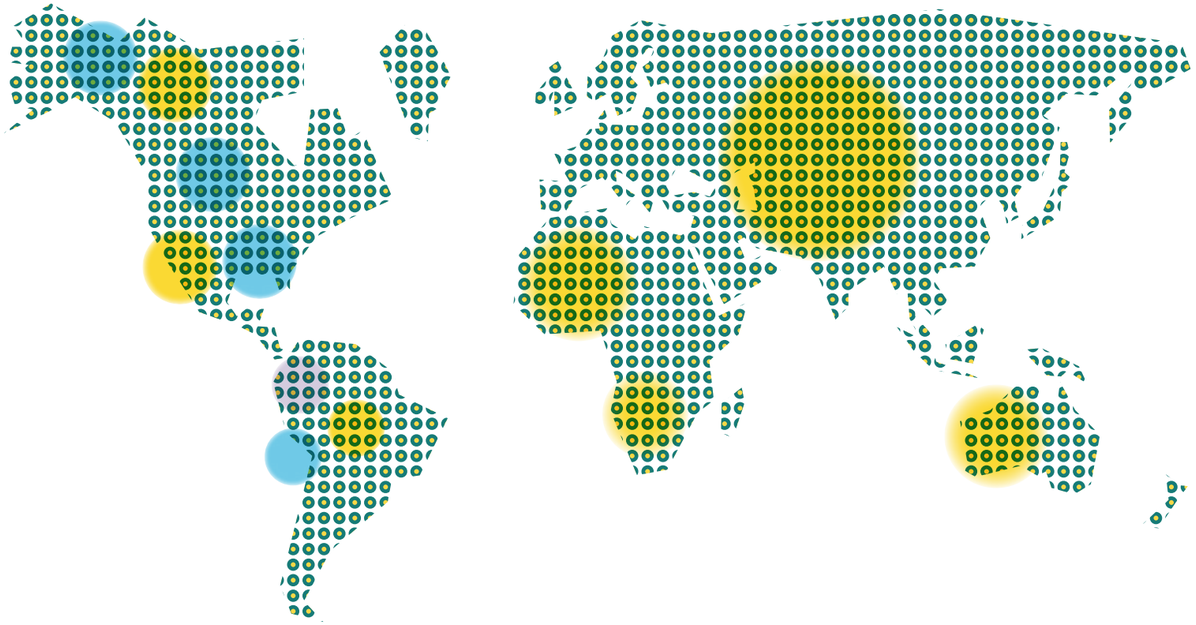
Source: Own elaboration based on FIA IV Region.

With the articulation of the National Road Safety Agencies, the Automobile Clubs and the Inter-American Development Bank, the FIA Foundation is carrying out helmet donation campaigns, with the aim of raising awareness about the importance of the existence of helmets in the Latin American market, with the characteristics. So far, the countries involved are Costa Rica, Uruguay and the Dominican Republic, and there are plans to extend this project to at least three countries in the region during the year 2021.

The most widespread technical standards in the world

For safety helmets, there are different technical standard bodies. For this reason, helmets available on the market are approved by different standards. In turn, Latin American countries usually have a National Standard. The latter are based on the most widely recognized standards.

ILLUSTRATION 8 - **MOST USED STANDARDS BY REGION**



Source: Own elaboration based on NZI Helmets.

UNECE R 22.05

DOT-218

NTC 4533 2017

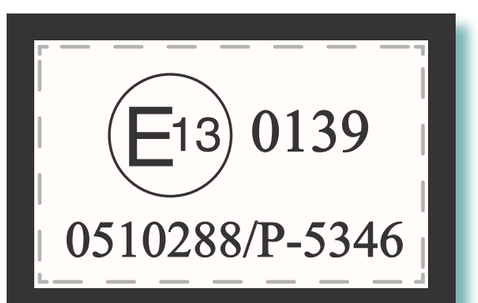
United Nations Regulations

The United Nations, UNECE R.22.05, regulation is used in 45 countries on 4 continents, the only mandatory standard or regulation for motorcycle manufacturers, importers, distributors, and users.

By simply looking at the label of a helmet approved under UNECE regulation R.22.05, you can obtain a lot of information regarding its origin.

In this example, the following data can be obtained from this label:

ILLUSTRATIONN 9 - UNECE R22.05 HOMOLOGATION LABEL.



Source: UNECE

E
UNECE R.22.

13
Certified by the Luxembourg authority (The number varies by country).

5
Version of Regulation 22 for which the product was approved.

10288
Helmet type approval number.

P
The helmet is protective (the chin guard is tested and approved as a full-face helmet. Could be NP or J.

5346
Batch test control number, identifies the production lot for which test results are available.

This standard has as basic requirements for approval:

Prototype homologation tests in an accredited laboratory.

Production qualification tests in an accredited laboratory.

Conformity testing of the batches produced.

The dynamic tests to which a safety helmet is subjected, to be approved by the regulations, are as follows:

Photometric Assay:

The minimum value of the luminous intensity coefficient of the surface of the material shall not be less than the values established by the standard.

Resistance to an External Agent

After contact with a given solvent, there should be no signs of distortion in the retro-reflective area and no signs of cracking.

Compatibility of materials

Neither adhesive parts nor retro-reflective material should affect the dynamic performance of the safety helmet.

Impact absorption test

The shock absorption capacity is determined by recording as a function of time the deceleration imparted to a helmet-equipped head when it is dropped in free fall at a specified impact velocity onto a fixed steel anvil.

Abrasion resistance

Rotational forces, caused by helmet protrusions and friction against the outer surface of it, can cause serious brain injuries.

The test seeks, through the displacement of a carriage that erodes the outer surface of the helmet, that the protrusions are detached or allow sliding over them.

Stiffness Test

By placing the helmet between two plates and applying a known load, the deformation is measured. This test is performed to check that the shell can withstand the direct impact, adequately distributing the energy.

Dynamic Retention System Testing

The retention mechanism (straps and fastening device) must not be wound up more than what the standard dictates in each impact. The resistance to abrasion of the straps is verified, as well as the impossibility of unintentional opening of the clasp, due to the stresses endured.

Roll Off Test:

It checks that the position of the helmet in relation to the head will not change excessively after an impact. In this test, the correct functioning of the restraint system is a key aspect.

Visor Test

The visor must not include any parts that may obstruct the peripheral vision of the user. At the same time, it must be free of bubbles, streaks, dull spots, holes, mold marks or other defects, originated by the manufacturing process. The light diffusion shall not exceed the limits preestablished by the standard.

In addition, the visor is also dynamically tested to determine its level of resistance to impact.

This method of certification ensures that every helmet approved under UNECE R.22.05 provides at least a certain standard of quality. This is useful for both consumers and inspectors.

ILLUSTRATION 10 - PROTECTION AREAS IN HELMETS APPROVED UNDER UNECE R.22.05 STANDARD

IN OPEN HULLS, TYPE "J":

IN FULL-FACE HELMETS, TYPE "P":

Source: Own elaboration based on NZI Helmets.

New set of amendments to the United Nations Standard: UNECE R22.06

During the year 2021, a sixth series of amendments to the United Nations Regulation Number 22 was published.

This review differs from that of 2005, mainly in the following factors:

- **More collision parameters will be considered than are currently available, and for the first time the effects of side impacts and brain shaking-impact will be studied.**

If the helmet has built-in technology such as Bluetooth and/or video cameras, the helmets must be tested with and without them. Only accessories tested and approved during the helmet homologation process will maintain the validity of the homologation.

- **Sizes should be indicated in centimeters and letters.**

In addition, a new marking system has been added to improve the traceability of approved products and prevent counterfeiting, as well as to facilitate police work in the control of the use of approved equipment.

For countries that are participants of Regulation 22, the following schedule is available:

JANUARY 2021

Official Publication of UNECE R22.06

JUNE 2022

For new approvals, UNECE R22.06 is mandatory.

JUNE 2023

Continued production under UNECE R22.05 is prohibited, new production is according to UNECE R22.06.

DECEMBER 2023

Prohibit the sale of safety helmets approved under UNECE R22.05.

NZI HELMETS CONTRIBUTION

DOT FMVSS 218

ILUSTRATION 11 - DOT LABEL

Source: Department of Transportation (DOT)

This standard is a regulation designed by the U.S. Department of Transportation, which establishes minimum requirements that helmets must meet to reduce injuries and deaths of motorcyclists because of head injuries.

This certification involves a different process than the United Nations standard because its approval is based on an "honor" system, in which the manufacturer directly certifies that its product complies with the requirements of the standard.

The authority may, within the United States, perform random tests to verify that such helmets follow the safety standard. In the case of safety helmets that are marketed outside the United States, it is recommended that the receiving countries implement a testing scheme for these helmets to ensure that they are functioning properly before they are marketed.

The helmet must bear the "Self-Certification" label, which is the manufacturer's certification of its product's compliance with applicable federal motor vehicle safety standards.

ILUSTRATION 12 - AREAS OF PROTECTION IN HELMETS APPROVED UNDER DOT FMVSS 218 REGULATIONS.

Source: Own elaboration based on data provided by NZI Helmets.

The tests that helmets certified under this standard must comply with are as follows:

Impact absorption tests:

The deceleration imparted to a head equipped with a helmet when it collides with a fixed steel anvil is measured.

Penetration Resistance:

When the helmet is subjected to the penetration test, the projectile must not perforate it.

Resistance of the Retention System:

Configuración:

Each helmet shall have a continuous contoured protective surface that conforms to the requirements of the standard. In addition, the helmet must provide a clearance for peripheral vision of at least 105 degrees.

Projections:

The helmet shall have no rigid projections inside the outer shell. Towards the outside of the outer shell, there should be no protrusions that are not specifically related to the operational requirements of the helmet. In any case, these projections must not protrude more than 5 nm.

As for the area of protection on which the DOT regulations focus, it is the same, regardless of whether the helmet is full-face or open face.

Children's Helmets

Globally, about

3%

of motorcycle riders killed were children.

Traveling with a child as a passenger is a controversial issue. On the one hand, it is known that in many cases, especially in low- and middle-income countries- a motorcycle is the only means of transportation available to a family, but it should be noted that:

1. **Children are at greater risk of suffering worse consequences from a concussion.**
2. **Due to being in a formative stage, a child's brain and skull are more vulnerable.**
3. **Relative to adults, a child's neck muscles are weaker and their spine, being in a formative stage, does not restrict movement as much as that of adults (because they have more cartilage and fewer bones).**

As a result of the three points mentioned above, the natural best practice is to avoid, by all possible means, children riding motorcycles.

It is of great importance that, in the case of driving with children on board, if the local law allows it, every consideration should be taken to ensure their safety.

The operation of the helmet, from the point of view of the physics of its performance, must be analogous to that of the helmet to be used by an adult. But it should be noted that children should use safety helmets that are specifically designed - and approved - to function on their heads, which are smaller than those of adults.

United Nations Regulation No. 22 allows the testing of helmets designed for children's use. The same applies to helmets designed for children between 4 and 12 years of age, approved under FMVSS 218.

(UN, 2016)

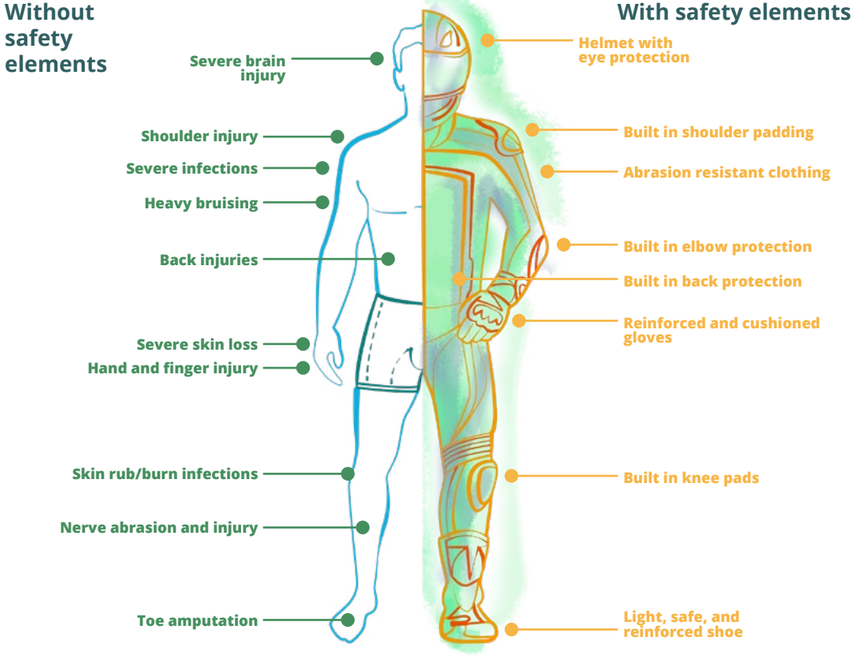
Protective gear for motorcyclists

In addition to head protection, which was discussed earlier, it is also important for motorcycle users to wear protective equipment to protect other areas of the body.

Protective equipment, in addition to the safety helmet, consists of clothing (boots, jackets, gloves and pants) designed to protect motorcyclists in the event of a crash.

The publication Roadmap for the improvement of road safety for motorcycle and moped riders (Fundación Mapfre, 2021) mentions that, when looking at the statistical data on the areas of the body affected by traffic crashes involving mo-

ILLUSTRATION 13 - PROTECTIVE ELEMENTS ACCORDING TO BODY AREA



Source: Own elaboration based on (ITF, 2015).

torcyclists and passengers, it can be seen that 24% of serious injuries occur at the level of the trunk, while 20% and 31% occur at the level of the upper and lower limbs, respectively.

More particularly, it can be observed that in motorcycle drivers, of the seriousness of the injuries at the thorax level, a percentage close to 50% are AIS3 (Abbreviated Injury Scale) or higher. In turn, about 10% of the injuries to the upper extremities are of "serious" severity (AIS3) and, finally, a percentage of more than 20% of the injuries to the upper extremities are of "serious" to "maximum" severity (AIS3 to AIS6) (ACEM, 2003).

When the same criteria are observed, this time for motorcycle passengers, it is noted that, although injuries to the upper extremities tend to be less serious, the behavior of injuries to the lower extremities remains basically stable with respect to the motorcycle driver. Finally, slightly less than 30% of the injuries to the thorax are of AIS3 severity or higher.

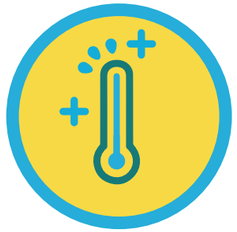
The use of protective clothing is an intervention whose effectiveness is promising (OMS, 2017). It allows the motorcyclist and his passenger to have less risk of injury due to friction against the ground and impact against other objects in a collision (ITF , 2015).

It should be remembered that these impacts, when they occur at the level of the thorax or back, can generate serious or fatal injuries. The protections of the safety equipment act in a way to reduce the deceleration of the body and dissipate the forces received. (ITF , 2015). It is considered that motorcyclists who use all safety equipment are between 20% and 60% less likely to be hospitalized due to a traffic crash (Rome, 2009).

In turn, the garments that make up the safety equipment also provide active protection to the motorcycle user (i.e., they do not only act after the crash occurs) (Rome, 2009):

Low temperatures
Exposure to low temperatures can cause the motorcyclist to become fatigued, decrease alertness and cause reaction times to increase. Proper safety equipment consists of insulating fabrics, with the objective of maintaining the body temperature at the appropriate threshold.

Humidity
When there is humidity and wind in the atmosphere, heat transfer is accelerated. This results in the user feeling cold when riding a motorcycle, even in temperate climates. Adequate safety equipment has the necessary vents to keep the body dry and prevent moisture accumulation, in addition to being waterproof.



High temperatures
Failure to use adequate equipment can cause burns, both from the sun and hot air. As mentioned, safety clothing has ventilations and insulating materials, which allow keeping the body temperature at adequate thresholds.

Importance of each of the garments that make up the safety equipment:

BOOTS

The effectiveness of this safety element lies in the resistance to tearing that its material possesses, its thermal conductivity and the level of protection that it provides to the ankle. (Instituto Mapfre, 2014).

This footwear must be able to protect the user against burns due to involuntary contact with high temperature parts, for example, the motorcycle exhaust and must also have the necessary reinforcements to protect the integrity of the foot against impacts. Finally, it must also be abrasion resistant, protecting the user from burns caused by friction against the ground in the event of a fall. It is estimated that the use of boots reduces by 33% the chances of suffering injuries in the area covered by them. (Elvick, et al., 2009)

In addition to the above mentioned, the boots must provide the user with sufficient comfort and mobility to ride the motorcycle without discomfort. At the same time, they do not have laces, to prevent them from getting tangled, the closure is usually by means of a zipper system.

GLOVES

When the motorcycle user falls to the ground, as every person does, he tends to put his hands in front of his body. When in motion and falling onto a hard surface, hand injuries usually occur, because of friction between the skin and the asphalt. (Instituto Mapfre, 2014).

In addition to the active protection mentioned above, gloves are intended to protect against injuries caused by abrasion. It is also recommended that they have special protections on the knuckles and wrists; protecting the joints of the body is always important. These protections, depending on how the motorcycle will be ridden, vary in their rigidity. (Rome, 2009). It is shown that the use of gloves reduces the chances of suffering hand injuries by 50%. (Elvick, et al., 2009).

JACKETS AND PANTS

ILLUSTRATION 14: RISK OF INJURY ACCORDING TO IMPACT ZONE.

Source: Own elaboration based on (Rome, 2019).

These garments must comply, like the abovementioned with the condition of protecting users against abrasion, in the event of a fall. In addition, it is of utmost importance that they have joint and back protection, thus seeking to mitigate the negative consequences of an impact. It is estimated that the use of jackets and gloves reduces 33% of the chances of suffering injuries in the areas that they cover. (Elvick, et al., 2009)

In this case, it is also important that these garments are, whenever possible, be light-colored and with retro-reflective bands, to increase nighttime visibility for the motorcyclist and the accompanying passenger.

The illustration shows the risk of injury according to the impact zone. The red areas are those with the highest risk while the white areas are those with the lowest risk. The rest of the zones are divided into a gray scale, the darker the gray, the higher the risk of injury.

As with safety helmets, it is important that the clothing be approved under a technical standard, to ensure correct performance in a crash situation. The European standards that regulate clothing are:

TABLE 7: TECHNICAL STANDARD FOR EACH SAFETY EQUIPMENT COMPONENT

Component	Technical Standard
Impact protection for extremities	EN 1621-1
Impact protection for the back	EN 1621-1
Pants and jackets	EN 17092 (sustituye a EN 13595)
Boots	EN 13634
Gloves	EN 13594

Clothing with air bags

Airbag jackets are a technology aimed at providing passive safety to the motorcycle user. Due to their effectiveness, their use is mandatory in some motorcycling competition disciplines.

By not having a structure to protect a person in the event of a crash, the motorcyclist, and the accompanying passenger, will continue to face the dangers of receiving bodily impact, but the use of this clothing, like air bags in cars, aims to reduce injury to certain areas of the body (mainly in the neck, chest and back) (ITF , 2015).

There are principally two mechanisms that allow for the correct operation of this clothing. The first is the one in which the jacket is attached to the motorcycle by means of a cable. When a crash occurs and the user's body is separated from the vehicle, the tension in the cable generates the detonation of a compressed gas capsule, which causes the clothing to inflate. The other is through a sensor, usually located on the front wheel of the vehicle, which measures its acceleration. When a shock (high deceleration) is detected, the sensor sends a signal to the jacket, which causes it to inflate. In both cases, if the fabrics are not torn, the jackets can be reused, and only needing to replace the compressed gas capsule.

The International Transport Forum (ITF) states that the main difference between the two mechanisms is that the wireless one allows the air bag to be activated in less time (about 45 milliseconds), while the other equipment has an activation time of about 90 milliseconds (ITF , 2015).

The use of this type of equipment generates the chances the user would suffer serious neck injuries would be low. Regarding injuries at chest level, the use of jackets with airbags decreases the chances of having injuries of AIS3 severity by 14%. In terms of mass use, companies in Colombia have achieved a 90% reduction in the number of days of disability due to motorcyclist crashes among users (Centro de Innovación para Motociclistas, 2019).

It should be noted that this product must also be approved by a technical standard (national or international). For example, the European Union has the EN 1621-4 standard in place for this type of equipment. Approval under the technical standard is the only way to verify that this device will function in the manner for which it was designed, effectively protecting the motorcycle user.

Reflective Apparel

Unlike daytime driving, at night, drivers have limited visibility. In addition, the human eye's capacity for contrast perception is reduced. As a result, road users in lower volume vehicles (motorcyclists and cyclists) and pedestrians must maximize their chances of being seen (Elvick, et al., 2009)

High visibility clothing is therefore a good option to diminish the problem of not being seen. There are many types of clothing on the market for this purpose. Among the options, retro-reflective materials are the best choice as they reflect all the light they receive, while other materials reflect only part of it (Elvick, et al., 2009)

In addition to the use of clothing with retro-reflective sections, it is important to note that the use of light colors tends to make it easier for the motorcyclist to be seen during the day (light colors reflect about 80% of the light they receive, while dark colors reflect about 5%).

The use of clear and retro-reflective clothing, generates in drivers of other vehicles an increase in the perception of risk, generating less risk that the motorcycle user is not properly warned (ITF , 2015). On the other hand, (EMMA, 2003) concluded that in 13% of the crashes studied, the use of dark clothing reduced visibility.

It is also necessary to note that several studies have observed that not only the color of the clothing is important, but its effectiveness varies according to the environment in which it is used, since the goal is to generate a contrast with the environment. For example, for city driving, the use of light colors provides positive results in terms of the ability to be seen. In open spaces such as roads and on clear days, the contrast can also be generated by dark colors (ITF , 2015).

Regarding the technical standard, as mentioned in the different elements that make up the motorcyclist's protective equipment, the European technical standard under which the visibility parameters are certified is EN 471 "High visibility signaling clothing", it is recommended that these parameters certify this technical standard or similar.

Vehicles

On August 31, 2020, the United Nations General Assembly approved Resolution 74/299. This document formally proclaims the period 2021-2030 as the Second Decade of Action for Road Safety, which aims to reduce deaths and injuries caused by road crashes by at least 50%.

To achieve this goal in a sustainable manner, the Resolution requests member governments to implement different policies. One of the aspects that countries should emphasize is the adoption of policies and measures to implement the United Nations vehicle safety regulations or equivalent national standards.

In the framework of the Third Global Ministerial Conference on Road Safety, a series of recommendations were provided to decision-makers. One of them, more precisely recommendation number 6 was: "To achieve higher and more equitable levels of road safety worldwide, we recommend that vehicle manufacturers, governments and fleet buyers ensure that all vehicles produced for each market are of the highest safety performance levels, that incentives are provided for the use of vehicles with better safety performance where possible, and that the highest levels of safety are required in vehicles used in private and public fleets".

The above, aims to ensure that vehicles comply with the minimum requirements to protect users, in terms of passive and active safety. When it comes to motorcycles, active safety systems are of particular importance, because it is not a vehicle where too many solutions in passive safety can be incorporated (DEKRA , 2010).

The following is a list of the United Nations regulations that deal exclusively with motorcycles/mopeds (Categories L_3 y L_1 respectively).

TABLE 8: UNITED NATIONS REGULATIONS ON MOTORCYCLES - 1958 AGREEMENT

Regulation	Subject	Category
UN - R40	Polluting gases emission	L_3
UN- R41	Sound emission	L_3
UN-R47	Polluting gases emission	L_1
UN-R50	Front and rear position lights, brake and direction indicators on mopeds and motorcycles	L_1,L_3
UN-R53	Lighting system Installation	L_3
UN-R56, UN-R76, UN-R82	Headlamps for mopeds	L_1
UN - R57, UN - R72	Motorcycle headlamps	L_3
UN - R60	Driver-operated controls, signals, and indicators.	L_1,L_3
UN - R62	Anti-theft devices	L_1,L_3
UN - R63	Sound emission	L_1
UN - R74	Lighting system Installation	L_1
UN - R75	Tires	L_1,L_3
UN - R78	Brakes	L_1,L_3
UN - R81	Rearview mirrors	L_1,L_3
UN - R87	Daytime running lights	L_1,L_3

Note: Although there are more regulations that cover L class vehicles, the most obvious ones are listed. The reader is advised to read all UNECE regulations whose scope includes "L" vehicles.

SOURCE: OWN ELABORATION BASED ON THE UNITED NATIONS LIST.

TABLE 9: UNITED NATIONS MOTORCYCLE REGULATIONS - 1998 AGREEMENT

Regulation	Subject	Category
UN- GTR 2	Measurement procedure for pollutant gases and consumption in motorcycles	L_3
UN- GTR 3	Brake system for motorcycles	L_1,L_3
UN- GTR 12	Identification, control, operation, and location of controls, tokens, and indicators	L_1,L_3
UN- GTR 17	Carter and evaporative emissions	L_1,L_3
UN- GTR 18	On-board diagnostic (OBD) systems	L_1,L_3

SOURCE: OWN ELABORATION BASED ON THE UNITED NATIONS LIST.

In the case of Federal Motor Vehicle Safety Standards (FMVSS) regulations, those that apply to motorcycle are:

TABLE 10: FMVSS MOTORCYCLE REGULATIONS

Regulation	Subject	Category
FMVSS 108	Lamps, reflective devices, and associated equipment	L_1,L_3
FMVSS 111	Rearview mirrors	L_1,L_3
FMVSS 119	Tires	L_1,L_3
FMVSS 120	Selection of tires and rims	L_1,L_3
FMVSS 122	Brakes	L_1,L_3
FMVSS 123	Controls and indicators	L_1,L_3

Note: While there are more regulations that cover Class L vehicles, the most obvious ones are listed. The reader is advised to read all FMVSS regulations that cover "L" vehicles.

SOURCE: OWN ELABORATION BASED ON DATA FROM THE NATIONAL HIGHWAY TRAFFIC ADMINISTRATION (NHTSA, 2021).

This section addresses the importance of some of the standards or their national and international equivalents by explaining what they state. Those referring to motorcyclists' safety equipment are described above.

Anti-lock Brakes (ABS) and Combined Brake System (CBS)

The loss of control of a vehicle, when executing a braking maneuver, is a causal factor in traffic crashes. When the wheel locks (while the vehicle is moving, the wheel remains static, sliding on the pavement instead of rolling), the vehicle's maneuverability is immediately lost, as well as its stability. When this happens on a motorcycle, the result is that the rider falls to the ground without the possibility of maneuvering to avoid it (Rune Elvick, 2009). In addition, the fear of locking the tires when braking causes motorcyclists to not properly utilize 100% of the vehicle's braking power (DEKRA , 2010).

Anti-lock braking technology (ABS) consists of a sensor that constantly monitors that the wheel is rotating. If when pressing the brake, the wheel locks, the sensor will immediately register it, operating on the braking device, to decrease the braking force and allow the wheel to continue rotating, allowing the locking situation not to occur. In addition to the contribution to the vehicle's maneuverability, the use of ABS brakes allows the motorcycle to require less distance to stop. (ITF, 2015).

There are several studies that evaluate the contribution, in terms of safety, of the use of ABS brakes on motorcycles. On the one hand, the study by the International Transport Forum (Improving safety for motorcycle, scooter, and moped riders, 2015) estimates that 25% of the crashes studied could have been avoided using ABS. On the other hand, the Swedish Traffic Authority study (Increased safety on motorcycle and mopeds, 2016) estimates that the potential of the intervention (motorcycles equipped with ABS) would reduce the number of fatalities by 40%.

On the other hand, there is also the combined braking system, better known as

CBS. To understand its functional principle, it is important for the reader to remember that, generally, the motorcycle has two brakes that are operated independently from each other. One of them, the front one, is operated with the right hand, while the rear one is operated with the right foot (this is for most motorcycles, although some have other command distributions) (ITF, 2015).

When executing the braking maneuver, the rider must manage the force on each of the brakes in such a way as to take advantage of the maximum braking capacity of the motorcycle, while at the same time not losing stability.

Motorcycles equipped with CBS technology have a system where braking is automatically distributed between the brakes of the two wheels, resulting in safer braking, because the probability of error by the rider in the braking technique is reduced, and over a shorter distance.

It is necessary to clarify that ABS and CBS technologies are complementary, and if both are present, the braking maneuver of a motorcycle becomes safer for its users. Having mentioned the advantages, it should also be noted that some studies have identified negative trends of ABS/CBS in terms of reckless driving due to having a vehicle with higher braking capacity (DEKRA , 2010).

Brake assist systems have a cost-benefit ratio of approximately 4.7. This means that for every 1 euro invested in these systems, the benefit created is 4.7 euros.

Daytime running lights

Motorcycles and mopeds are more difficult to see in traffic. This is due to their smaller dimensions, compared to the other users with which they share the road. In fact, a common cause of crashes involving these vehicles is the impossibility of being seen in time by the driver of the vehicle impacting them (Rune Elvick, 2009).

One of the ways to increase the ability to be seen in traffic is using daytime running lights, which is considered by the WHO as an intervention of promising effectiveness, for the improvement of road safety of motorcycle users (OMS, 2017). It is also an intervention recommended since 1968 by the Vienna Convention to its participant countries (ITF, 2015).

The use of daytime running lights reduces between 29% and 40% of crashes that are linked to visibility. In European countries that require daytime driving with lights on, the crash rate is 10% lower than in those European countries that do not. Considering the total number of crashes involving motorcycles and/or mopeds, the use of daytime running lights can reduce them by 7%. A reduction in fatal crashes involving motorcycles and mopeds during the daytime of 13% and 15% has also been achieved in the United States and Singapore, respectively (OMS, 2017), (Elvick, et al., 2009) , (ITF, 2015).

It is recommended that daytime light use by motorcycles be in accordance with United Nations Regulation number 87, FMVSS 108, or analogous. In turn, with the aim of always assisting motorcycle users in the use of lights, there is the "Automatic Headlamp On" (AHO) technology, which consists of a device that ensures that while the motorcycle is turned on its daytime running lights will also be on.(OMS, 2017), (ITF, 2015).

The use of AHO technology has been mandatory since January 2016 in the European Union through regulation EU 168/2013 for all vehicles. Other countries that require the use of this system are Canada, Russia, and New Zealand (Cámara de la Industria Automotríz, 2017).

Vehicle Technical Verification (VTV)

The use of motorcycles, as with any machine, generates different levels of wear and tear in its parts, which may cause traffic crashes, loss of control over the vehicle and failure of passive safety systems, if not identified in a timely manner etc.

It must be considered that not all breakage or other levels of wear can be observed by the human eye, and as technology continues to advance, fault detection is performed by specifically designed equipment (Rune Elvick, 2009).

The purpose of the Vehicle Technical Verification or VTV (also known as Vehicle Technical Inspection or ITV) is to check that the vehicle meets the technical conditions required by the legislation applicable to the country where it circulates. It is carried out with calibrated equipment capable of determining whether the vehicle is roadworthy or not. In addition to ensuring that the vehicles that circulate are in conditions to do so, the VTV has positive effects on reducing the environmental impact due to the use of vehicles (Rodríguez, et al., 2015).

Among the legal instruments on road safety of the United Nations, we can find those that cover the technical inspection of vehicles. In this regard, there is the 1997 Agreement on the Vehicle Technical Inspection Regime. The ratification of this agreement by Latin American countries is discussed in section three of this report.

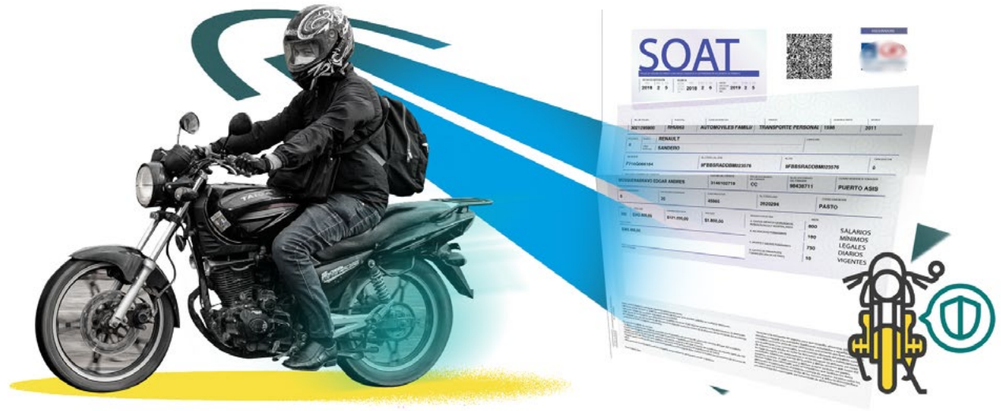
Although it is well known that proper vehicle maintenance contributes to the safety of its users, there is no broad consensus on how to measure said contribution. A consensus has not been reached due to the different measurement techniques used, as well as determining whether a technical failure was the trigger for the crash or a series of other factors.

Some studies establish that the proportion of crashes due to technical failures ranges from 1.5% to 24.4% (Rune Elvick, 2009). In motorcycles and mopeds, another study establishes that in 5.1% of the crashes the motorcycles had technical failures that contributed to the crash. Most of the faults identified in this publication were in the tires of the vehicles, as well as in their braking systems (EMMA, 2003).

On the other hand, another study (DEKRA , 2010) establishes that in 23.6% of the motorcycles inspected, 33.9% of the crashes were due to defects. This means that in 8% of the cases the defects caused incidents.

The study "Reducing the death toll of road crashes in Costa Rica through the introduction of roadworthiness inspections by the government" (Schulz & Sebastian, 2019) relates the obligatory implementation of a roadworthiness inspection system to a 40% decrease in the number of crashes one year after its implementation, in 2002. At the same time, the study estimates the number of traffic fatalities prevented by the roadworthiness inspections. Between 2003 and 2015, it is estimated that the system has saved 1,520 lives on Costa Rica's roads.

Although it is clearly difficult to establish an exact figure, VTV programs contribute to the safety of motorcyclists and vehicle drivers in general. In addition to ensuring that vehicles have no technical defects, they ensure that they have not been modified inappropriately. For example, one of the studies mentioned above established that 17.8% of the mopeds tested had been manipulated to exceed the appropriate horsepower or other factors (EMMA, 2003).



Mandatory Insurance

Owning a motorcycle and a vehicle in general allows satisfying needs and expectations, both for pleasure and necessity. However, owners and users must understand the real risk dimension to which they are exposed on account of their use.

There are risks associated with a motorcycle that may be like those to which owners of other types of vehicles are exposed. For example, the economic effort involved in acquiring one or other vehicle and the damage that could be caused if it were stolen or damaged in a collision. If this were the case, the owners of both types of vehicles would see a decrease in their income, either due to the loss of the object as such or by the costs incurred for its repair.

Another risk refers to the liability arising from damages caused to third parties. Drivers of vehicles in general, including motorcycles, should be aware that the damage is the starting point of civil liability and being a source of obligations should result in the full reinstatement of the victim, in such a way as to return the person to the situation or as close as possible to how he or she was in before the crash. This means that he who causes physical or material damage to another must pay compensation required to cover the victim's losses. Driving is a dangerous activity, and, in that context, drivers are liable for the actions or omissions incurred during the exercise of this activity.

However, from a road safety perspective, the risks associated with a motorcy-

cle are several times greater than those of users of other types of vehicles, given the difference in the level of protection available to each.

It should be remembered that Newton's law is a fundamental pillar for understanding the biomechanics associated with a collision. Among others, kinetic energy plays a determining role in the severity of the injuries suffered by a human being. The body of a vehicle has the capacity to disperse the energy received because of a collision, minimizing the impact it can have on the occupants of the passengers inside. In the case of motorcycles, there is a low and inadequate use of protective elements that do the job of dispersion, and therefore the human body receives the transfer of energy from the impact. Hence the importance of the use of integral protection equipment for motorcycle occupants, which includes certified helmets, protective elements covering the upper torso, upper and lower joint protectors, back protectors, footwear, and gloves.

In the absence or inadequate use of protective equipment, a collision with another vehicle or fall will result in physical injuries such as contusions, abrasions, and fractures, when colliding with a fixed object which results in injuries to the thoracic spine as the driver is ejected and impacts with a rigid surface. In both cases, there is probability of death.

This makes a strong difference between motorcycles and other vehicles: in the event of a simple collision, the former will have at least some physical injury, which will be aggravated the lower the motorcyclist's protection or the stronger the impact.

The insurance contract is a risk transfer instrument, by means of which individuals and legal entities transfer the risk to an insurance company so that in the event of the occurrence of any insured risk situation, the latter will be the one to pay the corresponding indemnity. By doing so, whoever has contracted the insurance will be protecting his assets or guaranteeing the necessary instruments to access the required health services.

Regarding the situation of theft or material damage, the insurance market offers products specially designed for motorcyclists to provide protection in case of partial or total damage, while including civil liability coverage. This means that in those cases in which the motorcyclist is found guilty of the crash and must compensate the victim, it will be the insurer who will pay the corresponding amount. Some insurance companies offer all-risk products, i.e., policies that, in addition to the coverages, cover the owner of the vehicle in case of theft or natural disasters. In this way, the owner has the protection of his patrimony, especially in relation to civil liability, which is a much higher amount than the cost of the vehicle itself.

In addition to the property coverage explained above, the insurance market offers coverage focused on protecting people against events affecting their existence, health, or vigor. Insurance companies offer health, vehicle, or life insurance policies.

Even though the insurance companies' portfolio is broad, the level of insurance purchases per vehicle does not correlate to the level of risks to which one is exposed. This also applies to motorcycles. Given the implications of traffic crashes on people's health and their impact on public health, countries around the world have adopted mandatory vehicle insurance policies. Some of them limit their coverage to personal injury or death, while others provide additional coverage for property damage. However, some Latin American countries have not yet made such insurance mandatory (Table 10).

TABLE 11: MANDATORY VEHICLE INSURANCE IN LATIN AMERICA AND THE CARIBBEAN

Country	Has mandatory insurance	Offers coverage for motorcyclists	Includes medical expenses	Includes property damage
Argentina	Yes	Yes	Yes	-
Bolivia	Yes	Yes	Yes	-
Brasil	Yes	Yes	Yes	-
Chile	Yes	Yes	Yes	-
Colombia	Yes	Yes	Yes	-
Costa Rica	Yes	Yes	Yes	-
Ecuador*	-	Yes	Yes	-
El Salvador	-	-	-	-
Guatemala	-	-	-	-
Guyana	Yes	Yes	Yes	Yes
Honduras	-	-	-	-
Jamaica	Yes	Yes	Yes	Yes
Mexico**	-	-	-	-
Nicaragua	Yes	Yes	Yes	Yes
Panama	Yes	Yes	Yes	Yes
Paraguay	Yes	Yes	Yes	-
Peru	Yes	Yes	Yes	-
Dominican Republic	Yes	Yes	Yes	Yes
Surinam	Yes	Yes	Yes	Yes
Uruguay	Yes	Yes	Yes	-
Venezuela	Yes	Yes	Yes	Yes

Source: Diagnosis "Movernos Seguros" Road safety through vehicle insurance in Latin America and the Caribbean. (IDB, 2019b)
***Ecuador** dismantled the SOAT as an insurance contract and implemented the SPPAT as a government service for which citizens pay a fee.
****Mexico** adopted mandatory insurance in 2014 to cover crashes occurring on federal roads, highways, and bridges.

Reference has been made as to how insurance companies have contributed to road safety as an instrument of consideration and protection for victims in their role of being covered, but an insurance contract has the capacity to have an impact on the five pillars of road safety. Therefore, insurers have been incorporating more and more preventive elements that meet the needs of motorcyclists for their overall safety and road safety. It is not uncommon to now see insurance contracts that contain protection coverage such as travel review, in which the active and passive systems of the motorcycle are reviewed before a trip, a review for purchase and sale processes such as experts that determine the condition of a motorcycle before a transfer of ownership, detection of mechanical failures so that the owner can tune up his motorcycle and preventive maintenance services, to mention a few.

Motorcyclists in general should be considered an at-risk road user insofar as they are vulnerable in the event of a traffic crash, either by collision or fall.

However, such political-social-sanitary sensitivity should not be a license for motorcyclists to perform dangerous maneuvers, ride in prohibited areas or circulate with total disregard for traffic regulations, even when the physical structure of motorcycles makes them more versatile than other vehicles.

From the above we can see that the insurance contract seeks to provide property or personal protection for the owners and users of motorcycles, both in terms of prevention and compensation. In the case of countries where insurance is mandatory, compliance with this measure seeks to improve road safety and guarantee the necessary resources to ensure immediate and comprehensive access to health care for all those affected. But beyond the obligation, users should know that there are complementary solutions that adapt to the needs of each person.

To use motorcycles safely and comfortably, it is necessary to adopt safe behavior on public roads, complemented by an insurance protection program tailored to the needs of each user. This protects assets and lessens the risks associated with road safety.

Although mandatory insurance generates an additional cost for vehicle owners, including motorcyclists, its existence guarantees the necessary resources for the timely care of victims of traffic crashes.

The results of the Comparative Report of Results by Segment, conducted by the National Consulting Center in Colombia in 2015, to know the perception of the Mandatory Vehicle Insurance 8SOAT) in that country, show the level of agreement on various issues related to it.

TABLE 12: LEVEL OF AGREEMENT OF THE SURVEYED SEGMENTS ON SOAT CHARACTERISTICS

Country	Public opinion	Drivers	Victims	Health centers
Positive image of insurance	73%	80%	91%	86%
Agrees due to obligation	94%	92%	96%	95%
The creation of SOAT has been positive for the country	89%	87%	93%	93%
SOAT is support in case of traffic accident	96%	93%	96%	98%

SOURCE: (CENTRO NACIONAL DE CONSULTORÍA EN COLOMBIA, 2015)

Although, at first, it is not easy nor pleasant to accept the existence of mandatory insurance, as victims and hospitals have demonstrated its benefits, the general population understands and agrees to its importance.

Infrastructure

The Stockholm Declaration, in the framework of the Third Ministerial Conference on Road Safety (2020), recognizes the need to promote an integrated approach to road safety, such as Safe System and Vision Zero.

The motorcycle is a means of transport whose balance is more unstable than that of other vehicles with which it shares the road. The ability of motorcyclists to maintain this balance is a function of more than one factor, one of them being the condition of the infrastructure where they ride (other factors are the speed, the condition of the tires and driving skills). It should therefore be considered that a defect in the road may have no consequences for the driver of a car, and at the same time cause major problems for the motorcyclist.

This section addresses issues related to the design of infrastructure interventions related to the safety of motorcycle and moped users.

Road Surface

When the surface condition is not adequate, the trajectory of the motorcycle can be affected, both by the problems encountered and by the maneuvers aimed at avoiding them. These maneuvers are usually unforeseen, taking other road users by surprise and, therefore, increasing the probability of crashes occurring (Wittink, 2001).

The recommendations, in terms of the level of surface maintenance, based on the International Good Practice Guide for Motorcyclists: Road Safety Measures. (Ferrer & Rubino, 2017) y (EMMA, 2006) are:

- **Promptness to repair potholes and clean up spills.**

The existence of potholes on a road affects the stability and trajectory of all vehicles on the road. On board a two-wheeled vehicle, stability can be even more affected, which represents a risk of the user suffering a fall, with negative consequences in the event of possible impacts or being run over by other vehicles.

Quick action must also be taken to clean the roadway in the event of possible spills due to lubricant and other fluid leaks, which can cause the roadway operators to lose grip of the road and stability.

Pavement roughness specification.

The grip of a vehicle to the ground is determined by the amount of friction between the tire and the ground. Thermoplastic and metallic materials tend to generate lower levels of contact, even more so in wet conditions, some types of paints can also decrease the level of contact.

It is also necessary to consider the roughness generated by sealants used for pavement crack repairs.

In situations where grip is not sufficient, the motorcycle will lose the ability to pull against the pavement, which may cause it to slide, resulting in a loss of stability and possible falls. Although this situation should always be prevented, special attention should be paid to areas where motorcyclists must make changes in direction, such as curves and corners.

Reduction of irregular surfaces and safety edges.

Joints between paved lanes, parallel to the direction of movement, can be especially dangerous for motorcyclists.

It is also recommended to avoid, whenever possible, the use of gratings and metal plates. If they must be used, it is suggested that they should not be used in acceleration, braking or direction change areas, that there should be no gaps between them and the pavement, and that they should be at the same height (if not, they should have beveled edges that generate a “ramp” effect).

ILLUSTRATION 15: DANGEROUS JOINTS IN ROADWAY

Source: (Ferrer & Rubino, 2017)

Regarding safe edges, it is recommended that, at each edge of the roadway, along the entire length of the roadway, there should be an asphalt wedge of 30 to 35 degrees.

ILLUSTRATION 16: BEVELING OF THE SAFETY EDGE AT AN ANGLE

Source: (Ferrer & Rubino, 2017)

As mentioned above, the different types of horizontal markings can affect a vehicle’s grip, and the loss of grip can cause motorcyclists to fall, especially in traffic circles and curves. Therefore (EMMA, 2006) recommends the use of different thicknesses depending on the type of demarcation to be used, to better protect motorcycle and moped riders. This information can be seen in Table 12.

TABLE 13: RECOMMENDED THICKNESS ACCORDING TO TYPE OF HORIZONTAL DEMARCATION

Source: Own elaboration based on (EMMA, 2006)

Layer Type	Recommended thickness
Paint	0.35 millimeters
Thermoplastic materials	3.0 or 1.5 millimeters
Prefabricated demarcation	0.5 to 3.0 millimeters
Cat’s eye” reflectors	20 millimeters

In the case of crosswalks and colored pavement areas, the recommendation is the use of anti-slip paint, as well as periodic grating of the painted strips.

It is recommended that all those interventions of horizontal demarcation, be carried out with materials conforming to EN 1436 or similar, to obtain adequate levels of slip resistance. At the same time, a period should be established after which the marking is tested again, to ensure the correct maintenance of its roughness (ERF & FEMA, 2018).

Side barriers (Guardrails)

The design of side barriers should contemplate motorcycle and moped users. The "classic" design of barriers represents a high risk for them. The risk of death of a motorcyclist upon impact against a side barrier is 80 times higher than, for the occupants of a car, even when properly using a safety helmet (Ferrer & Rubino, 2017).

The space left uncovered between the crash barrier and the ground represents a danger for the motorcycle user, because it will impact be impacted by the user's body against the barrier. There is then a risk of going under the crash barrier or even worse, impacting one of the vertical posts that support it, which can result in extremely serious injuries or death (DEKRA , 2010), (ERF & FEMA, 2018).

In addition, these barriers often have sharp edges and are sized to adequately cushion the impact of high-mass vehicles, resulting inefficient in slowing the deceleration of a body upon impact (Ferrer & Rubino, 2017).

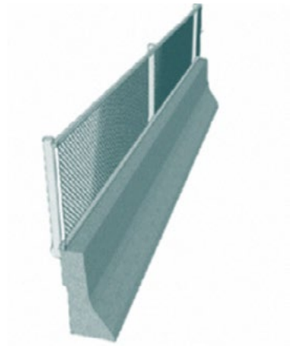
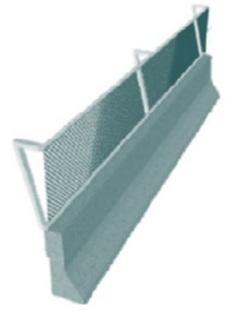
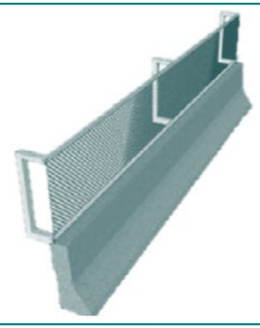
The use of containment barriers is recommended, which contemplate these dangers suffered by users of two-wheeled motor vehicles, which cover the space mentioned above, in addition to better cushioning the impact, protecting users against the danger situations addressed. In some cases, existing barriers can be modified and adapted with these protection systems (DEKRA , 2010), (Fundación Mapfre, 2021), (ERF & FEMA, 2018).

ILLUSTRATION 17: SIDE BARRIER WITH PROTECTION AGAINST MOTORCYCLIST IMPACTS

Source: (ERF & FEMA, 2018)

There is a possibility of modifying concrete barriers with mesh to help prevent vehicle users and a passenger onboard, from being thrown over the barriers (Silvestre Dobrovolny, et al., 2019) The following options can be observed to achieve this objective.

TABLE 14: DIFFERENT CONTAINMENT DESIGNS OF TO BE INSTALLED INSTEAD OF ONLY CONCRETE BARRIERS.

Name	Configuration	Comments
Vertical post design, with the fenders directly attached to the post.		
Option A: Weak post		**Components are available.** **Simplicity of construction.** **Feasibility of the motorcyclist impacting directly against the pole.** **The pole acts as an energy absorption system.**
Post design where the post protrudes to the rear of the system (the fenders are attached to a horizontal guide).		
Option B: "7" shaped post		**Limits the likelihood of the motorcyclist hitting the pole.** **Welding process required**
Option C: "U" shaped post		**Limits the likelihood of the motorcyclist hitting the pole.** **Welding process required**

Source: (Silvestre Dobrovolny, et al., 2019)

“Road Planning: “It is time to include motorcyclists”

In charge of the Motorcyclist Safety Area, the National Road Safety Agency of the Argentine Republic has published the Road Planning and Motorcyclists manual (ANSV, 2021b), whose objective is the inclusion of motorcycle and moped users in infrastructure work plans, thus adding them to the “design vehicles” in such plans.

This manual has recommendations for different types of interventions, aiming - with a vision based on the Safe Systems paradigm - to address the problems suffered by motorcyclists.

These recommendations address the following types of interventions:

Exclusive or preferential spaces for motorcyclists.

Protective barriers.

Speed Reducers.

Obstacles on the sides of the road lanes.

Intersections, especially traffic circles.

Curve design.

In a country where motorcycles represent at least one third of the vehicle population, the publication of this manual represents a step towards their inclusion in the development of roads, in the understanding that, although infrastructure is not the main reason for the occurrence of motorcycle crashes, some modifications may contribute to reduce the crash rate.

https://www.argentina.gob.ar/sites/default/files/planificacion_vial_y_motociclistas-3.pdf

Speed management

The Stockholm Declaration of the Third Global Ministerial Conference on Road Safety highlights that a focus on speed management is fundamental to reducing carbon emissions, improving air quality, and creating safer, more sustainable cities where pedestrians and cyclists have the space they need to travel safely.

It also establishes the need to maintain the focus on speed management, including strengthening enforcement to prevent speeding, and requiring a 30 km/h maximum in areas where vulnerable road users and vehicles mix on a frequent and planned basis, except where there is strong evidence that higher speeds are safe.

The maximum speed limit recommended for urban areas by the World Health Organization is 50 km/hour, except in places with high volumes of pedestrians and cyclists, where there are frequent conflicts between motor vehicles and vulnerable users; in this case, the recommended speed limit is 30 km/h, as mentioned above. If limits higher than 50 km/h are considered, there should be infrastructure conditions that fully segregate the different road users, with no intersections and with adjacent areas free of fixed objects over three meters: hence, no interactions between vulnerable road users and motor vehicle drivers (Seguí Gómez, et al., 2020).

Tools for prioritization of public policy and interventions in the city of Bogota - Road Risk Perception Survey (RPRS)

The different areas of the District Secretariat of Mobility of Bogotá, Colombia have worked together to collect data that will allow, on the one hand, to inform decision-making aimed at the prevention and mitigation of the elements, circumstances and behaviors that lead to most road crashes and, on the other hand, to facilitate the evaluation of results and the monitoring of the strategies and actions implemented in the city.

Among the main sources of information is the Road Risk Perception Survey (EPRV), which had its first version in 2018 and was applied again in 2019. The 2018 survey sought to prioritize the social groups with the highest risk of being injured or killed in a road crash, and which should be key subjects of intervention in terms of prevention and control of road safety. To this end, information was collected, among other aspects, on beliefs, attitudes and practices regarding risk behaviors and protective behaviors on the road, on topics such as: speed, alcohol consumption, fatigue while driving and traffic rules.

Four findings in terms of road safety stand out from the EPRV 2018: 1) There is a high prevalence of risky behaviors, and at the same time a low perception of road risk by pedestrians. 2) In terms of speed, surveyed drivers perceive that driving faster than the allowed speed increases the probability of causing a road crash, however, more than half feel that speeding is exciting, reduces travel time, and is acceptable if the driver has experience driving. 3). Between 30% and 40% of drivers of cargo vehicles, bicycles and motorcycles consider that, if driving with caution or if the distance of the trip is short, it is not necessary to use personal protection elements such as helmets or seat belts and 4) more than a third of those surveyed believe that it is not mandatory to comply with traffic regulations.

Based on the lessons learned from this survey, the second version was developed in 2019, which aimed to measure the beliefs, knowledge, perceptions, and behaviors that influence the behavior of road users in their mobilization throughout the city. In addition, variables not addressed in the EPRV 2018 such as trust towards others and anger were included. In general, the results of the survey were intended to inform district actions towards the transformation of habits adopted by the different road users, which put their lives and the lives of others at risk in mobility.

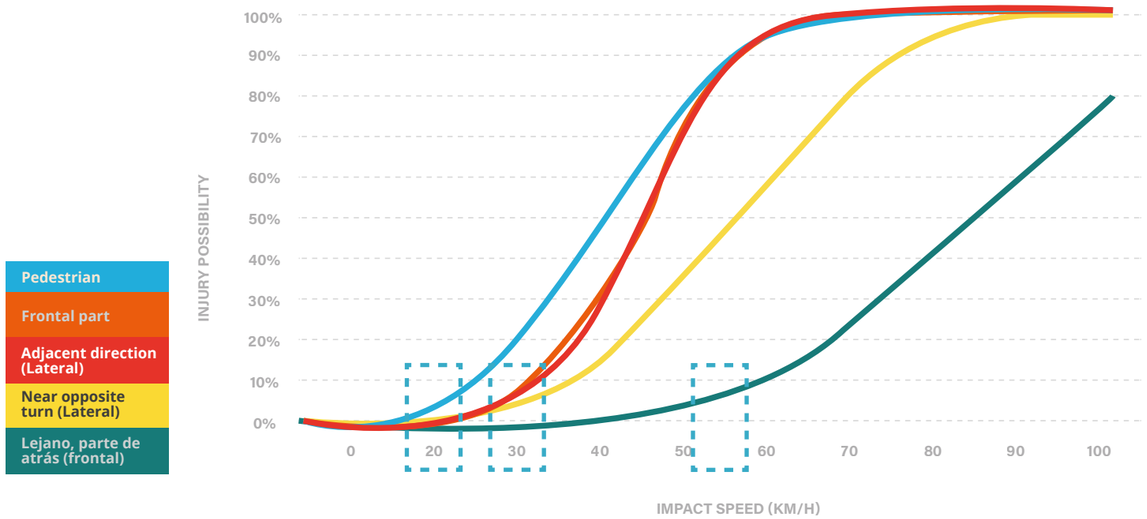
The EPRV 2019 showed beliefs and behaviors like those reported in the 2018 survey. It was found that speed continues to be valued by road users as an acceptable and even desirable behavior, despite being considered the first cause of road crashes. Particularly for motorcycle drivers, speed produces positive emotions and a feeling of freedom. In addition, 82% of those surveyed perceive that young people are the ones who exceed speed limits the most. Among other findings similar to those provided by the 2018 survey, some respondents reported not wearing a helmet or seat belt when making short trips.

These results indicate, for example, that driving faster than the permitted speed should be a priority in the plans, policies and actions related to the prevention of road crashes in Bogotá, which, in addition, prioritize the motorcyclist as the most vulnerable road user and most susceptible to engage in high-risk driving behaviors.

Source: Secretaría Distrital de Movilidad de la Alcaldía de Bogotá, Colombia.

The reduction of speeds in urban areas to 30 km/h would not only benefit motorcyclists but the entire group of vulnerable users (cyclists and pedestrians, as well as motorcyclists), it has broad additional benefits such as noise reduction and an increase in active mobility. The main reason for recommending the maximum speed limit is the likelihood of survival and behavior at the increased speeds at which humans are involved in crashes (Seguí Gómez, et al., 2020)

GRAPH 12 - PROBABILITY OF SEVERE INJURY VERSUS IMPACT VELOCITY ACCORDING TO TYPE OF USER



Source: Own elaboration based on (Seguí Gómez, et al., 2020)

It is necessary to consider that speed reduction should be done in a coherent manner, through the application of the Safe System principles, which include infrastructure designs such as lane reductions, series curves, traffic-light grade crossings and other features that do not allow driving at high speeds.

As mentioned at the beginning of Chapter 2, the implementations mentioned above are intended as an action guide aimed at improving motorcyclists' safety. For them to be effective, countries need to carry out an implementation process that includes an impact analysis of the measures they have taken, work groups with all the stakeholders involved and a process of effective communication with society about the new actions. In turn, several countries and cities have made progress working on this matter, so it is advisable to review previous experiences when exploring the possibility of generating new processes. The table below summarizes the recommendations needed at all levels of government.

TABLE 15: POLICY RECOMMENDATIONS AT ALL LEVELS OF GOVERNMENT

	Planning and data management	Licenses and training	Vehicles	Helmets	Other protection elements	Infrastructure and speed management
National/ federal level	Development of national strategic plans for motorcycles, using participatory methodology.	Implementation of licensing criteria for motorcyclists. A gradual licensing system is suggested. Implementation of a training-of-trainers program for safe motorcycle use.	Implementation of technical regulations to improve motorcycle safety. Implementation of a technical vehicle inspection system. Implementation of a mandatory vehicle insurance policy. Continuous monitoring of statistics on the rate of adherence to vehicle insurance for motorcycles. National campaigns for insurance adherence and vehicle inspections.	Implementation of a complete regulatory framework for helmets, making their use mandatory on all roads and following the best international technical standards. Constant process of improvement of technical standards according to new studies on the safety of this device. Implementation of an approval and testing system for helmets sold in the country. Incentives to produce helmets that follow the best standards in the country and for their sale and consumption. Coordination with subnational entities for campaigns to promote the use of helmets.	Study of the implementation of regulations for the mandatory use of other protective devices, such as clothing, airbags, and reflective clothing. Definition of minimum standards and homologation system for these products, independent of the obligation of use. Incentives to produce these elements that follow the best standards in the country and for their sale and consumption.	System of road safety audits and inspections on national roads, which also looks at the safety of the infrastructure for motorcyclists. Adaptation and rehabilitation of road infrastructure to improve motorcyclists' safety.
Subnational level	Ongoing collection of information on the use of motorcycles and safety elements through surveys and observations. Development of local motorcycle plans, with the participation of all entities. The development or updating of urban mobility policies should consider the effects on motorcycle mobility.	Implementation and/or improvement in the training and education of motorcyclists for the granting of licenses.	Local campaigns for insurance adherence and vehicle inspections.	Improving helmet enforcement mechanisms through police training and investment in personnel. Implementation of helmet campaigns in coordination with civil society groups.	Implementation of campaigns for the use of these protection elements in coordination with civil society.	System of road safety audits and inspections on provincial and municipal roads, which also looks at infrastructure safety for motorcyclists. Adaptation and rehabilitation of road infrastructure to improve motorcyclists' safety. Implementation of a speed management policy at critical points in the city, where there are high crash rates involving motorcycles.

Recommendations

The development of national and local strategic plans to address the road safety of motorcycle users, both in the city and on the road, is necessary to combine efforts and encompass the implementation to be carried out. These implementations are unlikely to be successful if they are carried out without adequate organization and impact assessment. Furthermore, this planning must be the result of joint participation of all the users involved, for example, civil society groups and public administrators. It is up to the public administration to make decisions by including and listening to all stakeholders.

Strategic plans should be established based on the Safe Systems paradigm, i.e., they should anticipate the fact that road users are susceptible to errors but should not be killed by them. The system should anticipate such errors and try to avoid them, and if they happen, diminish the consequences as much as possible.

In a more general framework, Urban Mobility policies should analyze and consider the motorcycle user separately from the 4-wheeled private vehicle user, study the impact that motorcycle use has on mobility, and include socioeconomic characteristics for which it is an attractive and increasingly used mode. For example, Transport Demand Management (TDM) policies that are focused on reducing travel in private vehicles (push) and promoting active modes and public transport (pull), should estimate and analyze the effects that would be generated in terms of changes in motorcycle use, either because they seek to discourage motorcycle use, not increase its use or provide attractive options so that users of other modes do not opt for the motorcycle as a preferred mode.

Therefore, the continous improvement and implementation of a safer and more affordable public transport system is necessary, to prevent people from switching to riskier means of transport -such as motorcycles and mopeds. This is embodied in target 11.2 of the United Nations Sustainable Development Goals: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all and improve road safety, including through the expansion of public transport, with special attention to the needs of people in vulnerable situations, such as women, children, persons with disabilities and older persons".

Regarding the use of safety helmets and protective equipment, it is important to establish an ambitious goal for their correct use. All users should wear them when using their vehicles, and the enforcement of a law requiring them is a way of tending towards this goal. In addition to the usage, it is important to establish an adequate regulatory, approval and testing system to ensure that only safe helmets, approved under technical standards, reach motorcycle and moped users.

Awareness and information campaigns on how safety helmets work, both at the national and local levels, could be tools to be explored in order to contribute to the increase in the helmet use rate considering that, regionally, helmets are often deemed as an element that must be used to avoid penalties by traffic officers. This paradigm must be changed, making users understand the real purpose and intent of this safety equipment, a mechanism that saves lives in case of crashes.

Regarding vehicle quality, it is also advisable to work on vehicle homologation and, specifically for motorcycles, legislation on anti-lock braking systems (ABS) for new vehicles and on automatic headlight ignition (AHO) technology is highly recommended.

Although, due to the nature of the motorcycle as a vehicle that does not offer structural protection to its users, there is no program like NCAP (New Car Assessment Program), the installation of the active safety elements, whose contribution to safety is proven and considered indispensable. A tax exemption for fleet purchasers should be considered to accelerate the fleet renewal rate and would be very useful in having new vehicles on the road.

Fleet maintenance is necessary to analyze causes for absenteeism of the Vehicle Technical Verification (VTV) and to establish an ambitious goal regarding the rate of verified vehicles. Although many countries in the region make VTV mandatory, compliance regarding this requirement is usually not verified. Allowing the circulation of vehicles in poor mechanical conditions not only increases the probability of crashes, but also due to poor performance, increases the polluting gases emission (Carbon Monoxides and Nitrous Oxides).

It is also necessary that the Mandatory Vehicle Insurance (MVS) policy be implemented at a national level in all the different countries within the region. Motorcycles should be specially considered within these programs. As mentioned in this publication, motorcycles are 26 times more likely to be killed in a traffic crash than car passengers. Considering that motorcycles are more likely to be involved in crashes, it is important that involved third parties be duly covered in addition to property damage.

Especially important in the region, where, as noted in the text, the presence of motorcyclists in the crash rate is well above the world average. For this reason, the adherence of motorcyclists to vehicle insurance programs should also be continuously monitored since it is common practice to purchase insurance at the time of acquiring a motorcycle but is then it is not renewed by the user.

It is advisable to apply gradual licensing systems that consider both the age of the driver and the power of the vehicle regarding issuing licenses to drivers. This system must rely on instructors and examiners who with proper technical training can assertively convey knowledge accurately, by using the highest standards. It is also important to create training plans for trainers, to ensure that the knowledge transmitted to the applicants is not only correct, but that it is updated with the best practices related to the subject matter.

The implementation of national (and local) campaigns, both in the case of Vehicle Technical Verification and in the case of Mandatory Vehicle Insurance is of great importance in seeking to obtain results within these areas.

Theoretical and practical training should be promoted to provide the motorcycle license applicant with experience prior to driving on the roads and, therefore, with more tools to react positively to the difficulties posed by them. While practical training should focus especially on defensive driving and attention to dangerous situations in traffic, theoretical training should include rules and laws of the place where the user will be authorized to ride and include road safety, personal and passenger protection.

According to the Safe System principle, the road environment should be designed in such a way that human error does not result in serious injury or death. Therefore, both infrastructure and the speed of roads are among the factors that must be considered to achieve safe environments.

Both the Stockholm Declaration and the recommendations of the expert panel at the Third Global Ministerial Conference on Road Safety address the need for a maximum speed of 30 kilometers per hour in areas where vulnerable road users interact with

vehicles on a frequent and planned basis, which is usually the case in urban areas. Unless there is strong evidence that higher speeds are safe, setting the above maximum speed is the best option.

There must be, then, consistency with the established speed limits and the infrastructure. To this end, implementations such as lane reductions, series curves, traffic-light grade crossings and other features that reduce the possibility that, intentionally or unintentionally, drivers do not exceed the maximum speed limit are included in the Safe System.

Regarding infrastructure, it is important that manuals begin to involve motorcyclists as users, not as vehicles that adapt to an existing environment. The system of road safety audits and inspections takes on special importance and prominence in this regard.

Among the experiences reviewed, stop zones as a strategy to physically separate motorcyclists from other traffic at intersections should be considered as a safe detection zone; it is not an intervention that has been proven to be effective. If it is to be considered for implementation, consideration should be given to the side effects that may arise, and how to lessen them. Possible adverse effects include: 1) Increased zigzagging maneuvers between vehicles by motorcyclists to reach a stopping zone, failing to comply with the good practice of occupying the same place as a car in the lane. 2) Inability of the safe stopping zone to accommodate all motorcyclists, generating queues between vehicles in areas of high motorcycle density. Inconvenience in road coexistence with pedestrians, due to the high acceleration of motorcycles and the proximity of the safe stopping zone to the crosswalk.

Practical tests for the issuance of motorcycle licenses must ensure that applicants have the basic notions of driving. That is why they must have an adequate degree of difficulty. Latin American countries have the Ibero-American Charter on Driving Licenses, whose use is highly recommended because it contains the requirements and procedures for the practical evaluation, in addition to being an agreement whose signature represents a commitment on the part of the nations.

It is necessary to mention in the understanding that mobility is a web composed of many users with different characteristics and that to achieve a reduction in the mortality of motorcycle users, in addition to the adoption of actions and regulations specifically mentioned for this group, it is advisable that transportation policies, in general, consider the potential effects they may have on motorcyclists and their passengers.

It is also recommended that the interventions and actions towards motorcyclist safety be accompanied by a measurement system, through monitoring and evaluation indicators, to know the impact of these actions and be able to make the necessary adjustments, thus following a process of continuous improvement in the adoption of measures.

Bibliography

ACEM, 2003. MAIDS -In -**Depth investigation of motorcycle accidents**. s.l.:s.n.

ACEM, 2006. **Guidelines for PTW-SAFER Road Resign in Europe**, Brussels: s.n.

AIP, 2017. **Head First, a case study of Vietnam´s motorcycle helmet campaign.** s.l.:s.n.

Alcaldía Mayor de Bogotá, 2019. **Encuesta de percepción de riesgo vial en la ciudad de Bogotá**, 2019, Bogotá: s.n.

ANSV, s.f. ANSV. [En línea]

Available at: https://ansv.gov.co/es/observatorio/estad%C3%ADsticas/historico-victimas

Banco Interamericano de Desarrollo, 2020. **Moviliblog**. [En línea]

Available at: https://blogs.iadb.org/transporte/es/covid-19-repensando-la-movilidad/

Banco Interamericano de Desarrollo, B., 2019. **Hechos estilizados de transporte urbano en America Latina y el Caribe**. s.l.:s.n.

BID, 2020. **Transportation Sector Framework Document**, Washington DC: s.n.

Buscher, G., 2015. **Women motorcycle passengers: the view from the backseat.** Phd Dissertation, s.l.: s.n.

Cabezas, E., Mora, L., Peña, G. & Siniterra, J., 2014. **Caracterización de las muertes por sinietros en motocicleta en Ibagué, 2008-2012.** Universidad de Tolima, s.l.: s.n.

CAF, 2013. **Metodología para elaborar planes de seguridad vial para motociclistas.** s.l.:s.n.

CAF, 2017. **Guía de Buenas Prácticas Internacionales para Motociclistas.** Medidas de Seguridad Vial. s.l.:CAF.

Cámara de la Industria Automotríz, 2017. **Las motocicletas en Colombia: aliadas del desarrollo del país.** Bogotá: s.n.

Centro de Innovación para Motociclistas, 2019. **Manual de: Elementos de protección personal (EPP) para trabajadores en moto.** Bogotá: s.n.

Cherpitel, C. J. y otros, 2021. **Road traffic Injuries and substance use among emergency department patients in the Dominican Republic and Perú,** s.l.: s.n.

CONASET, 2011. **Análisis Espacio Temporal de los Accidentes de Motocicleta en el Gran Santiago: Diagnóstico 2007-2011,** Santiago de Chile: s.n.

Daniel A. Rodríguez, M. S. C. F. P., 2015. **La motocicleta en America Latina: Caracterización de su uso e impactos en la movilidad en cinco ciudades de la región.** Bogotá: CAF.

DEKRA , 2010. **Motorcycle Road Safety, Strategies for preventing accidents on the roads of Europe.** s.l.:s.n.

DNII, 2021. DNII. [En línea]

Available at: https://dgii.gov.do/estadisticas/parqueVehicular/1Informes%20Parque%20Vehicular/ParqueVehicular2021.pdf

Elvick, R., Hoye, A., Vaa, T. & Sorensen, M., 2009. **The handbook of road safety measures-** Second edition. Bingley: Emeral Group.

ERF & FEMA, 2018. I**mproving infrastructure safety for powered two-wheelers.** Brussels: s.n.

Ferrer, A. & Rubino, J., 2017. **Guía de Buenas Prácticas Internacionales para Motociclistas.** Medidas de Seguridad Vial, s.l.: CAF.

Fundación Mapfre, 2021. **Hoja de ruta para la mejora de la seguridad vial de usuarios de motocicletas y ciclomotores.** Madrid: s.n.

Fundación Mapfre, 2021. **Hoja de ruta para la mejora de la seguridad vial de usuarios de motocicletas y ciclomotores.** Madrid: s.n.

Instituto Mapfre, 2014. **Seguridad Vial para Trabajadores Motoristas.** s.l.:s.n.

International Transport Forum, I., 2020. **Road Safety Anual Report 2020.** s.l.:s.n.

ITF , 2015. **Improving Safety for Motorcycle, Scooter and Moped Riders.** Paris: s.n.

ITF, 2015. **Improving Safety for Motorcycle, Scooter and Moped Riders.** Paris: s.n.

J. Monclús, y. F. M., 2013. **Informe sobre la seguridad de los motociclistas en Latinoamérica- Tendencias internacionales y oportunidades de acción.** s.l.:s.n.

Kudebong, M. y otros, 2011. **Economic Burden of Motorcycle Accidents in Northern Ghana,** s.l.: s.n.

Bibliography

Madariaga, S. d., 2009. **Vivienda, Movilidad y Urbanismo para la Igualdad en la Diversidad: Ciudades, Género, y Dependencia,** s.l.: s.n.

Mau-Roung Lin, et al, 2008. **A review of risk factors and patterns of motorcycle injuries.** s.l.:s.n.

MTOP, s.f. MTOP. [En línea]

Available at: https://observatorio.mtop.gub.uy/automotor.php

OCDE/FIT, 2017. **Benchmarking de la Seguridad Vial en América Latina.** s.l.:s.n.

OMS, 2017. **Seguridad de los vehículos de dos y tres ruedas.** Ginebra: s.n.

OMS, 2017. **Seguridad de los vehiculos de motor de dos y tres ruedas: manual de seguridad vial para decisores y profesionales.** Ginebra: s.n.

OMS, 2018. **Global Status Report on Road Safety 2018.** Ginebra: s.n.

OPS, 2008. **Cascos: Manual de seguridad vial para decisores y profesionales.** Washington D.C: s.n.

OPS, 2019. **Estado de la Seguridad Vial en la Región de las Américas.** Washigton DC: s.n.

Organización de las Naciones Unidas, O., 2020. **Documento de políticas: La Covid-19 en un mundo urbano.** s.l.:s.n.

Organización de las Naciones Unidas, O., 2020. **La COVID-19 en un mundo urbano.** s.l.:s.n.

Organización Panamericana de la Salud, O., 2019. **Estado de la seguridad vial en la Región de las Américas.** Washington D.C: s.n.

Oyesiku, O. O. & Odufuwa, B. O., 2002. **Gender Perspectives in travel behaviour of motorcycle passengers in nigerian intermediate cities,** s.l.: s.n.

RACE, s.f. **Chalecos y chaquetas airbag de moto: Ropa de protección del motorista, test de impacto.** s.l.:s.n.

Rodríguez, D. A., Santana, M. & Pardo, C. F., 2015. **La motocicleta en America Latina: Caracterización de su uso e impactos en la movilidad en cinco ciudades de la región.** Bogotá: CAF.

Rome, L. d., 2009. **The good gear guide for motorcycle & scooter riders.** s.l.:s.n.

Rune Elvick, A. H. T. V. M. S., 2009. **The handbook of road safety measures-** Second edition. Bingley: Emerald Group.

RUNT, 2021. RUNT. [En línea]

Available at: https://www.runt.com.co/runt-en-cifras

Schulz, W. H. & Sebastian, S., 2019. **Reducing the death toll of road accidents in Costa Rica through the introduction of roadworthiness inspections by the government,** s.l.: s.n.

Seguí Gómez, M. y otros, 2020. **Salvar vidas más allá de 2020: próximos pasos- una versión breve.** Estocolmo: s.n.

Silvestre Dobrovolny, C., Shi, S., Kovar, J. & Bligh, R. P., 2019. **Development and Evaluation of Concrete Barrier Containment Options for Errant Motorcycle Riders,** s.l.: s.n.

Todt, J., 2020. **COVID-19: repensando la movilidad. Moviliblog** (https://blogs.iadb.org/transporte/es/covid-19-repensando-la-movilidad/).

Tripodi, A. y otros, 2020. **Motorcycle Safety in Africa ,** s.l.: World Bank / African Development Bank.

Turner, B., Job, S. & Mitra, S., 2021. **Guide for road safety, Evidence of what works and what does not work.** Washington DC: s.n.

UN, 2016. **The United Nations Motorcycle Helmet Study.** New York & Geneva: s.n.

Waze, s.f. Waze. [En línea]

Available at: https://www.waze.com/es/covid19

Wittink, R., 2001. **Promotion of mobility and safety of vulnerable road users.** Leischedam: s.n.

MOTORCYCLES IN LATIN AMERICA

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