

**UNECE**

# Safer and Cleaner Used Vehicles for Africa

Part of the WP.29 “How it works – How to join it” series



**UNITED NATIONS**

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

# SAFER AND CLEANER USED VEHICLES FOR AFRICA

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## The United Nations Economic Commission for Europe

The United Nations Economic Commission for Europe (ECE) is one of the five United Nations regional commissions, administered by the Economic and Social Council (ECOSOC). It was established in 1947 with the mandate to help rebuild postwar Europe, develop economic activity, and strengthen economic relations among European countries, and between Europe and the rest of the world. During the Cold War, ECE served as a unique forum for economic dialogue and cooperation between East and West. Despite the complexity of this period, significant achievements were made, with consensus reached on numerous harmonization and standardization agreements.

Today, ECE supports its 56 member States in Europe, Central Asia, and North America in the implementation of the 2030 Agenda for Sustainable Development with its Sustainable Development Goals. ECE provides a multilateral platform for policy dialogue, the development of international legal instruments, norms and standards, the exchange of best practices, economic and technical expertise, as well as technical cooperation for countries with economies in transition.

Many of the norms, standards and conventions developed in ECE are used worldwide. A number of countries from outside the region participate in ECE's work offering practical tools to improve people's lives in the areas of environment, transport, trade, statistics, energy, forestry, housing, and land management.

ECE's multisectoral approach helps countries to tackle the interconnected challenges of sustainable development in an integrated manner, with a transboundary focus that helps devise solutions to shared challenges. With its unique convening power, ECE fosters cooperation among all stakeholders at the country and regional levels.

# Transport in the Economic Commission for Europe

## THE INLAND TRANSPORT COMMITTEE (ITC)

The Inland Transport Committee (ITC) was set up in 1947 to support the reconstruction of transport infrastructures in post-war Europe. Over the years, it has specialized in a harmonized and sustainable development of all modes of inland transport.

The ECE Sustainable Transport Division is secretariat to the ITC, to the ECOSOC Committee of Experts on the Transport of Dangerous Goods, and to the Globally Harmonized System of Classification and Labelling of Chemicals. The ITC, 18 working parties, the ECOSOC Committee and its sub-committees are intergovernmental decision-making bodies that aim to improve the everyday lives of people and businesses. Beginning in 2015, the Division also provided the secretariat for the Secretary-General's Special Envoy for Road Safety, Mr. Jean Todt, and from 2018, hosted the secretariat of the United Nations Road Safety Trust Fund.

The results are measurable, and the actions are concrete towards infrastructure development, improved traffic safety, environmental performance, energy efficiency, security, and the competitiveness of transport in general. Today's main results are (a) 58 United Nations transport conventions and an even larger number of technical regulations that are regularly updated and which provide an international legal framework for the sustainable development of national and international road, rail, inland water and intermodal transport, and vehicle construction, (b) the Trans-European North-South Motorway, Trans-European Railway and the Euro-Asian Transport Links projects which facilitate the coordination of multi-country transport infrastructure investment programmes, (c) the global TIR system which facilitates customs transit, (d) the For Future Inland Transport Systems (ForFITS) tool which can assist governments to monitor carbon dioxide (CO<sub>2</sub>) emissions from inland transport modes or to develop climate change mitigation policies, and the Safe Future Inland Transport Systems (SafeFITS) which can facilitate knowledge on transport policies for improving road safety, (e) the international methods of collection and data types in transport statistics, and (f) the studies and reports on transport policy development. For example, ITC devotes special attention to Intelligent Transport Services (ITS), sustainable urban mobility and city logistics, as well as to increasing the resilience of transport networks and services in response to climate change adoption and security challenges.

In addition, the ECE Sustainable Transport and Environment Divisions, together with the World Health Organization (WHO) - Europe, co-service the Transport Health and Environment Pan-European Programme (THE PEP).

## Executive summary

The Project of Safer and Cleaner Used Vehicles for Africa was established to contribute to the safer sustainable development of Africa by creating access to safer and cleaner used vehicles. Various studies have been carried out by different international bodies on the quality of the vehicle fleet in developing countries and commonalities in these studies (two of which are examined in Chapter 3) was that the quality of the vehicle fleet in developing nations (with a focus Africa) were poor compared to their counterparts in the exporting regions. Another commonality was that a greater percentage of the vehicle fleet were used imported vehicles, and these vehicles originated from exporting regions where the overall vehicle fleet were of a higher standard. Consequently, it was seen that there was little to no regulation in most African countries and there were no globally harmonized policies based on technical requirements for used vehicles transferred across borders.

To achieve the project's major objective, the United Nations Economic Commissions for Europe (ECE), United Nations Environment Program (UNEP), International Motor Vehicle Inspection Committee (CITA) and Fédération Internationale de l'Automobile (FIA) who are the main project partners were given different responsibilities based on their mission and specialties. Each project partner played a unique role and contributed to accomplishing the project objectives.

The Safer and Cleaner Used Vehicles for Africa project has the major objective to develop and harmonize minimum criteria for the safety and environmental elements of used vehicles to be exported/imported from one region/continent to another. This report gives a technical view to the background of the project, it highlights available international technical regulations which could be utilized by stakeholders and touches on some activities of the project.

This report highlights some of the key research carried out by notable organizations and it gives the basis for the reason behind the establishment of this project while creating awareness to the problem faced in the importing regions. Due to its Technical nature, this report highlights some of the key elements of the three United Nations Agreements which are the United Nations Regulations for vehicle approval (1958 Agreement), Periodic Technical Inspection (1997 Agreement) and Global Technical Regulations for vehicle certification (1998 Agreement) which may be used to facilitate the project objectives. The three UN Agreement are important technical work that may be applied in international vehicle regulations and is overseen by the World Forum for the Harmonization of vehicle Regulations (WP.29).

The activities of the project have created awareness of the consequences of having little to no regulation in the quality of used vehicles imported into a country. The project has also revealed the effects of a poorly managed vehicle fleet and the outcome of the project's activities have led to the development and harmonization of regional standards in Economic Community of West African States (ECOWAS) and East African Community (EAC). The activities from the project also led to the establishment of an Informal Working Group under WP.29 to establish a set of key technical environmental and safety requirements for both used and new vehicles that may be applicable in different economical regions.

For effective results, the project brought together both importing and exporting stakeholders in different regions to agree on key technical safety and environmental standards needed to be validated or certified at both the exporting ports and importing destinations. The global approach of this project is what establishes the mood for globally harmonized standards applicable in different regions/countries. However, implementation of standards or policies would have to be done at the national level.

In as much as the focus of this project is on Africa, the process used in achieving the project objectives may be extended to other importing regions where there are little to no regulations guiding their vehicle fleet.

This project is a first of its kind and while there may be room for expansion, the project partners and relevant stakeholders all have an important role to play. The implementation of Directives and Standards arising from this project may not produce instant results but overtime, an improvement in the environmental and safety elements of the vehicle fleet is expected to lead to more sustainable development in Africa.

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# CHAPTER 1

## Introduction

A major challenge to global road safety and clean and affordable road transport is the rapid growth of used vehicles in developing countries. Africa is expected to experience a lot of automotive growth largely because it is the second most populated continent with the lowest motorization rate in the world. The African car fleet is expected to grow four to five times by 2050 and 80-90 per cent of this growth will come from imported used vehicles. Currently, a significant share of these imported used vehicles do not meet basic safety and environmental standards.

The United Nations Road Safety Fund (UNRSF)<sup>1</sup> project, Safer and Cleaner Used Vehicles for Africa seeks to develop a program that will regulate the transfer of used vehicles to Africa with significant road safety benefits, for both car occupants, road users, pedestrians and co-benefits on the environment and economy. The project's aim is to provide a platform for the major exporters of used vehicles (European Union, United States of America, and Japan) and African importing countries to shift the paradigm on the export/import of used vehicles and to develop standards and policies on the transfer of used vehicles. The program also helps African countries to develop national standards and regulations (including existing global vehicle standards and regulations) and begin implementing these agreed standards. This project does not aim to restrict the transfer of used vehicles, but rather to shift the transfer to better quality used vehicles and this will lead to a transition towards importing safe and clean used vehicles into Africa. This is an important contribution to the implementation of Sustainable Development Goals 1, 3, 7 and 11<sup>2</sup> as well as the African National Action Plan<sup>3</sup> on road safety and the environment (air pollution and climate change).

Ultimately, vehicles will not legally authorized to be exported/imported into Africa if they are structurally unsafe and if they are not equipped with minimum safety technological requirements such as crash protection for occupants (e.g., Air bags), anti-lock braking systems, pedestrian protection. It will also ensure that illegal practices, like removing some equipment and safety features such as airbags and catalytic converters, will be rooted out through inspection schemes. It will ensure that structurally compromised vehicles, such as accidented vehicles are not exported to other countries but are handled in the right manner (through dismantling, recycling etc.) according to the End-of-Life Vehicle (ELV) policy in that country. This project therefore works in line with the Global Framework Plan of Action for Road Safety<sup>4</sup>, the work stream on safe vehicles, where all aspects of legislation, enforcement, education, technology, and international support will be covered

<sup>1</sup> UNRSF - Safer and Cleaner Used Vehicles for Africa.

<sup>2</sup> Sustainable Development Goals - United Nations Economic Commission for Europe (unece.org)

<sup>3</sup> UNECA - Decade of Action for Road Safety (African Action Plan)

<sup>4</sup> United Nations Road Safety Trust Fund, Global Framework Plan of Action for Road Safety.

## CHAPTER 2

### Background to the Project



Photo by: Njideka Jane Obikwelu

A study carried out by the United Nations Environment Program (UNEP), between 2015 to 2020 revealed Europe, Japan, the United States of America, and The Republic of Korea as the four major exporters of used vehicles.<sup>5</sup> This report showed that between 2015 and 2020, about 23 million used light-duty vehicles (LDV) were exported worldwide with some 66 per cent going to low-and middle-income countries and more than half of this amount going to Africa. Millions of the used cars that are exported from these regions to low-and middle-income countries are of poor quality, do not have adequate safety features, contribute significantly to air pollution and hinder efforts to mitigate the effects of climate change.

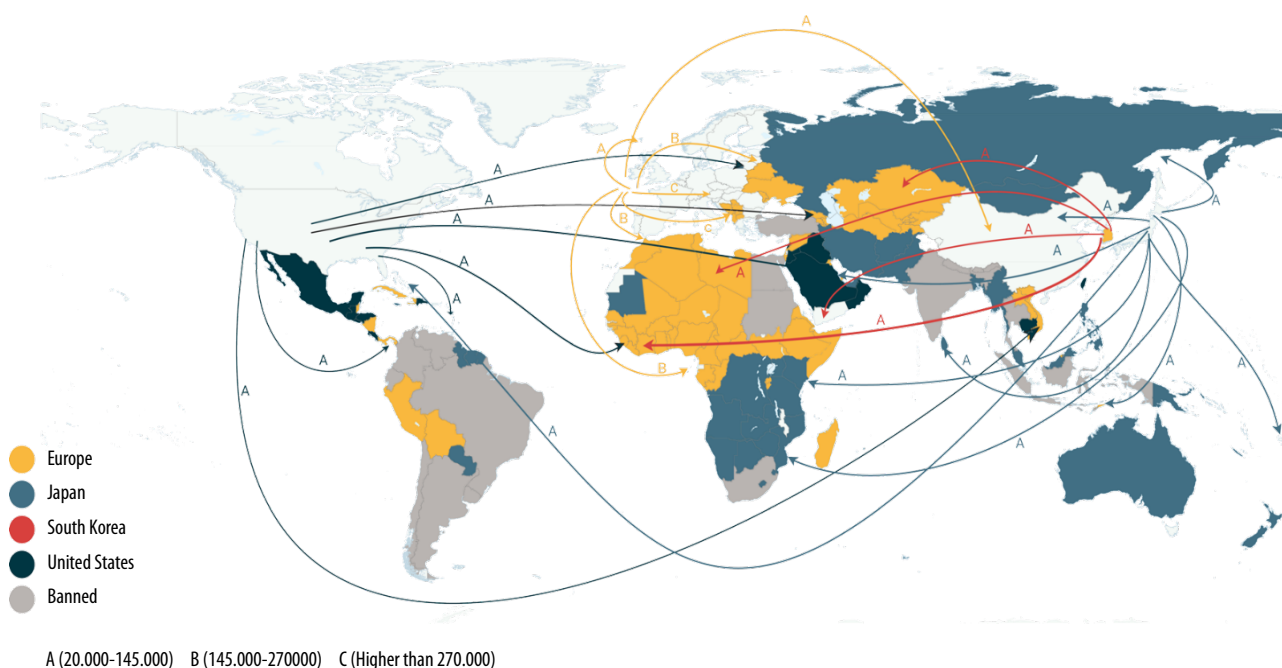
Every year, an estimated 1.3 million people die in road traffic accidents worldwide, leaving between 20 and 50 million people with non-fatal injuries<sup>6</sup>. This is the leading cause of death for young people aged 5-29 and the eighth leading cause of death globally. Ninety-three per cent of these deaths occur in low- and middle-income countries, although their vehicle fleet accounts for 54 per cent of the fleet worldwide. Africa has the highest rate of road traffic fatality at 26.6 death per 100,000 population<sup>7</sup>. More than half of all road deaths and injuries affect unprotected road users such as pedestrians, cyclists, motorcyclists, and their passengers.

<sup>5</sup> Global Trade in Used Vehicles - UNEP and USED VEHICLES AND THE ENVIRONMENT - Progress and updates 2021 | UNEP - UN Environment Programme (WHO, 2021 / <https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>)

<sup>7</sup> WHO, Global status report on road safety 2018 <https://www.who.int/publications/i/item/9789241565684>

Looking at the environment, air pollution is a growing menace in the world and was responsible for 9 per cent of global deaths in 2017<sup>8</sup>. It is estimated that one in eight deaths per year is attributed to air pollution worldwide while particulates are the cause of 4.2 million premature deaths in the world.<sup>9</sup> Though in the case of vehicles, these emissions are not only attributed to used vehicles but new vehicles with obsolete technology. The map below (Figure 2) depicts the flow and scale of light duty vehicles from the three major exporters in 2017. It may also be important to note that this may not be the destination for all imports as some countries that ban or regulate imports of used vehicles within their country may re-export them to other countries in their region.

**Figure 2** Shows used Light Duty Vehicles (LDV) Quantity and flow to main destination markets from for European Union, Japan, United States of America and Republic of Korea.



Source: Used Vehicles and the Environment, 2021  
 see: [http://airqualityandmobility.org/usedvehicles/usedvehicles\\_updatereport2021.pdf](http://airqualityandmobility.org/usedvehicles/usedvehicles_updatereport2021.pdf)

## 2.1. Project Benefits

Through this project Africa is expected to have major safety, environmental, and economic co-benefits, where the approved minimum standards will ensure that the used vehicles are equipped with safety or environment-protection features. This can include features like the catalytic converters, airbags and working braking systems. Also, the illegal practices of stealing or tampering with safety and environment-protection features on the vehicles will be stopped. The project is driven by demand, and it will provide a platform to support exporters and importers to agree on a set of regulations for used vehicles. This can include, for example, the requirement that used vehicles have minimum safety and environment equipment installed, and/or meet specific vehicle regulatory requirements, standards, or specifications.

The project has utilized data from the 2015-2020 UNEP global study on the trade in used vehicles. The study provides detailed data on the number and quality of used vehicles being exported to Africa, current practices, and regulations on the export as well as imports of used vehicles, and opportunities for improvements. Using the data now available, the programme is focusing on immediate action and implementation.

<sup>8</sup> WHO/Europe | Evolution of WHO air quality guidelines: past, present and future (2017)

<sup>9</sup> Vehicle Regulations in Africa - Dr. G.K Ayetor

The implementing organizations (listed in Chapter 4) together, have a wide range of experience in developing and harmonizing policies in the automotive and environmental sectors. Therefore, this partnership will effectively deliver the major benefit of safer and cleaner used vehicles for Africa. The expected outcomes of this project which will also benefit participating countries, regions and continent which are:

- i. The establishment of a minimum set of requirements between exporting and importing countries for the transfer of used vehicles to Africa. This can serve as a formula that can be utilized by other continents and regions who do not have the right policies governing the importation of used vehicles.
- ii. Successful implementation of this project will corroborate that African governments are able to adopt and harmonize national and regional standards and policies for importing used vehicles.
- iii. The establishment of an inspection and monitoring framework as well as a compliance system to be used by importing and exporting countries' authorities to ensure used vehicles meet agreed standards and policies.
- iv. Capacity building through training for policy development, inspection, data sharing and enforcement.
- v. The project is transformative and aimed at immediate impact, it focuses on scale by putting in place proposed standards to be used by African countries. The project and its partners will work with the African sub regional bodies to ensure harmonization and replication.

## CHAPTER 3

### Literature Review

#### 3.1. United Nations Environment Program (UNEP) Worldwide Study

UNEP carried out worldwide research which revealed the major exporters of used vehicles to be the European Union, Japan, the United States of America, and The Republic of Korea. The study revealed that between 2015 – 2020 about 23 million used light duty vehicle (LDV) were exported to 208 countries and territories worldwide across seven regions, from these four main exporters.

During this period, around 66 per cent of the used LDVs were exported to developing and transitional countries. From these exports of used LDVs to developing and transitional countries, Africa received the highest share of exports (24 per cent), followed by Eastern Europe, Caucasus, and Central Asia (14 per cent), Asia -Pacific (12 per cent), the Middle East (10 per cent), and Latin America and the Caribbean (8 per cent). From 2015 to 2020 the European Union traded around 11.5 million used LDVs, 58 per cent of which remained within the European Union and 42 per cent being exported outside the European Union. Used LDVs trade within European Union countries, plus imports from the United States of America, Japan and Republic of Korea to the European Union was 31 per cent of the total units traded globally. For the period 2015 to 2020, the European Union remained the largest exporter of used LDVs, considering trade within and outside the European Union at (49 per cent) followed by Japan (26 per cent), the United States of America (18 per cent), and Republic of Korea (8 per cent). Between 2017 and 2020, the European Union, Japan, and The Republic of Korea exported a total of 760,139 hybrid, plug-in hybrid, and battery-powered electric used vehicles globally. Data for the European Union and Republic of Korea was for LDVs, while for Japan this included LDVs and buses, data was unavailable for the United States of America.

Key concerns emanating from this study are:

- i. Pollutants and climate emissions of used vehicles.
- ii. The quality and safety of used vehicles.
- iii. Energy consumption and
- iv. The costs to operate used vehicles.

This trade needs to be supervised. Regulation is essential to ensure an improvement in the quality of the vehicles and to reduce urban air pollution and global climate emissions. Based on the study, it was seen that most developing countries have limited or no regulations on governing the quality and safety of imported used vehicles and where rules and regulations do exist, they are often poorly enforced. Equally, few developed countries have restrictions on the export of used vehicles. Regulations can take many forms from complete import bans to age restrictions, fiscal incentives, labelling and awareness requirements. Regulations reduce imports of old and polluting used vehicles, and encourage the imports of cleaner used vehicles, including very low and no emissions vehicles.

The stricter an importing country is on regulating the import of used vehicles and associated technology, the cleaner and more efficient the vehicle technology brought into a national market is. When combined with appropriate fuel quality in the importing country, used vehicles which meet emission standards can lower the impact from both CO<sub>2</sub> and non-CO<sub>2</sub> emissions and road safety can largely be improved. Some countries have been providing incentives for the import of used hybrid electric (HEV) and electric (EV) vehicles and this has assisted a switch to cleaner fleets. Some countries which had banned the import of all used vehicles are now permitting used hybrid electric vehicles or full electric vehicles. The report presented three case studies that gives concrete data and challenges in the trade of used vehicles.

Kenya - more than 95 per cent of vehicles currently being added to Kenya's rapidly growing light duty vehicle fleet are imported used vehicles, mainly from Japan. Kenya has an age limit for used vehicle import of maximum eight years. This results in the majority of the vehicles imported being around seven years old. The Kenyan fleet is relatively young and clean compared to other countries in the region, most notably Uganda and Rwanda which similarly import used vehicles from Japan. Uganda imposed an age limit of 15 years as recently as 2019. Rwanda has no age limit for used vehicle imports. As a result, the fleets in Uganda and Rwanda are much older than the Kenyan fleet. Consequently, average fuel consumption and CO<sub>2</sub> emissions are about one quarter higher than in Kenya.

The Netherlands - is an important exporter of used vehicles through its Rotterdam and Amsterdam ports, exporting 35,000 vehicles to West Africa in 2017-2018. Most of those vehicles did not have a valid roadworthiness certificate at the time of export. Most of them were between 16 and 20 years old and fell below Euro 4/IV vehicle emission standard. Morocco is exceptional in that it has set up Euro 4/IV standards and Ghana has established age and fiscal policies which result in import of Euro 4 standard used vehicles. In December 2019, the Human Environment and Transport Inspectorate of the Dutch Ministry of Infrastructure and Water Management tested 160 vehicles in the port of Amsterdam set for export to Africa. More than 80 per cent of the vehicles were below Euro 4 standard and most of the vehicles did not have valid roadworthy certificates. A significant number had key emissions and safety equipment removed or not working. In 2021 West African countries, coordinated by the regional cooperation body the Economic Community of West African States (ECOWAS), introduce minimum requirements for used vehicles. Most vehicles currently exported from The Netherlands will not meet this requirement.

Mauritius - is a small island developing state that has successfully introduced a set of policies to improve the quality of used vehicles. Mauritius only allows used vehicles which are not older than three years. It also introduced a CO<sub>2</sub> based vehicle taxation scheme and set up a verification and inspection scheme for used vehicles. Recently, Mauritius introduced fiscal incentives for low and no emissions vehicles. As a result, it has seen a major increase in the import of used (hybrid) electric vehicles.

Of the 146 developing and transitional countries studied to determine their used LDVs import policies, there has been progress since 2020 on Regulations for ensuring better quality used vehicles. This improvement is related to work of the project of "Safer and Cleaner Used Vehicles for Africa". From 47 countries with 'good' or 'very good' policies, this has now increased to 62 countries.

Since the inception of the project, 15 countries of ECOWAS region have adopted a Vehicles Directive for Euro 4/IV equivalent emission standards, which was implemented from January 2021. Peru adopted Euro 6/VI emission standards in October 2021 with an implementation date of October 2024 concurrently with 10 ppm Sulfur fuels. Cambodia adopted Euro 4/IV emission standards this year, to be implemented by end of 2021. At the same time Ethiopia introduced in 2019 higher taxation for used LDVs (up to 500 per cent) to discourage import of older used LDVs.

### 3.2. The Human Environment and Transport Inspectorate (ILT) of The Netherlands

The Human Environment and Transport Inspectorate (ILT) is the supervising authority of the ministry of infrastructure and water management. ILT works on a sustainable and safe living environment, safe transport, and reliability of the housing corporations. The ILT is the competent authority for the enforcement of two European Union frameworks of environmental law affecting old and used vehicles:

- i. The European Union Waste Shipment Regulation EC/1013/2006 ("EVOA").
- ii. Directive 2000/53/EU on end-of-life vehicles (the "ELV" Directive).

ILT conducted research on the quality of used vehicles being exported from the Netherlands to African countries. The study showed that about 80 per cent of the vehicles exported from the port of The Netherlands to African countries are old, below Euro 4/IV emission standard and they often do not have a valid road worthiness certificate. Many of these export vehicles, therefore, are a cause for pollutant and climate emissions and less road safety in the recipient countries.

The study also showed that the quality of used cars exported to West Africa is quite like the quality of cars dismantled in the Netherlands. Towards the end of their operating lives, many vehicles are usually exported to another country where they are either being driven or dismantled. There is an unspoken law of the market where; if there's someone willing to pay for a vehicle regardless of the condition, the vehicle is sold and with lack of proper regulations, these cars can still be driven in its new location.

The main objective of this study was to

- i. Assess the quality and state of exported vehicles to African countries
- ii. To compare these results to the kind of used vehicles that West African countries will require for import now and in the future.

#### *ILT Research*

The research was done in two parts. The first was a desk study focused on official registers for exports against the actual vehicles to be exported and the second was a field study of vehicles meant for export. This two-part study gave a clear overview of the characteristics of used vehicles for export and gave detailed information on the quality of a limited group of vehicles at the time of export.

One part of the study was to match data from customs with data from the national vehicle authority of The Netherlands (RDW), this link between these databases gives a lot of information about the state of a vehicle. Access to vehicle information is very crucial when it comes to future policies on maintaining a solid trade of used vehicles.

The desk study showed that about 80 per cent of the vehicles for export were:

- i. Quite old age between (16 – 20) years.
- ii. Mostly Euro 3 and below.
- iii. Of high mileage and;
- iv. Didn't have a valid roadworthiness certificate.

The second part of the study was a 3-day field inspection study which was done with RDW. The aim of this 3-day inspection was to assess the state of vehicles being exported and analyse the emission state of the vehicle. Some of the key observations from this inspection was:

- i. Some of the vehicles were completely worn out (without speaking about the technical condition of the vehicle).
- ii. Most of the vehicles set out for export didn't have a Particulate filter (key environmental component). One out of five diesel cars will not pass the roadworthiness on emissions;
- iii. About 56 per cent of petrol vehicles and 46 per cent of diesel vehicles would not pass the periodic roadworthiness certificates and;
- iv. 1 out of 8 airbags had a malfunction

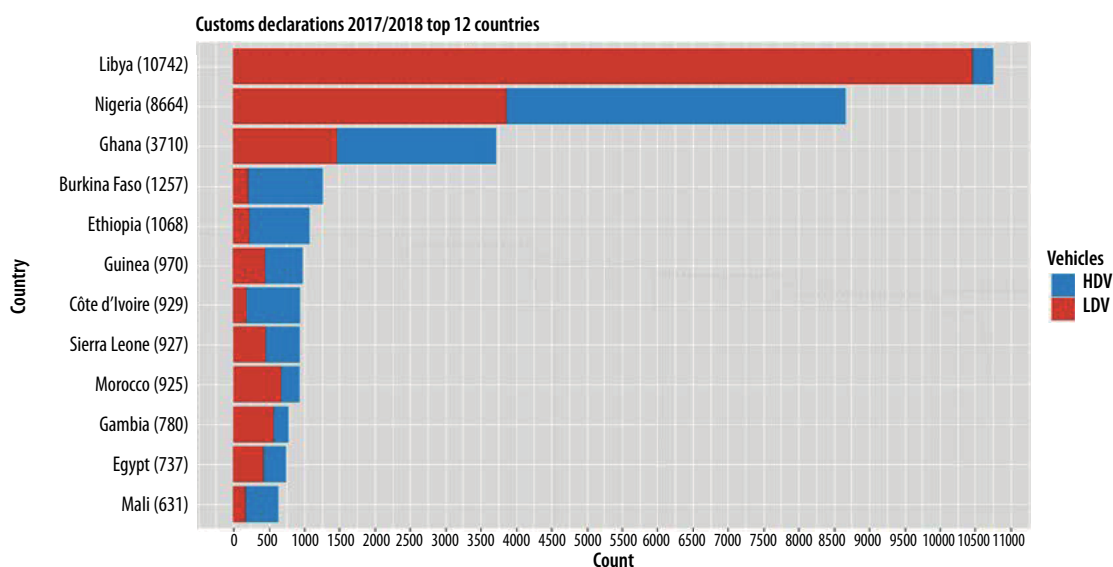
**Destination of Used Vehicles:**

The study showed the following 12 countries as the main export destinations of vehicles exported from the port of the Netherlands.

Libya, Nigeria, and Ghana are the top three destinations as Nigeria and Ghana have the largest fuel and vehicle markets in West Africa. Libya has a high number of new vehicle registrations annually and a high number of vehicle registration per thousand residents compared to Ghana and Nigeria.

Libya functions as a gateway for used vehicles moving to other countries in the region like Sudan, Chad, Niger, and possibly some West African countries.<sup>10</sup>

**Table 1** Types of vehicles to top 12 destinations



Source: Used Vehicles exported to Africa – a study on the quality of used vehicles see:<https://www.ilent.nl/documenten/rapporten/2020/10/26/rapport--used-vehicles-exported-to-africa>

<sup>10</sup> The UN comrade statistics show that exports of vehicles to Libya from Belgium, The Netherlands, and Germany together have increased greatly since 2016



### Study in Relation to Regulations:

From this study, comparison of the age of exported used vehicles to the current policies these countries have on imports of used vehicles (see Table 2) reveals that

- i. Countries banning used imports receive them nevertheless
- ii. Countries with age restrictions import older vehicles nevertheless

Though, it has to be taken into consideration that some of these vehicles are still redistributed to other countries. Also, vehicles move between countries easily therefore, a thorough work of regional policies or harmonization of policies between regions is very vital.

When analysing the vehicles imported into these countries with the vehicles driven against the available policies on importation of used vehicles, it shows that appropriate policies when enforced accordingly, tends to work. The adoption of a policy isn't just enough but the appropriate legislation that is taken into consideration is compulsory in the movement towards a cleaner vehicle fleet.

**Table 2** Age of export vehicles to top 12 countries compared to current import limits.

ECOWAS Countries	Mean age LDV Exported in 2017/2018	Mean Age HDV Exported in 2017/2018	Current National Regulations and policies Note: ECOWAS countries have decided on new regulations for vehicles by 2021: Import vehicles max 10 years, recommendation max 5 years for LDVs, minimum euro 4/IV emission standards
BURKINA FASO	15.3	14.8	No import restrictions, no tax incentives, no euro emission standards
COTE D'IVOIRE	14.2	15.7	Passenger vehicles and taxis imported < 5 years. Minicars (9-34 seats) and vans (< 5 tons) imported < 7 years. Cars (>34 seats), vans (>5 tons) imported < 10 years. Note the decree (no 2017-792 on age restriction of used import vehicles) was adopted on 6 Dec 2017 and was applied since 1st July 2018 (This means that the new age standard was not in force during a long period of our desk study covering expert date of 2017 and 2018)
GAMBIA	18.8	17.1	No import restrictions. No emission standards
GHANA	12.4	14.5	Customs Act, 2015 (Act 891) established a penalty system with graduated fees to serve as disincentive for importing LDVs and HDVs over 10 years. Taxes are based on the Customs Freight and Insurance (CFI) value. New regulations came into effect in April 2020 (Customs Amendment Bill, 2020) as a revision to the Customs Act of 2015. This law seeks to ban the import of LDV's older than 10 years. Implementation is set to commence in October, 2020
GUINEA	17.2	17.5	No import restrictions.
MALI	14.9	16.4	Encouragement of import of new vehicles: incremental tax on age.
NIGERIA	17.7	18.9	LDVs and HDVs < 15 years, Euro 2/II emission standards.
SIERRA LEONE	18.1	20	No import restrictions. No incentive for cleaner vehicles: used vehicles pay less tax than new vehicles
Other Countries	Mean age LDV Exported in 2017/2018	Mean Age HDV Exported in 2017/2018	Current National Regulations and policies
EGYPT	13.8	8.4	Ban on import of used vehicles except electric vehicles up to an age of 3. Regulations allow for entering used cars into the country for exceptional cases (most likely returning residents), provided the Egyptian national bought it new abroad (first owner) and documentation is verified by Egypt embassy at concerned country.
ETHIOPIA	12.6	12.0	No import restrictions. New regulation prepared to limit the age of import vehicles to 5 years.
LIBYA	17.8	14.3	LDVs and HDVs < 10 years. Tax of 800-1000 LD for each car imported. Decree No 148 was implemented in May 2019. Government enforcement is difficult due to the political situation in the country. The Government of National Accord only has control in ports on the west side of the country. (This means that the new age standard was not into force in the period of our desk study covering export data of 2017/2018. However, the ILT field inspections in December 2019 showed that none of the 110 passenger cars were inspected and destined for Libya was younger than 10 years. Their average age was 18.8)
MOROCCO	4.7	7.7	LDVs and HDVs < 5 years since 2010. Minimum Euro 4 emission standards for import vehicles since 2015.

Source: Used Vehicles exported to Africa – a study on the quality of used vehicles  
see: <https://www.ilent.nl/documenten/rapporten/2020/10/26/rapport--used-vehicles-exported-to-africa>

## CHAPTER 4

# UNRSF- “Safer and Cleaner Used Vehicles for Africa” Implementing Partners

The Safer and Cleaner Used Vehicles for Africa project which is sponsored by the United Nations Road Safety Fund (UNRSF), is led by the United Nations Environment Programme (UNEP) and United Nations Economic Commission for Europe (ECE). It is implemented together with key partners which are the International Motor Vehicle Inspections Committee (CITA), and The Fédération Internationale de l'Automobile (FIA).

### 4.1. United Nations Road Safety Fund (UNRSF):

Established in April 2018, the UN Road Safety Fund plays a unique role as the central UN fund aimed at reducing road fatalities. The fund works every day on projects that reduce the danger people face in traffic in low-and-middle-income countries. Every year 1.35 million people die in road crashes with more than 50 million seriously injured. Most crashes affect young people and the cost to society is extremely high.

UNRSF has a vision to build a world where roads are safe for every road user, everywhere. All road users regardless of where they live and what they earn should be safe when they use the world's roads.

Its mission is to finance and leverage further funding for high-impact projects based on established and internationally recognized best practices that increase road safety and minimize and eventually eliminate road crash trauma for all road users.

### 4.2. United Nations Environment Program (UNEP):

Established in 1972, UNEP is the leading global environment authority responsible for environmental issues at the global and regional level within the United Nations system. UNEP's mission is to provide leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations. To accomplish its mission, UNEP:

- i. Assesses environmental conditions and trends at the global, regional, and national levels,
- ii. Develops international agreements and national environmental instruments and
- iii. Strengthens institutions for wise environmental management.

UNEP works closely with member States as well as representatives from civil society, businesses and other major groups and stakeholders. UNEP also hosts several environmental conventions, secretariats and inter-agency coordinating bodies and is always in search of new ways to leverage partnerships to drive sustainable development.

### 4.3. International Motor Vehicle Inspection Authority (CITA):

CITA is the international association of public and private sector organizations actively involved in mandatory road vehicle compliance.

CITA is:

- i. Dedicated to improving road safety, protecting the environment and to developing best practice on mandatory vehicle compliance activities.
- ii. An international forum for exchanging information, experience and expertise related to vehicle compliance.
- iii. Recognized by the European Commission, the United Nations Economic Commission for Europe (The World Forum for the Harmonization of Vehicle Regulations – WP29), the World Health Organization, the Global Road Safety Facility of the World Bank, and other international stakeholders for its expertise about vehicle compliance.

Furthermore, CITA:

- i. Develops best practice recommendations and drafts international standards
- ii. Coordinates research, studies, and investigations
- iii. Organizes conferences and seminars on inspection methods, standards, and equipment. They also create awareness on quality control, quality assurance and accreditation.
- iv. Provides training for to stakeholders, capacitate authorities and facilitate on information systems used to improve inspection consistency and effectiveness.

#### **4.4. The Fédération Internationale de l'Automobile (FIA):**

Founded in 1904, the FIA's initial aim was to bring coherent governance and safety to motor sport. Through the expertise gained in that arena, the FIA has since grown into a global organization that not only promotes motor sport, but also safe, sustainable, and accessible mobility for all road users across the world. As such, the federation works across three key interlinked areas of activity – Sport, Campaigns, and Mobility.

In the realm of Mobility, the FIA aims to ensure that safe, affordable, and clean systems of transport are available to all. The promotion of safe and sustainable forms of mobility has in turn led the FIA to commit to global sustainability initiatives and also to find its own major response to road safety concerns, FIA Action for Road Safety. The FIA Action for Road Safety campaign launched in support of the UN Decade of Action for Road Safety is based around four key priorities:

- i. Advocacy at the highest levels: The FIA has developed key working relationships with international institutions such as the UN, the World Health Organisation, the European Union and the World Bank and governments around the world.
- ii. Action by clubs on the ground – The FIA is supporting its club network through the FIA Grant Programme. Established in 2012, the Grant Programme works with clubs to improve road safety at a local level.
- iii. Motor sport and Road Safety – The FIA has mobilised the motor sport community to promote the FIA's Action for Road Safety.
- iv. Campaigns & Partnerships - The FIA has launched its own initiatives, such as the 10 Golden Rules and an online pledge in its mission to make roads safer. To mobilise for the cause, the FIA has also established numerous institutional and corporate partnerships with leading actors.

Furthermore, FIA's support on road safety involves calling on governments at national and international level to embrace the Safe System Approach and promote action on capacity building, safe drivers, safer vehicles, safer infrastructure, and post-crash response.

## CHAPTER 5

## Regulations in the Transfer of Used Vehicles in Other Parts of the World

Regulations in the importation of used vehicles can take many forms – technical legal requirements, complete bans, age restrictions, fiscal incentives, labelling and awareness requirements. Sometimes regulations are harmonized at regional and sub-regional levels and while some countries strictly enforce these standards, others hardly put any form of enforcement in place. In 2019, at least \$16 billion worth of used vehicles were imported into Africa which represented a drop in value of 8.6 per cent compared to 2018.<sup>11</sup> In 2015 Asia was the largest exporter of used vehicles to Africa accounting for 45 per cent followed by Europe (43 per cent) and the United States of America (8 per cent). The dominance of Asian used vehicle export to Africa has since seen a gradual decline but this has given way to increase the European and American export. In 2019, Europe's share of used vehicle export to Africa was 45 per cent followed by Asia (34 per cent) and the United States of America (18 per cent)<sup>12</sup>

Data presented from UNEP's global study highlights different regions in the import/export used vehicles. Data below along with some existing regulations gives better understanding of the Regulatory situation in different regions.

**Table 3** Top African Markets for Import of Used Cars

Countries	2018	2019	2020	TOTAL
Libya	230,537	388,104	173,277	791,918
Nigeria	156,063	159,207	152,343	467,613
Kenya	73,026	71,694	54,528	199,248
Tanzania	87,466	52,208	41,845	181,519
Ghana	51,054	53,190	62,596	166,840
Benin	44,176	60,940	47,395	152,511

Source: Used Vehicles and the Environment, 2017  
see: <https://www.unep.org/resources/report/global-trade-used-vehicles-report>

**Table 4** Top Asian Pacific Markets for Import of Used Cars

Countries	2018	2019	2020	TOTAL
New Zealand	113,316	106,518	84,632	304,466
Mongolia	69,007	69,848	58,592	197,447
Cambodia	49,523	57,007	31,352	137,882
Myanmar	46,424	50,051	23,115	119,590
Sri Lanka	70,756	26,194	9,219	109,169
Pakistan	47,389	9,548	21,613	78,550
Malaysia	22,408	20,983	18,265	62,016

Source: Used Vehicles and the Environment, 2017  
see: <https://www.unep.org/resources/report/global-trade-used-vehicles-report>

<sup>11</sup> Vehicle regulations in Africa: Impact on used vehicle import and new vehicle sales.

<sup>12</sup> Vehicle regulations in Africa: Impact on used vehicle import and new vehicle sales (researchgate.net)

**Table 5** Top Middle East Markets for Import of Used Cars

Countries	2018	2019	2020	TOTAL
UAE	217,086	31,5011	236,833	768,930
Jordan	68,363	63,326	65,630	197,319
Oman	54,317	45,209	21,562	121,088
Yemen	41,625	18,261	11,432	71,318
Lebanon	4,715	12,767	20,602	38,084
Israel	11,755	12,107	12,237	36,099
Iraq	5,627	3,822	18,919	28,368

Source: Used Vehicles and the Environment, 2017

see: <https://www.unep.org/resources/report/global-trade-used-vehicles-report>

**Table 6** Top Eastern Europe, Caucasus, and Central Asia (EECCA) Markets for Import of Used Cars

Countries	2018	2019	2020	TOTAL
Ukraine	90,018	178,173	260,575	528,766
Serbia	115,713	106,961	129,093	351,767
Georgia	97,017	183,159	64,884	345,060
Russian Federation	92,318	118,304	121,762	332,384
Bosnia Herzegovina	60,790	51,660	46,051	158,501
Albania	16,976	18,979	24,933	60,888
Turkey	8,959	41,614	8,772	59,345

Source: Used Vehicles and the Environment, 2017

see: <https://www.unep.org/resources/report/global-trade-used-vehicles-report>

**Table 7** Top Latin American Countries (LAC) Markets for Import of Used Cars

Countries	2018	2019	2020	TOTAL
Chile	108,428	91,795	80,498	280,721
Mexico	52,567	55,410	42,246	150,223
Dominican Republic	50,667	53,244	43,864	147,775
Guatemala	25,808	27,015	27,168	79,991
Jamaica	26,719	29,501	20,537	76,757
Honduras	11,121	10,015	10,178	31,314
Bahamas	9,682	10,663	9,442	29,787

Source: Used Vehicles and the Environment, 2017

see: <https://www.unep.org/resources/report/global-trade-used-vehicles-report>

**Table 8** Top European Union (EU) Markets for Import of Used Cars

Countries	2018	2019	2020	TOTAL
Germany	228,972	227,149	192,271	648,392
France	150,914	193,861	200,302	545,077
Poland	112,261	114,033	81,634	307,928
Netherlands	92,792	110,005	99,698	302,495
Italy	76,427	66,525	93,887	236,839
Lithuania	57,668	72,453	63,775	193,896
Belgium	72,217	89,193	81,755	243,165

Source: Used Vehicles and the Environment, 2017

see: <https://www.unep.org/resources/report/global-trade-used-vehicles-report>

Importation of used cars is practiced all over the globe and even countries that have thriving automotive manufacturing markets still engage in the import of used vehicles from other countries or regions. According to Europe Eurostat, Germany is the highest exporter of used vehicles in Europe.<sup>13</sup>

In 2020, Germany exported \$123 billion in vehicles, making it the first largest exporter of vehicles in the world. The main destination of vehicles from Germany in 2020 were China (\$16.7 billion), United States of America (\$15.1 billion), United Kingdom (\$13.3 billion), France (\$8.26 billion) and Italy (\$6.92 billion)<sup>14</sup>. In the same year (2020), Germany imported \$68.9 billion in vehicles, becoming the 2nd largest importer of vehicles in the world. At the same year, Cars was the 1st most imported product in Germany. Germany imports vehicles primarily from: Spain (\$7.06 billion), United States of America (\$6.46 billion), Czechia (\$6.12 billion), Slovakia (\$5.92 billion), and Mexico (\$4.92 billion).

Analysis of regions that have programs in place to ensure only the import/export of safe and sufficiently clean vehicles proves that any region can improve the quality of the vehicles (used and new) entering its territory with the right policies. Implementation and enforcement of these policies will however need to take place at national level to be effective.

## 5.1. Europe

Within Europe vehicles are expected to pass an inspection test. When purchasing a vehicle, investigating if it has passed its most recent inspection and under what conditions it passed, may give an indication of its state of roadworthiness. However, passing these test does not necessarily mean that the vehicle is in a good condition. There are several verification processes involved in vehicle transfer within and outside the European Union.

### Legal Time Frame for Vehicle Inspections

The consumer would need to check with the seller when the most recent vehicle inspection was performed and when the next one is due. The legal timeframe within which a car usually has to pass a vehicle inspection varies between Member State. However, national legislation reflects the minimum requirements of **Directive 2014/45/EU**<sup>15</sup> and it states that passenger cars and light commercial vehicles must at least be tested 4 years after their first registration date and every 2 years thereafter. The following deadlines are based on cars for personal use. Specific rules exist for specific categories of vehicle. Most Member States impose general timeframes starting with the date on which the car is first registered.

For example, in Denmark, Greece, France the first periodic inspection has to take place 4 years after the vehicle is first registered and subsequently every 2 years.

In the Netherlands, Portugal, and Slovenia, the first periodic inspection has to take place 4 years after the vehicle is first registered. The next two inspections take place at 2-year intervals. Subsequently, the vehicle must be inspected every year.

<sup>13</sup> [https://ec.europa.eu/eurostat/statistics-explained/index.php?oldid=328429#Germany\\_is\\_the\\_EU.27s\\_largest\\_exporter\\_of\\_cars](https://ec.europa.eu/eurostat/statistics-explained/index.php?oldid=328429#Germany_is_the_EU.27s_largest_exporter_of_cars)

<sup>14</sup> <https://oec.world/en/profile/bilateral-product/cars/reporter/deu>

<sup>15</sup> Directive 2014/45/EU of the European Parliament and of the Council of 3 April 2014 on periodic roadworthiness tests for motor vehicles and their trailers <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0045&from=EN>

In Belgium and Norway, the car must undergo its first vehicle inspection 4 years after it is first registered, and then every year.

### *Is the Vehicle Seller Legally Obligated to Provide vehicle inspection before sale?*

This depends on the member states. In some Member states, the vehicle seller is not obliged to organize a roadworthiness test to sell a car in 23 countries: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Finland, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia and UK.

The seller does have to provide a report on the state of the car in seven countries: Belgium, Bulgaria, Estonia, Spain, France, Cyprus and Hungary

In France, the seller has to provide a valid technical report from a vehicle inspection carried out no more than 6 months prior to sale for every car registered more than 4 years previously. The buyer is entitled to see the inspection report before the sale

When buying cross-border, consumers may wish to organise a technical inspection in the country of purchase, close to the seller's premises instead of driving home first.

### *Vehicle Registration*

After successful purchase, to register a vehicle, a consumer has to show that a technical inspection has been performed in 19 member states

**Table 9** Vehicle registration and Technical Inspection

<b>Austria</b>	<b>Yes</b> , the consumer has to have a “§ 57a KFG” <sup>16</sup> confirmation, which proves that the car is roadworthy.
<b>Belgium</b>	<b>Yes</b> , the consumer has to provide a technical inspection certificate for second-hand cars.
<b>Bulgaria</b>	When registering a car in Bulgaria for the first time, if it is not a new car, the Traffic Police will carry out a technical inspection which is valid for one year. The inspection is part of the registration process and is performed at the same place.
<b>Croatia</b>	<b>Yes</b>
<b>Cyprus</b>	<b>Yes</b> . Once the vehicle passes the technical inspection, a number of documents plus a Department of Road Transport (DoRT) certificate and an insurance certificate should be taken to the DoRT Vehicle Examination Centre for registration.
<b>Czech Republic</b>	<b>Yes</b>
<b>Denmark</b>	<b>No</b> . However, if you cannot provide proof that the car has passed a technical inspection, it will be necessary to perform one
<b>Estonia</b>	<b>No</b>
<b>Finland</b>	<b>Yes</b>
<b>France</b>	<b>Yes</b> , as the consumer has to present a certificate of roadworthiness issued within the previous 6 months when registering a car older than 4 years of age. This certificate is issued after a technical inspection (“contrôle technique”).
<b>Germany</b>	<b>Yes</b> , the consumer has to show a valid roadworthiness certificate if the car is older than 3 years.
<b>Greece</b>	<b>Yes</b> . For second-hand cars only, the consumer needs to show proof that the car has passed a roadworthiness test.
<b>Hungary</b>	The car should be checked by the national inspection service.
<b>Italy</b>	<b>Yes</b>
<b>Latvia</b>	For new vehicles which were not previously registered in Latvia or abroad, the first technical inspection has to be performed no later than 24 months after they are first registered in Latvia. Further periodic technical inspections shall be performed each year in accordance with the time period indicated in the permit for participation in road traffic.
<b>Lithuania</b>	<b>Yes</b>
<b>Luxemburg</b>	<b>Yes</b> , for second-hand cars.
<b>Malta</b>	<b>Yes</b>
<b>Netherlands</b>	<b>Yes</b> . The consumer needs to prove that the required periodic vehicle inspection has been carried out.
<b>Norway</b>	<b>No</b> , as long as a European Certificate of Conformity (COC) is provided.
<b>Poland</b>	<b>No</b> , but under Polish law, passenger cars must be inspected once a year.
<b>Portugal</b>	<b>Yes</b> , unless it is a new car with a COC.
<b>Romania</b>	<b>Yes</b>
<b>Slovakia</b>	<b>Yes</b>
<b>Slovenia</b>	<b>Yes</b>
<b>Spain</b>	<b>Yes</b> , if the car is older than 4 years of age.
<b>Sweden</b>	A technical inspection is performed as part of the registration process
<b>United Kingdom</b>	<b>Yes</b>

Source: European Consumer Centre; see: [https://www.europe-consommateurs.eu/fileadmin/Media/PDF/publications/etudes\\_et\\_rapports/Etudes\\_EN/Cross\\_border\\_car\\_purchases\\_and\\_registration.pdf](https://www.europe-consommateurs.eu/fileadmin/Media/PDF/publications/etudes_et_rapports/Etudes_EN/Cross_border_car_purchases_and_registration.pdf)

<sup>16</sup> In Austria, the regular inspection of motor vehicles and certain trailers prescribed by the Motor Vehicles Act of 1967 is referred to as a recurring assessment, also referred to as §57a assessment. The vehicle assessment is generally regulated in Section V Inspection and assessment of motor vehicles and trailers of the Motor Vehicles Act (KFG)



### *Documents provided by Seller:*

The documents listed below form a non-exhaustive list

- i. **Contract of sale or an invoice:** A contract of sale or invoice should be provided by the seller in all EU Member States and Norway. Concerning formal requirements contracts may need to respect in order to be legally valid
- ii. **Registration certificate:** The seller must provide the consumer with the registration certificate. A separate de-registration certificate might be issued, or de-registration could be indicated on the registration certificate
- iii. Proof that a car is not pawned
- iv. **Technical inspection certificate:** A technical Inspection certificate is not mandatory in all countries but may be needed to register a car in another country.
- v. **Service book:** Traditional service books are often not produced for new cars. This book allows a consumer to check if a car has been serviced, for example in Germany, Croatia and Slovakia.
- vi. **History of the car:** Checking the history of a car may give an indication as to its condition, mileage and real value. It may also unconverted any financial claims on it or past road accidents

### *European Certificate of Conformity*

**Directive 2007/46/EC** establishes a framework for the approval of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles (Framework Directive). Directive 2007/46/EC foresees an EU type approval procedure to ensure that a type of vehicle is in line with technical prescriptions and security norms established at EU-level. Under EU rules, "Before a vehicle is allowed to be put on the market, it has to fulfil all the relevant Type or Individual Approval requirements guaranteeing an optimal level of safety and environmental standards."The technical characteristics of a car are then indicated in a document drawn up by the manufacturer called the Certificate of Conformity (COC)

Subsequently, "Every Member State has the obligation to register for the first time any vehicle that received the European Type-approval on the basis of the "Certificate of Conformity" issued by the vehicle manufacturer. This registration is the official authorisation for use on public roads and enforces the different introduction dates of different vehicles' requirements."The COC is valid in all EU countries, Iceland, Liechtenstein and Norway.

## **5.2. New Zealand Vehicle Importation Compliance Process**

Since the late 1990's New Zealand has relied mostly on the importation of its vehicles (some of which are new), but a good number of these vehicles are used. Controlling the safety and legality of all imported used vehicles are vital therefore an efficient and reliable process is essential to accomplishing this. This process is what would be analysed in the second part of this chapter.

The Importer motor Vehicle Association (VIA)<sup>17</sup> is a business association representing the government for many years to develop one of the most robust and efficient systems in the world for the monitoring and controlling of the importation of used vehicles

The import process ensures the standards of 4 key elements are met on every motor vehicle that enters the New Zealand market and Japan accounts for about 95% of off its import.

- i. Safety standards
- ii. Emissions standards
- iii. Confirmation of ownership
- iv. Compliance requirements

### *Vehicle Transfer Process*

The vehicle transfer process begins from the Auction of motor vehicles at the country of export (In this case Japan), and it follows a series of steps and processes to arrive at the destination country in New Zealand through to its registration process. This process has been perfected over years of its continuous routine and this has made it a very process to be studied and possibly emulated.

<sup>17</sup> Imported Motor Vehicle Industry Association (via.org.nz)

1. **Auction:** The process begins in Japan. The auction process relies on a detailed car grading system where independent inspectors examine and grade every auction vehicle for defects which is noted on the auction sheet. The accuracy and authenticity of this process is critical to the successful auction of buyers as the auction takes place electronically.
2. **Pre-shipping Inspection:** After auction, cars bound for New Zealand must go to an approved pre-shipping inspection centre and they are located at ports throughout Japan. These centres are approved and regularly audited by the New Zealand Transport Agency (NZTA)<sup>18</sup> and the Ministry for Primary Industries<sup>19</sup>. The inspection is a very essential part of the entry certification procedure. There are two major inspections:
  - i. The bio-security inspection: This includes a full internal and external clean of the car.
  - ii. The structural screening inspection, covers confirming the ID of the car, recording of the odometer reading and any water damage, structural damage, and rust on the car.

Once the inspections are complete, a colour coded sticker is placed on the vehicle confirming it has concluded its inspection. There are two stickers confirming that the biosecurity and structural inspections have been done

3. **De-registration:** While pre-shipping inspections are carried out, the vehicle is de-registered with the Japanese transport authorities. This requires the
  - i. Submission of the ownership papers,
  - ii. Confirming the title of ownership and the
  - iii. Issuance of an export certificate
  - iv. All these are required before the vehicle is permitted to leave the country.
4. **Entry Certification:** This is the first step at the port of entry after customs clearance. The entry certification also known as compliance, ensures that each vehicle entering New Zealand, adheres to its safety and environmental standards and it is carried out by an inspector from a government appointed key service delivery partner. The entry certification procedure has two elements,
  - i. The physical inspection of the vehicle:
 

This involves a partial disassembly and thorough inspection of the vehicle, and this handle checks for:

    - Rust
    - Structural repairs
    - Structural damages
    - Brakes
    - Exhaust emissions
    - Seat belts and anchorages

If necessary, minor repairs will be carried and the vehicles are rechecked to ensure roadworthiness before any certification can be issued.
  - ii. Document verification to ensure it complies with all relevant manufacturing standards and specification.

5. **Certified Repairs:** If extra repairs are needed after the physical inspection of the vehicle, an NZTA appointed certifier handles the responsibility of carrying out extra body works or rust repairs. Repair certifiers are completely independent of compliance shops and this separation helps to reinforce the integrity and independence of the importation process.
6. **Registration:** Once the vehicle has completed all necessary checks it is then certified for entry and able to be registered for use on the road.

The vehicle importation industry employs thousands of highly trained people from the inspectors through to the repair mechanics. This process has been streamlined and perfected over the years to ensure that it is not only robust and efficient, but that the New Zealand public can have confidence in the safety of the cars they drive.

<sup>18</sup> Home | Waka Kotahi NZ Transport Agency (nzta.govt.nz)

<sup>19</sup> Ministry for Primary Industries | NZ Government (mpi.govt.nz)

## CHAPTER 6

### World Forum for the Harmonization of Vehicle Regulation (WP.29)

The World Forum or WP.29 is the only global forum for harmonizing vehicle regulations and rules on vehicle performance and on vehicle parts and equipment, vehicle safety, environmental pollution, energy efficiency, anti-theft and security. WP.29 is the worldwide regulatory forum in which relevant stakeholders from the world participate in its three sessions, annually. Countries joining the World Forum benefit from a global platform where state-of-the-art technical regulations are discussed and adopted, reducing the administrative burden for contracting parties, and offering harmonized technical specifications for faster deployment of vehicle technologies aimed at achieving sustainable mobility.

The World Forum is a permanent forum in the framework of the Inland Transport Committee (ITC). The terms of reference and rules of procedure of WP.29 allow for the smooth administration of the three major international United Nations Agreements on motor vehicles: the 1958 and 1998 Agreements on regulations for the certification of new vehicles, including performance requirements, and the 1997 Agreement on rules for periodical technical inspections of vehicles in use. WP.29 ensures consistency between the regulations and rules developed under the three Agreements and adapts them to technical progress and to the current pace of innovation. These three UN Agreements were adopted in 1958, 1997 and 1998, and they provide a legal framework allowing Contracting Parties to establish internationally harmonized regulatory instruments concerning the certification of motor vehicles, their equipment and parts, and rules for technical inspections of vehicles in use. The regulatory framework developed by WP.29 allows the mass market introduction of innovative vehicle technologies, while continuously improving global vehicle safety, energy efficiency and environmental performance.

WP.29 is unique worldwide – all nations, all vehicle manufacturers and many intergovernmental (IGOs) and non-governmental organizations (NGOs) participate. Any Member State of the United Nations may participate and may adhere to any of the vehicle Agreements. Regional Economic Integration Organizations (REIOs) that are set up by countries, such as the European Union, also participate and, subject to their subsidiary arrangements, may become Contracting Parties to the Agreements. NGOs are welcome in a consultative capacity. The World Forum's work is fully transparent. The agendas, working documents, reports and informal documents are available online.<sup>20</sup>

#### 6.1. The United Nations 1998 Agreement

The 1998 Agreement establishes a process by which countries from all regions of the world can develop UN GTRs (global technical regulation) jointly on safety, environmental protection systems, energy sources and theft prevention of wheeled vehicles, equipment, and parts cover, but are not limited to vehicle construction, exhaust systems, tyres, engines, acoustic shields, anti-theft alarms, warning devices and child restraint systems. The goal of the UN 1998 Agreement is to continuously improve global safety, decrease environmental pollution and consumption.

##### *Principal Elements of the 1998 Global Agreement:*

- i. Members of Economic Commissions for Europe (ECE), the United Nations and REIOs formed by countries which participate in ECE activities are eligible to become Contracting Parties to the 1998 Agreement.
- ii. The Executive Committee of the 1998 Agreement (AC.3) is composed of all the Contracting Parties to the Agreement. AC.3 oversees the process of recommending, developing, and amending UN GTRs and adopts the new UN GTRs or new amendments once developed.
- iii. The Agreement explicitly recognizes the importance of continuously improving and seeking high levels of safety and environmental protection, and the right of national and subnational authorities to adopt and maintain technical regulations that are more stringently protective of health and the environment.
- iv. The development of global technical regulations will be transparent

<sup>20</sup> [www.unece.org/trans/main/welcwp29.html](http://www.unece.org/trans/main/welcwp29.html)

- v. The Agreement outlines two processes to establish UN GTRs. The first is the harmonization of existing regulations or standards. The second is the establishment of new UN GTRs if regulations or standards are non-existent
- vi. A consensus vote is required to establish a new UN GTR. Thus, if any Contracting Party votes against a recommended UN GTR, it would not be established.

## 6.2. The United Nations 1958 Agreement

The 1958 Agreement is a multilateral agreement, open for all countries being UN Member States worldwide, with the objective of establishing harmonized uniform United Nations Regulations for vehicles and their components relating to safety, environment, energy, and anti-theft requirements. The agreement provides harmonized technical UN Regulations for the approval/certification of new wheeled vehicles, their equipment, and parts, including provisions for the reciprocal acceptance of approvals issued under UN Regulations annexed to this Agreement. UN Regulations adopted by Contracting Parties to the 1958 Agreement pursuant to the Agreement govern the approval of road vehicles, their equipment, and parts for sale in those countries without the need for further national certification according to the principle “approved once, accepted by all Contracting Parties”. The agreement addresses safety requirements for vehicles, their environmental performance (air and noise pollution), energy-efficiency and security.

The aim of the 1958 Agreement is to promote the harmonization of UN Regulations and mutual recognition of approvals amongst Contracting Parties to the Agreement.

### *Principal Elements of 1958 Agreement:*

- i. Members of ECE, other members of the United Nations and of Regional Economic Integration Organizations (that participate in ECE activities) are eligible to become Contracting Parties to the 1958 Agreement
- ii. The 1958 Agreement seeks to establish UN Regulations for wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles, and conditions for granting type approvals and their reciprocal recognition for use by Contracting Parties who choose to implement UN Regulations once developed.
- iii. Under the Agreement, new UN Regulations and amendments to existing UN Regulations are established by a vote of a four-fifth majority of Contracting Parties present and voting. The established UN Regulation is notified to each Contracting Party and forwarded to the United Nations Secretary-General as depository of the agreement.
- iv. UN Regulations annexed to the 1958 Agreement are required to include technical requirements and alternative requirements as appropriate; test methods by which performance requirements are to be demonstrated; The conditions for granting type approvals and their reciprocal recognition, including markings and conditions for ensuring Conformity of Production (COP)
- v. A Contracting Party that has adopted a UN Regulation annexed to the Agreement is allowed to grant type approvals for a motor vehicle equipment and parts covered by the UN Regulation and is required to accept the Type approval of any other Contracting Party that applies the same UN Regulation.
- vi. A Contracting Party may decide to apply a former version of a UN Regulation annexed to the Agreement, subject to notification to the WP.29 Secretariat.
- vii. The Agreement also permits at any moment in time a Contracting Party upon notice to the United Nations Secretary-General, to begin applying a not yet applied UN Regulation annexed to the Agreement or to cease application of a UN Regulation that it has applied. In the latter case the Contracting Party is required to notify the United Nations Secretary-General of its decision one year in advance.
- viii. A Contracting Party applying UN Regulation can reject vehicles, equipment and parts that are not approved or certified in conformity with that UN Regulation.

## 6.3. The United Nations 1997 Agreement

The 1997 Agreement on periodical technical inspection provides the legal framework and procedures for the adoption of uniform UN Rules for carrying out technical inspections of vehicles that are in use and for delivering international inspection certificates. The UN Rules for vehicle inspection that are annexed to the Agreement have been developed with the technical expertise of WP.29 participants and, in particular, of the International Motor Vehicle Inspection Committee (CITA). Initially designed for heavy duty vehicles, the scope of these rules has been extended to cover passenger cars and light duty vehicles.

### *The Principal Elements of the 1997 Agreement:*

- i. Members of ECE, other members of the United Nations and REIOs [that participate in ECE activities] are eligible to become Contracting Parties to the 1997 Agreement.
- ii. The 1997 Agreement provides the legal framework and procedures for adopting uniform UN Rules on the technical inspections of vehicles that are in use and on the reciprocal recognition of the inspection certificates.
- iii. Under the Agreement, new UN Rules and amendments to existing UN Rules are established by a vote of a two-thirds majority of Contracting Parties present and voting. The established UN Rule is submitted to the United Nations Secretary-General and then each Contracting Party is notified.
- iv. The new UN Rule or amendment to an existing UN Rule enters into force for all Contracting Parties which have not notified the Secretary-General of their objection within six months following notification, unless more than one-third of the Contracting Parties so object. If more than one-third of the Contracting Parties object, the UN Rule or amendment does not enter into force for any Contracting Party.
- v. The UN Rules under the 1997 Agreement define the applicable vehicle categories and the related inspection intervals, items to be inspected, inspection method, the principal reasons for a rejection, and the method of assessment into three risk categories. The inspection techniques use currently available equipment without dismantling or removing any part of the vehicle.
- vi. The International Technical Inspection Certificate issued by designated Technical Inspection Centres of a Contracting Party shall be reciprocally recognized by other Contracting Parties applying the same Rule(s) for the purpose of cross boarder circulation of vehicles.
- vii. The periodical inspection reports of the Contracting Parties to the Agreement may be used as an alternative. Sample reports should be transmitted to the secretariat of WP.29 which then transfers the information to the other Contracting Parties.
- viii. The Agreement also permits a Contracting Party, upon notice, to begin applying a UN Rule that has been annexed to the Agreement or to cease applying a UN Rule that had been applied. In the latter case the Contracting Party is required to notify the United Nations Secretary-General of its decision one year in advance.

The Agreement introduces requirements on the conformity of periodical technical inspection process addressing elements such as test facilities and equipment, requirements for competences, training and certification of personnel performing inspections as well as supervision of testing centres.

### **There are four rules under the UN 1997 Agreement on PTI**

#### **1. RULE 1: Protection of The Environment**

Rule 1 under the 1997 agreement establishes uniform provisions for periodical technical inspection of wheeled vehicles regarding protection of the environment. The inspection here covers:

- i. Identification of the vehicle,
- ii. Environmental nuisances
- iii. Noise emissions
- iv. Other items related to protection of the environment

#### **2. RULE 2: Uniform Provisions for Periodical Technical Inspection (PTI) of Wheeled Vehicles Regarding Their Roadworthiness**

Rule 2 under the 1997 agreement covers the inspection of the vehicle to assess if it is roadworthy.

#### **3. RULE 3: Periodical Technical Inspections of motor vehicles using Compressed Natural Gas (CNG), liquified petroleum gas (LPG) and/or liquified natural gas (LNG) in their propulsion system**

The inspection shall cover at least the items listed below, provided they are installed in the vehicle.

- i. Legal requirements of the gas installation
- ii. Fuel control command if present

- iii. Ventilation housing, including its ventilation pipes
- iv. The tank level gauge
- v. Other components of the gas filling system: like valves, pipes, injectors
- vi. The electronic control unit
- vii. Checks for leakage

**4. RULE 4: Uniform provisions for PTI of motor vehicles equipped with electric or hybrid propulsion system(s) regarding their roadworthiness**

The inspection shall cover at least the items listed below, provided they are installed in the vehicle.

- i. Electric Vehicle and Hybrid Electric Vehicle’s electrical hazard marking
- ii. Electric regenerative braking system
- iii. Low voltage electrical wiring
- iv. Inspection on electric power train.

**A. Minimum Requirements Concerning Roadworthiness Tests<sup>21</sup>**

The minimum requirements are captured in the UN Rules established under the Agreement as well as in Resolution R.E.6 <sup>22</sup>. There are three categories expected for the minimum requirements and they are the:

**a) Date and Frequency of Testing**

Vehicles shall be subject to a roadworthiness test at various intervals depending on the vehicle category. Tests shall follow the frequency below:

<b>Table 10</b> Inspection Intervals	
<b>Vehicle Categories</b>	<b>Maximum Inspection Intervals</b>
Passenger-carrying motor vehicles: M1, except taxis and ambulances Goods vehicles: N1	Four years after the first entry into service of the first registration and every two years thereafter
Passenger-carrying motor vehicles: M1 used as taxi or ambulances, M2 and M3 Goods vehicles: N2 and N3 Trailers: O3 and O4	One year after the first entry into service of the first registration and annually thereafter

Source: UNECE, Rules Annexed to the 1997 Agreement  
see: <https://unece.org/rules>

**b) Contents and Methods of Testing**

The tests shall cover key safety features of the vehicle such as the braking equipment, the steering, lighting equipment, axles, wheels tyres, suspension system, chassis and its attachments, and any other equipment. The test shall cover at least these items and use the minimum standards and recommended methods outlined in the Rule.

**c) Assessment of Deficiencies**

- i. For each item to be tested, the Rule provides a possible list of the deficiencies and their level of severity
- ii. Deficiencies that are found during the periodic testing of the vehicles shall be categorized in one of the following groups:

<sup>21</sup> Directive 2014/45/EU of the European Parliament and of the Council of 3 April 2014 on periodic roadworthiness tests for motor vehicles and their trailers and repealing Directive 2009/40/EC (Text with EEA relevance)

<sup>22</sup> Resolution R.E.6

- iii. Minor deficiencies having no significant effect on safety of the vehicle or impact on the environment and other minor non-compliances.
- iv. Major deficiencies that may affect the safety of the vehicles or have an environmental impact or may put other road users at risk.
- v. Dangerous deficiencies constituting a direct and immediate risk to road safety or having an impact on the environment which justify that a member State or its competent authorities may prohibit the use of the vehicle on public roads.

A vehicle having deficiencies falling into more than one of the deficiency groups referred to in (ii) above shall be classified in the group corresponding to the more serious deficiency.

#### **A. International Technical Inspection Certificate**

Member States shall ensure that testing centres or relevant authorities that have carried out the roadworthiness test on a vehicle issue a roadworthiness certificate for that vehicle indicating at least the standardized elements of the corresponding contents of the roadworthiness certificate. The periodical technical inspection reports, which are in use in the countries of the Contracting Parties to the Agreement, may be used as an alternative. A sample of them shall be transmitted to the Secretary-General of the United Nations for information to the Contracting Parties.

##### **a) Minimum Contents of a Roadworthiness Certificate:**

- i. Vehicle Identification Number (VIN) number or chassis number
- ii. Registration plate number of the vehicle and country symbol of the State of registration
- iii. Place and date of the test
- iv. Odometer reading at the time of the test, if available
- v. Vehicle category, if available\*
- vi. Identified deficiencies and their level of severity\*
- vii. Result of the roadworthiness test\*
- viii. Date of the next roadworthiness test or date of expiry of the current certificate, if this information is not provided by other means
- ix. Name of testing organisation or centre and signature or identification of the inspector responsible for the test
- x. Other information\*

\* recommended elements, not mandated by the specimen for the International Technical Inspection Certificate

##### **b) Follow-up of Deficiencies**

- i. In the case of minor deficiencies only, the test shall be deemed to have been passed, the deficiencies shall be rectified, and the vehicle shall not be retested
- ii. In the case of major deficiencies, the test shall be deemed to have failed. The member State or competent authority shall decide how long the vehicle shall be used before it shall undergo another roadworthiness test
- iii. In the case of dangerous deficiencies, the test shall be deemed to have been failed. The member State or the competent authority may decide the vehicle is not to be used on public roads and that the authorization for its use in road traffic is to be suspended for a limited period during which the deficiencies are rectified, and a new roadworthiness certificate is issued.

##### **c) Proof of Test**

- i. The testing centre or relevant authority of the member State that has carried out the roadworthiness test shall provide a proof such as an indication on the vehicle registration document, a sticker, a certificate, or any other easily accessible information for each vehicle that has passed the test. The proof shall also indicate the expected date of the roadworthiness test.
- ii. Where the tested vehicle belongs to a vehicle category which is not subject to registration in the Member State where it has been put into service, that Member State may require the proof of test to be displayed in a visible manner on that vehicle.

For ease of circulation, each member State shall recognize the proof provided by a testing centre or competent authority of another member State.

### **C. Vehicle Technical Inspection as a tool for Export / Import of Used Vehicles**

While importing a used vehicle, the main concern should be to check whether the vehicle meets the safety requirement of the importing country. A roadworthiness test checks the safety performance of the vehicle against already predefined criteria to establish the safety and usability of the vehicle. Roadworthiness is basically a term used to define if a vehicle that meets the standard requirements for safe and sound driving on roads and the test also determines that vehicles have not been illegally modified. Ideally, a roadworthiness is to be carried out at the exporting country to ensure that only quality used vehicles were exported.

Other international and regional legislation in this field addressing the shipment of potential harmful goods or waste are:

- i. Basel convention
- ii. Bamako convention
- iii. ELV Directive of the European Union (currently being revised)
- iv. Roadworthiness package of the European Union (currently being revised).

Details of these legislation can be found in Annex I of this report.



## CHAPTER 7

### Minimum required regulation

#### 7.1. United Nations Safety Regulations

##### *Minimum Safety Requirements as Established by 1958 and 1998 Agreement*

Among the UN Regulations acceded to under the 1958 Agreement are the basic safety features of wheeled vehicles, equipment and parts which can be fitted or used on wheeled vehicles, and they cover the necessary safety elements which are required to protect the vehicle, its passengers, and pedestrians from accidents during driving as well as environmental protection and protective and antitheft devices. Table (11) has been developed by ECE to cover all basic safety aspects of a vehicle, and any country may apply this Regulations while the Contracting Parties to the 1958 Agreement are entitled to grant approvals in accordance with UN Regulations and are bound by mutual recognition of approvals provided under the 1958 Agreement. This will facilitate international transfer of vehicles and their components to show which requirements vehicles were meeting when manufactured. Coupled with other requirements at the time of export, such as roadworthiness tests / periodic technical inspection tests, this could provide a quantifiable definition of “used quality vehicles”.

**Table 11** Minimum Safety Requirements

Topic	Passenger cars UN Regulation	PTWs UN Regulation	Commercial vehicles UN Regulation
Active safety			
Brakes	R 13 H (incl. ABS)	R 78 (incl. ABS) GTR 3	R 13 (incl. EVSC)
Electronic Stability Control	R 140 / GTR 8		
Steering	R 79		R 79
Tyres	R 30/ GTR 16	R75	R 54
Mechanical couplings			R 55
Passive safety			
Helmets		R22	
Safety belts anchorages	R 14		R 14
Safety belts	R 16		R 16
Seats/ head restraints	R 17, R 25/ GTR 7		
Frontal collision	R 94		
Lateral collision/Pole side impact	R 95, R 135/GTR 14		
Pedestrian Safety	R 127/ GTR 9		
Child restraints	R 44		
Electric Vehicle safety	R 100/ GTR 20	R 136	
Cabs strength			R 29
General safety			
Buses and coaches			R 107
Safety glazing	R 43/ GTR 6		R 43
Devices for indirect vision			R 46
Underrun protection			R 58, R 93
Lighting and light installation			
Installation of lighting	R 48	R 53, R 74	R 48

Source: UNECE, World Forum for Harmonization of Vehicle Regulations

see: <https://unece.org/transport/vehicle-regulations/world-forum-harmonization-vehicle-regulations-wp29>

The UN Regulation and UN GTRs seeks to improve the behaviours, handling, and equipment of vehicles to decrease the possibility of road crash and to better protect occupants and other participants in road traffic in case of a crash.

Some of the regulations seek to increase the driver's ability to detect and avoid hazards. Others seek to increase the driver's ability to maintain control of the vehicle. Specific examples of current UN Regulations include, lighting and light-signalling devices, braking and running gear, including steering, tyres, and rollover stability where the technology changes rapidly.

### Active safety

Active safety refers to the elements/systems of a vehicle that are developed to help drivers reduce the severity of accidents or avoid them entirely by managing braking, steering, stability, and propulsion. Active safety features of a vehicle are designed to improve safety while driving the vehicle and are used to maintain the stability of the vehicle while undertaking regular driving tasks such as braking, accelerating, and steering.

Active Safety Systems are constantly being improved by vehicle manufacturers using advanced driving assistance systems (ADAS) and in this report, we will highlight the basic UN Regulations for ensuring active safety of a vehicle.

## A. BRAKES – UN Regulation No. 13-H, UN Regulation No. 13 and, UN Regulation No. 78

### UN Regulation (13-H) <sup>23</sup>

**Scope:** Light vehicles up to 3,500kg maximum mass (cars, vans, and light trailers)

A brake is a mechanical device that inhibits motion by absorbing energy from a moving system and they are perhaps the most important safety feature of any vehicle. A brake can also be defined as an automotive part where the forces opposing the movement of the vehicle develop. It may be a:

- i. Service brake which is also known as the primary braking system, and it is typically operated by foot, and it is mechanically separated from the parking brake or emergency braking system. For reasons of redundancy, service brake systems are two-circuit systems.
- ii. Emergency braking systems can be considered as a back-up system or subsystem of the braking system that can help safely bring the vehicle to a standstill in cases of failure of the service brake and thus providing for a redundancy of the system. Emergency braking systems are usually formed by one of the two-circuit service braking system or by the parking brake.
- iii. Parking brake also known as the hand break is a secondary braking mechanism that is used to keep the vehicle securely motionless when parked especially on steep inclines or declines. Parking brake is also called an emergency break because it can help safely bring the vehicle to a stop in an emergency.

UN Regulation 13H addresses uniform provisions concerning the approval of passenger cars regarding braking. According to this Regulation, the braking equipment shall be so designed, constructed, and fitted as to enable the vehicle in normal use, despite the vibration to which it may be subjected, to perform its full function of safety by retarding the vehicle's motion according to the provisions of this regulation.

Pursuant to this Regulation, vehicles are submitted to undergo braking test and to assess the braking performance requirement of the vehicle before it can be approved. Some of the tests performed for these assessments are:

- i. General braking test: this includes, general performance test, measurement of braking performance, behaviour of vehicle during braking (dynamic stability), ordinary performance with cold brakes, fade, and recovery tests.
- ii. Performance of braking systems: these involves testing service braking system where the system shall be tested with a connected and disconnected engine. Performance of braking system shall be tested in a secondary braking system with a disconnected engine
- iii. Test on response braking time: Here a vehicle is equipped with a service braking system which is totally or partially dependent on a source of energy other than the muscular effort of the driver.

<sup>23</sup> UN R.13H: Addenda to the 1958 Agreement (Regulations 0-20) | UNECE

- iv. Tests to determine distribution of brake forces between axles to guaranty stability while braking provided that the vehicle is not equipped with an anti-lock system
- v. These tests are to ensure that the braking system(s) performs its operational function to assists in safe vehicle operation and control under a variety of driving conditions and road surfaces.

### *Test Requirements for Vehicles Fitted with Anti-lock Braking Systems (ABS)*

An anti-lock system is a part of a service braking system which automatically controls the degree of slip in the direction of rotation of the wheel(s) on one or more wheels of the vehicle during braking.

#### *General requirements*

- i. Any electrical failure or sensor anomaly that affects the system with respect to the functional performance requirement in this annex, including those in the supply of electricity, the external wiring to the controller(s), the controller(s) and the modulator(s) shall be signalled to the driver by a specific optical warning signal.
- ii. Sensor anomalies, which cannot be detected under static conditions, shall be detected not later than when the vehicle speed exceed 10 km/h.
- iii. The operation of the anti-lock system shall not be adversely affected by magnetic or electrical fields.
- iv. In the event of a single electrical functional failure which only affects the anti-lock function, as indicated by the warning signal indicated in (i) above, the subsequent service braking performance shall not be less than 80 per cent of its optimal performance.
- v. The operation of the anti-lock system shall not be adversely affected by magnetic or electrical fields.

#### **UN Regulation 13 (UN R.13)<sup>24</sup>**

**Scope:** Heavy duty vehicles of 3,500kg mass and above.

**Additional Requirements:** This covers among others:

##### **i. Air brake systems**

Air brakes are typically used in heavy duty vehicles and are made up of a supply system and a control system. The supply system compresses, stores and supplies high pressure air to the control system. The control system consists of service brakes, parking brakes, a control pedal, and an air storage tank.

The air braking system begins with a compressor which is driven by the engine and provides the system with the required air under pressure. The compressor draws filtered air from the atmosphere and compresses it storing the compressed ait in high-pressure reservoirs. Most heave duty vehicles have a gauge within the drivers view indicating the availability of air pressure and a warning light that automatically comes on once the pressure drops below a certain point. Reservoirs are used to store the air and they hold the air until it is required by the system, and this is also known as the supply system of the circuit. To operate the brake the driver has two controls; the foot pedal (which is used to control the service brakes) and the hand control valve, which is a hand operated lever, similar to the hand brake in a car and the driver uses this to overcome the power spring holding the brakes. The foot control valve and hand control valve make up the control circuit.

Finally, we have the actuators that use air from the controls to actuate and release the brakes as required by the driver.

Load sensing valves adjust the brake forces at individual axles to keep the vehicle in a stable condition during braking by avoiding skidding or blocking of the tyres.

##### **ii. Compatibility requirements towing trailers/semi-trailers**

For keeping stability during braking of vehicle combinations, trucks/trailers or trucks/semi-trailers, brake forces of the individual vehicles need to be adjusted in a way that their decelerations are compatible to each other.

<sup>24</sup> Addenda to the 1958 Agreement (Regulations 0-20) | UNECE

**iii. Endurance braking systems (retarder)**

Means an additional braking system having the capability to provide and to maintain a braking effect over a long period of time without a significant reduction in performance. The term “endurance braking system” covers the complete system including the control device. Endurance braking systems need to have the capacity to provide 6 per cent brake efficiency under maximum design weight condition at a speed of 30km/h without reduction of the retarding force.

**UN REGULATION No. 78 - BRAKING (CATEGORY L<sup>25</sup> VEHICLES)<sup>26</sup>**

**Scope:** This Regulation applies to vehicles of category L (mopeds, motorcycles three-and four-wheelers) with maximum speed of 25km/h

For vehicles of category L, the brake system shall meet the requirements of the

- i. **Service brake system control operation** where vehicles shall have configurations that enable a rider to actuate the service brake system control while seated in the normal driving position and with both hands on the steering control.
- ii. **Secondary brake system control operation:** Vehicles shall have configurations that enable a rider to actuate the secondary brake system control while seated in the normal driving position and with at least one hand on the steering control.
- iii. **Parking brake system:** This system shall have a control which is separate from the service brake system controls; and be held in the locked position by solely mechanical means.
- iv. **Two-wheeled vehicles of categories L1<sup>27</sup> L3<sup>28</sup>** shall be equipped with either two separate service brake systems, or a split service brake system, with at least one brake operating on the front wheel and at least one brake operating on the rear wheel
- v. **Category L5<sup>29</sup> and L7<sup>30</sup>** Vehicles shall be equipped with a parking brake system and a foot actuated brake which operates by
  - A split service brake system; or
  - A CBS that operates the brakes on all wheels and a secondary brake system, which may be the parking brake system.

The brake systems of category L vehicles will be required to undergo

High speed test, Dry stop test – single brake control actuated, Dry stop test – all brake control actuated, wet brake test, heat fade test, parking brake system test partial failure test and ABS test.

**B. ELECTRONIC STABILITY CONTROL (ESC) – UN Regulation No. 140 (UN R.140)<sup>31</sup>**

**Scope:** Light vehicles up to 3,500kg maximum mass (cars and vans)

An electronic stability control is a computerized technology designed to improve a vehicle’s stability by detecting and reducing loss of traction (skidding). An Electronic stability control (ESC) is a system:

- i. That improves vehicle directional stability by at least having the ability to automatically control individually the braking torques of the left and right wheels on each axle<sup>32</sup> to induce a correcting yaw<sup>33</sup> based on the evaluation of actual vehicle behaviour in comparison with a determination of vehicle behaviour demanded by the driver
- ii. That is computer controlled using a closed-loop algorithm to limit vehicle oversteer and understeer based on the evaluation of actual vehicle behaviour in comparison with a determination of vehicle behaviour demanded by the driver.

<sup>25</sup> L-category vehicles are a classification of road transport vehicles that range from powered two/three-wheelers (motorbikes, mopeds etc), quadricycles and ‘micro cars’.

<sup>26</sup> Addenda to the 1958 Agreement (Regulations 61-80) | UNECE

<sup>27</sup> A two-wheeled vehicle with maximum design speed not exceeding 50km/h

<sup>28</sup> A two-wheeled vehicle with maximum design speed exceeding 50km/h

<sup>29</sup> A vehicle with three wheels symmetrically arranged in relation to the longitudinal median plane with maximum design speed exceeding 50km/h

<sup>30</sup> A vehicle with four wheels unladen mass is not more than 400 kg (not including electric batteries)

<sup>31</sup> UN R.140: Addenda to the 1958 Agreement (Regulations 121-140) | UNECE

<sup>32</sup> An axle group shall be treated as a single axle and dual wheels shall be treated as a single wheel.

<sup>33</sup> Yaw rate means the rate of change of the vehicle’s heading angle measured in degrees/second of rotation about a vertical axis through the vehicle’s centre of gravity

- iii. That has a means to directly determine the value of the vehicle's yaw rate and to estimate its sideslip or side-slip derivative with respect to time.
- iv. That has a means to monitor driver steering inputs; and
- v. That has an algorithm to determine the need, and a means to modify propulsion torque, as necessary, to assist the driver in maintaining control of the vehicle.

UN Regulation No. 140 (UN R 140) address uniform provisions concerning the approval of passenger cars with regard to Electronic Stability Control (ESC) Systems. The scope of this regulation applies to the approval of vehicles of category M1<sup>34</sup> and N1<sup>35</sup> with regard to their electronic stability control system.

Pursuant to UN R.140, vehicles equipped with an ESC will have to meet certain performance requirements in such a way that the ESC system satisfies the directional stability criteria and responsiveness criteria.

The ESC will have to meet certain general requirements some of which are:

- i. The ESC shall be so designed, constructed and fitted as to enable the vehicle in normal use, despite the vibration to which it may be subjected, to comply with the provisions of this Regulation.
- ii. In particular, the ESC shall be designed, constructed, and fitted as to be able to resist the corroding and ageing phenomena to which it is exposed
- iii. The effectiveness of the ESC shall not be adversely affected by magnetic or electrical fields.

Vehicles equipped with an ESC will have to meet certain functional requirements in such a way that the ESC system:

- i. Can apply braking torques individually to all four wheels
- ii. Is operational over the full speed range of the vehicle, during all phases of driving including acceleration, coasting, and deceleration (including braking), except:
  - When the driver has disabled ESC;
  - When the vehicle speed is below 20 km/h;
  - When the vehicle is being driven in reverse.
- iii. Remains capable of activation even if the antilock braking system or traction control system is also activated.

### C. STEERING – UN Regulation No. 79 (UN R.79)<sup>36</sup>

**Scope:** Light duty vehicles and heavy-duty vehicles (cars, vans)

A steering wheel and the system it connects to primarily controls the direction of a vehicle. It converts rotational commands of the driver into swivelling movements of the vehicle's wheels. UN Regulation No. 79 (UN R.79) establishes uniform provisions concerning the approval of vehicles with regard to steering equipment. The intention of this regulation is to establish minimum provisions for the layout and performance of steering systems fitted to vehicles used on the road.

The scope of this Regulation applies to the steering equipment of vehicles of categories M, N and O<sup>37</sup>.

According to UN R.79, construction provisions of a steering shall be such that:

- i. The steering system shall ensure easy and safe handling of the vehicle up to its maximum design speed or in case of a trailer up to its technically permitted maximum speed.
- ii. It shall be possible to travel along a straight section of road without unusual steering correction by the driver and without unusual vibration in the steering system at the maximum design speed of the vehicle.

<sup>34</sup> Vehicles designed and constructed for the carriage of passengers and comprising no more than eight seats in addition to the driver's seat, and having a maximum mass ("technically permissible maximum laden mass") not exceeding 3,5 tons

<sup>35</sup> Vehicles for the carriage of goods and having a maximum mass not exceeding 3,500kg

<sup>36</sup> UN R.79: Addenda to the 1958 Agreement (Regulations 61-80) | UNECE

<sup>37</sup> M: Motor vehicles having at least four wheels and for the carriage of passengers; N: Power-driven vehicles having at least four wheels and for the carriage of goods; O: Trailers (including semitrailers)

- iii. The direction of operation of the steering control shall correspond to the intended change of direction of the vehicle and there shall be a continuous relationship between the steering control deflection and the steering angle.
- iv. The steering equipment shall be designed, constructed, and fitted in such a way that it can withstand the stresses arising during normal operation of the vehicle, or combination of vehicles. The maximum steering angle shall not be limited by any part of the steering transmission unless specifically designed for this purpose.

#### Requirements for Power Steering and Maximum Application Force

There are different types of steering equipment, and they are primarily distinguished based on the way the steering forces are produced.

For motor vehicles there are the Main steering equipment, Self-tracking steering equipment, and Auxiliary steering equipment.

**Main steering system:** steering equipment of a vehicle which is mainly responsible for determining the direction of travel. It may comprise of

- i. Manual steering equipment: in which the steering forces result solely from the muscular effort of the driver.
- ii. Power assisted steering equipment: in which the steering forces result from both the muscular effort of the driver and the energy supply. The steering forces can be provided by the muscular effort of the driver alone if there is a fault in the steering (integrated power systems)
- iii. Full-power steering equipment" in which the steering forces are provided solely by one or more energy supplies.

**Self-tracking steering** is a system designed to create a change of steering angle on one or more wheels only when acted upon by forces and/or moments applied through the tyre to road contact.

**Auxiliary steering equipment** is a system in which the wheels on axle(s) of vehicles of categories M and N are steered in addition to the wheels of the main steering equipment in the same or opposite direction to those of the main steering equipment and/or the steering angle of the front and/or the rear wheels may be adjusted relative to vehicle behaviour

The Full-power steering equipment is a main steering system in which the steering forces are provided by solely one or more energy supplies.

The Full-power steering system shall be designed:

- i. Such that the vehicle cannot be driven indefinitely at speeds above 10 km/h where there is any fault which requires operation of the warning signal referred to in (i) above under construction provisions
- ii. In case of a failure within the control transmission, except for those parts listed in (iv) above (construction provisions) it shall still be possible to steer with the performance laid down in this Regulation for the intact steering system.
- iii. In the event of a failure of the energy source of the control transmission, it shall be possible to carry out at least 24 "figure of eight" manoeuvres, where each loop of the figure is 40 m diameter at 10 km/h speed.
- iv. In the event of a failure within the energy transmission, there shall not be any immediate changes in steering angle.

#### UN R.79 also makes provisions for warning signals in case of a steering fault such that:

- i. Any fault which impairs the steering function and is not mechanical in nature shall be signalled clearly to the driver of the vehicle. For instance, in the case of a motor vehicle, an increase in steering force is considered to be a warning indication; in the case of a trailer, a mechanical indicator is permitted.
- ii. Optical warning signals shall be visible, even by daylight and distinguishable from other alerts; the satisfactory condition of the signals shall be easily verifiable by the driver from the driver's seat; the failure of a component of the warning devices shall not entail any loss of the steering system's performance.
- iii. Acoustic warning signals shall be by continuous or intermittent sound signal or by vocal information. Where vocal information is employed, the manufacturer shall ensure that the alert uses the language(s) of the market into which the vehicle is sold. Acoustic warning signals shall be easily recognized by the driver.
- iv. Requirement for power steering and maximum application force.

## D. TYRES -UN Regulation No. 30, UN Regulation No. 75 and UN Regulation No. 54

### UN Regulation No. 30 (UN R.30)<sup>38</sup>

**Scope:** covers new pneumatic tyres designed primarily, but not only, for vehicles in categories M<sub>1</sub>, O<sub>1</sub><sup>39</sup> and O<sub>2</sub><sup>40</sup>. It does not apply to tyres designed for:

- i. The equipment for vintage cars
- ii. Competitions

A tyre is a strong, flexible rubber casting that surrounds a wheel's rim to transfer the load of a vehicle from the axle through the wheel to the ground and to provide traction on the surface over which the wheel travels.

UN R.30 establishes the uniform provisions concerning the approval of pneumatic tyres for motor vehicles and their trailers.

Pursuant to UN R.30, Pneumatic tyres submitted for approval are required to meet the requirements detailed in this regulation and it covers:

- i. **Dimensions of Tyres:** The dimensions of the tyre are calculative procedures that are used to determine the section width of the tyre, outer diameter of the tyre, tyre-section width specifications, tyre-outer diameter specifications. In-depth details of the calculation process can be found in the Regulation.
- ii. **Load speed performance test:** This is used to verify the capability of the tyre of being used under maximum normal load at maximum speed of a tyre for a defined duration when it is correctly inflated. A tyre which after undergoing the load/speed test does not exhibit any tread separation, ply separation, cord separation, chunking or broken cords shall be deemed to have passed the test.
- iii. **Tread-wear Indicator:** Tread wear indicator bars are small, raised bars found within the grooves of your tires between the tread markings. The pneumatic tyre shall include not less than six transverse rows of wear indicators, approximately equally spaced and situated in the principal grooves of the tread. The tread-wear indicators shall be such that they cannot be confused with the rubber ridges between the ribs or blocks of the tread.
- iv. **Relevant markings:** Dimensions, load capacity, speed index, [production date, maximum inflation pressure], special applications (e.g., snow, re-enforced, run-flat) and approval mark.

The application for approval of a type of pneumatic tyre shall be submitted by the holder of the trade name or mark or by his duly accredited representative. The application shall specify details of the tyre such as: The tyre-size designation, the trade name or mark, the speed category, load capacity index of the tyre, measuring rim and test rim etc.

If the pneumatic tyre submitted for approval in pursuance of this Regulation meets the requirements basic on UN R.30, approval of that type of tyre shall be granted and an approval number shall be assigned to each type approved.

### UN Regulation No. 75 (UN R.75)<sup>41</sup>

**Scope:** This Regulation applies to new pneumatic tyres for motorcycles and mopeds.

For motorcycles and mopeds, tyres would be expected to meet certain requirements and they are:

- i. **Dimension requirement:** Dimension requirement of the tyres includes the section width, and outer diameter, of the tyre. The section width is the linear distance between the outsides of the side walls of an inflated pneumatic tyre, excluding elevations due to labelling (marking), decoration or protective bands or ribs and the outer diameter is the overall diameter of an inflated new pneumatic tyre.
- ii. **Load/speed performance test:** The tyre shall undergo a load/speed performance test with detailed test description given in UN R.75. This test is used to determine the maximum load weight that a tyre is meant to carry and a tyre that does not exhibit any tread separation, ply separation, cord separation chunking, or broken cords shall be deemed to have passed the test.

<sup>38</sup> Addenda to the 1958 Agreement (Regulations 21-40) | UNECE

<sup>39</sup> Trailers with a maximum mass not exceeding 750kg

<sup>40</sup> Trailers with a maximum mass exceeding 750 kg but not exceeding 3,500 kg

<sup>41</sup> Addenda to the 1958 Agreement (Regulations 61-80) | UNECE

- iii. Dynamic growth of tyres: Tyres that are deemed to have passed the load/speed performance requirements will be submitted for a dynamic growth test. This test is used to determine the maximum growth of a tyre due to the effect of the centrifugal force at the maximum permissible speed

#### UN Regulation No. 54 (UN R.54) <sup>42</sup>

**Scope:** This Regulation applies to pneumatic tyres for heavy duty vehicles including buses, coaches, trucks and heavy trailers.

Heavy duty vehicles are expected to meet the following requirement:

- i. **Dimension requirement:** Dimension requirement of the tyres includes the section width, and outer diameter, of the tyre. The section width is the linear distance between the outsides of the side walls of an inflated pneumatic tyre, excluding elevations due to labelling (marking), decoration or protective bands or ribs and the outer diameter is the overall diameter of an inflated new pneumatic tyre.
- ii. **Load/speed endurance test:** The tyre shall undergo a load/speed endurance test with detailed test description given in UN R.54. This test is used to determine the maximum load weight that a tyre is meant to carry and a tyre that does not exhibit any tread separation, ply separation, cord separation chunking, or broken cords shall be deemed to have passed the test.
- iii. **Other specificities of interest:** Tyres which have the symbol "Ω" at least 20 mm in diameter, or the word "REGROOVABLE", moulded into or on to each sidewall can be regrooved allowing for a longer use or lifespan.

For increasing tyres lifetime, tyres can be retreaded by replacing the worn tread with new material. It may also include renovation of the outermost sidewall surface (e.g., Additional Sidewall Protection) and replacement of the crown plies or the protective breaker (more information see UN Regulation No. 109) <sup>43</sup>

#### E. MECHANICAL COUPLING – UN Regulation No. 55 <sup>44</sup>

**Scope:** It applies to devices and components intended for motor vehicles and trailers.

This Regulation lays down the requirements which mechanical coupling devices and components shall meet to be regarded internationally as being mutually compatible. Mechanical coupling devices and components mean all those items on the frame, load-bearing parts of the bodywork and the chassis of the motor vehicle and trailer by means of which they are connected to form the combination of vehicles or the articulated vehicles. Fixed or detachable parts for the attachment or operation of the mechanical coupling device or component are included in UN Regulation No. 55 established uniform provisions concerning the approval of mechanical coupling components of combinations of vehicles.

##### Some General Requirements for Mechanical Coupling Devices or Components

- i. All parts of the mechanical coupling device or component whose failure could result in separation of the vehicle and trailer shall be made of steel. Other materials may be used provided that equivalence has been demonstrated by the manufacturer to the satisfaction of the Type Approval Authority or Technical Service of the Contracting Party applying this Regulation.
- ii. The device shall undergo series of test to ensure there will be no cracks, fractures or any excessive permanent distortion which would be detrimental to the satisfactory operation of the device or component.
- iii. The mechanical coupling devices or components shall be designed and manufactured such that in normal use and with correct maintenance and replacement of wearing parts they will continue to function satisfactorily and retain the characteristics prescribed by this Regulation.
- iv. The mechanical coupling devices or components shall be safe to operate and coupling and uncoupling shall be possible by one person without the use of tools. With the exception of Class T couplings only devices which allow automatic coupling shall be allowed for the coupling of trailers having a maximum technically permissible mass greater than 3,500kg.

<sup>42</sup> Addenda to the 1958 Agreement (Regulations 41-60) | UNECE

<sup>43</sup> UN Regulation No. 109

<sup>44</sup> Addenda to the 1958 Agreement (Regulations 41-60) | UNECE



### 7.1.1. Passive Safety

Passive safety refers to the safety components that protect the occupants of a vehicle and other road users in case of a car crash or collision. These safety features reduce the impact of an accident or level of injury and mitigate consequences of an accident during and after impact. In other words, these safety feature mitigates consequences of an accident during or after impact as from the moment that the first contact is made.

These features are very important because they can be the difference between life and death after a road accident or car crash.

**Figure 3** Helmet Use



Photo by: Njideka Jane Obikwelu

#### A. PROTECTIVE HELMETS AND VISORS – UN Regulation No. 22 <sup>45</sup>

**Scope:** This Regulation applies to protective helmets for drivers and passengers of mopeds and of motorcycles with or without sidecar 1/ and to the visors fitted to such helmets or intended to be added to them.

A protective helmet means a helmet primarily intended to protect the wearer's head against impact. Some helmets may provide additional protection. A helmet works in three ways:

- i. It prevents direct contact between the skull and the impacting object by acting as a mechanical barrier between the head and the object.
- ii. It spreads the forces of the impact over a greater surface area so that they are not concentrated on a particular area of the skull; and
- iii. It absorbs the impact energy and reduces the magnitude of the forces transmitted to the skull and brain.

UN Regulation No. 22 establishes uniform provision concerning the approval of protective helmets and their visors for drivers and passengers of motorcycles and mopeds.

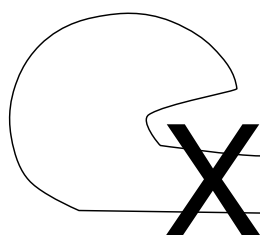
<sup>45</sup> Addenda to the 1958 Agreement (Regulations 21-40) | ECE

**General Specifications:**

The basic construction of the helmet shall be in the form of a hard outer shell, containing additional means of absorbing impact energy, and a retention system. No component or device may be fitted to or incorporated in the protective helmet unless it is designed in such a way that it will not cause injury and that, when it is fitted to or incorporated in the protective helmet, the helmet still complies with the requirements of this Regulation.

The protective helmet may be fitted with ear flaps and a neck curtain. It may also have a detachable peak, a visor and a lower face cover. If fitted with a non-protective lower face cover the outer surface of the cover shall be marked "Does not protect chin from impacts" and/or with the symbol shown in figure 4 below indicating the unsuitability of the lower face cover to offer any protection against impacts to the chin.

**Figure 4** Does not protect chin



Source: UNECE, UN Regulation No. 22

see: <https://unece.org/transport/vehicle-regulations-wp29/standards/addenda-1958-agreement-regulations-21-40>

Each helmet type fitted with a visor shall undergo three major tests:

- i. Impact absorption test,
- ii. Rigidity test and
- iii. Retention (detaching) test.

The largest size of each helmet type shall be tested for impact absorption and rigidity. For tests of the retention system, helmet sizes shall be chosen such that the helmet to be tested shall be that offering the least favourable conditions (such as thickest padding, etc). Additionally, for each smaller head-form size within the size range of the helmet type two helmets shall undergo the impact absorption test. One helmet shall be heat conditioned, and the other low temperature conditioned. The conditioned helmets shall be impacted against either anvil, in equal numbers, if possible, at the choice of the laboratory.

Other important tests to be conducted here are:

- i. The Visor test: where the visor is means a transparent protective screen extending over the eyes and covering all or part of the face
- ii. Tests on the chinstrap like micro-slip test, test for resistance to abrasion, and ease of release test for the chin strap

A good quality helmet is made with expanded polystyrene (EPS) lining that absorbs the impact to the head in a crash, decreasing the severity of serious head or brain injury. The lining is covered with a hard outer shell that cushions the head and reduces the extent of trauma. For maximum protection, the helmet must fit on the head and have strong straps to ensure the helmet will stay on in the event of a crash.

## B. SAFETY/SEAT BELT ANCHORAGE – UN Regulation No. 14 (UN R.14) <sup>46</sup>

**Scope:** All motor vehicles

Safety belts and safety belt anchorages are critical safety items for passengers in case of sudden acceleration/deceleration and accidents. A safety-belt without proper anchorage does not serve any purpose. The strength of vehicle safety-belt anchorage is an important index of vehicle safety regulations and in the event of a collision, the tearing or rupture surrounding the seat belt anchorages can be the main cause of casualties.

For this regulation, a safety-belt anchorage means the parts of the vehicle structure or the seat structure or any other part of the vehicle to which the safety-belt assemblies are to be secured.

The UN Regulation No. 14 establishes the uniform provisions concerning the approval of vehicles with regard to safety-belt anchorages.

Subject to the application of this UN Regulation, anchorages for safety-belts shall be so designed, made and situated as to:

- i. Enable the installation of a suitable safety-belt. The safety-belt anchorages of the front outboard positions shall be suitable for safety-belts incorporating a retractor and pulley.
- ii. Reduce to a minimum the risk of strap damage due to contact with sharp rigid parts of the vehicle or seat structure.
- iii. Reduce to a minimum the risk of the belt's slipping when worn correctly.
- iv. Enable the vehicle, in normal use, to comply with the provisions of this UN Regulation.

For anchorages which take up different positions to allow persons to enter the vehicle and to restrain the occupants, the specifications of this UN Regulation shall apply to the anchorages in the effective restraint position.

After production of safety anchorage, tests will be carried out to ensure they meet the desired specification therefore, subject to provisions of UN R.14 or at the request of the manufacturer, tests may be carried out either on a vehicle structure or on a finished vehicle. The test may be restricted to the anchorages relating to only one seat or one group of seats on the condition that:

- i. The anchorages concerned have the same structural characteristics as the anchorages relating to the other seats or group of seats; and
- ii. Where such anchorages are fitted totally or partially on the seat or group of seats, the structural characteristics of the seat or group of seats are the same as those for the other seats or groups of seats.

### Test requirements for safety-belt anchorages:

- i. General test requirements for safety-belt anchorages: All the safety-belt anchorages of the same group of seats shall be tested simultaneously. However, if there is a risk that non-symmetrical loading of the seats and/or anchorages may lead to failures, an additional test may be carried out with non-symmetrical loading. etc.
- ii. Specific test requirements for safety-belt anchorages: These are test carried out in configuration of a three-point incorporating a retractor having a pulley or strap guide at the upper belt anchorage.
- iii. At the request of the car manufacturer, a dynamic sled test can be performed as an alternative to general test requirements and specific test requirement for safety-belt anchorages.

## C. SAFETY-BELTS – UN Regulation No. 16 (UN R.16) <sup>47</sup>

**Scope:** All motor Vehicles

An arrangement of straps with a securing buckle, adjusting devices and attachments which is capable of being anchored to the interior of a power-driven vehicle and is designed to diminish the risk of injury to its wearer, in the event of collision or of abrupt deceleration of the vehicle, by limiting the mobility of the wearer's body. Such an arrangement is generally referred to as a "belt assembly", which term also embraces any device for absorbing energy (tension release) or for retracting the belt. The safety belt is designed to minimise the risk of injury in an accident or incident by restraining your movements.

<sup>46</sup> UN R.14: Addenda to the 1958 Agreement (Regulations 0-20) | UNECE

<sup>47</sup> UN R.16: Addenda to the 1958 Agreement (Regulations 0-20) | UNECE

The UN Regulation No. 16 (UN R.16) establishes uniform provisions concerning the approval of:

- i. Safety-belts, restraint systems, child restraint systems and ISOFIX<sup>48</sup> child restraint systems for occupants of power-driven vehicles.
- ii. Vehicles equipped with safety-belts, safety-belt reminders, restraint systems, child restraint systems, ISOFIX child restraint systems and i-Size child restraint systems<sup>49</sup>.

**Safety-belt specifications:** According to the purview of the safety belts, it shall have the following specifications:

- i. General Specifications: The belt or restraint system shall be so designed and constructed that, when correctly installed and properly used by an occupant, its satisfactory operation is assured, and it reduces the risk of bodily injury in the event of an accident. The straps of the belt shall not assume a dangerous configuration.
- ii. Rigid Parts: The rigid parts of the safety-belt, such as buckles, adjusting devices, attachments, and the like, shall not have sharp edges liable to cause wear or breakage of the straps by chafing. The rigid parts intended to absorb energy or to be subjected to or to transmit a load shall not be fragile.
- iii. Buckle: The buckle shall be so designed as to preclude any possibility of incorrect use. This means, among other things, that it shall not be possible for the buckle to be left in a partially-losed condition. Two belts or restraint system are required for the buckle inspection some of the test performed here are the buckle durability.
- iv. Straps: The characteristics of the straps shall be such as to ensure that their pressure on the wearer's body is distributed as evenly as possible over their width and that they do not twist even under tension. They shall have energy-absorbing and energy-dispersing capacities. The straps shall have finished selvages which shall not become unravelled in use.
- v. Belt assembly or restraint system: This system shall undergo the Dynamic and Static tests to assess the dynamic performance and breaking strength of the belt under specific conditions as described in the Regulation.

To ensure safety belts meets the required specifications, different parts of the safety belt will undergo several tests like the micro-slip test, the corrosion test, conditioning of straps for the breaking-strength test, etc. Once the required tests are complete, approval is granted by the country's national authority for commercialization. UN R.16 also covers certain requirements concerning the installation of safety belts in the vehicle.

#### D. SEATS/HEAD RESTRAINTS (HEADRESTS) – UN Regulation No. 17, No.25. (UN R.17<sup>50</sup>, UN R.25<sup>51</sup>)

**Scope:** All motor vehicles of categories M<sub>1</sub>, M<sub>2</sub>, M<sub>3</sub> and N but does not apply to vehicles with side-facing or rearward-facing seats.

**Seats** means a structure which may or may not be integral with the vehicle structure complete with trim, intended to seat one person. Depending on its orientation, a seat is defined as:

- i. **Forward-facing seat;** means a seat which can be used whilst the vehicle is in motion, and which faces towards the front of the vehicle.
- ii. **Rearward-facing seat;** means a seat which can be used whilst the vehicle is in motion, and which faces towards the rear of the vehicle.
- iii. **Side-facing seat;** means a seat which can be used whilst the vehicle is in motion, and which faces towards the side of the vehicle.

Head restraint (also publicly known as headrest) is an automotive device whose function is to limit the rearward displacement of an adult occupant's head in relation to his torso in order to reduce the danger of injury to the cervical vertebrae of that occupant in the event of an accident. A head restraint can be:

- i. Integrated head restraint means a head restraint constituted by the upper part of the seat back which cannot be detached from the seat or the vehicle structure except by the use of tools or following the partial or total removal of the seat furnishings.

<sup>48</sup> ISOFIX is a system of attachment points for the connection of child restraint systems to vehicles.

<sup>49</sup> i-Size child restraint systems are restraint systems based on the child's height

<sup>50</sup> UN R.17: Addenda to the 1958 Agreement (Regulations 0-20) | UNECE

<sup>51</sup> UN R.25: Addenda to the 1958 Agreement (Regulations 21-40) | UNECE

- ii. Removable head restraint means a head restraint constituted by a component separable from the seat, designed for insertion and positive retention in the seat back structure.
- iii. Separate head restraint means a head restraint constituted by a separate component of the seat, designed for insertion and/or positive retention in the structure of the vehicle.

UN R.17 establishes uniform provisions concerning the approval of vehicles with regards to the seats, their anchorages, and any head restraints while UN R.25 establishes uniform provisions concerning the approval of head restraint (headrest), whether or not incorporated in vehicle seats.

### Required Tests

In accordance with UN R.17 a vehicle will be submitted for approval to assess if it meets the relevant requirement of seats fitted with head restraints or seats capable of being fitted with head restraints. Pursuant to this regulation, tests are carried out to:

- i. Test of the strength of the seat-back and its adjustment systems
- ii. Test of the strength of the seat anchorage and the adjustment, locking and displacement systems.
- iii. Test of the performance of the head restraint
- iv. Determination of the height of the head restraint
- v. Determination of the width of the head restraint
- vi. Test for checking energy dissipation on the seat-back and head restraint.
- vii. Test of of the rear parts of seat backs and the design of devices intended to protect the occupants from the danger resulting from the displacement of luggage.
- viii. Determination of whiplash injuries (Neck Injury Criteria (NIC)) with the use of the BioRID II UN dummy to seats having a design torso angle no less than 20° and no greater than 30°. However, at the manufacturer's request, seats with a design torso angle between 15° and 20° may be tested at a torso angle of 20° or the closest locking position above.

According to UN R.25 the presence of a head restraint in a vehicle shall not be an additional cause of danger to occupants of the vehicle, in particular it shall not in any position of use exhibit any dangerous roughness or sharp edge liable to increase the risk or seriousness of injury to the occupants.

Parts of the front and rear faces of the head restraint (excluding parts of the rear faces of head restraints designed to be installed in seats behind which no other seating positions are provided) shall be so padded so as to prevent any direct contact of the head with the components of the structure.

Tests carried out within the purview of UN. R25 are done in order to:

- i. Determine the reference point of the seat to which the head restraint is incorporated: The head restraint shall be anchored to the seat or, where appropriate, to the vehicle structure, in such a way that no rigid and dangerous part projects from the padding of the head restraint, from the anchorage or from the seat back as a result of the pressure exerted by the head during the test.
- ii. Determine the height of the head restraint: test is carried out to determine the height of the head restraint such as to provide suitable support for the head of a person normally seated.
- iii. Determine the width of the head restraint: test is carried out to determine the width of the head restraint such as to provide suitable support for the head of a person normally seated.
- iv. Determine the effectiveness of the device: here, the effectiveness of the head restraint shall be checked by a static test.

Determination of head restraint gaps.

### E. FRONTAL COLLISION – UN Regulation No. 94 (UN R.94)<sup>52</sup>

**Scope:** vehicles of category M1 (passenger cars) of a total permissible mass not exceeding 3,500 kg and to vehicles of category N1 (small trucks) of a total permissible mass not exceeding 2,500 kg; other vehicles may be approved at the request of the manufacturer.

UN Regulation No. 94 (UN R. 94) establishes uniform provisions concerning the approval of vehicles with regard to the protection of the occupants in the event of a frontal collision.

Frontal collision test is a crash test whose readings are used to assess protection given to adult occupants in the front seat of a vehicle.

For safety requirements, a frontal collision test provides insight on the protection offered by the vehicle itself to the occupants in the front seat of a vehicle. Test procedures for accurate frontal collision of a vehicle shall be representative of the series production, it shall include all the equipment normally fitted in the vehicle and shall be in normal running order.

The protective system for the front seating positions during the test shall:

- i. Include belt and the belt components shall meet the requirements of UN R.16.
- ii. Include anchorage points when the protective system for the front seats includes belts provided the anchorage point conforms to UN R.14.
- iii. Be equipped with airbags for seats: for a vehicle, designed to be fitted with an airbag assembly intended to protect the driver, this information shall consist of the inscription "AIRBAG" located in the interior of the circumference of the steering wheel.

#### Tests Carried Out:

The tests carried out to assess the protective component in the event of frontal collision shall be carried out in accordance with the methods described in UN R.94 and it shall be considered satisfactory if the following are satisfied at the same time.

- i. The Head Performance Criterion (HPC) is satisfied. The HPC is considered satisfied when, during the test procedure, there is no contact between the head and any vehicle component.
- ii. The following bodily criteria are satisfied at the same time:
  - Injury criteria for the neck (NIC),
  - Thorax compression criterion (ThCC),
  - The femur force criterion (FFC),
  - Tibia compression force criterion,
  - Tibia index (TI) and
  - The movement of the sliding knee joints shall all be satisfied.
- iii. Following the test, the residual steering wheel displacement, when measured at the centre of the steering wheel hub, shall not exceed 80mm in the upwards vertical direction and 100mm in the rearward horizontal direction.
- iv. No door shall open during the test.
- v. After the impact the door shall be unlocked.
- vi. After the impact, it shall be possible, without the use of tools, except for those necessary to support the weight of the dummy to:
  - Open at least one door.
  - To release the dummies from their restraint system.
  - To remove the dummies from the vehicle without adjustment of the seats.

<sup>52</sup> UN R.94: Addenda to the 1958 Agreement (Regulations 81-100) | UNECE

- vii. In the case of a vehicle propelled by liquid fuel, no more than slight leakage of liquid from the fuel feed installation shall occur on collision.
- viii. Pursuant to this Regulation if the vehicle type submitted for approval meets the requirements above and all requirements of this regulation, approval of that vehicle type shall be granted.

#### F. LATERAL COLLISION/POLE SIDE IMPACT – UN Regulation No. 95, 135 (UN R.95<sup>53</sup>, UN R.135<sup>54</sup>)

**Scope:** Vehicles of category M1 with a maximum permissible mass not exceeding 3,500 kg and to vehicles of category N1.

Lateral collision impact involves a vehicle travelling sideways into rigid roadside objects such as trees or poles. Often this is the result of a loss of control on the part of the driver, owing to speeding, misjudgement of a corner or because of a skid in slippery conditions. Compared to a frontal impact, there is very little space inside the vehicle interior in which to absorb energy and as a result, severe injury to the head and the chest can be common.

The UN Regulation No. 95 (UN R.95) establishes uniform provisions concerning the approval of vehicles with regard to the protection of occupants in the event of a lateral collision. It establishes the uniform provisions concerning the approval of vehicles with regard to their pole side impact performance (PSI).

Similar to the frontal collision, tests shall be carried out to examine the safety condition of the vehicle passengers using a dummy to assess:

- i. Head Performance Criterion,
- ii. The thorax performance criteria,
- iii. The pelvis performance criterion and
- iv. The Abdomen performance criterion.

During these tests, some important tests requirements needed to ensure safety after a lateral collision impact are:

- i. No door shall open during the test.
- ii. After the impact, the side doors on the non-struck side shall be unlocked.
- iii. After the impact, it shall be possible without the use of tools to:
- iv. Open a sufficient number of doors provided for normal entry and exit of passengers, and if necessary, tilt the seatbacks or seats to allow evacuation of all occupants
- v. Release the dummy from the protective system
- vi. Remove the dummy from the vehicle
- vii. No interior device or component shall be detached in such a way to increase risk of injury
- viii. Ruptures, resulting from permanent deformation are acceptable, provided these do not increase the risk of injury, etc.

If the vehicle type submitted for approval pursuant to UN R.95 and UN R.135 meets the specifications and test requirements, approval of that vehicle type shall be granted. An approval number shall be assigned to each type approved. Its first two digits (at present 03 corresponding to the 03 series of amendments) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party may not assign the same approval number to another vehicle type.

#### G. PEDESTRIAN SAFETY – UN Regulation No. 127 (UN R.127)<sup>55</sup>

**Scope:** Applies to motor vehicles of categories M1 and N1

Pedestrian safety performance focuses on mitigating a pedestrian's impact with a car in the case of collision. Pedestrians are particularly the most vulnerable ones in the effect of a collision or accidents. In most accidents, the pedestrian collides with

<sup>53</sup> UN R.95: Addenda to the 1958 Agreement (Regulations 81-100) | UNECE

<sup>54</sup> UN R.135: Addenda to the 1958 Agreement (Regulations 121-140) | UNECE

<sup>55</sup> UN R.127: Addenda to the 1958 Agreement (Regulations 121-140) | UNECE

the front of the vehicle. UN R.127 establishes the uniform provisions concerning the approval of motor vehicles regarding their pedestrian safety performance.

For cases of car-pedestrian crashes, the moving speed of the vehicle has a direct impact on the injury level of the pedestrian as well as the rate of fatality. Speed has been identified as a key risk factor in such crashes. Pedestrians have been shown to have a 90 per cent chance of survival when struck by a car travelling at 30km/h or below but have a less than 50 per cent chance of surviving an impact at 45km/h. however, pedestrians have almost no chance of surviving an impact at 80km/hr<sup>56</sup>. Most attempts at reducing pedestrian deaths had historically focused solely on education and traffic regulation. Since the 1970s crash engineers began to use design principles that have proven successful in protecting car occupants to develop vehicle design concepts that can reduce the likelihood of injuries to pedestrians in the event of a car-Pedestrian crash.

UN R.127 pedestrian safety protection involves the use of design principles that have proven successful in protecting car occupants to develop vehicle design concepts that reduce the likelihood of injuries to pedestrians in the event of a car-pedestrian crash.

These involve redesigning the bumper, hood (bonnet), the windshield and pillar to be energy absorbing (softer) without compromising the structural integrity of the car.

Though, head injuries may receive the most attention because of their frequency and severity, the most frequently injured body region is the lower extremity. The initial contact between vehicle and pedestrian is almost always between the vehicle bumper and pedestrian lower extremity.

Pedestrian knee ligament injuries and lower leg fractures are among the most debilitating long-term injuries in motor vehicle crashes. Expert engineers focus on redesigning vehicles to mitigate these pedestrian injuries through improved vehicle bumper systems. The aim of UN R.127 is to understand the car-pedestrian interaction, which is characterized by several tests to assess the possible damages that can occur in the case of a pedestrian collision, and they are:

- i. Legform test to bumper
- ii. Flexible lower legform to bumper
- iii. Upper legform to bumper
- iv. Headform tests

These tests are carried out with design principles applied to the vehicle with an aim to assess the level of protection given to a pedestrian in case of a car-pedestrian crash such that the above tests are fulfilled. The Contracting Parties to the Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the Type Approval Authorities which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval are to be sent.<sup>57</sup>

#### H. CHILD RESTRAINTS – UN Regulation No. 44 (UN R.44)<sup>58</sup>

**Scope:** To child restraint systems which are suitable for installation in power-driven vehicles having three or more wheels, and which are not intended for use with folding (tip-up) or with side-facing seats.

Child restraint system is an arrangement of components which may comprise the combination of straps or flexible components with a securing buckle, adjusting devices, attachments and in some cases a supplementary device as a carrycot, infant carrier, a supplementary chair and/or an impact shield, capable of being anchored to a power-driven vehicle. It is so designed as to diminish the risk of injury to the wearer, in the event of a collision or of abrupt deceleration of the vehicle, by limiting the mobility of the wearer's body. A child restraint is a device used to protect a child in a motor vehicle and they are important because babies and children are the most vulnerable road users.

ISOFIX: is a system for the connection of child restraint systems to vehicles which has two vehicle rigid anchorages, two corresponding rigid attachments on the child restraint system and a mean to limit the pitch rotation of the child restraint system.

The UN Regulation No. 44 (UN R.44) addresses the uniform provision concerning the approval of restraining devices for child occupants of power-driven vehicles ("Child Restraint System").

<sup>56</sup> WHO on Road Traffic Injuries - Road safety (who.int)

<sup>57</sup> <https://unece.org/transport/vehicle-regulations-wp29/standards/addenda-1958-agreement-regulations-121-140>

<sup>58</sup> <https://unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/2015/r44r3e.pdf>



Child restraints fall into five “mass groups”:

- i. Group 0 for children of a mass less than 10 kg.
- ii. Group 0+ for children of a mass less than 13 kg.
- iii. Group I for children of mass from 9 kg to 18 kg.
- iv. Group II for children of mass from 15 kg to 25 kg.
- v. Group III for children of mass from 22 kg to 36 kg.

According to UN R.44, child restraints system are required to meet some general specifications as well as particular specification as described in Regulation 44.

#### General Specifications:

- i. The child Restraint’s positioning and securing on the vehicle: Child restraint can be positioned in front or rear seat position according to categories such as “universal”, “semi-universal”, “restricted”, “specific vehicle” as long as the restraints are fitted in conformity with the manufacturer’s instructions.
- ii. Configuration: The restraint gives the required protection in any intended position of the restraint system.

#### Particular Specifications:

- i. These are provisions applicable to the assembled restraint:  
A complete child restraint shall be subject to the corrosion test, energy absorption, overturning test and dynamic test.
- ii. Provisions applicable to individual components of the restraint: These tests are carried out on individual components like:
  - Buckle,
  - Adjusting device to assess the ease of adjustment
  - Retractors
  - Straps and
  - ISOFIX attachment device.

Each sample submitted in for approval will have to meet the specifications set forth in specification and test requirements covered in this Regulation in every respect before approval can be granted. Once approvals are granted, an approval number shall be assigned to each child restraint type approved.

Its first two digits (at present 04 corresponding to the 04 series of amendments which entered into force on 12 September 1995) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval.

## I ELECTRIC POWER TRAINED VEHICLE and BATTERY SAFETY – UN Regulations No. 100<sup>59</sup>

**Scope:** The scope of this Regulation applies to two parts:

**Part I:** Safety requirements with respect to the electric power train of light duty vehicles with a maximum design speed exceeding 25 km/h and operated by electric power.

**Part II:** Safety requirements with respect to the Rechargeable Energy Storage System (REESS), of road vehicles of categories M and N equipped with one or more traction motors operated by electric power.

Rechargeable Energy Storage System (REESS)“ means the rechargeable energy storage system that provides electric energy for electric propulsion.

#### Main Elements of the UN. Reg 100

- i. It is performance-oriented and technology neutral.
- ii. It is Not design specific that it may prevent future technologies.

<sup>59</sup> <https://unece.org/transport/vehicle-regulations-wp29/standards/addenda-1958-agreement-regulations-81-100>

- iii. It addresses potential risks of Electric Vehicles (EVs) in use or after a crash event.
- iv. Provides protection from electrical shocks associated with the high voltage circuits of EVs.
- v. It addresses potential hazards associated with lithium-ion batteries.
- vi. Rechargeable Electrical Energy Storage System (REESS) (in particular, containing flammable electrolyte).

### Requirements for Electric Vehicle Safety

In part I, the UN Reg.100 makes provisions for:

- i. Protection against electrical shock (in use and in post-crash).
- ii. Protection from electrolyte spillage after a crash.
- iii. Fire protection.
- iv. Functional safety requirements.

### Requirements for REESS safety (In use and post-crash)

Part II UN Reg.100 makes provisions to ensure battery management system maintains the safety of the battery during use and after a crash. These provisions address risks from:

- i. Thermal shock and cycling
- ii. Mechanical shock/integrity/vibration
- iii. Fire resistance
- iv. External short circuit/overcurrent/overcharge/over-discharger protection
- v. Over-temperature protection
- vi. Thermal propagation
- vii. Water exposure resistance
- viii. Gas management

To ensure overall safety of vehicles equipped with a REESS containing flammable electrolyte, the occupants of the electric vehicle should not be exposed to a hazardous environment resulting from a thermal propagation (which is triggered by a single cell thermal runaway due to an internal short circuit or damage).

Thermal runaway begins when the heat generated within a battery exceeds the amount of heat that is dissipated to its surroundings and if the cause of the heat is not remedied, the condition will worsen. Potential triggers of thermal runaway include overcharging the battery, overheating the battery, exposure to high temperatures or mechanical shocks.

### Challenges Associated with Future Development

- i. For Thermal Propagation

To ensure protection from hazards resulting from thermal propagation,

- It is important to conduct Validation Tests at Global Scale to verify robustness in terms of repeatability and reproducibility of results before it is adopted.
- Validation in terms of Evaluated Intended Safety Characteristics is therefore necessary

- ii. REESS

Defining a uniformly applicable threshold (for giving warning before critical situation happens) is challenging because:

- Materials and designs of REESS are diverse
- Robustness of the REESS against failure has competitive nature and it is difficult to be standardized
- Determining a uniform Threshold is difficult as it depends on the vehicle system

### iii. Heavy Vehicles

- Adaptations from passenger cars to light commercial vehicles in necessary
- Applicability of some of the test and requirements on heavy duty vehicles in current draft is challenging
- It is advisable that technical discussion would start after the contents of the passenger cars/light commercial vehicles have been defined

## PHASE 2 of UN Regulation 100

An informal working group (IWG) of experts is carrying out technical work to address some relevant items in Phase 2 development of UN GTR No. 20 on Electric Vehicle Safety. The activities of this IWG are relevant for the future development of UN Regulation No. 100 since the present and future versions of the UN Regulation. 100 are and will be aligned to this UN GTR. Requirements of future amendments to the UN Regulation will address the following items:

- i. Water immersion test
- ii. Long-term fire resistance test
- iii. Rechargeable Electrical Energy Storage System (REESS) rotation tests
- iv. REESS vibration profile
- v. Flammability, toxicity, and corrosiveness of vented gas (i.e. detection and quantification of venting for tests addressing safety of REESS post-crash, potential risk of “toxic gases” from non-aqueous electrolyte)
- vi. Thermal propagation and methods of initiation in battery system
- vii. Post-crash REESS safety assessment and stabilization procedures
- viii. Protection during Alternating Current and Direct Current charging and feeding process
- ix. Overcurrent requirements plus test (component based)

The IWG is currently conducting research and running tests on thermal propagation, water immersion, toxicity and gas management and three-dimensional vibration to enhance safety performance of Electric Vehicles.

There may be hazards associated with the use of EVs and they depend on certain factors (like vehicle maintenance, ambient temperature of where it is driven, quality of the roads etc) however, there are technical research and work being carried out to mitigate these hazards.

UN Reg. 100, creates provisions that addresses the safety performance during in-use and post-crash of electric vehicles using science-based, data driven and performance-based approach to prevent the mismatch between the lab and the real world.

## J. ELECTRIC POWER TRAIN VEHICLES 136 <sup>60</sup>

**Scope:** This Regulation covers safety requirements with respect to electric power train vehicles and Rechargeable Electrical Energy Storage System (REESS) both of category L. It does not cover post-crash requirements of road vehicles.

Where, UN Regulation No. 136 establishes Uniform provisions concerning the approval of vehicles of category L with regard to specific requirements for the electric power train.

The requirement of a category L vehicle with regards to electric safety are:

- i. Protection against electric shock: These electrical safety requirements apply to high voltage buses under conditions where they are not connected to external high voltage power supplies.
- ii. Functional Safety: refers to a momentary indication, as minimum, that is given to the driver when the vehicle is in “active driving possible mode” This safety feature will be active even when the driver leaves the vehicle. The driver shall be informed by a signal (e.g. optical or audible signal) if the vehicle is still in the active driving possible mode.
- iii. Determination of hydrogen emissions to be carried out on all vehicles equipped with open type traction batteries.
- iv. Requirements of a Rechargeable Electrical Energy Storage System (REESS) with regard to its safety.

<sup>60</sup> Addenda to the 1958 Agreement (Regulations 121-140) | ECE

- v. Vibration test: The purpose of this test is to verify the safety performance of the REESS under a vibration environment which the REESS will likely experience during the normal operation of the vehicle.
- vi. Thermal shock and cycling teste: The purpose of this test is to verify the resistance of the REESS to sudden changes in temperature
- vii. Mechanical test: this test simulates a mechanical impact load which may occur at an unintended drop after REESS removal.
- viii. Fire resistance test: The purpose of this test is to verify the resistance of the REESS, against exposure to fire from outside of the vehicle due to e.g. a fuel spill from a vehicle (either the vehicle itself or a nearby vehicle). This situation should leave the driver and passengers with enough time to evacuate.
- ix. External short circuit protection: The purpose of this test is to verify the performance of the short circuit protection. This functionality, if implemented, shall interrupt, or limit the short circuit current to prevent the REESS from any further related severe events caused by short circuit current.
- x. Over-discharge protection: The purpose of this test is to verify the performance of the over-discharge protection. This functionality, if implemented, shall interrupt, or limit the discharge current to prevent the REESS from any severe events caused by a too low SOC <sup>61</sup> as specified by the manufacturer.
- xi. Over -temperature protection: The purpose of this test is to verify the performance of the protection measures of the REESS against internal overheating during the operation, even under the failure of the cooling function if applicable. In the case that no specific protection measures are necessary to prevent the REESS from reaching an unsafe state due to internal over-temperature, this safe operation must be demonstrated.

#### K. CABS OF COMMERCIAL VEHICLES – UN Regulation No. 29 <sup>62</sup>

**Scope:** This Regulation applies to vehicles with separate driver’s cab of category N<sub>1</sub> with regard to the protection of the occupants of the cab.

UN Regulation No. 29 establishes the uniform provisions concerning the approval of vehicles with regard to the protection of the occupants of the cab of a commercial vehicle. This Regulation therefore focuses on the protection of occupants in commercial vehicles.

##### General Requirements:

The cab of the vehicle shall be so designed and attached to the vehicle so as to eliminate to the greatest possible extent the risk of injury to occupants in the vehicle in the of an accident. To achieve this vehicles of categories N1 and N2 (not exceeding a gross mass of 7,500kg) shall be subjected to a series of test as briefly described below.

##### Test Procedures

- i. Front Impact Test: This test shall involve an impactor made of steel that strikes the cab in the front direction towards the rear of the cab. The direction of the impact shall be horizontal and shall be parallel to the median longitudinal plane of the vehicle. The result of test shall prove the safety of the vehicle in the case of a collision to the front of the cab.
- ii. Front Pillar Impact test: The impactor designated for this test shall be rigid and its mass shall be evenly distributed and not less 1,000kg. In the case of the front pillar impactor test, the impactor shall strike the cab at the front in the area of the windshield towards the direction of the rear of the cab. This test should be able to prove the strength of the protective pillars to which the windshield is connected, and it should be able to resist further injuries to the passengers of the cab.
- iii. Roof Strength Test: the impactor for this test shall be rigid and its mass shall be evenly distributed with a mass not less than 1,500kg. The impactor shall strike the upper side of the cab to certify its strength and it shall be done by a loading device to the roof of the cab corresponding to the maximum mass authorized for the front axle of axles of the vehicle. This test shall certify the strength of the roof and certify a balanced centre of gravity of the vehicle while loaded and in motion especially in the case of rotational motion.

<sup>61</sup> SOC is the available electrical charge in a tested device expressed as a percentage of its rated capacity

<sup>62</sup> Addenda to the 1958 Agreement (Regulations 21-40) | ECE

## 7.1.2. General safety

### A. GENERAL CONSTRUCTION OF BUSES AND COACHES – UN Regulation No. 107<sup>63</sup>

**Scope:** This scope applies to every single-deck, double deck, rigid-deck or articulated vehicle of category M2 or M3<sup>64</sup>.

The vehicles shall undergo certain tests to ensure they meet the minimum safety requirements.

- i. **General requirement:** If the driver's compartment is without a roof, the driver should have some special protection against strong wind, sudden dust, heavy rain etc. Provisions cover doors, emergency exits, steps, gangways, standing platforms, seats and wheelchair places and their fixings, as well as interior materials, among others.
- ii. **Stability test:** The stability of the vehicle shall be such that the point at which overturning occurs would not be passed if the surface on which the vehicle stands were tilted to both sides in turn to an angle of 28 degrees from the horizontal.
- iii. **Protection against fire risks:** This include series of tests and checks to ensure the vehicle is protected from threats of fire within and outside the bus and coach. Series of checks done in:
  - Engine compartment: No flammable sound-proofing material or material liable to become impregnated with fuel, lubricant or other combustible material shall be used in the engine compartment unless the material is covered by an impermeable sheet.
  - Electrical equipment and wiring: all cables shall be well insulated and all cables and electrical equipment shall be able to withstand the temperature and humidity conditions to which they are exposed. The engine compartment, attention shall be paid to their suitability to withstand the temperature and humidity conditions to which they are exposed. No cable used in an electrical circuit shall carry a current in excess of that acceptable for such a cable in the light of its mode of installation and the maximum ambient temperature.
  - Batteries: All batteries shall be well secured and easily accessible, and the battery compartment shall be protected from the risk of short circuit.
  - Fire extinguishers and first-aid equipment: Space shall be provided for the fitting of one or more fire extinguishers (one being near the driver's seat) and or more first-aid kits.
  - Fire detection: Vehicles shall be equipped with an alarm system detecting either an excess temperature or smoke in toilet compartments, driver's sleeping compartments and other separate compartments.

### B. GENERAL SAFETY GLAZING – UN Regulation No. 43 (UN R.43)<sup>65</sup>

**Scope:** For all vehicles

Safety glass is a feature used in all automobiles. It is manufactured to reduce the likelihood of injury if it breaks. The safety glass elements in a vehicle include all transparent parts such as e.g., the windshield, the side, and the rear windows.

The windshield is located in front of the vehicle and can be a determining factor to save a life in the case of impact collision. It has to sustain different forms of pressure and safety regulations. It will normally consist of two layers of glass with a laminate in-between where, this laminate is a safety feature that serves as protection to prevent the outer glass of the front windshield from affecting the inner glass, and to keep the small pieces attached to the laminate, when glass is broken.

The side and rear windows are usually made of tempered glass, which is produced by heating the glass to more than 1,100°F and then rapidly cooling it. This "tempering" process makes the glass many times stronger than un-tempered glass of the same thickness.

If broken, tempered glass is designed to disintegrate into small pieces of glass about the size of rock salt. There should be no large, jagged pieces of glass to injure the driver or passengers.

The UN ECE Regulation 43 (R43) establishes uniform provisions concerning the approval of safety glazing materials and their installation on vehicles. This regulation focuses on robustness and the safety aspect of the glass as a critical component in any

<sup>63</sup> Addenda to the 1958 Agreement (Regulations 101-120) | ECE

<sup>64</sup> M<sub>2</sub>: buses and coaches with more than eight seats (in addition to driver's) and less than 5,000kg. M<sub>3</sub>: buses and coaches with more than eight seats (in addition to driver's) and more than 5,000kg

<sup>65</sup> Addenda to the 1958 Agreement (Regulations 41-60) | ECE

vehicle. A significant number of tests are performed on the glazing elements before it is incorporated in a vehicle or sold as spare parts. Some of these tests include:

- i. **Fragmentation test:** which is a test to verify that fragments produced by a fracture of the glass are such as to minimise the risk of injury.
- ii. **Mechanical strength test:** to assess the penetration resistance of automotive safety glass (e.g. to avoid an object to penetrate in the vehicle through the windscreen);
- iii. **The headform test:** to limit the injury in the event of impact of the head against the glass (e.g. occupants thrown against the windscreen in the case of a car crash);
- iv. **Multiple tests of resistance:** such as resistance to abrasion, high temperature, radiation, humidity, temperature changes and foreign chemicals.
- v. Multiple tests to assess the optical qualities and ensure perfect vision for the driver: such as light-transmission test, optical-distortion.

### General Requirements for all Glazing Materials

- i. All glazing materials, including glazing material for the manufacture of windscreens, shall be such that, in the event of shattering, the danger of bodily injury is reduced as far as possible. The glazing material shall be sufficiently resistant to the incidents likely to occur in normal traffic, and to atmospheric and temperature conditions, chemical action, combustion, and abrasion.
- ii. Safety glazing materials shall in addition be sufficiently transparent, shall not cause any noticeable distortions of objects as seen through the windscreen, and shall not give rise to any confusion between the colours used in road traffic signs and signals. In the event of the windscreen's shattering, the driver shall still be able to see the road clearly enough to be able to brake and stop his vehicle safely.

### C. DEVICES FOR INDIRECT VISION – UN REGULATION No. 46<sup>66</sup>

**Scope:** This Regulation applies to all compulsory and optional devices for indirect vision.

A device for indirect vision is a device intended to give a clear view of the rear, side or front of the vehicle within the fields of vision.

Within the scope of this Regulation, devices for indirect vision means devices intended to give a clear view of the rear, side or front of the vehicle within the fields of vehicles vision defined. They can be conventional mirrors, camera-monitor system (CMS) or other devices able to present information about the indirect field of vision to the driver.

#### *Classes of device for Indirect Vision:*

A device for indirect vision is a device intended to give a clear view of the rear, side or front of the vehicle within the fields of vision. They are grouped into classes based on having one or more common characteristics

- i. Class I: "Rear-view device", giving the field of vision such that the driver can see at least 20m wide, flat, horizontal portion of the road centred on the vertical longitudinal median plane of the vehicle and extending 60m behind the driver's ocular point.
- ii. Class II: "Main rear-view device" on both driver and passenger sides, the field of vision shall be such that the driver can see 5-meter wide, flat, horizontal portion of the road on both sides of the vehicle and extends 20 meter behind the driver's ocular point. In addition, the road shall be visible to the driver over a width of 1 meter, starting from a point of 4 meter behind the vertical plane passing through the driver's ocular point.
- iii. Class III: "Main rear-view device": on both driver and passenger sides, the field of vision shall be such that the driver can see 4-meter wide, flat, horizontal portion of the road on both sides of the vehicle and extends 20 meter behind the driver's ocular point. In addition, the road shall be visible to the driver over a width of 1 meter, starting from a point of 4 meter behind the vertical plane passing through the driver's ocular point.

<sup>66</sup> Addenda to the 1958 Agreement (Regulations 41-60) | ECE

### The Device requirements

The devices for indirect vision shall be required to meet certain requirements:

- i. General requirements for mirrors: where all mirrors shall be adjustable. All rear-view mirrors shall have the edge of the reflecting surfaces enclosed in a protective housing (holder).
- ii. General requirements for devices other than mirrors: If adjustment by the user is needed, the device for indirect vision shall be adjustable without the use of tools. If a device for indirect vision can only render the total prescribed field of vision by scanning the field of vision, the total process of scanning, rendering and reset to its initial position together shall not take more than 2 seconds.
- iii. Devices for Indirect Vision: Shall be fitted in such a way that the devices do not move so as significantly to change the field of vision as measured or vibrate to an extent which would cause the driver to misinterpret the nature of the image perceived. These conditions shall be maintained even when the vehicle is moving at speeds of up to 80 per cent of its maximum design speed not exceeding 150km/h.

### D. REAR UNDERRUN PROTECTIVE DEVICES (RUPDS) – UN Regulation No. 58 <sup>67</sup>

**Scope:** This Regulation applies to RUPDs which are intended to be fitted to vehicles of categories M, N and O<sub>1</sub>.

Underride truck crashes occur when a passenger car rides under the rear of a large truck. These kinds of accidents are especially dangerous because of the size difference between trucks and passenger cars. Therefore, it is necessary to install the Rear Underrun Protection Device (RUPD) at the rear of trucks for safety enhancement.

UN Regulation N.58 establishes uniform provision concerning the approval of:

- i. Rear Underrun Protection Devices.
- ii. Vehicles with regard to the installation of an RUPD of an approved vehicle type.
- iii. Vehicles with regard to their rear underrun protection.

As a general requirement for the three categories of provision established by this Regulation, all vehicles shall be so constructed and/or equipped as to offer effective protection over the whole rear width against under-running of vehicles in the event of rear collision with vehicles of category M<sub>1</sub> and N<sub>1</sub>.

#### Basic Requirement of RUPDs

- i. The cross-member shall have a section height of at least 120 mm. The lateral extremities of the cross member shall not bend to the rear or have a sharp outer edge; this condition is fulfilled when the lateral extremities of the cross-member are rounded on the outside and have a radius of curvature of not less than 2.5 mm.
- ii. The RUPD may be so designed to have several positions at the rear of the vehicle. In this event, there shall be a guaranteed method of securing it in the service position so that any unintentional change of position is precluded.
- iii. For RUPD that are designed to have several positions at the rear of the vehicle, a label shall be provided either with (a) symbol(s) or in the language(s) of the country where the device is sold to inform the operator about the standard position of the RUPD to offer effective protection against under-running.
- iv. The RUPD shall offer adequate resistance to forces applied parallel to the longitudinal axis of the vehicle.

Basic Requirement of Vehicle with regard to the installation of an RUPD

- v. The width of the rear protective device shall at no point exceed the width of the rear axle measured at the outermost points of the wheels, excluding the bulging of the tyres close to the ground, nor shall RUPD be more than 100 mm shorter on either side. Where the device is contained in or comprises the vehicle bodywork which itself extends beyond the width of the rear axle, the requirement, that the width of the RUPD shall not exceed that of the rear axle, shall not apply.
- vi. The maximum mass of a vehicle type for which approval is requested shall not exceed the value indicated on the Type approval communication form of each approved RUPD intended to be installed on that vehicle.

<sup>67</sup> Addenda to the 1958 Agreement (Regulations 41-60) | ECE

**Basic Requirement of a vehicle with regard to its rear underrun protection (RUP)**

- i. The width of the RUP shall at no point exceed the width of the rear axle measured at the outermost points of the wheels, excluding the bulging of the tyres close to the ground, nor shall RUP be more than 100 mm shorter on either side. Where the device is contained in or comprises the vehicle bodywork which itself extends beyond the width of the rear axle, the requirement, that the width of the RUP shall not exceed that of the rear axle, shall not apply.
- ii. The cross-member shall have a section height of at least 120 mm. The lateral extremities of the cross-member shall not bend to the rear or have a sharp outer edge, this condition is fulfilled when the lateral extremities of the RUP are rounded on the outside and have a radius of curvature of not less than 2.5 mm.
- iii. The RUP may be so designed to have several positions at the rear of the vehicle. In this event, there shall be a guaranteed method of securing it in the service position so that any unintentional change of position is precluded. The force applied by the operator to vary the position of the RUP shall not exceed 40 daN.

**E. FRONT UNDERRUN PROTECTIVE DEVICES (FUPDS) – UN Regulation No. 93<sup>68</sup>**

**Scope:** This Regulation applies to commercial trucks and trailers for the carriage of goods.

The main purpose of this Regulation is to offer effective protection for vehicles of category M1 or N1 against the underrunning of vehicles in the event of a frontal collision.

The front underrun protection prevents smaller vehicles in frontal crashes from being dragged under the body of a large truck. In its function as a high-strength steel abutment, it activates the energy-absorbing areas of the body of the advancing vehicle (crumple zones) so that the energy of the collision can be dissipated. In head-on collisions of light duty vehicles (LDV) and heavy trucks, the car often under runs the front of the truck, and the vehicle and its passengers would have serious or fatal injuries. The crash safety performance of the car depends on the way its structural parts interact with the structural parts of the truck. This phenomenon leads to serious and fatal injuries for car occupants because of intrusion of the car structure into the passenger compartment. This has led to the development of test procedure for energy-absorbing front under run protection systems for trucks.

UN Regulation No. 93 establishes uniform provisions concerning the approval of:

- i. Front underrun protective devices (FUPDs)
- ii. Vehicles with regard to the installation of an FUPD of an approved type
- iii. Vehicles with regard to their front underrun protection (FUP)

**Basic Requirements of an FUPD**

An FUPD shall offer adequate resistance to forces applied parallel to the longitudinal axis of the vehicle and also satisfy certain dimensional requirements. These shall be demonstrated in accordance with the test procedure.

The device may be so designed that its position at the front of the vehicle can be varied. In this event, there shall be guaranteed methods of securing it in the service position so that any unintentional change of position is precluded. It shall also be possible to for the operator to vary the position of the device by applying a force not exceeding 400 N.

The outermost surface of every front guard installation shall be essentially smooth or horizontally corrugated save that domed head of bolts or rivets may protrude beyond the surface to a distance not exceeding 10mm.

**Basic Requirements for Installation of an Approved FUPD**

The maximum mass of a vehicle type for which approval is requested shall not exceed the value indicated in the approval communication form of each approved FUPD intended to be installed on that vehicle. The vehicle with FUPD installed shall satisfy certain dimensional requirements optimize safety. In measuring distances, any part of the vehicle which is more than 2 meter above the ground shall be excluded.

**Basic Requirements for a Vehicle with FUP**

The FUP shall offer adequate resistance to forces applied parallel to the longitudinal axis of the vehicle. The FUP shall also satisfy certain dimensional requirements to reduce possibility of underrun of vehicles.

<sup>68</sup> Addenda to the 1958 Agreement (Regulations 81-100) | ECE



The device shall be so designed that its position at the front of the vehicle can be varied. In this way, there shall be a guaranteed method of securing it in the service position so that any unintentional change of position is precluded.

The FUP shall have sufficient strength that the horizontal distance measured in the rearward direction between the foremost part of the vehicle after the application of test forces and the test ram contact surfaces on the vehicle does not exceed 400mm.

## F. LIGHTING AND LIGHTING INSTALLATION – UN Regulation No. 48

**Scope:** This regulation applies to vehicle of categories M, N and to their trailers (category O).

Properly installed and maintained lighting and light signalling equipment can make the difference between life and death. Headlights allow you to see road markings, signs and unexpected obstacles. Lighting and light-signalling devices are a necessary component of your car providing that it can be seen and activities such as turning or braking can be signalled to other road users via direction indicator lamps or stop lamps, and it's important to keep them in top working condition for safety.

UN Regulation No. 48 (UN R.48) addresses the Uniform provisions concerning the approval of vehicles with regard to the installation of lighting and light-signalling devices.

### Headlamp:

A Headlamp is the lamp attached to the front of a vehicle to illuminate the road ahead. Headlamps are often called headlights but in the most precise usage, headlamps are the term for the device used to illuminate the road or emit light signal to other drivers while headlight is the term for the beam produced from the device. Headlamps are classified according to:

- i. The characteristics of the optical system
- ii. Suitability for right-hand or left-hand or for both traffic systems.
- iii. The kind of beam produced (passing beam or driving beam or both)
- iv. The materials constituting the lenses and coating if any
- v. However, a device intended for the installation on the left side of the vehicle and the corresponding device intended for the installation on the right side of the vehicle shall be considered to be of the same type.

### Specifications:

- i. **For general specifications:** General specifications for lighting shall apply to all lighting devices including those meant for illumination and signaling as well as the installation process of these devices:
  - The lighting devices shall be so fitted that under normal operating conditions it will not be possible for the lamp to be inadvertently maladjusted
  - The lighting device and lighting installation are subject to a number of general and individual specification depending on the light type and its functions.
  - The illuminating devices shall be installed such that correct adjustment of their orientation can easily be carried out.
  - Lamps constituting a pair shall satisfy the same colorimetric requirements and have substantially identical photometric characteristics
  - Lamps constituting a pair shall be symmetrical to one another in relation to the median longitudinal plane.
  - In the case of headlamps fitted with measures to prevent discomfort to other road-users in a country where traffic operates on the side of the road opposite to that of the country for which the headlamp was designed, such measures shall be achieved automatically or by the vehicle user with the vehicle in the park condition without the need for special tools.
- ii. **Individual Specifications:** Establishes the individual specifications of each lighting device depending on the lighting functions and its position on the vehicle.
- iii. **Main-beam (Driving-beam) Headlamp:** Main-beam headlamp is the lamp used to illuminate the road over a long distance ahead of the vehicle. They are mandatory for motor vehicles but are prohibited on trailers.
- iv. **Dipped-beam (Passing-beam) Headlamp:** Dipped-beam headlamps are located at the front of the vehicle and are designed for increased visibility when driving at night-time. They are the brightest light used for visibility that will not dazzle other road users. They are mandatory on motor vehicles but prohibited on trailers.

- v. **Front positioning lamp:** Is the lamp used to indicate the presence and the width of the vehicle when viewed from the front
- vi. **Front Fog Lamp:** Is a lamp used to improve the illumination of the road ahead of the vehicle in case of fog or any similar condition of reduced visibility. It is optional on motor vehicles but prohibited on trailers.
- vii. **Reversing Lamp:** Reversing lamp is located at the rear of the motor vehicle and it is the lamp used to illuminate the road to the rear of the vehicle and to warn other road-users that the vehicle is reversing or about to reverse. They are mandatory on motor vehicles and trailers.
- viii. **Direction-indicator Lamp:** Located at the front and the rear part of the motor vehicle on both sides, they are blinking lamps on one of the sides used to indicate to other road-users that the driver intends to change direction to the right or to the left.
- ix. **Hazard Warning Signal:** Are a pair of intermittent simultaneous flashing light on both sides to the front and to the rear that warn other drivers that the vehicle could constitute a temporary obstruction or danger to other road users. They are mandatory on all motor vehicles.
- x. **Rear positioning lamp:** Is the lamp used to indicate the presence and width of the vehicle when viewed from the rear.
- xi. **Stop Lamp:** Stop lamp is used to indicate to other road-users to the rear of the vehicle that its driver is applying the service brake. The stop-lamps may be activated by the application of a retarder or a similar device if decelerations of more than 5 – 7 m/sec<sup>2</sup> are reached.
- xii. **Rear Fog Lamp:** Is a lamp used to make the vehicle more easily visible from the rear in dense fog.
- xiii. **Parking Lamp:** Is the lamp used to draw attention to a stationary vehicle.

Lighting devices can also be categorized according to their positioning such as the front position and rear positioned lamps.

## 7.2. Emission standards

With environmental pollution being a significant and growing concern across the globe, governments and car manufacturers are actively working to reduce harmful emissions from cars. Emission standards are the legal requirements governing harmful tailpipe emissions into the atmosphere. Emission standards set quantitative limits on the permissible amount of specific air pollutants that may be released from the vehicle tailpipe per unit of distance travelled. They are generally designed to achieve air quality standards to not exceed specific concentrations of harmful pollutants in the atmosphere and to protect human life and biodiversity. Different regions and countries have different standards for vehicle emissions.

There are largely three main sets of standards: United States, Japanese, and European, with various markets mostly using these as their base. Sweden, Switzerland, and Australia had separate emissions standards for many years but have since adopted the European standards.

An emission standard sets thresholds above which a different type of vehicle emission control technology might be needed to clean exhaust gases. While emission standards have been used to reduce emissions for conventional pollutants such as oxides of nitrogen (NO<sub>x</sub>), hydrocarbons (HC) carbon monoxide (CO) or particulate matters (PM and PN), fuel quality standards have been used to reduce other type of pollutants such as Sulphur oxides (SO<sub>x</sub>).

The European emission standards were introduced in the early 1970s to help towards the measuring and control of the environmental impact of new cars. The European emission standards are vehicle emission standards for exhaust emissions of new vehicles sold in the European Union and European Economic Area (EEA) member States. The standards are defined in a series of European Union Directive and Regulations staging the progressive introduction of increasingly stringent standards.

At the UN level, ECE/WP.29 has adopted emissions standards for cars (UN Regulation No. 15, replaced by UN Regulation No. 83, complemented by UN GTR No. 15 and UN Regulation No. 154), motorcycles (UN Regulation No. 40 and UN GTR No. 2) and trucks (UN Regulation No. 49 and UN GTR No. 4) and for non-road mobile machinery (UN Regulation No. 96 and UN GTR No. 11). The various series of amendments to UN Regulations Nos. 83 and 49 contain various level of stringencies equivalent to the Euro standards; equivalence between UN Regulations and Euro level of stringencies can be found in Annex IV.

To be considered sufficiently clean, a vehicle should comply with the following minimum regulatory provisions, as defined in Table (12).

**Table 12** Minimum environmental compliance at the new vehicle certification stage

Topic	Passenger cars	PTWs	Commercial Vehicles
<b>Air Pollution</b>			
Tailpipe pollutant emissions	R 83.05-B	GTR 2	R 49.03-B2
Smoke	R 24		
<b>Climate</b>			
Tailpipe CO <sub>2</sub>	R 101	GTR 2	R 49.03-B2
<b>Electrified Vehicles</b>			
Range	R 154		
Battery durability	GTR 22		

Source: UNECE, World Forum for Harmonization of Vehicle Regulations

see: <https://unece.org/transport/vehicle-regulations/world-forum-harmonization-vehicle-regulations-wp29>

### Toxic Emission: Stages, Technology and Legal Framework

The following is a summary list of the standards, when they come into force, what they apply to, the UN Regulation No. 49 and UN Regulation No. 83 and corresponding EU directives provide the definition of the standard. UN Regulation No. 101 (often used in conjunction with UN regulation No. 83) provides harmonized provision to measure tailpipe CO<sub>2</sub> emissions under the NEDC test procedure, as well as EV range determination. UN Regulation No. 154 offers nevertheless a much more accurate range determination procedure for electrified vehicles.

Other UN legislative tool also could be used to offer minimum environmental protection, such As UN regulation No. 24 that is sued to measure diesel smoke, also used during periodic technical inspections. For EVs, the recent UN GTR No. 22 provides in-vehicle battery durability minimum requirements.

#### i. **01 series of amendments to UN Regulation No. 83 - Euro 1 equivalent: Introduced in 1992**

The 01 series of amendments to UN Regulation No. 83 generalized the introduction of first-generation catalytic converters to petrol cars and unleaded petrol for all cars to reduce carbon monoxide (CO) emissions.

**Table 13** 01 Amendments to UN R.83

Gases	UNR 83.01 emission limits
CO	2.72 g/km (petrol and diesel)
HC+ NOx	0.97 g/km (petrol and diesel)
PM	g/km (diesel only)

Source: UNECE, World Forum for Harmonization of Vehicle Regulations

see: E\_ECE\_324\_Rev.1\_Add.82\_Rev.1\_E\_ECE\_TRANS\_505\_Rev.1\_Add.82\_Rev.1-EN

#### ii. **03 series of amendments to UN Regulation No. 83 – Euro 2 equivalent: Introduced in 1996**

The 03 series of amendments to UN Regulation No. 83 further reduced the limit for carbon monoxide emissions and reduced the combined limit for unburned hydrocarbons and oxides of nitrogen for both petrol and diesel vehicles.

It introduced separated emissions limits for petrol and diesel.

**Table 14** 03 Amendments to UN R.83

Gases	UNR 83.03 emission limits	
	Petrol	Diesel
CO	2.2 g/km	1.0 g/km
HC+ NOx	0.5 g/km	0.7 g/km
PM	no limit	0.08 g/km

Source: UNECE, World Forum for Harmonization of Vehicle Regulations  
 see: [https://unece.org/sites/default/files/2021-11/ECE\\_TRANS\\_WP.29\\_2021\\_144-E.pdf](https://unece.org/sites/default/files/2021-11/ECE_TRANS_WP.29_2021_144-E.pdf)

iii. **05 series of amendments to UN Regulation No. 83 – Row A – Euro 3 equivalent: Introduced in 2000**

The 05 series of amendments to UN Regulation No. 83 – Row A modified the test procedure to eliminate the engine warm-up period and further reduced permitted carbon monoxide and diesel particulate limits. It also added a separate NOx limit for diesel engines and introduced separate HC and NOx limits for petrol engines.

**Table 15** 05 Amendments to UN R.83 (Row A)

Gases	UNR 83.05-A emission limits	
	Petrol	Diesel
CO	2.3 g/km	0.64 g/km
HC	0.20 g/km	
NOx	0.15 g/km	0.50 g/km
HC+ NOx		0.56 g/km
PM	No limit	0.05 g/km

Source: UNECE, World Forum for Harmonization of Vehicle Regulations  
 see: [https://unece.org/sites/default/files/2021-11/ECE\\_TRANS\\_WP.29\\_2021\\_144-E.pdf](https://unece.org/sites/default/files/2021-11/ECE_TRANS_WP.29_2021_144-E.pdf)

- EU Directive for any vehicle—98/69/EC <sup>69</sup>

iv. **05 series of amendments to UN Regulation No. 83 – Row B – Euro 4 equivalent: Introduced in 2005**

The generalization of low sulphur diesel allowed for stricter and more efficient emission control strategies reducing NOx and PM limits for diesel; some vehicles also included active or passive diesel particulate filters. Most petrol engines were fitted with 3-way catalytic converters that effectively treated NOx, CO and HC once warmed up.. It can be considered as a significant step forward in emission reduction and might be seen as the minimum requirement for cleaner vehicles.

**Table 16** 05 Amendments to UN R.83 (Row B)

Gases	UNR 83.05-B emission limits	
	Petrol	Diesel
CO	1.0 g/km	0.50 g/km
HC	0.10 g/km	
NOx	0.08 g/km	0.25 g/km
HC+ NOx		0.30 g/km
PM	No limit	0.025 g/km

Source: UNECE, World Forum for Harmonization of Vehicle Regulations  
 see: [https://unece.org/sites/default/files/2021-11/ECE\\_TRANS\\_WP.29\\_2021\\_144-E.pdf](https://unece.org/sites/default/files/2021-11/ECE_TRANS_WP.29_2021_144-E.pdf)

<sup>69</sup> Directive 1998/69 - Measures to be taken against air pollution by emissions from motor vehicles - EU monitor

The Introduction of On-board diagnostics (OBD) system allows provided some benefits to lifetime compliance, indicating the owner when issues with emission control systems was detected.

v. **The 06 series of amendments to UN Regulation No. 83 – Euro 5 equivalent: Introduced in 2009**

All diesel cars needed particulate filters to meet the new requirements. For the first time there was a particulate limit for petrol engines – applicable to direct injection engines only. Addressing the effects of very fine particle emissions, the 06 series of amendments to UN Regulation No. 83 introduced a limit on particle numbers for diesel engines in addition to the particle mass limit. This applied to all new diesel cars from 2013.

**Table 17** 06 Amendments to UN R.83

Gases	UNR 83.06 emission limits	
	Petrol	Diesel
CO	1.0 g/km	0.50 g/km
HC	0.10 g/km	
NOx	0.06 g/km	0.18 g/km
HC+ NOx		0.23 g/km
PM	0.0045 g/km (direct injection only)	0.0045 g/km
PN [# /km]		6.0x10 <sup>11</sup> /km

Source: UNECE, World Forum for Harmonization of Vehicle Regulations  
 see: [https://unece.org/sites/default/files/2021-11/ECE\\_TRANS\\_WP.29\\_2021\\_144-E.pdf](https://unece.org/sites/default/files/2021-11/ECE_TRANS_WP.29_2021_144-E.pdf)

vi. **The 07 series of amendments to UN Regulation No. 83 – Euro 6 equivalent: Introduced in September 2014 – came into force September 2015**

The 07 series of amendments to UN Regulation No. 83 was introduced in 2015. Emission limits were reduced by about 50 per cent during the certification test, requiring new technologies in the vehicles such as Selective Catalytic Reduction (SCR) in diesel engines.

**Table 18** 07 Amendments to UN R.83

Gases	UNR 83.07 emission limits	
	Petrol	Diesel
CO	1.0 g/km	0.50 g/km
HC	0.1 g/km	
NOx	0.06 g/km	0.08 g/km
HC+ NOx		0.17 g/km
PM	0.0045 g/km (direct injection only)	0.0045 g/km
PN [# /km]	6.0x10 <sup>11</sup> /km (direct injection only)	6.0x10 <sup>11</sup> /km

Source: UNECE, World Forum for Harmonization of Vehicle Regulations;  
 see: [https://unece.org/sites/default/files/2021-11/ECE\\_TRANS\\_WP.29\\_2021\\_144-E.pdf](https://unece.org/sites/default/files/2021-11/ECE_TRANS_WP.29_2021_144-E.pdf)

- i. The original version of UN Regulation No. 154 – Euro 6c equivalent (Level 1A) Introduced in 2021, UN Regulation No. 154 is expected to gradually substitute UN regulation No. 83; the main difference between the two is the introduction of the World Harmonized Test Procedure (WLTP) as a test procedure instead of the NEDC that was the basis of UN Regulation No. 83. WLTP covers a wider range of engine operating conditions, allowing for more realistic emission values compared with on-street driving patterns. Emission limits remain unchanged compared with Euro 6. UN Regulation No. 154 is the first emission related legislation that has been included in the International Whole Vehicle Type Approval (IWVTA), as detailed in UN Regulation No. 0.

## ANNEX 1

# International and Regional Activities in The Field of Used Vehicles and Shipment of Waste

### A. Basel Convention

Analysing the lifespan of a vehicle, the Basel convention applies mostly to the End-of-life stage of a vehicle. Basel Convention, is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent the transfer of hazardous waste from developed to developing countries.

The Basel convention was adopted in March 1989 but entered into force on 5th May 1992 and has a total of 188 contracting Parties to the agreement. The three main pillars of the Basel convention are to:

- i. Minimize the generation of wastes
- ii. Promote environmentally sound management of hazardous wastes and other wastes
- iii. Control the transboundary movement of hazardous wastes and other wastes

Basel convention addresses two types of wastes: Hazardous wastes and other wastes however, it does not address the movement of radioactive waste. The convention is also intended to minimize the rate and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation, and to assist less developed countries in environmentally sound management of the hazardous and other wastes they generate.

The Basel convention ties in closely to the End-of-Life vehicle (ELV) Directive because proper definition and agreement of what an ELV is would reduce the incidents of trade of vehicles classified as ELVs. Bearing in mind that only countries who are contracting Parties to the Basel convention and who have an accepted definition of ELV recognized by other involving parties can utilize the Basel convention in preventing the trade in ELVs.

Some challenges faced by the convention is when waste traders seek to exploit the good name of recycling and begin to justify all exports as moving to recycling destinations. Due to these challenges, several contracting Parties to the convention believed a full ban for exporting waste may be needed including exports for recycling. These concerns led to several regional waste trade bans, including the Bamako Convention.

### B. The Bamako Convention

The Bamako convention is a treaty of African nations that puts a ban on the importation of Hazardous wastes into the continent. The reason for this convention arose from the failure of the Basel convention to limit the trade of hazardous wastes to low-and-middle income countries and from the realization that many developed nations were exporting toxic wastes into the continents. The Bamako convention is like the Basel convention except that

- i. It is much stronger in prohibiting all imports of hazardous wastes and
- ii. It does not make exceptions on certain hazardous waste (like radioactive materials) made by the Basel convention

#### The purpose of the Convention

- i. Is to prohibit the import of all hazardous wastes into the African continent for any reason
- ii. To ensure that disposal of wastes is conducted in an "environmentally sound manner".
- iii. To prohibit all ocean and inland water dumping or incineration of hazardous wastes.
- iv. To minimize and control transboundary movements of hazardous wastes within the African continent.
- v. To establish the precautionary principle.

A general obligation for the operation of Bamako convention is that countries should ban import of hazardous and radioactive wastes as well as all forms of ocean disposal. For Intra-African waste trade, parties must minimize the trans-boundary movement of wastes and only conduct it with consent of the importing and transit states among other controls; they should minimize the production of hazardous wastes and cooperate to ensure that wastes are treated and disposed of in an environmentally sound manner.

The word wastes come up severally in the context of the Bamako convention and this means contracting parties must have similar definitions of wastes in the context of what an ELV is and at what point do these countries consider a vehicle as waste. Only when this has been established between contracting parties, can this convention be used as a tool in the control of movement of ELVs into the continent and between countries.

A major transboundary condition for the movement of waste entails that the transboundary movement of these wastes must be between contracting Parties.

## C. European Union Legislation

### 1. EU Roadworthiness Package ; EU Directive 2014/45/EU:

The Directive 2014/45/EU on periodic roadworthiness test for motor vehicles aims to improve road safety by setting minimum requirements for periodic roadworthiness tests of vehicles and trailers in the European Union (EU).

The European Union roadworthiness package is a threefold legislative proposal focused on periodic roadworthiness tests, technical roadside inspections of commercial vehicles and vehicle registration documents. This directive was prepared by the commission with an aim to update and harmonize across Europe the existing rules on Periodic Technical Inspection (PTI).

The package proposed minimum standards that will have to be implemented at European level to enhance road safety and environmental protection.

#### The main novelties of Directive 2014/45/EU include:

- i. Improving the quality of vehicle tests by setting common minimum standards for equipment, training of inspectors and assessment of deficiencies.
- ii. Harmonised requirements for the control of cargo securing during roadside inspections of goods vehicles above 3,500kg
- iii. Making electronic safety components (such as ABS, ESC, and airbag) subject to mandatory testing.
- iv. First European measures to combat mileage fraud.
- v. Compulsory EU wide testing for heavy motorbikes unless a Member State achieves equivalent road safety enhancement by other measures. Motorbike riders are the highest risk group of road users.
- vi. In all cases, the Directives set common EU wide minimum standards for vehicle checks with Member States free to go further if appropriate.

The newly applied rules will enhance road safety and contribute to the objective of reducing deaths and serious injuries on Europe's roads. They will also:

- i. Enhance protection of vulnerable road users and motorcyclists in particular,
- ii. Provide for a single European area for technical roadworthiness control based on harmonized standards for aspects of control, equipment, qualification of inspectors and assessment of defects and on co-operation among Member States,

Ideally, as already mentioned above there are two types of checks, roadside inspections, and periodic checks where the vehicle owner takes their car for a thorough check at a specialist centre.

#### Periodic checks:

EU law ensures that most vehicles and trailers are inspected at regular intervals. It provides a basis for checking that vehicle throughout the European Union are in a roadworthy condition and meet the same safety and environmental standards as when they were first registered.

(Note: Technical content is equivalent with that of the 1997 Agreement and its Rules)

**Roadside Inspection:**

Under EU law, unannounced roadside inspections of commercial vehicles can be carried out in any EU country, whether or not the vehicle is registered in the European Union. These checks cover brakes, emissions, and the vehicle's overall condition. Drivers may also be required to produce recent inspection reports or proof the vehicle has passed the mandatory roadworthiness test.

**2. End of Life Vehicle (ELV) Directive 2000/53/EC**

Is a directive of the European Union addressing the end of life for automotive products and it sets recovery targets for recycling of vehicles and components, it encourages manufacturers to design their vehicles with part reuse and recycling in mind and restricts the use of certain heavy metals in new vehicle manufacturing processes.

The ELV Directive was adopted in 2000 to minimise the impact of end-of-life vehicles (ELVs) on the environment and to improve the environmental performance of all the economic operators involved in the life cycle of vehicles. The Directive has contributed to an increase in the number of Authorised Treatment Facilities (ATF) and a proper treatment of all materials contained in end-of-life vehicles (ELVs). The high targets under the Directive (95 per cent reuse and recovery and 85 per cent reuse and recycling) have largely been met and a substantial reduction in the use of hazardous substances in the new cars has been achieved.

The European commission undertook an ex-post evaluation of five waste streams to assess if the legislation is "fit for purpose" and two major challenges have been identified: the illegal ELV treatment operators and the illegal shipment of ELVs which may account for many missing vehicles. The major findings can be categorized accordingly:

The commission is presently reviewing the ELV Directive and

- i. The first part of the review has been finalized and investigated the performance of ELV Directive till date
- ii. The second part of the review (Impact assessment) will investigate measures to improve the implementation of the ELV Directive.

Based on this evaluation, they were some key findings

A major problem in the implementation of the Directive is the large number of "missing vehicles" where:

An estimated 35 per cent of ELVs each year are not reported, and this is about 4million vehicles and some possibilities to account for these missing vehicles are

- i. The vehicles are typically exported (as used vehicles or illegally as ELVs) with this, export are not being reported
- ii. Only a part of deregistered ELVs receive a certificate of destructions (CoD)
- iii. Not all owners of the end-of-life vehicles deliver them to an ATF in exchange for a CoD

The Directive leaves out 25 per cent of vehicles (e.g., trucks and motorcycles). Some important points to be considered for better tracking of ELVs:

- i. A globally accepted definition of ELV
- ii. Better statistics to enable better monitoring (e.g., monitoring of intra-EU trade, monitoring of extra EU-trade, reporting on vehicle stock import/export)
- iii. Enforcement measures to reduce illegal dismantling of ELVs at dealers and repair shops
- iv. Legally binding guidelines to distinguish ELVs from used cars

To address these issues, the Commission carried out a compliance promotion initiative to assess the implementation of the ELV Directive with emphasis on the ELVs of unknown whereabouts.



## ANNEX 2

### Activities On the Exporting Regions

#### A. First Exporting Stakeholders Workshop

In line with the objectives of the “Safer and Cleaner Used Vehicles for Africa” Project, the first exporting countries stakeholders workshop held on 18th December 2020. The workshop had experts in the automotive industry from different countries with wealth of real time experience and technical background in automotive standard development and regulations.

The first workshop in the series of workshops within this project focused on the regulatory frameworks in place to regulate the cross-border exchange of vehicles and the digital exchange of vehicle information between exporting and importing regions to prevent the falsification of vehicle documentation.

Some of the regulatory frameworks that were highlighted in the workshop are:

- i. Basel convention,
- ii. Bamako convention
- iii. End of Life (ELV) Directive,

All of which have been discussed in Annex I of this report.

Speaking on the approach to cross country frameworks on the exchange of digital vehicle information was a representative from Netherlands Vehicle Authority (RDW). The representative of RDW spoke on the operations of EUCARIS.

EUCARIS is a multilateral treaty that allows member States to share their digital data on driving licenses and vehicle registration cards with each other in order to track document fraud and international vehicle theft. EUCARIS treaty was developed in 1995 and signed by EUCARIS treaty parties in 2000. The original aim of the EUCARIS treaty was the prevention of crime related to export or import of stolen vehicles and to facilitate registration of imported vehicles but overtime the activities of EUCARIS has evolved and now acts as an exchange mechanism for all transport and mobility related data between registration authorities in Europe. All EU member States are connected via the TESTA network and data is exchanged between registration authorities via this network. In terms of coverage, EUCARIS has 41 connections in 36 member States and exchange over 200,000,000 messages annually. The EUCARIS general assembly, which is the highest authority of EUCARIS, have an agreement to expand the EUCARIS network through a gateway via the internet where non-EU member States can access the network.

Another example of an existing framework for sharing of vehicle data which was highlighted during the workshop, is a tool developed by CITA that shows the regulations a vehicle should comply with depending on the year the vehicle is manufactured.<sup>70</sup>

A major takeaway from the first meeting was the knowledge that there are existing frameworks which if utilized appropriately, can be a major form of support to maintaining legitimate vehicle information when exporting or importing used vehicles. These existing frameworks can also facilitate the exchange of important vehicle information between relevant authorities in different countries provided concerned member States are operating under a set of bilateral agreements. If such frameworks are properly utilized, more frameworks can be modelled after the existing ones, they can be enhanced and be integrated to enable both exporting and importing countries/regions authorities have access to this data.

#### B. Second Exporting Stakeholders Workshop

On 22nd February, the second exporting stakeholders workshop held with representatives from the European Union, the United States of America and Japan in attendance. The second workshop focused on the minimum performance requirement of a vehicle at the time of construction and minimum performance requirement just before the vehicle is exported. There was also representation from the American Association of Motor vehicle Administrators (AAMVA) who gave a detailed presentation on the exchange of vehicle information within the US.

<sup>70</sup> citainsp.org

Speaking on Safety, at the time of construction, a vehicle is deemed safe if it has undergone the basic UN safety test under the UN 1958 Agreement highlighted in Chapter 6 of this report. For environmental safety, EURO 4/IV emission limits of vehicle's have been adopted by the 15 member States of the Economic Commission for West African States (ECOWAS). Some advantages of the Euro 4 engine highlighted by comparing its operation to that of the Euro 3 and Euro 5/6 engines. While the Euro 3 gasoline cars typically require a closed loop three-way catalyst to target hydrocarbon (HC), carbon monoxide (CO) and Nitrogen oxides (NOx) needs low Sulphur fuel to operate optimally for many years and the Euro 4 engine does not require any of such additional or external technologies. The Euro 5/6 engine utilizes the control technology of a selective catalytic reduction that mitigates NOx emissions, but this technology requires an additive made of urea for the converter to function. Unlike the extra technological features which gives room for tampering and can't affect the overall quality of the vehicle's emission, the Euro 4 engine works on emission control of greenhouse emission gases without an additional technology while still maintaining a safe driving condition for the vehicle during its emission.

For the requirement at the time of construction, a new vehicle with basic UN safety features and a minimum Euro 4 engine would be the minimum requirement.

At the time of export, a new that has met the basic safety and environment features, would need to have been maintained during the years of its operation with a proof of a roadworthiness certificate. It was established during the meeting that vehicles, that do not have a recent or up to date roadworthiness test at its originating country is not deemed safe for export to another country. The European Union Roadworthiness Directive is meant for vehicles within the European Union region and covers the export and import of these vehicles within the region. If the vehicles are to be exported out of the European Union to a different continent, these vehicles will have to be deregistered, however, the exporter of this vehicle may wish to take the vehicles for additional testing for the purpose of exporting. In summary, it is the responsibility of the importing country to set legislation in place that will only permit the importation of vehicles that meet the country's minimum requirement. This topic also brings us to the agreement in the first meeting which had a focus on frameworks for the exchange of vehicle data between exporting and importing countries in such a way that the relevant authorities have access to this important piece of document to facilitate effective shipment process and clearance and also avoid the falsification of data on vehicles that may have not met the necessary requirements. For this to be successful, data shared across this framework will have to be tamper proof, so integrity of the information is guaranteed

An LDV that has undergone regular PTI with a proof of a roadworthiness certificate that is not older than 5 years would be cleared for export to member States in ECOWAS.

Another area that was highlighted by representatives of CITA is in vehicle inspection procedures by the authorized officials. In EU Directive 2014/45/EU there are annexes covering: requirements for inspection procedures, facilities and test agreement, competence-based training with certification for inspection officials and the supervising bodies in charge of PTIs. For an effective PTI regime, all contracting parties to the project need to work on the areas mentioned and there needs to be mutual recognition of these areas from member States.

In summary, the second workshop for exporting stakeholders yielded certain unanimous facts such as

- i. The requirements for a vehicle at the time of production should be in conformity to the UN 1958 agreement with regards to basic safety.
- ii. The vehicles should at least be a Euro 4 engine and agree with Euro 4 emission requirements
- iii. At the time of export, assuming should have a valid roadworthiness certificate and should also agree with I and ii above
- iv. There needs to be a harmonized training procedure and certification for inspection authorities and a mutual recognition of this training among the contracting parties

## ANNEX 3

### Activities On the Importing Regions

#### A. First Importing Stakeholders Workshop

The first African used vehicles importers meeting was held on 25 June 2021. The meeting brought together twenty-seven (27) African countries and African regional bodies namely the Africa Union Commission (AUC), the UN Economic Commission for Africa (UNECA), the Economic Community of West African States (ECOWAS) and the East Africa Community (EAC). Participants to this virtual meeting were drawn from government, industry, and non-governmental agencies. This first used vehicles importers meeting was organized by UNEP, in attendance were the UN Economic Commission for Europe (ECE), Federation Internationale d'Automobile (FIA) and the International Motor Vehicles Inspection Committee (CITA), in addition to the AUC and UNECA.

Jean Todt of the FIA gave a keynote speech stating the project's aim was to support African countries to develop minimum set of requirements for the importation of used vehicles. He highlighted progress made by ECOWAS and The East African Community (EAC) in taking steps to adopt directives and to harmonize vehicles emission standard and age limit within their regions.

Based on the high vehicle growth rate in ECOWAS and considering that majority of these vehicles are used vehicles, ECOWAS has developed and adopted two directives to harmonize fuel (diesel and petrol) specifications and vehicle emission standards. The directives also include age limit of vehicles imported in the sub region. The directives adopted specified 50 parts per million (ppm) as maximum allowable sulphur levels in imported fuels from 1st January 2021. All ECOWAS countries have been given a maximum of 10 years to comply with the directives and this approach will allow progressive penetration of vehicles with better technologies with regards to fuel and vehicle emission standards and to progressively introduce electric vehicles.

While harmonization of standards in EAC started as far back as 2000, there has not been any harmonized standard for vehicles within the region due to different policies within the region. Although there has been positive focus on the quality of fuels within the region and the standards for diesel and petrol have had their sulphur levels reduced to 50ppm.

In 2019 EAC was able to adopt and harmonize vehicle emission standards to Euro 4/IV within the region and some countries have already implementing this standard, a good example is Rwanda.

It was established that for a successful implementation within the African continent, the adoption and harmonization of the standards will go from sub regional to regional then to continental and for this to be achieved, the African Union Commission (AUC) and the Regional Economic Communities (RECs) will have to be funded by the United Nations Road Safety Fund. Implementing partners: United Nations Economic Commissions for Europe (ECE), United Nations Environment Programme (UNEP), The Fédération Internationale de l'Automobile (FIA) and International Motor Vehicle Inspection Committee (CITA) to participate in the process.

#### B. Joint Importers & Exporters Meeting

The Joint importers & exporters meeting held on 1 September 2022 in Kigali, Rwanda. It was held in hybrid format with 70 in-person and virtual participants. There was active participation from both importing and exporting stakeholders from West Africa, East Africa, Europe and the Americas. The meeting was officially opened by the Chief technical advisor in charge of Transport from the Ministry of Infrastructure, Rwanda, and was followed by an opening statement from the secretary of the East African Community (EAC) and a Keynote address delivered by the UN Secretary-General's Special Envoy on Road Safety.

The meeting had several presentations on the recommended technical international regulations (see table 11 pg 31, in-depth studies carried over the years and a description of current inspection situations at the port of export and the destination port. After several discussions, and deliberations the principles for minimum used vehicles standards for Africa, were established by consensus, as reproduced below:

### Principles For Minimum Used Vehicles Standards for Africa

- **Main Principle:**
  - Vehicles should be safe for passengers in the vehicle and to road users
  - Vehicles should not unnecessarily harm environment and climate
- **Shared Responsibility:**
  - All stakeholders involved (exporters, carriers, and importers) should take responsibility of vehicles in their jurisdiction
  - Regulators and governments shall set the necessary legal framework
  - Implementation of legal framework in the form of Regulations will be done at national level
  - Private sector and vehicle operators shall comply with established legal framework
- **Necessary Inspection Criteria:**
  - At the export before shipping
  - At the point of destination
- **Minimum Safety and Environmental Criteria to be Defined**
  - Based on international vehicle regulatory framework or equivalent national/regional standards.
  - Regulatory framework to cover active, passive, and general safety as well as emission requirements.
- **Information Exchange and Vehicle Compliance to be Put in Place**
  - Sharing of technical vehicle data between exporting and importing side
  - Vehicle compliance regime (e.g., PTI) to safeguard the safety and environmental performance imported and in-use vehicles for further use.

### Conclusion

There are several frameworks and agreements that have been established at regional and international levels however, for a more coordinated approach there needs to be unique harmonization of these framework subject to the international vehicle regulatory framework. African delegates are thereby welcomed to actively participate at the international level of technical deliberations where this harmonization process will take place.

## ANNEX 4

### Equivalence Table Between EU and UN Tailpipe Emission Standards

**Table A.01** Equivalence table between EU and UN tailpipe emission standards for cars (M1) and vans (N1)

Vehicle class	UN emission standard UN Regulation No.	EU emission standard	EU regulatory text	Test cycle
<b>M1</b>	83.01 (Rev.1)	Euro 1	Directive 91/441/EEC	EDC
	83.03 (Rev. 1 amend. 2)	Euro 2	Directive 94/12/EC	EDC
	83.05 (Rev. 2); A-2000	Euro 3	Directive 98/69/EC; A-2000	NEDC
	83.05 (Rev. 2); B-2005	Euro 4	Directive 98/69/EC; B-2005	NEDC
	83.06 (Rev. 4)	Euro 5	Regulation 715/2007/EC	NEDC
	83.07 (Rev. 5)	Euro 6	Regulation 715/2007/EC	NEDC
	154.00 Level 1A	Euro 6c	Regulation 2017/1151 and 2017/1347	WLTP
<b>N1</b>	83.02 (Rev. 1 amend. 1)	Euro 1	Directive 93/59/EEC	EDC
	83.04 (Rev. 1 amend. 4)	Euro 2	Directive 96/69/EC	EDC
	83.05 (Rev. 2); A-2000	Euro 3	Directive 98/69/EC; A-2000	NEDC
	83.05 (Rev. 2); B-2005	Euro 4	Directive 98/69/EC; B-2005	NEDC
	83.06 (Rev. 4)	Euro 5	Regulation 715/2007/EC	NEDC
	83.07 (Rev. 5)	Euro 6	Regulation 715/2007/EC	NEDC
	154.00 Level 1A	Euro 6c	Regulation 2017/1151 and 2017/1347	WLTP

Source: UNECE, World Forum for Harmonization of Vehicle Regulations see:[https://unece.org/sites/default/files/2021-11/ECE\\_TRANS\\_WP.29\\_2021\\_144-E.pdf](https://unece.org/sites/default/files/2021-11/ECE_TRANS_WP.29_2021_144-E.pdf)  
 Note: 83.01 means the 01 series of amendments to UN Regulation No. 83

**Table A.02** Equivalence table between EU and UN tailpipe emission standards for trucks

UN emission standard UN Regulation No.	EU emission standard	EU regulatory text	Test
	Euro 0	Directive 88/77/EEC	R49
49.02 (Rev.2); A-1992	Euro I	Directive 91/542/EEC	R49
49.02 (Rev.2); B-1995	Euro II	Directive 91/542/EEC	R49
49.03 (Rev.3 amend.1); A-2000	Euro III	Directive 1999/96/EC	ESC (steady-state) and ELR (smoke)
49.03 (Rev.3 amend.1); A-2000	Euro III	Directive 1999/96/EC	ETC (transient)
49.03 (Rev.3 amend.1); B1-2005	Euro IV	Directive 1999/96/EC	ESC (steady-state) and ELR (smoke)
49.03 (Rev.3 amend.1); B1-2005	Euro IV	Directive 1999/96/EC	ETC (transient)
49.03 (Rev.3 amend.1); B2-2008	Euro V	Directive 1999/96/EC	ESC (steady-state) and ELR (smoke)
49.03 (Rev.3 amend.1); B2-2008	Euro V	Directive 1999/96/EC	ETC (transient)
49.03 (Rev.3 amend.1); C	EEV	Directive 1999/96/EC	ESC (steady-state) and ELR (smoke)
49.03 (Rev.3 amend.1); C	EEV	Directive 1999/96/EC	ETC (transient)
49.06 (Rev. 6)	Euro VI	Regulation 595/2009	WHSC (steady-state)
49.06 (Rev. 6)	Euro VI	Regulation 595/2009	WHTC (transient)
49.07 (Rev. 7)	Euro VI step E	Regulation 2019/1939	WHSC and WHTC

Source: UNECE, World Forum for Harmonization of Vehicle Regulations see:[https://unece.org/sites/default/files/2021-11/ECE\\_TRANS\\_WP.29\\_2021\\_144-E.pdf](https://unece.org/sites/default/files/2021-11/ECE_TRANS_WP.29_2021_144-E.pdf)

# Safer and Cleaner Used Vehicles for Africa

Part of the WP.29 “How it works-How to join it” series, this publication introduces current challenges and situation on the transfer of used vehicles to Africa with huge impact on the road safety and environmental situation in this region. It further provides an overview of the global flow of used vehicles between regions and continents and regulatory framework on the transfer of used vehicles in other parts of the world.

The international regulatory framework based on the three United Nations vehicle Agreements provides a sound basis for enhancing vehicle safety and reducing their emissions. Technical description of the recommended UN Regulations/UN GTRs is provided to assist countries in Africa for setting up their national requirements for import of used vehicles.

Information Service  
United Nations Economic Commission for Europe

Palais des Nations  
CH - 1211 Geneva 10, Switzerland  
Telephone: +41(0)22 917 12 34  
E-mail: [unece\\_info@un.org](mailto:unece_info@un.org)  
Website: <http://www.unece.org>

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