

# MAKING THE ROAD SECTOR A KEY VEHICLE FOR SUSTAINABLE DEVELOPMENT



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# **MAKING THE ROAD SECTOR A KEY VEHICLE FOR SUSTAINABLE DEVELOPMENT**



**Bangkok, 2016**



## FOREWORD



Roads are the oldest and most popularly used mode of transport and have been responsible for catalyzing human civilization and supporting economic and social development globally throughout the centuries. Roads provide convenience and flexibility. Whether directly connecting goods, people and services door-to-door or to other forms of transportation such as maritime, air and railway, effective road networks are a vital to prosperity of any economy.

The 2030 Agenda for Sustainable Development is bringing new challenges to the road sector around the world. Roads cut across many of the sustainable development issues as they can be an enabler of economic prosperity. However, there are many road related issues that must be addressed in order for roads to support growth that is inclusive and sustainable.

As the world's second largest consumer of energy, the transport sector consumes 28 per cent of total global energy; and roads consume more than 77 per cent of this total. . Correspondingly, road transport is responsible for three quarters of the 23 per cent of the global greenhouse gas emissions released by the transport sector as a whole. If current trends continue, by 2050 road sector energy consumption will increase by 63 per, and to greenhouse gas emissions from road transport will also increase by 63 per cent.

The road sector must also prioritize improving road safety. Road accidents are the leading cause of fatalities in Asia and the Pacific. In 2013, 1.25 million people died from road traffic crashes and another 20-50 million suffered from non-fatal injuries. To bridge the gap between public health and transportation, Sustainable Development Goal (SDG) 11 calls for the improvement of road safety by 2030 and Goal 3 aims to halve global deaths and injuries from road traffic accidents by 2020. Recent studies on the global trends of road fatalities demonstrate that these SDG targets require our urgent attention if they are to be achieved.

In addition, road transport internationalization, intelligent transport systems, the transport of dangerous goods, and road security add to the myriad of insurmountable challenges the sector faces.

The 2030 Agenda provides an opportunity for all countries to work together to transform the road sector for the benefits of all. Creating and implementing innovative sustainable road solutions will depend on leveraging regional and international collaboration. ESCAP's member States have called for regional solutions. Therefore, establishing an international intergovernmental road organization is one approach that could help fill the existing global institutional gaps and help ensure the sustainability of the road sector moving forward.

This report explores the viability of such an international road organization to promote coordinated strategies, harmonized rules and standards, share best practices and provide

technical assistance in the road sector. It demonstrates the need for such an organization and provides an analysis of the costs, benefits and possible functions of such an organization, as well as outlines a road map for its implementation.

A prosperous Asia-Pacific region requires road development that is inclusive and sustainable. ESCAP stands ready to enable its member States to enhance their collaboration on road and transport matters, so that as a region we can achieve the Sustainable Development Goals.

A handwritten signature in black ink, appearing to read 'Shamshad Akhtar', with a stylized flourish at the end.

**Dr. Shamshad Akhtar**

Under-Secretary-General of the United Nations and

Executive Secretary of the Economic and Social Commission for Asia and the Pacific

## EXECUTIVE SUMMARY

Roads are the oldest and the most popularly used mode of transport. They catalyzed human civilization and have been supporting economic and social development of the world. As the most convenient and flexible mode, road transport provides door-to-door delivery of all kinds of goods by its own. It also supports door-to-terminal movements of maritime, air and railway goods to enable them to function.

The study by the International Road Federation (IRF) on the Socio-Economic Benefits of Roads in Europe showed that trucks carried nearly 80 per cent of all goods measured in tonne-kilometre. The road sector contributed approximately 22 per cent of gross domestic product (GDP) to the EU 25<sup>1</sup> economy and 5 per cent of the EU 25 employment. Vehicle related taxes accounted for 10.2 per cent of the total fiscal income of some European countries.

However, the road sector around the world is facing overwhelming challenges under the sustainable development agenda. Addressing those challenges needs strong intergovernmental support at the international level to promote coordinated strategies, recommend harmonized rules, set common standards, recommend best practices, suggest good procedures, provide technical assistance and build members' capacity. They need to be addressed in one comprehensive platform.

Other modes of transport are supported by their respective intergovernmental bodies. However, equivalent intergovernmental support to the road sector is very limited. What is missing in the road sector is strong intergovernmental support. This support is urgently needed so that the sector can continue to contribute to economic and social development while addressing challenges in a manner that is consistent with the Sustainable Development Goals.

The present study report reviews the status of and the challenges facing the road sector under the sustainable development agenda, identifies the gap in the existing global institutional setting and the need for supporting sustainable development in the road sector, evaluates possible options to fill the gap and meet the need, and explores the viability of establishing an intergovernmental international organization for roads.

The challenges facing the road sector can be grouped into six areas namely: energy consumption and emissions; road safety; internationalization; intelligent transport systems; dangerous goods; and security.

The transport sector consumed 28 per cent of total global energy in 2014 making it the second largest consumer of energy. Within the sector, road transport consumed about 77 per

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<sup>1</sup> 25 member States of the European Union.

cent of its total. If current trends continue, the road sector is expected to increase its energy consumption by 29 per cent from 2015 to 2030 and 63.8 per cent by 2050.

Reflecting the energy consumption figures, the transport sector, released 23 per cent of global CO<sub>2</sub> emissions making it the second largest emitter. Within the sector 75 per cent of emissions were from road transport. If current trends continue, road transport's CO<sub>2</sub> emissions are expected to increase by 28.88 per cent from 2015 to 2030 and 63.18 per cent from 2015-2050.

In 2013, 1.25 million people died from road traffic injuries and another 20-50 million more people suffered from non-fatal road traffic injuries. Sustainable Development Goal 11 includes the improvement of road safety by 2030 and Goal 3 is to halve global deaths and injuries from road traffic crashes by year 2020. However, recent research by the International Transport Forum (ITF) shows that the global trend in road fatalities will miss the targets in both the United Nations Decade of Action for Road Safety and the Sustainable Development Goals.

The internationalization of road transport has, in most regions, brought with it many challenges which both control authorities and road transport operators are struggling to manage. Some of these challenges include: lack of widely recognized intergovernmental standards on competencies of international road transport operators; international movement by road being permitted but largely confined to border areas and a limited number of roads using transport permits issued for a designated route by a specified individual vehicle; differences between countries in the sets of rules and regulations related to road transport; visa application processes that are rarely simple and straightforward and often require a considerable amount of paperwork and time; differences in the vehicle weight and dimension and other safety requirements related with the vehicle structure or construction, when moving across borders; lack of adequate insurance products covering cross border and transit transport of vehicles; differences in requirements, categories and issuance institutions governing driver licenses; different formats for road signs, signals, signage and markings (posing problem for both tourists and drivers of commercial vehicles); lack of harmonization of registration books, road worthiness certificates, periodical inspection certificates and registration plates of vehicles; barriers to intermodal cross-border movements requiring trucks to transfer their loads at border areas or limited use of prime movers and trailers in "trailer swaps" because prime mover and trailer are insured as a single unit.

Information and communication technology (ICT) has, over the last decade or so, pervaded most of our life, and started to revolutionize transport systems through intelligent transport system (ITS). There has however been a lack of intergovernmental leadership on ITS development which has raised issues of effective regulations and policies for interoperability, and technical and service harmonization. It also raises non-technical issues, including private security issues, and the legal responsibility in case traffic crashes or operational malfunctions.

There is a global code and global instructions for the transport of dangerous goods by sea and by air which are administered by the International Maritime Organization (IMO) and the

International Civil Aviation Organization (ICAO). There are also sets of instructions which are applicable to member States of the Organization for Cooperation between Railways (OSJD) and the Intergovernmental Organization for International Carriage by Rail (OTIF). In the road sector, there is an agreement, however, its geographical scope is limited to Europe.

Consequently, the road sector faces the challenges of: more disastrous accidents; prevention of cross-border by road and maritime-road intermodal transport due to the absence of global, unified mandatory regulations for the transport of dangerous goods; lack of a centralized management system for the safe delivery to the final destination of dangerous goods; and slow adoption of ICT in transporting dangerous goods.

Security of road transport and its infrastructure is an increasing challenge for governments worldwide. The current situation being characterized by: more frequent terrorist attacks with vehicles; more attacks to vehicles in operation; deficiency of standardization for road security; necessity for regulatory frameworks and guidelines through global leadership; and a lack of understanding of the usefulness of the technologies which can assist in improving road transport security.

In the area of road safety, the General Assembly has invited the World Health Organization (WHO), working in close cooperation with the United Nations regional commissions, to act as a coordinator on road safety issues within the United Nations system. In pursuance of this mandate, WHO works on improving the quality of road safety data; monitoring and evaluation (culminating in the “Global Status Report on Road Safety”); and keeping road safety on the agenda. To support this work, the Global Road Safety Facility (GRSF), administered by the World Bank (WB), provides funding, knowledge, and technical assistance to low and middle-income countries.

In addition to their mandated cooperation with WHO in road safety the functions of the regional commissions include the provision of a regional intergovernmental forum to consider regional cooperation issues among their members and their work programmes include normative, operational and exchange of experiences in the field of transport through either division or unit for transport.

In infrastructure, these functions have included the support to the development of regional intergovernmental agreements on the Trans-African, European, Asian and Arab Mashreq highway networks, including road routes and guidelines on road classification and design standards.

In the facilitation of international road transport, regional commissions also provide support to their members by undertaking studies of issues, developing guidelines and frameworks and supporting the negotiation of subregional agreements.

In the case of Economic Commission for Europe (ECE), it has provided the forum to negotiate and adopt 34 legal instruments relating to road transport. Of these, there are five

conventions or agreements, discussed below, which are of potential relevance to the functions of an International Road Organization (IRO).

The Economic and Social Council (ECOSOC) Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals issues the Recommendations on the Transport of Dangerous Goods which are included in the annex of “Model Regulations on the Transport of Dangerous Goods (Model Regulations)”. These regulations form the basis of the IMO, ICAO, OSJD and OTIF regulations.

The road sector has a number of non-governmental organizations including the World Road Association (PIARC), the International Road Transport Union (IRU) and IRF. These organizations represent the interests of the road transport industry and provide technical advice to members in various areas including infrastructure, safety, environment and disaster management as well as education and training. IRU manages the private sector side of the functioning of TIR (Transports Internationaux Routiers or International Road Transports) Convention.

The maritime, air and railway transport sectors each have their own organizations, namely, IMO, ICAO and a number of railway organizations including OSJD and OTIF, as well as the nongovernmental organization with special consultative status with ECOSOC, the International Union for Railways (UIC).

IMO, with 171 member States and three associate members, was established in 1949 by the Convention. Its purpose as stated in Article 1(a) of its Charter is “*To provide machinery for co-operation among Governments in the field of governmental regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade; to encourage the general adoption of the highest practicable standards in matters concerning maritime safety, efficiency of navigation and the prevention and control of marine pollution from ships; and to deal with legal matters related to the purposes set out in this article;*”

IMO is now responsible for more than 50 international conventions and agreements and has adopted numerous protocols and amendments. The most important legal instruments supporting safety and efficient shipping are the International Convention for the Safety of Life at Sea (SOLAS), the International Convention for the Prevention of Pollution of the Sea by Oil (MARPOL), the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) and the Convention of Facilitation of International Maritime Traffic (FAL).

ICAO manages the administration and governance of the Convention on International Civil Aviation (Chicago Convention). It works with the Convention’s 191 member States and with industry groups to reach consensus on international civil aviation Standards and Recommended Practices (SARPs), Procedures for Air Navigation (PANS) and policies in support of a safe, efficient, secure, economically sustainable and environmentally responsible civil aviation sector.

Over 12,000 SARPs and five PANS provide the fundamental basis for harmonized global aviation safety and efficiency in the air and on the ground, the worldwide standardization of functional and performance requirements of air navigation facilities and services, and the orderly development of air transport.

In the maritime and civil aviation sectors, IMO and ICAO play the key roles in the development of the two modes of transport. They regulate and formalize international maritime and air transport respectively and their conventions and standards also have significant impact on domestic transport. Their conventions and standards are widely accepted by countries and in both cases, their portfolios deal comprehensively with environmental protection, safety, facilitation, transport of dangerous goods, security and ICT applications.

The main activities of OSJD include development of international transport law; administration of the Convention concerning International Passenger Traffic by Rail (SMPS), the Convention concerning International Goods Traffic by Rail (SMGS) and other legal documents connected with the international railway traffic; co-operation on the solution of the problems connected with the economic, information, scientific, technological and ecological aspects of railway transport; co-operation in the field of railway operation and technical matters connected with further development of international railway traffic; and collaboration with other international organizations engaged in railway transportation matters, including those of combined transport.

The aim of OTIF is to promote, improve and facilitate, in all respects, international traffic by rail. This aim is achieved by a uniform system of laws in a number of fields including: the contract of carriage of passengers and goods in international through traffic by rail between member States (CIV and CIM); the contract of use of wagons as means of transport in international rail traffic; the contract of use of infrastructure in international rail traffic; and the carriage of dangerous goods. Other activities concern provisions on interoperability and technical harmonization in the railway field; the technical approval of railway material intended for use in international traffic; and contributing to the facilitation of border crossing in international carriage by rail.

The fact that the railway sector has two intergovernmental organizations is largely a legacy of the “Cold War”, OSJD having its origins in the states that formed the Former Soviet Union and OTIF being of Western European origin. In more recent times there has been increased cooperation between them particularly in Euro-Asian rail transport and the development of a unified CIM/SMGS consignment note.

The membership of UIC is drawn from integrated railway companies, infrastructure managers, and railway or combined railway transport operators, rolling stock and traction leasing companies and service providers. Its major role is in technical standardization in the rail transport sector through the issuance of obligatory or recommended “UIC Leaflets” which aim at unifying or standardizing the construction measures. In December 2012, the

UIC standardization platform was launched to develop international railway standards from the current UIC Leaflets in phases.

In contrast, the above summary and the reviews of the challenges in Chapter 2 and the existing organizations in Chapter 3 show very weak intergovernmental support at the international level for the road sector. As a result the road sector has a serious deficiency of standards/norms, regulatory frameworks, guidelines, associated technical assistance and capacity building. This institutional gap has caused many of the difficulties and challenges arising in the road sector.

Today, the road sector is dealt with in a piecemeal manner. This piecemeal approach means that there are many intergovernmental and nongovernmental organizations at the global, regional, subregional, bilateral and national levels that are dealing with parts of road issues. The net effect of this approach is that there are areas of road transport policy, legislation and operations which are not adequately addressed within the current institutional framework.

These “institutional gaps” occur not only in relation to issues arising in the road sector, but also geographically. In particular, many developing countries are not included, or they perceive that they are not included, in global processes to address issues arising in the road sector.

There is an urgent need for a road organization similar to IMO or ICAO to provide comprehensive and integrated support for inter-related greenhouse gas emissions, road safety, internationalization, ITS, dangerous goods and security.

The goals in establishing an IRO should be to fill in the gaps left by existing institutions and to complement, rather than duplicate or overlap with, their work. A prerequisite would be that an IRO would cooperate with other organizations.

Following the examples of IMO and ICAO, an IRO can serve as a global intergovernmental platform of States for roads and road traffic. Its main roles being to adopt coordinated strategies, set common standards and definitions, recommend best practices and good procedures, provide associated technical assistance and build members’ capacity for safe, efficient and environmentally friendly development of road transport.

Based on these principles, possible functions of IRO are suggested in Chapter 5.2 of the study report. In summary they could include:

- **Green transport:** recommending policy and regulatory frameworks, harmonizing technical and operational standards, promoting technological and operational innovations, sharing good practices;
- **Road safety:** setting technical standards, recommending laws and rules, raising awareness, sharing good practices;
- **International transport:** harmonizing technical and operational standards, simplifying and harmonizing documentation and formalities, and sharing good practices;

- **ITS:** setting technical standards, recommending policy and regulatory frameworks, advocating deployment and sharing good practices;
- **Dangerous goods:** standardizing classification and packing and labelling, setting technical and operational standards on carriage, recommending regulations, harmonizing certification of professional competency of operators and drivers and sharing good practices; and
- **Security:** recommending measures, regulatory frameworks, infrastructure facilities, preparedness and response, standardizing prevention and enforcement measures.

These functions do not duplicate or overlap with the functions of ITF, ECA (Economic Commission for Africa), ECLAC (Economic Commission for Latin America and the Caribbean), ESCAP (Economic and Social Commission for Asian and the Pacific), ESCWA (Economic and Social Commission for Western Asia), the World Bank, and the ECOSOC Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals. Its functions will complement the work of global non-governmental organizations in the road sector, such as PIARC, IRU and IRF.

They would not include functions mandated to WHO, namely, improving the quality of road safety data; monitoring and evaluation; and keeping road safety on the agenda.

They would also not duplicate or overlap with the mainstream work of ECE. In this respect it is envisaged that only five conventions/agreements of 34 legal instruments relating to road falling under the purview of ECE are of potential relevance to the functions of IRO, including:

- Convention on Road Traffic 1968
- Convention on Road Signs and Signals 1968
- Agreement on Minimum Requirements for the Issue and Validity of Driving Permits 1975
- Agreement concerning the Adoption of Uniform Conditions for Periodical Technical Inspections of Wheeled Vehicles and the Reciprocal Recognition of Such Inspections 1997
- General Agreement on Economic Regulations for International Road Transport 1954

The Road Traffic and Road Signs and Signals Conventions have less than 40 percent global participation and could be promoted by IRO for improving road safety and facilitation of international road transport. The remaining three agreements only have 2-7 per cent global participation and have a high value for IRO to review, revise and organize negotiation of global legal instruments for the facilitation of international transport and improvement of road safety. Two of them require ECE member States, consultative status or participation in ECE's activities.

The study report considers the advantages and disadvantages of a number of organizational options for an IRO. These include: 1. Establish an international road organization (IRO); 2. Enhance the five United Nations regional commissions; 3. Empower one of the five United Nations regional commissions; 4. Develop from a regional organization to a global

organization; 5. Establish multiple specialized agencies for road safety and green road transport; and 6. Set up a global inland transport committee.

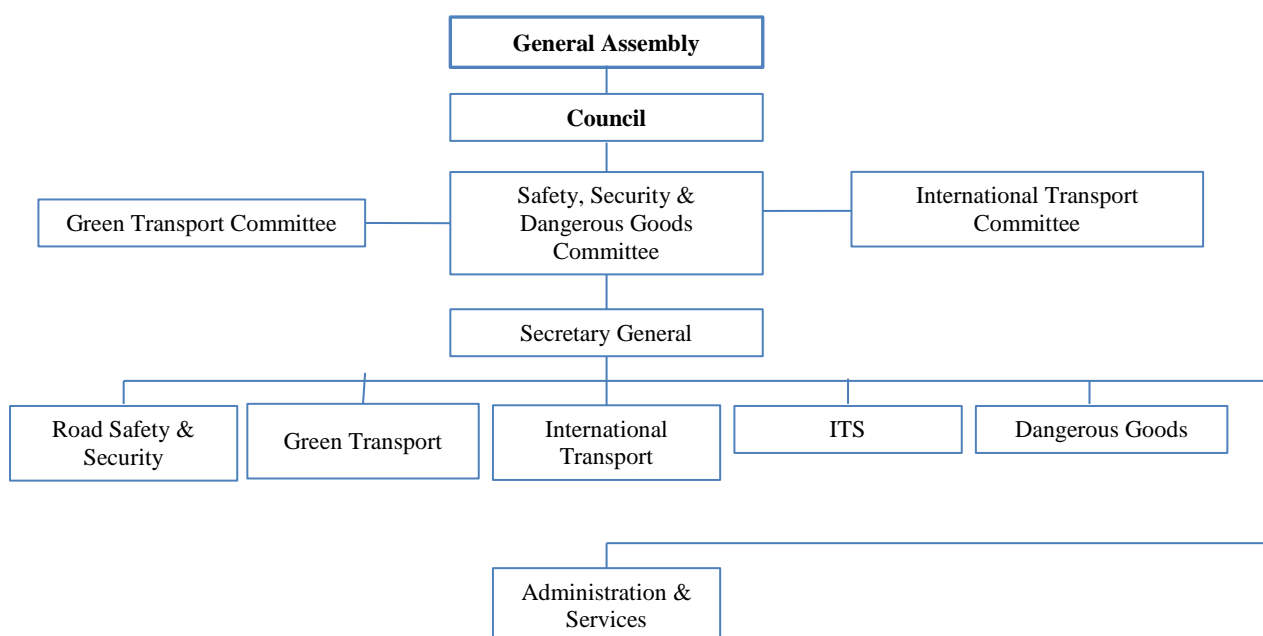
Among these options, the establishment of IRO, Option 1, is considered as the best solution to fill in the institutional gap in the road sector because of its scope, efficiency, effectiveness and simplicity. Organized in such a manner, an IRO can fully address the sustainable development challenges facing the road sector in a comprehensive and integrated manner.

Following normal practices, IRO could be established as an intergovernmental organization. Then after some years of successful operation, IRO could apply for the status of a specialized agency of the United Nations.

The study report provides an outline of the organizational structure, staffing, cost estimate, funding and financial arrangements for an IRO.

The following Figure shows an indicative organizational structure which would include three legislative committees and a secretariat with six divisions.

< Organizational chart and staffing of IRO >



The estimated annual cost, based on 30 posts (19 professional and 11 general service) including administrative costs but exclusive of the provision of physical infrastructure and servicing is around USD 2.5 million.

The possible funding and financial arrangements are discussed, based upon the United Nations, the IMO and ICAO methodologies. The methodology for assessment needs extensive consultation among members. However, in the case of an IRO, consideration may be given to such variables as the number of registered road vehicles and road lengths.

Taking into account the experience of IMO and ICAO, wide participation in IRO and the current situation of roads, member States of IRO would probably need to contribute USD 500 - 250,000 per year for each member if its budget would be USD 2.5 million per annum in the initial five years.

A cost-benefit analysis is undertaken which only takes into account the benefits of reduced road injuries and deaths, reduced climate change impact from carbon emissions, and reduced health impediments from air pollution. The outcome of the analysis is that the benefits would be magnitudes greater than the costs thereby providing strong empirical justification for establishing an IRO.

Partnerships between an IRO and other road related organizations are a vital element in an IRO performing its functions and providing quality service to its member States. The study report outlines collaboration with the organizations related to overall transport policy; technical collaboration on roads related issues with intergovernmental organizations, collaboration with the United Nations regional commissions in the areas of green transport, road safety, ITS, dangerous goods and security, and cooperation with non-governmental organizations active in the roads sector.

It is foreseen that the non-governmental organizations related to roads, including PIARC, IRF and IRU, would be represented in the IRO's General Assembly and technical committees thereby providing them with an intergovernmental platform to lobby or voice their concerns, requests and initiatives. Requests, facts and research works from the non-governmental organizations can lay solid ground for IRO to develop norms, guidelines, frameworks and recommendations. On the other side, the non-governmental organizations can be instrumental for the applications of the norms, recommendations and guidelines set by IRO.

A road map for establishing an IRO is outlined in the study report which considers: charter drafting; negotiation of a draft charter; signing of a charter; an interim secretariat; entry into force of the charter; initial operation and further development as a specialized agency of the United Nations; headquarters agreement.

The establishment of IRO provides the opportunity to deal comprehensively and inclusively to address environmental protection, safety, facilitation, transport of dangerous goods, security and ICT applications, many of which are crucial to achieving the Sustainable Development Goals.

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## INTRODUCTION

Roads are the oldest and the most popularly used mode of transport, from the ancient walking paths to today's modernized expressways and future smart ways, and from the riding horses to today's motor vehicles and future self-driving vehicles. Roads catalyzed human civilization and have been supporting economic and social development of the world. Nowadays, the world's total length of road networks has reached 64 million kilometres<sup>2</sup> and the global population of registered motor vehicles has grown to 1.78 billion<sup>3</sup>.

As the most efficient, convenient and flexible mode, road transport provides door-to-door delivery of all kinds of goods by its own. It also supports door-to-terminal movements of maritime, air and railway goods to enable them to function.

Distinguished from all other modes of transport, roads are not only used by professional transporters but also largely by the general public, for walking, cycling and driving motor vehicles. They provide people with access to school, work places, medical services, social events, markets and resources. Owing to such wide range of functions, roads are the easiest and fastest solution to rural development and poverty alleviation.

A case study on Europe<sup>4</sup> by IRF showed that trucks carried nearly 80 per cent of all goods measured by tonne-kilometre. The road sector contributed approximately 22 per cent of gross domestic product (GDP) to the EU 25<sup>5</sup> economy and 5 per cent of the EU 25 employment. Vehicle related taxes accounted for 10.2 per cent of the total fiscal income of some European countries.

However, the road sector around the world is facing unprecedented challenges under the sustainable development agenda:

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<sup>2</sup> Estimated from various sources.

<sup>3</sup> WHO data depository for road safety, accessed on 5 April 2016.

<sup>4</sup> International Road Federation (2007), The Socio-Economic Benefits of Roads in Europe.

<sup>5</sup> 25 member States of the European Union.

- **Energy consumption and greenhouse gas emissions:** Road transport consumes 77 per cent of total energy used by the entire transport sector and is responsible for 75 per cent of total CO<sub>2</sub> emissions of the transport sector<sup>6</sup>. Taking into account the overall 28 per cent of energy consumption and 23 per cent of CO<sub>2</sub> emissions by the transport sector, lower fuel efficiency and higher emissions per tonne-kilometre, and measures taken by other modes of transport, the road sector becomes crucially important for achieving Sustainable Development Goals (SDGs).
- **Road safety:** Globally road crashes killed 1.25 million people in 2013<sup>7</sup>. With the current trend in the world, many developing countries will miss the global goal to halve road fatalities and injuries by 2020.
- **Internationalization:** Hundreds of bilateral and multilateral agreements have been signed by countries in an attempt to open the borders and domestic roads for international transport. Cross-border transport by road has been developed from inter-country to inter-subregional and inter-regional (such as Eurasian transport). The International Transport Forum (ITF) estimated that global road passenger travel will grow by 120-230 per cent and freight volumes by 230-420 per cent till 2050.<sup>8</sup> However, numerous persistent non-physical barriers cause delays and high costs, and even suspension of transport. Yearly 1.2 billion of international tourists<sup>9</sup> often face different traffic rules, signs and signals, markings, insurance schemes and facilities. More road crash cases with involvement of tourists have been observed, in particular those driving local road vehicles. Efficient international intermodal transport of containers is impeded by different rules for road haulage with foreign trailers.
- **Security:** While transport is an enabler of economic activity it also is a vector for most of the trans-national crimes that lead to security concerns for the countries. These persistent challenges include theft/pilferage of goods, human and drug trafficking, smuggling of contraband including arms and ammunition. In addition, international terrorist groups increasingly use road vehicles to kill innocent people. Almost all of these threats are perpetrated using road transport in one form or another. Efficient and effective measures are not in place in many countries.
- **Smart roads and vehicles:** Increasing number of vehicles on the roads has led to the deployment of intelligent transport system (ITS) for their better management. Large variety of such advanced systems has been seen across countries and even within a country. Self-driving vehicles are on test along roads but corresponding infrastructure and legal frameworks have not been prepared. ITS is seen as a way forward to deal with many of the challenges in the road sector. However, there is a need to harmonize design and operating standards for such systems so that they are commercially available for use especially in least developed and landlocked developing countries to deal with the challenges to road transport.

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<sup>6</sup> International Energy Agency (IEA), "World energy balances", IEA World Energy Statistics and Balances (database), DOI: <http://dx.doi.org/10.1787/data-00512-en> (Accessed on 18 March 2016); CO<sub>2</sub> Emissions from Fuel Combustion Highlights 2015, P11.

<sup>7</sup> World Health Organization (WHO), Global Status Report on Road Safety 2015.

<sup>8</sup> International Transport Forum (ITF) 2015, Transport Outlook 2015.

<sup>9</sup> World Tourism Organization (UNWTO), World Tourism Barometer 2015.

Addressing those challenges needs strong intergovernmental support at international level to promote coordinated strategies, recommend harmonized rules, set common standards, recommend best practices, suggest good procedures, provide technical assistance and build members' capacity. The above summarized challenges are inter-related. They need to be addressed in one comprehensive platform.

Other modes of transport are supported by their respective intergovernmental bodies: for maritime transport, the International Maritime Organization (IMO); for air transport, the International Civil Aviation Organization (ICAO); for rail transport, the Organization for Cooperation between Railways (OSJD) and the Intergovernmental Organization for International Carriage by Rail (OTIF). Equivalent intergovernmental support to the road sector is very limited.

Similar to the non-governmental organizations for other modes of transport, globally there are a few non-governmental organizations for road, namely World Road Association (PIARC), IRF and IRU, which play a significant role in advocating for the road sector, promoting industry self-regulation, sharing experience and providing services to their members. However, none of them can set standards, recommend rules and coordinate policy framework as an intergovernmental body would do.

The Economic Commission for Europe (ECE) has been making efforts to try to help set global standards for road safety and international road transport since the early 1990's. Due to its role as a regional commission and limitation of capacity and resources in comparison with the intergovernmental bodies for maritime, air and railway transport, it faces the following difficulties: (a) Representation of other regions at the ECE's meetings and reflection of the situations of other regions in the conventions/agreements have been modest; (b) Countries' participation in ECE's conventions/agreements are very low in general; (c) The influence and coverage of the conventions/agreements administered by ECE are insufficient to address the challenges in the road sector under the sustainable development agenda; (d) Conversion of the European agreements into global conventions has been unsuccessful; (e) Some conventions/agreements require ECE's membership, consultative status with ECE or participation in ECE's activities. Economic and Social Commission for Asia and the Pacific (ESCAP) has also started its role as a regional norm/standard setting commission. It tries to focus on the regional standards which do not need global harmonization.

What is missing in the road sector to contribute to sustainable development is stronger intergovernmental support, which is urgently needed to help the road sector address the common challenges and develop in a sustainable manner at the intergovernmental level.

The present study report reviews the status and challenges of the road sector under the sustainable development agenda, identifies the gap of the existing global institutional setting and the need for supporting sustainable development in the road sector, evaluates possible options to fill the gap and meet the need, and explores viability to establish an intergovernmental international organization for roads.

# 2

## STATUS & KEY CHALLENGES OF THE ROAD SECTOR

### 1. Energy Consumption and Greenhouse Gas Emissions by the Road Sector

#### 1.1. Energy consumption

The transport sector is the second largest consumer of energy. In 2014, it consumed 2,627,018 kilo-tonnes of oil equivalent (ktoe), amounting to 28 per cent of global total energy consumption, as seen in Table 1. The only larger consumer was industry, which represented 29 per cent of global total consumption. Transport was followed by residential uses consuming 23 per cent and commercial and public services consuming 8 per cent of global total energy consumption.

Within transport, the road sector accounted for about 77 per cent of the energy consumed by transport and 21 per cent of global total energy consumption.

**Table 1. World energy consumption by source and sector, 2014**

(a) Total final consumption (Kilo-tonnes of oil equivalent)

	Transport	Of which: Road	Industry	Residential	Commercial and public services	Other	Total final consumption	Percentage by source
Oil products	2,426,327	1,864,647.79	294,673	207,079	85,502	730,062	3,743,642	40%
Natural gas	97,903	38,101.43	548,536	419,665	181,717	172,162	1,419,982	15%
Coal	2,861	-	858,235	74,640	34,914	103,972	1,074,623	11%
Renewables	73,889	73,117.81	187,436	874,599	30,194	14,592	1,180,713	13%
Electricity	26,035	284.94	725,372	460,413	376,237	117,841	1,705,899	18%
Other	3	-	136,915	105,729	36,077	21,107	299,831	3%
<b>Total</b>	<b>2,627,018</b>	<b>1,976,141.96</b>	<b>2,751,166</b>	<b>2,142,125</b>	<b>744,641</b>	<b>1,159,738</b>	<b>9,424,689</b>	<b>100%</b>
Percentage by Sector	28%	21%	29%	23%	8%	12%	100%	

**Table 1. World energy consumption by source and sector, 2014 (continued)****(b) Consumption by sector (Percentage)**

	Transport	Of which: Road	Industry	Residential	Commercial and public services	Other
Oil products	92.4	94.4	10.7	9.7	11.5	63
Natural gas	3.7	1.9	19.9	19.6	24.4	14.8
Coal	0.1	0	31.2	3.5	4.7	9
Renewables	2.8	3.7	6.8	40.8	4.1	1.3
Electricity	1	0	26.4	21.5	50.5	10.2
Other	0	0	5	4.9	4.8	1.8
Total	100	100	100	100	100	100

**(c) Consumption by source (Percentage)**

	Transport	Of which: Road	Industry	Residential	Commercial and public services	Other	Total
Oil products	64.8	49.8	7.9	5.5	2.3	19.5	100
Natural gas	6.9	2.7	38.6	29.6	12.8	12.1	100
Coal	0.3	0	79.9	6.9	3.2	9.7	100
Renewables	6.3	6.2	15.9	74.1	2.6	1.2	100
Electricity	1.5	0	42.5	27	22.1	6.9	100
Other	0	0	45.7	35.3	12	7	100
Total	27.9	21	29.2	22.7	7.9	12.3	100

Source: IEA (2016), "World energy balances", IEA World Energy Statistics and Balances (database).

92.4 per cent of transport's energy came from oil products in 2014. The road sector was equally as dependent, getting 94.4 per cent of its energy from oil.

In 2014 the transport sector was the largest consumer of oil derivatives by a huge margin. It consumed 64 per cent of the total global consumption of oil derivatives, or 2,426,327 ktoe out of the total 3,743,642 ktoe consumed. The road sector constituted roughly 50 per cent of global total oil product consumption.

**Table 2. Global oil product consumption by transport and roads**

	Transport		Road	
	Ktoe	Average Annual Growth	Ktoe	Average Annual Growth
1990	1,477,318	1.00%	1,111,730	1.60%
1995	1,622,758	2.50%	1,240,015	2.60%
2000	1,870,251	2.20%	1,420,002	2.30%
2005	2,094,274	2.60%	1,590,916	2.30%
2010	2,252,458	1.40%	1,719,676	1.50%
2014	2,426,327	2.00%	1,846,648	2.30%

Source: IEA (2016), "World energy balances", IEA World Energy Statistics and Balances (database).

As shown in Table 2, in 1990 transport consumed 1,477,318 ktoe of oil products and road transport consumed 1,111,730 ktoe. Later in 2014 transport and roads consumed 2,426,327 ktoe and 1,864,648 ktoe respectively. During this time period, annual oil product consumption by transport increased by 64 per cent and consumption by road transport

increased by 67 per cent. By comparison, annual global oil product consumption has increased by only 45 per cent<sup>10</sup>. This shows that both transport and road transport's consumption of oil products are rising faster than global consumption of oil products, and their share of total oil consumption is rising.

If current trends continue, the road sector is expected to increase its energy consumption by 29 per cent from 2015 to 2030. Looking further, its consumption will increase 63.8 per cent by 2050<sup>11</sup>.

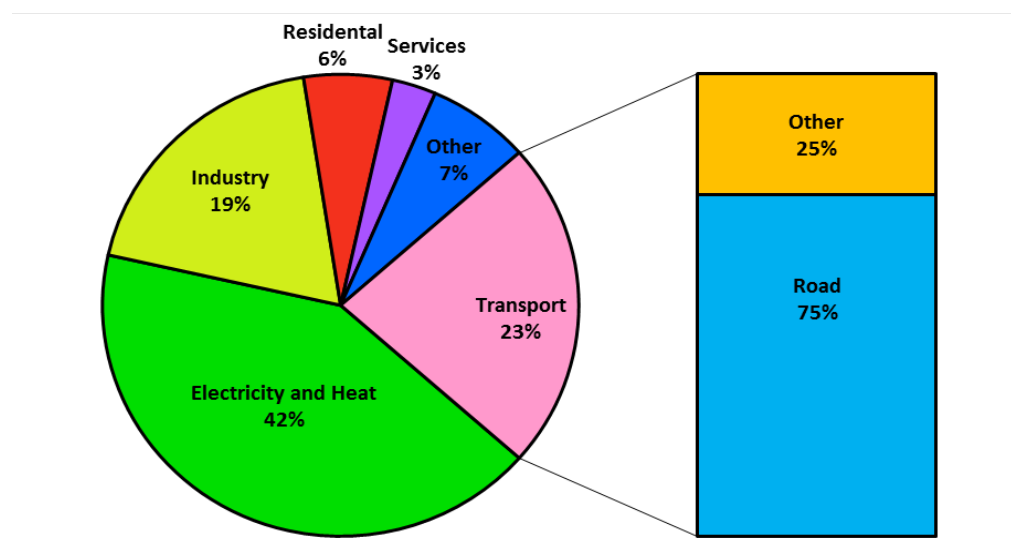
## 1.2. Greenhouse gas emissions

In December 1997 the Kyoto Protocol was adopted and named six gases as the largest contributors to climate change. These gases were carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF<sub>6</sub>) and were deemed: "greenhouse gasses".

Carbon dioxide, nitrous oxide, and methane account for 99 per cent of greenhouse gas emissions. Carbon dioxide alone accounts for 76 per cent of greenhouse gas emissions<sup>12</sup>. Although the transport sector emits methane, nitrous oxide, and hydrofluorocarbons, the overwhelming majority of transport's emissions are carbon dioxide emissions.

As seen in Figure 1, in 2013 global CO<sub>2</sub> emissions were predominately caused by electricity and heat generation. Electricity and heat generation caused 42 per cent of global CO<sub>2</sub> emissions while transport, the second largest emitter, released 23 per cent of global CO<sub>2</sub> emissions. Industry emitted 19 per cent of total emissions.

Figure 1. Global CO<sub>2</sub> emissions by sector, 2013



Source: International Energy Agency, CO<sub>2</sub> Emissions from Fuel Combustion Highlights, 2015

<sup>10</sup> IEA (2016), "World energy balances", IEA World Energy Statistics and Balances (database).

<sup>11</sup> IEA Energy Technology Perspectives 2016.

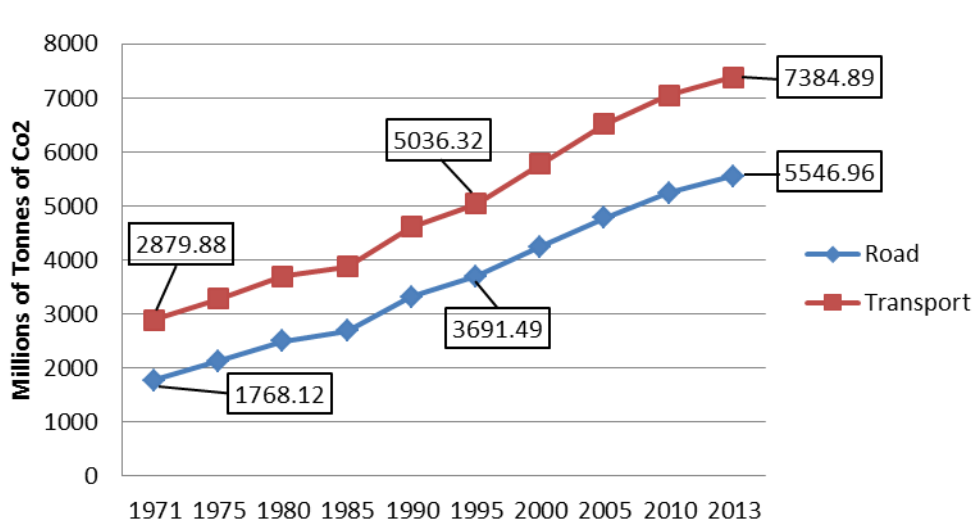
<sup>12</sup> IPCC: Fifth Assessment Report, Climate Change 2014: Mitigation of Climate Change.

Out of total CO<sub>2</sub> emissions by transport, 75 per cent were caused by road transport. This means that road transport equated to roughly 17 per cent of global CO<sub>2</sub> emissions.

Figure 2 shows that in 2013 the transport sector emitted a total of 7,384.89 millions of tonnes of CO<sub>2</sub> (mt CO<sub>2</sub>) into the atmosphere, while the road sector emitted 5,546.96 mt CO<sub>2</sub>.

From 1995 to 2013 transport and road transport's annual emissions have risen by 46.63 per cent and 50.26 per cent respectively. Comparing their 2013 emissions to their 1971 emissions, transport and road transport's annual emissions have risen by 156.43 per cent and 213.72 per cent respectively. Transport and road's emissions rose faster than global total CO<sub>2</sub> emissions which during the same time period rose by 130 per cent. This shows that the shares of global emissions transport and road transport have been rising.

**Figure 2. Estimated CO<sub>2</sub> emissions from transport and roads, 1971-2013**



Source: IEA (2016), "CO<sub>2</sub> emissions by product and flow", IEA CO<sub>2</sub> Emissions from Fuel Combustion Statistics (database).

Transport's per capita CO<sub>2</sub> emissions rose by 35 per cent from 1971 to 2013. And road's per capita CO<sub>2</sub> emissions rose by 65.8 per cent during the same time period<sup>13</sup>.

Road transport's CO<sub>2</sub> emissions are expected to increase by 28.88 per cent from 2015 to 2030 and 63.18 per cent from 2015-2050 if current trends continue<sup>14</sup>.

## 2. Road Safety

Despite road injury deaths being some of the most preventable, 1.25 million people died from road traffic injuries in 2013.<sup>15</sup> That is 17.4 deaths per 100,000 people. Along with them, another 20-50 million more suffer from non-fatal road traffic injuries.<sup>16</sup>

<sup>13</sup> IEA (2016), "Per capita CO<sub>2</sub> emissions by sector", IEA CO<sub>2</sub> Emissions from Fuel Combustion Statistics (database).

<sup>14</sup> IEA Energy Technology Perspectives 2016.

<sup>15</sup> WHO, 2015, Global Status Report on Road Safety 2015 (Geneva).

Road traffic injury is one of the top ten causes of death globally. It is also the leading cause of injury deaths; followed by suicide, falls, and interpersonal violence<sup>17</sup>

These traffic crashes come at a great economic cost. Most of these crashes affect the family's most economically active agent, meaning that any loss or disability of this member can financially cripple a family. It could also result in the family needing to take care of the disabled family member for the rest of their lives.

It is estimated that these road injuries and deaths cost approximately 3 per cent of global GDP annually. However, it is estimated to cost the low and middle income countries 5 per cent of their annual GDP. These figures account for the health, insurance, and legal fees associated with traffic injuries.<sup>18</sup>

Low and middle income countries comprise 90 per cent of road traffic deaths<sup>19</sup>. Low and middle income countries have road traffic death rates that are more than twice that of high income countries. The low and middle income countries have respective death rates of 24.1 and 18.4 road traffic fatalities per 100,000 people compared to the high income countries, which have 9.2 road traffic fatalities per 100,000 people. Vehicles sold in 80 per cent of all countries worldwide fail to meet basic safety standards.<sup>20</sup>

## *2.1. The global goal on road safety*

Since 2003, the United Nations General Assembly has adopted seven resolutions calling for strengthened international cooperation and multisectoral national action to improve road safety situation. In its resolution 64/255 of 10 May 2010 on improving global road safety, the General Assembly proclaimed the period 2011-2020 as the Decade of Action for Road Safety with a goal to stabilize and then reduce the forecast level of road traffic fatalities around the world by increasing activities conducted at the national, regional and global levels.

In its latest resolution 70/260 of 15 April 2016 on improving global road safety, the General Assembly expresses its concern that, despite the stabilization of the global number of road traffic fatalities since 2013, the number of road traffic crashes remains unacceptably high, and crashes represent a leading cause of death and injury around the world. The resolution also invites member States and the international community to intensify both national and international collaboration with a view to meeting the ambitious road safety-related targets in the 2030 Agenda for Sustainable Development.

Road safety target is included in Sustainable Development Goals (SDGs) under Goal 3 “ensure healthy lives and promote well-being for all at all ages” with Target 3.6 to halve

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<sup>16</sup> WHO, 2015, Global Status Report on Road Safety 2015 (Geneva).

<sup>17</sup> WHO, 2015, WHO Health in 2015: From MDGs to SDGs (Geneva).

<sup>18</sup> Dahdah S and McMahon K., 2008, the True Cost of Road Crashes: Valuing Life and The Cost Of A Serious Injury (Washington, International Road Assessment Programme, World Bank Global Road Safety Facility).

<sup>19</sup> WHO, 2015, 10 Facts on Global Road Safety (Geneva).

<sup>20</sup> WHO, 2015, 10 10 Facts on Global Road Safety (Geneva).

global deaths and injuries from road traffic crashes by year 2020 and Goal 11 “By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons”.<sup>21</sup>

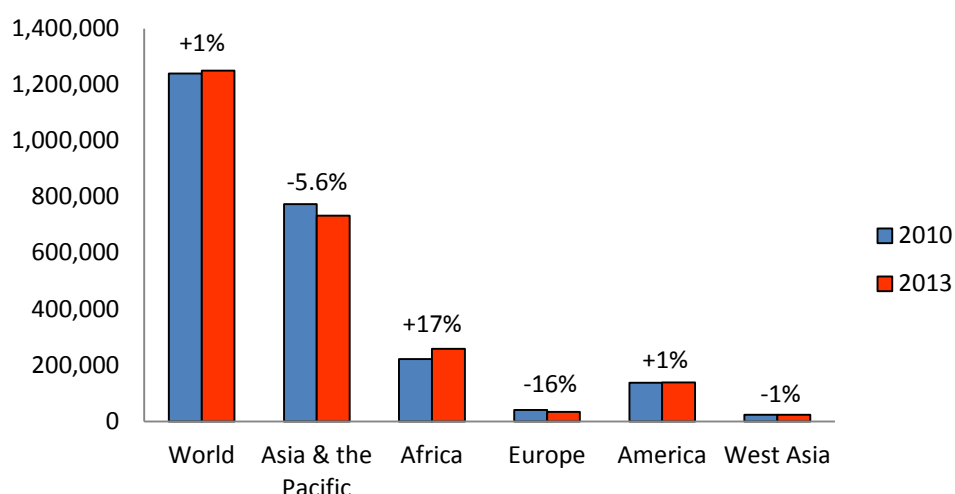
## 2.2. Progress in achieving the global road safety goal since 2010

Figure 3 depicts global and regional progress in improving road safety with the available data from the World Health Organization (WHO) Global Road Safety Status Reports and the geographical division of the United Nations regional commissions<sup>22</sup>. The Figure compares the estimated number of traffic deaths in 2010 when the Decade of Action for Road Safety started and that in 2013, which was the latest data available in the WHO reports.

The global deaths from road traffic crashes were 1.24 million in 2010 and 1.25 million in 2013. From 2010 to 2013, the road traffic deaths grew nearly 1 per cent globally. The best performing region was Europe, reduced 16 per cent. The second best was the Asia-Pacific region, 5.6 per cent. The rest of the regions showed increase with Africa on the top at a growth rate of 17 per cent.

The data from WHO showed that except Europe, all other regions will most probably miss the SDGs target to halve the road traffic deaths and injuries by 2020 if no much stronger measures are urgently taken.

**Figure 3. Estimated number of road traffic deaths**



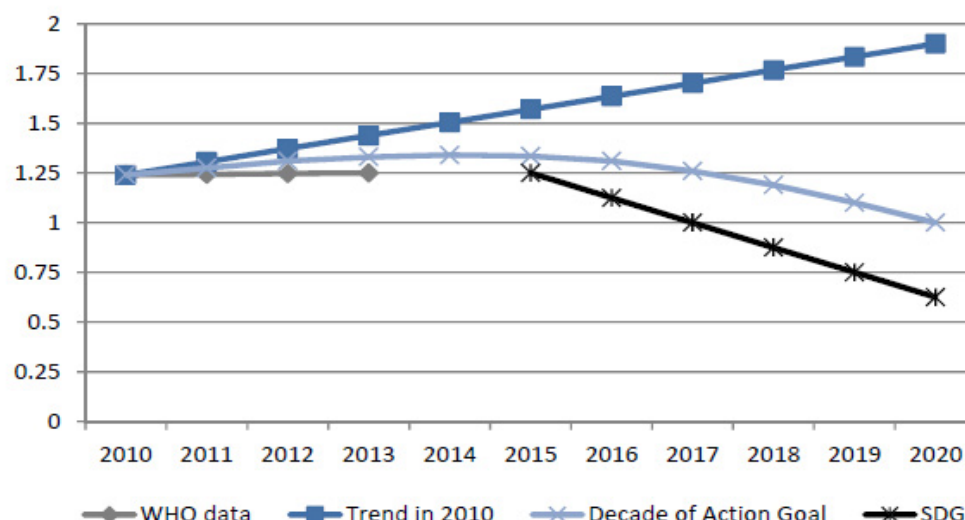
Source: WHO (2013), *Global Status Report on Road Safety 2013*; WHO (2015), *Global Status Report on Road Safety 2015*

<sup>21</sup> The General Assembly resolution 70/1 of 25 September 2015.

<sup>22</sup> The United Nations regional commissions: Economic Commission for Africa, Economic Commission for Europe, Economic Commission for Latin America and the Caribbean, Economic and Social Commission for Asia and the Pacific, Economic and Social Commission for Western Asia.

A recent research by ITF shows that the global trend in road fatalities will miss the targets in both the UN Decade of Action Goals and sustainable development targets (see Figure 4).

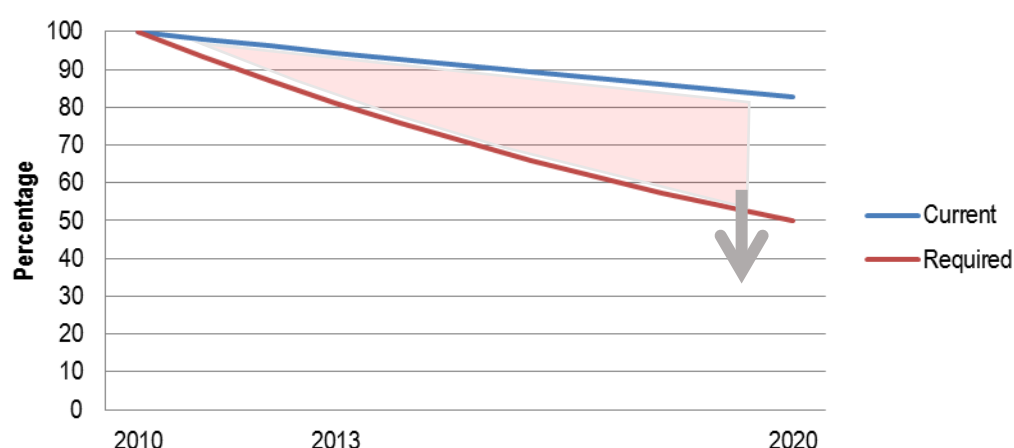
**Figure 4. UN Decade of Action Goals and Sustainable Development Targets**



Source: ITF (2016), pp41, *Zero Road Deaths and Serious Injuries - Leading a Paradigm Shift to a Safe System (Paris)*.

The Asia-Pacific region, as the second best performer, managed to reduce the fatality figure between 2010 and 2013 at the average rate of 1.9 per cent per annum. However, this speed is far from sufficient to enable the region to accomplish the SDGs Target 3. Less than 20 per cent reduction will be achieved if the region continues at this pace (see Figure 5). This will be even more challenging considering the fact that motorization rate of the region has been increasing at the average of 7.2 per cent per annum between 2010 and 2013.

**Figure 5. Estimated reduction of road traffic fatalities 2010-2020 in Asia-Pacific**



Source: ESCAP

Although the Asia-Pacific region showed decrease in road traffic deaths, the total number of fatalities was still the highest among all the regions, 733,000 people.

## *2.3. Challenges in improving road safety*

### *Road users*

Roads are the most popular mode of the transport. Unlike other modes of transport, roads are not only used by professional transporters or commercial transporter, like bus operators or trucking companies but also largely used by the general public, including private vehicle drivers, private vehicle passengers, cyclists, pedestrians and own-account transporters. Their individual behaviors and inter-actions are a key factor affecting road safety.

Regulating the individual behaviors and inter-actions of such wide range of users and enforcing regulations are extremely complicated. Most national traffic rules are strong in regulating individual behaviors and inter-actions of motor vehicle drivers but weak in regulating cyclists, pedestrians and passengers. For example, many countries have banned the use of mobile phones while driving cars but have not taken action against the use of mobile phones while riding bicycles or walking. The WHO Global Status Report on Road Safety 2015 indicated that 49 per cent of all road traffic deaths occurred among pedestrians, cyclists and motorcyclists, and 31 per cent were car occupants.

The second weak area is qualifications required for issuance of driving license and related institutional settings. Most countries enforce age limitation, written test and skill exam and some require health certificate. However, the personal history in alcohol addiction, drug use and crime record is not checked in most countries. Institutional settings for issuance of driving license vary in different countries, and are simple in most developing countries. Many road crashes or attacks with vehicles were in fact rooted from improper issuance of driving license. Further detailed requirements for different categories of driving license are different from country to country, which affects safe driving in foreign countries in cross-border transport and international travels.

The third weak area is behavior and inter-action in a vehicle crash. Many road traffic deaths were caused by inadequate reactions to crashes. Most traffic rules require drivers to report to police and keep the sites. However, no further professional reactions are advised to organize rescue, prevent possible subsequent crashes, investigate reasons of crashes and amend traffic rules or take other legislative or technical measures.

The fourth weak area is education and training. As road vehicle are simpler than aircraft and ship, enough attention was not paid to education and training of drivers or even professional drivers road vehicles. Traffic rules require skills to steer vehicles but not comprehensive knowledge and skills on safety. Non drivers' education is far less than sufficient to reduce the largest share of road traffic deaths. In many countries, drivers do not stop or even slow down at zebra crossings. Very often, pedestrians do not follow traffic rules to cross the roads at the designated places. Education and human behaviors are equally important.

The fifth weak area is different traffic rules in many countries. Although most traffic rules look similar, there are numbers of opposite differences. For example, some countries' rules

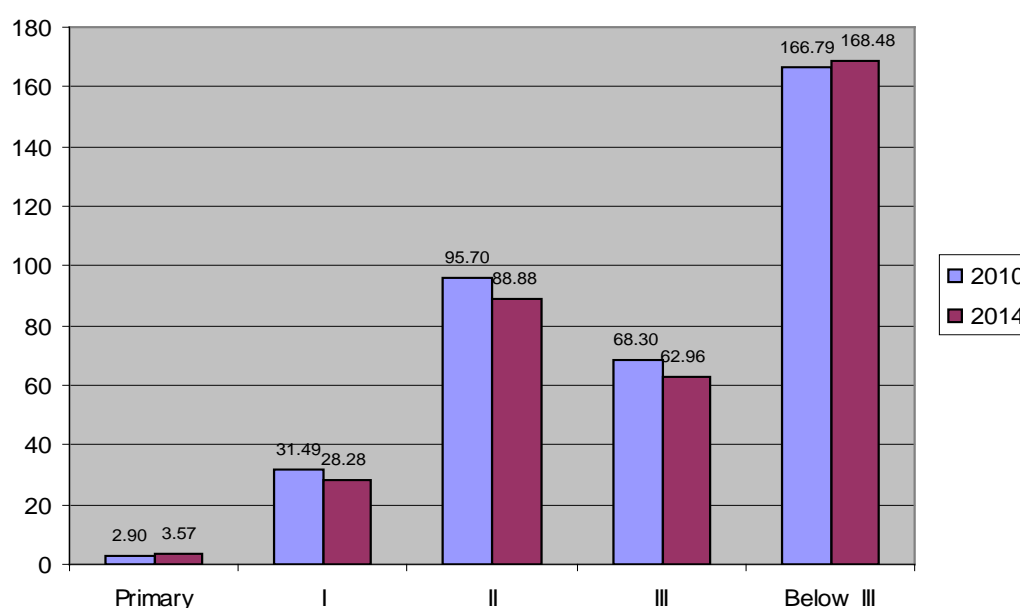
allow vehicle to enter main road without stop at junction but others not. In some countries, drivers use headlight flash to warn others to stop, which means to give others way in other countries. Such differences have already caused many deadly traffic crashes with involvement of foreign walking and car renting tourists and cross-border vehicles.

### *Road infrastructure and facilities*

The WHO Global Status Report on Road Safety recognizes the road infrastructure and facilities as one of the key factors affecting road safety. Road design, construction, maintenance, signs, signals, markings, separation, side protection and lighting etc. provide physical conditions for the use by vehicles. Improper condition of any of them causes traffic crashes and increases the risk of traffic crashes.

According to the data available from the ESCAP's Asian Highway Database, there is a clear correlation between the class of the road and road safety performance: primary class Asian Highway roads have the best safety record, at 3.57 fatalities per billion vehicle-km, while those below class III have the worst record at 168.48 fatalities per billion vehicle-km.<sup>23</sup> The average fatality rates for other classes of Asian Highway routes were 28.28 fatalities per billion vehicle-km (class I), 88.88 fatalities per billion vehicle-km (class II) and 62.96 fatalities per billion vehicle-km (class III).<sup>24</sup>

**Figure 6. Average fatality rates per billion vehicle-km by Asian Highway class**



Source: ESCAP Asian Highway database

Studies show a strong correlation between infrastructure design and road safety. In many countries, the installation of barriers to separate opposing directions of traffic and/or different types of vehicles, the application of access control principles, better geometric design of

<sup>23</sup> Further information on this matter is available in E/ESCAP/AHWG(6)/1.

<sup>24</sup> Ibid

roads to increase the sight distance in curves and the improvement of road shoulders are examples of infrastructure-related measures that have contributed to a reduction in road accidents and fatalities wherever they have been applied.

There were cases of traffic crashes on highway due to lower separation barriers between two directions of traffic, which couldn't block headlight from opposite direction of traffic. There were also places, called black spots, on roads with more traffic crashes due to various reasons, such as a sudden drop or corner in a straight road, a sharp curve, a hidden junction on a fast road, improper guidance on speed limitation, and poor or concealed warning signs at junction.

Design of pedestrian crossings and installation of safety devices at and near the crossings are also crucially important for pedestrian to safely cross the roads. Sufficient technical measures are needed in addition to strict enforcement of traffic rules.

An estimated 34 per cent of all vehicle crashes are due, at least in part, to road factors.<sup>25</sup> Factors like the width of lanes and roadway shoulders, prevalence of roadside objects, curvature of the road, driver's sight distance on a road, and the presence of a median separating the flows of traffic all affect the frequency and severity of vehicle crashes<sup>26</sup>.

Emergency response infrastructure is extremely effective in abating road injury deaths. If an injured person receives first aid within the first ten minutes after an accident, as called "golden time", they are 60 per cent more likely to live<sup>27</sup>. In order to contact a local response team universal access numbers are needed. A universal access number for emergency response exists in 116 countries<sup>28</sup>.

Facilities to support emergency response to traffic crashes and investigation on causes of road safety incidents in connection with road infrastructure and facilities are generally weak in most developing countries. These caused delay of the golden time period for rescue and develop specific preventive measures or corrections to infrastructure design and installation.

Nowadays, innovative ITS has been deployed in some countries to assist in managing traffic, in particular for urban traffic and expressways. ITS have great potential to help improve road safety if it is developed and deployed correctly. Integration of ITS within other road facilities, safety audit and harmonization across cities, expressways or countries is needed to bring the ITS' safety role in full functioning.

There are many countries with national standards on design and construction of roads but there are also many countries without national standards or norms. In some developing

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<sup>25</sup> American Association of State Highway and Transportation Officials (AASHTO), 2010, Highway Safety Manual (Washington DC).

<sup>26</sup> Ishtiaque Ahmed, "Road infrastructure and road safety", Transport and Communications Bulletin for Asia and the Pacific: Designing Safer Roads, No. 83 (2013). Available from [www.unescap.org/sites/default/files/bulletin83\\_Fulltext.pdf](http://www.unescap.org/sites/default/files/bulletin83_Fulltext.pdf).

<sup>27</sup> WHO- Global Plan, Pillar 5: Post-crash Response.

<sup>28</sup> WHO- 10 Facts on Global Road Safety, Fact 9.

countries, roads were built with financial assistance by different donors and followed different standards. In some cases, road signs for the same purpose are inconsistent even along the same road as its sections were financed by different donors.

The missing part is intergovernmental support to collect experience and good practices on road standards and norms from different countries and further refine as global recommendations on continuous basis with development of technologies and identification of new black spots.

### *Vehicles*

Safe vehicles are also a widely recognized key factor for road safety. The WHO Global Status Report on Road Safety 2015 reported that 80 per cent of all countries worldwide fail to meet the vehicle safety standards.<sup>29</sup>

Vehicles can be built with enhanced safety features, such as strong structure, crumple zone, air bags and anti-locking in crash. Additional electronic devices can make vehicles even much safer, such as electronic stability control (ESC), lane departure warning system (LDWS), forward collision warning system (FCWS), speed alarm, alcohol level detection, driving hours recorder, in-vehicle SOS devices, and detection of nearby walkers and barriers. Standards can be further elaborated and promoted at international level.

On the other side, set of traffic rules and technical standards for vehicles from initial inspection, vehicle registration to periodical inspection are needed. In addition, institutional setting to ensure enforcement of the rules and applications of the standards are also required. The rules and standards have to be updated and corresponding training standards for inspection officers have to be also updated.

Currently most regulations focus on motor vehicles (four- or more-wheelers). The WHO Global Status Report on Road Safety 2015 reported that nearly a quarter of all road traffic deaths are among motorcyclists globally with the Southeast Asia and Western Pacific Region each accounting for 34 per cent of the world's motorcyclist deaths, and the African Region 7 per cent. The report also found that the proportion of motorcyclist deaths had increased from 15 to 20 per cent of the total road traffic deaths from 2010 to 2013. This reflects the need for more measures for motorcycles and other two-wheelers.

New generation of vehicles, self-driving or autonomous vehicles, is in intensive testing and even on roads of some countries. In addition to its impact on the requirements for infrastructure and traffic rules, new standards for vehicles and vehicle inspection need to be deliberated and developed.

## **3. Internationalization of Road Transport**

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<sup>29</sup> WHO- 10 Facts on Global Road Safety, Fact 10.

With the invention of the motor car, transport by road has witnessed exponential growth. The emergence of reliable and efficient vehicles and the simultaneous development of inter-country and regional road networks, has enabled motor vehicle users to cross the borders and countries for transporting passengers and goods. The rise in international tourist arrivals has also resulted in a greater demand for road transport services in the form of city tours and hiring of vehicles while visiting countries. The rising disposable incomes in both developed and developing countries has also seen a greater demand for consumer goods which are now being delivered to end users through a multimodal and intermodal transport network involving road, rail and maritime networks. In a globalized world the road transport network has an important role to play in moving passengers and cargoes, however many challenges still exist which need to be addressed.

### *3.1. Challenges in international road transport*

International road transport has grown rapidly over the last few decades and countries around the world have benefitted from improved transport links that open up new markets for export and import of goods and services. A reduction in trade barriers has also contributed to increased regional and global trade and the emergence of supply chains spread across the globe. As trade barriers have reduced countries have set up cross border road transport agreements to promote trade between countries and regions.

Bilateral or multilateral road agreements have been established to promote and facilitate trade between countries or several countries. The World Trade Organization (WTO) List of Bilateral Road Agreements (LIBRA)<sup>30</sup> database contains over 800 road freight transport agreements established between countries. The main function of the agreements is to open domestic routes and/or border crossings for transport. It shows that roads have been widely used for cross-border and transit transport.

Roads came much earlier than other modes of transport. Its international operation could be traced back to the ancient silk road. However, its further development was interrupted by wars. After the end of the cold war, revitalization of the silk road has been called with a number of initiatives. Modern internationalization of roads started relatively later compared with other modes of transport. This may be partly because of blocking of passage over land in most countries in the past and partly due to the fact that there is no international organization like IMO (for maritime) and ICAO (for aviation) to support the development of the international dimension of road transport operations. Therefore, this mode of transport continues to face key challenges which impede its international service.

Road transport operations between more than two countries can be subject to two or more agreements. There is often no consistency between bilateral and multilateral agreements as the content can differ between countries and regions. It is common that the bilateral agreements concluded by one country with each of its neighbors differ on substance. Road

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<sup>30</sup> Available from [https://www.wto.org/english/tratop\\_e/serv\\_e/transport\\_e/dbroadagr\\_e.xls](https://www.wto.org/english/tratop_e/serv_e/transport_e/dbroadagr_e.xls)

transport operators have to keep track and be mindful of the rules offset by all the agreements concluded by their country, which add to the workload and costs of compliance.

Following the end of the Second World War, trade between countries in the European region picked up as the region experienced economic growth, resulting in increased cross border movement of cargoes in Europe. The European region was one of the first to have regional agreements for road transport between countries. The need for improved road connectivity in the European region was recognized early on with the “Declaration on the Construction of Main International Traffic Arteries 1950” and subsequent agreements aimed at promoting cross border road transport and facilitation measures. In the Latin American Region an Agreement on International Road Transport for Passengers and Cargoes was signed by the governments of Argentina Bolivia, Brazil, Chile, Paraguay, Peru and Uruguay in 1990<sup>31</sup>. The road Transport Agreement known by its Spanish Acronym ATIT, governs the movement of goods and passengers between these countries’ and onward to non-signatory countries. In addition to transport arrangements, the agreement covers aspects of customs, insurance and immigration matters with a section on sanctions.

In Africa more recently there exists the Tripartite Agreement on Road Transport between the Governments of Kenya, and Tanzania Uganda, that was signed in 2001 and which lays down the regulations for movement of commercial vehicles between these territories.

The ESCAP’s database collected more than 400 bilateral road transport agreements in Asia. Although some can be traced back to 1950’s for transit, a majority of them were signed after 1990, in particular for inter-state transport. There are also more than 30 multilateral agreements related to opening of routes for international transport by road. However, most of the multilateral agreements have not been implemented mainly due to lack of common basis for international transport, such as driver’s visa and qualification, vehicle insurance, standards for vehicle, qualification of operator, road rules and regulations, and regulatory regime including documentation and formalities.

The Economic Cooperation Organization (ECO) and IRU organized the Silk Road Demonstration Caravan in September-October 2010 with participation of eight countries. The aggregated analysis for all journals of the caravan showed that waiting time in queues and the time taken by all kind of procedures related with control and inspections took up to 30 per cent of the total trip time. Out of the average 9.1 days duration of journey per truck, about 1.5 days per truck-journey was spent only for waiting in queues. The record waiting time reached as high as 175 hours (more than one week) per border.<sup>32</sup>

The caravan also found other difficulties, such as visa, permit, fuel, insurance, unofficial payment, Customs procedures, and permissible weight and dimensions of vehicles, which are typical in international road transport in most regions and perhaps part of the reasons for long

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<sup>31</sup> The Latin American Association for Integration (ALADI)

<sup>32</sup> Economic Cooperation Organization and International Road Transport Union, Final Report of the Silk Road Demonstration Caravan 2010.

time spent at border crossings.<sup>33</sup> In fact, on the other side, authorities also face difficulties to manage cross-border process of diverse and less formalized road transporters.

It is evident that the cross border transport agreements have to some extent shown opening of the borders for transport by road. However, both control authorities and road transport operators in most regions are struggling to manage the transport process with difficulties, which include:

#### *Less formalized international road transport operators*

There are no widely recognized intergovernmental standards on competencies of international road transport operators. Many government authorities consider road transport operators as high risk of group in cross-border clearances because they are mostly one- or several-truck companies, less organized, less stable in financial and business status, less formally established, less familiar with the cross-border formalities and procedures, and lack of competency certificates recognized by governments. As a result, government authorities are cautiously careful about and facing stress in visa issuance, document clearances and inspection of vehicles and goods. It was reported that some transport operators were registered in a country and later closed business after selling transport documents received from the government and in some cases drivers smuggle small quantity of goods with truck carrying goods approved by authorities. Sometimes, authorities couldn't find transport operators after. Although such cases cannot represent the majority of the road transport industry, they do lead to negative image of the industry and reduce confidence level of authorities to the road carriers.

On the other side, road transport carriers cannot efficient operate due to difficulties in visa and cross-border formalities. In many countries, difficulties for cross-border truck drivers are not only at border crossings but also at dozens of check points along roads set by various regulatory authorities.<sup>34</sup> In some countries, trucks have to be escorted by law enforcement officers.<sup>35</sup>

#### *Road transport permits*

In Asia, international movement by road is permitted but it is largely confined to border areas and a limited number of roads using transport permits issued for a designated route by a specified individual vehicle. As a result goods carried by road either have to be transshipped at border areas or, where transport is permitted, at loading points along a designated route adding cost and delay to the transport process. The permit valid for a single trip is popularly used. Road transport carriers are not able to plan their operations and have to repeatedly apply for transport permits. Formats and conditions of transport permits under different

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<sup>33</sup> S Khumalo and E Chibira, 2015, Finding Practical Solutions to Cross-Border Road Transport Challenges In SADC: A Review of Major Challenges and Prospects (Pretoria).

<sup>34</sup> S Khumalo and E Chibira, 2015, Finding Practical Solutions to Cross-Border Road Transport Challenges In SADC: A Review of Major Challenges and Prospects (Pretoria).

<sup>35</sup> Arab Union of Land Transport and IRU, 2009, Middle East Trade & Road Transport Survey.

agreements are varied and make regulatory authorities, carriers and drivers difficult in conforming different requirements.<sup>36</sup>

Such situation also exists along the Southern African Development Community corridors. Transport operators face difficulties with obtaining cross border road transport permits and when permits are issued for a specific duration which requires to constantly re-apply or renew.<sup>37</sup>

### *Different rules and regulations*

The bilateral agreements on international road transport mostly focus on exchange of traffic rights and associated basic principle arrangements, such as permits, transport routes, bus schedule, mutual recognition of national driving licenses, mutual recognition of vehicle documents and exemption of duties and taxes on temporary importation of temporary importation. Other matters not specified in the agreements are governed by domestic laws, rules and regulations.

Sets of rules and regulations related to road transport are different between countries. Such rules and regulations may, in many cases, include road traffic rules, rules on procedures for handling traffic crashes, law relating to vehicle insurance, road transport regulations, law of transport contract, regulations on carriage of dangerous goods, law or regulations on international road transport, and rules on road charges. Sufficient knowledge of numerous different rules and regulations in various countries become an impossible task for road carriers and drivers. It is often that road carriers and drivers pay fines several times a trip without understanding of reasons and repeatedly fined. Sometimes road transport managers describe their international operations as “difficult with a single inch of movement”.

### *Visa for professional driver and crew members*

Visa is a key requirement before undertaking any form of commercial road transport between international borders. Mostly drivers and crew members are required to apply for visas in advance of undertaking travel between countries and if travelling through multiple countries than there is a need to secure visas from several embassies. Visa application processes are rarely simple and often require a lot of paperwork and time. Visas are normally only issued in the drivers' home country by the respective embassies in the capital city and once on the road applying for additional visas is not easy. Drivers of commercial vehicles unlike seafarers and airline professionals do not have an international system to govern their movement across borders. Moreover, professional drivers are often issued single entry visas and are required to reapply for visa for each trip. The requirement to be personally present for some visa applications also adds to the cost and time spent to obtain the visas. In the absence of a

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<sup>36</sup> ESCAP, 2011, Monograph Series on Facilitation of International Road Transport in Asia and the Pacific (Bangkok).

<sup>37</sup> S Khumalo and E Chibira, 2015, Finding Practical Solutions to Cross-Border Road Transport Challenges In SADC: A Review of Major Challenges and Prospects (Pretoria).

harmonized system to govern visa issuance to commercial vehicle drivers and crew, transport operators rely on bilateral or subregional agreements that have been set up for this purpose.

Although visa issue for professional driver has been raised at international level, it has not been solved widely. Facing much more diverse road industry like small operators or one-truck company in comparison with international airlines and shipping lines, this issue cannot be easily solved in the absence of a global standard and effective tools or instruments to convince the authorities.

### *Vehicle weights and dimensions*

In addition to vehicle insurance and cross border agreements, motor vehicle must also comply with the vehicle weight and dimension and other safety requirements related with the vehicle structure or construction that may be different across borders. Moreover, the weight requirements for loaded vehicles at the point of origin may be very different from those in transit countries or at the destination. Very often vehicles are prevented from entering foreign countries although bilateral or multilateral agreements grant permission for them to cross the borders.

Trucks are purchased on the basis of national norms on weights and dimensions. Largely diversified national norms from country to country limit the efficient use of truck capacities and harm the environment. On the other side, overloaded foreign trucks are considered dangerous and harmful for local roads and penalized drastically.

### *Insurance coverage*

Third party motor vehicle insurance and other forms of vehicle insurance are essential to cover claims arising in the event of traffic accidents, however most insurance companies offer products that are largely applicable to the jurisdictions where they operate, which can be a problem for vehicles crossing borders, as their insurance coverage may cease once they leave their national borders. This also poses a problem to road transport operators that may need to transport goods through multiple jurisdictions. This problem has been dealt with by the Green Card System<sup>38</sup> of motor insurance, which provides motor vehicle drivers with an insurance certificate to certify that drivers hold the minimum required insurance in the event of a traffic accident. The green card system is valid in 48 countries. In the ASEAN<sup>39</sup> subregion motor vehicle insurance is required for commercial vehicles moving across the borders of member countries for facilitation of goods in transit. The green card system, regional agreements and bilateral agreements have all contributed to facilitation road transport at the international and regional levels. However, a true global system would further facilitate movement of commercial and private vehicles across borders and eliminate the need for compliance with multiple schemes and jurisdictional requirements.

### *Driving permit: one purpose but different in many ways*

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<sup>38</sup> Council of Bureaux (CoB) source: <http://www.cobx.org/>

<sup>39</sup> Association of Southeast Asian Nations.

Categories and formats of driving permits are different in most countries. One category of a driving permit in one country often carries different meaning of same category in another country. Permission for driving one type of vehicle with corresponding valid driving permit is sometimes not accepted by other countries due to such differences. In international commercial transport by road, dozens of categories and formats of the driving permits confuse border-crossing inspection and clearances, and also law enforcement officers on roads. It is more difficult for a local car rental company and police when a foreign tourist rents a vehicle with a domestic driving permit.

More importantly, conditions and requirements for issuance of driving permits valid for different types of vehicles are different in most countries. For example, any healthy citizen older than 18 years can apply for a driving permit valid for truck in one country but only a five-year holder of a driving permit valid for a private car can be eligible for applying for a driving permit for truck in its neighbouring country. When a driver holding a driving permit valid for truck drives a truck to cross the border, safety issue is raised. It is also an issue for migration drivers to find driver's jobs or tourists for driving non-sedan vehicles.

#### *Different road signs and signals*

Driving across borders or in different countries requires that drivers can read and understand road signage in order to comply with local rules and to avoid traffic incidents. Road signage, across countries takes on very different formats, which can be confusing to temporary visitors. International travelers and drivers of commercial vehicles need to familiarize themselves with the road signs and rules prevalent in countries their visiting or transiting. The Convention on Road Signs and Signals 1968 forms the basis for traffic signs, signals and road markings in countries that are parties to the convention. However, not all countries are party to the convention and therefore are not obliged to comply with the convention. Countries that are not party to the Convention may follow different formats for road signage and markings which can pose a problem to tourists and drivers of commercial vehicles.

#### *Temporary admission of vehicles*

Registration books, road worthiness certificates, periodical inspection certificates and registration plates of vehicles are not harmonized in format and content across countries. Although most bilateral road transport agreements provide a principle of mutual recognition of the vehicle documents and registration plates, many countries use the national languages in vehicle documents and registration plates. When a road vehicle crosses the border to a foreign country with a different national language, border authorities face difficulties in recording and processing clearances, in particular with computerized systems. Local traffic police, traffic management and terminal management also face difficulties in identifying the vehicle and processing its documents. In the case of traffic crash with involvement of the vehicle but without the vehicle on site, the vehicle cannot be easily identified and held for responsibility.

Mostly exemption of duties and taxes for temporary importation of vehicles is stipulated in bilateral road transport agreements. However, guarantee for re-exportation by locally registered entity is often required by Customs authorities. It increases time and cost for vehicles to cross the border. It in particular creates difficulties for small and medium-sized transport operators to find local partner guarantors.

### *3.2. Emergence of intermodal transport*

Intermodal transport can be defined as the movement of passengers or cargoes between two destinations using multiple modes of transport. Today intercontinental trade is largely dependent on sea and air links to move cargoes across countries, with road and railway for transport from sea ports to the final or transit destination. Intra-regional trade dominates by road transport. Railway transport starts to take a share in inter- and intra- regional trade with support of road transport. Intermodal transport has already emerged and is the way forward to promote sustainable transport.

The emergence of containerization in the 60s revolutionized the movement of cargoes by sea. Containerization resulted in the transport of goods in a standard sized container that was then stacked and loaded onto ships for transport by sea. The containerization of other modes of transport (rail and trucks) further enhanced inland transport networks. However, transport of cargoes remained restricted to point to point shipments on a single mode of transport. Efficiency gains aimed at improving transit times saw the further integration of the maritime and land transport systems in an effort to improve transport times and remove bottlenecks when moving from one mode of transport to another.

Globalization and increased economic activity and trade between countries has resulted in transport of goods across different modes of transport and transport operators are no longer focused on a single mode of transport, but are now offering services across multiple modes in an effort to provide customers with time bound door to door shipment services.

To further enhance trade between countries and regions and to promote sustainable development, policy makers have been exploring options to develop existing road transport networks, dedicated transport corridors and rail corridors that together with maritime links can efficiently provide intermodal transport links. However barriers to intermodal cross border movement have emerged from the road transport sector. While trucking can be used to move maritime containers further inland, there are often problems at border crossing between countries. Trucks are often not allowed to move across borders, and often when permitted to cross borders, the movements are restricted to border zones only. In such a scenario, trucks are required to transfer their loads at border areas onto trucks that are registered in the next country for onward carriage. These changes add to the costs of transport and also add to time delays when moving goods across borders.

On some transport corridors instead of a cargo or container transfer there is the possibility of a trailer swap, where the containerized cargo attached to a trailer remains untouched on the

trailer or semitrailer, and the trailer or semi-trailer is detached from the prime mover and attached to another prime mover at the border. However, this gives rise to liability issues as the prime mover and trailer may be insured together and the transfer of the trailer onto another prime mover in a different country may void insurance commitments in the country of origin. Prime movers and trailers are often insured together and separation of either piece may void third party insurance policies.

In addition to loss of insurance coverage resulting from cross border trailer movements, other barriers such as the weight and dimensions of the trailers may arise. Countries have different rules and regulations for the weight and dimensions of trailers and prime movers and often these regulations may impede certain categories of vehicles from carrying out cross border movements. Cross border movements of trucks and trailers are also impeded when there is a lack of reciprocal recognition of vehicles documents such as road worthiness certificates. While intermodal transport networks using road rail and maritime networks can play an important role in reducing the carbon footprint of the transport sector, much needs to be done to remove the barriers that impede international road transport.<sup>40</sup>

### *3.3. Rapidly rising international tourism*

The rise in international tourist arrivals, the emergence of new technologies that enable end users to rent motor vehicles with relative ease, the rising disposal incomes, are some of the factors that have driven the demand for car rental services. However, despite this growth trend in car rental services, tourists and temporary users of motor vehicles, and commercial vehicle drivers often face several hurdles when driving outside their home countries due to the existence of multiple international driving permits, different road traffic signs and signals in different countries and problems associated with visas, motor vehicle insurance among others, when crossing borders.

International and domestic tourism has also seen a greater demand for air and land transport links, as increasingly wealthy populations are now travelling for leisure and business in greater numbers.

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<sup>40</sup> ECLAC, 2009, Landlocked Countries in South America: Transport System Challenges (Santiago).

### Box 1. Deaths of Chinese tourists raise safety issues

A traffic crash killed four Chinese tourists in Arizona, USA, on 24 July 2016. The crash occurred at an intersection along state Route 93, when a left-turning van driven by a Chinese tourist collided with a bus traveling in the opposite direction, according to the Arizona Department of Public Safety.

The investigation determined on 26 July 2016 that the van failed to yield the right-of-way at a stop sign and was struck by the bus. All van occupants were wearing seat belts at the time of the crash. It also said that the investigation was ongoing, and an inspection of the bus would be performed by the department's commercial vehicle inspectors.

A Los Angeles-based lawyer raised questions over the department's conclusions about the crash, saying those involving fatalities usually require months of investigation to determine fault. The lawyer said "Traffic accident investigators will have to investigate the integrity of the vehicle, i.e., checking the brakes, determining how fast the bus was going, as well as determining the well-being of the bus driver, (which) are all important factors that must be considered when giving judgment. In addition, an autopsy report is obviously needed for an accident that involves the deaths of human beings, and that itself would require at least a month before results come out."

Self-driving tours have become popular among Chinese tourists. A Chinese tourism operator said in an earlier interview "The biggest challenge for Chinese self-driving tourists is the language barrier and lack of knowledge of local traffic rules."

*Source: Lia Zhu, China Daily, 28 July 2016, [http://usa.chinadaily.com.cn/epaper/2016-07/28/content\\_26254229.htm](http://usa.chinadaily.com.cn/epaper/2016-07/28/content_26254229.htm), accessed on 4 October 2016.*

International tourist arrivals have been increasing year on year since the 90's and from 435 million in 1995 International tourist arrivals hit a new high of 1,184 million in 2015<sup>41</sup> an increase of 50 million over 2014 (1,134). Over 54 per cent of international tourist arrivals in 2014 were by air, however the share of international tourist arrivals by road has also increased over the years and was 39 per cent in 2014 with arrivals by other forms of surface transport (rail 2 per cent, water 5 per cent) and air 54 per cent accounting for the remainder<sup>42</sup>. A study by the World Tourism organization estimates that international tourist arrivals will increase by 43 million a year on average between 2010 and 2030 reaching 1.8 billion arrivals by the year 2030<sup>43</sup>, of which 48 per cent will be arrivals via surface transport (road, rail and water). A consequence of rising international tourist arrivals has been the rise in demand for car rental services and motor cycles ranging from a few hours to days, although it is important to note that car rental and motorcycle rental services are not solely used by tourists. An analysis of car rental services by end use found that of the four segments "intercity",

<sup>41</sup> UNWTO World Tourism Barometer, volume 14 May 2016

<sup>42</sup> UNWTO World tourism Highlights 2015

<sup>43</sup> UNWTO Tourism towards 2030, page 14

“intracity”, “on-airport”, and “others”, the car rental service at airports was the most prominent segment, accounting for 49.5 per cent share of the overall market, in 2014<sup>44</sup>.

Challenges due to rising international tourism

- **Lack of knowledge of local traffic rules and regulations**

The road signage and traffic signals used often differ across countries due to lack of a global harmonized system. Apart for a unified system there is the problem of language as many countries produce road signs and signals in the local language. Although there exists global conventions that aim to harmonize certain aspects of road signs and signals, several countries are not party to such conventions. Even in countries that are party to international conventions there is a lack of effective implementation of these conventions, inadequate intergovernmental elaboration of the conventions, coordination and dissemination of new developments in traffic rules, signs and signals, lack of good technical and regulatory solutions to left- and right-hand driving. International drivers out of their home country are required to learn as much as they can before they set out to drive in another country. As an example, New Zealand provides special leaflets to foreign tourists who rent cars. Such practice has not been popularly used in other countries.

- **Driving license requirements**

Although international driving permit is recommended in the Vienna convention that governs the issues of driving permit, the lack of universal adoption of the Vienna convention and global acceptance of the driving permit has resulted in a lot of confusion as drivers may not be eligible to drive in the visiting country using the International permit. The presence of multiple permits may also create confusion as drivers need to determine which document is required for the destination country.

- **Insurance coverage**

Insurance schemes differ across countries and across motor vehicle rental companies. Vehicle owner’s national insurance schemes are often not valid outside their home countries. This poses a problem when visiting a foreign country as tourists need to select a local insurance policy to cover them in the event of an accident. The presence of multiple insurance schemes in different countries often can confuse the end users as they may end up being under insured and not able to cover the cost of accidents or third party liabilities.

## 4. Intelligent Transport Systems

### *4.1. Intelligent transport systems blaze the way*

Over the 2005-2014 decade, the demand for vehicles has increased approximately 4 per cent around the globe, as measured in the database for vehicle in use from International

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<sup>44</sup> Future Market Insights Car Rental Market; Promotion of Tourism Worldwide to Drive Growth: Global Industry Analysis and Opportunity Assessment 2015–2025

Organization of Motor Vehicle Manufacturers<sup>45</sup>, and as of 2014, 1.2 billion vehicles were in use.

Over the same time period, information and communication technology (ICT) has already pervaded most of our life, and started to revolutionize transport systems through ITS. ITS basically deploy communications, control, electronics and computer technologies to improve the performance of road, railway, air and maritime transport systems.<sup>46</sup> More recently, ITS include cutting-edge technologies and applications, such as in-vehicle navigation systems, vehicle-to-vehicle (V2V) applications, vehicle-to-infrastructure (V2I) applications, and vehicle-to-everything (V2X) applications. Efforts toward advancing ITS technologies have received steady attention around the world to address the challenges from transport systems, after the United States (US) initiated the Electronic Route Guidance Systems (ERGS) for drivers in the 1960s.<sup>47</sup>

Deployment of ITS varies in different countries, but the motivation is the same to improve safety, mobility, and reliability. In more details, ITS can provide two types of benefits from the viewpoint of society and users. Society-wide benefits include improved mobility for people and freight, less traffic congestion, a better managed transportation infrastructure, reduced environmental impact of surface transportation, and reduced fatalities and crash severity.<sup>48</sup> The second benefits, on the other hand, may focus more on the user's perspective by increasing quality of services, such as reducing travel uncertainty, increasing security for freight movement and personal travel, increasing efficiency for both the operators and users.<sup>49</sup> As examples of the former, the Colorado Department of Transportation in the United States released the 9-19 per cent reduction in travel times and an increase speed by 7-22 per cent from two adaptive signal systems on corridors, generating a 2-7 per cent reduction in fuel consumption and up to 17 per cent reduction in pollution emissions in 2012.<sup>50</sup> New South Wales, Australia also found that in-vehicle safety systems could decrease the fatalities by up to 16 per cent based on reported crash data from 1999 to 2008.<sup>51</sup> On freeway of the Republic of Korea, Automatic Crash Information Notification Systems could reduce the fatalities by 11.8 to 18.1 per cent.<sup>52</sup> Real-time bus information ("Countdown") in London, United Kingdom, contributed to the improvement of user's satisfaction by dropping the

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<sup>45</sup> Available from <http://www.oica.net/category/vehicles-in-use/>, accessed on 19 August 2016.

<sup>46</sup> Ezall, S. (2010). Explaining international IT application leadership: intelligent transportation systems. The Information Technology & Innovation Foundation, Washington, D.C. Available from [http://www.itif.org/files/2010-1-27-ITS\\_Leadership.pdf](http://www.itif.org/files/2010-1-27-ITS_Leadership.pdf), accessed on 19 August 2016..

<sup>47</sup> Vanajakshi, L., Ramadurai, G., and Anand, A. (2010). Intelligent transportation systems: synthesis report on ITS including issues and challenges in India. Centre of Excellence in Urban Transport. IIT Madras.

<sup>48</sup> Yokota, T. (2004). ITS technical note for developing countries. Washington, D.C.: World Bank.

<sup>49</sup> Ibid.

<sup>50</sup> Hatcher, G., Burnier, C., Greer, E., Hardesty, D., Hicks, D., Jacobi, A., Lowrance, C., and Mercer, M. (2014). Intelligent transportation systems benefits, costs, and lessons learned: 2014 update report. FHWA-JPO-14-15. Washington, D.C.: U.S. Department of Transportation.

<sup>51</sup> Anderson, R.W.G., Hutchinson, T.P., Linke, B., and Ponte, G. (2011). Analysis of crash data to estimate the benefits of emerging vehicle technology. CASR Report Series, CASR094. Center for Automotive Safety Research. The University of Adelaide. Australia.

<sup>52</sup> Available from <http://www.itsbenefits.its.dot.gov/its/benecost.nsf/ID/718A71F8C5A3806B85257BB7006E76A5?OpenDocument&Query=Home>, accessed on 19 August 2016.

perceived waiting times from 11.9 minutes to 8.6 minutes.<sup>53</sup> Test study for the in-vehicle traffic map device (“TrafficGauge”) in Washington, United States, also showed that travelers changed their travel routine once every 4.2 times that they used this device, and saved an average of 30 minutes in travel time.<sup>54</sup>

In response to the keen interest for sustainability over the past years, ITS brings diverse disciplines together to deliver more efficient, and sustainable transport. ITS America exemplifies this by adopting the updated position statement about “ITS technology and sustainable transportation”<sup>55</sup> in 2012. Given that transport accounted for 23 per cent of world CO<sub>2</sub> emissions in 2013, driven by mostly the road sector (three quarters of transport emission) which increased by 68 per cent compared to the one in 1990<sup>56</sup>, ITS in the road sector can make instrumental contributions to sustainable transport. One case illustrates this possibility that a Green Routing System for passenger vehicles made the 16.77 per cent reduction of carbon monoxide (CO), and the 19.47 per cent reduction of Nitrogen Oxides (NO<sub>x</sub>) in the Buffalo-Niagara region of New York of the United State<sup>57</sup>.

#### *4.2. Moving toward an autonomous vehicle<sup>58</sup> environment*

The era of ITS has offered unprecedented advantages to the society. Recent enhancements in ICT have moreover given the transformative power of wireless connectivity among vehicles through V2V, V2I, V2X communications and mobile applications. For example, in April 2016 a convoy of self-driving trucks completed first European cross-border trip of more than a dozen self-driving trucks made by six of Europe’s largest manufacturers from their production bases in Sweden, Denmark, Belgium and Germany to their final destination in the port of Rotterdam in the Netherlands.<sup>59</sup> These imply drastic changes, which will recast the way people drive, and open the new generation of autonomous vehicles.

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<sup>53</sup> Available from [http://trb.org/news/blurp\\_detail.asp?id=1709](http://trb.org/news/blurp_detail.asp?id=1709), accessed on 19 August 2016.

<sup>54</sup> Briglia, R.M., Fishkin, E., Hallenbeck, M.E., and Wu, Y-J. (2010). An analysis of the Puget Sound in-vehicle traffic map demonstration. WA-RD 737.1, Washington State Department of Transportation. Seattle. Available from <http://www.wsdot.wa.gov/research/reports/fullreports/737.1.pdf>, accessed on 19 August 2016.

<sup>55</sup> ITS America. (2012). ITS America position statement, ITS Technology and Sustainable Transportation.

Available from

<http://documents4sharing.itsa.wikispaces.net/file/view/2K+ITS+Tech+++Sustainability+Transpo.pdf>, accessed on 19 August 2016.

<sup>56</sup> International Energy Agency. (2015). Key trends in CO<sub>2</sub> emissions excerpt from: CO<sub>2</sub> emissions from fuel combustion. IEA Statistics, France. Available from

<http://www.iea.org/publications/freepublications/publication/CO2EmissionsTrends.pdf>, accessed on 17 November 2016.

<sup>57</sup> Available from <http://www.itsbenefits.its.dot.gov/ITS/benecost.nsf/SummID/B2013-00866>, accessed on 19 August 2016.

<sup>58</sup> According to the definition by National Highway Traffic Safety Administration in the United States of America, “automated vehicle” includes four levels, and the fourth level (“full self-driving automation”) may also be referred to “autonomous vehicles”. This study adopts this hierarchy (see [http://autocaat.org/Technologies/Automated\\_and\\_Connected\\_Vehicles/](http://autocaat.org/Technologies/Automated_and_Connected_Vehicles/)).

<sup>59</sup> Available from <https://www.cnet.com/news/driverless-truck-convoy-platoons-across-europe/>, accessed on 17 November 2016

Various active actions are currently underway around the world in autonomous vehicles. In 2012, the National Highway Traffic Safety Administration (NHTSA) of United States Department of Transportation (USDOT) launched the pilot safety study (Safety Pilot Model Deployment<sup>60</sup>) with nearly 2,800 vehicles to test mostly V2V applications. V2I applications for traffic signal timing and emergency vehicles were also tested with 27 roadside units covering 75 miles of road in this study. In Europe, the European Union has invested automated driving-related research projects, called City Alternative Transport (CATS) and CityMobil<sup>61</sup>. Several member States from the European Union also have initiated the national plans for automated vehicles. For example, the German Federal Ministry of Transport and Digital Infrastructure established the “Automated Driving” Round Table to taking care of issues relevant to automated driving. The introduction of highly automated driving by 2020 has been set as an objective in the Round Table<sup>62</sup>. The United Kingdom invested Pound 33 million for the “driverless car” trials in four cities in 2014<sup>63</sup> and completed the regulatory review in 2015.<sup>64</sup>

Some Asian countries have already paved the way for automated vehicles. In Singapore, representatively the first test site for self-driving vehicle technologies and mobility concept was established by Land Transport Authority in 2015<sup>65</sup>.

It is expected that automated driving (eventually autonomous vehicle) environment can hurdle current societal issues from road sector - safety, mobility and reliability. Research for NHTSA found that the combination of V2V and V2I applications potentially address 81 per cent of unimpaired driver crashes in all types of vehicles and 83 per cent in all light-vehicles<sup>66</sup>. USD 178.8 billion in societal benefits annually are expected if connected vehicle safety applications are deployed across the entire U.S. vehicle fleet.<sup>67</sup>

### *4.3. Leapable barriers with ITS for the sustainability*

Today’s cities around the world are in the stage of transforming living environments in a way enhancing the sustainability. The important spot in this transformation is in the road sector, considering its importance in GHG emissions. ITS has changed the extent to which relevant agencies conduct the roles, and also provided the opportunities to collaborate with different

<sup>60</sup> Available from [http://www.its.dot.gov/research\\_archives/safety/safety\\_pilot\\_plan.htm](http://www.its.dot.gov/research_archives/safety/safety_pilot_plan.htm), accessed on 19 August 2016.

<sup>61</sup> ERTRAC Task Force. (2015). Automated driving roadmap—status: final for publication. Belgium.

<sup>62</sup> Available from [http://www.bmvi.de/EN/TransportAndMobility/Mobility/AutomatedDriving/automated-driving\\_node.html](http://www.bmvi.de/EN/TransportAndMobility/Mobility/AutomatedDriving/automated-driving_node.html), accessed on 19 August 2016.

<sup>63</sup> Available from <https://www.parliament.uk/documents/commons-committees/science-technology/evidence-tests/Driverless-cars.pdf>, accessed on 19 August 2016.

<sup>64</sup> Available from <https://www.gov.uk/government/publications/driverless-cars-in-the-uk-a-regulatory-review>, accessed on 19 August 2016.

<sup>65</sup> Available from <https://www.lta.gov.sg/apps/news/page.aspx?c=2&id=e6dc5dff-8892-4f7f-9a3e-c89d29c0642c>, accessed on 19 August 2016.

<sup>66</sup> Najm, W.G., Koopmann, J., Smith, J.D., and Brewer, J. (2010). Frequency of target crashes for IntelliDrive safety systems. Report No. USDOT-HS-811-381. Washington, D.C.: U.S. Department of Transportation.

<sup>67</sup> Available from <http://www.its.dot.gov/factsheets/pdf/ConnectedVehicleBenefits.pdf>, accessed on 19 August 2016.

systems, disciplines, industries, and even governmental agencies. With the advent of automated vehicle technology, a fundamental vision for ITS applications is shifted and the possibility for better sustainability in transport is increased. Contrastively, the robust platform is in demand, integrating various stakeholders' needs and facilitating advanced ITS technology's penetration. Given that future ITS applications require V2V, V2I, and V2X communications within multimodal and multinational environment, to make successful contributions to sustainable transport by ITS technologies, several issues need to be addressed accordingly.

### *Interoperability issues for ITS applications*

There are diverse utilizations of ITS, although the service goals are similar. For example, smart card systems are gaining the popularity in many Asian and European countries, but these systems feature a colorful array of interfaces, facilities, and technologies. Variable Message Signs also have inconsistent message sets from one country to another which could cause the drivers' distractions, resulting in the higher possibility of traffic crashes. Further, because road infrastructure and facilities have been treated domestically, other incompatible issues are anticipated with the introduction of V2I, V2X technologies and electric vehicles. In spite of the advancement of electric vehicles, for example, the lack of unified recharging systems and global harmonized initiatives impede further adoption of low-carbon vehicles. These fragments can be problematic according to the rising number of vehicles across the country borders.

Although many efforts for the ITS standards have been made by different standard organizations, such as International Standard Organization (ISO), European Committee for Standardization (CEN), International Electrotechnical Commission (IEC), and International Telecommunication Union (ITU)<sup>68</sup>, there are still lots of discordant standards for ITS applications. Provided that more multinational ITS applications are being materialized to enhance the sustainability, this discontinuity could hinder the seamless ITS services among the countries on the roads. More detailed ITS standards including technical and service harmonization, supported by effective regulations and policies, need to be set up, thereby strengthening collaboration to preparing the vehicle trips across the countries. Note that administrative awareness for standardized regulatory framework, rather than only voluntary standards, could be more effective in this regard.

### *Lack of intergovernmental leadership on ITS development*

As the well-coordinated use of ITS can provide the seamless journey to users, a comprehensive transport plan with ITS is undertaken to attain the sustainable goals in many countries. With consideration for increasing movements among countries, and the forthcoming autonomous vehicle environment, the main bottlenecks of ITS deployment are the imbalanced spread of ITS technologies, the lack of harmonized concepts, plans and management systems among countries. ITS is redefining the roles of transport agencies and

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<sup>68</sup> Available from [http://www.iso.org/iso/iso\\_technical\\_committee%3Fcommid%3D54706](http://www.iso.org/iso/iso_technical_committee%3Fcommid%3D54706), accessed on 19 August 2016.

revving up the opportunity to collaborate across systems, disciplines, and industries. Without a multifaceted approach, this situation can afflict the penetration of advanced solutions by ITS enabling to increase the social benefits.

To be specific, in comparison with ITS development in high-income countries, the proliferation of ITS is still rare in low-income countries, mostly struggling with basic infrastructure delivery. Offering already proven solutions and experiences to low-income countries can help catch up and develop their ITS services; however, non-harmonized approaches among countries might rather prevent successful practices in a given region. Concordant and consistent approaches (or framework) including ITS concepts and plans would be accordingly essential to drive towards benefiting from ITS technologies, and preparing the autonomous vehicle environment. More strengthened collaborations among countries are expected by common approaches, such that ITS deployment is conducted in a way to reducing the complexity of the present system and ensuring cost-effective deployment strategies. Contrary to other transport modes, such as maritime, air and rail<sup>69</sup>, there is no intergovernmental body to coordinate such approaches in ITS deployment.

#### *Non-technical issues from ITS technologies*

ITS is not a topic only for technical matters. The advancements of ITS technologies bring concerns in terms of security and law. ITS is based on ICT, and private data is exchanged to a larger extent in recent V2V, V2I, and V2X communications. For example, traffic and road conditions are constantly monitored through ITS tools, and this allows operators to have real-time information from individual vehicles and infrastructure. Collected data is fundamentally processed and distributed in various manners. It should be easier within the upcoming autonomous vehicle environment to monitor all movements of each vehicle. Private information will be shared between the vehicles and with infrastructure to control vehicles in order to prevent crashes, reduce congestion, and minimize fuel consumption. Also, increasing cooperation with private sectors (e.g., traffic information services with smart phones) may cause higher attention regarding the privacy security issues. The protection of individual information and related security of ITS applications therefore becomes more instrumental, which have not been considered seriously.

Another issue is about the legal responsibility in case traffic crashes or operational malfunctions happen by ITS applications (e.g., Advanced Emergency Braking System and Lane Departure Warning System). Because relevant international law has not been established yet, further clarification needs to be discussed at the national and international levels. This issue is also related to the insurance liability and legal rights. Given that autonomous vehicles are coming, current driver-oriented insurance and rights policies could lead to numerous problems by dramatically changed nature in the operation of new system. It is time, therefore, to start considering non-technical issues from ITS applications and making a consensus among countries through the global intergovernmental platform.

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<sup>69</sup> International Maritime Organization (IMO) for maritime transport, International Civil Aviation Organization (ICAO) for air transport, Organization for Cooperation between Railways (OSJD), and Intergovernmental Organization for International Carriage by Rail (OTIF) for rail transport.

## 5. Dangerous Goods

### 5.1. Handling of dangerous goods in the road sector needs more attentions

Dangerous goods are referred to as hazardous materials including flammable, explosive, radioactive, corrosive, oxidizing, asphyxiating, toxic, pathogenic, or allergic materials, which are mostly transported by road, rail, and inland waterway<sup>70</sup>. Road transport (58 per cent) showed the largest share of the dangerous goods traffic in the EU-15 in 2002, comparing to rail transport (25 per cent) and inland waterway (17 per cent)<sup>71</sup>. Transporting the dangerous goods on the roads also had the highest increase by 27.4 per cent within the EU-15 from 1990 to 2002, followed by inland waterways (11.1 per cent) and rail (-9.4 per cent)<sup>72</sup>. The carriage of dangerous goods slightly increased by 1.5 per cent from 73,946 million tonne-kilometres in 2013 to 75,027 million tonne-kilometres in 2014<sup>73</sup>. In the United States, trucks moved more than half of all dangerous goods shipments, with respect to both volume (59.4 per cent) and values (62.8 per cent) in 2012, which were increased by 27.3 per cent and 75.1 per cent from 2007, respectively<sup>74</sup>. In the Republic of Korea, around 80 per cent of dangerous goods were transported on the roads, except for the radioactive waste<sup>75</sup>.

The consequences of any incidents involving dangerous goods can be fatal because of the secondary damages resulting from exposure, especially in case shipments are transported on the road through city centres or damageable environment. According to the USDOT, more than 17,000 dangerous goods-related incidents occurred in 2014, of which road-related incidents occupied 87.9 per cent (15,045 incidents)<sup>76</sup>. This rate had grown steadily from 2011, meaning that the possibility regarding dangerous goods-related incidents on the road had been growing constantly. Other statistical facts from the Korea Transportation Safety Authority<sup>77</sup> exemplify the seriousness of the situation. That is, even though dangerous goods vehicles take only a minor portion (0.02-0.05 per cent) of total number of crashes on the roads in the Republic of Korea, 2013, the fatality rate is around four times higher than the one from passenger vehicles. While the fatality rate by crashes from passenger vehicles is 1.92

<sup>70</sup> Nowacki, G., Krysiuk, C., and Kopczewski, R. (2013). Dangerous goods transport problems in the European Union and Poland. *The International Journal on Marine Navigation and Safety of Sea Transportation*, vol. 10, No. 1.

<sup>71</sup> DaGoB Project Office (2006). Summary of evaluation of EU policy on the transport of dangerous goods since 1994. DaGoB Publication Series 1:2006. Turku School of Economics. Turku, Finland.

<sup>72</sup> Ibid.

<sup>73</sup> Available from [http://ec.europa.eu/eurostat/statistics-explained/index.php/Road\\_freight\\_transport\\_by\\_type\\_of\\_goods#Road\\_freight\\_transport\\_of\\_dangerous\\_goods](http://ec.europa.eu/eurostat/statistics-explained/index.php/Road_freight_transport_by_type_of_goods#Road_freight_transport_of_dangerous_goods), accessed on 19 August 2016.

<sup>74</sup> U.S. Department of Transportation, U.S. Department of Commerce. (2012). United States: 2012. EC12TCF-US(HM), Washington, D.C. Available from <http://www.rita.dot.gov/bts/sites/rita.dot.gov/bts/files/ec12tcf-us-hm.pdf>, accessed on 19 August 2016.

<sup>75</sup> Kim, J. (2015). A study on developing the management center and operational strategies for transporting dangerous goods. 2015-2. Traffic Safety Research. Korea Transportation Safety Authority.

<sup>76</sup> U.S. Department of Transportation. (2016). Transportation statistics annual report 2015. Washington, D.C. Available from [https://www.rita.dot.gov/bts/sites/rita.dot.gov/bts/files/TSAR\\_2015\\_final\\_0.pdf](https://www.rita.dot.gov/bts/sites/rita.dot.gov/bts/files/TSAR_2015_final_0.pdf), accessed on 19 August 2016.

<sup>77</sup> Kim, J. (2015). A study on developing the management center and operational strategies for transporting dangerous goods. 2015-2. Traffic Safety Research. Korea Transportation Safety Authority.

persons per 100 crashes, the fatality rate from dangerous goods vehicle is 8.51 persons per 100 crashes.

## *5.2. Feasible hurdles to minimize the risk with dangerous goods on the roads*

Emphasizing that dangerous goods-related incident can cause the lethal severity on both human lives and the environment, in that negative ripple effects by fires, explosions and chemical poisoning might be produced. More importantly, it is challenging to estimate the extent of impacts and to quantify the scale of damages. Transporting dangerous goods on the roads need to be specially managed accordingly through well-defined treatments and designated authority.

### *Difficulties in cross-border and intermodal transport*

Unlike maritime and air transport, there is no universal standard on definitions, classification, labelling and packaging of dangerous goods for transport by road. It relies on countries to determine domestic standards. It leads to different standards in difference countries. Vehicles and goods are refused to enter foreign countries or are required to re-pack in line with receiving country's standards when carrying dangerous goods to cross the borders.

In many countries, domestic standards for dangerous goods by road are different from that by maritime transport. When trucks are used to carry maritime dangerous goods to inland places, goods have to re-packed and re-labelled. Additional handling of dangerous goods causes damage to goods and even loss or leakage of goods, which poses more risks or danger.

### *Needs of unified mandatory regulations for road transport*

With internationalization of manufacturing companies, the boundary between domestic and international logistics has smoothly faded away. Robust exchanges among countries of freight through the roads have become common. In particular, maritime, air and railway transport heavily relies on road to collect and deliver goods. Given that international regulations and many relevant domestic regulations for air and maritime transport were already harmonized, the lack of global regulations governing dangerous goods of the road sector causes severe incidents from time to time. It is known that the weak regulatory scheme can bring about only feeble managements and treatments in the situation of incidents. Regulatory scheme should therefore be taken to ensure that such transport is carried out under the best possible conditions of safety. Through the enforcement authority, the harmonized mandatory regulations based on the United Nations Model Regulations are in demand in this sense that can be adopted in each country around the world. Because the complication of dealing with dangerous goods, such as documents preparation, goods packaging, labelling, and classification, international regulations should take into account the different circumstances between developed, developing and least developed countries. Coordination

with regulations of other transport modes (i.e., ICAO TI, IMO IMDG Code, OTIF RID)<sup>78</sup> is another need in response to the growing attention for the intermodal facilities between countries. Additionally, the road signs and marks for dangerous goods' carriages need to be specified in the consistent manner with harmonization of other road signage.

### *Lack of the centralized management system*

While developing the unified mandatory regulations is a proactive approach, the centralized governance is another consideration from the follow-up operation and management perspective. Managing dangerous goods requires not only the regulatory scheme but also customized administrative works, in part for drawing the blueprint (future implementation plans), cooperation with other international/national organizations/institutions, training programmes, monitoring occasions and compliance with the regulations. Especially, because of the absence of the internationalized central platform in the road sector, in terms of transporting dangerous goods, time-sensitive international issues have not been properly addressed until now. Traffic crashes involving dangerous goods exemplify this case, as crashes usually need the intervention of various treatments (e.g., emergency services) and procedures from different agencies. The mutual exchange of information and timely coordination should be put in place to avoid the further severe situation.

The safe delivery to the final destination is the top priority of transporting dangerous goods. One effective strategy is to bypass/avoid vulnerable areas and use the shortest route during transporting across the countries, which can be done by centralized management system on the collaborative platform. In current situation, dangerous goods carriage needs to be stopped at the border to complete different regulatory procedures in each country. Different authorities between countries generate the delays even if global mandatory regulations are ratified and applied to carriage. Another present challenge is to developing the comprehensive plan which helps set up detailed actions to respond the ever-changing issues from transporting dangerous goods. International governance can play an important role to resolve these issues in this regard.

### *Slow adoption of ICT*

Even if global regulatory scheme regarding dangerous goods is provided, unfortunately problems still remain in the road sector which can make extensive deficiency on the roads. Globally, there is no monitoring system which controls dangerous goods vehicles in real-time. With the fast advancement of ICT in recent years in the transport sector as a form of ITS, some countries have already started initiating the real-time monitoring system project for dangerous goods vehicles. One case is the Hazmat Transport Vehicle Tracking System (HTVTS)<sup>79</sup> in Singapore, supported by the Fire Safety Petroleum and Flammable Materials

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<sup>78</sup> Technical Instructions for the Safe Transport of Dangerous Goods by Air (TI), International Maritime Dangerous Goods Code (IMDG Code), Regulations concerning the International Carriage of Dangerous Goods by Rail (RID).

<sup>79</sup> Seng, C. (2008). Safety and security system for hazmat transport vehicles in Singapore. Asian Disaster Reduction Center. Available from

Regulations from 2005. The main objective of the HTVTS is to minimize the vulnerability and to respond quickly to any incident involving dangerous goods vehicles by tracking the movement and location on a 24/7 basis. The Dangerous Goods Transportation Routing, Monitoring and Enforcement (GOOD ROUTE)<sup>80</sup> project in Europe is another example to develop a cooperative system for dangerous goods vehicle's routing, monitoring, re-routing (if necessary). In the recent years, China, Thailand and Viet Nam have made real-time monitoring of carriage of dangerous goods by road compulsory. ICT also can collect the accurate information of dangerous goods-related incidents, such as vehicle type, incident time, and location. This information can be the basis to create the global statistics for dangerous goods-related incidents that is the irreplaceable element in the future plan. Unfortunately discussions have been however made locally to use ICT for dangerous goods carriage, and to make matters worse, only a few countries have had opportunities to attempt the implementation. As another case, in order to streamline the border crossing procedures easily, ICT applications, such as on-board equipment and automatic vehicle identification, can be applied to complete the operational requirements shortly passing through the border. With help of ICT, the efficiency of managing international movements of dangerous goods can be improved and the possibility of incidents can be significantly reduced. Accordingly, timely provision of global common standards and guidelines on the use of ICT for monitoring carriage of dangerous goods by road will significantly enhance safety of such carriage.

## 6. Road Security

### *6.1. Growing security challenges on the road*

Apart from the road traffic safety, road security is another emerging challenge. It causes devastating impacts on the society. More attacks with vehicles have been seen around the world in the recent years regardless war torn or peace countries, developing or developed countries. On 3 July 2016, a vehicle packed with explosives was detonated at the busy shopping Centre in Baghdad, Iraq, killing 292 people.<sup>81</sup> On 14 July 2016, a 19-tonne truck was deliberately driven at a speed of close to 90 kilometres per hour into crowds celebrating Bastille Day in Nice, France, killing 86 people and injuring 434. Such shocking news occupied headlines of TV channels and newspapers from time to time.

Road vehicles have become the easiest tools available to make massive attacks. The road sector is now facing unprecedented security threats. However, road transport lags behind other modes of transport, which have tightened security measures. Currently security frameworks exist for maritime transport as provided in the International Convention for

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[http://www.adrc.asia/publications/TDRM2005/TDRM\\_Good\\_Practices/PDF/PDF-2008e/7.Singapore.pdf](http://www.adrc.asia/publications/TDRM2005/TDRM_Good_Practices/PDF/PDF-2008e/7.Singapore.pdf), accessed on 19 August 2016.

<sup>80</sup> Available from <http://www.transport-research.info/project/dangerous-goods-transportation-routing-and-monitoring>, accessed on 19 August 2016.

<sup>81</sup> Available at <http://www.independent.co.uk/news/world/middle-east/baghdad-bombing-death-toll-rises-to-nearly-300-in-isis-car-bombing-a7127386.html>, accessed on 26 September 2016.

Safety of Life at Sea (SOLAS) and the International Ship and Port Facility Security (ISPS) Code, and air transport provided under Annex 17 to the Chicago Convention. There is no similar framework for road transport. Transport authorities have a pivotal role in addressing security threats such as by introducing security criteria for licensing of vehicles, transport operators, personnel and intermodal facilities and monitoring them.

Many countries have taken measures to prevent vehicle attack, such as use of road blockers in office buildings, installation of satellite positioning system to monitor vehicles and increase of police or military check points on roads. Some countries even deploy one or two security officers on each bus running in important cities. However, attacks with vehicles cannot be effectively prevented and costs for security are becoming unaffordable.

Cyber security in the road sector also poses high risk. Attacks can be launched in the database, control systems and telecommunication systems both in road facilities and vehicles. The challenge is that cyber-attacks are ever-growing and have transformed in various ways. An experiment<sup>82</sup> in the USA in 2011 on attacking a moving vehicle at a speed of 40 miles per hour demonstrated the severity of cyber security on road systems.

Another threat is pilferage. According to the US Federal Bureau of Investigation<sup>83</sup>, 53.3 per cent of 547 incidents of cargo theft reported from 17 States in 2014 took place in road transport. Likewise, the European Parliament in 2007 indicated that the economic losses by lost or stolen goods in EU were around Euro 8.2 billion, excluding costs the industry suffers.<sup>84</sup> The trend of cargo theft incidents in many countries around the globe had shown the increase from 2011 to 2012.<sup>85</sup> Road transport is especially on the high risk in cargo theft incidents in many countries.<sup>86</sup>

## *6.2. Limited collaborative actions for security in the road sector around the world*

Even though the road systems are exposed to various security threats with multinational nature, there are still no proactive actions at the global level. As acknowledged by the 2002 National Strategy for Homeland Security<sup>87</sup> in the US, “a successful strategy for homeland security requires international cooperation”.

As of now, only scattered collaboration in a small portion of security area is sporadically observed. As examples, the European Commission (EC)’s Joint Research Centre initiated a

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<sup>82</sup> Departments of Computer Science and Engineering of University of Washington and University of California San Diego. (2011). “Comprehensive Experimental Analyses of Automotive Attack Surfaces”. Available from <http://www.autosec.org/pubs/cars-usenixsec2011.pdf>, accessed on 13 September 2016.

<sup>83</sup> Available from <https://ucr.fbi.gov/cargo-theft-2014>, accessed on 13 September 2016.

<sup>84</sup> European Road Transport Research Advisory Council (ERTRAC) (2011), “European Roadmap Safe Road Transport”, ERTRAC Working Group on Road Transport Safety and Security, accessed on 13 September 2016.

<sup>85</sup> FreightWatch International, Inc. (2013), “2013 Global Cargo Theft Threat Assessment”, Supply Chain Intelligence Center, accessed on 13 September 2016.

<sup>86</sup> Ibid.

<sup>87</sup> Office of Homeland Security. (2002). “The National Strategy for Homeland Security”, The White House. Available from <https://www.dhs.gov/sites/default/files/publications/nat-strat-hls-2002.pdf>, accessed on 16 September 2016.

process of US-EU collaboration on security standards in 2010, and a supporting document for further concrete actions was issued by the US Department of Commerce in 2012.<sup>88</sup> For freight transport security, Canada, EU, New Zealand and the Republic of Korea joined a voluntary supply chain security programme led by the US Customs and Border Protection (CBP), namely the US Customs-Trade Partnership against Terrorism.<sup>89</sup>

Contrary to the lack of attention on the road sector, air and maritime transport sectors have already brought the global attentions for security. IMO developed the “International Ship and Port Facility Security (ISPS) Code” in 2004 which is a comprehensive set of measures to respond to the potential threats on security of ships and port facilities.<sup>90</sup> ICAO is even ahead. Five security-related acts have been developed since 1969. One is the “Convention for the Suppression of Unlawful Acts against the Safety of Civil Aviation” in 1971 which aims to prevent any attack for airport facilities including the hijacking.<sup>91</sup> Another is for identifying the potential explosives, called the “Convention on the Marking of Plastic Explosives for the Purpose of Detection” in 1991.<sup>92</sup> A regional effort to curb the terrorism has also made in the air and maritime transport sectors, e.g., “Secure Trade in the APEC Region (STAR) Initiative” by the Asia-Pacific Economic Cooperation in 2002<sup>93</sup>. With proper support from international organizations, air and maritime transport sectors are relatively well-responsive to security threats.

### *6.3. Eye-catching challenges for road transport security*

Road security is an intricate matter because every component of a road system needs to be secured, including drivers, trucks, buses, terminals and other road infrastructure and facilities. In particular, as some road facilities, e.g., bridges or tunnels, are national and/or international symbolic icons, it might be easy to be exposed to security threats. Society is not accepting the unsecured transport systems, and thereby improving the road facility quality and strengthening the systems’ security aspects are of particular interest to all stakeholders. As a matter of urgency, identifying possible hindrances is worth to eliminate the potential threats and increase the security level. A three-fold issue is articulated for the prioritization of actions.

#### *Deficiency of standardization for road security*

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<sup>88</sup> National Institute of Standards and Technology, 2012, “The Benefits of U.S.-European Security Standardization”, US Department of Commerce, DOI: <http://dx.doi.org/10.6028/NIST.IR.7861>, accessed on 9 September 2016.

<sup>89</sup> Available from <https://www.cbp.gov/border-security/ports-entry/cargo-security/c-tpat-customs-trade-partnership-against-terrorism>, accessed on 13 September 2016..

<sup>90</sup> Available from [http://www.imo.org/blast/mainframe.asp?topic\\_id=897#what](http://www.imo.org/blast/mainframe.asp?topic_id=897#what), accessed on 13 September 2016.

<sup>91</sup> Available from <http://www.un.org/en/sc/ctc/docs/conventions/Conv3.pdf>, accessed on 13 September 2016.

<sup>92</sup> Available from <http://www.un.org/en/sc/ctc/docs/conventions/Conv10.pdf>, accessed on 13 September 2016.

<sup>93</sup> Available from <http://www.apec.org/Groups/SOM-Steering-Committee-on-Economic-and-Technical-Cooperation/Working-Groups/Counter-Terrorism/Secure-Trade-in-the-APEC-Region.aspx>, accessed on 13 September 2016.

Differences and the lack of knowledge in security standards on the roads across the countries could negatively affect the road security. Standards are the basic enabler of international collaboration and harmonization by providing lexicons and related items necessary to coordinate and integrate the systems across the countries. From an economic perspective, international standards spur the productivity, economic growth, more cross-border trade, enhanced credibility and reduced transaction costs.

Recognizing the importance, for example, the security standardization is a particular concern in the US-EU collaboration as afore mentioned.<sup>94</sup> Some international organizations for standards, e.g., International Standard Organization (ISO), European Committee for Standardization (CEN) and International Electrotechnical Commission (IEC), have co-worked on the technical specifications for security device. In EU, the CEN/TC 391 for Societal and Citizen Security<sup>95</sup> is charged of security standardization activities, and ISO/TC 292 for Security and Resilience<sup>96</sup> broadly works for the standardization in the field of security. No common standards make divergent national standards which can be a major obstacle to avoid the threats effectively. Internationally deliberated comprehensive measures incorporating the use of the devices, like operational standards, have yet established to apply to the road systems as a whole. Further, increasing possibilities of cyber-attacks on road facilities are not negligible, requiring new standards. In this context, six priority areas are potentially fruitful for the standardization pertaining to road security - counterterrorism, border-crossing security, cyber security, road infrastructure security, vehicle-related security and restoring security in crisis.

### *Necessity for regulatory frameworks and guidelines by the global leadership*

As noticed from other transport sectors, the establishment of regulations or guidelines for the security has been hauled by the international organizations, such as IMO and ICAO. Because no global centralized leadership exists in the road sector, no comprehensive, elaborated and coordinated plan for security exists at present. The main elements of the security plan should include clear goals, monitored assets and choke points, to which special attention should be given. The plan serves as the baseline by all stakeholders and related bodies to achieve desired security goals. Regulatory frameworks and guidelines can act as practical provisions within the plan to ensure the best level of security possible for the road sector. For instance, one guideline about emergency preparedness can take into account all decisions of which transport corridors to shut, how to divert traffic to other routes, how to respond the downstream effects by the sudden attacks. Also, frameworks and guidelines from the regulatory perspective can provide tailored indications to guarantee the level of security of

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<sup>94</sup> National Institute of Standards and Technology. (2012). "The Benefits of U.S.-European Security Standardization", U.S. Department of Commerce, DOI: <http://dx.doi.org/10.6028/NIST.IR.7861>, accessed on 9 September 2016.

<sup>95</sup> Available from <http://www.cencenelec.eu/standards/Sectors/DefenceSecurityPrivacy/Security/Pages/default.aspx>.

<sup>96</sup> Available from, accessed on 9 September 2016. [http://www.iso.org/iso/home/standards\\_development/list\\_of\\_iso\\_technical\\_committees/iso\\_technical\\_committee.htm?commid=5259148](http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=5259148), accessed on 9 September 2016.

the system. However, the current lack of centralized leadership makes it difficult to establish a common set of frameworks and guidelines from the global level to national level.

Recent attacks tend to exert severe influences in both society and human lives. The failure of satisfying the technical standards in any component of the road system ruins the overall security of the system. Accordingly, the regulatory frameworks and guidelines can help avoid these loopholes within the entire road system. Suitable measures are also adopted as part of frameworks and guidelines. By doing so, a sound strategy for monitoring the conformity of regulations and security enforcement is attainable.

#### *Lack of understanding for the usefulness of technologies*

As a matter of fact, secured inland movements by road vehicles between countries require numerous and complex processes. For example, functioning status of vehicles, monitoring the suspicious vehicles, pre-screening information of goods and drivers, and emergency communications. Although the cutting-edge technologies are able to support most of the required systems for assuring the security, little attention has been given to their use. This is because the global consensus, including standards, the form of applications and technical regulations/guidelines, has not been reached yet in this area. The discrepancy between brand new technologies for security and their actual knowledge by stakeholders is another reason.

Considering that technological developments have continued to grow and cyber-attacks have multiplied in recent years, application of advanced technologies in the road security is significantly useful. As an example, with help of advanced cooperative systems between vehicles and control centre, a prompt communication system can be established to respond to the emergency situations created by attackers, and to monitor the vehicle's status and location for the purpose of prevention and timely rescue. In general, the strategy for security can be broken into four steps: prevention, protection, response and recovery. New technologies integrating and coordinating resources and information are effective in each step for ensuring the security. Centralized monitoring system, vehicle or driver identity system, behavioral detection system, on-board vehicle system, and route guidance system are such cases. Further, the deployment of intelligent surveillance and alarm systems, combining the optical technologies (e.g., camera) can block attacks in intermodal and multimodal facilities, and road infrastructure. Lastly, the application of advanced ITS technologies (i.e., V2V, V2I and V2X) can allow to identify the potential threats, to monitor the incoming and outgoing traffic in a real time base, and even to control remotely the suspicious vehicles in the near future. To optimize synergy with technologies in road transport security, it is important to have the common platform utilizing the knowledge, and setting up implementation plans with proper regulations/guidelines.

# 3

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## REVIEW OF THE EXISTING ORGANIZATIONS RELATING TO THE ROAD SECTOR

There are a number of intergovernmental and non-governmental organizations working for various aspects of transport. The study reviews the mandates, working scopes and main activities of the organizations related to the road sector to identify ways to help address the challenges, in particular the gaps of international mechanisms for the road sector.

### 1. World Health Organization (WHO)<sup>97</sup>

In April 2004, the United Nations General Assembly resolution 58/289 on improving global road safety “*Invites the World Health Organization, working in close cooperation with the United Nations regional commissions, to act as a coordinator on road safety issues within the United Nations system*”. The World Health Assembly accepted this invitation in May 2004.

The World Health Organization (WHO) set up the United Nations Road Safety Collaboration (UNRSC) which holds biannual meetings to discuss global road safety issues. UNRSC is an informal consultative mechanism whose members are committed to road safety efforts and in particular to the implementation of the recommendations of the global report on road traffic injury prevention.

Following the First Global Ministerial Conference on Road Safety in Moscow, the Russian Federation in November 2009, the Decade of Action for Road Safety 2011-2020 was officially proclaimed by the United Nations General Assembly in March 2010<sup>98</sup> with a goal to stabilize and then reduce the forecast level of road traffic fatalities around the world.

WHO publishes the Global Status Report on Road Safety series. The report provides the state of global road safety and progress in legislation, road user behavior, vehicles and roads. The report also provides more detailed information country by country.

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<sup>97</sup> Available from <http://www.who.int/en/>

<sup>98</sup> General Assembly resolution 64/255 on improve global road safety.

WHO produces advocacy materials for road safety and road safety training manual. It leads public campaign on road safety week and the world day of remembrance for road traffic victims. In November 2015, WHO organized the 2<sup>nd</sup> Global High-Level Conference on Road Safety in Brasilia, Brazil.

## **2. World Bank (WB)<sup>99</sup>**

The Global Road Safety Facility (GRSF), a global partnership programme administered by the World Bank (WB), was established in 2006 to help address the growing challenges of road traffic deaths and injuries in low and middle-income countries. GRSF provides funding, knowledge, and technical assistance to strengthen the efforts of countries to build their scientific, technological and managerial capacities.

GRSF has three main objectives:

- Strengthened global, regional and country capacity to support sustainable reductions in road deaths and injuries in countries;
- Scaled up global safety funding, coordination, and advocacy mechanism; and
- Mainstreamed road safety component in all WB-funded road infrastructure projects.

In fiscal year 2015, GRSF disbursed approximately USD 3.9 million in grant financing and supporting institutional management capacity reviews, infrastructure assessment, technical assistance, and other advisory services, and leveraging USD 151 million in road safety lending across the WB projects.

Since its inception, GRSF has helped the WB move from a piecemeal approach to road safety to a more comprehensive, systematic approach in its operation. In 2008, the WB made road safety pillar of its strategy for transport sector.

The Strategic Plan for 2013-2020 sets out how it will contribute to the Global Plan for the Decade of Action for Road Safety, leverage the global expertise of the WB, and work in close collaboration with donors and UNRSC partners.

The GRSF's funding allocation follows a principle to maximize road safety impact by governments and partner organizations. It has developed a comprehensive results framework to monitor the delivery of outcomes, including capacity building, infrastructure safety, advocacy, enforcement, and research and development.

## **3. International Transport Forum (ITF)<sup>100</sup>**

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<sup>99</sup> Available from <http://www.worldbank.org/>

<sup>100</sup> (a) Dublin Declaration, An International Transport Forum: A Declaration Adopted by the ECMT Council of Ministers in Dublin, European Conference of Ministers of Transport Council of Ministers, 18 May 2006; (b)

The International Transport Forum (ITF) was created in 2006 by the member countries of the European Conference of Ministers of Transport (ECMT). It is founded on the legal basis of the ECMT Protocol and the legal agreements of the Organization for Economic Cooperation and Development (OECD). Administratively it is integrated with OECD. ITF is a forum platform with a public face and not an international organization.

ITF works mainly at research of all transport modes, namely road, railway, aviation and maritime transport. It acts as a think tank for transport policy and organizes the annual summit of transport ministers. Its mission is to foster a deeper understanding, among policy makers and wider audiences, of the role of transport in economic growth, environmental sustainability and social inclusion and to raise the public profile of transport policy. Its research subjects cover all modes of transport but do not overlap with sectoral or modal organizations, such as ICAO and IMO.

The Annual Summit of Ministers on transport policy of strategic importance is held by ITF. Policy recommendations, declarations and resolutions on general transport policy are adopted by the ITF's Council of Ministers of Transport during the Summit.

The multilateral quota system for road transport in Europe established in 1974 by ECMT continues under the management of a special working group and supervision of the Transport Management Board. Its major policy matters are referred to European Ministers for decision. The licenses equivalent to permits issued under the system allow road transport operators to carry goods between the ECMT member countries.

ITF provides a discussion and sharing platform for analysis or reports on road policy, road safety, urban mobility, analysis of road data, country cases, automated driving, vehicle emissions and development trend. It also produces Road Safety Annual Report, which focuses policy on vulnerable road users, enforcement of drink driving laws, speed limits and the wearing of seat belts and motorcycle helmets, analysis of road safety performance and adaption policies.

#### **4. United Nations Regional Commissions**

There are five regional commissions under the Economic and Social Council (ECOSOC) of the United Nations. They work for member States in their respective geographical areas. Some regional commissions also have non-regional member States due to historical changes of countries, overlapped geographical coverage or special connections with regional member States, such as past colonies and trust territories. Staff and main operations of the regional commissions are financed with the regular budget of the United Nations. Part of their specific activities is supported by donors and partners, such as research, seminars and workshops. Their further information is provided in the following sub-sections.

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Renewed Mandate of the International Transport Forum, 2014; (c) <http://www.itf-oecd.org/road>, accessed on 9 October 2016.

#### *4.1. Economic Commission for Africa (ECA)<sup>101</sup>*

Established in 1958, the Economic Commission for Africa (ECA)'s mandate is to promote economic and social development, regional integration, and international cooperation for Africa's development.

ECA has seven main areas of work: macroeconomic policy, social development, regional integration and trade, natural resource management, innovation and technology, gender, and governance.

ECA operates at the regional and subregional levels. It places a special focus on collecting regional statistics in order to ground its policy research and advocacy on clear objective evidence; promoting policy consensus; providing meaningful capacity development; and providing advisory services to governments, intergovernmental organizations and institutions in key thematic fields.

Specialized regional advisory services and capacity development support to member States are provided in the following priority areas:

- Promotion of industrialization;
- Design and implementation of macroeconomic policy;
- Design and articulation of development planning;
- Supporting mineral resources contract negotiations; and
- Promoting the proper management of natural resources for transformation.

Transport is a part of the Regional Integration and Trade Division. The Division's work is split into four Sections: Industrialization and Infrastructure; Investment Policy; Food Security, Agriculture and Land.

The Division is in charge of providing recommendations to member States on the best practices for the development of transport infrastructure. It also researches the trends and roadblocks to the implementation of regional infrastructure programmes and provides policy recommendations to accelerate their implementation. ECA developed the index of regional integration, which takes into account the amount of road and transport infrastructure<sup>102</sup>.

The Division works with the African Union, and member States to develop and implement programmes such as transit transport corridors, the Trans-African Highways (TAH) network, the African transport policy programme, and the programme for infrastructure development in Africa. It also leads the development of the African action plan to implement the Global Plan for the Decade of Action for Road Safety.

The Intergovernmental Agreement on the Trans-African Highway Network, jointly supported by the African Union Commission, ECA, African Development Bank (AfDB) and others,

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<sup>101</sup> Available from <http://www.uneca.org/>

<sup>102</sup> ECA- Regional Integration and Trade Division, African Regional Integration Index- Report 2016

was adopted by the African Conference of Ministers of Transport held in Malabo, Equatorial Guinea, in April 2014 and endorsed by the Assembly of the African Union in June 2014. It includes highways routes, basic guidelines for road classification and design standards, road safety, social development and environment.

#### *4.2. Economic Commission for Europe (ECE)<sup>103</sup>*

The Economic Commission for Europe (ECE) was established in 1947. Its major aim is to promote pan-European economic integration. ECE works in the areas of economic cooperation and integration, environmental policy, forest, housing and land, sustainable energy, statistics, trade and transport.

ECE facilitates greater economic integration and cooperation among its member States and promotes sustainable development and economic prosperity through:

- Policy dialogue;
- Negotiation of international legal instruments;
- Development of regulations and norms;
- Exchange and application of best practices as well as economic and technical expertise; and
- Technical cooperation for countries with economies in transition.

The road sector is managed by Sustainable Transport Division, whose mission is to promote sustainable inland transport, including road, railway and inland waterway.

Sustainable Transport Division encompasses four Sections, namely Dangerous Goods and Special Cargoes Section, Vehicles Regulations and Transport Innovations Section, Transport Facilitation and Economics Section and Sustainable Transport Section.

The Division promotes sub-regional cooperation among Central, Eastern and South-Eastern European countries in the frameworks of the Trans-European Motorway (TEM) and Trans-European Railways (TER) Projects. The Division also promotes development of Euro-Asian Transport Links and supports together with ESCAP a Project Working Group under the Special Programme for the Economies of Central Asia (SPECA).

ECE has negotiated and adopted 58 legal instruments on road, railway and inland water transport. An overview of the legal instruments is provided in Table 3. Further detailed analysis of them in connection with the potential institutional gap is provided in Annex I.

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<sup>103</sup> Available from <http://www.unece.org>

**Table 3.** Summary of numbers of the legal instruments on transport in different fields

Field		Number of legal instruments on transport
Inland water transport		<b>10</b>
Railway		<b>5</b>
Common for different modes		<b>9</b>
Road subtotal, of which:		<b>34</b>
	Updated with other legal instrument	4
	European agreement	10
	Protocol to legal instrument	4
	Customs	4
	Private law	2
	Detailed technical instrument on vehicle	2
	Road safety & cross-border transport matters	8
Grand total		<b>58</b>

Of the 34 legal instruments relating to road, eight conventions/agreements are of potential relevance to the functions of a specialized road agency,<sup>104</sup> including:

- Convention on the Taxation of Road Vehicles for Private use in International Traffic 1956
- Convention on the Taxation of Road Vehicles engaged in International Passenger Transport 1956
- Convention on the Taxation of Road Vehicles engaged in International Goods Transport 1956
- Convention on Road Traffic 1968
- Convention on Road Signs and Signals 1968
- Agreement on Minimum Requirements for the Issue and Validity of Driving Permits 1975
- Agreement concerning the Adoption of Uniform Conditions for Periodical Technical Inspections of Wheeled Vehicles and the Reciprocal Recognition of Such Inspections 1997
- General Agreement on Economic Regulations for International Road Transport 1954

<sup>104</sup> 1. ECE administers some Customs conventions. Following the practices of IMO and ICAO, a specialized road agency will cooperate with WCO but not develop and administer Customs conventions in its functions. 2. ECE provides the secretariat services to the World Forum for the Harmonization of Vehicle Regulations. The regulations incorporate the technological innovations of vehicles for improved safety and environmental performance. Similar to IMO and ICAO, this will be mostly not the focus of the specialized road agency and not included into the IRO's functions. 3. It should not be an intention of the specialized road agency as an intergovernmental body to work for the private law.

The principle of the three conventions on mutual exemption of the taxation on purchase and ownership for vehicle in use for cross-border transport has been included in bilateral or multilateral agreements on international road transport. They will not become a subject in the specialized road agency's agenda. Therefore, only five of the eight conventions/agreements need to be further assessed. Further detailed analysis of the conventions/agreement is provided in Chapter 5. Analysis of Institutional Gap, Possible Functions and Possible Options for Closing the Institutional Gap in the Road Sector.

### *4.3. Economic Commission for Latin America and the Caribbean (ECLAC)<sup>105</sup>*

The Economic Commission for Latin America the Caribbean (ECLAC) was established in 1948. ECLAC was founded with the purpose of contributing to the economic development of Latin America and the Caribbean, and to reinforce economic relations among member countries.

ECLAC's major working areas are gender affairs, international trade and integration, economic development, production and productivity management, social development, sustainable development and human settlements, statistics, planning for development, population and development, and natural resources and infrastructure.

ECLAC undertakes studies and research; promotes regional and subregional cooperation and integration; gathers, organizes, interprets and disseminates information and data relating to the economic and social development of the region; provides advisory services to governments at their request; formulates and promotes development cooperation activities and projects of regional and subregional scope; assists in bringing a regional perspective to global problems and forums and introduces global concerns at the regional and subregional levels.

Matters related to transport are managed by the Infrastructure Services Unit of the Natural Resources and Infrastructure Division in parallel with another Unit for Natural Resources and Energy. The focus of the ECLAC's Natural Resources and Infrastructure Division<sup>106</sup> is to foster competitiveness and greater productivity for economic and social development through the sustainable management of natural resources and the provision of infrastructure services in the countries of the region. The main activities of the two units include research and analysis to support public policymakers in the areas of natural resources and infrastructure; Technical assistance and training; and Support for political dialogue and regional integration.

The Infrastructure Services Unit supports for building the institutional operating and regulatory framework for transport in the Latin American and Caribbean region, through capacity building initiatives, expert group meetings, policy recommendations and technical

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<sup>105</sup> Available from <http://www.cepal.org/en>

<sup>106</sup> Available from <http://www.cepal.org/en/about-natural-resources-and-infrastructure>

cooperation. The Unit undertakes research and makes policy recommendations in the following areas<sup>107</sup>:

- Infrastructure, transport services and integration;
- Regional integration as a facilitator of economic development;
- Facilitating trade and transport; and
- Logistics.

The Infrastructure Services Unit also hosts the Maritime and Logistics Profile web portal<sup>108</sup> which includes information on port activities, maritime market information, modal activity and country level information and infrastructure and logistics profiles within the region.

#### *4.4. Economic and Social Commission for Asia and the Pacific (ESCAP)*

Established in 1947, the Economic and Social Commission for Asia and the Pacific (ESCAP) works to overcome some of the region's key challenges by providing results oriented projects, technical assistance and capacity building to member States.

ESCAP promotes rigorous analysis and peer learning, translates these findings into policy dialogues and recommendations, and provides good development practices, knowledge sharing and technical assistance to member States in the implementation of these recommendations.

ESCAP uses its convening power to bring countries together to address challenges through regional cooperation, including:

- Issues that all or a group of countries in the region face, for which it is necessary to learn from each other;
- Issues that benefit from regional or multi-country involvement;
- Issues that are transboundary in nature, or that would benefit from collaborative inter-country approaches; and
- Issues that are of a sensitive or emerging nature and require further advocacy and negotiation.

ESCAP provides a forum for its member States to promote regional cooperation and collective action and assist countries in building and sustaining shared economic growth and social equity.

ESCAP's norm setting and policy work focus on impacts on people's lives by helping countries shape and implement a more balanced and inclusive development agenda for the region.

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<sup>107</sup> ECLAC: thirty years of contributing to transport Infrastructure building in Latin America and the Caribbean

<sup>108</sup> Available from <http://www.cepal.org/perfil/default.asp?idioma=IN>

Transport Division works for enhancing regional connectivity, cooperation and integration in the field of transport. Its programme of work reflects the need for achieving SDGs into connectivity activities.

Transport Division encompasses with three Sections, namely, Transport Infrastructure, Transport Facilitation and Logistics, and Transport Policy and Development.

ESCAP's work in the field of transport is under the vision of an integrated intermodal transport and logistics system, set by the Ministerial Conference on Transport in 2006 and endorsed by the Commission in 2007, which integrates economic, social and environmental pillars of sustainable development into transport connectivity agenda in a balanced and integrated manner.

By supporting the development of an intermodal regional network, ESCAP works to strengthen connectivity, optimize the use of existing infrastructure and increase the level of integration between the different transport modes. As building blocks, the Asian Highway, Trans-Asian Railway and Dry Port networks have been formalized through three intergovernmental agreements.

The Intergovernmental Agreement on the Asian Highway Network was signed in 2004 and entered into force in 2005. The agreement includes highway routes, the classification and design standards. The agreement on the Trans-Asian Railway with railway lines network entered into force in 2009. The agreement on dry ports including list of dry ports and basic guiding principles for operation of dry ports entered into force in 2016.

ESCAP also works to assist member countries in tackling non-physical barriers to cross-border and transit transport to achieve operational connectivity. To this end, ESCAP promotes the unhindered and safe movement of vehicles, goods and people across borders and through countries of the region through the establishment of regional facilitation frameworks, assistance in formulating and implementing road transport agreements, development of models, provision of facilitation tools and regional harmonization of documentation and procedures. Two regional frameworks for the facilitation of international road and railway transport have been endorsed by the Commission. A series of models have been developed to assist member countries in standardizing, harmonizing and simplifying formalities for cross-border by road and railway.

ESCAP also assists countries in developing transport logistics policies and in enhancing the quality of transport through improving the skills of logistics service providers and transport professionals.

ESCAP extends its work to rural connectivity, urban mobility and road safety to help maximize positive impact of connectivity to the environment and society. The regional road safety goals and targets were adopted by the Ministerial Conference on transport development in 2006.

#### ***4.5. Economic and Social Commission for Western Asia (ESCWA)***

The Economic and Social Commission for Western Asia (ESCWA) was established in 1973 to strengthen international cooperation and promote development in Western Asia.

ESCWA's objectives are:

- To support economic and social development in member countries;
- To promote interaction and cooperation between member countries;
- To encourage the exchange of experience, best practice and lessons learned;
- To achieve regional integration and ensure interaction between Western Asia and other regions; and
- To raise global awareness of the circumstances and needs of member countries.

It addresses these objectives through its Natural Resources Division, Technology for Development Division, Gender and Woman Issues Division, Social Development Division, Statistics Division, Economic Development and Integration Division, and Governance and Conflict Issues Division.

ESCWA provides a framework for the formulation and harmonization of sectoral policies for member countries, a platform for congress and coordination, a home for expertise and knowledge, and an information observatory.

The Economic Development and Integration Division handles transport and logistics issues. It promotes capacity building on policies, laws, and regulations for transport and logistics issues. The Division assists member States in achieving regional transport infrastructure and transport corridors. For instance, ESCWA developed the Integrated Transport System in the Arab Mashreq (ITSAM) as a blueprint of how to improve trade and the interconnectivity of the region.

An Agreement on International Roads in the Arab Mashreq was signed in May 2001 and has been ratified by 13 ESCWA member States. It includes highway routes, technical specifications, and standard road signs, traffic signals and pavement marking.

### **5. ECOSOC Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals**

Given that transporting dangerous goods requires special arrangements with regulations, a Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals <sup>109</sup> has been established within the

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<sup>109</sup> In 2001, the Committee was reconfigured and renamed "Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized Systems of Classification and Labelling of Chemicals" (see [http://www.unece.org/fileadmin/DAM/trans/danger/publi/unrec/rev17/English/Rev17\\_Volume1.pdf](http://www.unece.org/fileadmin/DAM/trans/danger/publi/unrec/rev17/English/Rev17_Volume1.pdf)).

framework of the ECOSOC for harmonization of hazard classification criteria, hazard communication tools (GHS) and for transport conditions for all modes of transport (TDG)<sup>110</sup>. The Committee of Experts issues the Recommendations on the Transport of Dangerous Goods. The recommendations about the transport of dangerous goods are stated in the annex of “Model Regulations on the Transport of Dangerous Goods (shortly Model Regulations)”<sup>111</sup>, which provide the basic scheme of provisions with flexibility for developing uniform national and international regulations on the diverse modes of transport. Based on this regulatory scheme, air and maritime transports have created their own global regulations by the intergovernmental bodies. For instance, ICAO has developed “Technical Instructions for the Safe Transport of Dangerous Goods by Air (TI)” with modifications to accommodate features of air transport, which contains inspection and enforcement procedures to ensure that dangerous goods are being carried in compliance with the requirements in each member State<sup>112</sup>. IMO has also produced the “International Maritime Dangerous Goods Code (IMDG Code)” to regulate the safe transportation of dangerous goods by sea. This Code’s requirements apply to the member States under the International Convention for the Safety of Life at Sea (SOLAS)<sup>113</sup>. As of January 2015, the IMDG Code is mandatory for application in 162 countries, and the ICAO TI is mandatory for 191 countries<sup>114</sup>.

On the other hand, OTIF has developed “Regulations concerning the International Carriage of Dangerous Goods by Rail (RID)”, as part of the Convention concerning International Carriage by Rail<sup>115</sup>. For the road transport, ECE member States formulated a European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) in 1957<sup>116</sup>. Because of lack of global intergovernmental body for the road sector, there is no global specific detailed legal instrument on carriage of dangerous goods by road equivalent to the IMO IMDG Code and the ICAO TI.

## 6. Non-governmental Organizations relating to Road Sector

### 6.1. The World Road Association (PIARC)<sup>117</sup>

The World Road Association was established in 1909, following the first international road congress held in Paris in 1908 when it was called the Permanent International Association of Road Congresses (PIARC). It has consultative status with ECOSOC.

<sup>110</sup> Available from <http://www.unece.org/trans/danger/danger.html>.

<sup>111</sup> Available from [https://www.unece.org/fileadmin/DAM/trans/danger/publi/unrec/rev19/Rev19e\\_Vol\\_I.pdf](https://www.unece.org/fileadmin/DAM/trans/danger/publi/unrec/rev19/Rev19e_Vol_I.pdf).

<sup>112</sup> Available from <http://www.icao.int/safety/DangerousGoods/Pages/background.aspx>.

<sup>113</sup> Available from <http://www.imdgsupport.com/Free%20IMDG%20Code%20introduction%2037-14.pdf>.

<sup>114</sup> Available from <http://www.unece.org/transport/areas-of-work/dangerous-goods/legal-instruments-and-recommendations/ghs/transdangerpublighsimplementation-e/legal-inst-list.html>.

<sup>115</sup> Available from

[http://www.otif.org/fileadmin/user\\_upload/otif\\_verlinkte\\_files/07\\_veroeff/99\\_geschuetzt/RID\\_2013\\_e/RID\\_2013\\_E.pdf](http://www.otif.org/fileadmin/user_upload/otif_verlinkte_files/07_veroeff/99_geschuetzt/RID_2013_e/RID_2013_E.pdf).

<sup>116</sup> Available from [http://www.unece.org/trans/danger/publi/adr/adr\\_e.html](http://www.unece.org/trans/danger/publi/adr/adr_e.html).

<sup>117</sup> Available from <http://www.piarc.org/en/>

It is an international forum for the discussion of all aspects of roads and road networks, established principally for professionals in its member countries. It also provides an overview of the policies and trends that affect all road users.

PIARC has members in 140 countries, including governments, individuals, companies, authorities and organizations.

The Council of PIARC has the ultimate responsibility for the governance of PIARC. It is composed of delegations from members, each led by a first Delegate. The Council elects the officers, the Secretary General and the members of the Executive Committee. The Council meets once a year.

The Executive Committee manages the Association by delegation of the Council. It is supported by the Commissions on Finance, Communications and Strategic Planning, and General Secretariat.

General Secretariat is composed of support staff and staff seconded by members. It provides a secretarial service for the Council, the Executive Committee and the Commissions and service to the Technical Committees.

The PIARC Technical Committees bring together experts from numerous areas including road safety and design, network operations and maintenance, finance and governance. Experts are nominated by members to work on issues identified under the Association's Strategic Plan endorsed by member countries.

The Strategic Plan for 2016-2019 sets the organizational structure of the Technical Committees according to five strategic themes: A-Management and Finance; B-Access and Mobility; C-Safety; D-Infrastructure; E-Climate Change, Environment and Disasters.

The goal of Theme A is to encourage the development of policies and strategies that result in transport administrations that perform well, measure performances, and incorporate innovative financing mechanisms to meet the ever changing needs of the road transportation community.

The goal of Theme B is to encourage the improvement of access and mobility provided to the traveling public and industry through efficient road network operation and integration with other transport modes.

Theme C aims to improve the safety and efficiency of road transport, including the movement of people and goods on the network, while effectively and widely promulgating knowledge of all aspects of road safety and encouraging implementation of positive practices.

Theme D focuses on improving the quality and efficiency of road infrastructure through the effective management of assets in accordance with user expectations and government requirements.

The goal of Theme E is to increase resiliency and efficiency of road infrastructure through the effective management of assets in accordance with user expectations and government requirements.

The result of the Technical Committees is shared with members through the “Routes/Roads”, which is an informational magazine published quarterly by PIARC. The articles present analysis, summaries, recommendations or stages of practices in a country covering subjects of topical interest in the theme of roads and road transport.

PIARC organizes the World Road Congress every four years since 1908, with the aim of sharing techniques and expertise worldwide in the field of road infrastructure and road transport. As a complement to World Road Congress, PIARC has organized International Winter Road Congress every four years since 1969.

## *6.2. International Road Transport Union (IRU)<sup>118</sup>*

The International Road Transport Union (IRU) is a nongovernmental organization with consultative status with the United Nations Economic and Social Council (ECOSOC). IRU started in 1949 as a group of national road transport associations from eight western European countries: Belgium, Denmark, France, the Netherlands, Norway, Sweden, Switzerland and United Kingdom, and became an industry federation of 150 national member associations and associate members in 74 countries.

The trigger for the establishment of IRU was the complexity of transport across European countries destroyed by the World War II, mainly humanitarian (under the Red Cross flag) and the transport of materials needed for reconstruction. Borders were difficult to cross: documents for the driver, vehicle and cargo were not mutually accepted, and the general climate was characterized by lack of trust and fear for the national security.

Its main functions include:

- A lobby organization for the road transport industry (cargo and passengers), representing the interests of bus, coach, taxi and truck operators from large fleets to individual owner-operators;
- To manage, on the private sector side, the functioning of TIR, an international transit system that allows goods to transit from a country of origin to a country of destination in sealed load compartments with Customs control recognition along the supply chain. IRU has a formal partnership with ECE as the TIR Secretariat; and
- The IRU Academy is a body dedicated to road transport training by developing training programmes.

The General Assembly is IRU’s highest authority; it is composed of all active and associate members and meets twice a year to define the IRU’s political and practical objectives and to

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<sup>118</sup> Available from <https://www.iru.org/>

discuss, adopt and communicate the IRU's position on all matters relating to road transport policy.

The IRU Presidential Executive is the executive body of the IRU General Assembly and is responsible for directing the affairs of the organization according to the IRU Constitution and Rules of Procedure. It carries out all decisions taken by the General Assembly, and assists the latter in achieving the IRU's transport policy objectives.

The IRU's General Assembly is supported by two Councils: Goods Transport Council and Passenger Transport Council.

The Goods Transport Council is composed of all active members representing the professional transport of goods by road for hire and reward and for own account. It is responsible for defining IRU goods transport policy objectives and discussing, adopting, and communicating the IRU's position on all questions related to goods transport by road global level. It meets twice a year and hold statutory elections every two years to elect its board.

The Passenger Transport Council is composed of all active members representing the professional transport of passengers by road, including taxis and hire cars with driver. It is responsible for passenger transport and its operation system is same to the Goods Transport Council.

IRU has seven expert Commissions, advisory groups which help develop policies, best practice and programmes in the areas of Customs affairs, economic affairs, legal affairs, road safety, social affairs, services and technical affairs.

IRU has three working parties on intermodal transport, dangerous goods, and taxis and hire cars with drivers, with experts from member associations.

The IRU secretariat led by a Secretary General delivers the IRU's strategic objectives and manages operations on a daily basis.

### ***6.3. International Road Federation (IRF)<sup>119</sup>***

The International Road Federation (IRF) is a non-governmental organization founded in 1948 with a consultative status with ECOSOC. Its mission is to encourage and promote development and maintenance of better, safer and more sustainable roads and road networks.

IRF has members and associates in over 118 countries, including road professionals, including national road associations, engineering societies, advocacy groups, and institutes of higher learning. IRF provides an information and knowledge platform.

The main functions of IRF are:

- To provide expertise for planning road development strategy and policy;

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<sup>119</sup> Available from <https://www.irfnews.org/>

- As a business network and a platform to communicate with and access to government officials and decision makers;
- To provide support and knowledge for the community of road professionals dedicated to the development of road infrastructure; and
- Through the International Road Education Foundation, to award grants to graduate engineers and other transport professionals, and also to honor and recognize road-industry projects demonstrating excellence and innovation.

The main function of IRF is implemented by three main structures: Committees, Regional Affairs and Learning Centre.

The Committees cover the areas of safety, asset management and ITS.

The results and recommendations of these Committees are incorporated in Policy Statements for IRF members. The Policy Statements cover practical areas such as cable barriers, driver training, enforcement, motorcycle safety, public-private partnerships, road markings, road safety, road safety audits, roadside safety hardware and vulnerable road users.

The IRF Learning Centre provides the members and road professionals with educational development opportunities and resources. It has developed a Global Training Curriculum for training of seasoned professionals.

# 4

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## EXPERIENCES FROM OTHER TRANSPORT ORGANIZATIONS

There are international intergovernmental organizations relating to specific modes of transport other than road. They have evolved to modern status, which are deeply involved in the development of green, safe and efficient transport in their respective sectors.

### 1. International Maritime Organization (IMO)<sup>120</sup>

The International Maritime Organization (IMO), a specialized agency of the United Nations, is the global standard-setting authority for the safety, security and environmental performance of international shipping. In 1949 an international conference in Geneva adopted a convention formally establishing IMO<sup>121</sup>. IMO convention entered into force in 1958 and the new organization met for the first time the following year. IMO currently has 171 member States and three associate members.

Its main role is to create a regulatory framework for the shipping industry that is fair and effective, universally adopted and implemented. IMO creates a level playing-field so that shipping lines cannot compromise on safety, security and environmental performance.

IMO measures cover all aspects of international shipping – including ship design, construction, equipment, manning, operation and disposal – to ensure that this vital sector remains safe, environmentally sound, energy efficient and secure.

IMO is now responsible for more than 50 international conventions and agreements and has adopted numerous protocols and amendments. The most fundamentally important legal instruments are the International Convention for the Safety of Life at Sea (SOLAS), the International Convention for the Prevention of Pollution of the Sea by Oil (MARPOL), the International Convention on Standards of Training, Certification and Watchkeeping for

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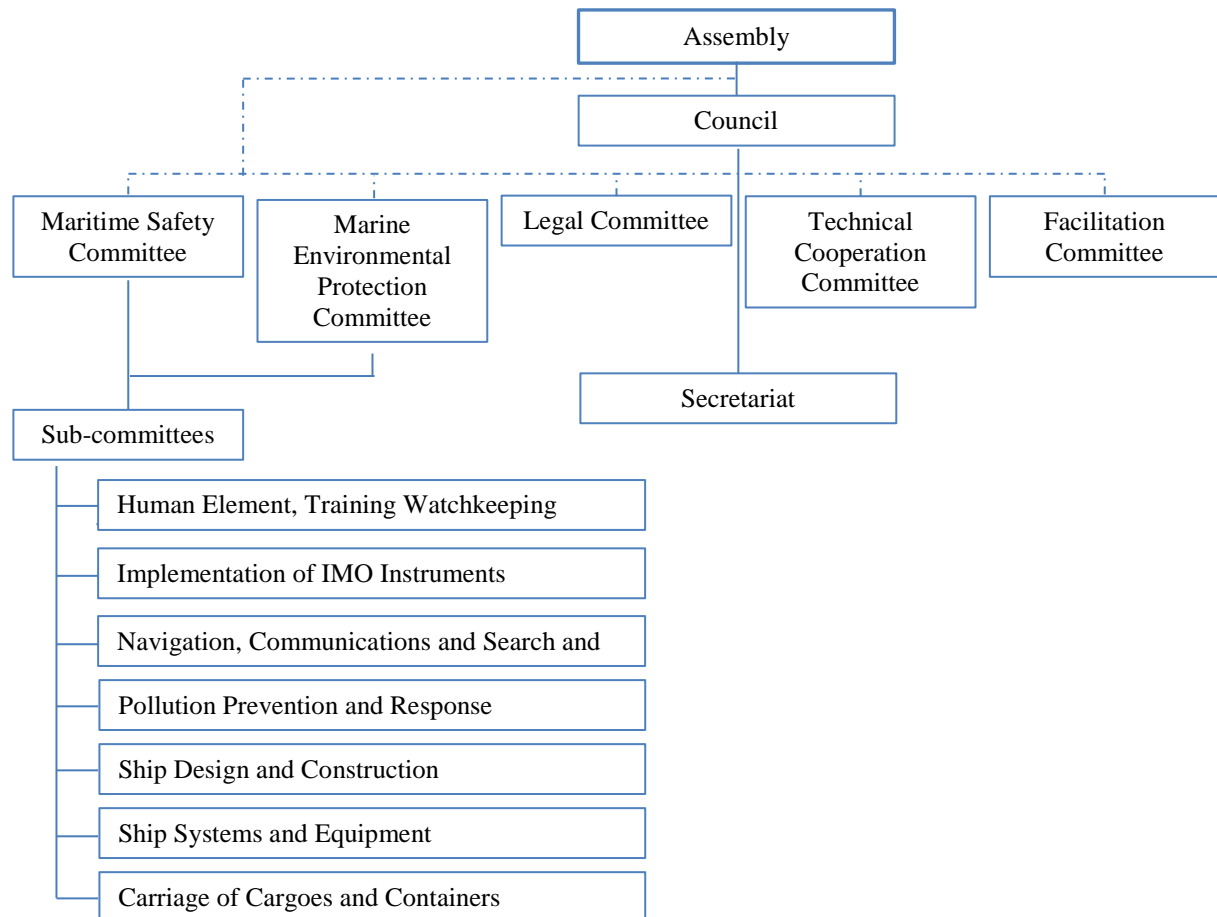
<sup>120</sup> Available from <http://www.imo.org/en>

<sup>121</sup> The original name was the Inter-Governmental Maritime Consultative Organization (IMCO). It was renamed as IMO in 1982.

Seafarers (STCW) and the Convention of Facilitation of International Maritime Traffic (FAL).

IMO consists of an Assembly, a Council, five main Committees and Secretariat.

**Figure 7. Organizational chart of IMO**



The Assembly is the highest Governing Body of the Organization. It consists of all member States and it meets once every two years in regular sessions, but may also meet in an extraordinary session if necessary. The Assembly is responsible for approving the work programme, voting the budget and determining the financial arrangements of the Organization. The Assembly also elects the Council.

The Council is elected by the Assembly for two-year terms beginning after each regular session of the Assembly. The Council is the Executive Organ and is responsible, under the Assembly, for supervising the work of the Organization. Between sessions of the Assembly the Council performs all the functions of the Assembly, except the function of making recommendations to governments on maritime safety and pollution prevention which is reserved for the Assembly.

The Maritime Safety Committee (MSC) is the highest technical body of IMO. It consists of all member States. The functions of MSC are to consider any matter concerned with aids to navigation, construction and equipment of vessels, manning from a safety standpoint, rules for prevention of collisions, handling of dangerous cargoes, maritime safety procedures and requirements, hydrographic information, log-books and navigational records, marine casualty investigations, salvage and rescue and any other matters directly affecting maritime safety.

The Marine Environmental Protection Committee (MEPC), which consists of all member States, is empowered to consider any matter regarding prevention and control of pollution from ships. In particular it is concerned with adoption and amendment of conventions and other regulations and measures to ensure their enforcement.

The MSC and MEPC are assisted in their work by a number of sub-committees which are also open to all member States.

The Legal Committee is empowered to deal with any legal matters within the scope of IMO. The Committee consists of all member States of IMO.

The Technical Cooperation Committee considers any matter relating to the implementation of technical cooperation projects for which IMO acts as the executing or cooperating agency and any other matters related to IMO's activities in the technical cooperation field.

The Facilitation Committee consists of all the members of IMO and deals with IMO's work in eliminating unnecessary formalities and "red tape" in international shipping.

## **2. International Civil Aviation Organization (ICAO)<sup>122</sup>**

The International Civil Aviation Organization (ICAO) is a specialized agency of the United Nations, established in 1944 to manage the administration and governance of the Convention on International Civil Aviation (Chicago Convention).

ICAO works with the Convention's 191 member States and with industry groups to reach consensus on international civil aviation Standards and Recommended Practices (SARPs), Procedures for Air Navigation (PANS) and policies in support of a safe, efficient, secure, economically sustainable and environmentally responsible civil aviation sector. These SARPs, PANS and policies are used by ICAO member States to ensure that their local civil aviation operations and regulations conform to global norms.

The establishment of SARPs and PANS are fundamental tenets of the Chicago Convention and a core aspect of the ICAO's mission and role. SARPs and PANS provide the fundamental basis for harmonized global aviation safety and efficiency in the air and on the ground, the worldwide standardization of functional and performance requirements of air navigation facilities and services, and the orderly development of air transport.

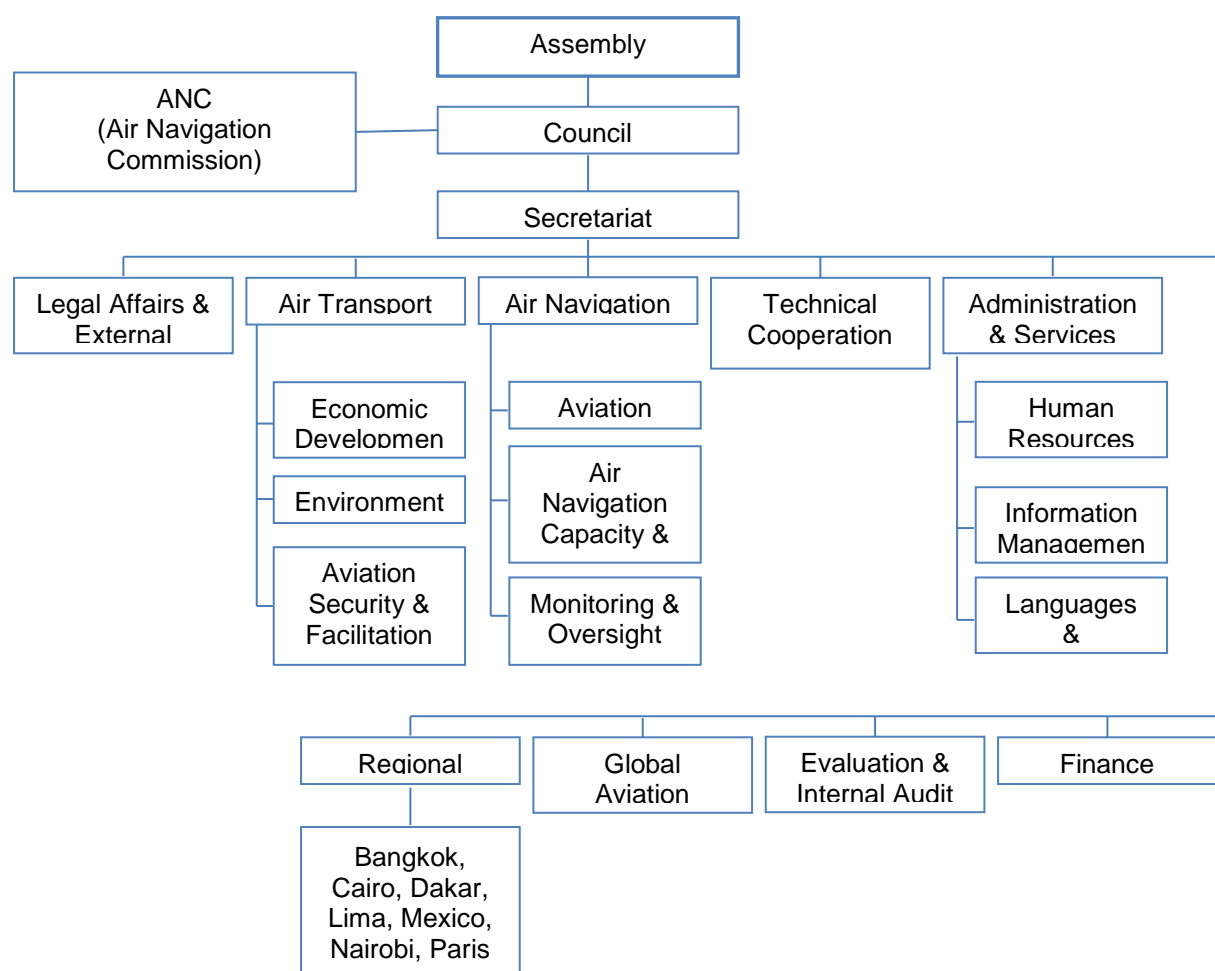
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<sup>122</sup> Available from <http://www.icao.int>

Now, ICAO manages over 12,000 SARPs across the 19 Annexes and five PANS to the Chicago Convention, many of which are constantly evolving in line with latest developments and innovations.

ICAO has the Assembly and Council as decision making bodies and the Bureaus under the Secretariat.

**Figure 8. Organizational chart of ICAO**



The Assembly, comprised of all member States of ICAO, meets not less than once in three years and is convened by the Council. An extraordinary meeting of the Assembly may be held at any time upon the call of the Council or at the request of not less than one-fifth of the total number of member States. The Assembly elects the members of the Council, examines and takes appropriate action on the reports of the Council, decides any matter reported to it by the Council, and approves the budgets of ICAO.

The Council is a permanent body of ICAO responsible to the Assembly. It is composed of 36 member States elected by the Assembly for a three-year term. It appoints the members of the Air Navigation Commission (ANC) and appoints the Secretary General. As one of the two governing bodies of ICAO, the Council gives continuing direction to the work of ICAO. In

this regard, one of its major duties is to adopt international Standards and Recommended Practices (SARPs) and incorporate these as Annexes to Chicago Convention.

The Air Navigation Commission (ANC) considers and recommends Standards and Recommended Practices (SARPs) and Procedures for Air Navigation Services (PANS) for adoption or approval by ICAO Council. The ANC is also tasked by the Council to manage the technical work programme of ICAO.

Five Bureaus under the Secretary General are operated by the Director of each Bureau: Air Navigation, Air Transport, Legal Affairs and External Relations, Technical Co-operation, Administration and Services.

ICAO has established Strategic Objectives in six areas: safety, security, environmental protection, efficiency, continuity and rule of law. Among these Objectives, the environmental protection is a key issue to the aviation industry as the concern to air pollution became a worldwide issue.

### **3. International Organizations related to railways**

While aviation and maritime transport have been supported by their respective intergovernmental organizations with the status of United Nations specialized agencies, railway transport has been supported by two different intergovernmental bodies. OSJD and OTIF have looked after the technical standards and legal and operational aspects of international rail transport based in principle on geographical location of their members.

There are also international associations established to enhance cooperation between railway companies, such as the International Union for Railways (UIC) and the International Rail Transport Committee (CIT). This Section provides an outline of the functions of those organizations.

#### ***3.1. Organization for Co-operation between Railways (OSJD)<sup>123</sup>***

The Organization for Co-operation between Railways (OSJD) is an intergovernmental organization established at the Railway Ministers Conference in Sofia, Bulgaria, on 28 June 1956 by the ministers in charge of railway transport from the Eastern European countries, China, Mongolia, USSR and Viet Nam.

OSJD now has 25 member government transport authorities, 25 member railway companies, 7 observers and 32 affiliated enterprises.

The main objective of OSJD is to provide, develop and improve the international transportation by rail between Europe and Asia. It includes development of international freight and passenger traffic, creation of common railway transport environment in the

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<sup>123</sup> Available from <http://en.osjd.org/>

Eurasian region, higher competitiveness and an increase in transcontinental railway routes as well as promotion of technological progress and technical-scientific cooperation in the field of railway transport.

The main OSJD working bodies are: Ministers Conference, Conference of General Directors, Committee, Commissions and Working Groups.

The Ministers Conference is the top governing body of OSJD. The sessions of the Ministers Conference consider and take decisions on issues concerning overall directions of the organization's activities.

The Conference of General Directors (authorized representatives) of Railways (CGD) is the top steering body at the level of railways and railway undertakings. Conference of General Directors organizes cooperation in the field of international railway traffic between Europe and Asia, including combined transportation, reciprocal exchange of information on expected international trade transportation and, based on this, develops joint competitive proposals, adopts rules for the use of wagons and coaches and containers for international services, and organizes the process of accounting between railways.

The Committee is the executive body of OSJD. It manages the OSJD activities in the period between the sessions of the Ministers Conference and Conference of General Directors.

The system of working bodies consists of commissions and permanent working groups, which focus on the main directions of the OSJD activities. There are five commissions (Commission on Transport Policy and Development Strategy; Commission on Transport Law; Commission on Freight Traffic; Commission on Passenger Traffic; and Commission on Infrastructure and Rolling Stock) and two permanent working groups (Permanent Working Group on Coding and Information Technology and Permanent Working Group on Finance and Accounting).

Besides the main OSJD working bodies, there are a number of ad hoc working groups and joint working groups for cooperation with other international organizations.

There are nine main agreements on railway operation concluded within the framework of OSJD. The main activities of OSJD are enlisted as follows:

- Development and improvement of international railway transportation with the traffic between and Asia in the first place, to include combined transportation;
- Development of consentaneous transport policy in the field of international railway traffic, elaboration of railway transport and OSJD activity strategies;
- Development of international transport law, administration of the Convention concerning International Passenger Traffic by Rail (SMPS), Convention concerning International Goods Traffic by Rail (SMGS) and other legal documents connected with the international railway traffic;
- Co-operation on the solution of the problems connected with the economic, information, scientific, technological and ecological aspects of railway transport;

- Development of measures aimed at the increase of railway transport competitiveness in comparison with other modes of transportation;
- Co-operation in the field of railway operation and technical matters connected with further development of international railway traffic; and
- Collaboration with other international organizations, engaged in railway transportation matters, including those of combined transport.

### *3.2. Intergovernmental Organization for International Carriage by Rail (OTIF)<sup>124</sup>*

The Intergovernmental Organization for International Carriage by Rail (OTIF) is an intergovernmental organization for promoting, improving and facilitating all aspects of rail transport. The organization came into being in May 1985 after the Convention concerning International Carriage by Rail (COTIF) entered into force in May 1980.

OTIF counts 50 member States and one associate member from Europe, North Africa, Middle East and South Asia.

One of the principal objectives of OTIF has been the establishment of uniform system of law on various aspects of rail transport and supporting its development and application among its members. These uniform rules are contained in appendices A to G to the COTIF.

OTIF has four main bodies to implement its goals with support of Secretary-General: General Assembly, Administrative Committee, Revision Committee and Expert Committees.

The General Assembly consists of the representatives from all the member States and meets once in three years or at the request of the Administrative Committee.

The Administrative Committee consists of representatives from one third of the member States as decided by the General Assembly. The Committee keeps a check on the administrative and financial business by the Secretary General and also approves the work programme, budget, management report and accounts of the organization.

The Revision Committee made of the representatives of the member States takes decision on the proposals to amend the provisions of the Convention and its Appendices that are subject to simplified and accelerated revision procedure. It also gives initial consideration to the proposals where final decisions are required to be made by the General Assembly.

The Secretary General, elected by the General Assembly performs the functions as the head of the Secretariat of the organization.

There are three expert Committees to consider technical issues. The RID Expert Committee is made from the representatives of the member States and takes decision on amendment to the Regulations concerning Carriage of Dangerous Goods (RID). The Committee of Technical

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<sup>124</sup> Available from <http://www.otif.org>

Experts decides on the amendment to the annexes to the Uniform Rules concerning the Validation of the Technical Standards and the Adoption of Uniform Technical Prescriptions applicable to the railway material intended to be used in the international rail traffic. The Rail Facilitation Committee deals with all issues related to cross border movement of rail traffic. It can recommend standards, methods, procedures and practices relating to rail facilitation.

Below are the main activities of OTIF.

- Further development of rail transport law in the following areas:
  - Contracts of carriage for the international carriage of passengers and goods (CIV and CIM),
  - Carriage of dangerous goods (RID),
  - Contracts of use of vehicles (CUV),
  - Contract on the use of railway infrastructure (CUI),
  - Validation of technical standards and adoption of uniform technical prescriptions for railway material (APTU),
  - Procedure for the technical admission of railway vehicles and other railway material used in international traffic (ATMF);
- Widening the scope of COTIF in order to make possible in the longer term through carriage by rail under a single legal regime from the Atlantic to the Pacific;
- Preparing for the entry into force of the Luxembourg Protocol (Registry for International Interests in railway rolling stock, Secretariat of the Supervisory Authority);
- The removal of obstacles to the crossing of frontiers in international rail transport;
- Participation in the preparation of other international conventions concerning rail transport within other international organizations

### 3.3. *International Union for Railways (UIC)*<sup>125</sup>

UIC was established on 17 October 1922 with a main purpose to harmonize and improve conditions for railway construction and operations. The idea of creating an international organization, bringing together the railway companies, was developed in the wake of the international conference of Portorosa, Italy on 23 November 1921, followed by the international conference of Geneva in 3 May 1922. The representatives favoured the “creation of a permanent rail administration focusing on international traffic for the standardization and improvement of conditions of railway construction and operations”.

UIC is structured as a three-level working organization. Common strategic orientation is dealt with at global level (*General Assembly, Executive Board*). The technical work of the various Special Regional Groups (SRG) is generated by their specific regional needs and requirements (*Regional Assembly, Management Committees*). UIC Headquarters serves both as a back-office and a shared service centre performing common administrative services and providing the necessary facilities, assistance and working infrastructure for project work.

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<sup>125</sup> Available from <http://www.uic.org/>

The General Assembly is the highest decision-making body on global issues. It comprises representatives of all members and is held at least twice a year.

The Executive Board consists of a maximum of twenty-one active members appointed by the various SRGs (from Africa, Asia, Europe, Middle East, America). It meets at least twice a year and not later than 5 weeks prior to the next General Assembly. The Executive Board is the permanent body representing the General Assembly. It prepares the General Assembly meetings and submits an annual management report to it and agrees on the core budget. The Executive Board approves strategic projects for global implementation and defines the related role of Regional Assemblies in such projects.

UIC has presently 82 members, 80 associate members and 35 affiliate members, including integrated railway companies, infrastructure managers, and railway or combined railway transport operators, rolling stock and traction leasing companies and service providers.

The main activities of UIC include:

#### *Standardization Platform*

- The UIC standardization platform was launched in December 2012 to develop standardization strategy on railway operations.
- The platform works for increasing the geographical scope and use of UIC standards, and achieving a balance between various stakeholders and standard bodies.

#### *Intercontinental combined traffic*

- Under this project completed in 2011, UIC undertook a study in collaboration with a consulting firm to establish a rail link between Asia and Europe.

#### *Organization of global rail freight conference*

- Since 2007, UIC has been organizing global conferences every alternate year. It brings together all stakeholders involved in rail transport such as policy makers, rail logistic service providers, customers, regulators and research institutions.

### **3.4. International Rail Transport Committee (CIT)<sup>126</sup>**

The International Rail Transport Committee (CIT) was formed in 1902 for simplification of formalities in international railway transport. The main objective of the CIT is to promote interoperability of international railway transport by promoting harmonization of legal frameworks and support uniform implementation of laws governing railway transport.

Currently, CIT is an association of about 200 railway undertakings and shipping companies which provide international passenger and/or freight services, including 129 members and 80 associate members.

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<sup>126</sup> Available from <http://www.cit-rail.org/en/>

CIT has five main bodies: General Assembly, Executive Committee, General Secretariat, Expert Committees and Working Groups.

The General Assembly is the supreme body of CIT. It provides the strategic direction approves budget, accounts and elects members of working bodies.

The Executive Committee directs the operations and administration and oversees the work of the Secretary General.

The General Secretariat, composed of eleven staff members, implements the decisions of the General Assembly and the Executive Committees and makes the arrangements for the meetings of the Executive Committee. And also it prepares the Annual Report, the Annual Accounts and Budget for presentation to the Executive Committee.

The Expert Committees are competent to adopt provisions on the implementation and application of International rail transport law in a standardized and practical way. To do that, the General Assembly delegates powers to the Committees.

The working Groups are responsible for preparing recommendations for decisions by Committees.

The important activities of CIT are as follows;

- Every two years, it brings together some 150 specialist in international rail transport law at a workshop where experts debate on the current legal developments and future direction of railway transport law.
- CIT supports the freight business by supporting its members in implementation of the legislation applicable and in particular the CIM Uniform Rules. It also aims to simplify and standardize the working relationships between transport undertakings and between them and their customers. In this regard it produces various reference documents such as agreements, basic contractual documents, manuals and forms.
- CIT helps implement international rail transport law by:
  - Drawing up and maintaining legal publications and boiler plate documents for international traffic by rail;
  - Standardizing the contractual relationships between customers, carriers and infrastructure managers;
  - Representing the interests of carriers by rail vis-à-vis legislators and authorities;
  - Providing regular briefings on legal issues; and
  - Organizing training courses and giving legal advice as requested.

# 5

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## **ANALYSIS OF INSTITUTIONAL GAP, POSSIBLE FUNCTIONS AND POSSIBLE OPTIONS FOR CLOSING THE INSTITUTIONAL GAP IN THE ROAD SECTOR**

### **1. Closing Institutional Gap**

In the maritime and civil aviation sectors, IMO and ICAO play the key roles in the development of the two modes of transport. They regulate and formalize international maritime and air transport respectively and their conventions and standards also have significant impact on domestic transport. Their conventions and standards are widely accepted by countries. It can be considered that if there are no the two organizations, there is no today's developed maritime and air transport.

IMO has formulated more than 50 conventions and numerous amendments to keep the conventions up to date. The famous International Convention for the Safety of Life at Sea 1974 (SOLAS), the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) and International Convention for the Prevention of Pollution from Ships 1973 (MARPOL) are participated by 165, 164 and 157 countries respectively.

ICAO manages over 12,000 Standards and Recommended Practices (SARPs) across the 19 Annexes to the Chicago Convention and five Procedures for Air Navigation (PANS) which are used by its 191 member countries. The global accident rate involving scheduled commercial operations achieved 2.8 accidents per million departures and 474 fatalities in 2015 in contrast with the shocking 1.25 million fatalities on roads in the same year.

In comparison with the remarkable work of IMO and ICAO, the reviews of the challenges in Chapter 2 and the existing organizations in Chapter 3 show weak intergovernmental support at international level for the road sector and resulted deficiency of standards/norms, regulatory frameworks, guidelines, associated technical assistance and capacity building. In particular, there is a stringent need for such an organization to provide comprehensive and integrated support for inter-related road safety, greenhouse gas emissions, internalization, ITS,

dangerous goods and security. Such gaps have caused the difficulties and challenges in the road sector.

The road sector has developed to a stage facing common challenges globally under the sustainable development agenda, such as energy consumption, emissions, road safety and international terrorist attacks. Meanwhile, road transport is becoming more internationalized with more regions to open the land borders and domestic roads for international transport and international intermodal transport. Rapid growth of international tourists also needs harmonized standards/norms and traffic rules on roads. Closing the institutional gap is an immediate need for the world under the sustainable development agenda.

The goal of the establishment of IRO should be to fill the gap of the existing institutions to complement rather than duplicate or overlap their work. IRO will cooperate with other organizations. Following the path of IMO and ICAO, IRO can provide intergovernmental support, set standards and norms, recommend regulatory frameworks, provide guidelines and associated technical assistance and capacity building in the fields of technical aspects of green transport, safety, international transport, dangerous goods, ITS and security of the road sector. It will become a new intergovernmental arm at global level to support the existing organizations and service the governments and the industry to help the road sector contribute significantly to sustainable development.

Following the practices of IMO and ICAO, IRO should not work for planning of international road network, formulation of agreements on traffic rights, coordination of transport quota, manufacturing of vehicles and customs conventions.

Based on the above principles, possible functions of IRO are suggested in Section 2 below. Clearly its functions are not duplicated or overlapped with the functions of ITF, ECA, ECLAC, ECE, ESCAP, ESCWA, the World Bank, and the ECOSOC Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals. Its functions will complement the work of global non-governmental organizations in the road sector, such as PIARC, IRU and IRF.

WHO has worked well in producing global status report on road safety and making the public campaign. Such work is not included in the IRO's possible functions. The WHO's report will provide general guidance to IRO in the field of road safety. IRO's technical work will help transform the recommendations of the WHO's report into technical and regulatory measures.

The basis of applications of the conventions/agreements developed under the auspices of ECE is traffic rights, visa for drivers, regulation of operators and vehicle insurance, which was set by ECMT and the European Commission. Such basis does not exist in most part of other regions. Other regions need an effective specialized organization to help build such basis.

Detailed analysis of the 58 conventions/agreements sponsored and administered by ECE found the following five instruments are relevant to the IRO functions:

- Convention on Road Traffic 1968
- Convention on Road Signs and Signals 1968
- Agreement on Minimum Requirements for the Issue and Validity of Driving Permits (APC) 1975
- Agreement concerning the Adoption of Uniform Conditions for Periodical Technical Inspections of Wheeled Vehicles and the Reciprocal Recognition of Such Inspections 1997
- Convention on the Contract for the International Carriage of Goods by Road 1956

**Table 4.** Summary of five conventions/agreements of relevance to the functions of IRO

Title	Total Parties	% of total UN members	ECE Member Parties	Non-ECE Member Parties	Remarks
Convention on Road Traffic, 1968	73	38%	45	28	Between 20 and 30 non-ECE Parties Between 60 and 80 Parties in total
Convention on Road Signs and Signals 1968	64	33%	42	22	Between 20 and 30 non-ECE Parties Between 60 and 80 Parties in total
Agreement on Minimum Requirements for the Issue and Validity of Driving Permits (APC) 1975	7	4%	6	1	Conditions for becoming a Party: ECE member States and States with consultative status, or participation in ECE's activities 1 non-ECE Party Below 15 Parties in total
Agreement concerning the Adoption of Uniform Conditions for Periodical Technical Inspections of Wheeled Vehicles and the Reciprocal Recognition of Such Inspections, 1997	13	7%	13	0	Conditions for becoming a Party: ECE member States, States with consultative status or participation in ECE's activities No non-ECE Party Below 15 Parties in total
General Agreement on Economic Regulations for International Road Transport, 1954	4	2%	4	0	No non-ECE Party Below 15 Parties in total

Source: Summary from Annex I.

As summarized in Table 4, among the five instruments relevant to the functions of IRO, the study found:

- Two instruments have between 20 and 30 non-ECE Parties and one instrument has 1 non-ECE Parties. The rest two instruments have no non-ECE Party.
- Two instruments have between 60 and 80 Parties in total and the other three instruments have less than 15 Parties in total.

- Two instruments require membership of ECE, consultative status with ECE or participation in ECE's activities to accede.
- Less than 10 per cent of 193 member States of the United Nations are Parties to three agreements which was signed in 1954, 1975 and 1997 respectively, and less than 40 per cent are Parties to two conventions signed in 1968.

In view of the above, the three agreements with 2-7 per cent of global participation have high value for IRO to review, revise them and organize negotiation of global legal instruments for the facilitation of international transport and improvement of road safety. The two conventions with 30-40 per cent of global participation can be promoted by IRO for improving road safety and facilitation of international road transport.

As IRO has a long list of work and the road sector is huge for various organizations to contribute in different fields and ways, IRO may focus on development of other instruments, standards and guidelines, which are not covered by the existing instruments but can complement these instruments. ICAO has developed and maintained over 12,000 Standards and Recommended Practices (SARPs) and Procedures for Air Navigation (PANS), and IMO has formulated and administered more than 50 maritime conventions and countless amendments/protocols. According to its potential functions, IRO may need to develop at least 300 conventions, agreements, standards, recommended rules and recommended practices. The above four conventions/agreement can be a small portion of the IRO's work.

All the above mentioned organizations will be partners of IRO. Details of the IRO's relationship with other organizations are described in Chapter 8.

## 2. Possible Functions of IRO

IRO serves as a global intergovernmental platform of States for roads and road traffic. Its main roles are to adopt coordinated strategies, set common standards and definitions, recommend best practices and good procedures, provide associated technical assistance and build members' capacity for safe, efficient and environmentally friendly development of road transport. Through IRO, the road sector can be formalized in a concordant manner.

In general, IRO role in the above mentioned areas would include:

- **Green transport:** recommending policy and regulatory frameworks, harmonizing technical and operational standards, promoting technological and operational innovations and sharing good practices;
- **Road safety:** setting technical standards, recommending laws and rules, raising awareness and sharing good practices;
- **International transport:** harmonizing technical and operational standards, simplifying and harmonizing documentation and formalities, and sharing good practices;

- **ITS:** setting technical standards, recommending policy and regulatory frameworks, advocating deployment and sharing good practices;
- **Dangerous goods:** standardizing classification and packing and labelling, setting technical and operational standards on carriage, recommending regulations, harmonizing certification of professional competency of operators and drivers and sharing good practices; and
- **Security:** recommending measures, regulatory frameworks, infrastructure facilities, preparedness and response, standardizing prevention and enforcement measures.

Examples of more detailed IRO's functions are provided as follows:

#### **a. Green Transport**

- Providing carbon emission calculator and fuel saving estimation tool
- Harmonizing technical standards of inspection methodology on carbon emission
- Providing guidelines on technical inspection on emission
- Recommending classification system on vehicle environmental performance
- Recommending regulatory frameworks for vehicle environmental performance
- Recommending technical norms and methodology on permissible vehicle weight and dimensions
- Recommending green practices in road planning, design, construction and maintenance
- Providing technical training standards for professional competency on energy efficiency, emission control and fleet management
- Recommending the use of new technology and new energy to reduce emission of road transport
- Providing guidelines on management of overweight and oversized vehicles
- Recommending good practices in disposal of garbage in transport process
- Recommending guidelines for environmental issues of road projects
- Recommending standards on vehicle recycling
- Recommending corporation programme for energy saving and emission reduction
- Elaborating training standards and advocating Eco-driving
- Preparing report of green road transport

#### **b. Road Safety**

##### General

- Advocating road safety
- Promoting safe practices and safety standards
- Developing and formalizing road safety audit system
- Harmonizing requirements for reporting road safety incidents
- Analyzing causes of road safety incidents and propose preventive measures
- Preparing road safety reports

##### Infrastructure

- Recommending design and maintenance standards on road infrastructure, e.g., curve radius, right of way, lane, slope, parking area, rest area, intersection, railway crossing
- Setting standards on road signs, signals and markings
- Setting standards on road safety facilities, e.g., lighting, communication system (emergency call service), lane separation, barriers, special markings
- Providing guidance on safety for workers in road construction and maintenance
- Harmonizing reporting and proposing methodology of assessing and determining black spot and technical measures
- Making technical recommendations on other requirements of road safety for infrastructure

### Operation

- Harmonizing traffic rules and regulations
- Recommending conditions for issuance of driving license
- Recommending institutional setting for issuance of driving license
- Recommending core training requirements for drivers and license issuance officer
- Recommending conditions for issuance of vehicle registration
- Recommending institutional setting for vehicle registration
- Setting standard of technical inspection of vehicle
- Recommending institutional setting for technical inspection
- Recommending core training requirements for inspectors
- Recommending guidelines on emergency response to traffic crashes
- Providing guidelines on corporation safety programme for road transport operators
- Harmonizing certificate for truck, carrier of dangerous good and oversize vehicle
- Providing guidance on delivery system of training programmes
- Making technical recommendations on traffic management
- Harmonizing enforcement

### **c. International Transport**

- Promoting mutual recognition of driving license and vehicle documents
- Harmonizing categories of driving license and conditions for issuance
- Harmonizing road vehicle registration and inspection certificates
- Finding solution to cross-border difficulty with locally unreadable plates
- Finding solution to free cross-border movement of trailer to facilitate cross-border and international intermodal transport
- Simplifying and harmonizing cross-border documentation and formalities
- Harmonizing documentation in use in road transport in passenger and goods operations
- Setting standards for electronic interchange of information
- Recommending solution to facilitated visa granting to professional driver and crew
- Recommending minimum coverage of compulsory insurance for cross-border vehicles
- Recommending institutional arrangements for cross-border insurance plan

- Setting standards on international intermodal transport vehicles
- Harmonizing regulatory requirements for international intermodal transport by road vehicles
- Harmonization regulatory requirements for cross-border carriage of dangerous goods
- Recommending guidelines on bus security
- Harmonizing requirements of professional competency for international road transport drivers and operators
- Harmonizing requirements of professional competency of drivers and operators for international carriage of dangerous goods

#### **d. ITS**

- Recommending policy and strategy on deployment of ITS
- Setting technical standards on functioning and operation of ITS
- Providing guidance in framing regulations and requirements
- Harmonizing the measures to deliver information to drivers
- Analyzing and reporting the needs for adjusting infrastructure, facilities and regulations with deployment of ITS
- Suggesting the method to estimate the benefits from implementing ITS
- Advocating deployment of ITS technologies
- Preparing report of deployment of ITS

#### **e. Dangerous Goods**

- Coordination with the ECOSOC Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals
- Standardizing classification, packing and labelling
- Setting technical and operational standards on carriage
- Recommending regulations on control, carriage and storage of dangerous goods related to road transport
- Harmonizing certification of professional competency of operators and drivers in handling dangerous goods
- Recommending guidelines for preparedness and response to crashes
- Investigating incidents of dangerous goods and identifying causes and preventive measures
- Preparing report of carriage of dangerous goods by road

#### **f. Security**

- Recommending infrastructure facilities for security
- Recommending vehicle security devices
- Developing security regulatory frameworks
- Suggesting security enforcement measures
- Harmonizing technical standards for security

- Recommending guidelines for road security measures, and preparedness and response to security incidents

### 3. Analysis of Possible Options

This section provides analysis of possible options to fill the institutional gaps in the road sector.

- Option 1 : Establish an international road organization (IRO)
- Option 2 : Enhance the five United Nations regional commissions
- Option 3 : Empower one of the five United Nations regional commissions
- Option 4 : Develop from a regional organization to a global organization
- Option 5: Establish multiple specialized agencies for road safety and green road transport
- Option 6: Set up a global inland transport committee

#### *3.1. Option 1: Establish an international road organization (IRO)*

This option is to establish a new international organization as an intergovernmental platform to promote green road transport, advocate for road safety, support international transport, recommend policy and strategy on the deployment of ITS, and deal with the transportation of dangerous goods and security.

Both the maritime shipping and aviation industries are regulated by the United Nations specialized agencies respectively, such as IMO and ICAO. The two organizations establish policies, standards, regulations and guidelines to make their industries safer, more efficient, more environmentally inclusive, more professionalized and more internationalized.

IRO can be established as a global intergovernmental organization which could be brought later into closer association with the United Nations system as a United Nations specialized agency.

IRO may start from a small scale to gradually grow up as reviewed and decided by its member States in every three or five years.

#### ***Advantages***

IRO can act as a platform, where governments would interact and cooperate, to provide comprehensive and integrated intergovernmental support to countries to address the overwhelming challenges in controlling greenhouse gas emissions, reducing road congestion, consuming less energy, smoothing international road transport, improving road safety, and making road sector safely smart and secure.

IRO could contribute to making this most diverse mode of transport more professionalized, regulated and internationalized, enabling it to contribute to the 2030 sustainable development agenda in poverty alleviation, energy efficiency, climate change, urban traffic congestion, innovative technologies, road safety, food security and access to health care.

An international organization with a clear mandate encompassing all issues within road transport will be able to account for all aspects of road related issues and represent the global community without a regional bias.

All other modes of transport benefit from having strong, intergovernmental organizations representing and defending their interests globally. Such organization is missing for the road sector. This missing causes threatening challenges in the road sector. With help of IRO, the road sector can be further developed in equivalent to other modes of transport.

### ***Disadvantages***

Efforts and financial contributions are needed to establish the new organization and make it function. However, technical and financial analysis shows that it is highly rewarding for member States in comparison with its huge impact as predicted in the present study report (see Chapter 7).

## ***3.2. Option 2: Enhance the five United Nations regional commissions***

There are five United Nations regional commissions, ECA, ECE, ECLAC, ESCAP and ESCWA. Among the five regional commissions, only ECE and ESCAP have Divisions dedicated to transport. Other three regional commissions include transport in Divisions with broader responsibilities. Option 2 will enhance the regional commissions to perform the functions of IRO.

### ***Advantages***

Less efforts will be required than the establishment of a new organization. It appears less costly than setting up a new organization.

### ***Disadvantages***

Enhancing the regional commissions also has budgetary implications to member States. Most regional commissions have very limited staff or no staff to work for the road sector. Under the current budgetary situation, it is impossible for the regional commissions to add several positions for the road sector. Even if number of staff can be increased, the overall budgetary increase will be most probably more than the establishment of a specialized agency. The financial resources available in nearly all the regional commissions cannot afford the costs for the formulation and implementation of the standards and regulations.

The circumstances of the five regions are quite different and member States of the regional commissions are also different. Standards and recommendations resulted from intergovernmental negotiations will be definitely varied, which will make the road sector more fragmented across the regions. Inter-commission's coordination will become extremely complicated and difficult to avoid duplication and overlapping due to large range of inter-related specific areas to be covered as listed in the possible functions of IRO.

### ***3.3. Option 3: Empower one of the five United Nations regional commissions***

The third option is to empower one of the regional commissions to act as a body to make global standards and recommendations.

#### ***Advantages***

Less efforts will be required than the establishment of a new organization. It appears less costly than setting up a new organization at the beginning if no complementary hosting facilities are provided.

#### ***Disadvantages***

Each regional commission is mandated to serve the member States in its geographical area. If one of them is empowered to act as a global body, this regional commission will face two scenarios: 1. totally working for global road issues; 2. dual roles as a global road agency and a regional commission.

#### **Scenario 1. Totally working for global road issues**

The review of the existing challenges in the road sector in Chapter 2 demonstrate a need for a dedicated global organization for the road sector. If one regional commission (transport part) works totally for global road issues, it means that it is converted to a global road organization. It will then lose its role to support its regional member States and leave its mandated region unattended by the United Nations. It will also lose its broader role in supporting the implementation of global agenda at regional level, such as sustainable development.

Each region faces its challenges in the road sector which should not be addressed through IRO as a global norm setting organization, such as aged road infrastructure and integration of the road sector in the economies in transition with others in the ECE region and development of road networks to support regional integration and strengthening of the role of road in poverty alleviation in other regions. A further specific example is ESCAP's support to a regional Asian Highway infrastructure network and the negotiations of traffic rights as well as poverty alleviation in rural areas through the Asian Highway network.

If this regional commission loses its regional functions, it may trigger a debate whether this regional commission (transport part) should use the regular budget allocated by the United Nations Headquarters for regional development. Logistically it should be financed either with a separate budget or with additional funding from member States. The former means to establish a new independent programme budget cut from the existing allocation to this regional commission but the United Nations needs to answer why this road organization cannot follow other intergovernmental bodies for air, maritime and railway being collectively funded by members and this modest budget allocation may support only a few staff and limit its future development. The latter will be the same as Option 1.

## **Scenario 2. Dual roles as a global road agency and a regional commission**

If one regional commission takes double roles as a global road agency and a regional commission for road, its role to neutrally reflect the diversified needs from all the regions will be easily questioned.

The circumstances of different regions are varied. It is difficult for the empowered regional commission to consider certain aspects of road related issues that could be more prevalent in the other regions. Standards and recommendations formulated under the auspices of the empowered regional commission may not incorporate the conditions, needs and positions of other regions. Therefore, member States of other regions may not feel properly represented. Such standards and recommendations are not recognized by member States of other commissions as truly global and cannot be easily applied in other regions.

Total capacity of any of the regional commissions for transport is far less than the need for addressing the challenges in the road sector. IMO and ICAO have around 300 international staff and nearly 700 staff respectively. Total number of staff of IRO will be 300-500 eventually according to its functions. Average size of transport part in the regional commissions is about 20 staff members, who are working for road, railway, water and intermodal transport and logistics. Filling the gap of human resources between the need for addressing the challenges in the road sector and the existing capacity of any regional commission is equivalent to establishment of IRO.

### ***3.4. Option 4: Develop from a regional organization to a global organization***

An organization starts at a regional level and later develops into a global organization.

#### ***Advantages***

Option 4 is low cost and easy to start. It is also easier to operate an organization consisting of fewer member States at a regional level. The organization can take advantage of a smaller structure and make decisions faster.

### ***Disadvantages***

Financially the cost of this regional organization will be high for the hosting region. It can be misunderstood that one region pays for services to other regions.

Technically it can be difficult for a regional organization to produce global standards and receive appropriate global recognition. Such a regional organization will face difficulties to attract participation of other regions' countries in its activities and thus be not able to incorporate the conditions and needs of other regions into standards and recommendations. As a result, the standards and recommendations cannot be applied to other regions.

If the regional organization produces regional standards and recommendations without adequate incorporation of other regions' situation and concerns, it will cause future difficulties in global harmonization or create a more complicated situation with many standards on the similar subjects from different regions.

The resources of a small organization are limited and it will take a longer time to make any good products. Without short-term visible outcomes, an organization cannot last long enough to become a global one.

### ***3.5. Option 5: Establish multiple specialized agencies for road safety and green road transport***

Rather than setting up one comprehensive organization, this option establishes several specialized agencies in important road related subsectors such as road safety, green transport and international road transport.

### ***Advantages***

Efforts to establish and costs to operate the organizations are dispersed to member states.

### ***Disadvantages***

A smaller organization must go through similar procedures to set up a new international organization. Several times of efforts will be required although the efforts are dispersed to different member States.

Each of the organizations need administrative support, such as human resources management, finance, visa support for staff and meeting participants, procurement, conference services and security. Total costs of all the organizations are more than one organization.

The subsectors are inter-related. For example, road safety is not only related to policy, traffic rules and regulations, infrastructure quality and facilities, but also to international transport, carriage of dangerous goods and ITS. The roles and functions of the new organizations will overlap with each other. Huge coordination work will be required but cannot ensure full consistency and mutual complementariness.

### *3.6. Option 6: Set up a global inland transport forum*

A global forum is set up for development of inland transport, including railway, road and inland waterway.

#### *Advantages*

It is advantageous for intermodal coordination and cooperation.

#### *Disadvantages*

It cannot be specialized for any mode of transport, in particular for the road sector which has grown up to the largest one in the transport sector.

This option seems overlapped with or covered by the functions of the International Transport Forum.

It is also partly overlapped with and covered by the responsibilities of OSJD, OTIF and CIT.

If such forum is functions fully in a comparable scale as IMO, ICAO, IRO, OSJD and OTIF, it will need much more financial and human resource than the establishment of IRO plus continued operation of the existing organizations. Otherwise, the forum will only become a place for policy debate.

### *3.7. Summary of Analysis*

Among the six obvious possible options, the establishment of IRO, Option 1, is the best solution to filling the organizational gap in the transport sector and institutional gap in the road sector because of its scope, efficiency, effectiveness and simplicity. IRO can fully address the challenges facing the road sector for sustainable development in a comprehensive and integrated manner.

The Options 2 and 3 are impossible in terms of the required enlargement of the United Nations regional commission(s) to play all or most functions needed by the road sector to meet the challenges.

The Option 4 may not sustain due to its geographical limitation and may result in inappropriate standards or different regional standards on the same subjects.

The Option 5 will lead to higher costs and more efforts but create inconsistent standards and recommendations because of inter-relationship of the subsectors, such road safety, carriage of dangerous goods, ITS and international transport.

The Option 6 is overlapped and duplicated with the existing global transport forum, ITF, and partially overlapped and duplicated with the existing railway organizations, OSJD, OTIF, UIC and CIT. It is not a specialized organization for the road sector.

# 6

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## **POSSIBLE STATUS, ORGANIZATIONAL STRUCTURE, STAFFING, COST ESTIMATE, FUNDING AND FINANCIAL ARRANGEMENTS**

### **1. Possible Status of IRO**

IRO can be established as an intergovernmental organization without relationship with the United Nations or as a specialized agency of the United Nations.

The two international organizations for maritime and air transport, namely IMO and ICAO, are specialized agencies of the United Nations. As the specialized agencies, IMO and ICAO formulate and monitor global technical standards for the two sectors respectively.

The functions of IRO needed to meet the challenges in the road sector require a status of IRO as a specialized agency of the United Nations.

Following normal practices, IRO can be established as an intergovernmental organization first. After some years of successful operation, IRO can apply for the status of a specialized agency. Such status can be established through a resolution of the United Nations General Assembly.

### **2. Organizational Structure and Staffing**

#### *General Assembly*

The General Assembly, comprised of all member States of IRO, is the highest decision making body of the organization. The General Assembly is responsible for deciding the organization's policy, approving the work programme and budget, determining the financial arrangements, and adopting the legal instruments, standards and recommended regulations. Especially the General Assembly has the power to approve the resolutions proposed by the Committees under the General Assembly.

## *Council*

The Council is elected by the General Assembly and is the executive organ of IRO. The Council is responsible, under the General Assembly, for supervising the work of the Organization. Between the sessions of the General Assembly the Council performs all the functions of the General Assembly with the authorized scope.

## *Committees*

IRO may start from less number of technical committees with focus on the three key theme areas at the beginning, i.e., Green Transport Committee (including ITS), Safety, Security and Dangerous Goods Committee, and International Transport Committee. The technical committees may be adjusted after some years of operation.

The technical committees consider and deliberate the draft norms, standards, legal instruments and recommended regulations, and proposed amendments to them. After adoption with adequate consideration and deliberation following the rules of meeting set by the General Assembly, the committees recommend the draft norms, standards, legal instruments and recommended regulations to the Council or General Assembly for approval.

The technical committees also recommend policy direction in their respective areas to the General Assembly for consideration and decisions.

The technical committees should also consider and elaborate the programmes, work plans and budgets in their respective areas, and then submit to the General Assembly for approval.

The technical committees can be participated by the member States with interest. Their chairs can be elected.

## *Secretariat*

The Secretary General is responsible for the management of IRO. The Secretary General may be appointed by the Council with approval of the General Assembly.

In view of the potential functions of IRO and staffing level of IMO and ICAO, the secretariat of IRO may be developed to an organization with 500 staff in the future.

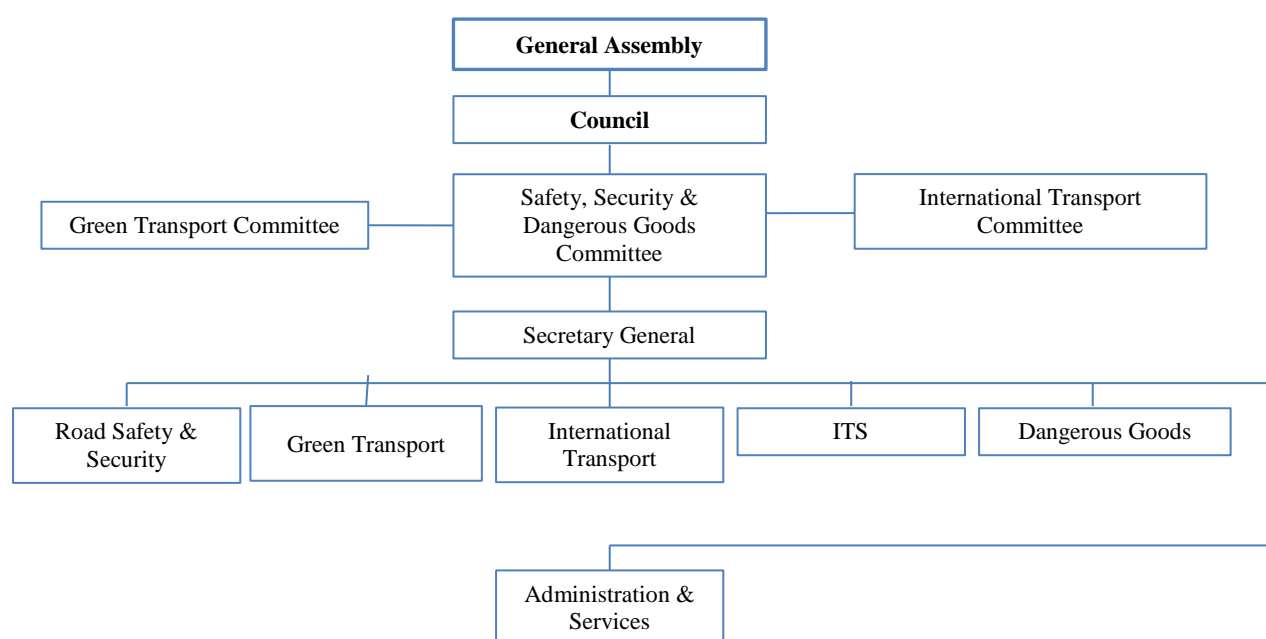
As the organization needs to gradually develop its work, it may start with a small secretariat. After about five years, the General Assembly may review the need and decide the staffing level of the secretariat in the next five years.

In order to ensure its well functioning and sustainable development, the secretariat may need five substantive divisions and one division of management and services under the Secretary General, namely, Green Transport Division, Road Safety and Security Division, International Transport Division, Dangerous Goods Division, ITS Division and Administrative Division. Each division deals with the functions described at the Functions of IRO in Chapter 5.2.

The divisions of road safety & security, dangerous goods and ITS support the activities of the Safety, Security and Dangerous Goods Committee; the division of green transport supports the Green Transport Committee; and the International Transport Committee is supported by the international transport division.

Figure 9 provides an overall organizational chart and staffing of IRO.

**Figure 9. Organizational chart and staffing of IRO**



### 3. Cost Estimate

The following table 5 provides estimates for staff and administrative costs, exclusive of the provision of physical infrastructure and servicing based on the salary scale for the professional and higher categories and average salary scale of general service (GS) staff of the United Nations system (in US dollars effective 1 January 2016).

**Table 5. Proposed Staffing and provisional cost estimate for one year**

<b>Staff Cost</b>	<b>\$2,174,404</b>
Budgetary provision is made for a total of 30 posts(19-Professional level, 11-GS level)	
* Based on salary scale for Professional and higher categories, in US dollars - effective 1 January 2016	
* General local level assumed for \$20,000/year	
<b>Non-Staff Cost</b>	<b>\$326,161</b>
Administrative & technical expenditure (15% to staff cost)	\$326,161
<b>Total</b>	<b>\$2,500,565</b>

Source: ESCAP

## 4. Funding and Financial Arrangements - Member States' Contributions

The experiences from the United Nations, IMO and ICAO can be the most useful reference for IRO to decide its member States' contributions for the operation and functioning of the organization. The methodologies used by the three organizations to calculate member States' contributions or assessment are preliminarily reviewed in this section and accordingly possible methodology for IRO is generally discussed.

### 4.1. United Nations methodology

The United Nations scales its member contributions based on member States Gross National Income (GNI). National income figures are retrieved from member States responses to the United Nations Statistics Division's annual national accounts questionnaire.

The minimum assessment for all countries is 0.001 per cent of the United Nations' annual budget. The maximum for all countries is 22 per cent of the United Nations' budget.

The Debt Burden Adjustment method was introduced in 1986 to relieve financial pressure on heavily indebted countries. For each statistical base-period, certain percentage of the member States annual total debt is deducted from its average GNI.

In order to help relieve the burden of least developed countries, these countries pay a smaller proportion than other member States. If a member State's per capita debt-adjusted income for the base-period is lower than the average per capita GNI for all member States, they qualify for this adjustment.

### 4.2. IMO methodology

Every member of IMO has to pay a "minimum assessment" for their membership. The "minimum assessment" is calculated by dividing 2.94 per cent of IMO's total budget among members, which comes up to be roughly 0.02 per cent per member.

The remaining 97.06 per cent of the IMO's total budget is paid by members in varying amount through the "basic assessment" (see Table 6).

For the "basic assessment", each member contributes a different amount according to their category (from 1-10). Category 1 members have the lowest United Nations contribution and Category 10 members have the highest United Nations contribution.

Based on each country's category, they will pay accordingly to their number of basic units. The value of a basic unit is determined by "dividing 12.5 per cent of the total budget assessment less the total minimum assessment for the relevant financial year, by the total number of basic units for all members."

An additional assessment determined by gross register tonnage as shown in the latest edition of Lloyd's Register of Shipping, less 50,000 tonnes on the basis of one share for each 1,000 tonnes.

**Table 6. Basic Assessment Rates**

Category	UN contribution (percentage)	Number of basic units
1	0.01 – 0.05*	0
2	0.01 – 0.05	1
3	0.06 – 0.25	10
4	0.26 – 1.00	25
5	1.01 – 1.50	48
6	1.51 – 2.00	87
7	2.01 – 4.00	140
8	4.01 – 7.00	201
9	7.01 – 10.00	275
10	More than 10.00	625
Associate Members	–	0

\* and having less than 50,000 grt.

Source: IMO Resolution A.726(17), 7 November 1991

### 4.3. ICAO methodology

ICAO's assessment of members' contributions is based on two factors: the member's ability to pay (75 per cent weightage) and their level of perceived interest in civil aviation (25 per cent weightage). Their interest in civil aviation is measured by taking the amount of aviation activity in tonne-kilometers and weighting it by 75 per cent for their international activity and 25 per cent for their domestic activity. The methodology has been summarized in Table 7.

**Table 7. Apportionment of Expenses**

The apportionment of expenses of ICAO among Contracting States can be broadly summarized as follows:			
Percentage limits	Maximum	25%	
	Minimum	.06%	
Computation of scale	Assessment = Level	75% capacity to pay (data from UN NY) + 25% interest and importance in civil aviation (in tonne kilometres) =	75% international services + 25% domestic services
Limits on increase	10% of previous year's contribution or .07% of total contribution (whichever is higher)		

Source: ICAO, Assembly 32<sup>nd</sup> session, Working Paper 36, AD/5 (23 June 1998)

A contracting State's contribution will fall between the limits of a maximum of 25 per cent and a minimum of 0.06 per cent of the ICAO's yearly expenses.

#### *4.4. Methodology for IRO*

Based on the practices of the United Nations, IMO and ICAO, IRO may also consider the principle of the member's ability to pay and their level of perceived interest in the road sector. The level of perceived interest in the road sector may consider the total number of registered vehicles and total length of road network in a member State or only total number of registered vehicles.

The methodology on assessment for IRO needs extensive consultation among member States. A particular study on this issue should be taken to provide technical support for consultation by member States.

According to the experience of IMO and ICAO, wide participation of IRO and current situation of roads, member States of IRO probably contribute USD 500 - 250,000 per year for each member if its annual budget is USD 2.5 million in the initial five years.

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## COST-BENEFIT ANALYSIS OF IRO TO COUNTRIES

### 1. Methodology

The following methodology is adopted in modeling the cost-benefit analysis of IRO:

- Shortlist the sets of significant costs and benefits;
- Commensurate the costs and benefits into common monetary terms in order to aggregate the values;
- Dynamic modelling on a 10-year time horizon (account for the time value of money using an appropriate discount rate);
- Combine the cost and benefit graphs to determine the rate of return on investment;
- Consider different future scenarios of costs/benefits.

### 2. Accounting of Costs

In accordance with Chapter 6.3, it is assumed that the fixed cost to be omitted since the physical infrastructure will be provided for by hosting country. Instead, the analysis focuses on the two variable costs: staffing, administrative & technical. They can be accounted for based on standard United Nations salary scale and planning norms.

At the onset, the aggregate cost is USD 2.50 million. Thereafter, IRO would experience organizational growth as it expands on the scope and depth of its programmes. To account for the increase in cost over time, two possible trends are considered over a 20-year horizon:

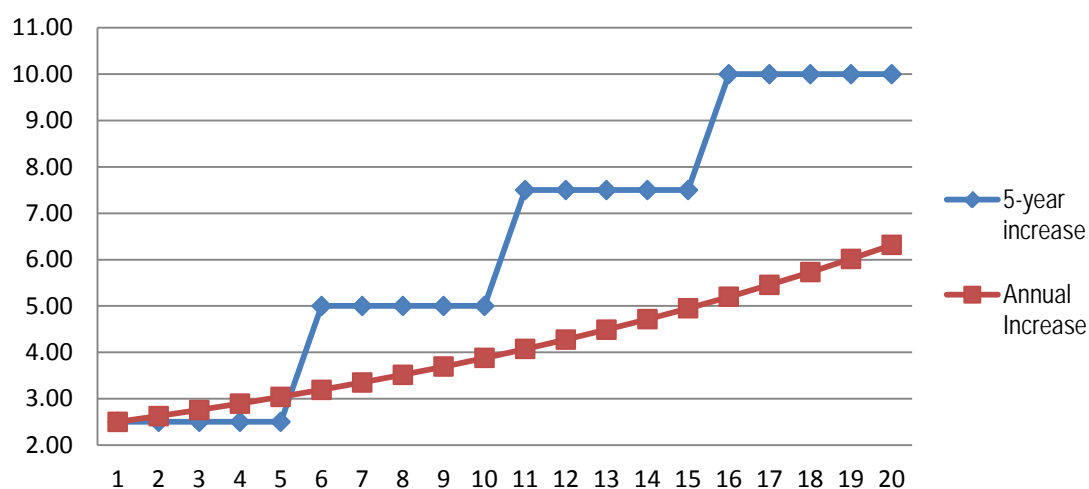
1. The hiring of 30 additional staff is expected every five years. The cost is depicted below as the blue line. This trend will continue until IRO achieves a full capacity of 450 staff.
2. An annual 5 per cent compounded increase is expected in cost due to the incremental enlargement of staff size. The cost is depicted below as the red line.

**Table 8.** Operation cost for IRO

Costs	Breakdown	Monetary value
Staffing	19-Professional level: Based on salary scale for Professional and higher categories	\$2,174,404
	11-G staffs: Assumed to be \$20,000/year	
Administrative & Technical	Assumed to be 15% of staff cost	\$326,161
Aggregate Cost:		\$2,500,565

Source: ESCAP

As can be observed in the graph, the first trend predicts higher costs for the initial 20 years and will have 150 staff. The second trend predicts lower costs in the first 20 years and may support 100 staff, but it increases exponentially over time.

**Figure 10.** Trend of estimated cost of IRO (Million, USD)

Source: ESCAP

### 3. Accounting of Benefits

In accordance to Chapter 5.2 IRO would deliver benefits in line with its role of “promote green road transport, road safety and security, support international transport, recommend policy and strategy on the deployment of ITS, and deal with the transportation of dangerous goods”, while helping to “coordinate solutions to the issues of the road sector and facilitate communication between decision makers”.

The benefits of IRO are grouped into three broad categories: reduced road injuries and deaths, reduced climate change, and reduced health impediments.

The overall figures are summarized in Table 9 below but the individual breakdown of each category is elaborated in sections 4, 5 and 6.

**Table 9. Summary of Potential Benefits**

Benefits	Annual value	Monetary value
Reduced road injuries & deaths	Save 3,678,000 lives and 22,646,131 DALYs (Disability-Adjusted Life Years) over 20 years <sup>127</sup>	\$5.715 trillion over 20 years, which is <b>\$285.75 billion/year</b> . <sup>128</sup>
Reduced climate change from carbon emission <sup>129</sup>	Conservative: Reduce 0.2 GtCO <sub>2</sub> (Gigatons CO <sub>2</sub> )/year  Optimistic: Reduce 1.1 GtCO <sub>2</sub> /year	Conservative: Save \$2.6 billion/year.  Optimistic: Save \$12.97 billion/year.
Reduced health impediments from air pollution <sup>130</sup>	Conservative (10% Reduction): Save 18,380 lives and 412,682 DALYs over 20 years <sup>131</sup>  Optimistic (20% Reduction): Save 36,759 lives and 825,364 DALYs over 20 years	Conservative (10% Reduction): Save \$1.567 billion/year  Optimistic (20% Reduction): Save \$3.135 billion/year
Aggregate Benefit:		\$289.92 – \$301.86 billion

Source: ESCAP

## 4. Road Injuries and Deaths

According to the World Bank and Institute for Health Metrics and Evaluation's 2014 report, motorized road transport causes 1,328,536 Deaths and 75,487,104 Disability-Adjusted Life Years (DALYs) annually.<sup>132</sup>

The DALYs indicator is used to quantify the harm done by a myriad of non-death injuries. It is the aggregation of the Years of Life Lost (YLLs) from a premature death and the Years of Life lived with Disability (YLD).

Noting that developing countries account for the bulk of the damage compared to developed countries, the breakdown of national figures has been extracted from the World Bank 2014 report and included in Annex II.

<sup>127</sup> International Road Assessment Programme (iRAP), A Business Case for Safer Roads

<sup>128</sup> International Road Assessment Programme (iRAP), A Business Case for Safer Roads

<sup>129</sup> International Energy Agency, Energy Technology Perspective (2015)

<sup>130</sup> World Business Council for Sustainable Development, Sustainable Mobility Project full report (2004)

<sup>131</sup> Reducing Air Pollution from Urban Transport, World Bank (2004)

<sup>132</sup> Global Road Safety Facility, The World Bank; Institute for Health Metrics and Evaluation, Transport for Health: The Global Burden of Disease from Motorised Road Transport (2014)

In terms of monetary loss, the World Bank estimated that road injuries and deaths cost 3 per cent of global GDP annually.<sup>133</sup> Taking into consideration the 2015 global GDP of USD \$77.825 trillion, a loss of \$2.335 trillion can be approximated due to road injuries and deaths.

### **Box 2. Understanding World Bank's methodology**

The figures were derived from the relevant national authorities and the data collection efforts of a global network of medical professionals. When faced with a lack of data from less developed countries, the Global Burden of Disease (GBD) 2010 estimation method was employed to overcome the problem. The GBD 2010 is a rigorous estimator jointly researched by the World Bank, WHO and Harvard University among others. A comprehensive explanation of the methodology can be found in Annex 1 of the aforementioned World Bank report.

Recognizing the significant number of lives and healthy years lost due to road transport, this study therefore analyzes the potential benefits of creating IRO to strengthen road safety and infrastructure. For this, reference was made to the International Road Assessment Programme (iRAP)'s Business Case for Safer Roads report (2016).

iRAP's report makes a conservative proposition that global efforts should be channeled to improve the top 10 per cent most dangerous transport infrastructure over 20 years. By doing so, iRAP believes that the rate of global fatalities and injuries can be lowered by 30 per cent.

In other words, a conservative estimation of the IRO's contribution over 20 years is the saving of 3,678,000 lives and 22,646,131 DALYs. In terms of monetary value, iRAP accounts that to be USD 5.715 trillion over 20 years, which is USD 285.75 billion/year.

It can be acknowledged once again that the circumstances differ among countries in different income categories: Low, Low middle, Upper middle, and High. As such, iRAP's breakdown for each category has been included in Annex III.

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<sup>133</sup> Dahdah S, McMahon K. The true cost of road crashes: valuing life and the cost of a serious injury. Washington: International Road Assessment Programme, World Bank Global Road Safety Facility; 2008.

### Box 3. Understanding iRAP's methodology

iRAP obtains the base figures of each country from the WHO Global Status Report on Road Safety (2013). From there, they studied the effect of road improvements from the data of Britain and OECD countries, in order to derive the understanding that a 10 per cent improvement over 20 years leads to 30 per cent less deaths and injuries.

In converting lives and DALYS to monetary terms, they assumed the following:

- Developed country fatality: 70 x GDP per capita
- Developing country fatality: 100 x GDP per capita
- Serious injury: ¼ of fatality value
- Over the time period of 20 years, a discount rate of 4 per cent was used to account for the time value of money.

## 5. Climate Change

The International Energy Agency (IEA)'s 2009 publication "Moving Toward Sustainability: Transport, Energy and CO<sub>2</sub>" tells us that transport contributes 23 per cent of the total world carbon emission, out of which road transport accounts for 75 per cent. In other words, road transport contributes 18.75 per cent of total world emission.

To understand the quantitative benefits of IRO, IEA's "Energy Technology Perspective 2015" is used as a reference which indicates that there are 3 possible scenarios for climate change induced by carbon emission in the 2013 – 2050 timeframe. Scenario 1 is considered as the baseline without IRO, while Scenario 2 and Scenario 3 are the potential scenarios with IRO.

Therefore, the cumulative results are summarized in Box 4.

In order to convert the reduction in carbon emission from GtCO<sub>2</sub> to monetary terms, we refer to Intergovernmental Panel on Climate Change (IPCC)'s Climate Change Summary for Policymakers 2007 report. By studying the economic loss in each country, the IPCC determined a global mean loss of USD 12 per tonne of CO<sub>2</sub>, while noting that there is a large distribution around the mean.

By using USD 12/tonne of CO<sub>2</sub> as a conversion factor, the potential cost-savings of IRO in Scenario 2 and Scenario 3 are determined in Box 4.

#### Box 4. Cumulative results of climate change according to 3 scenarios

##### Scenario 1: Business-As-Usual

- Without IRO, road transport **contributes 3.94 GtCO<sub>2</sub>**.
- $3.94 \text{ GtCO}_2 \times \$12/\text{tonne} = \$47.28 \text{ billion}$
- Loss of \$47.28bn expected by 2050, which is a **loss of \$1.28 billion/year**.

##### Scenario 2: Conservative Improvement

- With IRO, road transport's emission contribution is **reduced by 1.39 GtCO<sub>2</sub>**.
- $1.39 \text{ GtCO}_2 \times \$12/\text{tonne} = \$16.68 \text{ billion}$
- Cost savings of \$16.68bn expected by 2050, which is a **savings of \$0.45 billion/year**.

##### Scenario 3: Optimistic Improvement

- With IRO, road transport's emission contribution is **reduced by 7.50 GtCO<sub>2</sub>**.
- $7.50 \text{ GtCO}_2 \times \$12/\text{tonne} = \$90 \text{ billion}$
- Cost savings of \$90bn expected by 2050, which is a **savings of \$2.43 billion/year**.

## 6. Air Pollution

According to the World Bank and Institute for Health Metrics and Evaluation's 2014 report, the air pollution caused by road transport causes 183,797 Deaths and 4,126,824 Disability-Adjusted Life Years (DALYs) annually.<sup>134</sup>

The aforementioned result was derived via the World Bank's data collection from the relevant national authority and the global network of medical professionals. By analyzing the global top 10 causes of deaths, the World Bank narrowed the scope of the research. The collated result has been summarized in the Table 10, which is adapted from the 2014 report.

The highlighted figures can be aggregated into the 183,797 Deaths and 4,126,824 DALYs annually. To convert these into economic values, the World Bank's 2013 report on The Cost of Air Pollution: Strengthening the Economic Case for Action is referred. According to the report, the deaths and DALYs add up to USD 225 billion lost in labour income per year.

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<sup>134</sup> Global Road Safety Facility, The World Bank; Institute for Health Metrics and Evaluation, Transport for Health: The Global Burden of Disease from Motorised Road Transport (2014)

**Table 10.** The global top 10 causes of deaths

Rank	Cause	Global burden of disease		Burden attributable to motorized road transport	
		Deaths	DALYs	Deaths	DALYs
1	Ischemic heart disease	7,029,270	129,795,464	90,639	1,909,563
2	Stroke	5,874,181	102,238,999	58,827	1,148,699
3	COPD	2,899,941	76,778,819	17,266	346,376
4	Lower respiratory infections	2,814,379	115,227,062	5,670	489,540
5	Lung cancer	1,527,102	32,405,411	11,395	232,646
6	HIV/AIDS	1,465,369	81,549,177	-	-
7	Diarrheal disease	1,445,798	89,523,909	-	-
8	Road injury	1,328,536	75,487,102	1,328,536	75,487,104
9	Diabetes mellitus	1,281,345	46,857,136	-	-
10	Tuberculosis	1,195,990	49,399,351	-	-
	All other causes	24,207,527	1,682,995,639	-	-
<b>Total</b>		<b>52,769,676</b>	<b>2,482,258,070</b>	<b>1,512,333</b>	<b>79,613,928</b>

Source: World Bank and Institute for Health Metrics and Evaluation's 2014 report

To determine the potential benefits of IRO, the World Bank's Reducing Air Pollution from Urban Transport (2004) report is referred. In this report, the World Bank studied the data from Mexico City's campaign to lower air pollution and determined the potential cost savings in two scenarios – a conservative 10 per cent reduction of air pollution and an optimistic 20 per cent reduction. The summary table adapted from Mexico Air Quality Management Team (2002) presents alternate estimates of health benefits for ozone and PM<sub>10</sub> separately.

**Table 11.** Annual Health Benefits due to Ozone and PM<sub>10</sub> Reduction in Mexico (Million 1999 USD)

Methodology for calculation		Air pollution reduction	
Morbidity	Mortality	10%	20%
Benefits from ozone reduction			
COI	Human capital	18	35
COI + WTP	Human capital	75	151
COI + WTP	WTP	116	232
Benefits from PM <sub>10</sub> reduction			
COI	Human capital	96	191
COI + WTP	Human capital	644	1,289
COI + WTP	WTP	1,451	2,903

Source: Mexico Air Quality Management Team 2002

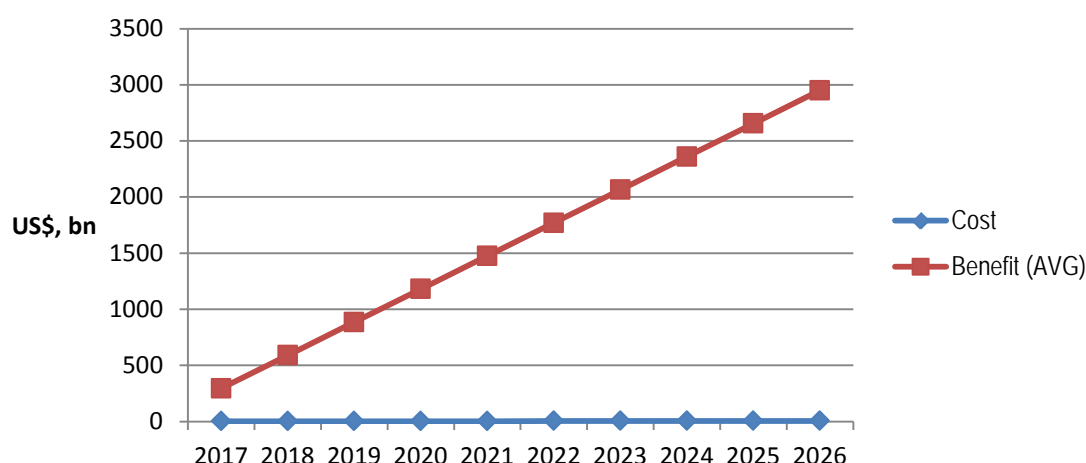
In terms of air pollution, this study focuses on ozone and PM<sub>10</sub> (Particulate matter/sulfates, CO, NO<sub>x</sub>, SO<sub>2</sub>, Lead) which are one of the major causes of air pollution inducing health problems. This study refers to the highlighted figures as they include both the Cost-of-Illness (COI)<sup>135</sup> and Willingness-to-Pay (WTP)<sup>136</sup>.

In the conservative scenario, air pollution is reduced by 10 per cent and a total of USD 1.567 billion is saved per year. In the optimistic scenario, air pollution is reduced by 20 per cent and a total of USD 3.135 billion is saved per year.

## 7. Summary of Costs and Benefits

Figure 11 shows the final estimates of costs and benefits.

**Figure 11. Summary of estimated costs and benefits of IRO**



Source: ESCAP

From the graph it can be seen that even if considering a conservative estimation of benefits and a generous estimation of costs, there is still an overwhelming gain from establishing IRO although growth of number of staff is included. Should the assumptions of the cost and benefit model hold, there will be a positive and increasing return on investment over time.

In summary, the cost-benefit analysis has provided strong empirical justification for setting up IRO.

<sup>135</sup> Cost of Illness (COI) refers to avoided medical costs.

<sup>136</sup> Willingness to Pay (WTP) presents aspects of the value of avoiding acute and chronic morbidity effects and mortality effects associated with acute and chronic exposure.

# 8

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## PARTNERSHIPS OF IRO WITH OTHER ORGANIZATIONS

Partnerships between IRO and other road related organizations will be definitely a priority for IRO to perform its functions and provide quality service to its member States in coordination and cooperation with other organizations.

IRO needs to maintain its role as a specialized agency and follow the functions approved by member States. It may follow the direction to complement the work of the existing organizations and avoid duplication of the work of others.

It can be predicted that IRO will develop and maintain good partnership with all relevant organization as a new positive force for the international community. Such partnership will be dynamic and continue to develop all the time. It is impossible to enlist all possibilities in cooperation under the present study report. Some examples of potential partnership are provided herewith to illustrate the ways of IRO to cooperate with other relevant organizations.

### **1. Collaboration with the Organizations related to Overall Transport Policy**

IRO may actively participate in the activities of the organizations related to overall transport policy to ensure incorporation of overall policy direction into its programmes. Meanwhile, IRO may also contribute to the policy debates with its professional knowledge and experience.

IRO may also share its data and information with such organizations and support the formulation and implementation of the organizations' programmes in its working area.

The examples of such organizations are the United Nations Department of Economic and Social Affairs (DESA) and ITF.

The United Nations regional commissions also elaborate transport policy. This type of collaboration may be extended to the regional commissions.

## **2. Technical Collaboration with the Intergovernmental Organizations related to Roads**

### ***2.1. Green transport***

IRO may take substantive technical role as an intergovernmental norm setting agency to complement the work of the existing organizations in promoting particular initiatives and technologies. The needs for norm setting and intergovernmental process from various initiatives and projects may be tabled to IRO. IRO may cooperate with others to promote the applications of its norms.

IRO may actively participate in the relevant activities of the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Environment Programme (UNEP) and DESA and regional commissions to learn updated global mandates related to green transport, and contribute to the discussion with its professional knowledge and experience.

IRO may exchange information regularly with the specialized agencies for other modes of transport, such as IMO and ICAO, to improve its programme for the road sector.

IRO may cooperate with the Global Environment Facility (GEF), the United Nations Development Programme (UNDP), government donors and the development banks, such as the World Bank, for joint programmes and projects.

The non-governmental organizations related to green transport can be invited to the IRO's conference to voice their concerns and the needs for intergovernmental discussion.

### ***2.2. Road safety***

WHO will continue to lead and coordinate within the United Nations system to monitor global status and progress in road safety, and promote policy change to improve policy environment for road safety.

IRO will technically support the WHO's work in road safety. There are numerous technical issues relating to road safety, including infrastructure design and construction, traffic rules, deployment of intelligent transport systems and operational practice of road carriers, which need intergovernmental elaboration and recommendation. IRO can play such role to complement the work of WHO. IRO can provide input to the WHO's Global Status on Road Safety. The partnership of the two organizations will help countries significantly improve road safety around the world.

The WHO's work in providing enabling policy, increasing awareness of governments and people, and identifying key risk factors and new emerging issues will help IRO receive support of its member States to the elaboration to road safety. IRO will provide technical and

regulatory solutions to the issues of road safety as response to the WHO's reports. IRO will become a new force to support the implementation of the Decade of Action for Road Safety.

IRO may provide technical support to other institutions' road safety programmes and projects, such as the World Bank's GRSF, iRAP, the United Nations regional commissions and IRF. The field experience from the programmes and projects can also contribute to the conception and formulation of the IRO's standards and regulations. The IRO's cooperation with those institutions will also promote wider application of the recommended standards and regulations in countries and assist developing countries in the application.

Joint projects of IRO and other organizations or institutions will become important for the above mentioned cooperation and can be gradually developed after the establishment of IRO.

### **2.3. International transport**

In the field of international transport, IRO may cooperate with the United Nations commissions closely and develop its programmes and plans for the formulation of standards and recommendations.

IRO needs also to coordinate with the World Customs Organization (WCO) for Customs related issues. IRO may reserve the Customs related issues to WCO and maintain good communication with WCO on Customs issues. Some Customs related conventions are administered by ECE. IRO may also need to coordinate and communicate with ECE.

An important non-governmental partner is IRU. This partnership is substantive and broad in the field of international transport. A specific example for cooperation with IRU is the visa for professional driver. In 1998, IRU adopted a resolution,<sup>137</sup> inviting international governmental bodies and national governments to *"Abolish the visa obligation for professional drivers in the possession of a special driver identification document to be introduced in an appropriate international convention" or "Issue multi-entry visas valid for one year;" and "Simplify the procedures and reduce the number and type of supporting documents required"*.

In 2002, IRU adopted a resolution<sup>138</sup>, requesting to *"Generalize the issue of annual multi-entry visas to professional drivers; Introduce simplified driver-friendly procedures; and Reduce prices for visas issued to professional drivers."*

In 2007, IRU followed up with a document entitled "IRU Position on the Need to Facilitate the Issuance of Visas to Professional Drivers". Its key elements were special visa treatment for professional drivers and issuance of long-term (minimum one year) multi-entry visas for professional drivers. The resolution also requested other international organizations and

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<sup>137</sup> Resolution on Barriers to International Transport of Passengers and Goods by Road.

<sup>138</sup> Resolution on the Issuance of Visas to Professional Drivers.

governments to seek bilateral and multilateral solutions for improving the conditions of issuing visas to professional drivers.

So far, there is no significant progress in similar visa treatment like that for seafarer, air crew and train crew. IRO may cooperate with IRU to use adequate set of instruments to formalize international road carriers and establish a system similar to the arrangements for air and maritime crew to satisfy the need of national authorities to safeguard the national interests and the need of international road carriers to ensure operational efficiency.

## *2.4. ITS*

IRO will coordinate with the International Standardization Organization (ISO) and European Committee for Standardization (CEN) to avoid overlapping or duplication. IRO will communicate with ISO and CEN for the need of technical specifications of devices and the ITS elements, and with the International Telecommunication Union for communication standards. IRO will focus on legal and policy environment and interoperability of ITS applications.

It will be beneficial for IRO to attend the annual ITS World Congress to learn the latest developments and the need of the industry for intergovernmental support at global level. It will also provide an opportunity for IRO to seek opinions of the industry on the plan and programme of IRO in the field of ITS.

## *2.5. Dangerous goods*

IRO may be represented in the ECOSOC<sup>139</sup> Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals to follow the Committee's recommendations for setting norms on carriage of dangerous goods by road.

IRO, as a global norm setting organization, may collaborate with ECE to coordinate its norms with the European Agreement concerning the International Carriage of Dangerous Goods by Road (1957).

IRO may exchange information regularly with the specialized agencies for other modes of transport, such as IMO and ICAO, to coordinate for smooth intermodal transfer of dangerous goods and to improve its programme for the road sector.

## *2.6. Security*

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<sup>139</sup> Economic and Social Council.

IRO may cooperate with the International Criminal Police Organization (INTERPOL) and the global associations of motor vehicles in elaborating recommendations on security facilities, devices, technical standards and measures.

### **3. Collaboration with the United Nations Regional Commissions**

The IRO's functions are not duplicated or overlapped with the work of ECA, ECLAC, ESCAP and ESCWA. IRO will significantly complement the work of the four regional commissions.

Several conventions in connection with road safety and international road transport were developed and administered by ECE. The study identified that five of these conventions may fall into the functions of IRO. As mentioned in Chapter 5. Global participation in three of the five instruments is extremely low although they were signed between 1954 and 1997, below 7 per cent. IRO may help review and revise them and organize negotiation of new agreements at global level. IRO can also help promote other two key conventions for road safety with 30-40 per cent of global participation, which have been repeatedly promoted by the United Nations General Assembly resolutions and the United Nations treaty events. The five conventions/agreements will account for a small portion of the IRO's conventions, agreements, standards, recommended rules and recommended practices. More other instruments will be developed by IRO. However, close collaboration with ECE is needed. In addition, IRO will focus on new legal instruments as proposed in the possible functions and approved by its general assembly. It will mainly fill in the gaps in the road sector. This approach will make IRO and ECE complementary with each other. IRO will help ECE to attract more participation in the legal instruments administered by ECE from outside of Europe.

IRO may cooperate with the United Nations regional commissions in a number of areas, such as transport policy, facilitation of international transport, implementation of road safety measures, promotion of deployment of intelligent transport system and development of green transport. In some areas, IRO may coordinate with the United Nations regional commissions.

The technical work of IRO with global dimension can significantly contribute to smooth and efficient international transport along the Asian Highway with the use of dry ports, achievement of the ESCAP Regional Strategic Framework for the Facilitation of International Road Transport and applications of the ESCAP transport facilitation tools. The IRO's global standards and regulatory recommendations can complement the ESCAP's efforts for regional harmonization to build a complete instrumental environment for international road transport.

Similarly, the IRO's work will also contribute and complement to the efforts made by ECA, ECLAC and ESCWA.

#### **4. Cooperation with Nongovernmental Organizations related to Roads**

It can be foreseen that cooperation with the non-governmental organizations related to roads, including PIARC, IRF and IRU, will be substantive and close. The non-governmental organizations can be represented in the IRO's General Assembly and technical committees as necessary.

The non-governmental organizations may use IRO as an intergovernmental platform to lobby or voice their concerns, requests and initiatives. Requests, facts and research work from the non-governmental organizations can lay solid ground for IRO to develop norms, guides, frameworks and recommendations. On the other side, the non-governmental organizations can be instrumental for the applications of the norms, recommendations and guidelines set by IRO.

The areas for cooperation are wide. For example, IRO may undertake joint research with PIARC and recommend to the IRO technical committees to deliberate some technical standards. After adoption of the standards, IRO and PIARC may jointly promote the standards for more effective and wider applications in countries.

Another example is capacity building for carriage of dangerous goods. Under the framework of IRO, member States may formulate convention or agreement on carriage of dangerous goods by road and set relevant standards. IRF or IRU may organize accredited training courses for managers and drivers of road carriers according to the legal instrument and standards as authorized by IRO.

IRO, as an intergovernmental platform to discuss the technical issues and standards of ITS, will also need to closely cooperate with the ITS associations to take their recommendations to intergovernmental level. On the other side, the ITS associations will also help implement the solutions and standards in countries.

# 9

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## ROAD MAP TO SET UP IRO

### Charter drafting

In order to set up IRO, draft charter, founding agreement or convention may be drafted by States which have interest in the establishment of IRO. Taking into account the challenges and issues facing the road sector, a leading State may prepared a draft charter. Any group of professionals or any organization with sufficient knowledge of this subject matter may also help prepare the draft for consideration by the interesting States or leading State.

The draft charter can be circulated to States, inviting comments on the draft. The text of the draft charter will be revised, reflecting the views received.

### Negotiation of the draft charter

When the draft charter is prepared, States who will be potential members of IRO may start to negotiate a draft charter. This can take place through a global conference to attract States as many as possible and to proceed with negotiation of the draft charter.

A global conference provides an opportunity to bring together potential members to build consensus on the draft charter. Before the conference commences, a preliminary discussion on how the work should proceed need to be taken into account.

Depending on the issues, there may be need for further consultation before the draft charter for the establishment of IRO could be adopted. The leading State needs to prepare a revised draft charter which will be circulated together with necessary documents. A further Conference could be convened later to consider and adopt a draft charter. In addition intense consultations may take place over the preceding months in order to reach consensus on the wording of appropriate provisions.

### Signing of the charter

After negotiation of the draft charter between States, a signing ceremony could be organized to invite States to express their commitment to be parties to the charter and to celebrate completion of the negotiation of the charter. The signing event of the charter will be first step of in ensuring that the charter enters into force as soon as possible and will be an official arena to encourage members to indicate that they will deposit their instruments of ratification immediately after signing the charter .

## **Interim secretariat**

Before entry into force of the charter, an interim secretariat may be needed to prepare a number of operational documents. The work of the interim secretariat is to provide technical, administrative and logistical support to the operation of IRO until the formal secretariat is established. This implies that the interim secretariat would take on the roles and responsibilities assigned to the formal secretariat temporarily. The interim secretariat will be fully accountable to all the member States.

One of the mandates of the interim secretariat is to convene the first General Assembly and receive nominations and election for the Council members and the Secretary General of IRO.

Given the urgency of the task, some steps have to be taken immediately after signing the charter to establish the interim secretariat. For following the objectives of the interim secretariat, administrative arrangements should be made so that the Acting Secretary General can, once appointed, select staff and lead the work of the team. The overhead cost for the interim secretariat will be covered from the voluntary contributions of member States.

## **Entry into force of the charter**

The charter will be subject to ratification by a minimum number of parties. The States with definitive signature or deposited instruments of ratification, acceptance, approval or accession after completion of their domestic legal process will become parties. The minimum number of parties to trigger entry into force of the charter will be specified in the charter.

## **Initial operation and further development as a specialized agency of the United Nations**

### ***Headquarters Agreement***

The decision as to where the headquarters of the organization locates can be taken by the member States of IRO. Selection of the headquarters can be on competitive basis. The member States which have interest in hosting the organization need to express their willingness and offers.

The headquarters agreement will be negotiated between IRO and the hosting State. The approval from the General Assembly of IRO is needed to sign the headquarters agreement from IRO side.

### *Relationship with the United Nations*

To enjoy the status, privileges and immunities provided in articles 104 and 105 of the Charter of the United Nations and Convention on the Privileges and Immunities of the Specialized Agencies, IRO may operate first and at the same time to prepare for the status as a specialized agency of the United Nations.

A resolution of the United Nations General Assembly for association of IRO with the United Nations can be promoted through its member States, in particular the hosting State. This matter can be tabled and discussed during the negotiation of the draft charter to shorten the decision making process within IRO.

## Annex I. Assessment of Relevance of the Legal Instruments Administered by ECE to the functions of IRO, as of 29 July 2016

		Title	IRO Functions (Y/N)	Total Parties	ECE Member Parties	ECE Member Non-party Signatories	Non-ECE Member Parties	Non ECE Member Non-party Signatories	Remarks
Infrastructure networks	1	Construction Traffic Arteries 1950							Updated with E Road Network (AGR) 1975
	2	E Road Network (AGR 1975	No						European Agreement
	3	E Rail Network AGC 1985	No						Railway
	4	European Agreement on Important International Combined Transport Lines & Related Installations (AGTC) 1991	No						European Agreement
	5	Protocol on Combined Transport on Inland Waterways							Waterways
	6	European Agreement on Main Inland Waterways of International Importance (AGN), 1996	No						Waterways
Road Traffic & Road Safety	7	Convention on Road Traffic, 1949							Updated with Convention on Road Traffic 1968
	8	Convention on Road Traffic, 1968	Yes	73	45	3	28	11	
	9	Protocol on Road Signs and Signals 1949							Updated with Convention on Roads Signs and Signals 1968
	10	Convention on Road Signs and Signals 1968	Yes	64	42	2	22	11	
	11	European Agreement supplementing the 1968 Convention on Road Traffic, 1971	No						European Agreement
	12	European Agreement supplementing the Convention on Road Signs and Signals (1968), 1971	No						European Agreement
	13	European Agreement on the Application of Article 23 of the 1949 Convention on Road Traffic concerning the Dimensions and Weights of Vehicles Permitted to Travel on Certain Roads of the Contracting Parties, 1950	No						European Agreement
	14	European Agreement supplementing the 1949 Convention on Road Traffic and the 1949 Protocol on Road Signs and Signals 1950	No						European Agreement
	15	European Agreement on Road Markings, 1957	No						European Agreement
	16	Protocol on Road Markings, Additional to the European Agreement supplementing the Convention on Road Signs and Signals, of 1 March 1973							Protocol
	17	Agreement on Minimum Requirements for the Issue and Validity of Driving Permits (APC) 1975	Yes	7	6	0	1	0	ECE member States and States with consultative status
Vehicles	18	Agreement concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be fitted and/or be used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions, 1958	No						Technical details of vehicles
	19	Agreement concerning the Adoption of Uniform Conditions for Periodical Technical Inspections of Wheeled Vehicles and the Reciprocal Recognition of Such Inspections, 1997	Yes	13	13	17	0	0	ECE member States, States with consultative status or participation in ECE's activities

	20	Agreement concerning the Establishing of Global Technical Regulations for Wheeled Vehicles, Equipment and Parts which can be fitted and / or be used on Wheeled Vehicles, 1998	No						Technical details of vehicles
Other Legal Instruments Related to Road Transport	21	European Agreement concerning the Work of Crews of Vehicles engaged in International Road Transport (AETR), of 1970	No						European Agreement
	22	Convention on the Taxation of Road Vehicles for Private use in International Traffic, 1956	No						
	23	Convention on the Taxation of Road Vehicles engaged in International Passenger Transport, 1956	No						
	24	Convention on the Taxation of Road Vehicles engaged in International Goods Transport, 1956	No						
	25	Convention on the Contract for the International Carriage of Goods by Road (CMR), 1956	Yes	55	48	0	7	0	ECE member States, States with consultative status or participation in ECE's activities
	26	Protocol to the Convention on the Contract for the International Carriage of Goods by Road (CMR), of 5 July 1978							Protocol
	27	Additional Protocol to the CMR concerning the electronic consignment note (e-CMR)							Protocol
	28	Convention on the Contract for the International Carriage of Passengers and Luggage by Road (CVR), 1973	Yes	9	9	2	0	0	ECE member States, States with consultative status or participation in ECE's activities
	29	Protocol to the Convention on the Contract for the International Carriage of Passengers and Luggage by Road (CVR), 1978							Protocol
	30	General Agreement on Economic Regulations for International Road Transport, 1954	Yes	4	4	9	0	0	
Inland Navigation	31	Convention relating to the Unification of Certain Rules concerning Collisions in Inland Navigation, of 1960	No						Navigation
	32	Convention on the Registration of Inland Navigation Vessels, of 1965	No						Navigation
	33	Convention on the Measurement of Inland Navigation Vessels, 1966	No						Navigation
	34	Convention relating to the Limitation of the Liability of Owners of Inland Navigation Vessels (CLN), 1973	No						Navigation
	35	Protocol to the Convention relating to the Limitation of the Liability of Owners of Inland Navigation Vessels (CLN), 1978							Protocol
	36	Convention on the Contract for the International Carriage of Passengers and Luggage by Inland Waterway (CVN), 1976							Navigation
	37	Protocol to the Convention on the Contract for the International Carriage of Passengers and Luggage by Inland Waterways (CVN), 1978	No						Navigation
Border Crossing Facilitation	38	Convention concerning Customs Facilities for Touring, 1954	No						Customs
	39	Additional Protocol to the Convention concerning Customs Facilities for Touring, relating to the importation of tourist publicity documents and material, 1954							Protocol
	40	Customs Convention on the Temporary Importation of Private Road Vehicles, 1954	No						Customs
	41	Customs Convention on the International Transport of Goods under Cover of TIR Carnets (TIR Convention), 1959							Updated with TIR convention of 1975

	42	Customs Convention on the International Transport of Goods under Cover of TIR Carnets (TIR Convention), 1975	No						Customs
	43	Customs Convention on the Temporary Importation for Private Use of Aircraft and Pleasure Boats, 1956	No						Aircraft & Boat
	44	Customs Convention on the Temporary Importation of Commercial Road Vehicles, 1956	No						Customs
	45	International Convention to Facilitate the Crossing of Frontiers for Passengers and Baggage carried by Rail, 1952	No						Railway
	46	International Convention to Facilitate the Crossing of Frontiers for Goods Carried by Rail, 1952	No						Railway
	47	Customs Convention concerning Spare Parts Used for Repairing Europ Wagons, 1958	No						Railway
	48	Customs Convention on Containers, 1956							Updated with Customs Convention on Containers of 1972
	49	Customs Convention on Containers, 1972	No						Customs
	50	European Convention on Customs Treatment of Pallets Used in International Transport, 1960	No						European Convention
	51	International Convention on the Harmonization of Frontier Controls of Goods, 1982	Partly	56	46	0	10	0	
	52	Convention on Customs Treatment of Pool Containers Used in International Transport, 1994	No						Customs
Dangerous Goods & Special Cargoes	53	SMGS Transit by Rail, 2006	No						Railway
	54	European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), 1957	No						European Agreement
	55	Protocol amending article 1 (a), article 14 (1) and article 14 (3) (b) of the European Agreement of 30 September 1957 concerning the International Carriage of Dangerous Goods by Road (ADR), of 1993							Protocol
	56	Convention on Civil Liability for Damage caused during Carriage of Dangerous Goods by Road, Rail and Inland Navigation Vessels (CRTD), 1989	Partly	1	0	1	1	1	Not in force
	57	European Agreement Concerning the International Carriage of Dangerous Goods by Inland Waterway	No						Navigation
	58	Agreement on the International Carriage of Perishable Foodstuffs and on the Special Equipment to be Used for such Carriage (ATP), 1970	Partly	50	47	1	3	0	ECE member States, States with consultative status or participation in ECE's activities

Source: Analyzed by the study team based on the information from the ECE Sustainable Transport Division website. Accessed on 29 July 2016.

Notes: (1) European Union is excluded from the above list. EU is party to Agreements No 18, 20, 40, 42, 44, 51 and 52;

(2) ECE Members: 56 members as listed on the ECE webpage: [www.unece.org/oes/member\\_countries/member\\_countries.html](http://www.unece.org/oes/member_countries/member_countries.html).

## ANNEX II. National figures for Deaths and DALYs

	1990		2010											2010						
Country	Road injury deaths		Official country statistics count	GBD 2010 road deaths count	Uncertainty range 95% CI	Road injury deaths						Nonfatal road injuries		Motor vehicle air pollution		Total burden (air pollution + road injuries)				
	Deaths count	Rate per 100,000				Rate per 100,000	Pedestrian %	Bicyclist %	Motorcycle rider %	Vehicle occupant %	Other %	Injuries warranting admission count	Total nonfatal injuries count	Deaths count	Uncertainty range 95% CI	Cause of death rank	YLL rank	YLD rank	DALY rank	
Afghanistan	4,590	34	1,501	10,213	(5,054 - 15,093)	32	14	6	12	64	4	36,483	345,765	1,388	(1,130 - 1,705)	10	8	5	8	
Albania	332	10	352	395	(259 - 533)	12	16	7	13	51	13	4,149	33,823	136	(112 - 161)	12	11	5	9	
Algeria	3,765	15	N.A.	4,283	(3,570 - 5,371)	12	6	9	8	74	2	51,649	432,149	417	(366 - 474)	9	7	7	6	
Andorra	5	10	3	6	(3 - 8)	7	19	11	14	55	1	63	519	6	(3 - 10)	10	10	9	9	
Angola	6,563	63	4,042	9,408	(2,450 - 31,110)	49	69	2	4	24	1	17,608	184,103	11	(8 - 13)	5	4	5	4	
Antigua and Barbuda	3	5	N.A.	5	(4 - 7)	6	14	8	8	69	1	104	837	0	(0 - 1)	11	10	8	10	
Argentina	3,389	10	5,094	6,067	(4,484 - 7,015)	15	15	7	14	63	1	39,338	341,421	278	(170 - 436)	9	9	10	8	
Armenia	676	19	285	474	(352 - 776)	15	34	4	3	56	3	4,230	35,180	162	(134 - 192)	12	11	9	11	
Australia	2,836	17	1,363	2,024	(1,629 - 2,590)	9	18	3	12	67	1	23,097	189,314	18	(11 - 28)	10	9	7	9	
Austria	1,411	18	552	723	(622 - 991)	9	18	10	15	56	1	6,272	52,525	393	(311 - 489)	10	10	10	9	
Azerbaijan	1,143	16	1,202	882	(585 - 1,510)	10	27	4	3	62	4	13,728	111,534	340	(297 - 383)	12	12	7	12	
Bahamas	48	19	N.A.	57	(43 - 72)	17	8	5	12	73	2	397	3,375	1	(0 - 2)	8	5	7	6	
Bahrain	128	26	73	256	(185 - 327)	20	3	5	5	87	1	2,162	18,211	10	(7 - 13)	6	3	8	4	
Bangladesh	3,432	3	2,872	6,113	(4,148 - 10,330)	4	34	14	11	29	11	298,166	2,304,607	2,667	(2,129 - 3,177)	12	11	6	10	
Barbados	30	11	19	31	(23 - 38)	11	14	6	7	72	1	332	2,709	2	(1 - 3)	10	9	7	8	
Belarus	2,332	23	1,190	2,117	(1,637 - 2,687)	22	37	6	6	47	3	14,393	123,448	665	(537 - 806)	11	10	11	10	
Belgium	1,921	19	840	1,345	(1,139 - 1,720)	12	15	16	18	49	2	7,362	64,902	928	(752 - 1,120)	10	10	9	9	
Belize	19	10	41	59	(42 - 71)	19	10	11	11	64	2	337	2,911	1	(0 - 1)	8	5	8	5	
Benin	982	21	816	1,726	(1,245 - 2,155)	19	36	5	16	39	4	10,624	91,918	22	(18 - 27)	6	6	8	7	
Bhutan	75	14	79	87	(53 - 147)	12	39	10	11	36	3	1,482	11,794	12	(9 - 16)	10	6	7	7	
Bolivia	1,476	22	1,681	1,989	(1,310 - 2,571)	20	45	5	4	45	2	11,183	97,324	23	(17 - 30)	8	6	9	7	
Bosnia and Herzegovina	45	1	336	65	(34 - 132)	2	29	11	7	49	4	4,893	37,699	187	(156 - 221)	13	13	7	13	
Botswana	155	11	385	283	(191 - 484)	14	36	7	14	38	5	1,962	18,242	0	(0 - 0)	8	4	9	4	
Brazil	31,443	21	36,499	43,985	(35,301 - 52,857)	23	34	4	23	38	1	166,013	1,538,102	618	(426 - 852)	9	6	12	7	
Brunei	40	16	46	50	(37 - 58)	12	17	13	12	58	0	356	3,076	1	(0 - 2)	8	7	9	7	
Bulgaria	1,219	14	775	913	(739 - 1,092)	12	19	6	7	64	4	7,818	65,719	844	(726 - 978)	12	11	6	11	
Burkina Faso	2,844	30	966	5,585	(4,271 - 7,113)	34	34	3	14	33	15	14,308	144,032	54	(41 - 70)	8	5	8	4	
Burundi	2,097	37	357	2,534	(812 - 5,044)	30	35	16	12	25	12	9,588	89,842	17	(12 - 24)	8	7	9	6	
Cambodia	875	9	1,816	2,394	(1,414 - 3,298)	17	10	6	23	52	10	21,924	183,274	129	(110 - 150)	10	7	7	8	
Cameroon	4,051	33	1,353	6,951	(4,682 - 9,920)	35	41	4	13	37	4	20,934	205,855	52	(44 - 62)	5	4	8	4	
Canada	4,191	15	2,227	2,962	(2,559 - 3,909)	9	17	5	10	68	1	33,251	275,144	607	(474 - 758)	10	9	10	10	
Cape Verde	45	13	63	80	(36 - 177)	16	44	7	10	35	4	646	5,490	1	(1 - 1)	9	5	9	8	
Central African Republic	916	31	145	1,911	(899 - 3,835)	43	47	4	15	26	9	4,357	44,557	12	(10 - 15)	5	6	5	6	
Chad	954	16	3,226	2,765	(2,144 - 3,536)	24	38	4	16	36	7	11,096	102,518	23	(17 - 31)	10	9	4	9	

	1990		2010											2010							
	Road injury deaths		Road injury deaths											Nonfatal road injuries		Motor vehicle air pollution		Total burden (air pollution + road injuries)			
Country	Deaths count	Rate per 100,000	Official country statistics count	GBD 2010 road deaths count	Uncertainty range 95% CI	Rate per 100,000	Pedestrian %	Bicyclist %	Motorcycle rider %	Vehicle occupant %	Other %	Injuries warranting admission count	Total nonfatal injuries count	Deaths count	Uncertainty range 95% CI	Cause of death rank	YLL rank	YLD rank	DALY rank		
Chile	1,587	12	2,071	2,204	(1,573 - 2,572)	13	47	7	7	37	2	17,104	144,068	220	(159 - 287)	9	8	9	7		
China	155,521	14	70,134	282,576	(205,235 - 414,850)	21	37	3	17	26	16	1,903,239	16,300,000	27,379	(23,028 - 31,278)	10	6	6	7		
Colombia	6,260	19	5,502	7,503	(5,997 - 9,241)	16	41	7	24	27	1	30,559	281,963	105	(73 - 145)	9	6	11	6		
Comoros	143	33	14	213	(122 - 411)	29	49	18	5	24	4	851	7,871	0	(0 - 0)	5	6	8	6		
Congo	1,005	42	269	1,916	(633 - 5,519)	47	65	2	5	27	1	3,236	35,686	15	(12 - 18)	6	4	10	4		
Costa Rica	429	14	700	753	(625 - 913)	16	36	9	17	36	2	4,676	41,535	24	(16 - 34)	9	5	12	5		
Côte d'Ivoire	3,383	27	699	6,536	(4,232 - 8,893)	33	37	4	17	39	4	19,363	188,795	68	(57 - 84)	8	6	10	6		
Croatia	1,019	23	426	537	(443 - 669)	12	20	10	15	53	2	3,799	32,727	267	(207 - 335)	10	10	6	10		
Cuba	2,247	21	809	1,162	(995 - 1,578)	10	32	17	12	35	5	13,751	112,686	83	(53 - 116)	12	9	7	8		
Cyprus	167	26	60	111	(93 - 140)	15	17	4	21	56	2	1,076	9,006	26	(20 - 33)	9	9	7	8		
Czech Republic	1,532	15	802	988	(795 - 1,229)	9	21	12	10	56	1	13,665	110,901	663	(552 - 776)	10	10	5	10		
Democratic Republic of the Congo	6,497	18	332	7,733	(5,107 - 11,060)	12	35	5	23	28	8	82,668	678,838	136	(110 - 170)	15	12	7	12		
Denmark	763	15	255	476	(394 - 603)	9	18	13	13	55	1	4,028	33,958	183	(135 - 236)	10	10	9	9		
Djibouti	303	54	N.A.	345	(167 - 723)	39	65	8	3	22	2	993	9,634	1	(1 - 2)	4	2	11	2		
Dominica	10	15	8	9	(7 - 11)	13	11	5	11	72	1	87	708	0	(0 - 0)	10	8	8	7		
Dominican Republic	1,185	16	2,470	2,231	(1,730 - 2,581)	22	4	1	6	89	1	9,040	84,034	55	(41 - 72)	8	5	6	6		
Ecuador	2,366	23	3,222	3,498	(2,798 - 4,157)	24	56	5	7	31	1	13,732	126,386	23	(16 - 32)	7	4	8	3		
Egypt	7,025	12	9,602	11,708	(9,030 - 13,959)	14	30	3	2	64	1	116,416	964,142	11,315	(9,876 - 12,579)	8	7	7	7		
El Salvador	1,375	26	1,017	1,589	(1,333 - 2,116)	26	10	14	14	58	3	5,344	50,112	15	(7 - 26)	8	5	12	6		
Equatorial Guinea	178	47	53	524	(109 - 1,855)	75	68	2	3	26	1	560	6,796	1	(1 - 2)	4	3	7	3		
Eritrea	682	22	N.A.	1,202	(898 - 1,673)	23	41	14	7	31	8	5,966	54,463	9	(7 - 11)	7	6	8	7		
Estonia	383	25	78	126	(100 - 182)	9	21	9	4	57	8	1,417	11,820	26	(14 - 41)	12	11	11	10		
Ethiopia	15,103	31	2,506	21,520	(16,689 - 27,821)	26	47	11	4	30	9	65,191	642,113	118	(96 - 143)	6	4	7	4		
Federated States of Micronesia	11	11	2	14	(9 - 23)	12	19	8	7	58	7	163	1,340	0	(0 - 0)	10	10	10	10		
Fiji	45	6	52	63	(53 - 78)	7	17	9	6	61	7	1,344	10,737	0	(0 - 0)	13	12	10	11		
Finland	660	13	272	387	(326 - 529)	7	12	12	11	63	2	5,092	41,515	44	(25 - 69)	12	9	8	10		
France	10,009	18	3,992	5,523	(4,699 - 7,626)	9	11	8	21	58	1	46,255	388,852	3,529	(2,808 - 4,280)	10	8	8	8		
Gabon	588	63	327	1,267	(340 - 3,485)	84	68	2	5	25	1	1,172	14,868	2	(2 - 3)	4	2	9	2		
Gambia	223	23	N.A.	387	(283 - 519)	22	37	4	15	38	6	2,016	17,906	4	(3 - 5)	7	5	7	6		
Georgia	1,206	22	685	515	(378 - 795)	12	9	4	4	81	2	5,320	43,693	228	(181 - 279)	12	11	8	12		
Germany	11,771	15	3,648	5,469	(4,689 - 7,584)	7	17	12	15	55	1	61,846	507,966	7,359	(6,118 - 8,729)	9	11	7	11		
Ghana	2,053	14	1,986	4,844	(3,267 - 6,097)	20	38	5	7	46	4	32,905	281,393	72	(61 - 84)	7	5	8	6		
Greece	2,179	21	1,451	1,773	(1,498 - 2,242)	16	15	8	25	41	11	12,006	103,222	742	(559 - 980)	11	9	7	9		
Grenada	8	8	N.A.	13	(9 - 16)	12	8	7	7	76	2	126	1,042	1	(0 - 1)	11	8	8	9		
Guatemala	590	7	958	944	(722 - 1,200)	7	37	5	8	45	4	17,381	137,969	44	(36 - 54)	14	13	9	12		
Guinea	1,019	18	503	1,869	(1,409 - 2,305)	19	33	5	17	39	6	12,295	105,831	33	(26 - 41)	9	8	8	9		
Guinea-Bissau	309	30	134	443	(288 - 600)	29	30	4	22	38	6	186	15,686	4	(3 - 6)	8	6	9	8		

	1990		2010											2010							
	Road injury deaths		Road injury deaths											Nonfatal road injuries		Motor vehicle air pollution		Total burden (air pollution + road injuries)			
Country	Deaths count	Rate per 100,000	Official country statistics count	GBD 2010 road deaths count	Uncertainty range 95% CI	Rate per 100,000	Pedestrian %	Bicyclist %	Motorcycle rider %	Vehicle occupant %	Other %	Injuries warranting admission count	Total nonfatal injuries count	Deaths count	Uncertainty range 95% CI	Cause of death rank	YLL rank	YLD rank	DALY rank		
Guyana	68	9	112	127	(72 - 171)	17	10	10	11	66	3	846	7,203	4	(2 - 6)	9	8	7	9		
Haiti	1,168	16	N.A.	1,395	(988 - 1,745)	14	7	9	10	65	8	11,270	94,986	62	(46 - 86)	14	13	7	12		
Honduras	654	13	1,217	1,231	(982 - 1,542)	16	36	7	11	43	4	6,920	60,980	27	(18 - 37)	11	8	11	8		
Hungary	2,194	21	740	1,246	(998 - 1,579)	12	28	18	9	44	1	13,285	109,725	816	(688 - 957)	12	11	7	11		
Iceland	27	10	8	16	(12 - 19)	5	7	8	10	69	7	253	2,035	2	(1 - 3)	9	8	7	9		
India	145,378	17	130,037	273,835	(176,843 - 440,771)	22	44	11	17	21	8	2,197,047	18,500,000	38,804	(32,697 - 44,928)	10	9	8	9		
Indonesia	43,407	24	31,234	65,335	(53,625 - 80,627)	27	12	6	19	57	6	360,187	3,170,472	1,374	(1,167 - 1,606)	7	5	6	6		
Iran	15,399	28	23,249	27,486	(19,719 - 34,419)	37	28	5	12	48	7	173,153	1,413,027	2,602	(2,265 - 2,951)	8	3	6	4		
Iraq	1,638	9	5,708	2,593	(2,027 - 3,652)	8	27	7	9	54	3	43,833	349,096	931	(803 - 1,055)	10	10	7	10		
Ireland	461	13	212	292	(238 - 412)	6	19	6	9	64	1	3,449	28,547	112	(75 - 154)	11	9	9	9		
Israel	573	12	352	729	(578 - 858)	10	38	4	7	51	1	5,362	45,641	304	(248 - 376)	9	8	8	7		
Italy	11,212	20	4,237	6,832	(5,829 - 9,084)	11	27	11	16	46	1	40,682	356,709	5,895	(4,731 - 7,104)	10	10	8	8		
Jamaica	42	2	319	85	(36 - 122)	3	16	6	16	59	2	3,366	26,529	17	(12 - 22)	13	13	7	9		
Japan	14,299	12	5,772	10,017	(8,284 - 14,084)	8	37	18	14	31	0	118,924	974,382	8,280	(6,524 - 10,200)	10	10	9	10		
Jordan	543	16	670	728	(593 - 882)	12	24	6	5	63	2	8,715	71,435	185	(156 - 213)	9	7	8	7		
Kazakhstan	3,768	23	3,379	3,965	(3,167 - 5,133)	25	26	4	4	64	2	19,011	170,027	283	(243 - 322)	10	10	8	10		
Kenya	3,648	16	2,966	7,820	(5,183 - 13,628)	19	51	12	4	29	3	48,022	427,257	15	(10 - 21)	7	4	7	5		
Kiribati	10	14	6	15	(11 - 19)	16	14	8	7	62	9	135	1,130	0	(0 - 0)	9	9	10	9		
Kuwait	311	15	374	493	(415 - 595)	18	12	12	12	61	2	4,276	36,137	40	(34 - 45)	9	4	7	6		
Kyrgyzstan	1,045	24	850	1,161	(900 - 1,394)	22	26	6	7	57	4	7,089	61,481	102	(87 - 118)	11	10	8	7		
Laos	555	13	767	1,068	(670 - 1,539)	17	11	4	25	53	7	7,668	65,649	68	(55 - 82)	11	9	6	9		
Latvia	882	33	218	344	(269 - 511)	15	37	8	5	48	2	4,830	39,225	84	(57 - 116)	11	10	11	9		
Lebanon	492	17	533	516	(369 - 715)	12	17	6	4	71	1	6,348	51,495	245	(203 - 291)	9	9	8	8		
Lesotho	76	5	362	232	(106 - 405)	11	26	8	18	37	11	2,362	19,535	7	(5 - 11)	15	14	10	16		
Liberia	428	20	78	561	(199 - 983)	14	23	5	29	35	9	5,091	42,338	8	(6 - 12)	10	11	9	12		
Libya	811	19	N.A.	1,322	(985 - 1,775)	21	17	5	5	72	1	9,136	76,161	83	(72 - 97)	9	6	9	7		
Lithuania	1,085	29	299	613	(510 - 857)	18	33	10	6	49	2	4,914	41,634	130	(98 - 168)	10	10	11	9		
Luxembourg	73	19	32	48	(36 - 60)	10	9	3	10	70	8	372	3,153	30	(19 - 43)	10	9	9	9		
Macedonia	144	8	452	133	(96 - 157)	6	6	3	4	83	4	2,720	21,354	128	(104 - 153)	12	12	5	11		
Madagascar	2,891	26	422	3,405	(2,631 - 4,846)	16	48	11	5	30	6	25,756	217,814	14	(9 - 20)	8	7	8	9		
Malawi	2,722	29	976	4,867	(3,293 - 6,560)	32	43	12	7	32	6	16,259	154,318	3	(2 - 5)	7	6	11	6		
Malaysia	2,638	15	6,872	4,106	(3,124 - 4,968)	14	4	4	21	69	1	52,427	422,519	405	(339 - 475)	9	8	9	7		
Maldives	30	14	6	29	(22 - 38)	9	9	13	17	55	6	535	4,267	2	(0 - 4)	7	5	5	7		
Mali	1,813	21	739	3,133	(2,379 - 3,924)	20	35	4	17	38	5	14,787	131,881	33	(26 - 44)	8	5	7	6		
Malta	15	4	15	16	(12 - 19)	4	14	8	18	53	7	330	2,615	39	(22 - 58)	10	10	9	9		
Marshall Islands	6	12	4	7	(5 - 10)	11	18	8	7	61	6	91	742	0	(0 - 0)	9	9	10	8		
Mauritania	514	26	163	1,016	(743 - 1,383)	29	35	5	15	40	5	3,090	30,463	5	(4 - 6)	6	5	8	6		
Mauritius	107	10	158	123	(79 - 151)	9	8	10	13	63	6	1,841	14,819	1	(0 - 3)	10	9	9	9		
Mexico	15,954	19	17,301	20,096	(16,217 - 24,578)	18	41	4	7	46	2	55,622	558,214	2,179	(1,892 - 2,478)	9	7	11	7		
Moldova	1,069	24	452	534	(447 - 745)	15	29	7	10	45	9	5,660	46,667	261	(215 - 309)	12	10	10	10		
Mongolia	462	21	477	661	(456 - 908)	24	21	4	5	66	4	3,668	32,991	26	(23 - 30)	10	8	9	8		

	1990		2010											2010					
	Road injury deaths		Road injury deaths									Nonfatal road injuries		Motor vehicle air pollution		Total burden (air pollution + road injuries)			
Country	Deaths count	Rate per 100,000	Official country statistics count	GSD 2010 road deaths count	Uncertainty range 95% CI	Rate per 100,000	Pedestrian %	Bicyclist %	Motorcycle rider %	Vehicle occupant %	Other %	Injuries warranting admission count	Total nonfatal injuries count	Deaths count	Uncertainty range 95% CI	Cause of death rank	YLL rank	YLD rank	DALY rank
Montenegro	70	12	95	82	(66 - 96)	13	48	7	11	33	2	768	6,389	31	(26 - 36)	10	10	6	10
Morocco	2,210	9	3,778	2,857	(2,421 - 3,872)	9	7	7	6	77	2	42,311	339,187	454	(394 - 522)	9	8	9	9
Mozambique	2,264	17	2,549	7,154	(5,493 - 11,166)	31	41	11	8	30	10	26,996	238,575	3	(2 - 5)	6	4	8	4
Myanmar	4,528	12	2,464	9,277	(5,037 - 13,985)	19	9	6	23	53	9	56,886	490,076	548	(422 - 703)	9	9	8	6
Namibia	111	8	292	222	(157 - 385)	10	32	9	11	42	6	2,107	18,961	0	(0 - 1)	12	11	9	12
Nepal	2,598	14	1,689	3,293	(2,493 - 4,197)	11	28	13	15	26	19	57,934	461,572	675	(570 - 800)	11	9	8	11
Netherlands	1,780	12	640	1,068	(898 - 1,493)	6	12	28	14	46	1	12,579	102,940	1,092	(885 - 1,323)	10	10	8	10
New Zealand	743	22	375	454	(390 - 562)	10	11	3	9	76	1	4,654	38,567	3	(2 - 5)	11	9	8	8
Nicaragua	512	12	742	639	(525 - 798)	11	22	10	13	50	4	6,810	56,293	12	(7 - 18)	9	9	11	9
Niger	1,496	19	703	2,078	(1,412 - 2,821)	13	30	5	19	39	7	18,891	156,679	46	(35 - 61)	14	13	5	13
Nigeria	32,606	33	5,279	74,548	(55,477 - 91,154)	47	41	3	18	30	8	154,369	1,608,482	297	(241 - 362)	3	2	8	2
North Korea	3,518	17	N.A.	3,726	(1,602 - 6,331)	15	15	6	12	26	42	40,189	329,849	725	(593 - 867)	11	9	9	10
Norway	514	12	208	279	(235 - 378)	6	13	6	13	67	1	3,629	29,595	15	(9 - 25)	11	10	10	11
Oman	857	46	820	1,090	(856 - 1,331)	40	68	2	2	28	0	3,717	36,799	41	(36 - 46)	3	1	7	1
Pakistan	8,867	8	5,192	16,573	(12,746 - 22,510)	10	39	13	13	28	7	331,613	2,651,023	4,496	(3,855 - 5,238)	12	10	7	12
Palestine	286	14	N.A.	440	(321 - 560)	11	15	6	5	73	2	5,630	46,594	132	(108 - 155)	8	6	7	6
Panama	439	18	422	591	(501 - 774)	17	42	6	4	46	2	3,343	29,132	8	(5 - 13)	10	6	12	7
Papua New Guinea	475	11	269	871	(545 - 1,197)	13	23	7	10	52	7	9,780	79,442	1	(0 - 1)	12	11	8	13
Paraguay	500	12	1,206	1,247	(823 - 1,469)	19	41	3	28	27	2	6,362	55,947	8	(3 - 15)	9	7	10	8
Peru	2,682	12	2,514	3,973	(3,103 - 4,649)	14	41	4	3	51	1	35,026	291,197	69	(50 - 90)	9	4	7	5
Philippines	4,317	7	6,739	8,396	(6,464 - 10,535)	9	21	5	19	50	5	110,309	900,551	554	(416 - 714)	10	12	9	14
Poland	7,513	20	3,907	5,681	(4,590 - 7,152)	15	34	10	5	50	0	46,151	391,422	1,814	(1,537 - 2,117)	11	11	6	11
Portugal	2,853	29	937	1,327	(1,097 - 1,940)	12	25	9	12	49	5	4,914	46,631	593	(443 - 768)	11	9	9	8
Qatar	80	17	228	306	(212 - 380)	17	7	12	14	64	3	3,564	29,191	7	(6 - 8)	3	1	8	2
Romania	4,159	18	2,377	2,906	(2,389 - 3,687)	14	22	9	8	56	5	12,279	112,734	1,581	(1,353 - 1,831)	12	11	7	11
Russia	40,747	28	26,567	33,379	(27,469 - 40,921)	24	42	3	5	48	2	179,432	1,569,191	6,572	(5,439 - 7,787)	10	10	10	10
Rwanda	2,885	41	438	2,492	(1,431 - 5,488)	23	53	13	5	23	6	12,724	111,807	16	(12 - 20)	7	6	7	6
Saint Lucia	26	19	14	25	(20 - 33)	14	10	6	6	75	2	211	1,791	1	(0 - 1)	10	8	8	8
Saint Vincent and the Grenadines	8	7	5	11	(8 - 13)	10	18	10	9	61	2	135	1,095	1	(0 - 1)	11	9	8	9
Samoa	16	10	55	15	(11 - 21)	8	18	9	5	60	7	272	2,153	0	(0 - 0)	11	10	8	11
Sao Tomé and Príncipe	12	10	33	15	(10 - 24)	9	38	4	14	40	4	220	1,775	0	(0 - 0)	10	7	10	11
Saudi Arabia	5,757	36	6,596	9,128	(7,304 - 10,400)	34	5	1	1	93	0	42,258	342,789	333	(285 - 376)	5	2	8	4
Senegal	392	5	277	645	(307 - 1,406)	5	48	5	16	26	5	14,528	114,598	12	(10 - 16)	15	16	7	15
Serbia	1,176	12	680	988	(769 - 1,141)	10	24	11	12	52	1	12,272	100,090	564	(475 - 654)	10	10	6	10
Seychelles	8	12	13	12	(8 - 18)	15	16	6	17	61	1	123	1,008	0	(0 - 0)	9	9	8	9
Sierra Leone	951	24	357	1,095	(627 - 1,505)	19	29	5	24	36	6	7,063	61,334	14	(11 - 18)	10	9	10	9
Singapore	256	9	193	164	(123 - 212)	4	23	9	40	28	1	3,574	28,787	44	(23 - 64)	11	9	7	9
Slovakia	971	18	515	618	(527 - 801)	11	29	11	7	51	1	5,796	48,554	356	(298 - 415)	10	10	6	10

	1990		2010											2010					
	Road injury deaths		Road injury deaths									Nonfatal road injuries		Motor vehicle air pollution		Total burden (air pollution + road injuries)			
Country	Deaths count	Rate per 100,000	Official country statistics count	GBD 2010 road deaths count	Uncertainty range 95% CI	Rate per 100,000	Pedestrian %	Bicyclist %	Motorcycle rider %	Vehicle occupant %	Other %	Injuries warranting admission count	Total nonfatal injuries count	Deaths count	Uncertainty range 95% CI	Cause of death rank	YLL rank	YLD rank	DALY rank
Slovenia	487	24	138	220	(183 - 297)	11	16	9	16	58	1	3,023	24,560	107	(85 - 132)	10	10	5	9
Solomon Islands	32	10	12	62	(44 - 84)	11	14	8	9	59	10	765	6,272	0	(0 - 0)	10	8	9	10
Somalia	1,898	28	N.A.	2,083	(1,509 - 3,255)	22	43	10	7	29	12	10,805	95,810	14	(11 - 18)	8	9	7	9
South Africa	2,597	7	14,804	4,479	(3,339 - 5,571)	9	50	5	7	36	1	51,312	422,129	231	(180 - 291)	10	10	9	11
South Korea	12,262	28	5,505	7,839	(6,365 - 9,651)	16	43	7	20	30	0	42,262	374,837	2,126	(1,673 - 2,586)	9	9	9	9
Spain	7,949	20	2,478	3,950	(3,403 - 5,439)	9	23	4	14	58	1	9,698	102,160	1,848	(1,487 - 2,253)	10	10	9	9
Sri Lanka	1,294	7	2,483	2,650	(1,832 - 4,226)	13	14	8	13	60	5	27,914	228,517	217	(168 - 271)	10	9	8	10
Sudan	5,511	21	3,582	10,278	(7,877 - 13,730)	24	65	7	3	22	3	27,318	273,830	43	(34 - 54)	5	4	9	5
Suriname	63	15	87	80	(55 - 97)	15	10	7	18	64	1	615	5,117	1	(1 - 2)	9	7	7	6
Swaziland	53	6	216	218	(127 - 346)	18	33	7	14	40	5	906	9,055	2	(1 - 3)	10	10	9	10
Sweden	1,011	12	266	512	(413 - 750)	6	14	9	13	63	1	7,134	57,704	159	(110 - 221)	11	9	8	10
Switzerland	1,120	17	327	594	(488 - 793)	8	28	12	11	47	2	2,691	24,535	444	(344 - 551)	10	10	7	9
Syria	825	7	2,118	1,100	(768 - 1,660)	5	18	6	5	68	3	24,325	194,113	970	(857 - 1,111)	9	9	7	10
Taiwan	5,330	26	N.A.	4,156	(3,234 - 5,562)	18	14	11	34	20	22	38,323	320,120	444	(363 - 537)	8	7	7	7
Tajikistan	803	15	442	619	(468 - 873)	9	20	5	4	66	5	9,690	78,354	97	(82 - 110)	15	12	6	14
Tanzania	4,857	19	3,582	9,404	(6,482 - 14,042)	21	53	7	5	29	6	51,035	464,028	12	(8 - 18)	7	5	8	6
Thailand	12,337	22	13,365	19,867	(14,779 - 24,943)	29	18	3	35	43	0	56,372	542,010	1,521	(1,276 - 1,828)	11	5	8	5
Timor-Leste	65	9	99	90	(49 - 134)	8	10	6	21	56	8	1,726	13,741	1	(1 - 2)	10	9	8	10
Togo	835	23	742	1,401	(966 - 1,733)	23	28	5	20	38	9	6,958	62,337	16	(13 - 20)	6	6	9	7
Tonga	10	11	6	12	(8 - 16)	11	20	8	4	59	8	148	1,207	0	(0 - 0)	11	11	9	10
Trinidad and Tobago	158	13	200	230	(170 - 295)	17	21	6	6	65	1	1,571	13,337	3	(1 - 5)	9	8	7	7
Tunisia	2,038	25	1,208	2,719	(1,880 - 3,317)	26	30	3	14	52	1	12,578	113,041	214	(181 - 255)	9	5	8	6
Turkey	8,022	15	5,253	5,810	(4,839 - 8,418)	8	19	3	8	68	3	63,339	520,623	2,402	(2,141 - 2,701)	9	9	8	10
Turkmenistan	704	19	N.A.	704	(487 - 1,118)	14	23	4	4	67	3	7,197	59,607	66	(55 - 75)	10	11	8	10
Uganda	3,185	18	2,954	7,365	(5,368 - 10,509)	22	54	10	7	24	5	37,368	332,414	30	(23 - 40)	5	4	9	5
Ukraine	12,059	23	6,116	8,007	(6,323 - 9,784)	18	37	7	5	47	5	49,729	431,242	4,272	(3,589 - 5,058)	11	10	9	10
United Arab Emirates	527	29	826	1,838	(1,128 - 2,654)	25	12	5	7	75	1	11,495	103,262	53	(45 - 62)	4	2	6	3
United Kingdom	5,526	10	1,905	3,710	(3,169 - 4,822)	6	24	5	16	54	1	45,987	376,369	3,384	(2,730 - 4,053)	12	10	9	11
United States	49,643	20	32,885	44,001	(36,199 - 53,473)	14	14	2	10	73	0	247,223	2,195,212	15,374	(12,643 - 18,263)	10	9	11	9
Uruguay	420	14	556	428	(332 - 514)	13	10	11	18	57	3	2,974	25,493	52	(26 - 84)	10	9	11	8
Uzbekistan	3,566	17	2,731	4,683	(3,598 - 6,555)	17	50	3	1	43	2	39,414	334,218	513	(448 - 582)	11	11	8	9
Vanuatu	19	13	4	35	(23 - 54)	14	16	8	7	61	8	332	2,776	0	(0 - 0)	9	8	9	8
Venezuela	4,696	24	7,714	7,616	(6,017 - 10,598)	26	33	8	12	45	2	25,149	240,924	150	(118 - 186)	8	5	11	5
Vietnam	9,146	14	11,859	16,371	(12,460 - 19,166)	19	13	7	58	15	7	249,726	2,034,092	607	(485 - 728)	8	5	6	6
Yemen	1,860	16	3,843	3,520	(2,003 - 5,220)	15	16	5	8	68	3	32,778	272,129	581	(486 - 710)	11	8	6	9
Zambia	2,276	29	1,348	2,798	(2,077 - 3,955)	21	53	8	5	30	4	14,883	131,637	4	(3 - 5)	9	6	9	6
Zimbabwe	1,453	14	1,777	3,527	(1,375 - 5,853)	28	11	10	31	11	38	10,477	96,577	2	(1 - 4)	10	8	9	8

Source: Global Road Safety Facility, The World Bank, Institute for Health Metrics and Evaluation, Transport for Health: The Global Burden of Disease from Motorised Road Transport (2014)

## Annex III. Valuation for Categories of Countries

### Summary

Country income category:	Low	Lower middle	Upper middle	High	All
Number of countries	33	49	47	49	178
<b>Current situation</b>					
Annual fatalities (per 100,000 pop)	128,000 (20.2)	494,000 (18.0)	509,000 (17.8)	94,000 (8.7)	1,225,000 * (18.1)
Annual fatalities and serious injuries (FSI)	1,408,000	5,434,000	5,599,000	1,034,000	13,640,000
Annual cost of FSI	\$20 billion (5% of GDP)	\$200 billion (5% of GDP)	\$780 billion (5% of GDP)	\$850 billion (2% of GDP)	\$1,860 billion (3% of GDP)
<b>What could be achieved</b>					
Improve 10% of roads	108,000 km	610,000 km	992,000 km	1,546,000 km	3,255,000 km
Build viable countermeasures	\$8 billion	\$61 billion	\$149 billion	\$464 billion	\$681 billion
Reduction in fatalities	384,000	1,483,000	1,528,000	283,000	3,678,000
Reduction in fatalities and serious injuries	4,224,000	16,313,000	16,808,000	3,113,000	40,458,000
Economic benefit	\$83 billion	\$663 billion	\$2,766 billion	\$2,202 billion	\$5,715 billion
Benefit cost ratio	11	11	19	5	8

Source: *The true cost of road crashes: valuing life and the cost of a serious injury*, Washington: International Road Assessment Programme, World Bank Global Road Safety Facility, Dahdah S, McMahon K. (2008)



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