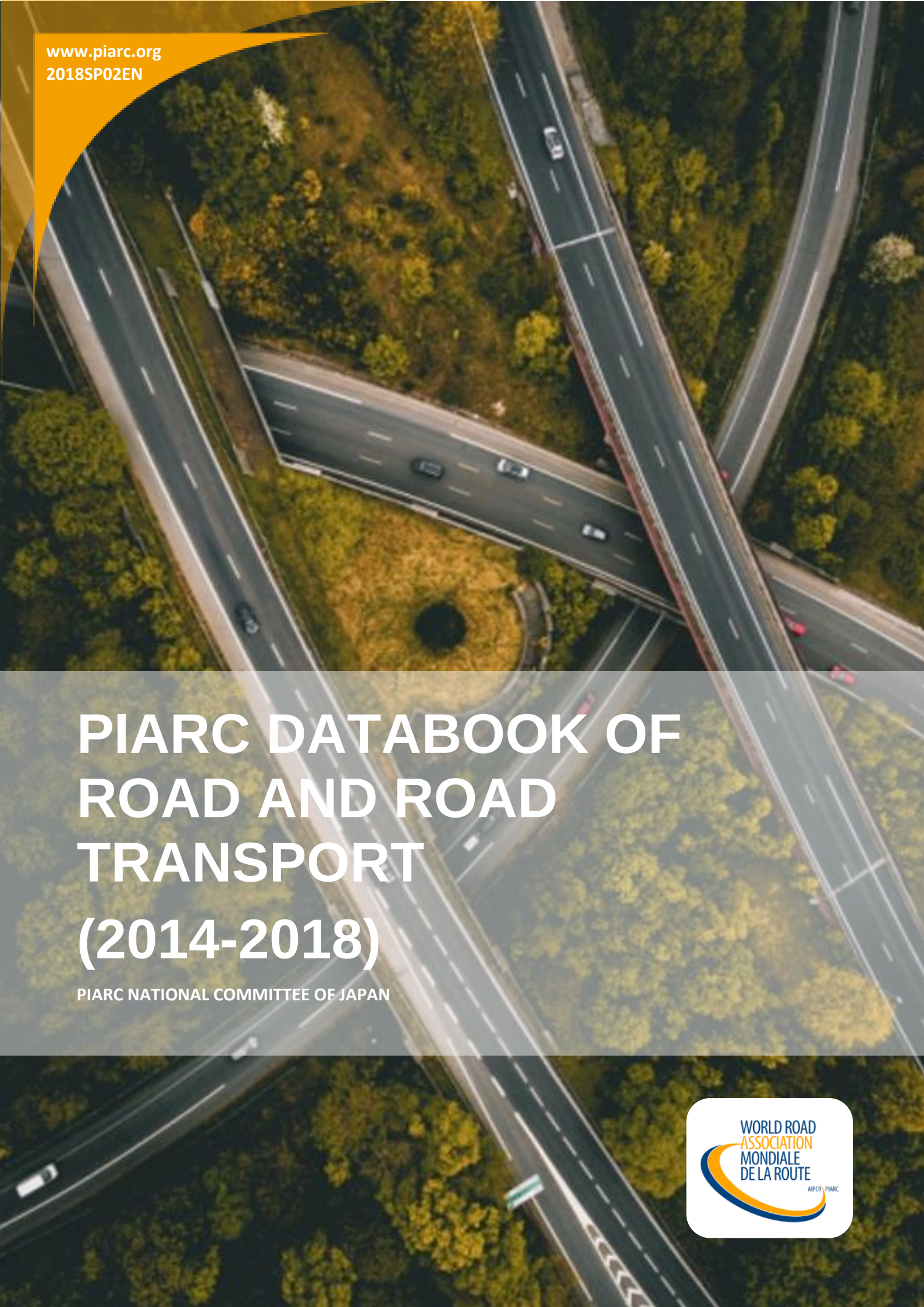
www.piarc.org
2018SP02EN



PIARC DATABOOK OF ROAD AND ROAD TRANSPORT (2014-2018)

PIARC NATIONAL COMMITTEE OF JAPAN

WORLD ROAD ASSOCIATION
MONDIALE DE LA ROUTE
AIPCR | PIARC

STATEMENTS

The World Road Association (PIARC) is a non-profit organisation established in 1909 to improve international co-operation and to foster progress in the field of roads and road transport.

Any opinions, findings, conclusions and recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of their parent organisations or agencies.

This report is available from the internet site of the World Road Association (PIARC): http://www.piarc.org

World Road Association (PIARC)

La Grande Arche, Paroi Sud, 5e étage, F-92055 La Défense cedex, France
International Standard Book Number: 978-2-84060-491-4

Frontcover © Japanese Road Association

PIARC DATABOOK OF ROAD AND ROAD TRANSPORT (2014-2018)

PIARC NATIONAL COMMITTEE OF JAPAN - CHAIRED BY SHIGERU KIKUKAWA

AUTHORS

Persons committed to the report:

Shigeru KIKUKAWA, Japan

Correspondents of PIARC Member Countries

Members of Working Group

Members of PIARC General Secretariat

Members of PIARC National Committee of Japan

PREFACE

Currently road administrations of many countries face austerities and have to tackle some difficult issues: investing on extension of road network, maintenance and rehabilitation of existing aged roads, prompt recovery of road operation from the damage caused by large-scale disasters, and creation of safe road space. They are requested to assess the importance of political measures and implement them adequately as well as effectively while carefully reviewing the present situation. Then it is critical to collect and analyse the statistics regarding road and road transport, and road administrators, especially engineers, are obliged to conduct quantitative research on and make an objective assessment of actions, in order of priority based on such data analysis.

Also we find it important to enable an international comparison of road statistics among the countries on the same definition and requirements, thereby allowing us to accurately gauge maturity of road and road transport of each country. Such data collection based on internationally uniform standard will lead to proper understanding of road network development, latest traffic situation, and traffic safety level of a country. Its road authority will accurately identify how developed its road and road transport are among the countries and what to do for further road development. In addition when political interventions are implemented, data provision will help us achieve consensus about their projects and facilitate communication between stakeholders. Figures are easy to understand and convincing, and they have to be presented by road administrations on any occasion if necessary.

Therefore, since 2014, PIARC Executive Committee has discussed how PIARC can produce its own international road statistics, and some pilot projects for its production were carried out.

PIARC consists of road administrations of 122 governments with their executives acting as First Delegates, and we will surely have the up-to-date data provided with enough accuracy from the reliable data source. Also our Technical Committee members of diversely academic and professional backgrounds will be able to

cooperate on extensive collection of many statistical data, and data provision as our own road statistics will help satisfy the needs of members, thereby raising the status of and adding the value to PIARC itself.

This report spells out details of our research and outcomes of some pilot projects, and the latest phase of “International Road Statistics of PIARC”, renamed as "PIARC Databook of Road and Road Transport", ready for dissemination, is included. We would like our first product to be further improved with more substantial data collection, by the initiative of the General Secretariat and the contribution from member countries, and we wish to have many readers benefit from this report anyway.

July 2018

Shigeru KIKUKAWA

Vice President of PIARC and Strategic Theme B Coordinator

President of PIARC National Committee of Japan

2018SP02EN

PIARC Databook of Road and Road Transport

The reliability and usability of statistics related to road and road transport should be carefully examined, and it is hoped that an international organization can take the initiative in disseminating the global road data with clear definition as well as consistency in order to avoid confusion among data users.

Probably only an international body with long history and organizational significance, such as PIARC, will be able to collect, maintain, and disseminate such road statistics because it has more than 120 governmental members which are expected to manage various figures up-to-date with enough accuracy. Actually there are some demands for road statistics to be managed by PIARC, and it is one of our missions to satisfy the needs of members, thereby raising the status of and adding the value to PIARC itself.

We expect that the goal of our road statistics is to create international Key Performance Indicators (KPIs) which represent the quality of road and road transport in each country. Although we have to start with a small set of data, through our continuous efforts we wish to realize the provision of such KPIs in wider areas, which then will become the global standard of measurement for road and road transport.

To achieve the goal there are three important factors as shown in the following:

· Selection of data which really suits the needs of the member countries and can offer enough comparability

· Clarification of data definition which is linked with data comparability and consistency

· Start with small number of data which quality can be ensured, and data source may be exploited from some selected countries.

After the PIARC road statistics is made available, we need to think of their maintenance and update. At the same time it is important to develop and upgrade

the data set by including the new items additionally. For example some data from Snow and Ice Data Book can be integrated into our road statistics, and collaboration with Technical Committees will help improvement of road statistics.

The work for further improvement and expansion can be undertaken by a small working group. It may need to be supported by the experts who volunteer to make efforts. And when a scheme of a permanent committee such as terminology is launched for the current or the next cycle, if this subject about road statistics falls within its scope, it would be of great help for further improvement.

Also dissemination of our knowledge base to current and potential members is of great importance. We may need to ask for aid of Communication Commission, and surely PIARC road statistics can be one of the flagship products in the future.

July 2018

Hirofumi OHNISHI

Former Strategic Theme Coordinator (Access and Mobility)

Associate member of PIARC Strategic Planning Commission

CONTENTS

1. Current situation of international road statistics 3
2. Objective of presentation of road statistics by PIARC 6
3. Past study results from the pilot project 8
   a. The 1st survey of the pilot project 8
   b. The 2nd survey of the pilot project 14
   c. Feedback from the pilot project 32
4. Production of latest phase of “International Road Statistics of PIARC” 35
   a. Selection of data items and clarification of their definition 35
   b. Surveying method 36
   c. Response to the survey 39
   d. Data aggregation and analysis 39
5. Conclusion 47

1. Current situation of international road statistics

In every nation, road administrations are struggling to draw up the financial plan for new road construction, countermeasures for aging roads, risk management and efficient use of existing assets, road safety improvements, etc. Therefore, road administrations are required to capture and assess extensive statistical data related to road and road transport with the aim of efficient budget allocation to each project and intervention, based on comparative and objective analyses. Statistics is principal information source which provides basic knowledge and facts on a variety of topics. As figures are always the most convincing evidence, accuracy and reliability of statistical data plays a pivotal role in generating in-depth and further discussion in an appropriate manner.

Actually there are some kinds of international road statistics made available. While analyzing them carefully and comprehensively, we expect that PIARC can produce its own road statistics which will satisfy the considerable and growing needs of data users.

It is probably not easy to regularly update the databook in the appropriate and responsible manner so that data preciseness and consistency are always maintained, and data publishers will have to shoulder the heavy burden of its survey and verification. Also data users are generally demanding, and it could be challenging to meet their increasing needs for data with accuracy and reliability.

Obviously PIARC has a long history since its establishment in 1909 and it has acquired organizational significance. Also PIARC brings together road administrations of more than 120 governmental members, and in the current strategic cycle (2016-2019) there are 17 Technical Committees and 5 Task Forces actively working in a variety of technical fields of road and road transport. All such activities related to PIARC must have amassed extensive and observational data. As a result such data storage and management capability of PIARC members will surely enable PIARC to edit its road databook on its own while benefiting data users of a variety of technical fields in terms of road and road transport.

In fact PIARC has already produced such a databook: the “Snow and Ice Databook”, mainly focused on winter service for road transportation. The data stored in the databook is accurate and reliable because it is collected by Technical Committee members consisting of professionals and experts of PIARC member countries. Many of them are dedicated to PIARC activities as representatives of road administrations of each country, and the same methodology can be adopted to produce the databook of the other technical areas as well.

Besides it is critical to compile some basic items of data for each country; such as length of road, traffic volume, number of accidents, etc. PIARC can then make the most use of its network of members of road administrations across the world while referring to some good examples of current road statistics such as TEN-T (Trans-European road Network - Transport) Performance Report published by the Conference of European Directors of Road (CEDR).

Looking at the data presented in the TEN-T report (2013), their definition for 3 road types: Motorway, Expressway, Ordinary is very simple and clearly mentioned.

Since TEN-T means a core transport network built on nine major corridors, TEN-T data does not correspond to that of PIARC road statistics which will be presented later in this report. For instance in terms of the length of Motorway for Austria, TEN-T (2013) indicates 1,667km while PIARC (2015) displaying 2,192km (refer to the 1st survey result of this report). Likewise, regarding the case of Germany, TEN-T (2013) shows 9,874km, and PIARC (2015) says 12,917km (also refer to the 2nd survey result of this report). Although the timing of data collection differs, we can easily guess that TEN-T does not cover the whole motorway network of a country, and the data is limited to the range of TEN-T.

Nevertheless we may be able to make the most use of TEN-T data for our road statistics because each European country seems to maintain enough data stock which enables road length of TEN-T to be displayed in accordance with number of lanes and type of structures (bridges and tunnels). There should be some room for collaboration with CEDR, and there is a practical possibility of sharing the data with some other international road statistics.

<CEDR definition of three road types>

Motorway: A road of two carriageways, separated by a physical barrier for most of its length. All crossings are normally grade separated. No stopping and usually a minimum speed. Access is generally restricted to certain types of vehicle.

Expressway: A national road or other high-speed road of one or two carriageways, with or without a physical barrier. Has some interaction with the normal network through high-quality interchanges (grade separated, at grade, roundabouts, etc.).

Ordinary: All other roads

2. Objective of presentation of road statistics by PIARC

As was repeatedly stated in the last pages, the reliability and usability of statistics related to road and road transport should be carefully examined, and it is hoped that an international organization can take the initiative in disseminating the global road data with clear definition as well as consistency in order to avoid confusion among data users.

Probably only the international body with long history and organizational significance, which is PIARC, will be able to collect, maintain, and disseminate such road statistics because it has more than 120 governmental members which are expected to manage various figures up-to-date with enough accuracy that should be distinctive from the other road statistics. Actually there are some demands for road statistics to be managed by PIARC, and it is one of our missions to satisfy the needs of members, thereby raising the status of and adding the value to PIARC itself. Also PIARC members are among heavy data users. Members of Technical Committees often need the dataset to conduct a statistical and comparative analysis whose result will be demonstrated in their technical reports. Improvement of data quality leads to improvement of quality of PIARC products as well.

Since the SPC meeting in Santiago 2014, we started to study the feasibility of road statistics while collecting some sensible advice from members. Some items of data were initially selected throughout the discussion among a small working group. The structure of a draft set of data was based on two parts: “Basic data” consists of fundamental country facts, and “Road data” focuses on the items related to road and road transport. Because of the initial approach to road statistics, only the items whose collection seems facile and straightforward were selected, and further developments might take place after discussion and examination.

TABLE 1 - Sample dataset for PIARC road statistics

Item			No.	Definitions
(1) Basic data	Surface area		1	
	Population		2	
	GDP		3	IMF World Economic Outlook Databases
	Unit			Millions or Billions
	Currency			US dollar or Euros
	Economic growth rate		4	IMF World Economic Outlook Databases
(2) Road data	Length by category (km)	Motorway (Expressway)	5	
		National (Federal) road	6	
		District (Prefectural) road	7	
		Municipal (Counrty) road	8	
		Total	9	
	Number of vehicles	Passenger vehicles	10	
		HGVs (Heavy Goods Vehicles)	11	
		Busses	12	
	License	No. of driver's license holders	13	
	Pavement	Paved ratio (%)	14	
	Safety	No. of fatal accidents	15	
		No. of injured accidents	16	
		Maximum speed limit (km/h)	17	
	Winter service	Annual amount of brine (ton)	18	

This set of data was the result of our initial study and looked very simple, but it finally required some amendments before starting pilot project to clarify the definition of each item, for example, what is the motorway considered in light of the international standards. The pilot project, whose details are spelled out in the latter chapters, could convince us to understand the significance of international road statistics as well as the difficulty to produce it.

3. Past study results from the pilot project

a. The 1st survey of the pilot project

In spring 2015 we somehow launched the pilot project focused on a limited number of items for road statistics whilst collecting the data from some member countries: France, Japan, Austria, Chile, Korea, Mexico, and the U.S. The collected items of data, carefully selected in discussion with France and Secretary General, were

(1) Road length by road type with definition,

(2) Number of vehicle in use with definition,

(3) Characteristics of road (no. of lane, design speed, speed limit),

(4) Road length by pavement and road type (paved ratio).

Through this 1st survey, we attempted to find how each country classified and defined its roads and vehicles whilst getting the latest figure of each relevant data, and then we presented the tables and the graphical images of our road statistics which would be distinctive and better for visualization.

Table 2 summarizes road type classification from this survey. Actually, it was found that the definition of each road type varies in country, and it was difficult from this survey result to group into the classes according to a common standard such as total road width, with/without legal definition, etc. Here we managed to classify into three, “Motorway”, “Principal arterial”, and “Others”, but this classification needed to be clarified for better definition and more reliability.

Table 2. Road type classification

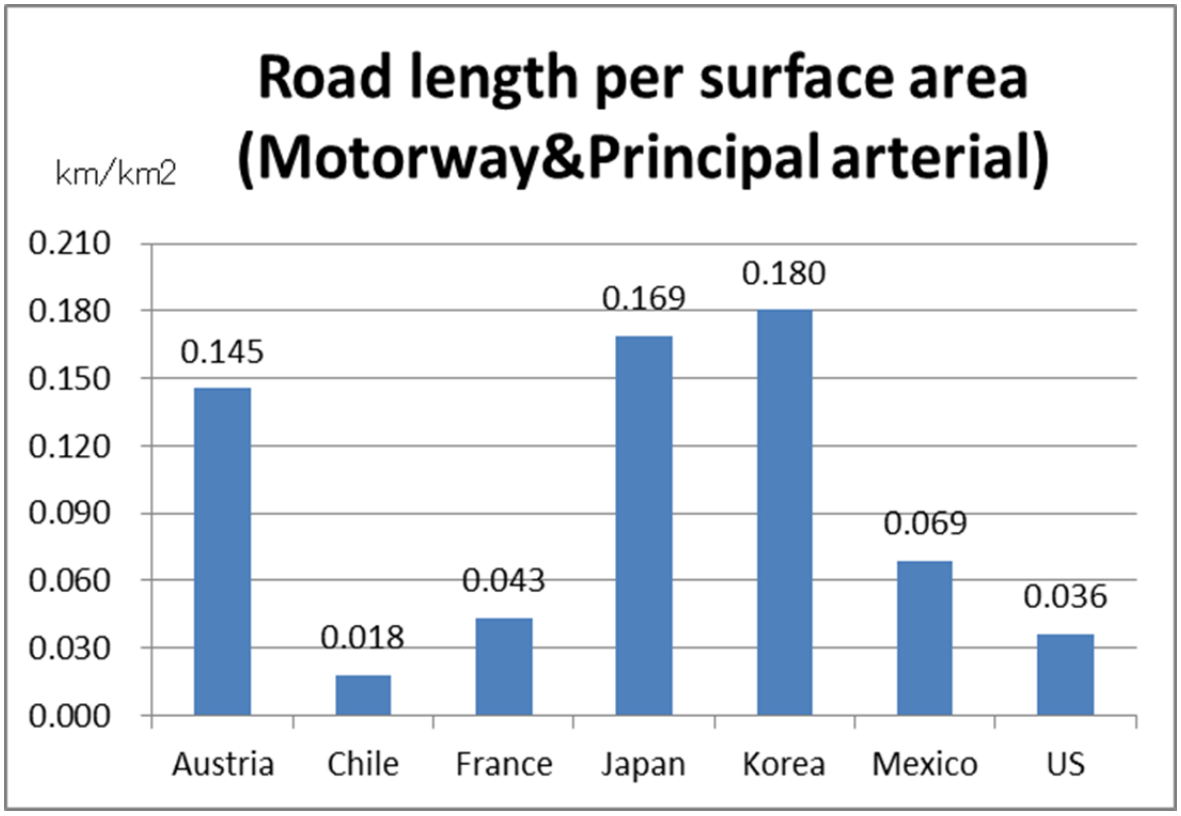
Country	Motorways		Principal Arterial	Others			
Austria	Motorway	Expressway	Secondary roads B	Secondary roads L		Municipal roads	
Chile	Autorrutas Concesionadas		Nacionales	Regionales Principales	Regionales Provinciales	Regionales Comunales	Regionales de Acceso
France	Autoroutes		Routes nationales	Routes dé partementales		Voies communales	
Japan	Expressways		Ordinary National Highways	Prefectural roads		Municipal roads	
Korea	National Expressway		National Highway	Special/ Metropolitan City road	Provincial road	Si/Gun road	
Mexico	Carretera Truncal Federal (Cuota)	Carretera Truncal Federal (libres)	Carretera Alimentadiras Estatales	Caminos Rurales		Brechas Mejoradas	
U.S.	Interstate	Other Freeways and Expressways	Other Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local

Here this is one of our outputs from this survey. Table 3 shows road length in type for each country.

Table 3. Road length in type for each country (As of 2014)

	Motorway	Principal arterial	Other roads	Total
Austria	2,192	9,997	112,399	124,588
Chile	2,232	11,308	66,354	77,801
France	12,750	10,930	1,021,000	1,044,680
Japan	83,58	55,432	1,153,337	1,217,128
Korea	4,139	13,950	87,944	106,033
Mexico	49,986	85,076	243,861	378,923
US	103,567	253,242	1,690,863	6,650,056
	km	km	km	km

The next two figures indicate graphically visualized status of Table3 combined with basic data: surface area of each country. The visualization of collected data in PIARC road statistics helps better understand the situation of road and road transport of each country and make a comparative analysis of the result, thereby highlighting our distinctiveness and usability as an international databook.



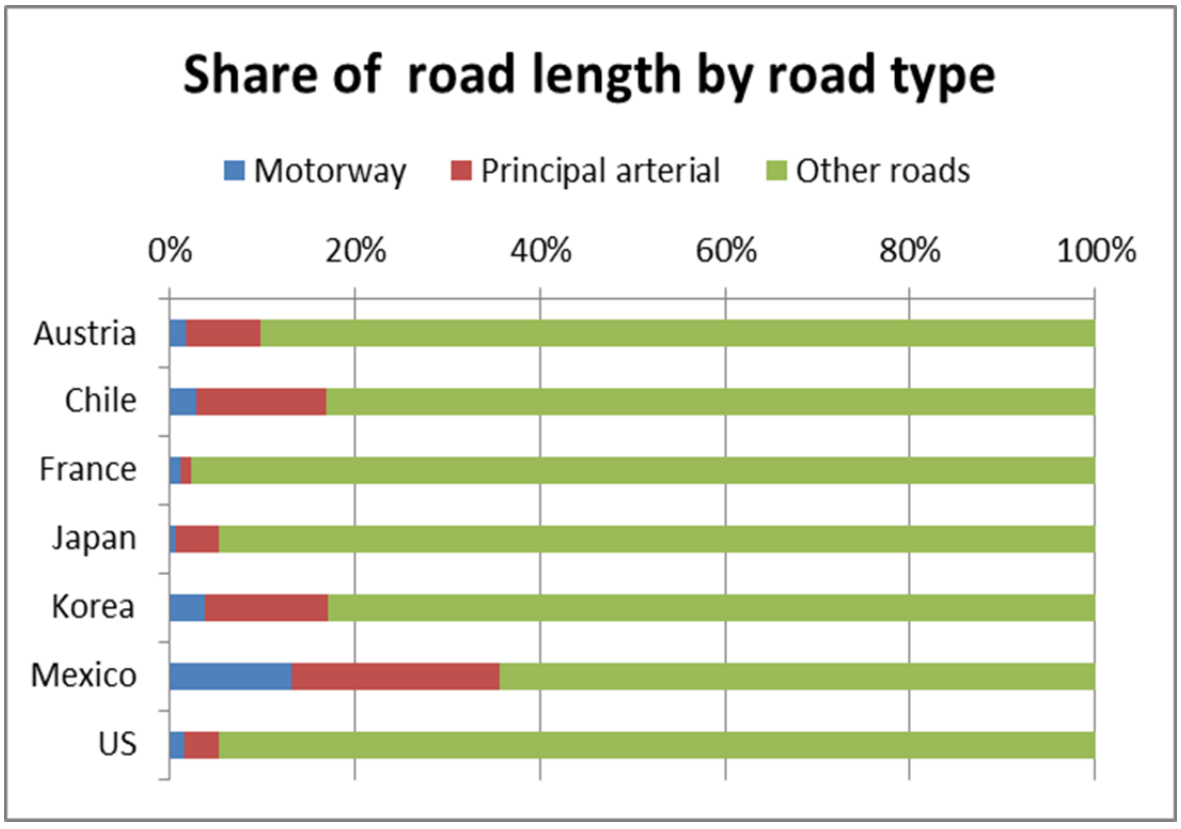


Figure 1.(above) Share of road length by road type

Figure 2.(below) Road length per surface area for Motorways and Principal arterial

In terms of characteristics of road, we collected the data about a few aspects. One of them was number of lanes, and Figure3 is the example of range of number of lanes for Motorway based on our definition.

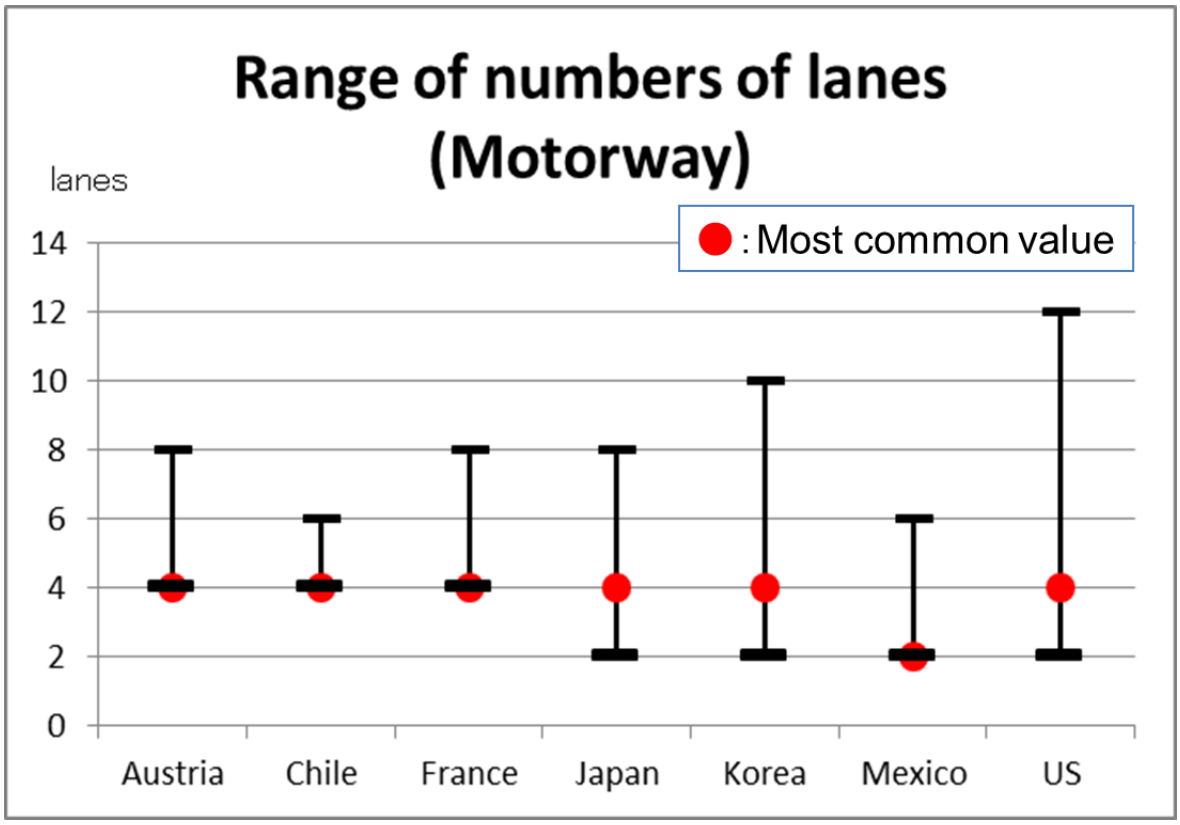
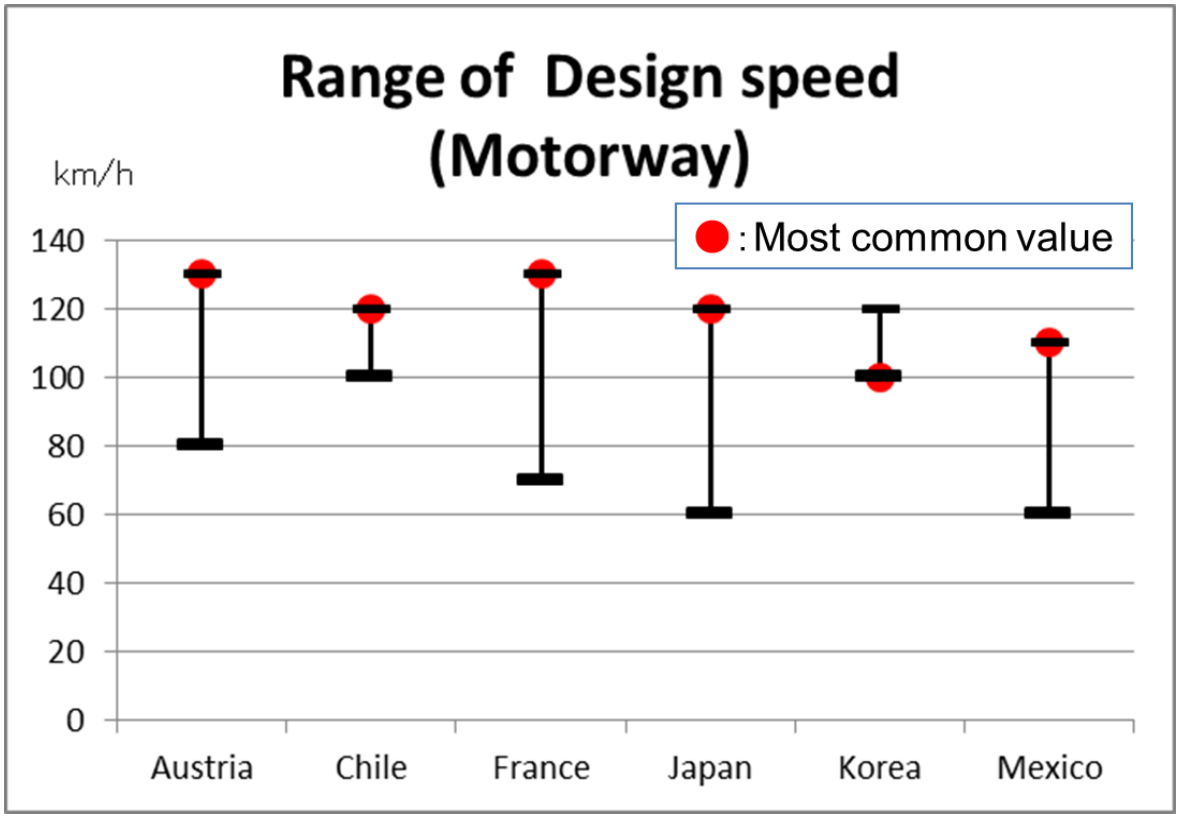


Figure3. Range of number of lanes in Motorway

In addition, range of design speed and that of speed limit for Motorway is provided in Figures 4 and 5. One of interesting findings from these figures is that most common value of speed limit in Japan (100km/h) is more conservative than that of design speed (120km/h), unlike the other 4 countries; Austria, Chile, France and Mexico. Road design specifications in Japan may become unnecessarily strict because they do not correspond to the actual legal traffic regulation, and this fact may be interpreted by the Japanese national characteristic: cautiousness, carefulness, etc.



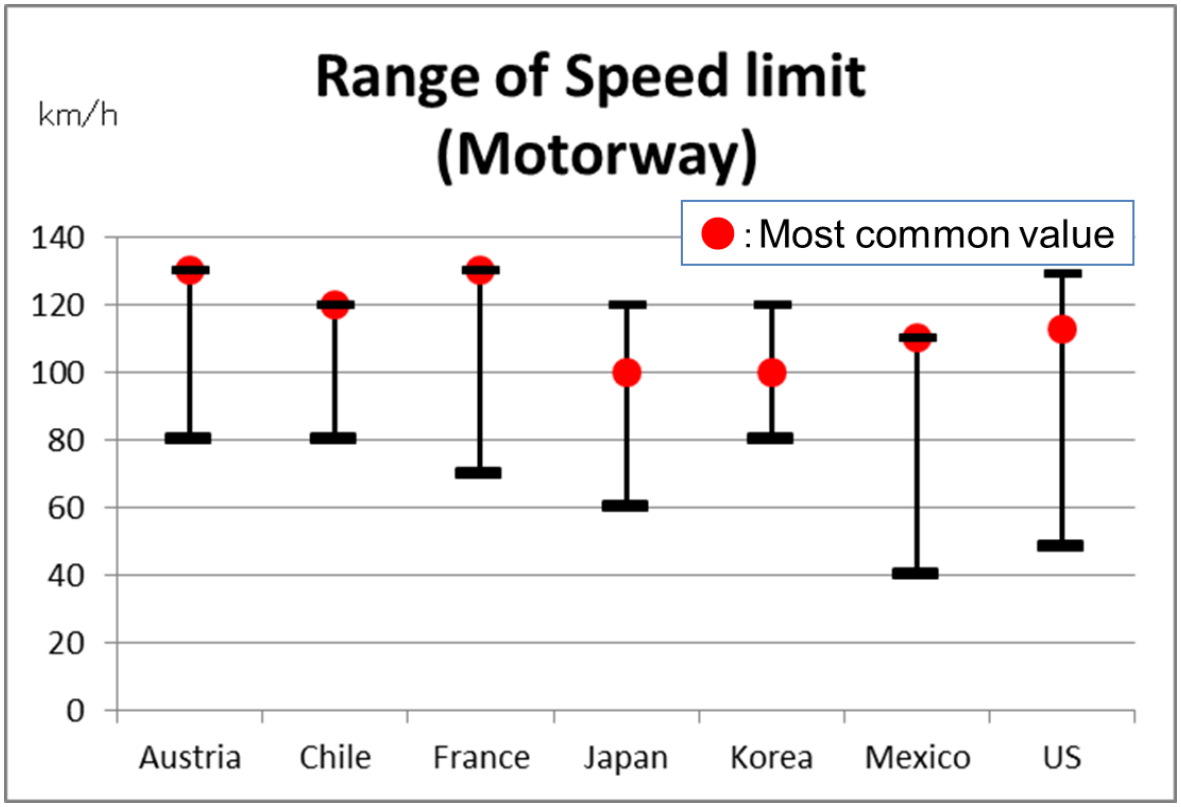


Figure4. (above) Range of design speed in Motorway

Figure5. (below) Range of speed limit in Motorway

We also collected the data about pavement. Table 4 shows paved ratio for each country. Looking at the result, we recognized that the paved ratio of some countries varies significantly in road type (in general most of high standard roads are paved and others are unpaved). Probably this tendency will be marked in developing countries, and the paved ratio will also be affected by the definition of roads.

Also, according to the survey, we recognized that there are two major types of pavement: asphalt and concrete. Actually there are the other types of pavement for paved roads, and what is more, the definition of “paved roads” may be ambiguous.

For example, one country can say that gravel roads are paved, but another may claim no. This kind of ambiguity needs to be examined from the data collected, especially from developing countries, and we will continue to study this case in order that the data of pavement will be incorporated into our statistics with clearer definition.

Table 4. Paved ratio in road type for each country

	Motorway	Principal arterial	Other roads	Total
Austria	100	100	100	100
Chile	100	80	15	25
France	100	100	100	100
Japan	100	99	80	81
Korea	100	100	96	97
Mexico	100	93	8	39
US	100	100	64	66
	%	%	%	%

b. The 2nd survey of the pilot project

The course of actions of the 1st survey was favorably reacted in the Executive Committee (ExCom) in Seoul November 2015, and the feedback was obtained from the result of the survey.

Firstly we could synthesize the various figures up-to-date which were collected from 7 ExCom member countries. Then we actually found the room for improvement aiming at more adequate and reasonable international comparison of road statistics, meaning that it was desirable to have much clearer definition and more accurate set of data. Also at this time we certainly entered the developmental stage to consolidate the ideas and opinions from ExCom member countries, thereby finalizing the initial set of data for the International Road Statistics of PIARC.

Following on from the result of the 1st survey, we conducted the 2nd survey of the pilot project for ExCom member countries. The main objective of this survey was to better clarify the definitions of road type as well as vehicle in use.

In the 1st survey we managed to classify the road type into 3 classes, and considering more information such as official definition, structure, administrator, etc, we attempted to divide the road type into 4 classes in a similar way for all countries. Likewise we tried to classify vehicle in use into 5 classes based on the same scale proposed while having classified it into 4 classes in the 1st survey.

In addition we acknowledged that it is critical to analyze the availability of the data which would be provided by ExCom member countries. For instance, suppose that we hope to make more detailed comparison, it is necessary to obtain the fractionalized data. On the other hand, however, some countries may not be able to provide such data as requested. Then we examined the possibility of data fractionalization in this survey. Through this 2nd survey we eventually expected to establish the classification of road type and vehicle in use based on our own definition for the International Road Statistics and aimed to enable more detailed international comparison.

Firstly considering the result of the past survey we found it reasonable to classify the road type into 4 classes as proposed in Table 5. Based on this proposition the survey was conducted to collect the official definition, the characteristics of each road type, etc. Some additional elements to better clarify each road type may be included in this classification depending on the result of the survey, and the output is explained later.

Table 5. Proposed definition of each road type

Motorways: **Roads primarily intended to provide interurban long distance/express transport. In principle, motorways 1) have limited access, 2) are divided to two different directions, and 3) have grade separation with other roads, railways, etc.**
Principal Arterial: **High-standard roads (except motorway) or national highways primarily intended to provide interurban long distance transport.**
Arterial: **Roads primarily intended to provide interurban transport, or that connect motorways and principal arterial roads.**
Others: **Other roads primarily intended to provide local transport.**

Then in line with defined road type we collected the information about road characteristics such as most commonly used number of lanes and its range, and we attempted to obtain the fractionalized data in road length for each class of road type. Here we divided the class of number of lanes into 8 (refer to Table 6). Likewise most commonly used design speed and speed limit with their range were surveyed while the road length for 5 classes of speed limit checked. Here we did not need data fractionalization of design speed for each road type because it seemed difficult to identify some sectional design speeds with their evidence traced back, especially when the corresponding roads were aging.

Table 6. Proposed data classification (1)

Road type with definition								
4 classes in road length	Motorways		Principal Arterial		Arterial		Others	
Number of lanes in both directions for each road type								
Most Common	Most commonly used number of lanes							
Range	Minimum to Maximum							
8 classes in road length	1	2	3	4	5	6	7	8 over
Design speed and speed limit for each road type								
Most Common	Most commonly used design speed and speed limit							
Range	Minimum to Maximum							
5 classes in road length	Less than 40km/h	40-60km/h		60-80km/h		80-100km/h		100km/h over

Then the road width for each class of road type was confirmed here (refer to Table 7). This kind of information is very critical to avoid such misunderstanding as interpretation of roads which may include even any tiny footpaths. Here there are two classes shown; “Able to pass each other” and “Unable to pass each other”. Generally the road width of “Able to pass each other” is considered as 5 meters or more while each vehicle is moving, but there is no clear value threshold. It was necessary to discuss how reasonably we can define the width with which road is counted as “road” in our statistics. Also the presence of pavement with surface type was surveyed here for each class of road type in length.

Table 7. Proposed data classification (2)

Road width for each road type		
2 classes in road length	Able to pass each other	Unable to pass each other
Pavement for each road type		
2 classes in road length	Paved	Unpaved
Surface type	Asphalt, cement, gravel, etc	

Regarding the vehicle in use, there were 5 classes proposed; “Passenger cars”, “Freight vehicles”, “Buses”, “Other vehicles” and “Two wheelers”. Unlike the classification of road type, definition of each class was not specified before the survey. Rather it was expected that the survey result would indicate certain level of common definition of each vehicle in use, and the output is explained later. Table 8 is the example of classification of Austria.

Table 8. Proposed vehicle in use classification (example of Austria)

Vehicle in Use	Definition of each class (example of Austria)
Passenger cars:	- **Seating capacity 8 or less (excluding driver)** - **Passenger use**
Freight vehicles:	- **Freight use**
Buses:	- **Seating capacity 8 or more (excluding driver)** - **Passenger use**
Other vehicles:	- **Tractors, drivable work machines, harvesters, campers, trailers, etc.**
Two wheelers:	- **Motorcycles with 2 or more wheels**

Table 9 shows the category of road defined as “Motorway” of each country, its compatibility with proposed definition of “Motorway”, and its administrator for each country. “○” means that proposed definition of “Motorway” is almost compatible with that of each country.

Table 9. Survey result of road type classification (1)

Country	Defined as "Motorway"	Compatibility with proposed definition	Administrator
Austria	Motorway, Expressway	○	ASFINAG
Argentina	National, Provincial, Semi-National & Provincial Highways	○ (National & Provincial)	Ministry National & Provincial Road Agency
Chile	Concession expressways	○	Ministry & Concession
France	Autoroutes	○	Ministry & Concession
Germany	Autobahn	○	Federal & State government
Italy	Motorways (toll & free)	○	Ministry &Road Agency
Japan	Motorway	○	Ministry & Concession
Slovenia	Highways	○	Road Agency
US	Interstate, other freeways & expressways	○	State government

Table 10 shows the category of road defined as "Principal Arterial" of each country, its compatibility with proposed definition of "Principal Arterial" and its administrator for each country. "○" means that proposed definition of "Principal Arterial" is almost compatible with that of each country, and "△" indicates uncertain level of compatibility. "–" means no information.

For example looking at the case of Austria, "Secondary roads B" is defined as "Principal Arterial" because it is "used by the regional traffic" and "serves as a connection to the primary roads network". Judged from this information only, however, it is difficult to identify this road as providing interurban long distance transport as defined in the proposed definition.

Also in Latvia "Main roads" is defined as "Principal Arterial", but in the survey we did not have any other information than road administrator.

Table 10. Survey result of road type classification (2)

Country	Defined as "Principal Arterial"	Compatibility with proposed definition	Administrator
Austria	Secondary roads B	△	Provincial government
Argentina	National network main roads	○	Ministry National Road Agency
Chile	National roads	○	Ministry & Concession
Ecuador	Principal arterial	-	-
France	Routes nationales	-	Local authorities
Germany	Federal trunk roads	○	Federal & State government
Italy	Main suburban roads	-	Road Agency
Japan	Ordinary national roads	○	Ministry & local government
Latvia	Main roads	△	State government
Slovenia	Main roads (1st & 2nd class)	○	Road Agency
US	Other principal arterial	○	State government

Table 11 shows the category of road defined as "Arterial" of each country, its compatibility with proposed definition of "Arterial" and its administrator for each country. "○" means that proposed definition of "Arterial" is almost compatible with that of each country, and "△" indicates uncertain level of compatibility. "–" means no information.

Table 11. Survey result of road type classification (3)

Country	Defined as "Arterial"	Compatibility with proposed definition	Administrator
Austria	Secondary roads L	△	Provincial government
Argentina	Urban national, National (Provincial) arterial paved	○	Ministry National & Provincial Road Agency
Chile	Principal (Provincial) regional roads	○	Ministry & Concession
Ecuador	Arterial	-	-
France	Routes departmentales	-	Departmental authorities
Germany	State and country roads	○	State government
Italy	Secondary suburban roads	-	Regional & country government
Japan	Prefectural roads	○	Prefectural government
Latvia	Regional roads	○	State government
Slovenia	Regional roads (1st & 2nd & 3rd class)	○	Road Agency
US	Minor arterial, Major (Minor) collector	○	State government

From here some survey results of data classification are presented. Figure6 is the example of the comparison by the detailed data of "Motorway". Looking at this graph, there is a certain share of 2-lane "Motorway" in some countries. If we wish to make a comparison of "Motorway" with 4 or more lanes, excluding 2 lanes or less, the data fractionalization enables us to conduct a comparative analysis of "Motorway" in line with functional level of service. Likewise it becomes possible to adopt a different approach to comparison of "Motorway" in terms of speed limit (refer to Figure7). Since "Motorway" is normally regarded as the road allowing higher speed limit, the share of speed limit, for example, less than 80km/h, can be excluded, and we can make a comparison of each country from the perspective of operational level of service.

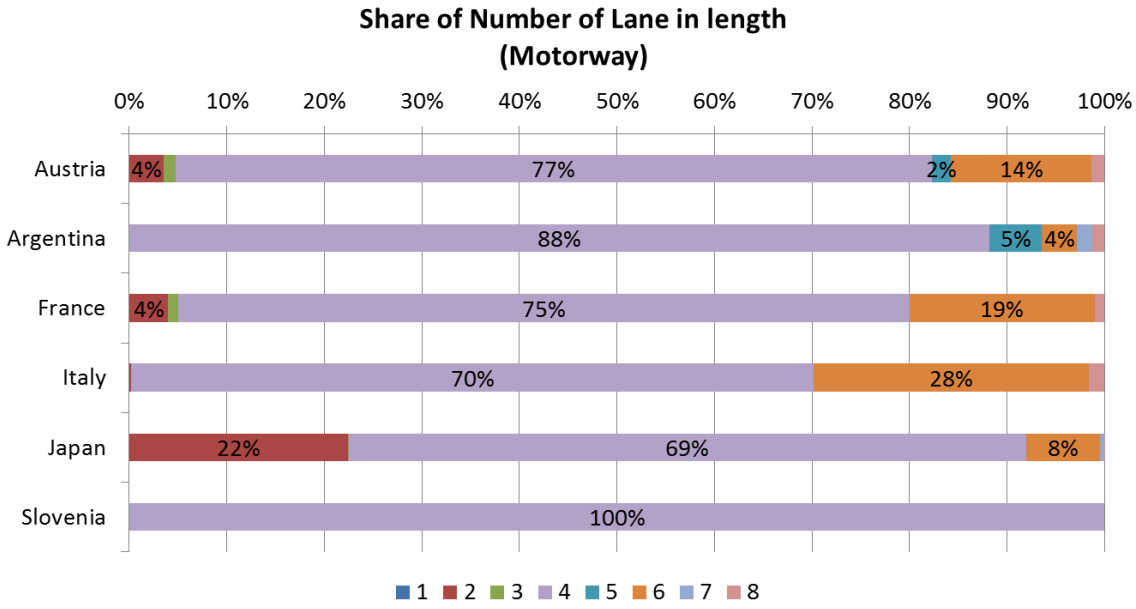


Figure 6. Share of number of lane in length (Motorway)

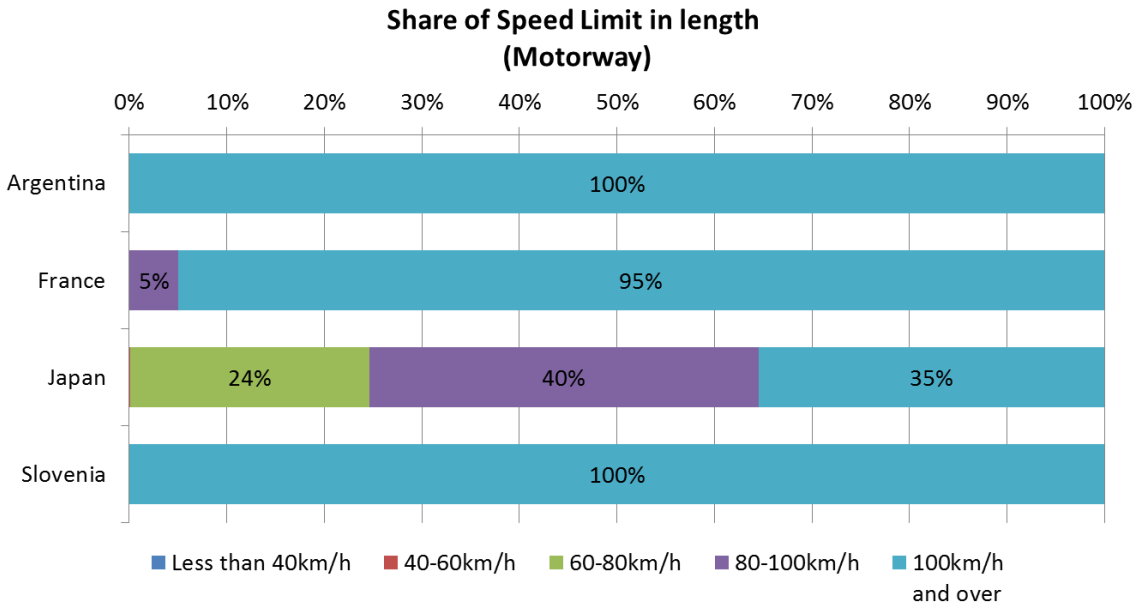


Figure 7. Share of speed limit in length (Motorway)

Figure 8 indicates the share of “Passable” and “Unpassable” in length for “Arterial”. In three countries there are certain percentage of “Unpassable” identified, and how reasonably we can define “Passable” and “Unpassable” needs discussion.

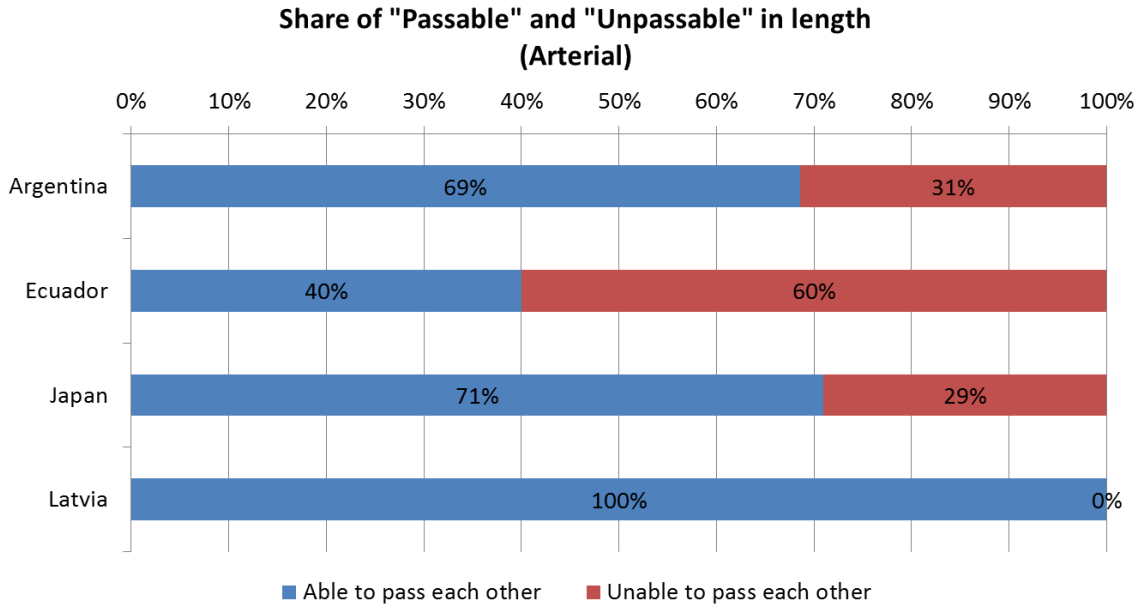


Figure 8. Share of "Passable" and "Unpassable" in length (Arterial)

Here the result of the 2nd survey based on the answers from ExCom member countries is summarized.

Looking at official definition and characteristics of each road type, proposed definition of "Motorway" seems to almost conform with the highest standard of road of each member country. As linked with data classification, however, it looks like more reasonable to fractionalize the data of "Motorway" because level of service varies in country, as exemplified in the previous page.

Regarding "Principal Arterial" and "Arterial", it seems difficult to clearly differentiate them equal for each country, and it may be wise for better classification to consider the category of its administrator, rather than road function or structure. "Others" can be treated as those isolated from the other higher classified roads and designed mainly for local transport, but it is necessary to examine the definition of roads with enough width. As the data varies significantly depending on the definition of road itself, especially in "Others", it is necessary to discuss how reasonably we can define the width with which road is counted as "road" in our statistics.

Although some countries struggled to collect the detailed data in road length for each road type in accordance with number of lane and speed limit, fractionalized

data in road length can be reflective of the actual level of service of road type, which leads to better international comparison of each country.

Then each road type basically accommodates enough wide lane (s), and as was explained, it is critical to consider how reasonably we can define “enough” width with which we can count as roads and also avoid counting such tiny footways that should not be counted as roads. Also presence of pavement and pavement type are virtually confirmed.

Regarding the definition and classification of vehicle in use, the answers from each country are tabulated from Table 12 to 15.

As shown in these tables we found it difficult to clearly classify each vehicle in use in the same manner because the degree of preciseness of each definition varies in countries; for instance South Korea, Slovenia and United States define each vehicle in use very precisely while some other countries provide relatively loose definition. Also looking at “Other vehicles”, they diversely include different kinds of vehicles depending on countries; trailer, light-loaded vehicle, emergency vehicle, etc. From this result obtained, it may be wise to exclude “Other vehicles” from classification and allocate them to the other types of vehicle in use.

Table 12. Survey result of vehicle in use classification (1)

	Passenger cars	Freight vehicles	Buses	Other vehicles	Two wheelers
Austria	- Seating capacity 8 or less (excluding driver) - Passenger use	- Freight use	- Seating capacity 8 or more (excluding driver) - Passenger use	- Tractors, Drivable work machines, Harvesters, Campers, Trailers etc.	- Motorcycles with 2 or more wheels
Argentina	Seating capacity 6 or less - Passenger use	Freight use	Seating capacity 10 or more - Passenger use.	Light vehicles load (up to 600 kg)	motorcycles
Chile	Automobiles, station wagons, jeeps, vans, minibuses and pick ups, for private use. Taxis, collective taxis, tourism taxis and similar vehicles for rent	It includes trucks single and articulated, agricultural tractors, other trucks and specialized self-propelled machinery.	It includes buses, minibuses, school buses, buses, or buses for transport of workers.	It includes self-propelled home trailers, non motorized trailers (up to 1.750 kg), drawing trucks (up to 1.750 kg) and other non motorized vehicles	It includes motorcycles and all motorized two wheelers.
France	Motor vehicle designed for transport of passengers, four wheels at least, with a maximum of eight seats in addition to the driver's seat and whose authorized loaded weight (PTAC) do not exceed 3,5 tons	A road vehicle whose authorized loaded weight (PTAC) exceeds 3,5 tons and designed for the transport of freight	A road vehicle whose authorized loaded weight (PTAC) exceeds 3,5 tons and designed for the transport of passengers	Light commercial vehicles: A road commercial carriage vehicle whose authorized loaded weight do not exceed 3,5 tons	
Germany	EU-legislation	EU-legislation	EU-legislation	EU-legislation	EU-legislation
Italy	As far as concerns the classification for tolled motorways this class involves: Motorcycles with cilynder capacity greater than 150 cc; all tourist vehicles, caravans and coaches, whose height measured to the first axle is less than 1.3 m. For other roads	As far as concerns the classification for tolled motorways this class involves: all vehicles for goods transport, other types of self-propelled vehicles and similar, whose height measured to the first axle is greater than 1.3 m. For other roads	large motor vehicles for passenger transport	Emergency vehicles? Special vehicles?	Bikes, motorbikes, moped, etc.
Japan	- Seating capacity 10 or less - Passenger use	- Freight use	- Seating capacity 11 or more - Passenger use	- Special use (Emergency vehicle, etc.)	- Two wheel
Latvia	For passenger use	For freight use	For passenger use	Trailers, quadricycles	Motorcycles, mopeds
Mexico	Four-Wheel Motor Vehicle that has a capacity of five persons, driver included	Motor Vehicle that consists of six or more tires designed for cargo transportation whose GVW is grater than 4 tons	Motor Vehicle that consists of six or more tires, made up of either integral or conventional structure and a capacity of at least 30 seats		Motor Vehicle with two tires lineally arranged

Table 13. Survey result of vehicle in use classification (2)

		Passenger cars	Freight vehicles	Buses	Two wheelers
South Korea	Sub compact	vehicles with an engine displacement of less than 1,000cc and dimensions of less than 3.6m in length, 1.6m in width and 2.0m in height	vehicles with an engine displacement of less than 1,000cc and dimensions of less than 3.6m in length, 1.6m in width and 2.0m in height	vehicles with an engine displacement of less than 1,000cc and dimensions of less than 3.6m in length, 1.6m in width and 2.0m in height	vehicles with an engine displacement of less than 1,000cc and dimensions of less than 3.6m in length, 1.6m in width and 2.0m in height
	Compact	vehicles with an engine displacement of less than 1,600cc and dimensions of less than 4.7m in length, 1.7m in width and 2.0m in height	vehicles with a room for 15 persons or less and dimensions of less than 4.7m in length, 1.7m in width and 2.0m in height	Vehicles with a maximum payload capacity of 1t or less and a total weight of 3.5t or less	Vehicles with a total weight of 3.5t or less
	Mid-size	Vehicles with engine displacement of 1,600 – 2000cc, or with the minimum dimension (either length, width or height) exceeding that of compact cars	Vehicles with a room for 16 to 35 persons, or with the minimum dimension (either length, width or height) exceeding that of compact cars and the length less than 9 m	Vehicles with a maximum payload capacity of between over 1t and below 5t, or a total weight of less than 10t	Vehicles with a total weight of between over 3.5t and below 10t
	Large	Vehicles with engine displacement of 2000cc or higher, or with the minimum dimensions (length, width and height) exceeding those of compact cars	Vehicles with a room for 16 to 35 persons, or with the minimum dimension (either length, width or height) exceeding that of compact cars and the length less than 9 m	Vehicles with a maximum payload capacity of 5t or higher, or a total weight of 10t or more	Vehicles with a total weight of 10t or more

Table 14. Survey result of vehicle in use classification (3)

	Passenger cars	Freight vehicles	Buses	Other vehicles	Two wheelers
Slovenia	Motorized vehicles with at least 4 wheels, intended for passenger transport with 8 seats at the most besides the driver's seat.	Motorized vehicles with at least 4 wheels, intended for freight transport. Freight vehicles are further categorized according to the total mass of the vehicle, ranging from below 3,5 tonnes to over 12 tonnes	Motorized vehicles, intended for passenger transport with more than 8 seats beside driver's seat. Buses are further divided according to the mass of the vehicle, ranging from up to max. 5 tonnes and over 5 tonnes	Other vehicles in Slovenia are further divided into different categories, such as: working vehicles, trailers, tractors and various tractor attachments, etc.	Motorized vehicle with two wheels. Motorwheelers are further divided according to the motor volume and end speed. Motorwheelers are thus ranging from below 50 cm3 and end speed less than 45 km/h and to over 50 cm3 and end speed over 45 km/h.

Table 15. Survey result of vehicle in use classification (4)

	Passenger cars	Freight vehicles	Buses	Two wheelers
United States	Sedans, station wagons, pickups, jeeps, SUVs, including taxicabs, rentals, ambulances and hearses. Any four or more wheeled passenger vehicles with a maximum GVW less than 10,000 lbs.	Freight vehicles are broken down into two types: Single-Unit. Single-unit means that a single frame supports both the power and the cargo carrying portions of a vehicle. Single-unit trucks exceeding 10,000 pounds maximum Gross Vehicle Weight (GVW). Single-unit trucks may cover all refuse collection trucks, neighborhood delivery trucks, camping and recreational vehicles, and motor homes. Single-unit trucks should also include farm trucks of at least 10,000 pounds GVW that are operable on all public roads. Truck Tractors. Truck tractors refer to vehicles possessing only a power unit. Truck tractors do not have cargo-carrying capacity through its own frame. It is used to pull trailers and other vehicles. Farm truck tractors should also be reported here unless a state restricts its operation on all public roads.	Vehicles with a capacity to carry 15 or more passengers.	Motorcycles are defined as vehicles with or without enclosures possessing the following characteristics: ◦ Two or three wheels in contact with the ground (excluding trailers suitable for motorcycle hauling); ◦ A seat or saddle for driver and passengers; and ◦ Wheel rim diameters 10 inches or more.

Summarizing the survey result of vehicle in use, firstly each country has its own definition of vehicle in use, and we found it difficult to fairly provide the definition of each vehicle type in a similar manner equal for all countries. While clarifying and respecting the definition given by each country, it may be wise to exclude “Others” from classification and allocate them to the other classes to make classification simpler.

Based on the survey result with several considerations, we could propose the developed definition of road type here (refer to Table 16). Firstly, as proposed in the 2nd survey, we defined 4 road types and consider some additional information, such as road width and road administrator.

Based on our definition we regarded each road type as “enough wide” for both directional traffic to pass each other. On the other hand, however, it may be claimed that “enough wide” is regarded as that for only one directional traffic to pass, especially in developing countries. Both definitions may be applied in accordance with each road type (for example “Motorway”, “Principal Arterial” and “Arterial” are defined as the former definition (enough wide for both directional traffic) while

"Others" as the latter (enough wide for one directional traffic)), so the validity of this definition may need some more discussion.

Also the category of the road administrator was included in our definition, and for example "Arterial" are in general managed by regional government for interurban transport, and "Others" are by local government for local transport.

Secondly we attempted to divide "Motorway" by level of service, such as number of lane & speed limit and most common value and range (min to max), as indicated in Table 17. As we recognized the difficulty of data collection for road length in line with number of lane and speed limit, the information about typical value with its range could be a substitute.

Table 16. Proposition of developed definition of road type classification (1)

Motorways: **Roads primarily intended to provide interurban long distance/express transport. In principle, motorways 1) have limited access, 2) are divided to two different directions, and 3) have grade separation with other roads, railways, etc. In general managed by government and authorized road agency**
Principal Arterial: **High-standard roads (except motorways) or national highways primarily intended to provide interurban long distance transport. Enough road width and in general managed by government and authorized road agency.**
Arterial: **Roads primarily intended to provide interurban transport, or that connect motorways and principal arterial roads. Enough road width and in general managed by regional government.**
Others: **Other roads primarily intended to provide local transport. Enough road width and in general managed by local government.**

Table 17. Proposition of developed definition of road type classification (2)

Number of lanes in both directions for "Motorway"								
Most Common	Most commonly used number of lanes							
Range	Minimum to Maximum							
8 classes in road length	1	2	3	4	5	6	7	8 over
Design speed and speed limit for "Motorway"								
Most Common	Most commonly used design speed and speed limit							
Range	Minimum to Maximum							
5 classes in road length	Less than 40km/h	40-60km/h	60-80km/h	80-100km/h	100km/h over			

If it is difficult to provide such detailed (fractionalized) data for "Motorway", it is acceptable to indicate the most common value with its range, and of course if some countries can provide the fractionalized data even for the other road types in a similar way, it is really welcomed and leads to better international comparison.

Table 18 summarizes the road length in road type for each country, based on our developed definition. The figures in red means the length of the road which is wide enough for the traffic to pass each other.

Looking at Argentina and Japan, for example, the road length in total becomes the one-fifth or quarter of the original data, and it is thought that figures based on our developed definition are more reflective of the real status of road network of each country.

Table 18. Road length by type based on developed definition (As of 2015)

Unit: Km

	Motorways	Principal Arterial	Arterial	Others	Total
Austria	2,192	9,997	23,640	88,759	124,588
Argentina	3,862	14,890 (13,628)	65,929 (45,196)	643,898 (84,422)	728,579 (146,748)
Chile	2,232	11,339	14,954	51,508	77,801
Ecuador	0	5,556 (2,222)	4,235 (1,693)	0	9,791 (5,556)
France	12,750	10,930	378,000	643,000	1,044,680
Germany	12,917	39,400	178,100	413,000	643,417
Italy	6,917	19,920	154,948	74,420	256,205
Japan	8,358	55,432 (51,489)	129,375 (91,844)	1,023,962 (192,049)	1,217,128 (343,740)
Latvia	0	1,675	5,473	66,444 (12,983)	73,592 (20,131)
Mexico	49,986	85,076	169,311	74,550	378,923
Slovenia	770	819	5,135	32,150	38,874
South Korea	4,139	13,950	38,212	49,733	106,033
United States	103,567	253,242	1,690,863	4,602,384	6,650,056

Also Figure 9 indicates the comparison of each country in terms of share of road length by road type. Each figure of this graph is also based on our developed definition, and compared with the original data, the share of “Others” in Japan is reduced by 28% (from 84 to 56%), and that of the other road types is increased significantly.

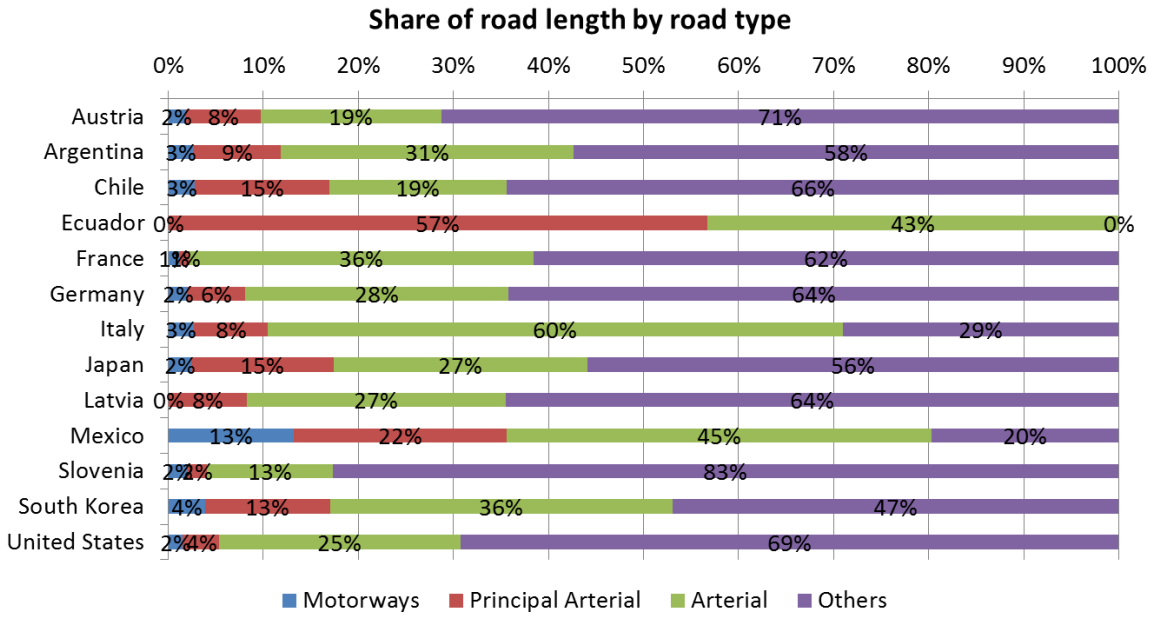


Figure 9. Share of road length by type based on developed definition

In terms of the proposition of developed definition of vehicle in use classification (refer to Table 19), considering the result of the 2nd survey, it was wise to place 4 classes of vehicle in use, excluding “Other vehicles” from classification, and allocate them to the other classes.

Also the definition of each class of vehicle in use was basically in line with that of each country, and it was desirable to have some pieces of information such as seating capacity, purpose of use, loaded weight etc. in order that we could eventually establish certain level of definition common to some countries. Regarding loaded weight, it may create division of “Freight vehicles” which will lead to more detailed classification and comparison of vehicle in use.

Table 19. Vehicle in use classification based on developed definition

Vehicle in Use	Definition of each type
Passenger cars:	- **Seating capacity** - **Passenger use**
Freight vehicles:	- **Freight use** - **Loaded weight (divided into some classes)**
Buses:	- **Seating capacity** - **Passenger use**
Other vehicles:	- **Tractors, drivable work machines, harvesters, campers, trailers, etc.**
Two wheelers:	- **Motorcycles with 2 wheels**

"Other vehicles" excluded but allocated to the other classes if possible
(Ex. Campers ⇒ "Passenger cars" ?)

Figure10 shows the share of vehicle in use by type for each country. With "Other vehicles" not excluded, there is a tendency that the share of "Passenger cars" is substantial, and in the United States, for example, "Freight vehicles" accounts for more than half.

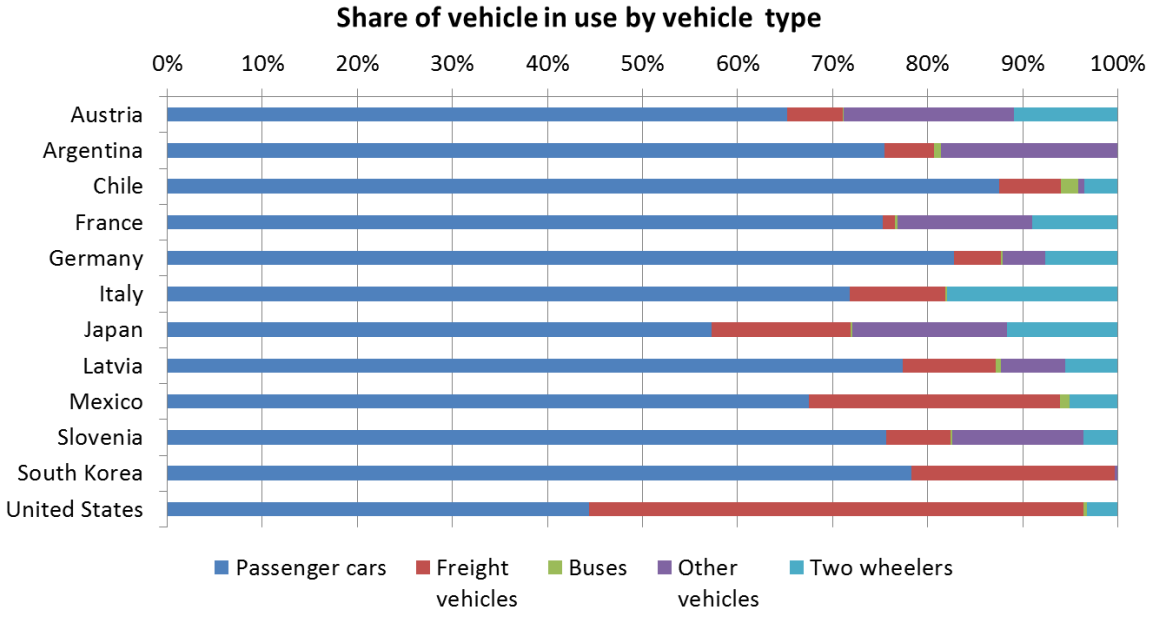


Figure 10. Share of vehicle in use by vehicle type based on developed definition

The standardized definition of road type and vehicle in use can create a variety of statistical outputs to enable a fair international comparison from many perspectives.

For example, combined with surface area, population, budget, we can show in our statistics the data such as

- Length of each road type per surface area
- Number of vehicle in use per population
- Maintenance cost per length for each road type
- No. of bridges (tunnels) per length of each road type

Especially when the fractionalized data for “Motorway” is made available, we can make more detailed statistical analysis for member countries.

In addition it becomes possible to subsequently extend the area of use of the collected data for management, mobility, traffic safety, infrastructure, environment and disaster, etc. For example, when you wish to know the share of road structures in length for each road type, combined with number and length of bridges and tunnels, we can make a fair comparison of each country in a similar way. It is also expected that our statistics collected from all member countries will be conducive to TC activities because all TCs usually treat basic road data relative to their topics.

c. Feedback from the pilot project

The feedback of the pilot project based on past two surveys was obtained from the discussion during the ExCom in Edinburgh spring 2016, and the main ideas are summarized in the following:

- Firstly we formed the Working Group to make further progress of the road statistics of PIARC. The members of the WG are listed in Table20.
- The second action is to select and start with a small number of simple data items of easy accessibility so that more countries will become involved.
- Thirdly it seems necessary to further investigate the cases of the existing road statistics currently made available in different regions.

Table 20. Members of Working Group (WG)

Country	Name of member (Associate)
Chile	Mr. José Miguel ORTEGA JULIO Mr. Miguel VALDES FLORES
Germany	Mr. Peter SCHMITZ
Japan	Mr. Shigeru KIKUKAWA and Mr. Hirofumi OHNISHI (Mr. Tomonobu TANINO and Mr. Takumi NISHIMURA)
Mexico:	Mr. Roberto AGUERREBERE (Mr. Hector BONILLA)
Slovenia	Mr. Bojan LEBEN (Mr. Bine PENGAL)
South Korea	Mr. Kang Hoon LEE (Mr. Insoo YEO and Ms. Won Jeong CHOI)
Tanzania	Mr. Joseph HAULE
United Kingdom	Mr. Roy BRANNEN (Mr. Justin WARD)
PIARC	General Secretariat

The first meeting of the WG was held in September 2016, and totally 7 members and their associates participated in discussion.

Although not all of us could join on-line discussion then, we came up with some thoughts and suggestions, and there were two key points to be considered for the next step.

Firstly, this is the initial stage of our road statistics, and therefore it is reasonable to **focus on "Motorway" and collect the data about road length**, if possible, in accordance with number of lanes, speed limit, etc. Also before data collection, the WG members will take the initiative in re-examining the definition of "Motorway" for several countries and conclude how PIARC reasonably defines "Motorway". In addition we were supposed to create/review the survey sheet which would be delivered to all member countries to produce our road statistics with clear and concise definition.

Secondly, regarding vehicle classification, **we take notice of four road types**; passenger cars, freight vehicles, buses and two wheelers. Such categorization was proposed in Edinburgh, but there were several issues to be considered (ex. Into what type is “Van”, “Camper”, etc. classified?), so we found it necessary to undertake further studies of how each member country categorizes its vehicles. In fact it was difficult to create a one-size-fits-all definition covering the needs from all member countries, so we eventually provided certain level of definition common to majority of member countries, allowing some exceptional classifications.

4. Production of latest phase of "International Road Statistics of PIARC"

a. Selection of data items and clarification of their definition

Based on the pilot project of two surveys and some discussions among WG members in a timely manner, we have finally decided to select two data items whose definition is clear: "Motorways" and "Vehicles in use". Their definitions are referred to Table21 and 22.

Regarding definition of motorways, there are three main check points for simple and clear definition, and urban motorways are treated differently. Also the category of the road administrator is finally excluded from this definition through our in-depth review.

Table 21. Definition of "Motorways" for PIARC road statistics

Motorways:
Roads primarily intended to provide interurban long distance/express transport. In principle, motorways **1) have limited access,** **2) are divided to two different directions, and** **3) have grade separation with other roads, railways, etc.** **Urban Motorways are not included in this definition, and they are treated differently.**

In terms of the definition of each vehicle type, our classification is almost equivalent to that of EU regulation and regarded as reasonable based on the result of the past two surveys of the pilot project.

Table 22. Definition of "Vehicles in use" for PIARC road statistics

Vehicle in Use	Definition of each class
Passenger cars	- Vehicles carrying passengers ▪ can be classified as passenger cars and buses
Freight vehicles	- Vehicles carrying goods ▪ can be classified as with light goods and heavy ones ▪ In Europe heavy goods vehicles hold gross vehicle weight over 3 500 kg
Motorcycles or Tricycles	- Vehicles with less than four wheels
Other vehicles	- Agricultural and forestry tractors and their trailers, special vehicles, etc.

b. Surveying method

Survey sheet with an official letter in three languages (English, French, and Spanish) was delivered by the General Secretariat on 30th May 2017 to the First Delegates of member countries. The survey sheet is structured as follows (refer to the following 2 pages), exemplified by an English version:

Question 1 Motorways

The objective of this survey is to study the length and definition of "Motorways" in member countries.
We have defined "Motorways" as follows, and please fill out the below form of cells coloured in blue.

	Definition
Motorways	Roads primarily intended to provide interurban long distance/express transport. In principle, motorways meet the following 3 structural conditions: 1) have limited access, 2) are divided to two different directions, and 3) have grade separation with other roads, railways, etc.

Q.1-1 Please present the official name and the latest length of "Motorways" of your country that fits into our definition. If there are more than one type of roads applicable to "Motorways" in your country, please provide their information in separate cells.

Year	**Motorways** (km)			
Year with the latest statistics				Total
				0

Note:
Please present the official name of "motorways" that fits into our definition.

Q.1-2 To check the equivalence of your "Motorways" to our definition, please answer the following three questions in terms of structural characteristics.

	Name of road	1) limited access (Yes / No)	2) divided to two different directions (Yes / No)	3) grade separation with other roads, railways (Yes / No)
Motorways				

Note:
Please present the official name of "motorways" that fits into our definition.

Q.1-3 Please present your official definition of "Motorways" and provide the information about legal documents specifying its definition, if any.

	Name of road	Official definition
Motorways		

Note:
Please present the official name of

In addition, some countries may define Urban Motorways different from "Motorways" or put it into one of your categories for roads.
If there is any defined data item for "Urban Motorways", please fill out the below form of cells likewise.
Unless "Urban Motorways" is distinguished from "Motorways", there is no need to answer the following questions.

Q.1-4 Please present the official name and the latest length of "Urban motorways" of your country. If there are more than one type of roads applicable to "Urban motorways" in your country, please provide their information in separate cells.

Year	**Urban Motorways** (km)			
Year with the latest statistics				Total
				0

Note:
Please present the official name of "urban motorways" that fits into our definition.

Q.1-5 Please present your official definition of "Urban Motorways" and provide the information about legal documents specifying its definition, if any.

	Name of road	Official definition
Urban Motorways		

Note:
Please present the official name of "urban motorways" that fits into our definition.

Please indicate the name of your data source for the above answers, and if it is made available online, provide us with its URL for our reference.

Source	
URL	

Question 2 Vehicles in Use

The objective of this survey is to study the number of and definition of vehicle in use in member countries.
We have defined four vehicle clasess as follows, and please fill out the below form of cells coloured in blue.

Class	Definition
Passenger cars	Vehicles carrying passengers -can be classified as passenger cars and buses
Freight vehicles	Vehicles carrying goods -can be classified as with light goods and heavy ones
Motorcycles or Tricycles	Vehicles with less than four wheels
Others	Agricultural and forestry tractors and their trailers, special vehicles, etc

Q.2-1 Please present the number of vehicles in use for the latest year in your country.

Thousands

Year with the latest statistics	**Passenger cars**	**Freight vehicles**	**Motorcycles or Tricycles**	**Others**	**Total**
					0

Q.2-2 As for "Passenger cars", if you can split into "Passenger cars" and "Buses", please provide us with the information about how you define them and each number of vehicles (present the name of official documents specifying its distinction if any). If not please skip to the next question.

For your reference, definition of vehicle classes may considerably differ between countries (e.g. weight, size, seating capacity, etc.).

Thousands

Class	Sub-Class	Definition	Number of vehicles
Passenger cars	**Passenger cars**		
	Buses		

Q.2-3 As for "Freight vehicles", if you can split into "Light goods vehicles" and "Heavy goods vehicles", please provide us with the information about how you define them and each number of vehicles (present the name of official documents specifying its distinction if any). If not please skip to the next question.

For your reference, definition of vehicle classes may considerably differ between countries (e.g. weight, size, seating capacity, etc.).
For instance, in Europe heavy goods vehicles hold gross vehicle weight over 3,500 kg while over 8,000 lbs in the U.S.

Thousands

Class	Sub-Class	Definition	Number of vehicles
Freight vehicles	**Light goods vehicles**		
	Heavy goods vehicles		

Please indicate the name of your data source and if it is made available online provide us with its URL for our confirmation.

Source	
URL	

Thank you for your cooperation!

Contact person

Please provide the information about the person in charge of the statistics:

Name	
Organisation	
Department	
Address	
E-mail	
Phone	
Fax	
Website	

c. Response to the survey

Totally 40 countries from each continent kindly responded to the survey. They are listed in accordance with region in Table 23.

Table 23. Regional distribution of countries which responded to the survey

Region	Country
East Asia and Pacific (7 countries)	Australia, China, Japan, Malaysia, South Korea, Singapore, Thailand
Europe (25 countries)	Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Moldova, Netherlands, Poland, Slovakia, Slovenia, Spain, Sweden, Switzerland
Latin America and the Caribbean (4 countries)	Argentina, Chile, Costa Rica, Mexico
North America (2 countries)	Canada-Quebec, United States
Sub-Saharan Africa (2 countries)	Guinea, Mali

Geographical distribution of those 40 countries is widespread and statistical significance of the survey result is reasonably assumed.

d. Data aggregation and analysis

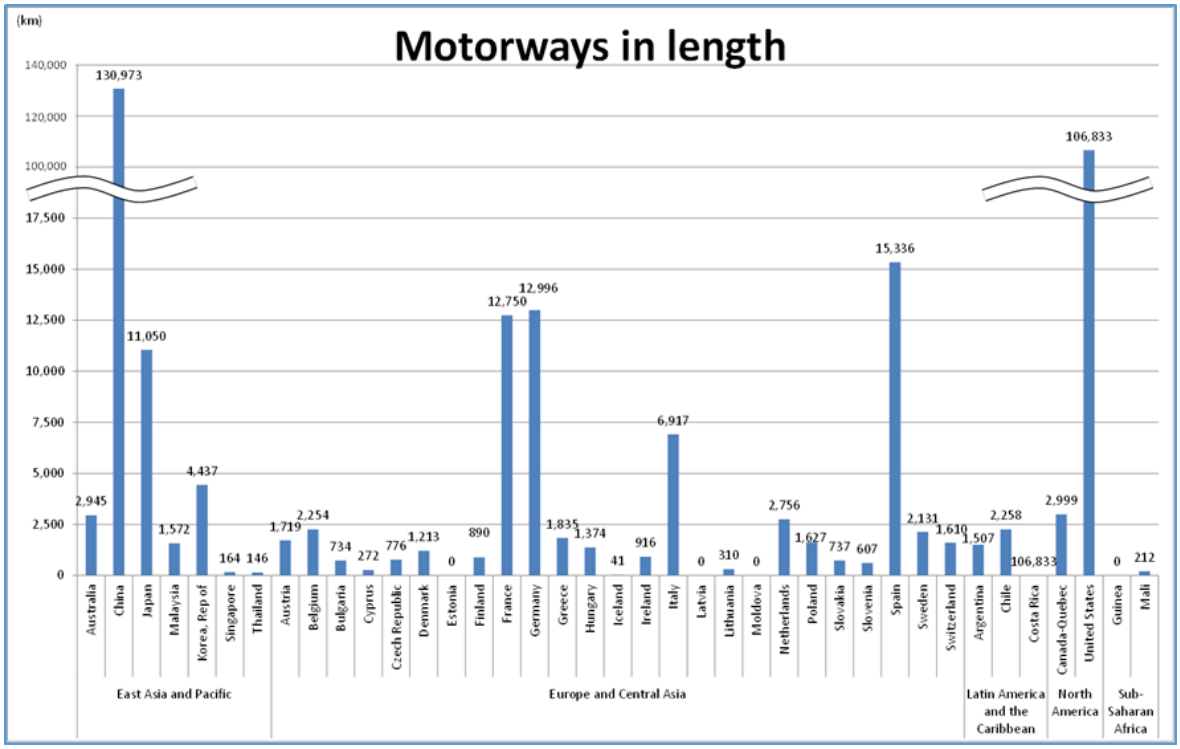
(1) Result of data aggregation

Overall survey result of “Motorway” and “Vehicles in use” is summarized in Table 24. Table 24 is just aggregation of the data, and Figures 11-15 illustrate graphical visualization of the result so that readers can make a comparative analysis of two data items in each country.

Table 24. Overall result of survey for PIARC Road Statistics

Number of vehicles (unit: thousands)

	Country	Motorway (km)	Passenger cars	Freight vehicles	Motorcycles or Tricycles	Others	Total
East Asia and Pacific	Australia	2,945	13,912	576	829	3,070	18,387
	China	130,973	140,959	20,656			161,615
	Japan	11,050	60,745	14,653	11,482	1,683	88,563
	Malaysia	1,572	13,184	1,191	12,677	561	27,613
	South Korea	4,437	18,231	3,492	2,181	80	23,984
	Singapore	164	623	163	143	28	956
	Thailand	146					
Latin America and the Caribbean	Argentina	1,507	10,501	3,238	6,582		20,321
	Chile	2,258	4,254	192	173	28	4,647
	Costa Rica	3					
	Mexico		25,165	9,705	1,873		36,742
North America	Canada-Quebec	2,999	5,164	146	209	897	6,416
	United States	106,833	243,806	11,203	8,601		263,610
Sub-Saharan Africa	Guinea	0	24	11	19		55
	Mali	212	29	63	55	11	158
Europe	Austria	1,719	4,831	440	816	1,333	7,422
	Belgium	2,254	7,974	1,113	676	505	10,269
	Bulgaria	734	2,811	368	177	96	3,451
	Cyprus	272	570	133	19		722
	Czech Republic	776	5,135	647	1,046	497	7,326
	Denmark	1,213	2,479	439	199		3,117
	Estonia	0	708	108	44	45	905
	Finland	890	2,656	409	165	402	3,632
	France	12,750	31,817	551	3,800	5,970	42,138
	Germany	12,996	45,883	2,912	4,314	2,459	55,568
	Greece	1,835	5,187	1,333	1,643		8,163
	Hungary	1,374	3,332	529	162		4,023
	Iceland	41	226	33	10	2	272
	Ireland	916	2,024	326	37	187	2,574
	Lithuania	310	1,315	116	40	144	1,614
	Italy	6,917	37,179	5,193	9,295		51,667
	Latvia	0	590	74	42	51	757
	Moldova	0	594	180	39	112	924
	Netherlands	2,756	8,110	2,085	653	60	10,909
	Poland	1,627	20,723	3,538	1,272	1,703	27,236
	Slovakia	737	2,131	305	14	102	2,552
	Slovenia	607	1,081	91	100	15	1,288
	Spain	15,336	23,205	4,902	5,221	1,090	34,418
	Sweden	2,131	4,782	616	375	596	6,369
	Switzerland	1,610	4,594	406	720	262	5982



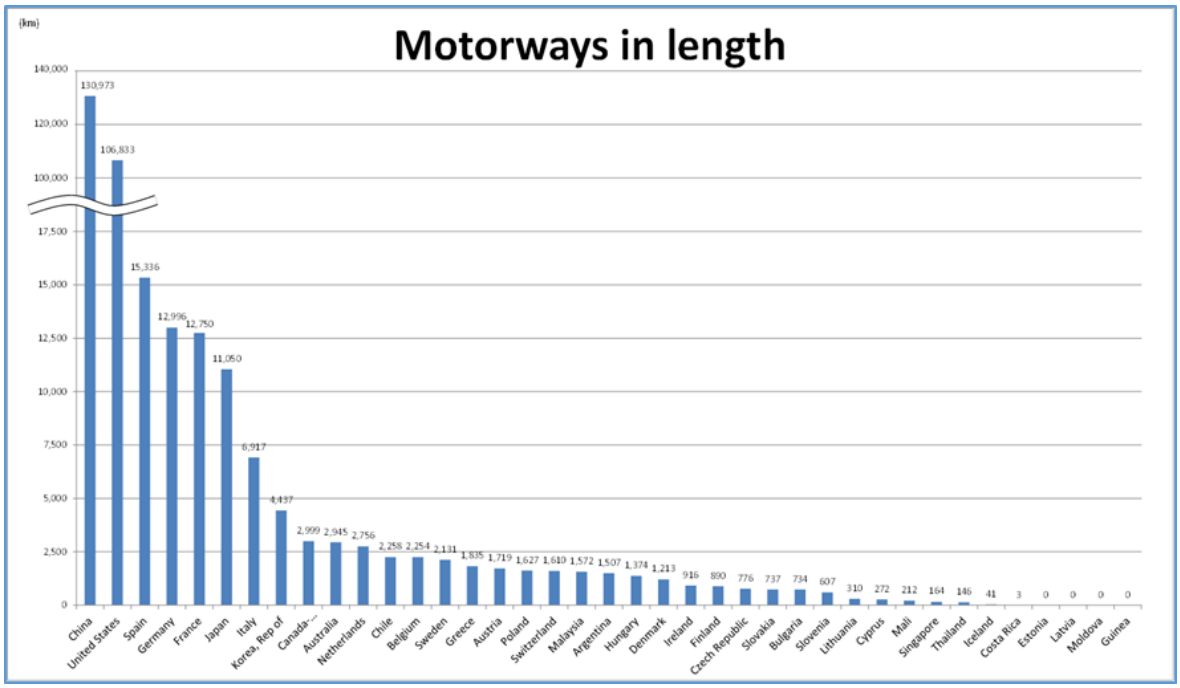
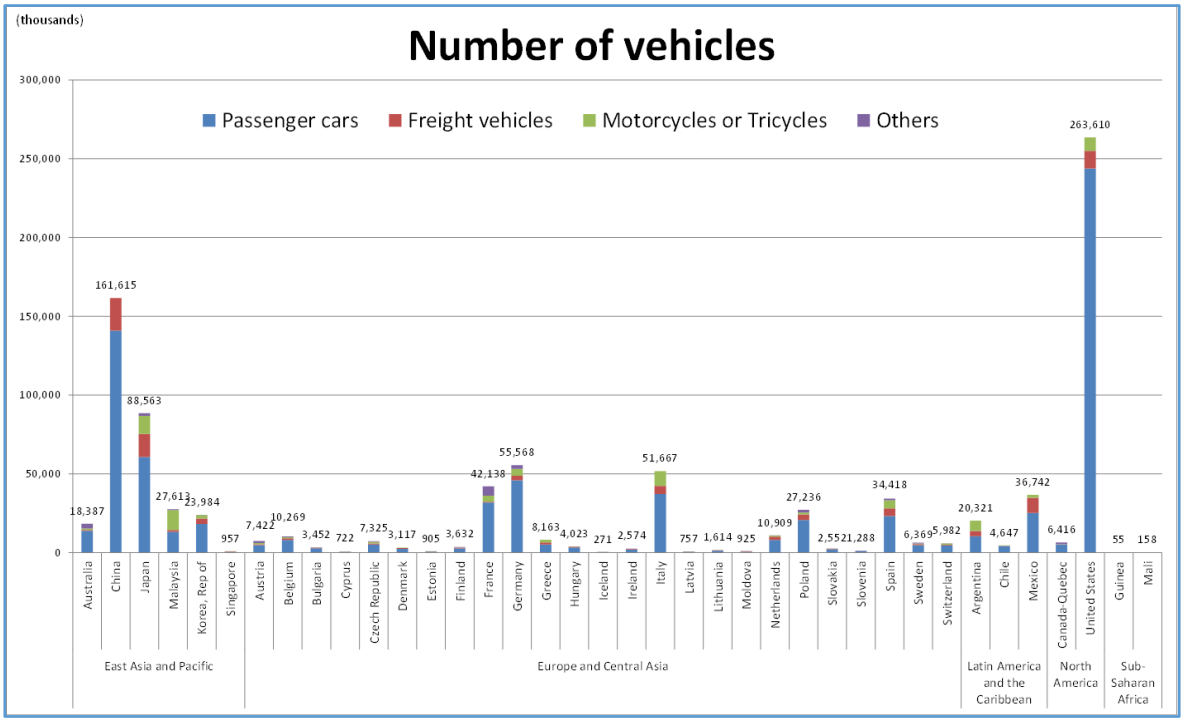


Figure 11 (above). Motorways in length in each country for each region

Figure 12 (below). Motorways in length in each country in descending order



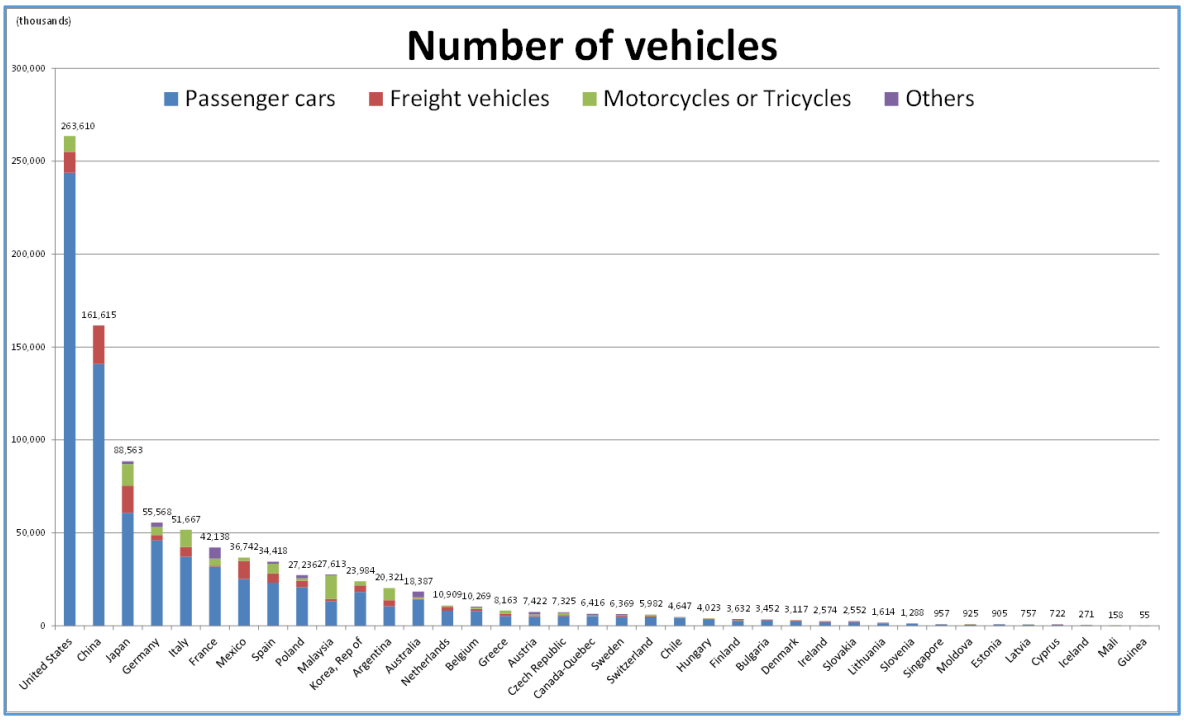


Figure 13 (above). Number of vehicles in use in each country for each region

Figure 14 (below). Number of vehicles in use in each country in descending order

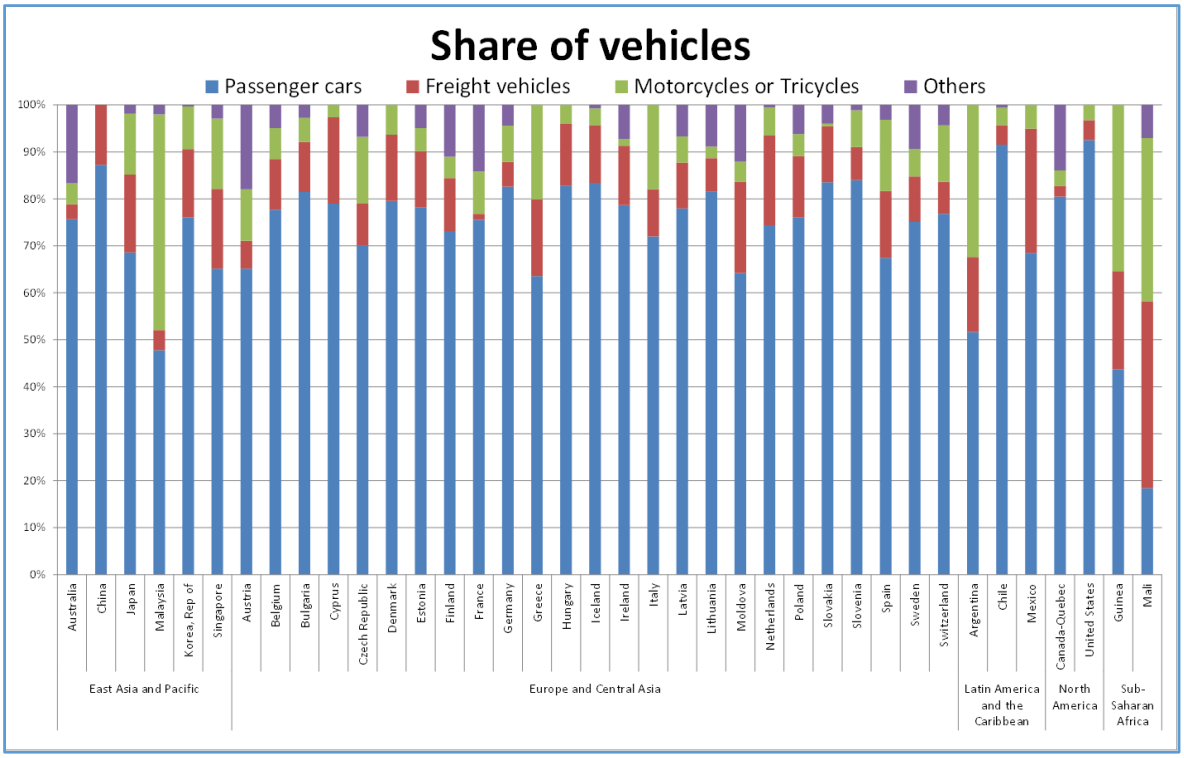


Figure 15. Share of vehicles in use in each country for each region

(2) Analysis with basic country data

We analyzed the collected facts in combination with some basic country data such as surface area, population, GNI, and so on

We attempted to discover the correlation between our data with such basic data of each country and summarized some interesting findings in the following (refer to Figures 16-19) and prove the significance of road transport for economic growth of a country.

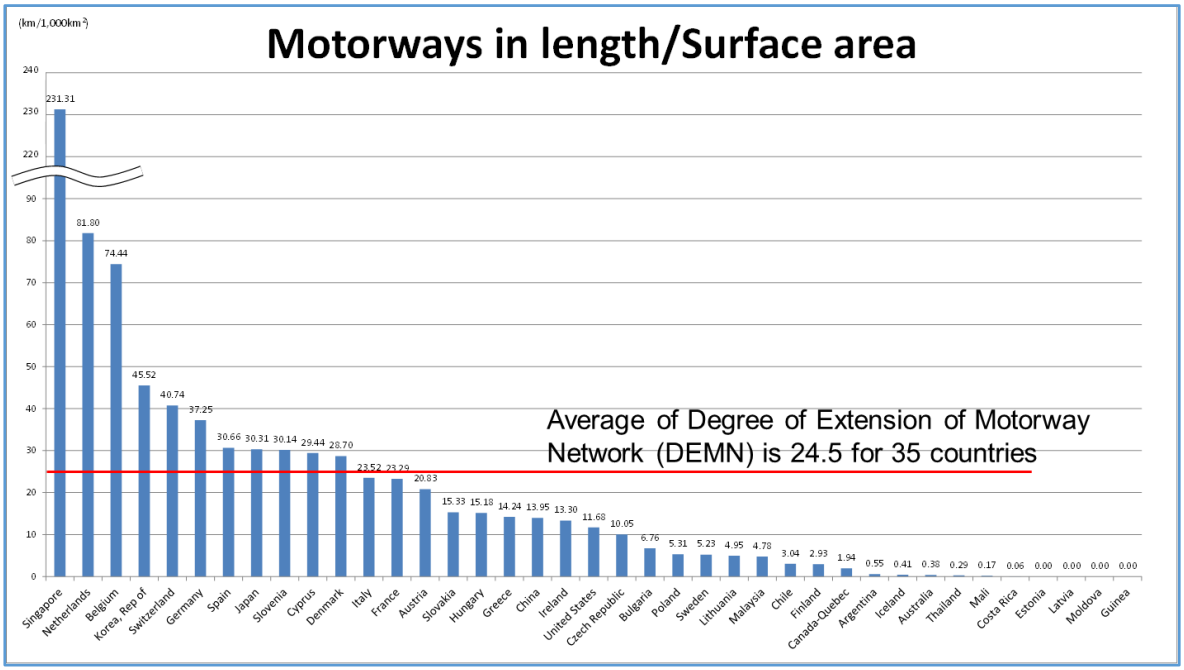


Figure 16. Motorways in length per surface area in each country

According to this graph of data collated in Figure16, length of motorways per surface area of a country, which may be regarded as Degree of Extension of Motorway Network (called DEMN) in a country, indication of Motorway density of a country, is greatest in Singapore, and the next is Netherlands followed by Belgium, South Korea, Switzerland and Germany. The average of DEMN except for five countries without motorway is 24.5.

Looking at the following graph in Figure 17, in the same manner number of vehicles in use per population is the highest in Belgium and followed by Italy, Austria, and the United States. Also the average value is 0.57 for 38 countries.

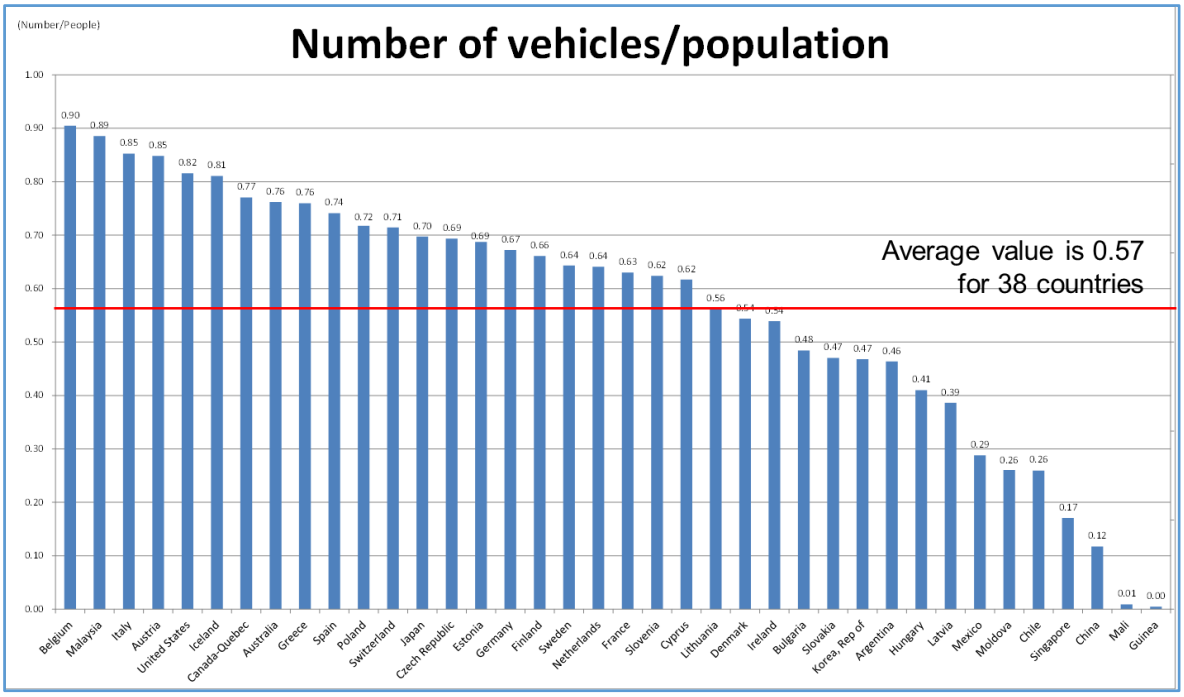
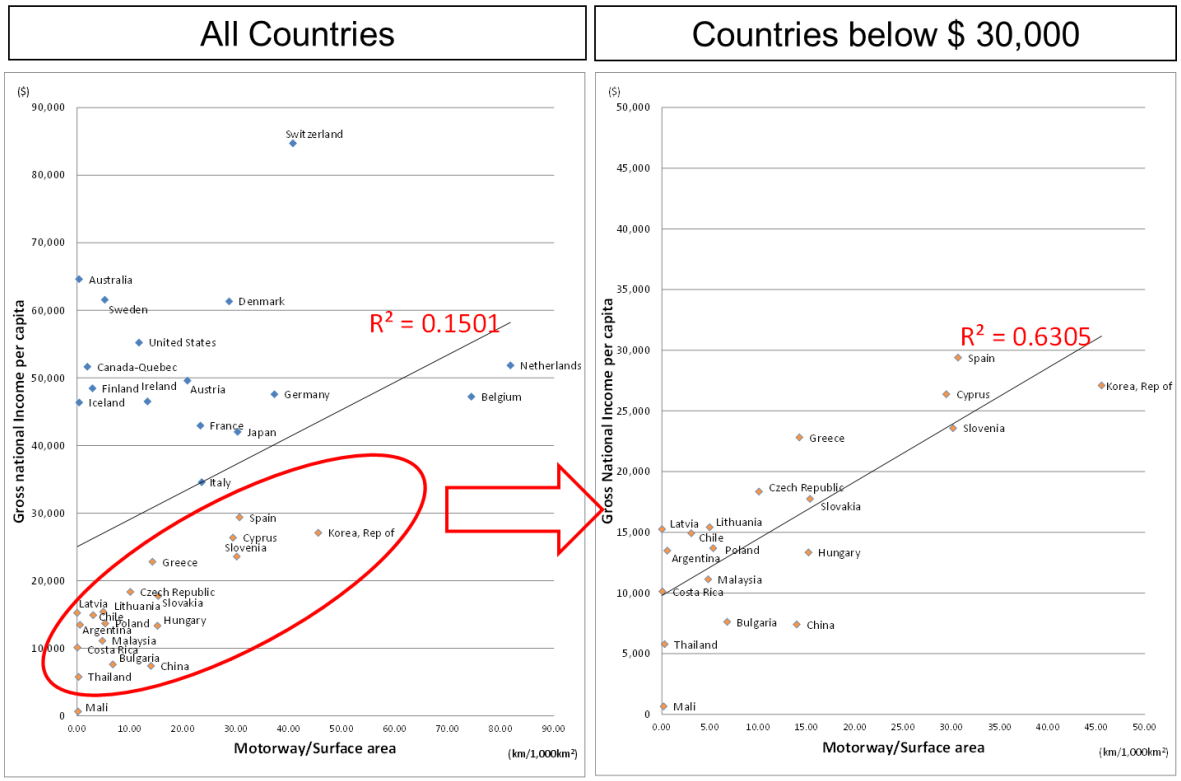


Figure 17. Number of vehicles per population in each country

In addition the correlation between two kinds of data, which is GNI per capita and motorways in length per surface area is discovered in Figure 18. Looking at the left graph, square of correlation coefficient is very low, but the right one indicates high correlation between the two data. It is assumed from this Figure that the higher degree of extension of motorway network is, the wealthier the country becomes, provided that GNI per capita is below $30,000. On the other hand the correlation is not clearly found for the countries whose GNI per capita exceeds $30,000.

The same kind of finding is presented in Figure 19. The right graph of Figure19 indicates that number of vehicles per population grows in better proportion to GNI per capita which is below $30,000. In other words, the wealthier to some extent the country becomes, the more vehicles people can own. Besides much wealthier countries do not necessarily own many vehicles per population.



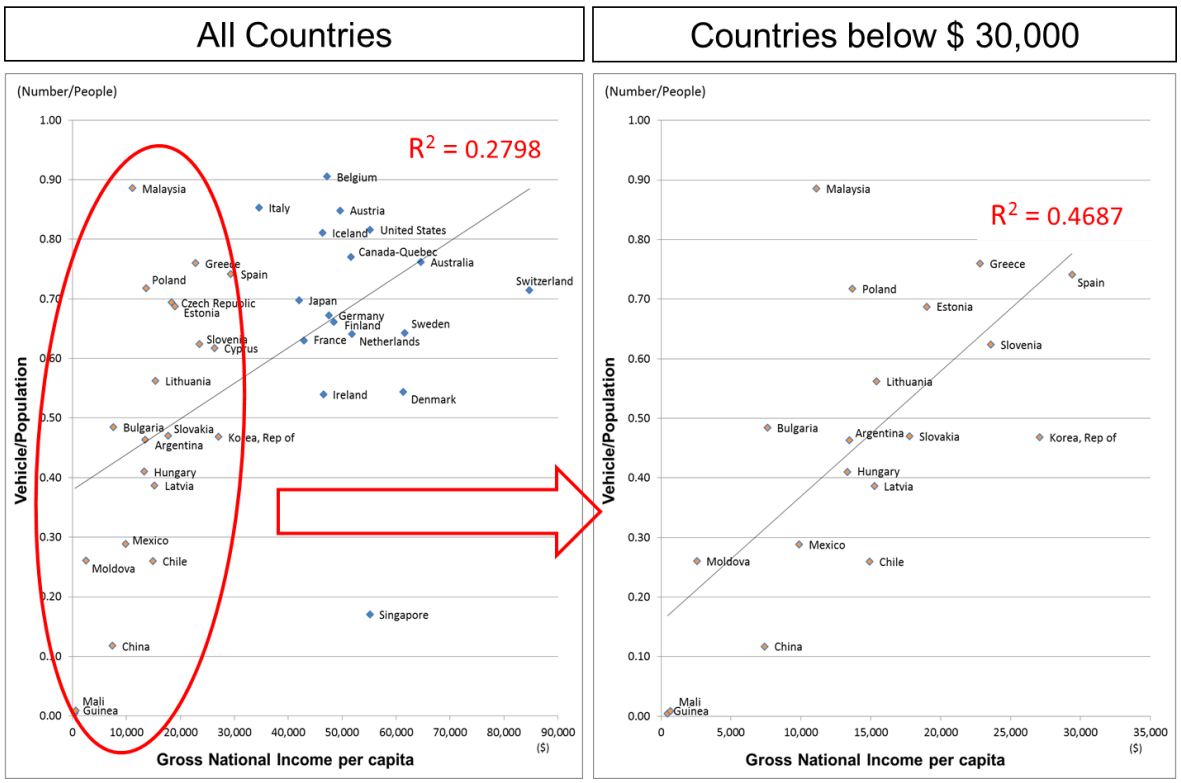


Figure18 (above). GNI per capita vs Motorways in length/Surface area

Figure19 (below). GNI per capita vs Vehicles in use/Population

5. Conclusion

If PIARC hopes to keep maintaining the status as a leading road organization, it is essential and mandatory to acquire the data which is both accurate and reliable. Unless PIARC serves such a fundamental and pivotal role in the field of road and road transport, the value of PIARC membership might be reduced. Thus, PIARC should take actions to further match up to the expectations of the road community. In addition to production of road statistics, for instance, establishment of international technical/operational standards is optional. Anyway how we can admirably suit basic needs of road administrations should be considered carefully.

Although only “Motorway” is focused on at this stage as a road type, we are in the middle of the project and at the following stages will consider the integration of data about other road types into our statistics. Needless to say the additional range of data should be clearly defined, too, and it is critical to develop and upgrade the data set in a timely and sustainable manner by including the new items additionally. It is highly possible that some data from Snow and Ice Data Book is integrated into our road statistics, and collaboration with Technical Committees will help its improvement. It is expected that the goal of our road statistics is to create international Key Performance Indicators (KPIs) which represent the quality of road and road transport in each country. Although we start with a small set of data, through our continuous efforts we wish to realize the provision of such KPIs in wider areas, which then will become the global standard of measurement we define for road and road transport.

Since 2014 PIARC National Committee of Japan has made a substantial contribution to this project of “International Road Statistics of PIARC”. The next steps of work toward its further improvement will be undertaken by PIARC General Secretariat, and it is hoped that more member countries and relevant assemblies will get involved. Certainly increased integration of our extensive data collection will upgrade our road statistics, thereby providing greater satisfaction for PIARC membership. If development of the ensuing actions is encouraged within the framework of PIARC leadership, National Committee of Japan still spares no efforts to work on it.

Finally we would like to express our sincere appreciation for many relevant people who contributed to some surveys and publication of this report.

World Road Association (PIARC)

La Grande Arche, Paroi Sud, 5e étage, F-92055 La Défense cedex, France

International Standard Book Number: 978-2-84060-491-4

Front Cover © Japanese Road Association