Standing Committee
for Economic and Commercial Cooperation
of the Organization of Islamic Cooperation (COMCEC)

COMCEC

Enhancing Road Maintenance in the OIC Member States

COMCEC COORDINATION OFFICE
March 2016

COMCEC

Standing Committee
for Economic and Commercial Cooperation
of the Organization of Islamic Cooperation (COMCEC)

Enhancing Road Maintenance in the OIC Member States

COMCEC COORDINATION OFFICE
March 2016

For further information please contact:
COMCEC Coordination Office
Necatibey Caddesi No: 110/A
06100 Yücetepe
Ankara/TURKEY
Phone: 90 312 294 57 10
Fax: 90 312 294 57 77
Web: www.comcec.org

Table of Contents

EXECUTIVE SUMMARY **1**

1. INTRODUCTION **7**

2. A FRAMEWORK FOR ROAD MAINTENANCE **9**
2.1. What is Maintenance? 9
2.2. Framework for Road Maintenance 10
2.3. Asset Management 11

3. THE IMPORTANCE OF ROAD MAINTENANCE AND THE BEST PRACTICES **13**
3.1. The Reasons for the "Maintenance Gap" 13
3.2. Roads as an Economic Motor 14
3.3. The Case for Road Maintenance 16
3.3.1. Reduction in the value of road assets 17
3.3.2. Higher vehicle operating and transport costs 18
3.3.3. Reduced access 19
3.4. Examples of Management of Road Sector – International Case Studies 20
3.4.1. South Africa 20
3.4.2. New Zealand 26

4. ROAD MAINTENANCE IN OIC MEMBER STATES **34**
4.1. Overview of Road Maintenance 51
4.1.1. Organization of Road Maintenance 52
4.1.2. Funding 56
4.1.3. Other Issues 57
4.2. Case Studies 58
4.2.1. Case Study – Morocco 58
4.2.2. Case Study – Turkey 65
4.2.3. Case Study – Senegal 70

5. CONCLUSIONS AND RECOMMENDATIONS **75**
5.1. Conclusions 75
5.2. Recommendations 77

LIST OF REFERENCES **81**
APPENDIX: Statistical Overview of Individual Countries **84**

List of Tables

Table 3-1 Effect of Road Roughness on Vehicle Operating Costs (Index of VOC: Good=100, at IRI=2.3)..... 18
Table 3-2 Roads Managed by SANRAL 22
Table 4-1 Socio-economic and Road Network Indicators..... 34
Table 4-2 Percentage of Road Categories in OIC Countries, USA and the EU 37
Table 4-3 Expenditures on Main Road Networks in Sub-Saharan African OIC Countries..... 51
Table 4-4 OIC Countries with Road Funds..... 53
Table 4-5 Socio-economic Indicators for Morocco..... 59
Table 4-6 Road Network by Road Category 59
Table 4-7 Rural Road Development Program 59
Table 4-8 Expressway Network..... 59
Table 4-9 Funding by Source for Road Projects 61
Table 4-10 Socio Economic Indicators for Turkey 65
Table 4-11 Length of Road Network by Road Type..... 65
Table 4-12 Composition of the Classified Network (CN) in Senegal 71
Table 4-13 Evolution of the TRU collection in Senegal (2009-2015) 73
Table 4-14 Sources of road financing and needs for road maintenance in Senegal (2009-2015)..... 74

List of Figures

Figure ES1 Generic Asset Management System 2
Figure 2-1 The Management Cycle 11
Figure 2-2 Generic Asset Management System 12
Figure 3-1 Forecasted quality of non-toll roads in South Africa 21
Figure 3-2 Organisational Structure of SANRAL 22
Figure 3-3 Planning Responsibilities Within SANRAL 23
Figure 3-4 Performance Management System of SANRAL 24
Figure 3-5 Asset Management System at SANRAL 24
Figure 3-6 Organisational Structure of New Zealand Transport Agency 28
Figure 3-7 Integrated Planning Strategy Used by NZTA 30
Figure 3-8 Strategic Context of SHAMP 31
Figure 3-9 NZTA Asset Management Cycle 31
Figure 4-1 Percentage of Road Type (Motorway, Highway, Secondary, Other) by Country 36
Figure 4-2 Percentage of Paved and Unpaved Roads by Country 38
Figure 4-3 Length of Road Network (KM) / 100 Square KM Area of Country 40
Figure 4-4 Length of Road Network (KM) / USD 10 Million GDP 42
Figure 4-5 Length of Road Network (KM) / 10,000 Population 44
Figure 4-6 Expenditures on Maintenance (Million USD) 46
Figure 4-7 Total Road Expenditures (Thousand USD) / Length of Road Network (km) 48
Figure 4-8 Expenditures on Maintenance as a Percent of Total Expenditures 50
Figure 4-9 Organisation of Ministry of Equipment, Transport & Logistics 60
Figure 4-10 Evolution of Road Network 1990 - 2014 62
Figure 4-11 Condition of the Road Network 63
Figure 4-12 Growth of State Highways and Provincial and Other Roads in Turkey (1967 – 2015) 65
Figure 4-13 Organogram of Turkish General Directorate of Highways 67
Figure 4-14 Year-end Budget / Initial Budget (1980 - 2014) for Turkish GDH 68
Figure 4-15 Initial and Year End Budgets for Turkish GDH (1980 - 2014) 69

List of Abbreviations

AGEROUTE	Agency of Works and Management of Roads
AICD	Africa Infrastructure Country Diagnostic
AMS	Asset Management System
CFR	La Caisse Pour Le Financement Routier (of Morrocco)
CN	Classified Network (in Senegal)
CNER	Le Centre National d'Etudes et de Recherches Routiers (in Morocco)
COB	Cartographic Data Bank of Morocco
COMCEC	Standing Committee for Economic and Commercial Cooperation of the Organization of the Islamic Cooperation
DOT	Department of Transport
EIB	European Investment Bank
FCFA	Currency of Communauté Financière Africaine (Senegalese currency)
FERA	Fund for Autonomous Road Maintenance (in Senegal)
FHWA	Federal Highway Works Administration (of the United States)
FSR	Fonds Speciale Routiere (of Morocco)
GDH	General Directorate of Highways (of Turkey)
HDM – IV	Highway Development and Management Model – Version 4
IFEER	Institute de Formation aux Engins et a l'Entretien Routier (in Morocco)
IRI	International Roughness Index
JICA	Japan International Cooperation Agency
MILT	Ministère des Infrastructures, des Transports terrestres et du Désenclavement (of Senegal)
Mio Veh-Km	Million Vehicle Kilometers
NCN	Non Classified Network (in Senegal)
NLTP	National Land Transport Plan (of New Zealand)
NZTA	New Zealand Transport Agency
OIC	Organisation for Islamic Cooperation
PERA	Annual Road Maintenance Program (of Senegal)
PPP	Public Private Partnership
PTIP	Public Transport Investment Program (of Senegal)
PWD	Public Works Department
RIB	Road Data Bank of Morocco
RONET	Road Network Evaluation Tools (suite of tools developed by the World Bank)
SANRAL	South African National Roads Agency Limited
SHAMP	State Highway Asset Management Plan
TRU	Tax on Road Use (in Senegal)
VCI	Visual Condition Index (of roads)
VOC	Vehicle Operating Costs
WRS	IRF - World Road Statistics

EXECUTIVE SUMMARY

This study commissioned by the Standing Committee for Economic and Commercial Cooperation of the Organization of the Islamic Cooperation (COMCEC) to study road maintenance practices in OIC Member States.

Importance of maintenance and the maintenance gap

Maintenance is important because poorly maintained roads lead to:

- Destruction of the value of road assets and its corresponding impact on government accounts and higher costs for road rehabilitation in the future
- Higher vehicle operating costs, fuel costs, and reduced road safety
- Reduced access resulting in poorer healthcare and fewer employment and educational opportunities

Unfortunately, however, the required maintenance works are not always carried out in a timely manner because of:

- Mismanagement of the road infrastructure, such as overloading of vehicles beyond legal limits,
- An inability to allocate required resources required,
- Underfunding of road assets and lack of will to keep them properly maintained because
    - Maintenance can be postponed as a lack of maintenance does not result in immediate asset failure
    - There is preference for building new roads, bridges etc., and
    - There is a shortage of expertise, institutions, and measures to keep the road assets in good condition.

Study objective and approach

The overall objective of this study is to provide an overview of road maintenance practices in the OIC Member States, the challenges they face, and recommendations for addressing these challenges.

To meet this objective, this study:

- Conducted an extensive literature review of maintenance practices in OIC Member States,
- Conducted an electronic survey of the road maintenance practices in the OIC Member States,
- Carried out three case studies covering Morocco, Turkey, and Senegal,
- Developed a framework that can be used for identifying and evaluating policy actions and investment priorities,
- Identified the challenges in improving maintenance of road networks, and
- Provided recommendations for meeting the challenges that have been identified.

Definition of maintenance use in this study

The maintenance activities that are the primary focus of this study are:

Routine maintenance – includes local repair of roadway and pavement; grading of unpaved surfaces and shoulders, maintenance of drainage ditches, side slopes, verges, traffic control devices, and furniture, roadside cleaning, dust and vegetation control, snow or sand removal, and maintaining rest areas and safety related installations.

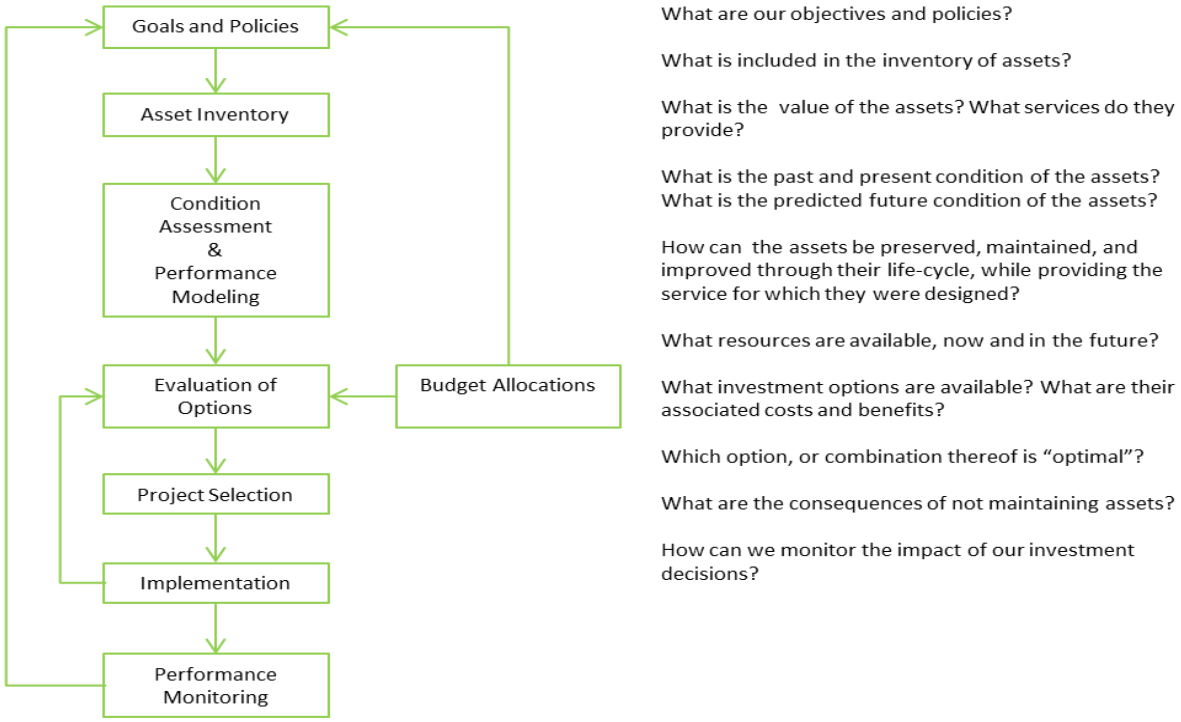
Resurfacing – involves re-graveling an unpaved road or resurfacing a paved road with an asphalt overlay to preserve the structural integrity and ride quality of the road.

A framework for maintenance

Most authorities responsible for the maintenance of road networks use an Asset Management System (AMS). An AMS covers the processes, tools, data, and policies necessary to effectively manage assets. An AMS includes the following components[1]:

- Goals and policies of the administration,
- Data,
- Resources and budget details,
- Performance models for alternative strategies and programme development,
- Project selection criteria,
- Implementation programme, and
- A monitoring and feedback loop.

Figure ES1 – Generic Asset Management System



Source: Consultant

[1] Organisation for Economic Cooperation and Development (2001) Asset Management for the Roads Sector, Paris

Lessons from international best practice

Experiences from across the world suggest that for required maintenance activities to be carried out properly and in a timely manner the following are important:

- Thorough planning and programming of maintenance works based on priorities,
- Availability of timely, accurate, and relevant data to support setting of priorities,
- An independent, secure, and stable source of funding for carrying out preventive maintenance,
- Having an appropriate institutional structure in place for managing and operating the road network. In particular, a separation of the financing of maintenance from the procurement and execution of works,
- Monitoring the results of maintenance works on road network performance,
- Linking the performance of the organisation responsible for management and operation of the road network to the performance of the maintenance works,
- Having the appropriate human resources in place not just to oversee the engineering and technical aspects of maintenance works, but also to undertake the planning and programming of these works, collecting and analysing data, and project and financial management expertise for managing maintenance contracts.

Observations on the road sector and maintenance in OIC Member States

- The road sector in most OIC countries is over-developed in terms of length relative to the size of the population and GDP.
- The share of motorways, highways, national and main roads in the total road network is disproportionately large in the OIC Member States.
- There is an acute lack of reliable and consistent data when it comes to expenditures in the road sector. It is rather surprising to note that this data is not readily available.
- For the limited number of countries for which data is available, there is a capital investment bias with the bulk of expenditures being rehabilitation and capital expenditures.
- Not surprisingly given the above, the road network in most OIC countries is not in a very good condition.
- The institutional development of the road maintenance sector in OIC Member States is lagging behind international best practices in terms of establishing road funds and road agencies. Thus, for example, a majority of OIC Member States still do not have an operational road fund. Unfortunately, even when the road fund exists, its performance can be improved. The situation with regards to road agencies is not significantly better.
- Many OIC Member States still carry out routine and preventive maintenance using force account methods, resulting in the well-known inefficiencies and delays in execution of the works.
- The governance, transparency of operation, and public accountability of the road maintenance organisations is in need of improvement so that these organisations can make decisions about road maintenance based on the needs and requirements rather than any other considerations.
- There is an issue with regards to the human resource side of government organisations involved in road maintenance; there is a shortage of qualified staff and it is becoming increasingly difficult for these organisations to attract the needed talent.
- The capabilities of the construction sector in many OIC Member States need to be upgraded and expanded so that they can undertake, for example, performance based maintenance contracts.

- The level of the fuel levy and road user charges is set at very low levels and need upward revision.
- The maintenance needs of, in particular the rural road networks, need to be given more attention during the planning a budgeting process than what they currently receive.

Recommendations and the way forward

Use of performance indicators for decision-making - Performance indicators should be defined and used in a consistent manner over time for making decisions about needs and requirements, investments, maintenance prioritization, or anything else.

Data collection – At a minimum there must be an asset register, a periodic survey to collect information on the condition of its assets, and collect data on traffic volumes and vehicle mix on the road network.

Financial Management Systems – A financial management system should be required to maintain the accounts of the organisation, and more importantly for producing reports linking the use of financial resources to the performance of the road assets and various activities.

Road Information System and Asset Management System – An integrated asset management system containing all relevant data on the assets (location and other attributes, and condition and quality) should be used and should be linked to the financial management system so as to permit an analysis of the efficiency and effectiveness of various activities.

Project Management System – A project management system that is capable of managing and monitoring projects is essential to the efficient performance of a highway agency. This project management system needs to be able to monitor progress on projects on a daily basis, manage project risks, and resource use on the project.

Risk Management Framework – Organisations need to develop a risk framework that incorporates the risks associated with these phenomenon and their potential consequences and incorporate these into their planning and budgeting.

In addition to the above recommendations, the progressively more challenging recommendations should be adopted by the organisations (depending on their level of maturity) responsible for maintenance in phases:

Phase 1 – Preparing the organisation for monitoring performance

This phase is intended to prepare an organisation for performance based management of road networks. Thus, this phase is intended to:

- Identify the shortcoming and needs with respect to the systems and procedures noted above
- Collect needed information
- Make changes to the institutional setting, including the legal and regulatory frameworks
- Make necessary internal reforms in the organisation

In terms of the institutional setting, the following is required:

- An autonomously functioning organisation that is authorised to take all decisions that it needs to take to ensure a well-functioning road network. In other words the organisation must be independent of political and other interference.
- A clear and comprehensive mandate for the organisation that is responsible for managing and operating the road network. This mandate needs to extend beyond, for example, just the construction and maintenance of highways. It needs to included, for example, the authority for enforcing weight limits on the roads, for raising finances to finance various activities, etc.
- The various functions of the organisation such as tolling, maintenance, planning, programming and budgeting should be separated as much as possible. For example, procurement, execution, and financing should not be in the hands of the same agency.
- The funding of the organisation should be explicitly linked to targets specified in something like a Service Level Agreement (SLA) that elaborates what the organisation is expected to do with the resources allocated to it.

In terms of the internal reforms at the organization the following is needed:

- Establishing guidelines for identifying and assessing maintenance needs and prioritising them in such a way that the activities to meet the identified needs are clearly linked to the performance goals and targets of the organisation.
- Internal separation of functions in such a way that the monitoring is separate from the actual activities themselves. Regular internal audits of performance should also be undertaken.

Phase 2 – Monitoring and improving performance

In this phase, there are three priorities, namely ensuring:

- Human resources issues
- Involvement of stakeholders and road users, and
- Financial security for the organisation

In terms of the HR issues, the following need to be addressed:

- The availability of properly qualified staff is becoming increasingly important at organisations responsible for managing and operating road networks.
- Attracting and retaining this talent requires that organisations pay attention to the criteria used for employing staff, particularly for non-engineering staff, and the salary structure for these positions (many of these people are eminently employable in the private sector).

There are two aspects to the stakeholder involvement:

- Steps for improving the capabilities of the road sector, and a programme for engaging the road sector contractors are an important part of improving the overall performance of the sector.
- Involving the road users in the performance and functioning of the organisation. This involvement is an important way to build support for the organisation and help it in its interactions with the government in getting needed resources.

Finally, it is essential that the level of available resources is adequate, and the annual variation in available resources is not so large so as to make planning difficult. To do this three things are proposed:

- Ring-fenced or earmarked budgets to guarantee revenue streams commensurate with the ambitions, objectives, and targets for the road sector. And establishment of an independent for taking decisions for procurement and execution of these works.
- Adequate funding. The level of funding should be linked to the targets that have been set for the road network in terms of performance.
- Including a valuation of the value of all road assets in the books of the organisation.

Phase 3 – Measuring performance based on outputs

The fundamental difference in this phase from the earlier phases is that now the emphasis is on realising the performance objectives in terms of the end-result, the outputs. In this phase, the focus should be on, for example, the cumulative delays resulting from maintenance works on the road network. This focus makes it important to no longer just do the maintenance, but do it in ways that minimise the interruptions and disturbances resulting from the maintenance works.

Phase 4 – Organisation wide performance monitoring

In this most mature phase, the entire organisation measures and monitors its performance at every stage of decision making, and in every decision that it takes.

1. INTRODUCTION

Roads are an important public asset; improving the road network can bring about immediate and large benefits by providing better access to hospitals, schools, and markets; improved comfort, speed, and safety; and lower vehicle operating costs. However, sustaining these benefits over time requires maintaining the road network in a timely and proper manner. Without periodic maintenance roads can quickly deteriorate; inhibiting the realisation of the long-term development impacts of building roads.

Delayed maintenance, and the resulting poor state of repair, makes roads more difficult to use. This results in increased vehicle operating costs (such as, for example, more frequent repairs, and more fuel use) and reluctance by transport operators to use the roads. This in turn reduces the benefits of providing more access to jobs, hospitals, schools, etc., and an overall loss of economic and social development opportunities.

Properly maintaining a road network requires regular and appropriate maintenance works. Delaying such maintenance erodes the value of this important public asset and results in unnecessarily large costs at some later time. If maintenance is not carried out in a timely manner, entire road sections may fail completely, requiring full reconstruction at a much higher cost than the cost of preventive maintenance.

A 1999 Michigan Department of Transportation (DOT) study provided, for the first time, hard evidence that preventive maintenance is a wise investment. According to the study, the DOT's preventive maintenance strategy is more than six times as cost-effective as rehabilitation and reconstruction projects. The Michigan DOT adopted its preventive maintenance strategy in 1992 to keep its 15,420 km (9,580 mi) of highways in the best shape possible despite a decline in funding. Since then, preventive maintenance treatments have been applied to about 4,260 km (2,650 mi) of asphalt and portland cement concrete pavements, at a cost of $80 million. According to the Michigan DOT, if the DOT had not implemented its preventive maintenance strategy, the DOT would have to spend $700 million today on rehabilitation and reconstruction projects to bring pavements up to their current condition - that's more than eight times the money that was spent on preventive maintenance treatments.

The South African National Road Agency Ltd. (SANRAL) estimates that repair costs are six times maintenance costs after three years of delayed maintenance, and 18 times the maintenance costs after five years. To avoid such escalating costs, SANRAL first “allocate[s] its available funding resources to ideal maintenance actions (e.g., reseals and overlays), and thereafter to more extensive maintenance actions (e.g., rehabilitation), and finally to new construction” (SANRAL 2004).

Deferred maintenance refers to the dollar amount of maintenance and rehabilitation work that should have been completed to maintain the pavements in acceptable condition but had to be deferred due to reduced maintenance funding or policy changes for the preventative maintenance and/or pavement rehabilitation programs. Pavements that remain untreated can deteriorate at a faster rate. The cost of repairs increases disproportionately as the condition of the pavement decreases over its life. According to the Federal Highway Administration (FHWA), deferring pavement preventive maintenance or rehabilitation can lead to a substantial increase in required repair costs (FHWA 2005).

Although maintenance engineers have been making the case for preventive maintenance for years, their message often goes unheeded. While some part of the overall road budget has to be spent on construction, some part has to be spent on maintaining the existing road network. But because new road construction is often financed by donor countries that provide “cheap money”, many countries favour

new road construction, rehabilitation, or reconstruction of roads over maintenance which has to be financed by own resources. This, together with the perception that delaying maintenance activities does not result in immediate asset failure, has resulted in a large backlog of roads needing maintenance.

The Organisation of Islamic Cooperation (OIC) includes countries that follow very different maintenance protocols and regimes and hence there is a wide range of variation in the state of repair of the road networks in the countries of the OIC. Thus, the OIC would like to assess the road maintenance strategies of three selected OIC Member States to support the development of a framework for identifying and evaluating policy actions and investment priorities.

Thus, the overall objective of the work being proposed here is to provide an overview of road maintenance practices in the OIC Member States, the challenges they face, and recommendations for addressing these challenges.

To meet this objective this study:

- Conducted an extensive literature review of the maintenance practices in place for maintaining road networks in the OIC Member States,
- Conducted an electronic survey of the road maintenance practices in the OIC Member States,
- Assessed the road maintenance strategies of three OIC Member States,
- Developed a framework that can be used for identifying and evaluating policy actions and investment priorities,
- Identified the challenges in improving maintenance of road networks, and
- Provided recommendations for meeting the challenges that have been identified.

The results of the above work are provided in this report in the following four chapters:

- A Framework for Road Maintenance
- The Importance of the Road Maintenance and Best Practices
- Road Maintenance in the OIC Member States
- Conclusions and Recommendations

Chapter 2 outlines a framework for road maintenance, a framework that includes institutional, financial, and technical elements. Chapter 3 makes the case for road maintenance, why it is important to undertake timely and regular road maintenance, and provides best practices from around the world. Chapter 4 does three things: 1) Presents an overview of the road networks in each of the OIC Member States, 2) Outlines the issues related to road maintenance in the Member States, and 3) Presents the case studies for Morocco, Turkey and Senegal. Chapter 5 presents our conclusions and recommendations for the OIC Member States for improving the state of road maintenance.

2. A FRAMEWORK FOR ROAD MAINTENANCE

This chapter briefly defines road maintenance and what it involves, review the problems and issues associated with road maintenance, and outline the framework for maintenance that was used in developing the email survey and the case studies.

2.1. What is Maintenance?

Maintenance is a series of activities designed to keep a road network serviceable by reducing the deterioration of pavements. There are different kinds of maintenance:

- Routine maintenance
- Resurfacing
- Rehabilitation
- Reconstruction
- Restoration
- Betterment
- New road construction

Routine maintenance – includes local repair of roadway and pavement; grading of unpaved surfaces and shoulders, maintenance of drainage ditches, side slopes, verges, traffic control devices, and furniture, roadside cleaning, dust and vegetation control, snow or sand removal, and maintaining rest areas and safety related installations.

Resurfacing – involves re-graveling an unpaved road or resurfacing a paved road with an asphalt overlay to preserve the structural integrity and ride quality of the road. Resurfacing is also sometimes referred to a periodic maintenance.

Rehabilitation – involves selectively repairing, strengthening and shape correction of the pavement or roadway (including minor drainage improvements) to restore a road's structural strength and ride quality.

Reconstruction – involves renewal of the road structure using existing earthworks and road alignments.

Restoration – major rehabilitation and reconstruction works considered together.

Betterment – are improvements related to the width, alignment, curvature, or gradient of the road to improve traffic safety, speeds, and capacity. These are usually not considered to be part of maintenance.

New construction – is the construction of a paved or gravel road on a new alignment, providing additional lane capacity, or constructing additional carriageways, frontage roads, grade separated intersections, or multi-lane divided highways. This is not considered to be part of maintenance activities.

Road networks are complex; spread over large geographic areas, and the pavement conditions are determined by traffic volumes and mix, climatic and environmental conditions. Given this complexity, it

is difficult to make long-term predictions about the future condition of road networks. However, maintenance is essentially a management problem that involves:[2]

- Delivering a defined quality of service
- Resources of people, materials and equipment
- Activities and procedures
- Location on the road network
- Timing of intervention
- Constrained budgets

2.2. Framework for Road Maintenance

Road maintenance is an integral part of road management. Thus, the starting point for elaborating the road maintenance framework is the framework for road management. Robinson (2008) defines four categories of functions for an organization responsible for managing a road network, namely:

1. Strategic planning
2. Programming
3. Preparation
4. Operations management

Strategic planning – involves analysing the road network and preparing a long-term strategic plan that includes future needs in terms of, for example, maintenance needs, the resource requirements for different future budgetary and economic scenarios.

Programming – involves developing a multi-year program of work and associated expenditures. This work program identifies future maintenance needs of the road network, and prioritises these needs based on costs and benefits and available budgets.

Preparation – involves developing the details for implementing the multi-year program of work – detailed designs and cost estimates are prepared.

Operations management – covers the management of daily on-going works activities of the organisation on a daily or weekly basis. This includes, for example, the scheduling of work, monitoring of the work, and evaluation of completed works.

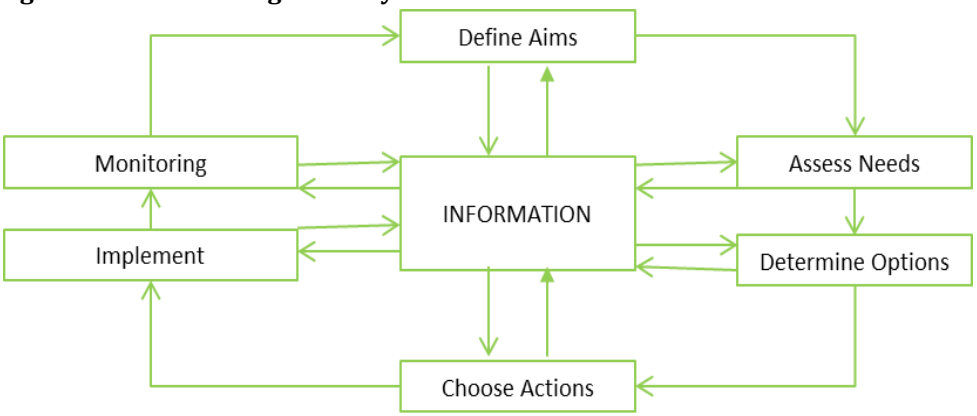
For each of these four categories of management functions a common system of decision-making can be used, namely:

- Defining the objectives,
- Assessing needs and requirements,
- Determining the various options for meeting the needs and requirements and realising the defined objectives,
- Choosing what to do from the available options,
- Implementing the chosen options, and

[2] Robinson, R., (2008) Restructuring Road Institutions, Finance and Management, Volume 1: Concepts and Principles, 207-208, University of Birmingham

- Monitoring the implementation of the options and the progress towards the objectives.

Figure 2-1 – The Management Cycle



Source: Consultant

The above four categories of management functions, and the management cycle for each of these are referred to as *Asset Management.* This asset management framework serves as the basis for the work described in this report.

2.3. Asset Management

Most authorities responsible for the maintenance of road networks in developed economies use, what is commonly referred to as, an Asset Management System (AMS). An AMS covers the processes, tools, data, and policies necessary to effectively manage assets. An AMS includes the following components[3]:

- Goals and policies of the administration,
- Data,
- Resources and budget details,
- Performance models for alternative strategies and programme development,
- Project selection criteria,
- Implementation programme, and
- A monitoring and feedback loop.

Each of these components, while common to all asset management systems, can be customized to match the needs of any given road administration. While an AMS is usually flexible enough to accommodate changes in goals, priorities and assets of any given authority, its establishment and operation must follow a systematic procedure that includes the development, or using existing, performance models, incorporating generally accepted economic and business practices. Thus, the use of an AMS requires adequately trained users with the necessary skills and competences in order to effectively be able to use the system.

[3] Organisation for Economic Cooperation and Development (2001) Asset Management for the Roads Sector, Paris

Core Principles of Asset Management

Policy Driven – Resources are allocated for undertaking different activities based on well -defined policy objectives

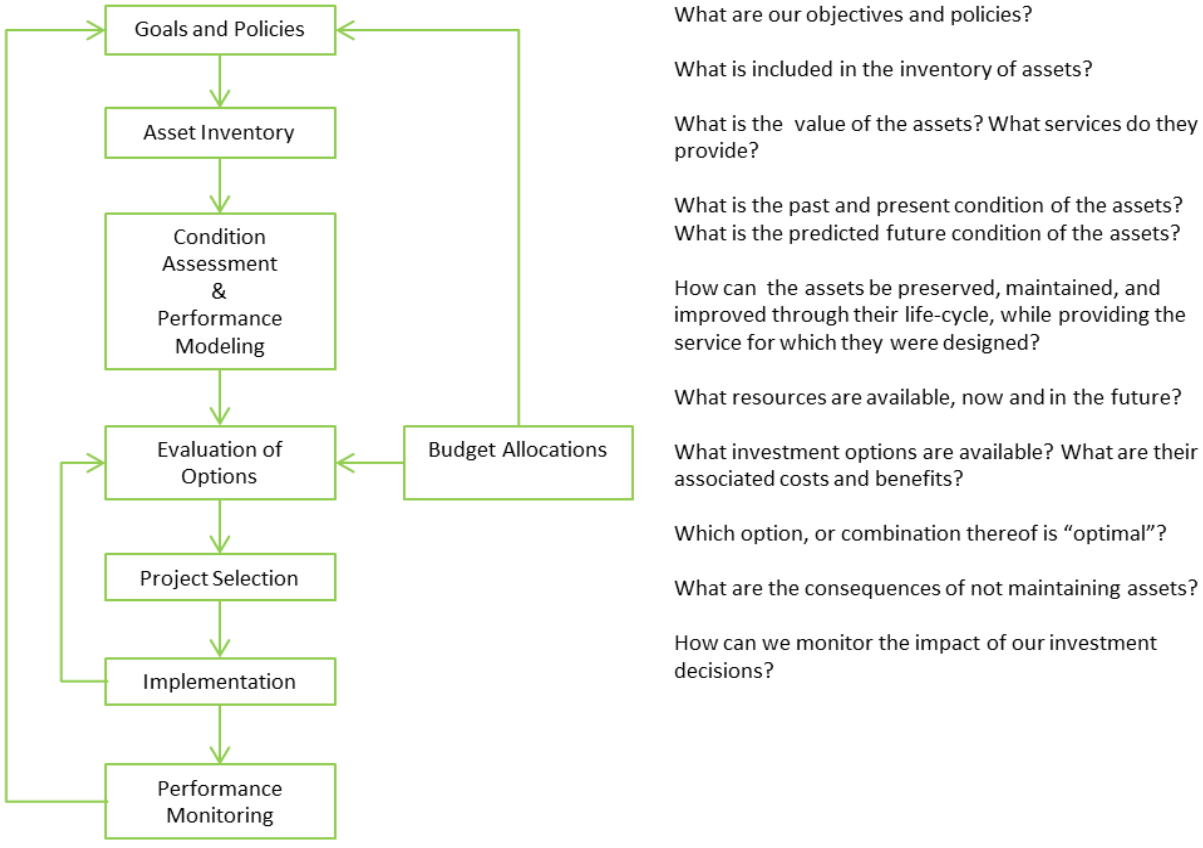
Performance Based – All policy objectives are translated into indicators to measure system performance and used for operational and strategic management

Analysis of Options and Trade-offs - The allocation of resources to different types of projects (maintenance versus rehabilitation) is based on evaluating how different budget allocations perform with regards to reaching the policy objectives

Decisions Based on Information – The costs and benefits of the different options is based on current, complete, and accurate data

Source: FHWA (2007) Asset Management Overview, US Department of Transportation.

Figure 2-2 – Generic Asset Management System



Source: Consultant

It is clear that most low and middle income countries do not have such comprehensive asset management systems in place to support the planning and budgeting of maintenance of road networks. This framework is used, however, as a structuring device to assess the state of road maintenance in the OIC Member States.

3. THE IMPORTANCE OF ROAD MAINTENANCE AND THE BEST PRACTICES

This chapter describes the reasons for the maintenance gap, makes the case for road maintenance by highlighting the economic importance of roads, and provides evidence for why spending on maintenance makes good economic sense, especially in view of the impacts of poorly maintained road networks on economic and social development, and provides examples of best practices from across the world.

3.1. The Reasons for the "Maintenance Gap"

Given the straightforward economic case for undertaking preventive maintenance, and the importance of doing so, it is worth recounting the reasons for why preventive maintenance is not undertaken as widely and regularly as one would expect it to happen.

There are essentially three factors that have can be held responsible for the poor maintenance of road networks, namely:

1. The structure and nature of organisations responsible for road maintenance
2. Lack of pressure for better roads
3. Inadequate and unreliable funding

In the past decades the focus has been on expanding road networks rather than on maintenance. The fact that larger road networks would, in the future, require funds for their maintenance was, till recently, largely ignored; the question of whether the resources need for maintaining these road networks were available or not was deferred to be answered at some future point in time. One of the reasons for why the question about the future availability of resources for maintain the roads that were being built was that the funds for road construction come from capital budgets, whereas the funds for maintenance come from operational budgets. The construction of new roads is also, at least in low and middle income countries, often financed via loans provided by multi-lateral development banks. Experience suggests that, for various reasons, it is easier to get approval from government, for projects requiring capital investments, than it is to get funds approved for recurring expenditures – the kinds of expenditures associated with maintenance of road networks. Thus, while the resources for building new roads are approved, the resources required for maintaining these roads are not. For the roads financed by loans, the provisions for financing the maintenance of these new roads were inadequately considered in the conditions for these loans, and even the weak contractual conditions are all too often poorly enforced.

One consequence of the expansion of the road networks that was not taken into account was whether the recurrent operational budgets available to agencies were large enough to support the regular preventive maintenance. As a result, the budgets that are available are often far too small to be able to support proper maintenance of the road networks and there is a significant "maintenance gap."

What has exacerbated the "maintenance gap" is that funding available for maintenance of agencies responsible for maintenance was limited, and there was no funding source dedicated to financing maintenance activities. Also, not unimportant in this context, is that the agencies responsible for maintenance were/are largely unaccountable for the problems caused by the lack of maintenance. This lack of accountability is compounded by a lack of proper understanding about what is needed to carry out long-term preventive maintenance. It was not, and still is not properly understood, that undertaking cost-effective maintenance requires a significant amount of planning, administrative and managerial

capacity in addition to the technical capacity. In many parts of the world, maintenance is still not considered to be a recurrent, preventive activity; it is still seen as something that is done to remedy the situation once a road has significantly deteriorated.

The issue of the lack of capacity was made even more severe by the decentralization of responsibilities from central to local bodies, without a corresponding transfer of financial resources. At the local levels, the technical, managerial and administrative capacity is simply lacking.

The organisations responsible for road maintenance do not bear the costs of poor maintenance; these costs are borne by road users. Neither do these organisations have any market forces nor do they have any competitive pressures that would make them improve the condition of the road network. Finally, these organisations have little, if any, direct interaction with the road users and hence are further insulated from any public pressures to improve road maintenance. Thus, without any public pressure to improve the condition of the road network, there is little political or administrative urgency attached to improving maintenance.

3.2. Roads as an Economic Motor

To assess the contribution of road investments to economic growth, several studies specify some sort of an aggregate production function that includes transportation infrastructure as explanatory variables. Most of these studies found that transportation infrastructure had a positive effect in terms of economic growth (Antle, 1983; Ratner, 1983; Binswanger et al., 1987; Aschauer, 1989; Binswanger, Khandker, and Rosenzweig, 1989; Baffes and Shah 1993; and Easterly and Rebelo, 1993).[4]

However, these studies do not account for reverse causality and this can lead to overestimating the positive effects of infrastructure on economic growth, and these studies fail to control for the quality of the road infrastructure which can lead to biases in the estimates of infrastructure's contribution to growth. Fernald (1999), however, using data from 29 U.S. manufacturing industries, from 1953 to 1989, examined the question of whether investments in road infrastructure lead to economic growth, or whether economic growth leads to larger investments in road infrastructure.[5] His findings also suggest that investment in road infrastructure does contribute to economic growth. Fernald's study does, however, suggest that the marginal returns to investments in roads may not be as high as commonly thought, primarily because road construction offers a one-off increase in productivity rather continuous improvement.

Studies by Fan et al. (1999, 2000, 2002, and 2004) in rural India, China, and Thailand also estimate the effect of infrastructure investments on economic growth and poverty.[6] Using sophisticated techniques

[4] Antle, J. M., (1983) Infrastructure and aggregate agricultural productivity: International evidence. Economic Development and Cultural Change 31 (April), 609 – 619; Baffes, J., and Shah, A., (1993) Productivity of public spending, sectoral allocation choices and economic growth. Paper presented at the 1993 Annual Meeting of American Economic Association, Anaheim, California; Binswanger, H., Khandekar, S., and Rosenzweig, M., (1989) How infrastructure and financial institutions affect agricultural output and investment in India. World Bank Working Paper Series 163. Washington D.C., USA; Easterly, W., and Rebelo, S., (1993) Fiscal policy and economic growth: An empirical investigation. Journal of Monetary Economics 32 (3) 417-458; Ratner, J. B., (1983) Government capital and the production function for US private output. Economic Letters 13: 213 – 217

[5] Fernald, J. G., (1999) Roads to prosperity? Assessing the link between public capital and productivity. The American Economic Review 89 (3) 619 - 638

[6] Fan, S., and P. G. Pardey. (1997). Research, productivity, and output growth in Chinese agriculture. Journal of Development Economics 53: 115–137; Fan, S., and N. Rao. (2002). Public investment and poverty reduction: A synthesis of issues, methods and major findings. Mimeo. Washington, D.C.: International Food Policy Research Institute; Fan, S., P.

these studies simultaneously controlled for investments in infrastructure factor and product markets. These studies consistently found that investments in roads made significant contributions to economic growth and reducing poverty - in rural India, public investment in rural roads was found to have had the largest positive impact on agricultural productivity growth, while in China and Thailand, road investments were found to have contributed significantly to growth in non-farm and total economic growth as well as to agricultural growth.

Differences in the level of accessibility can also lead to differing levels of economic performance and income levels between regions within a country. Lagging regions are often characterized by having poor infrastructure and this isolates local populations from educational, social, and economic opportunities and contributes to the rise of poverty in the region. Deichmann et al. (2000), Nagaraj, Varoudakis, and Veganzones (2000), and Stephan (2000) investigated the determinants of regional economic disparities and found that investments in road infrastructure contribute to raising incomes and labour productivity.[7]

In addition to affecting regional economic performance, road infrastructure also has implications for the volume of trade. Limao and Venables (1999) showed that infrastructure is a significant determinant of transportation costs, and that in landlocked regions transport costs can increase by 50 percents.[8] They concluded that most of Africa's poor trade performance is the result of weak infrastructure.

The accessibility of a region can also influence the food prices in the region. Minten and Kyle (1999) analysed the causes of food price variation and concluded that there is significant variation in food prices across regions and products, transportation costs explain most of the this variation, and road quality is an important factor in transportation costs: transportation costs were on average two times greater on dirt roads than on paved roads.[9]

Hazell, and S. Thorat. (1999). Government spending, agricultural growth and poverty: An analysis of interlinkages in rural India. IFPRI Research Report No. 110. Washington, D.C.: International Food Policy Research Institute; ———. (2000). Government spending, agricultural growth, and poverty in rural India. American Journal of Agricultural Economics 82 (4): 1038–1051; Fan, S., L. Zhang, X. Zhang, and X. Ma. (2001a). Regional priorities of public investment in rural China: A country-level analysis. Report prepared for the project Priorities of Public Investments in Chinese Agriculture. Washington, D.C.: International Food Policy Research Institute; Fan, S., C. Fang, and X. Zhang. (2001b). How agricultural research affects urban poverty in developing countries: The case of China. EPTD Discussion Paper 80. Washington, D.C.: International Food Policy Research Institute; Fan, S., L. Zhang, and X. Zhang. (2002). Growth, inequality, and poverty in rural China: The role of public investments. IFPRI Research Report No. 125. Washington, D.C.: International Food Policy Research Institute; Fan, S., S. Jitsuchon, and N. Methakunnavut. (2004). The importance of public investment for reducing rural poverty in middle-income countries: The case of Thailand. DSGD Discussion Paper No. 7. Washington, D.C.: International Food Policy Research Institute.

[7] Deichmann, U., Fay, M., & Lall, S. V., (2000) Economic structure, productivity, and infrastructure quality in Southern Mexico. Policy Research Working Paper Series 2900. Washington D.C., World Bank; Nagaraj, R. A., Varoudakis, A., & Veganzones, M. A., (2000) Long-run growth trends and convergence across Indian states, Journal of International Development 12: 45 – 70; Stephan, A., (2000) Regional infrastructure policy and its impact on productivity: A comparison of Germany and Fracne, Konjuknturpolitik 46 (940) 327 – 356.

[8] Limao, N., & Venables, A. J., (1999). Infrastructure, geographical disadvantage and transport costs. Policy Research Working Paper Series 2257. Washington, D.C.: World Bank.

[9] Minten, B., & Kyle, S., (1999). The effects of distance and road quality on food collection, marketing margins, and traders' wages: Evidence from former Zaire. Journal of Development Economics 60: 467–495.

3.3. The Case for Road Maintenance

Road Maintenance: Why and Who Benefits?

The purpose of maintenance is to ensure that the road remains serviceable during its lifetime. Maintenance is important because it:

- Prolongs the life of a road by countering the effects of deterioration and thus preserves the value of the previous investments and the road asset.
- Reduces Vehicle Operating Costs (VOC) by providing a smooth running surface.
- Preserves the benefits provided by the original roads by providing reliable access and travel times for people to access healthcare, employment and educational opportunities.

Governments should be interested in preserving the value of their road assets. However, in practice, the responsible agencies have little incentive to undertake preventive maintenance activities.

The people living and businesses operating in areas served by the roads and the vehicle owners and operators are the primary beneficiaries of good roads and improved access.

Source: Consultant

The World Bank (1988) produced a seminal report investigating the causes and remedies for deterioration of road networks.[10] One of the first sentences in this report states "The failure to maintain roads is tantamount to an act of disinvestment, for it implies the sacrifice of past investment in roads." This report further goes on to say that in 20 years' time, an estimated $45 billion worth of road infrastructure was lost owing to poor maintenance in the 85 countries that were included in the study. According to the World Bank, this loss could have been averted by spending $12 billion on carrying out preventive maintenance.

Poor maintenance practices impose the following costs on national economies:

1. Destruction of the value of road assets and its corresponding impact on government accounts and higher costs for road rehabilitation in the future
2. Higher vehicle operating costs, fuel costs, and reduced road safety
3. Reduced access resulting in poorer healthcare and fewer employment and educational opportunities

[10] World Bank (1988) Road Deterioration in Developing Countries: Causes and Remedies, A World Bank Policy Study

3.3.1. Reduction in the value of road assets

Roads are one of the largest, most important, and valuable assets managed by governments. To give an example, the value of the road network managed by the Japan Highway Public Corporation were roughly equal in value to the assets of General Motors (before its current problems).[11] The highway network of a small country like New Zealand is valued at roughly €15 billion making it the largest publicly owned asset in the country.[12] The future value of this road network (assuming no new construction) depends on the quality and timeliness of road maintenance. Without proper and timely road maintenance, the value of road assets can decline sharply, in turn reducing greatly the significant positive benefits that accrue from well-maintained road networks.

Impact of Delaying Road Maintenance on Africa's Road Network

Paradoxically, low income countries spend 50% more per kilometer [on road maintenance] overall than do middle-income countries, while countries with established road agencies and fuel levies seem to spend somewhat less than those without. The explanation is a pronounced capital bias in road spending, with investment accounting for two thirds of total spending in the [resource rich and] low-income countries, particularly those without adequate institutional mechanisms for funding road maintenance. Middle income countries and those with high fuel levies tend to spend more on maintenance without incurring higher road expenditure overall. This finding clearly shows that **timely attention to maintenance reduces the expenditure needed to sustain the road system in the long term**.

Source: Foster and Briceno-Garmendia (2011)

The implications of the lack of maintenance are severe. In the Philippines, it is estimated that the annual reduction in the value of road assets is twice the amount that would be required to undertake preventive maintenance of these road assets.[13]

In Asia, for many countries, roads represent the single largest asset owned by governments. Rural roads, or unpaved roads, are a large part of this public road network. For the 15 countries in the Asian region, asset value of rural roads alone represents almost 27% of the GNP of these countries.[14] In these same countries, there is also a huge maintenance gap, the expenditures on maintaining the rural roads network relative to the requirement are very small (typically well below 50%). This means that the value of the rural roads network is decreasing over time and the replacement costs are increasing.

The annual maintenance costs represent a small proportion of the cost of new construction and rehabilitation costs; 2-3% for a paved road, and 5-6% for an unpaved rural road. It is unfortunate that despite the rather clear cut case for investing in preventive maintenance, the amounts spent on

[11] Heggie, I. & Vickers, P. (1998) Commercial Management and Financing of Roads, World Bank Technical Paper, Washington DC, USA.
New Zealand Transport Agency (2012) State Highway Asset Management Plan 2012-2015, NZTA, New Zealand.
[12] New Zealand Transport Agency (2012) State Highway Asset Management Plan 2012-2015, NZTA, New Zealand.
[13] Donnges, C., Edmonds, G., & Johannessen, B., (2007) Rural Roads Maintenance: Sustaining the Benefits of Maintaining Access, Bankgkok, Thailand, International Labour Organisation.
[14] Ibid.

maintenance activities remains low in most middle and low income countries.[15] While unpaved roads deteriorate more or less uniformly over their design life, it is well known that the deterioration in the condition of paved roads does not follow a linear trajectory over time.[16] Newly paved roads slowly deteriorate, depending on the volume and mix of traffic, the climate and weather conditions, over the first half to –two-thirds of their life. After this, without adequate maintenance, the pavements deteriorate much more rapidly and eventually break apart completely.

Postponing road maintenance results in high direct and indirect costs. If road defects are repaired promptly, the cost is usually modest. If defects are neglected, an entire road section may fail completely, requiring full reconstruction at three times or more the cost, on average, of the costs of preventive maintenance.[17]

The South African National Road Agency Ltd. (SANRAL) estimates that repair costs rise to six times maintenance costs after three years of neglect and to 18 times after five years of neglect. To avoid such escalating costs, SANRAL first "allocate[s] its available funding resources to ideal maintenance actions (e.g., reseals and overlays), and thereafter to more extensive maintenance actions (e.g., rehabilitation), and finally to new construction" (SANRAL 2004)[18].

3.3.2. Higher vehicle operating and transport costs

Delayed maintenance has indirect costs as well. Neglected roads steadily become more difficult to use, resulting in increased vehicle operating costs (more frequent repairs, more fuel use) and a reluctance by transport operators to use the roads. This imposes a heavy burden on the economy: as passenger and freight services are curtailed, there is a consequent loss of economic and social development opportunities.

As roads deteriorate they get rougher. As roads get rougher, vehicle operating costs increase, especially for the heavier vehicles like trucks and buses.

Table 3-1– Effect of Road Roughness on Vehicle Operating Costs (Index of VOC: Good = 100, at IRI=2.3)

	Road condition	
Vehicle class	***Fair (4.6 IRI)***	***Poor (6.9 – 9.2 IRI)***
Small car	106	114-26
Buses	104	109-16
Light diesel truck	111	123-38
Heavy truck	114	129-46
Articulated truck	112	127-44

Source: World Bank (1988); (IRI - International Roughness Index)

While Table 3-1 is based on relatively old data, more recent studies reach very similar conclusions that as road roughness increases, vehicle operating costs also increase. For example, a recent study in Morocco investigated the relationship between maintenance budgets and transport costs.[19] The conclusions of this study showed that an increase of €2.65 billion, over 20 years, would deliver savings in transport costs of €7.5 billion. A World Bank study of maintenance strategies in Kyrgyz Republic

[15] Foster, V., & Bieceno-Garmendia, C., (2011) Flagship Report: Africa's Infrastructure: A Time for Transformation.
[16] World Bank (1988).
[17] World Bank (1988).
[18] SANRAL (South African National Road Agency Ltd). 2004. Annual Report 2004: Sustainability Report. Pretoria, South Africa.
[19] Mesnard, R., (2013) An application of HDM4 V2 in the Kingdom of Morrocco.

found that, over a 20 year period, increasing the maintenance budget by €320 million more than what would be required for a strategy funding only routine maintenance and delaying all other maintenance until reconstruction is required, would reduce transport costs by €2.1 billion.[20]

3.3.3. Reduced access

Poorly maintained roads mean longer travel times and reduced access. Longer travel times and reduced access is not just an irritant. In the context of development and poverty alleviation, longer travel times and reduced access take time away from other productive activities, and reduce the opportunities for development. In short these are major barrier to development and poverty alleviation. Reduced, or loss of, access leads not only to economic losses, but also to lower enrolment of children in schools, higher rates of infant, child and maternal mortality, and a general disconnect from the process of national development.[21]

The effects of poor maintenance of rural roads lead to particularly serious effects in terms of longer travel times and reduced access. When large sections of the population are living in rural areas, rural roads become a very important part of the road network in terms of providing access and helping to reach development goals.

Lack of access has its effect at the most basic level of living. If there is poor access to health services, people will remain unhealthy, children will die, and any epidemic will be likely to have catastrophic results. If there is poor access to clean water, again health will suffer. If there is poor access to basic information the household will be unaware of ideas and technology that might help them to lift their level of living. And if there is poor access to education, children will in the future share the limitations confronting their parents today. In addition, lack of access to markets ensures that whatever potential that exists for marketing crops will be limited.

Thus, it would not be an exaggeration to state that a lack of maintenance, especially of the rural road network, is often a major impediment to the achievement of a country's poverty reduction goals.

The results of longer travel times and reduced access

- Farmers are reluctant to grow a marketable surplus crop because of the difficulties and costs of transporting the crop to markets
- School enrolment and absenteeism is higher (both for teachers and students)
- Health care standards are poor because of the difficulty in reaching doctors, health care workers and facilities to get timely and appropriate health care
- Women's working days are longer and harder, because of the time that it takes to reach water and fuel sources; two essential elements for daily life.

Source: ILO (2007)

[20] World Bank (2012).
[21] Howe, J., (1997), Transport for the Poor or Poor Transport. ILO , Edmonds, G., (2005), Transport, Access and the Millenium Development Goals. ILO, ASIST AP 2005,

3.4. Examples of Management of Road Sector – International Case Studies

This section provides some examples of how the road sector is organised in different countries across the world. It also discusses the institutional structure and responsibilities for managing the road networks, and separately provides some examples of road funds from across the world.

This study provides examples from two countries, South Africa and New Zealand. These two countries have been selected because the South African National Roads Agency (SANRAL) and the New Zealand Transport Agency (NZTA) are among the best organised and managed road agencies in the world. Furthermore, SANRAL is also interesting because it is an example of a road agency in a middle income country and illustrates what is possible with limited resources. The New Zealand example is an agency that represents the "ideal" in terms of a road network should be managed and operated.

3.4.1. South Africa

The road network in South Africa consists of several types of roads, classified according to their functionality and management, namely:

- **National roads** are managed by SANRAL, a public agency with the Ministry of Transport as the only shareholder. SANRAL was established by means of the South African National Roads Agency Limited and National Roads Act (Act 7 of 1998). It is an independent statutory company operating along commercial lines and with considerable autonomy from the government.[22]

- **Provincial/regional roads** fall under the responsibility of the nine provinces. Eight of the nine provinces operate on a traditional road authority structure that typically includes departments such as Roads and Public Works for management and delivery of roads.

- **Local/municipal road**s are managed using multiform institutional arrangements. Most municipal road authorities have a traditional roads authority structure under the ownership of the council. Two or more municipalities can form a transport authority to take over municipal road functions and, currently, there are more than 250 "municipal road authorities" in operation.

In some metropolitan areas, like Johannesburg, Metropolitan Municipalities Roads Agencies have been established as their delivery arm, under the guidance of a Roads Agency Board. The ownership of roads still resides with the city, but the Metropolitan Roads Agency is responsible for the delivery of roads, based on a performance contract that it has with the city's contracting unit.

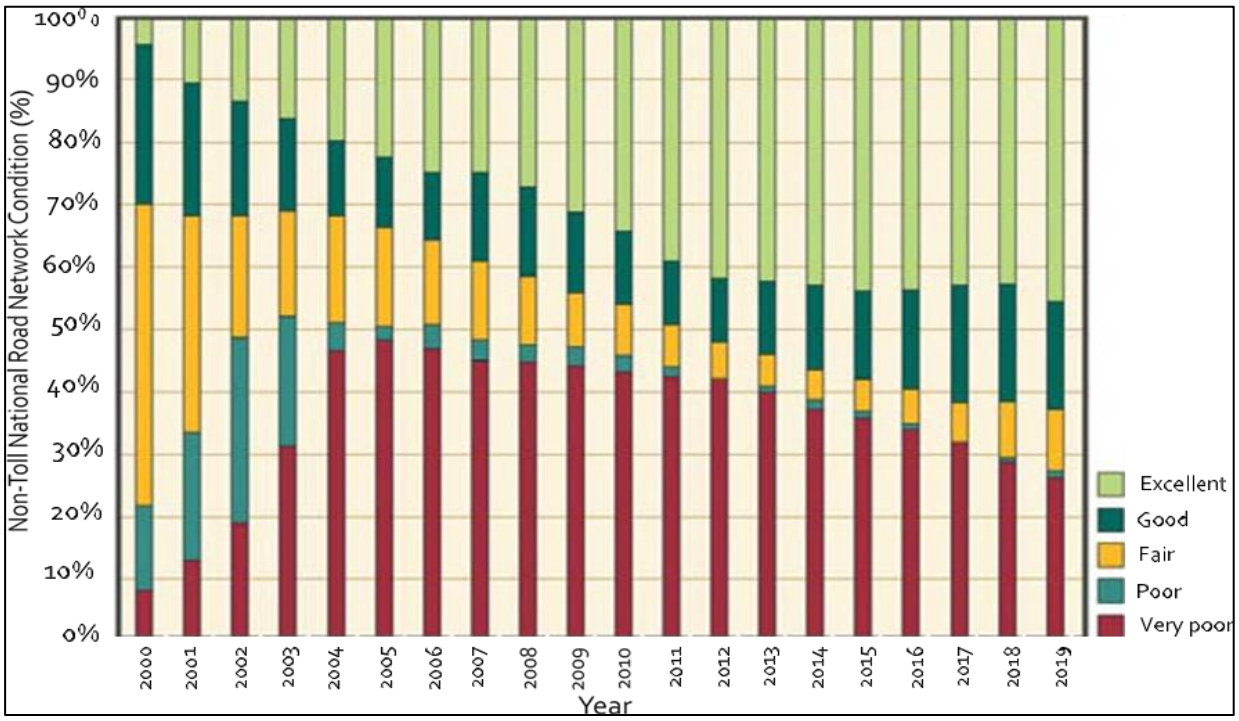
The coordination of and responsibility for the planning and delivery of the primary metropolitan road network requires particular attention with many municipal road networks having both provincial and national road components within their set-ups, where the "higher" spheres of government have tended to dominate.

Finally, some 220,000 km of roads are unproclaimed, meaning that they were never formally adopted by a particular government department as part of the official networks. Legally, no authority can spend money on roads that are not proclaimed. These are typically access roads in rural areas.

[22] SANRAL (2010). *Our history.* http://www.nra.co.za/live/content.php?Category_ID=21

The general state (or condition) of a gravel or paved road network system is described in terms of a Visual Condition Index (VCI). The VCI of a road network is ideally quantified (bi-) annually and, if given over time, shows the trend in road conditions. The VCI uses a five-point scale, that is, very good, good, fair, poor, and very poor. Considering non-toll roads only, about 35 per cent of provincial and 15 per cent of national roads are assessed as being in poor or very poor condition.[23] Figure 3-1 provides an overview of the quality and the expected quality of the non-toll national roads.

Figure 3-1 Forecasted quality of non-toll roads in South Africa[24]



Source: Consultant

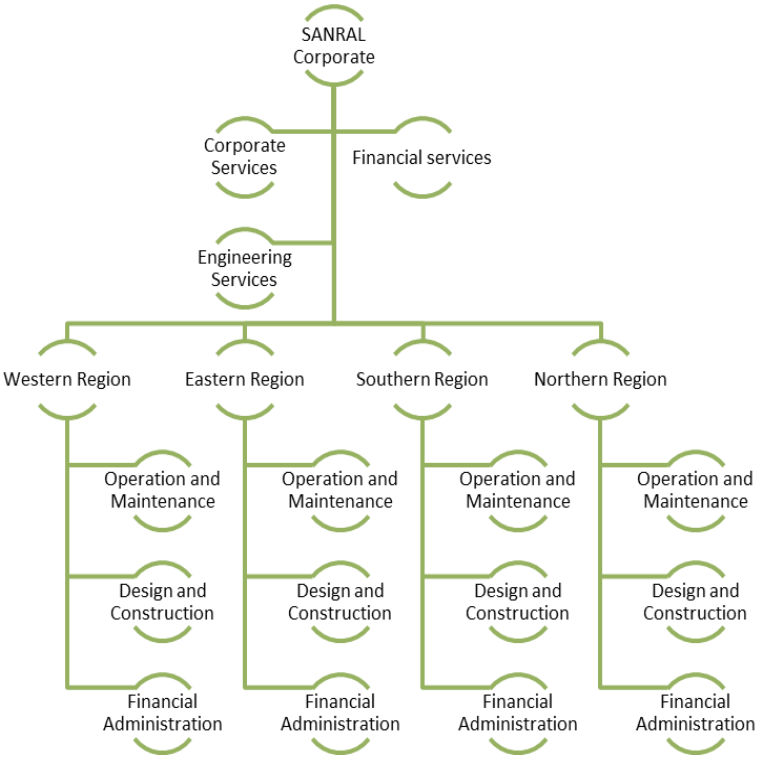
SANRAL

SANRAL manages 19,704 km of the national road network and this is expected to grow to 35,000 km. Of the national roads managed and operated by SANRAL, over 3,000 km are toll roads (see Table 3-2). Over the past 10 years, SANRAL has also incorporated certain provincial roads that it has identified as being of long-term strategic importance for the national road network.

As can be seen in Figure 3-2, SANRAL has a strong regional focus, with a head office being responsible for a limited set of core services limited to providing corporate, financial, and engineering services. The design and construction, operation and maintenance, and financial administration are all the responsibility of the regional offices.

[23] Council for Scientific and Industrial Research (2010). *The condition of provincial road networks.* www.csir.co.za
[24] The Strategic Vision of SANRAL for the year 2010

Figure 3-2 Organisational Structure of SANRAL



Source: Consultant

Table 3-2 Roads Managed by SANRAL

Design	Length of roads in category (km)
Toll, BOT	1,290
Toll, state	1,835
Non-toll	13,050
Total	16,175

Source: Consultant

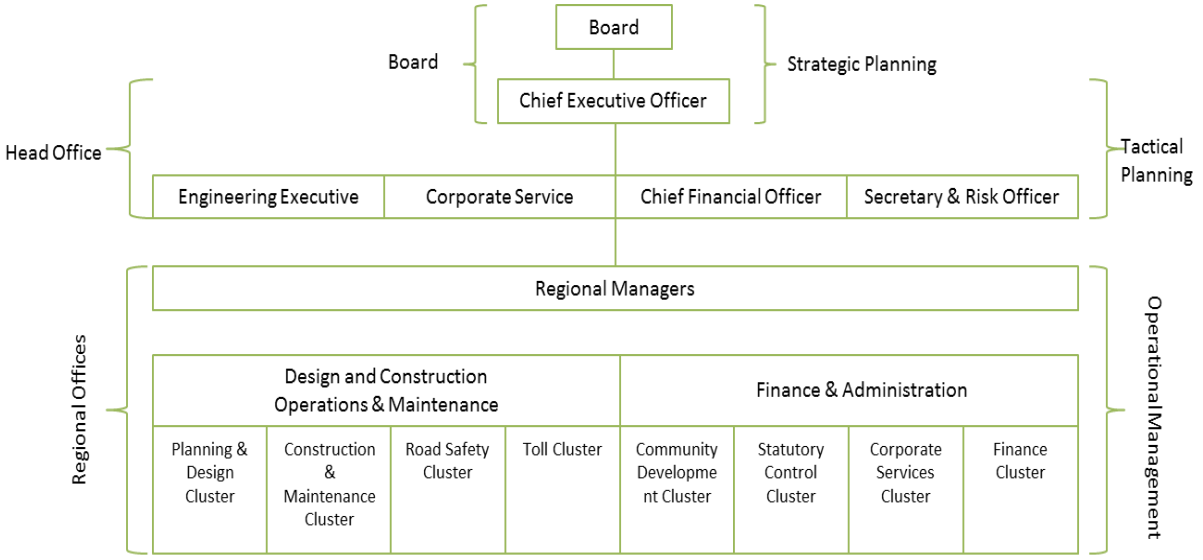
SANRAL has been entrusted with the task of developing and maintaining the national road network. To that end the following three tasks are identified:

- Planning and programming,
- Execution of works and delivery of services, and
- Audit and control.

Planning and Programming

In order to maximize the return on investment, SANRAL has developed a medium- and long-term asset management strategy. This strategy aims at holistic management and setting clear priorities for funding. The responsibility for planning is placed at different levels within SANRAL. The higher echelons are responsible for strategic planning, leaving the further detailing of these plans to the lower echelons of the organization. Figure 3-3 shows this distribution of responsibilities.

Figure 3-3 Planning Responsibilities within SANRAL



Source: Consultant

In the planning process, the following inputs are used to develop road works plans:

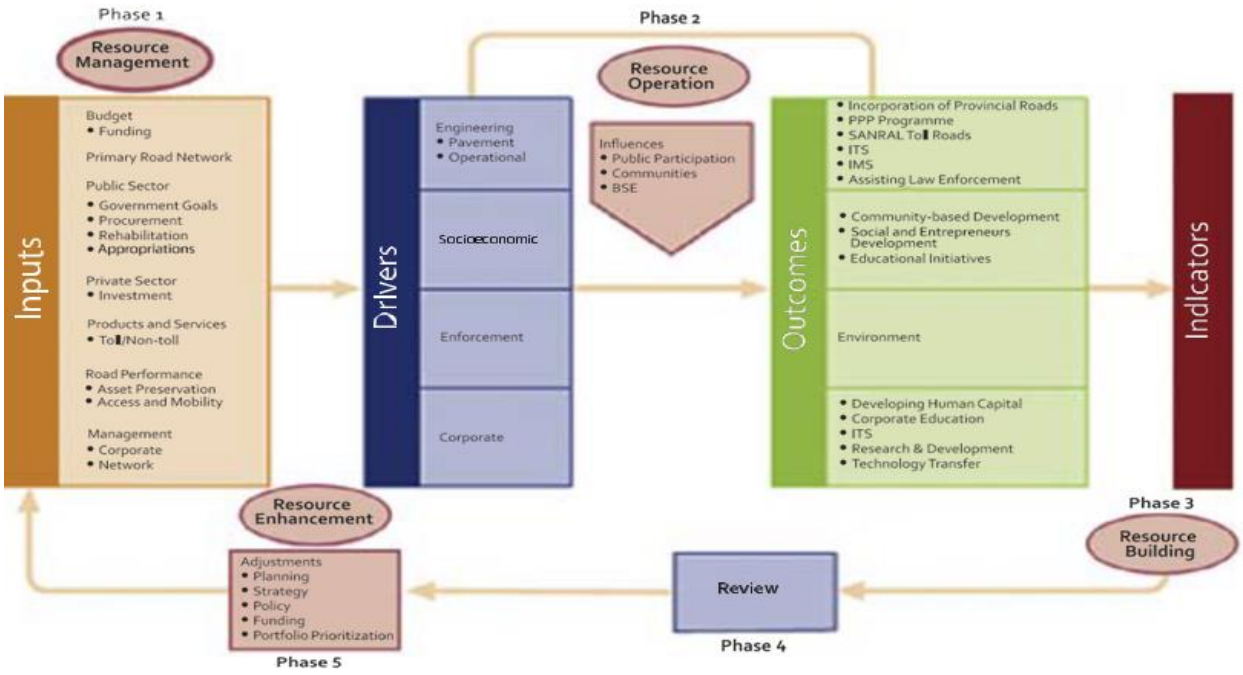
- Historical performance,
- Materials availability,
- Availability of funds/financial constraints,
- Traffic volume and composition,
- Road classification and adjacent land use, and
- Environment.

However, planning is driven by the impact of the quality of the road network experienced by its users. Financial constraints are incorporated through a Medium Term Expenditure Framework (MTEF), at least where it concerns non-toll roads. This MTEF details future allocations of available tax-based revenues and thus describes budget constraints.

Execution of Works and Delivery of Services

SANRAL employs an integrated approach to road network management. This approach is based on regular data collection to monitor the performance of the network. Maintenance and rehabilitation requirements are determined based on this approach. Supporting road network management are several smaller management programs. There is a united focus on delivering results that can be monitored through KPIs and the integrated approach to the network and individual stretches/projects which form part of the network. The overview presented in Figure 3-4 shows the overall performance management framework of SANRAL.

Figure 3-4 Performance Management System of SANRAL



Source: Consultant

Asset Management

The approach to asset management, as employed by SANRAL, affects the full range of activities where it concerns extensions of its asset base, for example, planning, engineering, finance, programming, and actual works. Figure 3-5 describes this approach.

Figure 3-5 Asset Management System at SANRAL

Source: Consultant

Private Sector Participation and Procurement

SANRAL has a management and financial focus with all service delivery outsourced which includes design, inspection, surveying, supervision, overload control (apart from law enforcement), traffic and safety management, and the carrying out of maintenance and construction works.

Procurement opportunities at SANRAL are published publicly, including the opportunities for small contractors. The publication is the start of a process of prequalification, adjudication and, finally, award of the contract. Social objectives in opportunities relate to the use of local labour and women, thereby complying with the principles of the Reconstruction and Development Program. Project Liaison Committees, the main contractor and members of the local community, are established for each of these projects to oversee the socioeconomic requirements.

Audit and Control

An Audit and Risk Committee regularly (four times annually) checks whether internal controls and systems have been put in place and whether these controls have functioned effectively. It checks, amongst others, whether identified risks are being addressed and have been disclosed.

The Audit and Risk Committee audits SANRAL on several aspects, including:

- Reduction of the organization's risks to an acceptable level,
- Meeting the business objectives of the organization,
- Ensuring the organization's assets are adequately safeguarded, and
- Ensuring that the transactions undertaken are recorded in the organization's records.

Other committees ensure a further transparent and good management of SANRAL, for example:

- A human resource and remuneration committee,
- A contracts committee, and
- An assets and liabilities committee.

SANRAL's Board of Directors is ultimately responsible and accountable for risk management within SANRAL, following the Public Finance Management Act of 1999. A dedicated management team (Risk Management Cluster) has the delegated responsibility to design, implement and monitor the process of enterprise-wide risk management.

The main tool used is the risk register. All employees are encouraged to express their concerns relating to the strategic and operational risks faced by the company. The risks are analysed and published in the risk register along with mitigating measures which is available to all staff. It forms a basis for the Internal Audit Coverage Plan.

Human Resource Management, Knowledge Development and Research

SANRAL has some 180 employees and has put in place a number of initiatives to support their development in view of its own tasks. It is worth noting that SANRAL was recognized as one of the best employers in South Africa in 2009-10. Quoted reasons for this success are the attention to the development and training of its employees as well as its HIV/AIDS campaign. SANRAL has built partnerships with the Gordon Institute of Business Science, the University of Stellenbosch and the

Engineering Council of South Africa to provide training programs to management staff, tailored to SANRAL's needs. Some 10 per cent of staff can attend yearly training courses.

Also SANRAL developed a Construction Management Program for all SANRAL employees who are involved in the management of construction delivery. This prestigious program is a collaborative effort between the Universities of Stellenbosch, Witwatersrand, Cape Town and Pretoria. Every year SANRAL appoints a number of project engineers/managers to attend the program.

Research and Knowledge Development

SANRAL runs a road infrastructure research program that aims to improve efficiency in road design and delivery. The focus is on developing economically favorable road techniques, including the development of performance-related design systems and improved building materials, but social science studies are also funded, for example, research on the current practice in HIV/AIDS education and training on SANRAL projects. SANRAL ensures that sustainable long-term research funding is available through its own funds and through partnerships with other road authorities and the industry. An advisory committee on road infrastructure research has been established to provide strategic direction and input on the best use of limited research funding, and for enhanced communication between industry participants. SANRAL will continue to fund various research projects, including:

- Accelerated pavement testing (rigid and flexible pavements),
- Updating and revision of technical methods for highways and technical recommendations for highway documentation,
- Cost-effective ways to upgrade gravel roads
- Large tri-axle testing, and
- Pedestrian safety management.

3.4.2. New Zealand

New Zealand has a widespread road infrastructure, consisting of state highways and local rural and urban roads. State highways are administered by NZTA. The state highway network provides a strategic road link between districts and regions. A state highway is a road that is declared to be a state highway under section 11 of the National Roads Act 1953 (section 60 of the Government Roading Powers Act 1989) or section 103 of the Land Transport Management Act 2003. Currently, their length is around 11,000 km. Local roads are those which are primarily administered by 'territorial authorities' (city and district councils) and make up about 80,000 km (88 per cent) of all New Zealand's roads.

Territorial authorities, along with regional councils and unitary authorities – collectively known as 'local government' – play a key role in the planning and funding system. Local government is responsible for developing, maintaining and operating the large network of local roads and for delivering public transport infrastructure and services.

Regional transport committees are appointed by the regional councils and unitary authorities. They consist of members of various government and public interest representatives. Regional transport committees prepare regional land transport strategies and regional land transport programs and provide advice as requested by the regional council. These programs are prepared every three years to set out a region's land transport activities

New Zealand Transport Agency

NZTA was created in August 2008 as a Crown entity by merging Transit New Zealand (the highway agency) and Land Transport New Zealand (the funding and planning agency). Its role and composition of the Board are set out in legislation. It has statutory independent decision-making responsibilities with respect to the allocation and investment of the National Land Transport Fund. The agency is responsible for the day-to-day management of land transport related activities. NZTA is thus not only responsible for roads but for all transport infrastructure. NZTA has the following responsibilities:

- Promote an affordable, integrated, safe, responsive and sustainable land transport system,
- Investigate and review accidents and incidents involving transport on land,
- Manage the state highway system, including planning, funding, design, supervision, construction and maintenance operations,
- Manage funding of the land transport system, including auditing the performance of organizations receiving land transport funding,
- Manage regulatory requirements for transport on land,
- Cooperate with, provide advice and assist any government agency or local government agency at the minister's request,
- Provide the minister with advice on its functions,
- Carry out any other land transport functions directed by the minister under the Crown Entities Act 2004, and
- Carry out the functions required by LTMA or under any other Act.

The ministry negotiates an annual performance agreement with NZTA on behalf of the minister; monitors the entities' performance against that agreement; and recommends appointments to the entities' governing bodies.

Strategy

Vision: Building a better transport system for New Zealanders

Mission: Our primary purpose is to promote an affordable, integrated, safe, responsive and sustainable land transport system

Goals and Objectives

- Improving customer service and reduce compliance costs
- Planning for and delivering roads of national significance
- Improving the road safety system
- Improving the efficiency of freight movement
- Improving the effectiveness of public transport

Structure

NZTA's structure (Figure 3-6) includes six business groups:

- The Strategy and Performance Group works to promote government themes, objectives and strategies and supports the Board's preparation of the NZTA,

- The Regional Partnerships and Planning Group works in partnership with local government on regional planning and programming processes,
- The Highways and Network Operations Group is responsible for building, maintaining and operating the state highway network,
- The Access and Use Group provides services such as driver licenses and motor vehicle registration, and also regulates transport operators,
- The Organizational Support Group develops and implements corporate strategies and policies to support overall organizational performance, and
- The People and Capability Group are responsible for implementing the human resources policy of NZTA.

The Minister of Transport can appoint up to eight members to the Board. The Board meets monthly from February to December. It is responsible for making independent decisions on allocating and investing funds from the National Land Transport Fund. The Board publishes its planned program of investment annually in the NZTA.

NZTA is primarily responsible for roughly 11,000 km of state highways. Around half of the 36 million vehicle km travelled each year is driven on these state highways. The quality of the network is good: in 2008 only 1.5 per cent of the road network had a roughness exceeding the threshold level for that type of road.

Figure 3-6 Organisational Structure of New Zealand Transport Agency

Source: Consultant

NZTA is responsible for tasks that range "from ensuring the government's national priorities are achieved, through to working with local councils in planning for their land transport needs, building and maintaining state highways, supporting the use of buses and trains, licensing cars, and providing cycle

ways and walkways for use." These tasks are set out in a comprehensive framework of legislation and performance is constantly monitored.

In order to fulfill these tasks, three underlying competencies are identified:

- Planning and programming,
- Execution of works, and
- Audit and control.

Planning and Programming

NZTA has an integrated planning strategy (see Figure 3-7). In this approach, different aspects of planning are considered jointly, and activities of different organizations relevant to transport infrastructure are also incorporated. The strategy aims to provide a clearly defined framework to guide the work with planning partners and local authorities at all levels –national, regional and local. NZTA has its own policy standards and guidelines on transport planning and land use planning as well as the integration of both approaches.

The National State Highway Strategy envisages the development of the road network over the next 30 years. The strategy is a touchstone for NTZA's work, influencing all its operating polices and plans and the funding proposals in the state highway works program. Also within the National Infrastructure Plan, the government has recognized seven roads of national significance that require special focus for investment to reduce congestion and improve safety.

The goals and objectives of the strategy are adopted in the NLTP which provides the initial framework for implementing actions that lead to the realization of the strategy and to advance the delivery of the identified roads of national significance. The NZTA also publishes a three-yearly Statement of Intent which defines immediate outcomes and five strategic priorities for the next three years based on the strategic directions.

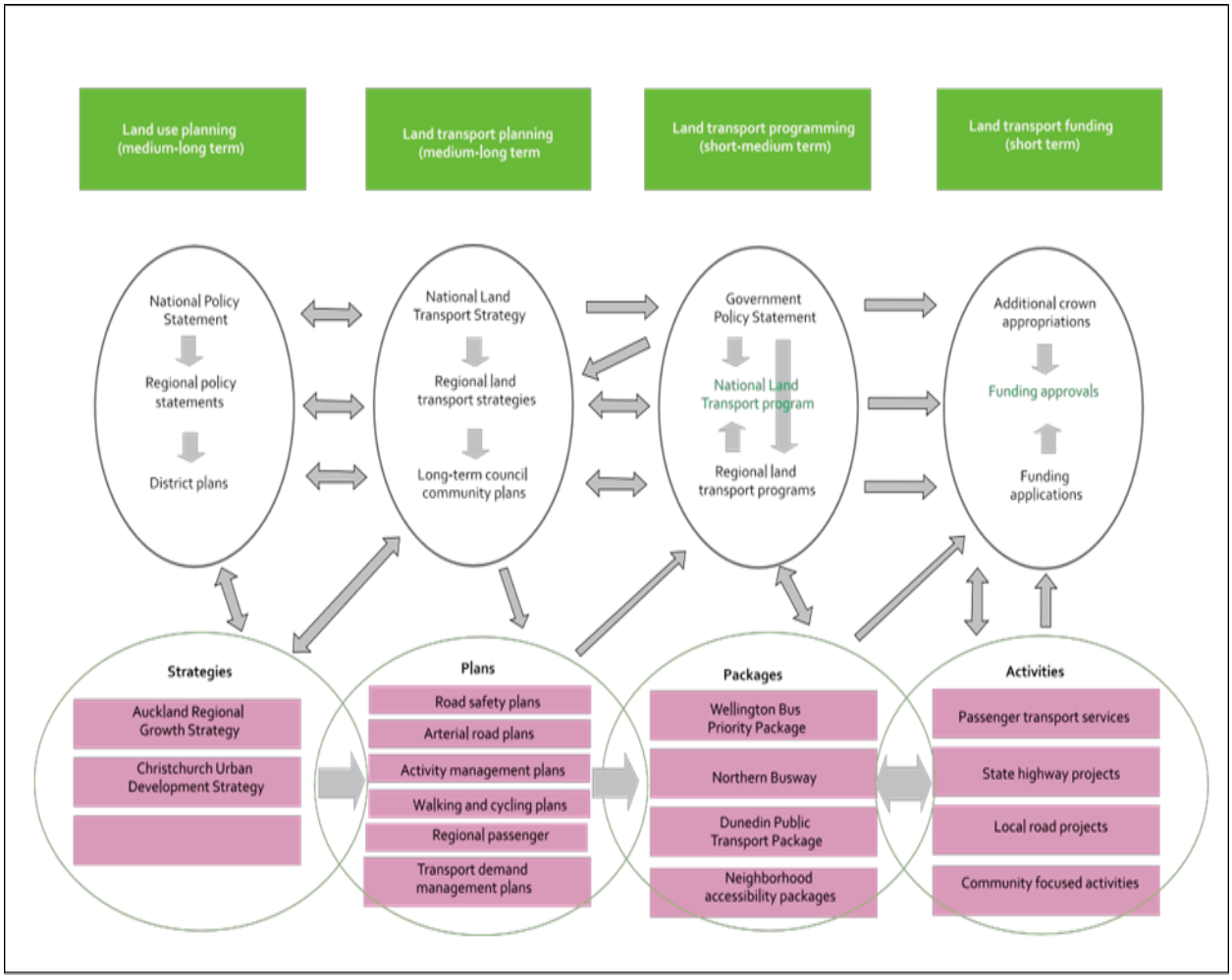
The State Highway Asset Management Plan (SHAMP) links the requirements of these policy and strategy documents to the actual road assets. SHAMP provides a national view based on a review cycle relating to the three-year NLTP, and draws from the perspectives of a number of other detailed plans, including the National State Highway Strategy, Investment and Revenue Strategy and State Highway Classification System (Figure 3-8). The plans join together to set out how the network should develop over the next 30 years.

SHAMP has a national 'operational business' focus and currently sits beside the Capital Plan. While the Capital Plan is developed and agreed at the political level, the asset stewardship expectations of SHAMP are recognized in capital program decision-making and project development. These two plans are closely coordinated and together define the state highway business and management of state highway assets. This is a key strategic management document for the NZTA that translates the long and short term goals and objectives into a plan to manage the assets, identifies the actual service required and expenditure that goes with it.

Execution of Works and Services

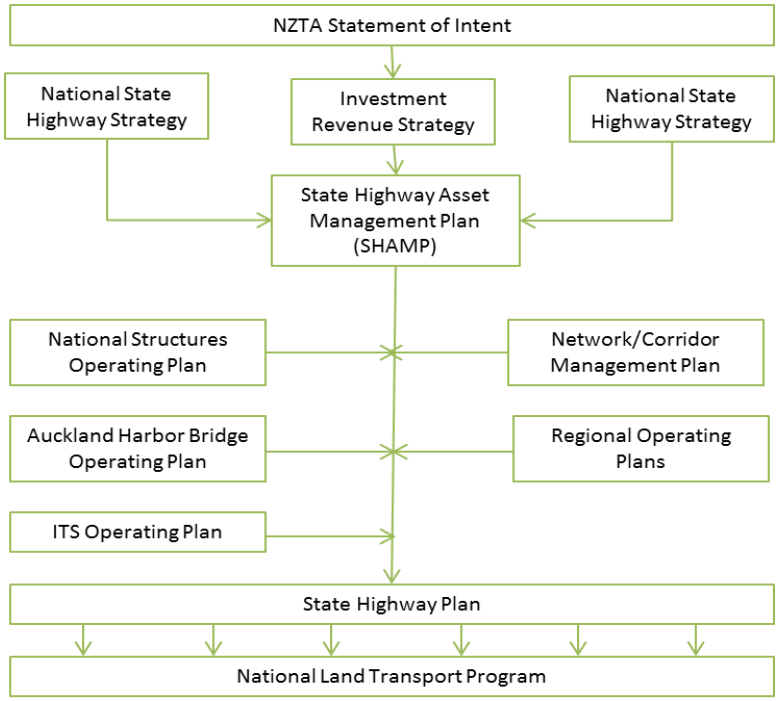
Network management aims at enabling efficient movement of people and goods across New Zealand's infrastructure. NZTA does this through management of its assets and the ways people use the network. NZTA uses a strategic and systematic process of operating, maintaining, upgrading and expanding physical assets to manage the effectiveness of transportation assets throughout their lifecycle. This integrated approach leads to the publication of SHAMP which covers all infrastructure assets that together form the state highway network, including road carriageways, bridges and structures, drainage features, traffic facilities, lighting, Intelligent Transport System assets, landscaping and miscellaneous assets within the road reserve.

Figure 3-7 Integrated Planning Strategy Used by NZTA



Source: Consultant

Figure 3-8 Strategic Context of SHAMP



Source: Consultant

The asset management cycle shown in Figure 3-9 summarizes how asset-related demands are assessed and met. SHAMP is structured to address each stage of this cycle and describe key improvement initiatives and targets for the next three years with respect to the asset and associated management practice. In 2008-09, approximately US$360 million was spent on maintaining and operating New Zealand's road network. The maintenance in New Zealand is organized through Network Management Areas.

Figure 3-9 NZTA Asset Management Cycle

Source: Consultant

Private Sector Participation and Procurement

Part of the work is outsourced to private sector suppliers on a competitive basis to ensure that the investments achieve the best value for money. Those consultants and contractors are mostly used in maintaining the network. In New Zealand too, PPPs are used for the funding of new projects.

NZTA maintains close working relationships with:

- Transport operators and the general public, who use the network,
- Transport committees, regional councils and territorial local authorities, which are responsible for implementing transport projects and other activities funded through NLTP,
- Suppliers, including contractors and consultants,
- NZ Police which provides a range of road policing services, and
- The Ministry of Transport which is responsible for developing the strategic transport policy and monitoring performance of state entities in the sector.

To obtain best value for money, all state highway improvement, maintenance and operations works are outsourced. Around 200 contracts are tendered on a competitive basis yearly. NZTA uses a range of delivery models, which are based on international best practice.

Within the Network Management Areas, the following four contract types to procure maintenance and operations are used:

- Performance-specified contracts, which are awarded for 10 years to single suppliers who are responsible for providing all services. Most resurfacing work is done through performance-specified contracts,
- Hybrid contracts which are awarded for five years and involve consultants and contractors working in a partnering arrangement to deliver services,
- Traditional contracts which are awarded for varying terms and involve consultants managing suppliers who deliver physical works on the highway network, similar to traditional road engineering construction contracts. Most pavement strengthening works and bridge repairs are managed through this type of contract, and
- Alliances, arrangements in which groups of organizations combine in partnership and work together.

Audit and Control

Both central and local governments have a responsibility to contribute to economic, social and environmental outcomes. Monitoring enables action to improve these outcomes. The monitoring activities of NZTA involve:

- The performance of the land transport system,
- Auditing organizations that receive public funds for developing, operating and maintaining land transport infrastructure and services,
- Checking that appropriate procurement procedures are used for projects involving public funds;
- Checking that good practices are being used when activities are implemented,
- Monitoring the costs associated with publicly funded activities, and
- Carrying out post implementation reviews to check that the forecast results are being delivered

NZTA has a legal obligation to audit organizations that are funded through NLTP. The audits typically take place in a cycle of two to four years. The audit program is published in May, in time for the upcoming NLTP year which starts in July. The categories of audit are:

- Post implementation reviews which examine the effectiveness of completed projects,
- Procedural audits covering financial accountability, procurement, passenger transport,
- Road infrastructure safety assessments which assess safety on the road network,
- Technical reviews covering road network assets, and
- Theme audits which examine topics affecting all organizations.

In addition, the Auditor-General performs yearly audits focusing on the financial position of NZTA.

Risk Management

Over the course of the last few years, NZTA has continued to advance the implementation of risk management, building on the work of the predecessor organizations. The implementation supports decision-making and provides confidence in achieving the objectives. An NZTA risk management approach has been adopted and a strategic risk profile and plan initiated with the Senior Leadership Team, with oversight from the Board Audit, Risk and Assurance Committee. Risk management is actively encouraged at all management tiers and for all critical activities performed by or for NZTA.

4. ROAD MAINTENANCE IN OIC MEMBER STATES

Table 4-1 gives data on the socio-economic indicators and the road network in OIC countries.

Table 4-1 Socio-economic and Road Network Indicators

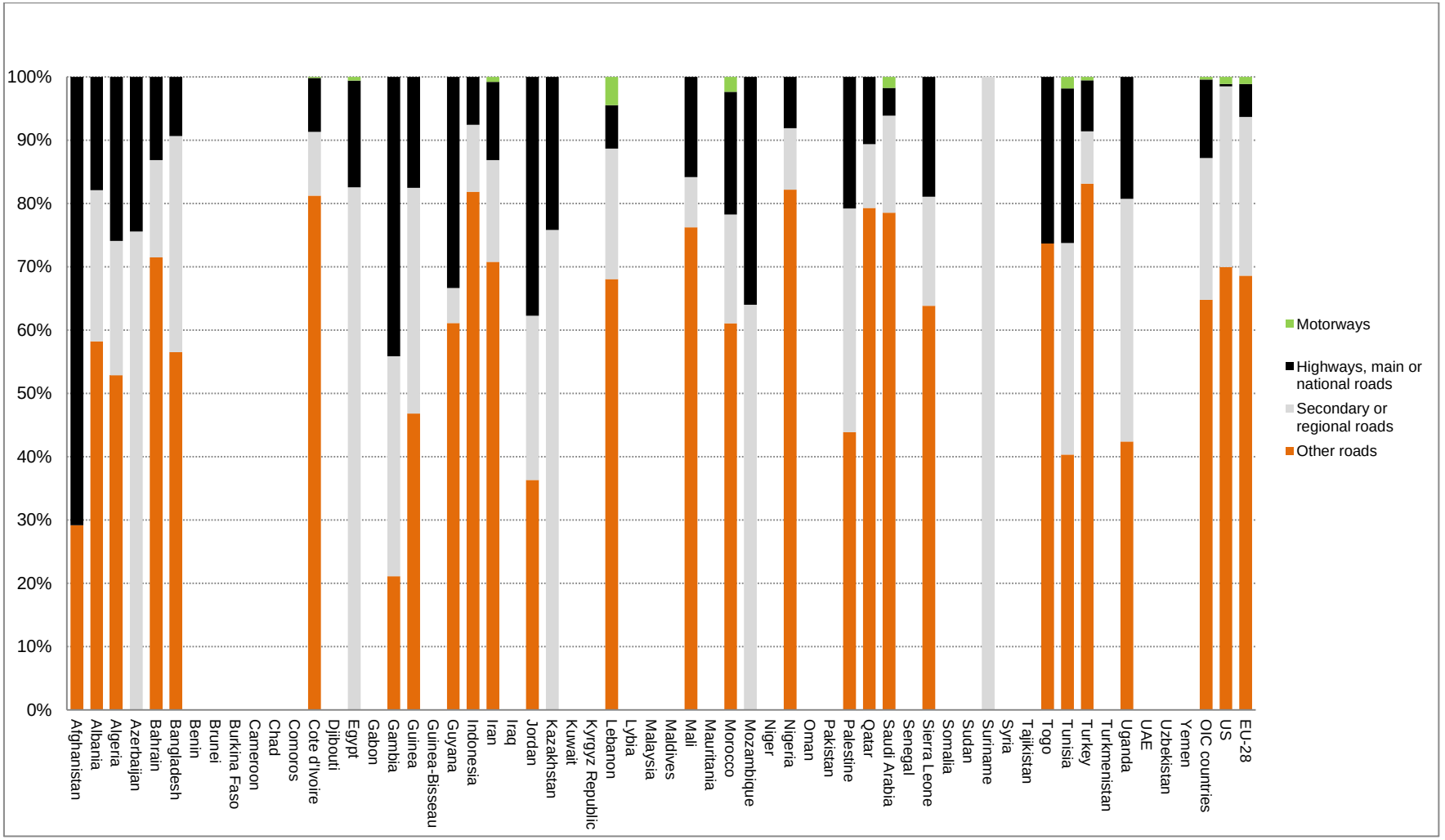
Indicator	Min	Max	Average	Min	Max
Population	345,023	249,865,631	28,922,429	Maldives	Indonesia
GNI per capita ($)	400	86,790	5,676	Niger	Qatar
Surface (Km²)	300	2,724,900	558,830	Maldives	Kazakhstan
Motorways (Km)	0	3,891	590	Albania	Saudi Arabia
Highways, main or national roads (Km)	0	38,570	11,534	Suriname	Indonesia
Secondary or regional roads (Km)	0	113,451	21,505	Togo	Egypt
Other roads (Km)	0	415,788	69,807	Suriname	Indonesia
Total length of roads (Km)	88	508,000	68,227	Maldives	Indonesia
Paved roads (%)	1	100	52	Chad	Jordan
Paved roads (Km)	88	355,220	35,740	Maldives	Turkey
Non-paved roads (Km)	0	220,074	31,423	Jordan	Indonesia
Length of roads by GDP per capita (Km/$)	0.03	300	49	Maldives	Uganda
Density of roads (Km/Km²)	0.005	5.6	0.32	Sudan	Bahrain
Traffic volume (Mio Veh-Km)	74	115,752	30,779	Gambia	Mozambique
Inland freight transport (Mio T-Km)	5	344,779	105,023	Mali	Kazakhstan
Inland passenger transport (Mio P-Km)	16	343,384	128,758	Gambia	Pakistan
Road freight transport (Mio T-Km)	4	224,048	63,737	Mali	Turkey
Road passenger transport (Mio P-Km)	16	322,765	122,394	Gambia	Pakistan
Persons Killed / 100,000 population	1	37	10	Burkina Faso	Lybia
Persons Injured /100,000 population	1	384	99	Bangladesh	Iran
Injury accidents /100,000 population	1	316	80	Bangladesh	Iran
Injury accidents / 100 million Veh-Km	13	1,693	471	Azerbaijan	Kazakhstan
Central Government expenditures (Mio USD)	1	6,582	756	Sierra Leone	Turkey
Regional/Local Government expenditures (Mio USD)	46	185	116	Tunisia	Morocco
Private sector expenditures (Mio USD)	135	135	135	Azerbaijan	Azerbaijan
Total expenditures (Mio USD)	1	6,582	959	Sierra Leone	Turkey

Investment expenditures (Mio USD)	1	5,785	623	Malaysia	Turkey
Maintenance expenditures (Mio USD)	0.13	797	130	Gambia	Turkey
Other expenditures (Mio USD)	0.02	66	17	Egypt	Saudi Arabia
Road Indirect Revenues: Fuel Tax (Mio USD)	1	178	83	Egypt	Kazakhstan
Road Direct Revenues: Toll (Mio USD)	2	450	131	Guyana	Turkey
Others Roads Revenues (Mio USD)	0	101	50	Guyana	Mozambique
Total revenues (Mio USD)	48	450	218	Guyana	Turkey

Source: Consultant

Figure 4-1 gives the proportion of the road network that is: a motorway; highway, main or national road; secondary or regional road; and other roads. What is clear from this picture is that with the exception of Afghanistan, a large share of the road network in most OIC countries is made up of secondary or regional roads, or other roads. However, on comparing the composition of the road network in the OIC countries as a group to the road networks in the United States, and the European Union as a whole, it is worth noting a big difference in the composition of the road networks in these three categories. It is striking to see that a large percentage of the total road networks in OIC countries are motorways and highways.

Figure 4-1 Percentage of Road Type (Motorway, Highway, Secondary, Other) by Country



Source: Consultant

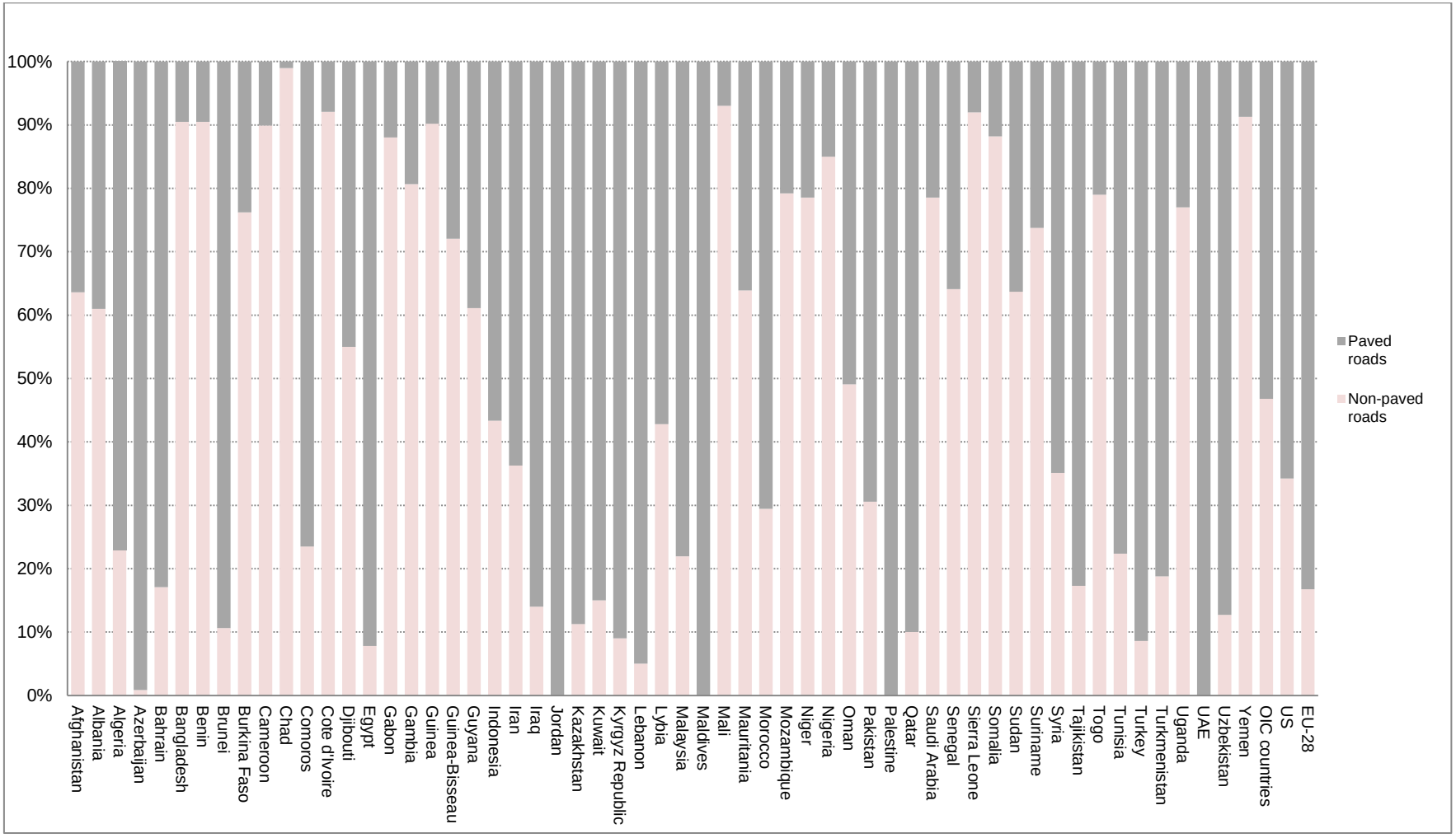
Table 4-2 shows that in OIC countries the proportion of the road network that is a motorway, highway, main, or national road is almost 12.8% compared to 1.4% for the US, and 6% for the EU. This finding suggests that the OIC Member States, as a group, are investing more in developing motorways and highways, and not investing in developing their secondary, regional and other roads. This focus on developing high-quality and high-volume roads requires large amounts of capital. Given the limited resources that are available in many OIC Member States, it is very likely that this focus results in insufficient resources being allocated to maintenance activities.

Table 4-2 Percentage of Road Categories in OIC Countries, USA and the EU

Type of Road	OIC (%)	US (%)	EU (%)
Motorways	0.42	1	1
Highways, main, or national	12.4	0.4	5
Secondary or regional	22	28.6	25
Other	65	70	69

*Source: Consultant*Figure 4-2 gives the proportion of the road network in each OIC country that is paved and unpaved. The paved road network is more than 50% of the total road network in Algeria, Azerbaijan, Bahrain, Brunei, Comoros Islands, Djibouti, Egypt, Indonesia, Iran, Iraq, Jordan, Kazakhstan, Kuwait, Kyrgyz Republic, Lebanon, Lebanon, Libya, Malaysia, Maldives, Morocco, Oman, Pakistan, Palestine, Qatar, Syria, Tajikistan, Tunisia, Turkey, United Arab Emirates, and Uzbekistan. The countries where the unpaved road networks are more than 50% of the total road network, with the exception of Afghanistan, Albania, and Bangladesh, are all in Africa. Thus, the OIC countries seem to split into two groups; the CIS countries, North African and Middle Eastern countries form one group where the road network is mostly paved, and the African countries form the second group where the road network is mostly unpaved. From a road maintenance point of view this is important because unpaved roads require different and more regular maintenance than paved roads, and delaying maintenance can often mean that the benefits of unpaved roads are completely lost, often requiring expensive rehabilitation later on.

Figure 4-2 Percentage of Paved and Unpaved Roads by Country

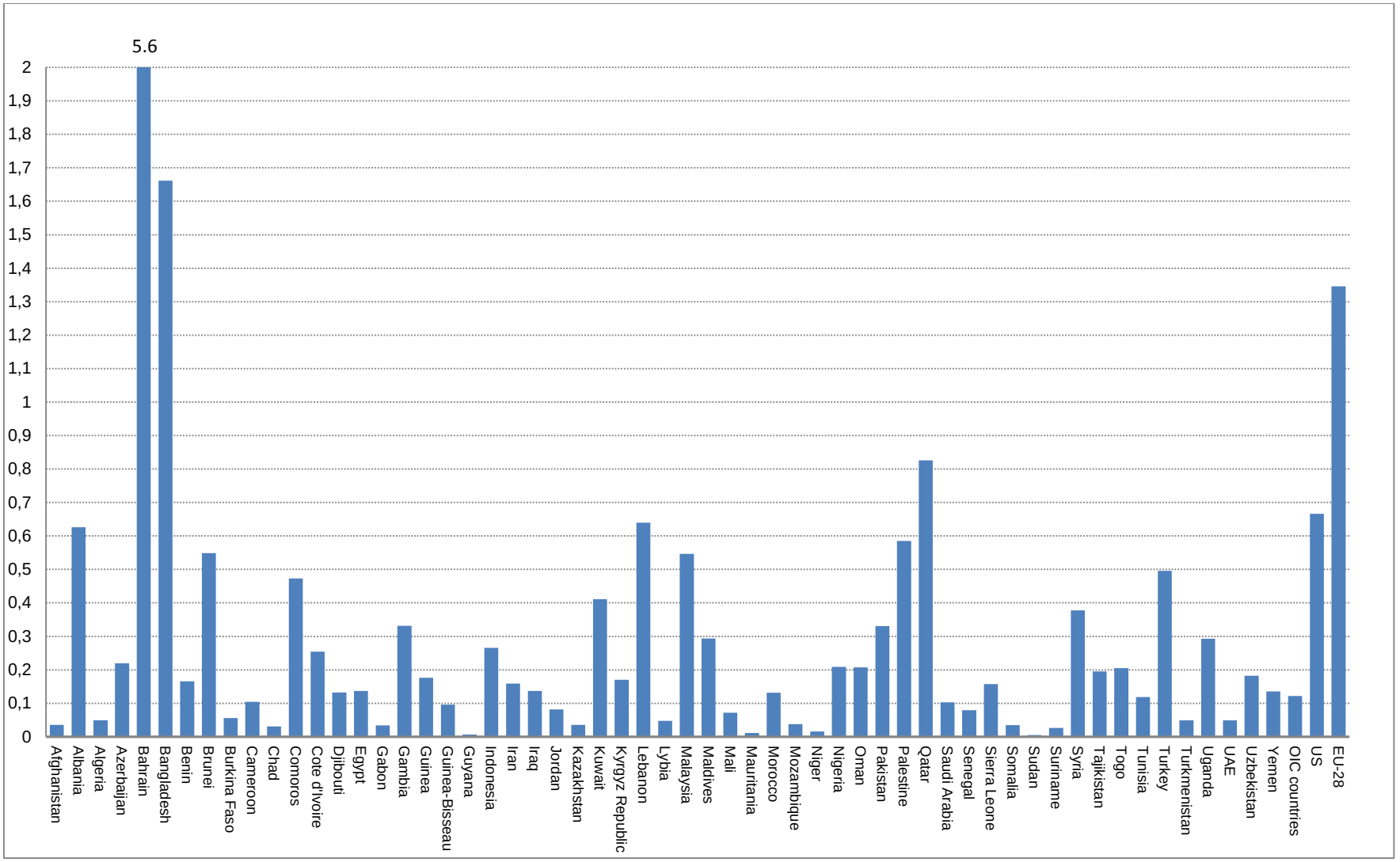


Source: Consultant

The share of the road network that is paved in the OIC countries as a whole is about 53%. The share of the road networks in the US and the EU are 66% and 83%, respectively. When taken together with the previous observation that a large proportion of the road network in the OIC countries consists of motorways, highways, national or main roads, is that OIC countries tend to focus much more on motorways, highways, national and main roads than on the other road types. As was noted earlier, the road networks in the OIC Member States seem to be unbalanced in terms of their focus on developing high-quality, high-volume roads. This, in turn, is likely to deprive maintenance activities of the resources they need.

Figure 4-3 gives the density (the length of road network divided by the area of the country) of the road networks in the OIC countries. This figure shows several things. First, there is a large variation in the density of the road networks in the different OIC countries. Albania, Bahrain, Bangladesh, Brunei, Comoros Islands, Gambia, Indonesia, Kuwait, Lebanon, Malaysia, Maldives, Pakistan, Palestine, Qatar, Syria, Turkey, and Uganda have more dense networks compared to the remaining countries. However, for some countries the low density of the road network reflects the geography of the country. For example, in Saudi Arabia, a very large part of the country is a desert with little to no habitation. The density of the road networks in the OIC countries as a group and individually, and this is not surprising, compared to the US and the EU, is quite low; for the OIC countries the density of the road network is 0.12 compared to 0.67 and 1.34 for the US and the EU, respectively.

Figure 4-3 Length of Road Network (KM) / 100 Square KM Area of Country

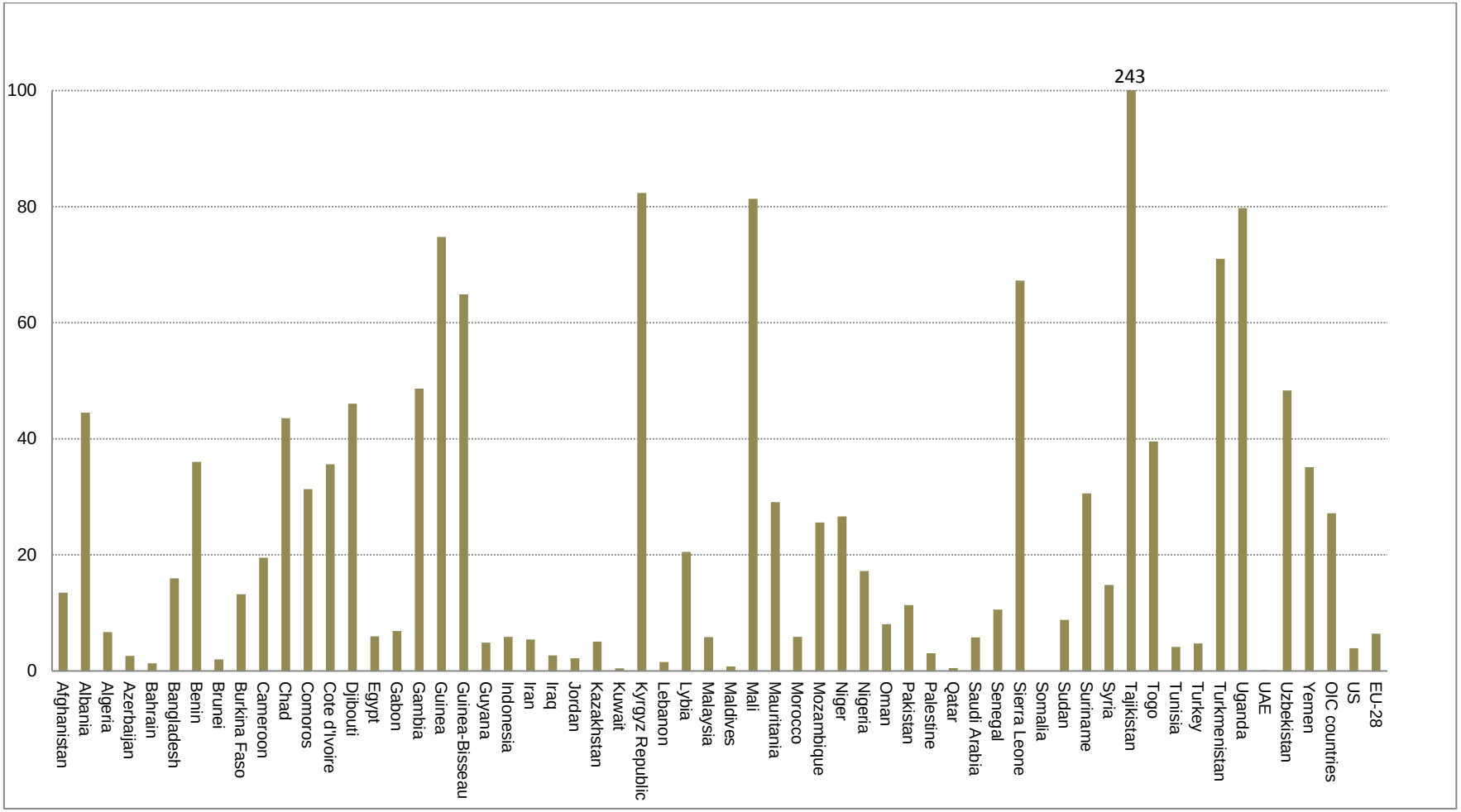


Source: Consultant

Figure 4-4 and Figure 4-5 give the length of the road network in km per USD 10 million GDP and the length of the road network in km per 10,000 population, respectively.

Figure 4-4 shows that the size of the road network relative to the country's GDP is, compared to the US and the EU, higher in all OIC countries except for Bahrain, Egypt, Gabon, Guyana, Indonesia, Iran, Iraq, Jordan, Kuwait, Lebanon, Maldives, Morocco, Palestine, Qatar, Saudi Arabia, Somalia, Tunisia, and Turkey. For the OIC as a whole, the length of the road network per USD 10 million GDP is about 27. For the US and the EU this number is 3.9 and 6.4, respectively. This is an important observation insofar that it suggests that many of the OIC countries have road networks that are too large for the size of their economy. Obviously, this has clear implications for the maintenance of the road networks as well, i.e., the resources to properly maintain the road networks in these countries is going to be limited.

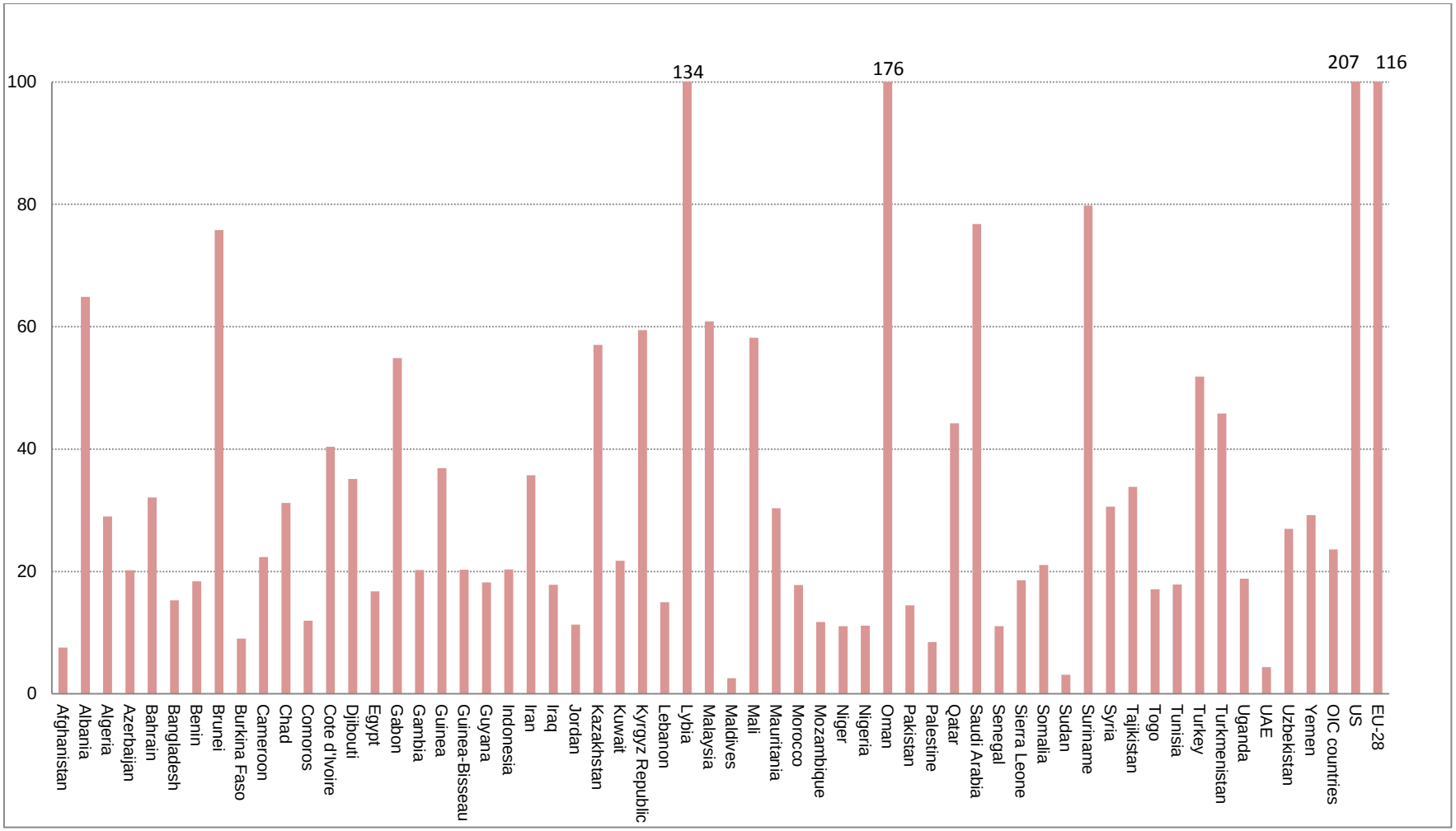
Figure 4-4 Length of Road Network (KM) / USD 10 Million GDP



Source: Consultant

Figure 4-5 shows the length of the road network relative to the country's population. All OIC countries (except Albania, Brunei, Malaysia, Saudi Arabia and Suriname) have fewer than 60 km of roads per 10,000 population. The OIC countries as a whole have 23.6 km of roads per 10,000 population compared to 207 and 116 for the US and EU, respectively. What this would suggest is that the length of the road network is inadequate to serve the population. Yet at the same time, compared to the US and the EU, the road networks in OIC countries are too large relative to GDP, and the proportion of the motorways, highways, national and main roads is also too high.

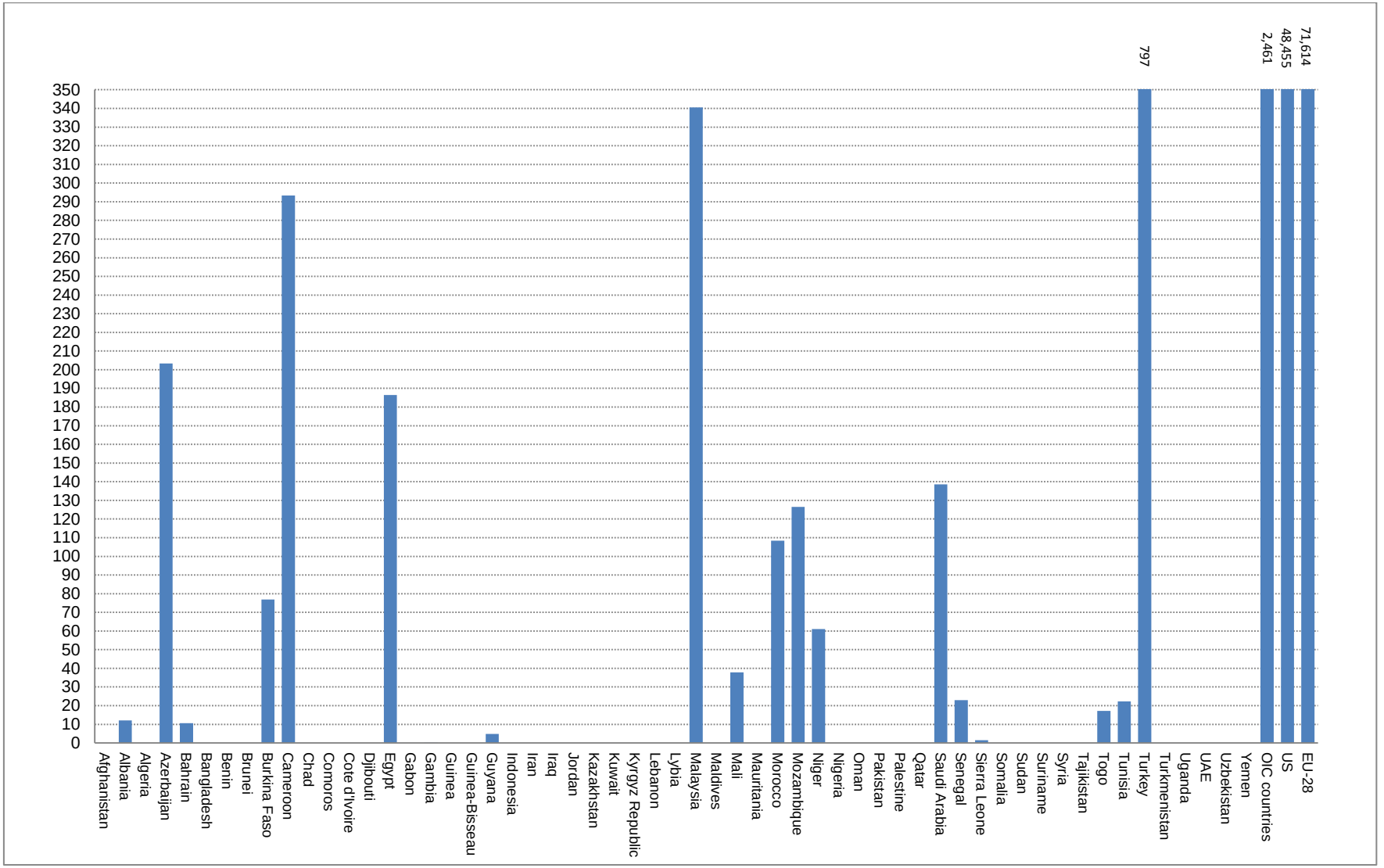
Figure 4-5 Length of Road Network (KM) / 10,000 Population



Source: Consultant

Figure 4-6 provides the data available for expenditures on road maintenance. The most obvious thing to note about this data is the lack of data for most countries. This is in and of itself a finding. The expenditures on road maintenance are very limited. This data comes from the World Road Statistics (WRS), an annual survey carried out by the International Road Federation. The advantage of the WRS data is that it is consistent and has been validated. Compared to the US and the EU, the average expenditure on maintenance appears to be quite low, Turkey being an outlier (at least among the countries for which there is data from the WRS).

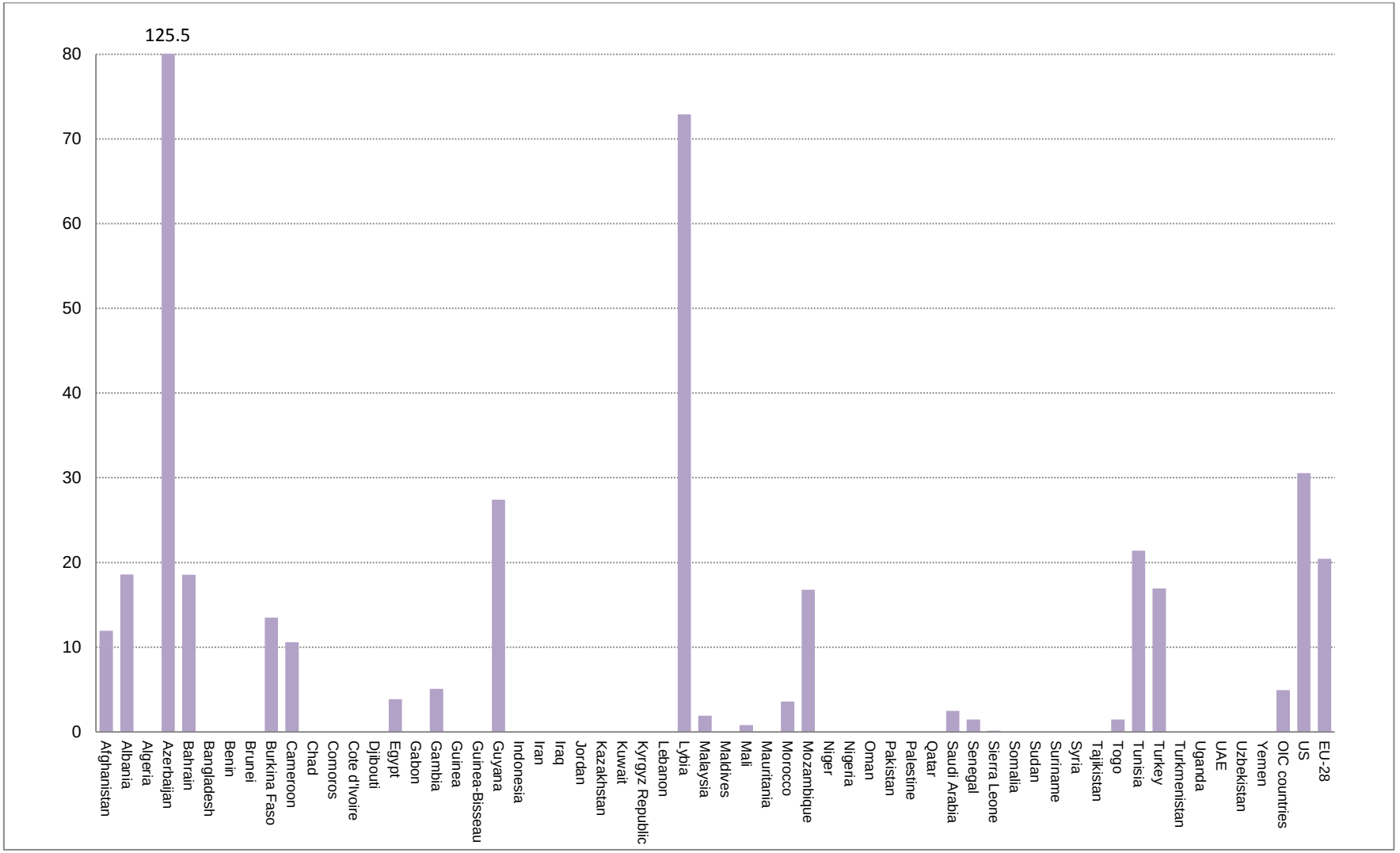
Figure 4-6 Expenditures on Maintenance (Million USD)



Source: Consultant

From the 16 OIC countries for which there is data available from the WRS, Azerbaijan and Libya (see Figure 4-7) have very high expenditures, significantly higher than the US and the EU. This is not altogether surprising as this reflects capital investments as well.

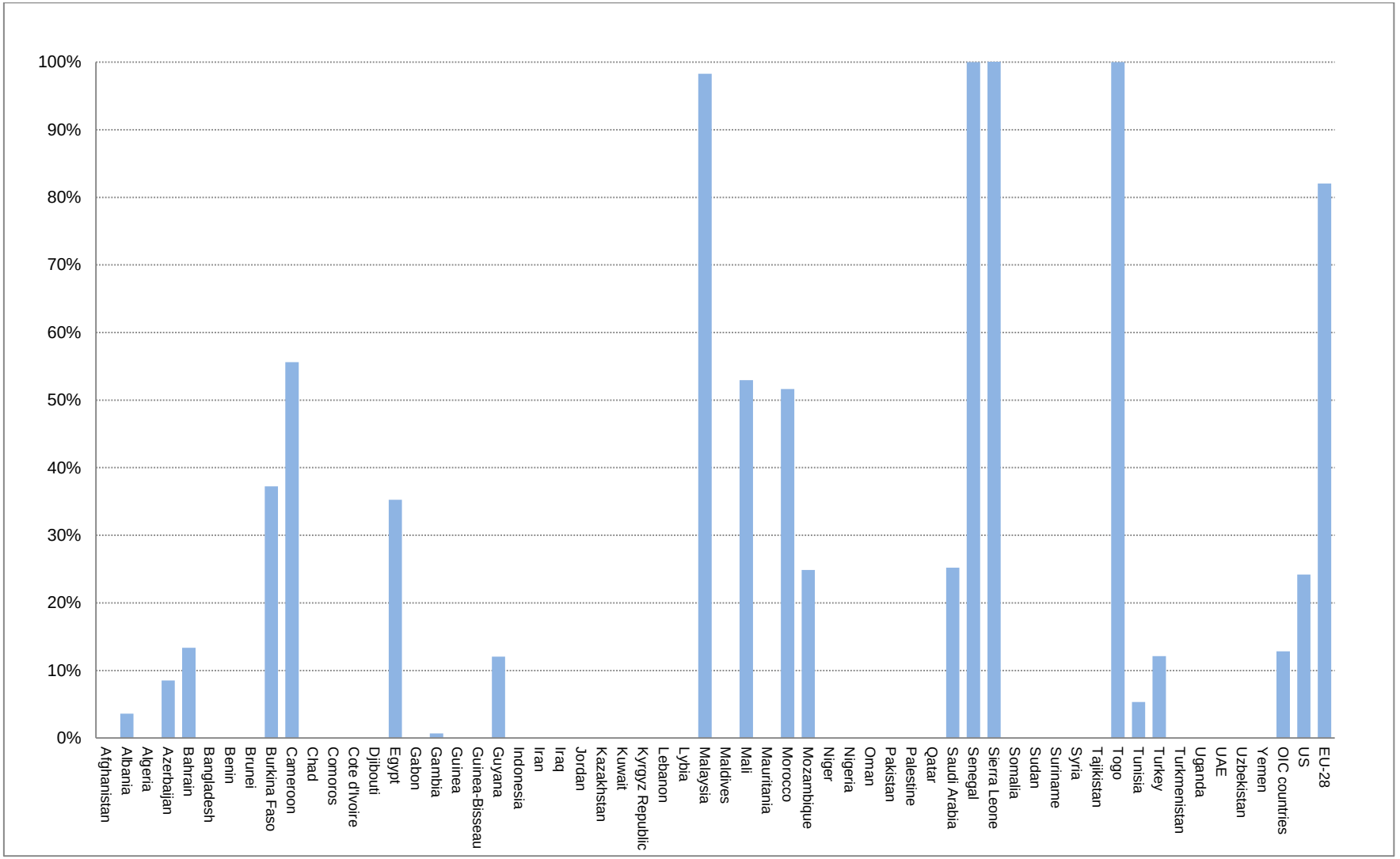
Figure 4-7 Total Road Expenditures (Thousand USD) / Length of Road Network (km)



Source: Consultant

Unfortunately, the data is too limited to make a useful comparison of the spending on maintenance as a percent of total expenditures on the road network (see Figure 4-8). However, eleven of the 18 countries, for which there is WRS data, are spending almost 25% on maintenance. This is a rather high proportion to spend on the maintenance of road networks that are not yet mature (except for Saudi Arabia). One explanation for this high level of spending on maintenance could be that these countries are undertaking maintenance to clear the backlog of maintenance. For three countries, Senegal, Sierra Leone and Togo, the total expenditures were the same as the expenditure on maintenance.

Figure 4-8 Expenditures on Maintenance as a Percent of Total Expenditures



Source: Consultant

For the OIC countries from Sub-Saharan Africa (Benin, Burkina Faso, Cameroon, Chad, Cote d'Ivoire, Niger, Nigeria, and Senegal) the Africa Infrastructure Country Diagnostic (AICD) studies provide some insights into the expenditures on roads.[25] Table 4-3 shows two things; the condition of the main road network is not very good in any of the Sub-Saharan African OIC countries, and second the annual average expenditures on road maintenance are rather low compared to what is spend on rehabilitation and capital expenditures. According to model estimates provided in the AICD study, the expenditures on maintenance and rehabilitation/capital should be split roughly 50-50. This, however, is not the case in Sub-Saharan African countries included in the AICD studies.

Table 4-3 Expenditures on Main Road Networks in Sub-Saharan African OIC Countries

	Length of Main Network	Roads in Good Condition	Maintenance Expenditures	Rehabilitation/Capital Expenditures
	(km)	(km)	Annual Averages in USD / km	
Benin	4,735	911	3,016	4,307
Burkina Faso	10,231	n.a.	n.a.	n.a.
Cameroon	11,008	2,372	2,609	5,823
Chad	n.a.	862	n.a.	n.a.
Cote d'Ivoire	13,291	4545	n.a.	9,016
Niger	6,055	3250	494	4,137
Nigeria	n.a.	n.a.	n.a.	16,964
Senegal	4,780	2,141	n.a.	24,938

Source: Consultant

Based on this admittedly limited review a few conclusions can be reached about the road sectors in OIC countries, and the current state of repair and maintenance. It should be kept in mind that the group of OIC countries is quite different in terms of their population, geography, size, and economic development. These differences lead also to differences in the road sector and its performance. Nevertheless, the conclusions that follow seem reasonable and defensible. The conclusions are:

- The road sector in most OIC countries is over developed in terms of length relative to the size of the population and GDP.
- The share of motorways, highways, national and main roads in the total road network is disproportionately large.
- There is an acute lack of reliable and consistent data when it comes to expenditures in the road sector. It is rather surprising to note that this data is not readily available.
- For the limited number of countries for which data is available, there seems to be a capital investment bias with the bulk of expenditures being rehabilitation and capital expenditures.
- Not surprisingly given the above, the road network in most OIC countries is not in a very good condition.

4.1. Overview of Road Maintenance

The OIC Member Countries follow very different maintenance protocols and regimes and hence there is a wide range of variation in the state of repair of the road networks in the countries of the OIC. The purpose of the current project is the assessment of the road maintenance strategies of OIC

[25] AICD Background Paper 14 (Phase 1), (2008), the Burden of Road Maintenance: Roads in Sub-Saharan Africa; AICD Background Paper 15 (Phase 1), (200*) Financing Public Infrastructure in Sub-Saharan Africa: Patterns and Emerging Issues.

Member States to support the development of a framework for identifying and evaluating policy actions and investment priorities.

To achieve this, the need to provide an overview of road maintenance practices in OIC Member States, the challenges they face, and recommendations for addressing these challenges is prevalent. To collect the necessary information, a literature review was carried out, with the purpose to cover the following issues:

- Collecting case studies highlighting the economic and social benefits of regular road maintenance.
- Gathering data and information to analyse the cost drivers of road maintenance and renewal in in sufficient detail to enable their comparison and assessment of relative importance.
- Highlighting best practices with regards to maintenance management.
- Gathering examples of alternative procurement and delivery service models, including the risks, costs and benefits of each model.
- Gathering available data and information on the type and frequency of required maintenance, the efficiency of carrying out this maintenance, how it is carried out, using what technology, and the adequacy of the current processes for meeting future requirements.
- Gathering available data and information on the institutional aspects of road maintenance; the allocation of responsibilities, budgeting, and availability of human resources.
- Gathering available data and information on the how road maintenance is financed and the adequacy of financing to meet current and future maintenance requirements.

The results of the literature review are divided into two groups dealing with issues related to:

- Organisation of road maintenance, and
- Funding

4.1.1. Organization of Road Maintenance

The typical road maintenance organisation is usually a part of a larger Ministry of Transport, or Public Works Department (PWD). This organisation is responsible for the development and maintenance of the road network. These road maintenance organisations either carry out the maintenance activities themselves, or they contract out all or part of the maintenance activities. The funds for undertaking the road maintenance activities are provided by the National Governments to the Ministry of Transport or PWD which allocates a certain portion of the budget for maintenance activities.

The above institutional structure has been identified as being linked several problems that make it difficult to properly undertake needed maintenance activities required for a well performing road network. These problems include competition for funds between road development and maintenance, with maintenance activities loosing out and being underfunded relative to needs, inefficient and slow execution of maintenance activities, and a near complete neglect of the maintenance needs of rural roads.

During the last decade, most governments have begun to realize the importance of road maintenance and followed a path of institutional reform. The road sector reforms over the last decade have mostly focused on:

1. Ensuring a larger and more stable flow of funds for road maintenance, and
2. Enhancing capacity to procure and/or execute the required maintenance works.

Through various initiatives of the World Bank, the Asian Development Bank and other development agencies, there seems to be a broad consensus among stakeholders on the desirable institutional structure for the road sector. This consensus revolves around the establishment and improvement of road funds, providing ring-fenced funds for road maintenance based on some form of earmarked revenue streams such as user charges or fuel levies. And second, the creation of an organisation (usually a road agency) with the capability to procure, manage and execute maintenance works.

Road funds were created with the aim of improving the condition of the road networks by providing more and stable funding for maintenance, and making road maintenance activities more business-like. The assumption being that users would be willing to pay more for using better, and if they were confident that their money (via the higher charges) was going to visibly improve the condition of the roads. Despite the broad consensus about the desirability and effectiveness of road funds, only 18 of the 57 OIC Member States have established a road fund. The OIC Member States that have established road funds are mostly in Africa.

Table 4-4 OIC Countries with Road Funds

Road Fund	Number of Countries
Established	20
Under development or non-existent	37

Source: Consultant

The number of countries that do not have a road fund is clearly an issue for OIC Member States. It should be underlined that it is not the presence or an absence of a road fund that is the issue, the issue is whether there is an adequate and stable flow of funds to finance required maintenance activities. Road funds are simply a mechanism for facilitating this.

Even the road funds that have been established are not all performing equally effectively. The effective performance of road funds requires a sound legal framework and institutional structure. In particular, for road funds to be effective there must be:

- A clear legal basis for the establishment, operation and activities of the road fund,
- A separation of functions, i.e., the road fund should only "fund" various activities and not be involved in the execution or implementation of these activities,
- Well defined user charges as the source of revenue,
- Direct transfer of revenues to the road fund, without any political or other intervention being required,
- Operationally independent of the Ministry of Transport, Road Authority, or any other government body involved in the management and operation of road networks,
- Representation of stakeholders and users on the Board of the road fund,
- Clear rules for allocating revenues to various activities,
- Independent auditing of the activities and accounts of the road fund,

- Transparency regarding the activities and accounts of the road fund, both of which should be publicly reported.

To varying degrees, the road funds that have been established in the OIC Member States are characterized by the following:

- The legal basis of many road funds remains weak.
- The independence and autonomy of the road funds is not ensured, there is significant risk of political interference as many of the representatives on the Boards of Road Funds are high-ranking civil servants and public sector representatives are usually in a majority.
- The participation of stakeholders in the road funds is very limited.
- The accountability and transparency of road funds is mostly limited to conducting an annual financial audit without any requirement for making the results of this audit public. There are few disclosure requirements for legal documents and annual reports with financial data on the activities of the road funds.
- Road funds rarely, if ever, use data-based performance indicators for monitoring and evaluating the impact of their funding activities. Thus, there is no link of the funding to improvements in the performance of the road network.
- Most road funds have a variety of revenue sources available to them, but the bulk of revenues for the road funds still come from the traditional fuel levy and budget support from general government revenues.
- Despite many road funds having been established to fund maintenance activities, many road funds finance road development and rehabilitation.

With regards to the OIC Member States that do not have road funds, there are a different set of issues that have to be addressed. Most OIC Member States do not have a road fund. In these Member States, the road maintenance activities are typically financed by general government tax revenues, usually called a Force Account. The funds available for funding maintenance are determined using some annual budget allocation process. This arrangement has been linked to the underfunding of maintenance activities because of budget allocation processes that are flawed and politicised, and pay little attention to the return on investment (which for maintenance activities can be quite high). Furthermore, ministries that spend large amounts of money (such as the Ministry of Transport, or the PWD) rarely win budgetary debates. Thus, maintenance rarely gets the optimal or needed level of funding.

Another problem with the above institutional structure is that it leads to a capital bias – the financing for maintenance is usually part of the annual budget, while new road construction is often financed from a development budgets that are less constrained than the annual budget supported by domestic revenue sources.

While road funds are viewed as the preferred mechanism for ensuring an adequate and stable flow of revenue for financing maintenance activities, creating road agencies has been seen as a desirable institutional response to the problems of poor management and operation of the road networks, and by extension the poor execution and delivery of maintenance activities.

A large number of OIC Member States have created some sort of a road agency or a road authority; this has not always delivered the expected benefits. There are several reasons for this.

While the reforms and restructuring have taken place, the staffs of a road agency is still largely made up of staff from the old road department and organisations. These staff often lacks the financial and management skills needed for managing complicated maintenance contracts. Hiring new staff with the requisite skill set is also complicated as the procedures for doing so are often the same as hiring a civil servant, and the salaries are also similar. As the road sectors have expanded, the demand in the private sector for such qualified and skilled people has also increased, making it hard for the road agency to attract the needed talent.

The level of autonomy of the road agency in decision making varies; from total responsibility for the road network to limited responsibility for execution of road maintenance programs. The freedom to prioritize maintenance activities, allocate funds, and execute projects in ways that are consistent with the assessed need for maintenance is essential for the road agency to perform better than the typical road departments in the line Ministries of Transport. When a road agency does not have this freedom, it is not surprising that the benefits that should follow from the creation of the road agency do not.

The issue of leadership of the road agency is also an important one. All too often, the person leading the new roads agency is a senior, politically connected serving, or ex civil servant rather being chosen on the basis of an open solicitation procedure. This defeats the very purpose of creating the road agency, i.e., to carry out maintenance activities based on need, rather than some other consideration.

For a road agency to be effective, it must have a strong construction sector and companies with whom it can partner to create a competitive procurement process, and advance the state of technology with regards to road maintenance. The companies engaged in road maintenance in many OIC Member States are often not conversant with the latest technology and techniques for road maintenance and neither are they able to, for example, deal with competitive procurement practices for maintenance, for example, performance based maintenance contracts.

There is a lack of competitive procurement practices because of maintenance works being carried out using force account methods. The lack of competition all too often results in maintenance works being delivered with poor quality, with delays, and too high a cost.

Most road agencies lack the data to carry out a serious prioritisation of maintenance needs and projects. While the use of road asset management systems seems be becoming more common, it is still not common for a road agency in an OIC Member States to have up to date data on the condition of their road assets. More often than not, the available data is limited to a small section of the road network, usually the motorways and highways and roads of national importance. There is a similar lack of data regarding traffic volumes, an important input into planning road maintenance.

Finally, the maintenance of rural roads is almost always an oversight, even within a road agency. While rural roads are not paved, building them does require some basic engineering skills and these roads require regular and proper maintenance. Given that there is usually no specific organisation or body to promote rural roads, the maintenance needs of rural roads are also often overlooked.

A second issue with maintenance being carried out by a national agency is the issue of competitive bidding. If the maintenance activities of the agency are funded by force accounts rather than public procurements using competitive bidding, there can be issues with regards to the costs and quality of the maintenance activities that are being undertaken. This should not, however, be taken to mean

that force accounts (for example such as the ones used in Tunisia and Indonesia) cannot be effective in road maintenance, just that it seems that more often than not, they are not as effective as other means to carry out road maintenance.

Despite the fact that force account performs satisfactorily in some countries, in some others it has been proven to be ineffective in carrying out maintenance of road networks, due to the fact that there is an over-supply of under-skilled and poorly supervised labour, resulting in low productivity (Togo). In addition, in some cases it was noted that new equipment deteriorated quickly due to poor maintenance and inappropriate use, as there is virtually no control of its use. As a result, maintenance works should be contracted out to take advantage of competition and wider skills.

When the Ministry of Public Works and Highways, or a department within the Ministry of Transport is responsible for maintenance activities, the maintenance activities are likely to suffer from the same problems as when the maintenance is carried out by a national agency responsible for road maintenance; there is no guarantee that the maintenance activities will not be underfunded, and the lack of competitive bidding opens up questions regarding the cost and quality of maintenance activities.

4.1.2. Funding

Developing countries experiencing high rates of growth spend between 2-3% of their GDP on developing and maintaining their transport infrastructure. Some countries have invested an even higher share of their GDP in the roads sector. For example, Japan invested between 3.5–3.8% of its GDP in the roads sector during the years 1964–73. By comparison, for the OIC Member States for which the data is available, the spending on the road sector ranges from between 0.25% for Bahrain to 8.27% for Albania and nearly 15% of GDP for Libya.[26] Albania, one of the poorest countries in the world, is spending significant amounts of money on improving its road network which explains the rather high percentage of expenditures on roads as a percentage of GDP. The remaining numbers are either on the low side, or within what is seen historically and in other parts of the world. One general observation is that low income countries tend to spend a higher percentage of GDP on roads. This, however, is easily explained by the fact that these countries are also involved in developing their road networks. Higher income countries have already developed their road networks and thus the capital expenditures that are involved are smaller.

In terms of expenditures on maintenance, it is observed that maintenance expenditures are typically lower than what is needed. There is, however, also a trade-off between maintenance and capital expenditures. When maintenance expenditures are less than what is needed, it leads to larger rehabilitation liabilities at some later date. Countries that are involved in developing their road networks with large investment programs often have too little resources left over to adequately fund the maintenance requirements.

The other important trade-off that is made when it comes to prioritising maintenance expenditures is between motorways and highways and the smaller secondary and other roads (including rural roads). As the size of the road networks increase, the resource requirements for maintaining the network also increase. The resources, however, remain limited. In this case, there is some evidence to suggest that the maintenance needs of the motorways and highways are met first, and what is left is allocated to meet the maintenance needs of secondary and other roads.

[26] Given the situation in Libya, the number for Libya should be used with some caution.

The sources of revenue for funding maintenance activities are primarily from user charges and from general tax revenues. In many cases, where OIC Member States have established a fuel levy to provide revenues to the road funds, and/or to the transport sector, the level of this levy is too low to provide adequate financing to cover the annual maintenance needs of these countries. This is especially true for the OIC countries that are investing in further expanding their road networks. The shortfall in funding from the fuel levies necessitates transfers from general tax revenues to finance road maintenance activities. The magnitude of these transfers can vary from one year to the next, and this leads to uncertainty about the total available funding for financing the maintenance of road networks.

Thus, with regards to funding there are two major issues:

1. The lack of adequate and stable funding for maintaining the road networks. Despite the establishment of the road funds in several Member States, adequate and stable funding for maintenance activities remains elusive.
2. A tendency to seriously underfund the maintenance needs for the portions of the road network that are not motorways, highways or national roads, requiring more expensive rehabilitation works at some later stage.

4.1.3. Other Issues

There are a few other issues that need to be highlighted with regards to road maintenance.

First, there is a serious shortage of trained personnel and staff for carrying out maintenance activities. It is increasingly difficult to find qualified personnel who are willing to come and work at the road agency, or for the government. This shortage is especially severe in some countries where lots of personnel retire in bunches and it becomes difficult to find staff to replace the retiring personnel.

Another important issue is that of overloading of (especially freight vehicles) that use the road network. The enforcement of weight controls is almost never carried out and is weak and ineffective. Yet, overloading is one of the major causes of accelerated deterioration of pavement conditions on the road networks. It is also not always clear which organization is responsible for enforcing the weight limits.

Third, the design standards that are in place are not suited for handling the large, heavy, multiple axle vehicles that are now commonly used to freight transport. Clearly, these obsolete design standards contribute to increasing the maintenance requirements to more than what they would be if the design standards were updated and reflected the development in vehicle technology over the years.

Finally, the capability to engage in multi-year maintenance planning and budgeting remains very weak in most of the OIC Member States. Even when the tools, for example the HDM-IV, are available, they are either not properly used, or not used at all to structure the maintenance process and set priorities. One of the primary reasons for this is the lack of proper data to support complex tools such as HDM-IV, or RONET.

The results of the literature review presented in this chapter paint a not all too rosy picture of road maintenance in OIC Member States. Based on the literature review the following can be concluded:

- The institutional development of the road maintenance sector in OIC Member States is lagging behind international best practices in terms of establishing road funds and road agencies. Thus, for example, a majority of OIC Member States still do not have an operational road fund. Unfortunately, even when the road fund exists, its performance can be improved. The situation with regards to road agencies is not significantly better.
- Many OIC Member States still carry out routine and preventive maintenance using force account methods, resulting in the well-known inefficiencies and delays in execution of the works.
- The governance, transparency of operation, and public accountability of the road maintenance organisations is in need of improvement so that these organisations can make decisions about road maintenance based on the needs and requirements rather than any other considerations.
- There is an issue with regards to the human resource side of government organisations involved in road maintenance; there is a shortage of qualified staff and it is becoming increasingly difficult for these organisations to attract the needed talent.
- The capabilities of the construction sector in many OIC Member States need to be upgraded and expanded so that they can undertake, for example, performance based maintenance contracts.
- The level of the fuel levy and road user charges is set at very low levels and need upward revision.
- The maintenance needs of, in particular the rural road networks, need to be given more attention during the planning a budgeting process than what they currently receive.

4.2. Case Studies

The three case studies covered:

1. Morocco
2. Turkey
3. Senegal

4.2.1. Case Study – Morocco

Morocco is a large country covering an area of 446,550 square km. It is a low income country (see Table 4-5) that has been investing significantly in expanding its road network. The road network is divided into three road categories; National, Regional and Provincial. The road network includes both paved and unpaved roads (see Table 4-6). In addition, there is also a developing expressway network (see Table 4-8).

Morocco has also been investing in developing its rural roads network to increase the accessibility of its rural population. In 2005, 54% of its rural population, 300,000 people had access to a rural road. In 2012, after completion of the 2nd Rural Roads Program, 80% of its rural population, 3 million people had access to a rural road. (see Table 4-7).

At the end of the completion of the 2nd Rural Road Program, 50% of the rural roads were government owned. However, the objective of the Moroccan Government is to transfer ownership for the entire rural roads network to the local communities that are served by these roads.

The Ministry of Equipment, Transport & Logistics, and Directorate of Roads is responsible for the development; operation and maintenance of the Moroccan road network. The AutoRoute du Maroc is responsible for the development, operation and maintenance of the expressway network.

Falling directly under the Directorate of Roads is the Institute de Formation aux Engins et a l'Entretien Routier (IFEER) and Le Centre National d'Etudes et de Recherches Routiers (CNER). The IFEER is responsible for delivering the needed vocational education to support the road sector. The CNER is responsible for supporting the technical development and maintenance of the road sector.

Table 4-5 Socio-economic Indicators for Morocco

MOROCCO	latest data (2000-2013)
Year	2013
Population	33,008,150
GNI per capita ($)	3,020
Surface (square KM)	446,550
Length of roads by GDP per capita (Km/$)	19
Density of roads (Km/Km2)	0.13

Source: Consultant

Description of Road Network

National roads make up about 20% of the total road network in Morocco, and most of these roads are paved roads. In fact, the bulk of the roads in Morocco are paved – 72% of the road network is paved. The length of the rural roads network is quite small compared to the road network – rural roads were only 15,000 km in length compared to 57,334 km of the national, regional and provincial roads network. Finally, the motorway network is quite small; it is only 770 km in length. However, another 283 km of motorways are under construction, and 241 km are planned for construction.

Table 4-6 Road Network by Road Category

Category	Paved (km)	Unpaved (km)	Total	%
National	10185	1214	11399	20
Regional	9510	581	10091	18
Provincial	21736	14108	35844	62
TOTAL	41431	15903	57334	100

Source: Consultant

Table 4-7 Rural Road Development Program

	Period	Length (km)
1st Rural Roads Program (PNRR1)	1995 – 2005	11,236
2nd Rural Roads Program (PNRR2)	2005 - 2012	15,000

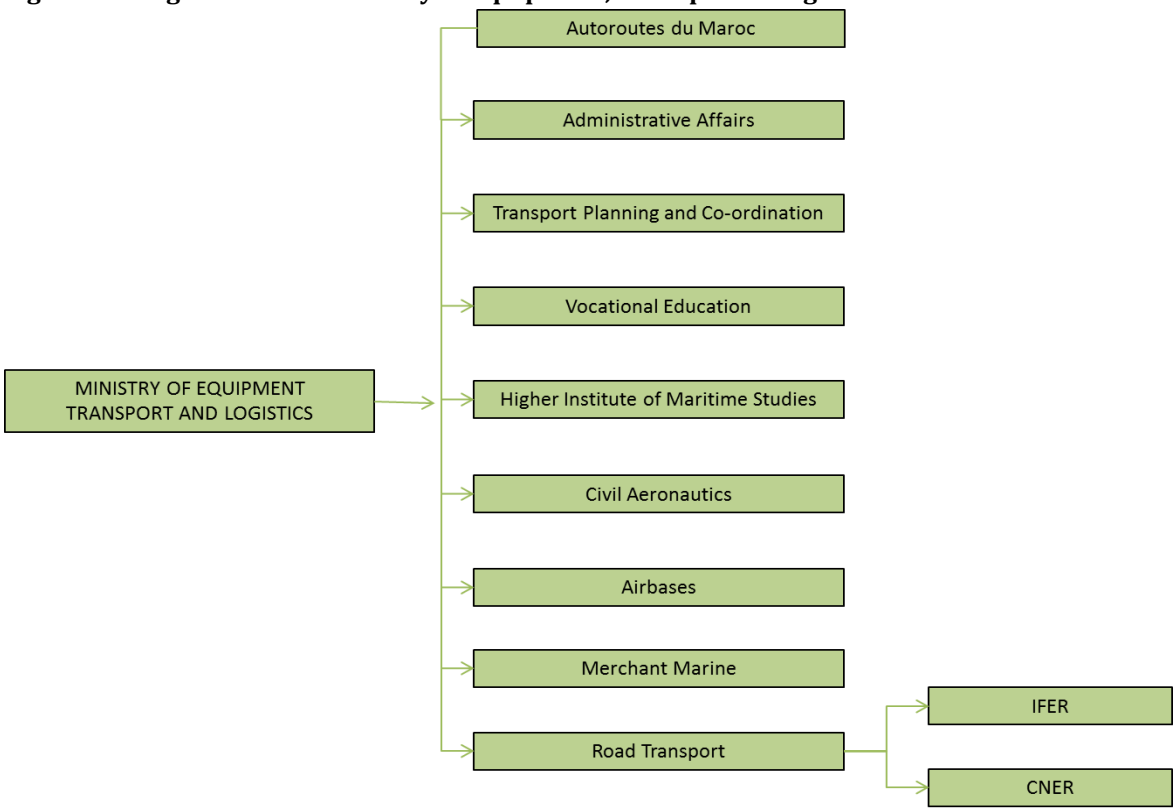
Source: Consultant

Table 4-8 Expressway Network

Expressway Network	Length (km)
In service	770
Under construction	283
Planned	241

Source: Consultant

Figure 4-9 Organisation of Ministry of Equipment, Transport & Logistics



Source: Consultant

Organization of Maintenance

The Ministry of Equipment, Transport and Logistics, Directorate of Roads is responsible for the development, operation and maintenance of the road network in Morocco. There is a maintenance department with the Directorate of Roads that is responsible for executing the required routine and periodic maintenance, as well as the rehabilitation works. The Directorate of Roads develops two types of maintenance plans: 1) a 5-year plan for preventive maintenance, and 2) a 2-year plan for routine maintenance. The preventive maintenance needs are ranked using the HDM-IV model and using Cost Benefit Analysis.

The Directorate of Roads has 55 regional and provincial directorates that are responsible for carrying out emergency, routine and periodic (rehabilitation and reinforcement) maintenance.

Emergency maintenance is carried out using own staff, while most routine and preventive maintenance is carried out by private contractors.

The CNER is responsible for carrying out:

- Two yearly road condition survey of the road network.
- Maintaining the Road Management System that includes a Road Data Bank (RIB) and a Cartographic Data Bank (COB)
- Research studies to determine, amongst other things, the optimal road strategy for road maintenance

The IFEER is responsible for providing vocational education to meet the requirements of the road sector with regards to maintenance and construction, in particular to train equipment drivers, operators, foreman, and site engineers. In addition to the IFEER, the Ministry of Equipment, Transport & Logistics also has two institutes for training technicians in Fez and Agadir.

In addition to the IFEER, the Ministry of Equipment, Transport & Logistics also has engineering schools in the cities of Oujda, Marrakech, and Casablanca.

The Ministry of Equipment, Transport & Logistics also maintains an on-going discussion with the association of contractors (Association Marocaine des Routes) and the Federation Nationale des Batiments et des Travaux. This is an important element of raising the level of quality among the contractors and construction industry.

Finally, the Ministry of Equipment, Transport & Logistics, together with the Association Marocaine des Routes has developed a Contractor Qualification System with several levels. At each level of this qualification system, contractor has to satisfy increasingly stringent requirements with regards to human resources, number of engineering staff, and capital of the company, equipment and references. Once qualified, a contractor can bid for work suitable for their level of qualification for a period of three years, after which the qualification must be renewed. This system of pre-qualification is important in reducing the length of time required for procuring maintenance works.

Financing of Maintenance

The financing for road projects (including maintenance) comes from four sources:

1. General tax revenues
2. The road fund (Fonds Speciale Routiere)
3. Partners
4. External funds (La Caisse Pour Le Financement Routier)

Table 4-9 Funding by Source for Road Projects

	General Budget (Million Dirhams)	FSR (Million Dirhams)	Partners (Million Dirhams)	CFR (Million Dirhams)
2015	2,026	3,207	106	2,408
2016	2,471	2,500	600	2,305

Source: Consultant

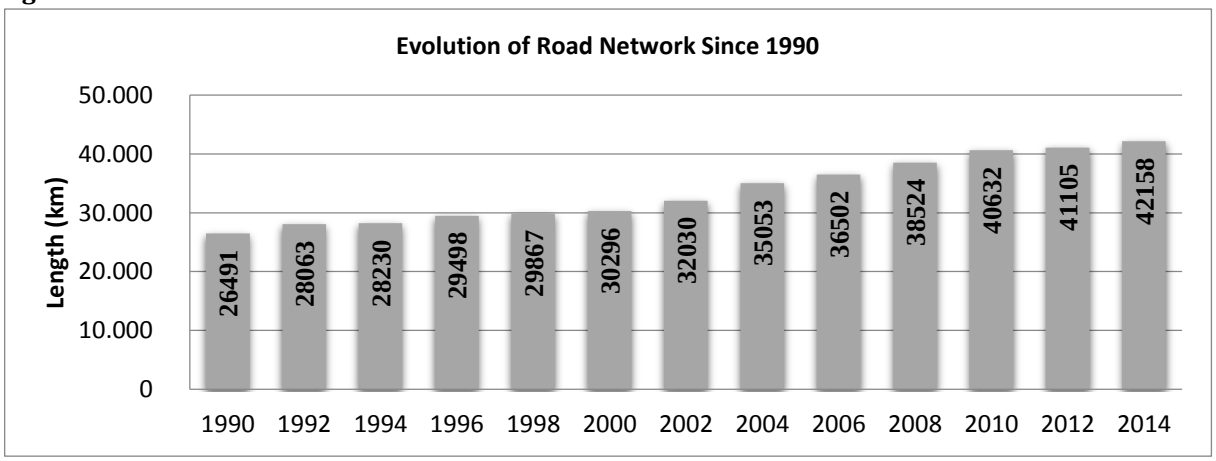
The maintenance works are financed via the General Budget and the road fund (FSR). In 2016 the total budget was about 5,000 million Dirhams. Maintenance works got 29.5% (1,432 million Dirhams) in 2016. This, however, is not even 50% of the financing needed to meet the maintenance needs. According to studies, the annual financing needed to meet the maintenance requirements is almost 3 million Dirham. Of the funds dedicated to maintenance, almost 71% of the funds are for routine and periodic maintenance, with the remaining being for rehabilitation, reinforcement and widening. The FSR get its revenues from fuel taxes.

Issues in maintenance of the road network

Figure 4-10 shows the expansion of the road network since 1990, the road network has been steadily growing from about 26,500 km in 1990 to over 42,000 km in 2014. Thus, the need for maintenance and resources to finance the maintenance has been increasing. During this same period, the volume of traffic on the road network has increased dramatically, from about 27 million vehicle kilometres in 1990 to over 90 million vehicle kilometres in 2014.

Increase in traffic volumes - This dramatic increase in traffic volume means that the road network needs to be properly maintained in order to handle this traffic. One of the problems is that the road network is not designed to handle the larger heavier vehicles that are currently in use. The Moroccan road network is designed to handle and axle load of 13 tonnes, whereas the current average axle load is 19 – 20 tonnes. Thus, the pavement deterioration is much more rapid and severe than if the road was designed to handle these higher axle loads. The road network is also not properly designed to handle the heavy multi-axle Lorries that are routinely used for freight transport. Again, the effect of this is more rapid and severe pavement deterioration than if the roads were designed taking the traffic mix and volumes into account.

Figure 4-10 Evolution of Road Network 1990 - 2014



Source: Consultant

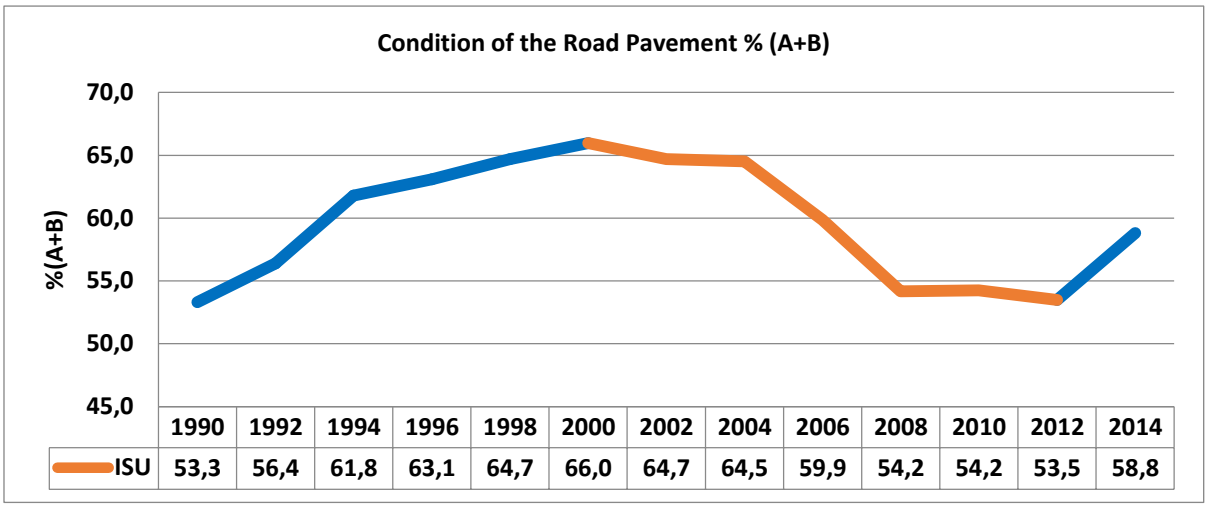
Overloading - Another issue that affects maintenance is the overloading of freight vehicles. Almost 40% of the vehicles do not respect the weight limits. Currently, there are 6 weighing stations in all of Morocco. The Moroccan Government is looking at ways to expand the number of weighing stations as this is having a serious effect on the condition of the road network.

Weather - Since 2008, severe rains and flooding have also caused problems in maintaining the road network. As a result of severe rains and flooding in 2008, 2009, 2010, and 2014 destroyed several roads requiring the equivalent of 3 years maintenance budget to rehabilitate the road network.

Figure 4-11 shows the condition of the road network. From 1990 to 2000, the percent of the road network that was in Good of Fair condition was increasing. However with a peak in 2000 (66%), the percent of the road network that was in Good or Fair condition started declining, falling to 53.8% in 2012. In 2012, the funding for maintenance was increased and this is immediately visible in an increase in the per-cent of the road network that is in Good or Fair condition. The increase in maintenance requirements because of a larger road network, the increase in traffic volumes,

overloading, and severe rains and flooding all contributed to deterioration in the condition of the road network.

Figure 4-11 Condition of the Road Network



	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014
ISU	53,3	56,4	61,8	63,1	64,7	66,0	64,7	64,5	59,9	54,2	54,2	53,5	58,8

Source: Consultant

Performance based maintenance contracts - The Moroccan Government experimented with performance based maintenance contracts in 1999 – 2001. These pilot projects, however, did not deliver satisfactory results. The primary reason for this was that neither the public organisations, nor the private contractors were prepared to undertake such complicated contracts with the accompanying monitoring requirements.

The Moroccan Government is, however, once again revisiting performance based maintenance contracts. Two performance based contracts for routine maintenance will shortly be launched, each contract covering a stretch of 250 kilometres (one at Oudja and the other south of Agadir). The objective of the Ministry is to look after the maintenance requirements of the strategic road network, and outsource the maintenance of all secondary and rural roads using performance based maintenance contracts.

Staffing – There are two issues related to staffing. First, the bulk of the staff employed by the ministry and its various department and institutes are all government employees, their employment is governed by government rules and regulations and they are paid salaries consistent with the government's pay scales. The salaries for government employment are low compared to the salaries paid by the private sector. Thus, the government is having some difficulty in competing with the private sector to attract the talent it needs. The second issue has to do with reducing the numbers of staff employed because of budget constraints; the objective is to reduce number of staff by 30% by 2020. This means that the maintenance will have to be outsourced even more than what is currently being done.

Rural roads – The funding for the maintenance of rural roads is simply not available, the National government does not have the resources for maintaining the rural roads network, and the resources in local communities for maintaining these roads are inadequate. Thus, the maintenance of rural roads is clearly a problem. Furthermore, the current legal framework is not sufficiently clear in specifying the responsibility of the local community for the rural roads that serve these communities.

Maintenance of equipment needed for pavement condition survey – CNER, the agency responsible for carrying out the pavement condition survey uses deflect graphs to measure pavement deflection, bump integrators, longitudinal profile analyzers to asses pavement evenness. When there are problems with this equipment, there is no one in Morocco who is able to carry out the necessary maintenance and repair in Morocco. This means that the down time because of equipment failure can be long, resulting in disruptions to scheduled surveys and other maintenance related work.

Lessons Learned

The Moroccan road network appears to be a reasonably well managed and maintained road network. The Moroccan authorities responsible for developing, managing and maintaining the road networks have won the confidence of various international lending agencies and institutions such as the World Bank, Japan International Cooperation Agency (JICA), and the European Investment Bank (EIB). This is important as it testifies to the quality and ability of the organisations and personnel involved in this process. This is also reflected in the strength and quality of the planning and other processes supporting the maintenance of the road network. **Thus, one important lesson that can be drawn from Morocco is the importance of collecting data (CNER collects traffic volume data at 250 points in Morocco and does the pavement condition survey every two years, and maintains the Road Management System). Once the data has been collected it is used to create multi-year plans, such as the two-year routine maintenance plans and the 5-year maintenance plan.**

Another important lesson from the Morocco case is the **importance of training and educating staff** such as foreman, site engineers, equipment drivers, and operators. The Ministry of Equipment, Transport and Logistics is heavily invested in educational institutions at all levels. The problems of staffing notwithstanding, this emphasis on education has helped to raise the quality of engineering works (including maintenance) in Morocco.

The **dialogue with the industry** is another noteworthy feature of the Moroccan Government's efforts to raise the quality of the contracting industry engaged in road maintenance. This has resulted in the contractor qualification system for pre-qualifying contractors for bidding on maintenance works which simplifies and expedites the procurement of maintenance works. This has also motivated the Ministry to revisit the use of performance based maintenance contracts.

The **department responsible for maintenance within the Ministry is at the same level as the department responsible for executing construction projects**. This is important as it makes clear that maintenance is as important as construction. Acknowledging the importance of maintenance, a large share of the resources available for maintenance is spent on routine maintenance and not on rehabilitation.

Enforcement of weight limits is going to become increasingly important as the road network expands further and traffic volumes increase. Overloading is clearly a problem, and enforcing weight limits will increasingly become a priority if the road network is to be maintained in a good condition.

Since 2008, the damage caused by severe rains to the Moroccan road network required rehabilitation that was the equivalent of three years maintenance budget. **Thus, clearly climate is a factor that needs to be considered when estimating the resources needed for maintenance.**

4.2.2. Case Study – Turkey

Turkey is a large country with a total area covering 783,562 square km. Its area covers a high central plateau (Anatolia); a narrow coastal plain; several mountain ranges. Turkey is a middle income country that is now investing in developing a motorway network and increasing the share of the network that is covered with an asphalt pavement.

Table 4-10 Socio Economic Indicators for Turkey

TURKEY	latest data (2000-2013)
Year	2013
Population	74,932,641
GNI per capita ($)	10,970
Surface (square km)	783,560
Length of roads by GDP per capita (Km/$)	35
Density of roads (Km/Km2)	0.50

Source: Consultant

Description of Road Network

The total length of the road network in Turkey is 388,366 kilometres. The road network is divided into four categories, motorways, state highways, provincial roads, and other (see Table 4-11). There are two things worth noting about the road network: 1) the total length of the road network that is covered with asphalt/concrete is quite low (it seems that surface treatments are the preferred pavement type), and 2) forest, rural and urban roads make up the large part of the total Turkish road network.

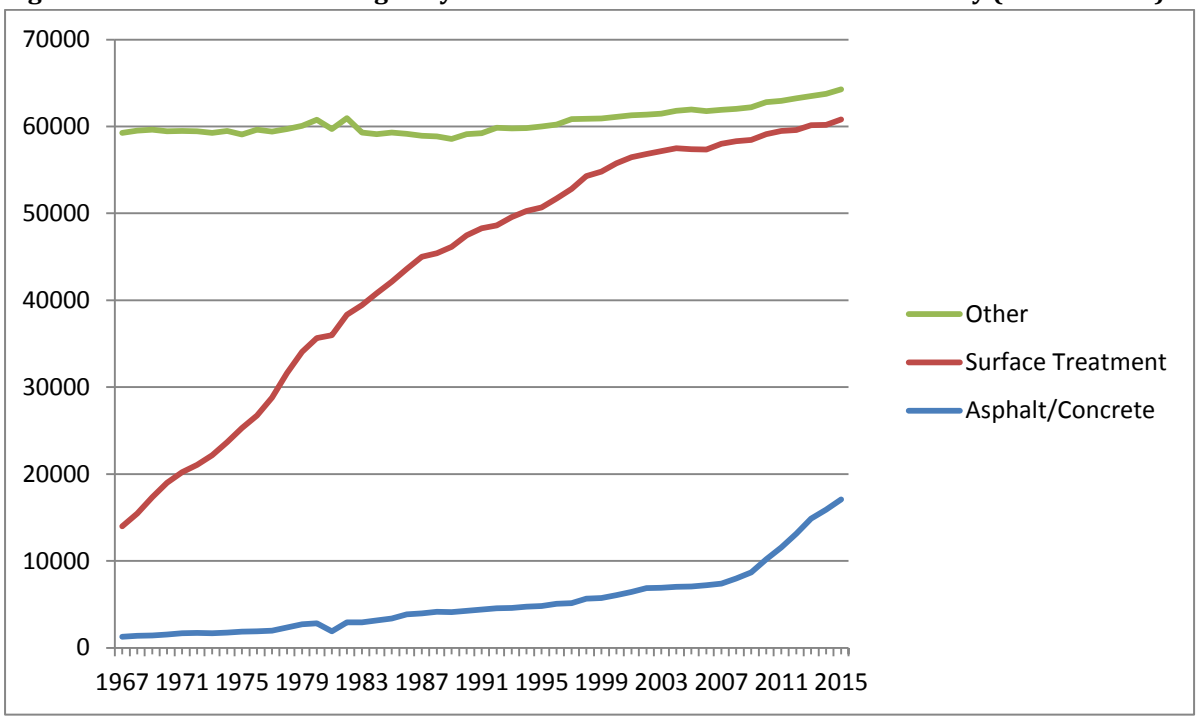
Table 4-11 Length of Road Network by Road Type

Road category	Asphalt/concrete	Surface Treatment	Other	Total
Motorways	2,159			2,159
State highways	14,393	16,399	421	31,213
Provincial roads	2.702	27.327	2,864	33,065
Forest, rural, tourist, and urban roads			321,929	321,929
Total	19,254	43,726	325,214	388,366

Source: Consultant

Figure 4-12 shows the growth of the road network in Turkey, excluding motorways, forest, rural and urban roads. What is quite striking about this graph is that the total length of state highways and provincial roads has not increased by much since 1967, in 1967, the total length was 59,257 km and in 2015 it was 64,278 km. The second thing this graph clearly shows is how the network of state highways and provincial roads is increasingly paved with a surface treatment, or asphalt/concrete.

Figure 4-12 Growth of State Highways and Provincial and Other Roads in Turkey (1967 – 2015)



Source: Consultant

Organisation of maintenance

The General Directorate of Highways (GDH) is responsible for maintain the motorways, state highways and provincial roads. The GDH is an institution that falls under the Ministry of Transport and Maritime Affairs. The total length of highway which is under the control of the GDH is 65,909 km.

Within the GDH there is a separate department, the Department of Facilities and Maintenance that is responsible for the maintenance of the road network and another department that is responsible for the surveys to collect data on the condition of the road network and other assets, the Department of Surveys, Design and Environment. Furthermore, there are 18 regional divisions of the GDH, which have 281 Maintenance Houses and 25 Motorway Maintenance and Operation Offices.

Maintenance works on state highways and provincial roads are carried out by the Regional Divisions and the Districts. Each district conducts the maintenance works and snow and ice removal with its own team within its geographic boundaries.

There are three types of maintenance works that are undertaken by the GDH:

- Routine maintenance
- Snow and ice removal
- Emergency maintenance.

Routine maintenance works include:

- Removing surface deformation on asphalt roads,
- Corrugation and rutting on surface of stabilized road,
- Repairing structures, such as, bridge, culvert, structures,

- Addressing the effects of flooding and erosion, and
- Clearing drainage systems, ditches and culverts as well as vegetation, etc.
- Snow and ice removal are also a prominent part of the maintenance works.

Most of the routine, periodic maintenance, rehabilitation and reinforcement works are contracted out by GDH to private contractors. Private contractors are awarded three-year maintenance contracts; these contracts are not performance based maintenance contracts.

Of the remaining roads, the construction and maintenance of the Touristic roads is done by the GDH, but paid for by the Ministry of Tourism. The Village, Forest, and Urban roads are under the control of the Provincial Special Administrations, The Ministry of Forests, and the municipalities, respectively.

There is little information on how the maintenance is carried out for the village, forest, and urban roads, or for that matter on the condition of these roads.

Figure 4-13 Organogram of Turkish General Directorate of Highways

Source: Consultant

Financing of maintenance

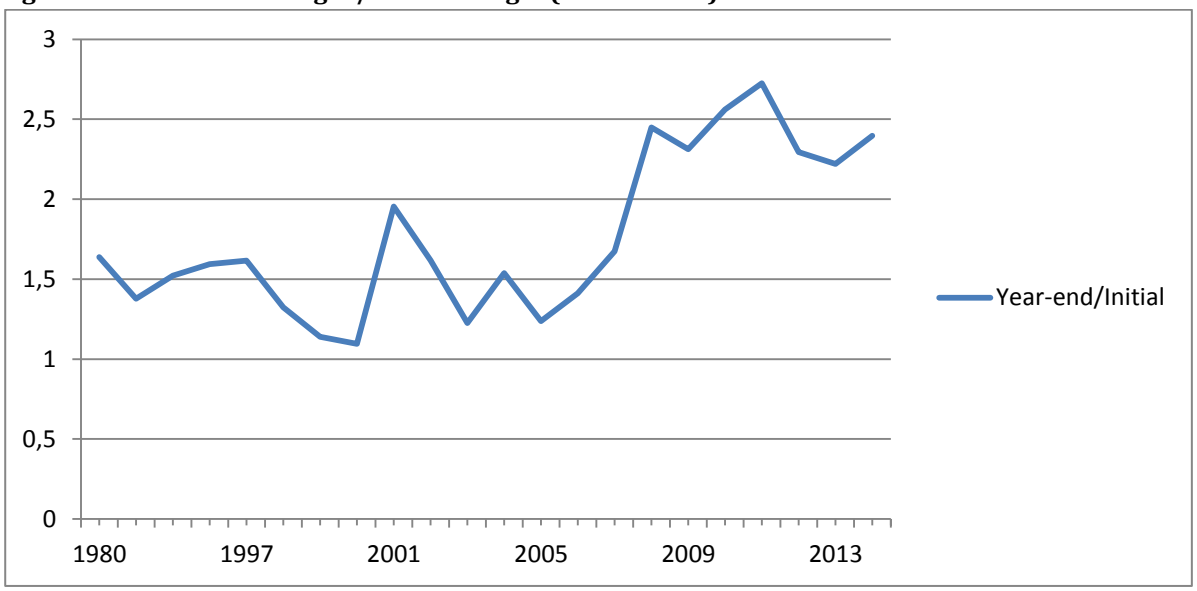
The General Directorate of Highways is a Government organisation that gets the bulk of its revenue from the general budget. In addition, it also has a supplementary budget. A budget is prepared for three years and submitted to the Turkish Parliament for approval. However, the Parliament approves and allocates an annual budget for GDH every year. In the past, the investments made by GDH have been supported by revenues from the supplementary budget, as well as from the Public

Participation Fund (started in 1984), and Fuel Oil Consumption Fund (started in 1985). However, both the Public Participation Fund and the Fuel Oil Consumption Fund have since been abolished.

Figure 4-14 shows the budget at the start of the year to the GDH, and the budget allocated to it at the end of the year. This figure shows several things. First the budget allocation has grown and grown significantly since 1980 and, second, the budget at the end of the year is significantly higher than the budget at the start of the year.

Figures (Figure 4-14 and Figure 4-15) show the total budget that is available to the GDH. According to the GDH, in 2014, they spend roughly 10–12% of their total budget on routine and periodic maintenance. The rehabilitation and reinforcement works were not included in this 10% figure.

Figure 4-14 Year-end Budget / Initial Budget (1980 - 2014) for Turkish GDH



Source: Consultant

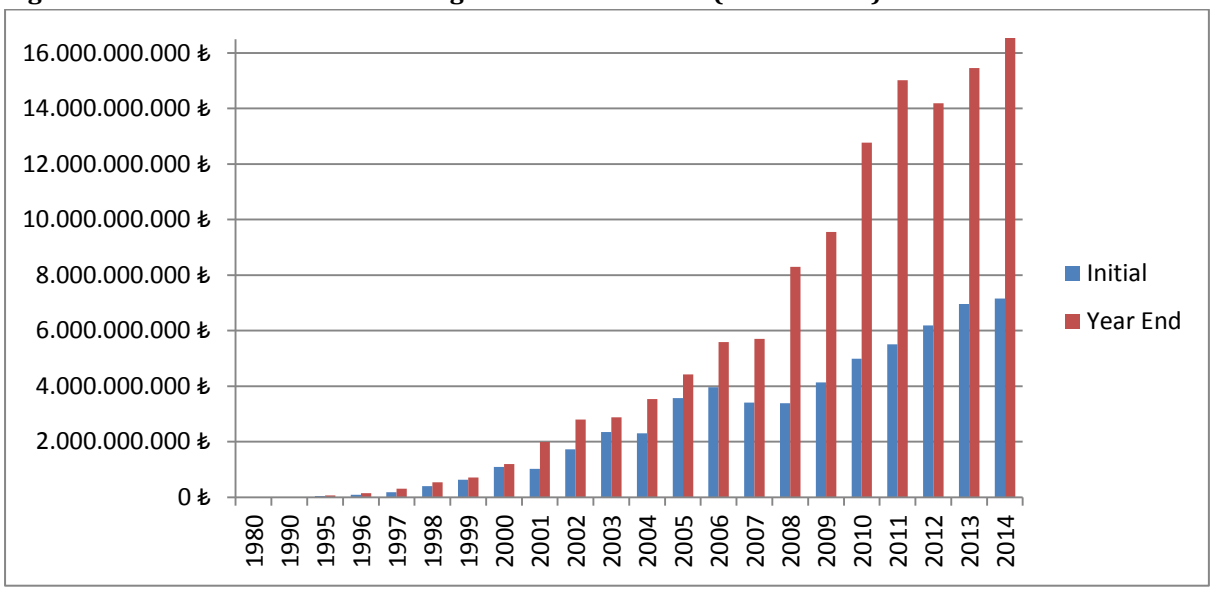
Figure 4-15 shows the ratio of the year-end budget to the initial budget for the GDH. This figure very clearly shows that over the years, the ratio has increased to more than 2 – the budget allocation at the end of the year is twice what it was at the start of the year. This is quite remarkable as it suggest some a very high level of ad-hoc, off-budget funding. This off-budget funding does not appear till late in the year, and this makes it difficult to plan for the annual maintenance needs as there is uncertainty about the total amount of resources for maintenance activities. In terms of planning, this uncertainty makes it difficult to engage in systematic annual and multi-year planning.

The revenues provided to GDH from the general budget are proving to be insufficient to cover the costs of expanding the road network. Thus, lending by International Financial Institutions is being used to supplement the revenues from the general budget.

In terms of the maintenance of the road sector, it was mentioned that rehabilitation and reinforcement projects are viewed as capital projects and not as maintenance projects. This rehabilitation and reinforcement projects are included in a 3 – yearly capital investment plan and submitted with their budget to the Parliament for approval. Thus, works that what would be considered as part of a maintenance plan are financed in Turkey using capital funds. This annual

budget approval process for capital projects means that there is little guarantee that the required maintenance needs will be adequately financed in any given year.

Figure 4-15 Initial and Year End Budgets for Turkish GDH (1980 - 2014)



Source: Consultant

Issues in maintenance of road network

Decentralisation of responsibility for rural, forest, urban and touristic roads – In addition to the roughly 66,000 km making up the national road network, there is an additional 321,000 km long road network comprising rural, forest, touristic and urban roads. These roads are the responsibility of the Ministry of Forests, Ministry of Tourism, and Municipalities, respectively. There is virtually no information available on these roads at a national level (at least a country level overview of this road network cannot be uncovered). This decentralisation is problematic on several levels. First, this 321,000 km is a huge network of roads, whose maintenance needs are bound to be large. It is entirely unclear whether these needs are being met at all. Second, a large part of the benefits of such roads are dependent on the roads being well maintained.

Lack of a maintenance management system – There is little by way of systematic up-to-date data to support a systematic assessment of the maintenance needs of the road network. This lack of data makes it difficult to prioritise maintenance projects, or to forecast future preventive maintenance needs. There is also no adequate pavement deterioration model that can be used to forecast future pavement conditions. Not having the necessary data or a pavement deterioration model means that it is becomes very difficult to develop a good budget to request funding for maintenance activities.

Delays in addressing the maintenance needs of the road network – Routine and periodic maintenance is postponed till such time that rehabilitation and reinforcement works are needed. It seems that surface dressing is used to resurface roads in need of maintenance, without considering the structural integrity of the underlying road.

Flawed technical solutions are applied to solve maintenance problems – It seems that in Turkey surface treatments are applied every 3 – 4 years. This is surprising as in countries like France, properly applied surface treatments can easily last for up to 10 years. This suggests that the

way surface treatments are being applied is not appropriate as they have a much shorter life expectancy than what is normally the case, resulting in higher expense.

Lack of earmarked funding to finance maintenance activities – As a result of the lack of earmarked funding, several of the larger maintenance works have to be financed via a capital investment plan, where the "maintenance" projects compete with other projects. Sometimes they get the needed funds, and sometimes they do not. This introduces uncertainty about whether a given set of maintenance activities can be undertaken, quite regardless of the urgency of undertaking these maintenance works.

Overloading of trucks – Almost 40% of the trucks on Turkish roads exceed the weight limits specified for the roads. This accelerates the pavement deterioration process. Normally, the agency that is in charge of the operations and maintenance of the road networks is also the agency in charge of enforcing the weight limits. In Turkey, however, the enforcement of weight limits on the road network is the responsibility of another, separate agency than the GDH.

Legal and regulatory framework is inhibiting innovative and modern contracting practices – Apparently, the laws in Turkey do not allow for Turnkey Projects, where all aspects of a project are outsourced. This also makes it difficult to introduce, for example performance based maintenance contracts.

Lessons learned

Need for institutional reform - From the review of the organisational and financial aspects of road maintenance in Turkey, it is quite clear that the institutional structure of the road sector needs to be updated. There is no independent road authority, nor is there a road fund. As a consequence the usual problems are observed with regards to maintenance that were also seen in many countries prior to their undertaking institutional reforms of the road sector. These included a backlog of maintenance works that are not being funded, variability in the annual budgets and funding of maintenance works, and a lack of transparency.

Need for planning of preventive maintenance activities – It is clear that in Turkey most maintenance works are not part of a short/medium term, or long-term maintenance plan. The data and modelling tools needed to support such planning are urgently needed.

Turkey is a good example of the importance of a well-designed institutional framework, well designed processes and legal and regulatory frameworks that allow the responsible agencies to discharge their responsibilities in as cost – effective a manner as is possible. Turkey does not have this, thus, the maintenance of Turkish roads is either not good enough, or it is unnecessarily expensive.

4.2.3. Case Study – Senegal

Senegal is situated in the West part of the African continent in the Sub-Saharan region. The country is classified as a lower middle-income by the World Bank. The surface area of Senegal covers 196,712 km^2. In the north it borders the Islamic Republic of Mauritania; in the East, Mali; in the South, Guinea-Bissau and the Republic of Guinea; and in the West there is the Atlantic Ocean.

According to the 2013 census, Senegal's population was slightly more than 13.5 million. During the period 1960 – 2002, the average growth rate of the population was 2.6%. However, from 2002 to

2013 the population growth increased sharply to 35%. The population is quite unevenly distributed across the country, 22% of the total population lives in the region of Dakar (0.3% of the total surface), with an average density of 4,147 persons/km^2.

Eleven Regions and thirty-four Departments compose the administrative division of Senegal. Each Department includes sub-prefectures, towns, villages and rural communities.

The gross domestic product (GDP) has grown steady evolution from 5,403 billion FCFA in 2007 to 7,225 billion FCFA in 2012. In the period 2007 – 2012, the GDP grew by 33% with an average annual GDP growth rate of 3.4%.

Description of Road Network

The road network in Senegal is divided in two categories:

Classified Network "réseau classé" (CN) (see Table 4-12)**:** This network is under the supervision of the Ministry of Infrastructure and Land Transport. In 2013, the total length of the CN was 15,609 km, and 36% of this network was paved. The assets of the CN are evaluated to be worth 1,860 billion FCFA.

Table 4-12 Composition of the Classified Network (CN) in Senegal

Classified Network (CN)	Total Classified Network (CN)	Paved Roads
Departmental roads	38%	14%
Track roads	29%	2%
National roads	23%	78%
Regional roads	8%	47%
Urban roads	2%	100%
TOTAL	**100%**	**36%**

Source: AGEROUTE

Non-classified Network "réseau non classé" (NCN): This network is under the administrations of municipalities or villages. The length of the NCN is between 30,000–45,000 km.

Organization of Maintenance

The entity in charge of the definition and implementation of the road policy in Senegal is the Ministry of Infrastructure and Land Transport (MILT) ("*Ministère des Infrastructures, des Transports terrestres et du Désenclavement*"). A General Secretariat, Directorates, Administration Agencies, Public Institutions and National Corporations make up the MILT.

For road maintenance, three entities from the MILT are responsible for maintaining the roads in Senegal:

1. Directorate of Roads
2. Agency of Works and Management of Roads (AGEROUTE)
3. Fund for Autonomous Road Maintenance (FERA)

The Directorate of Roads implements the road policy defined by the Ministry of Infrastructure and Land Transport. The main responsibilities of the Directorate of Roads are to:

- Develop a coherent policy to manage all the road network in Senegal,

- Ensure a development planning of the road network, a program of investments and the establishment of technical records to mobilize its financing,
- Ensure a technical coordination of public and private organizations which intervene in road maintenance and infrastructure,
- Provide support to local authorities in road infrastructure,
- Implement a national development strategy on rural roads,
- Monitor freight trucks and heavy vehicles in coordination with the Public Private Partnership-Afrique Pesagge-SA.

AGEROUTE is responsible of the management and coordination for the Classified Network in Senegal. This agency works in close collaboration with the Directorates of Roads. The main responsibilities of AGEROUTE are to:

- Assess the needs of road infrastructure and maintenance in Senegal,
- Propose to the MILT a road guidance for the road sector,
- Develop road projects and works,
- Create a data base for the road sector in collaboration with the MILT,
- Develop a three-year Public Investment Program (PTIP) for the country in terms of road maintenance, rehabilitation and new constructions. The PTIP is updated every year,
- Develop an annual road maintenance program (PERA),
- Propose road maintenance and financing strategies,
- Hire consultants and companies and ensure the good management of the companies working on the classified road network,
- Conduct technical studies, including studies to assess the feasibility of road projects,
- Support local authorities in implementing road projects,
- Contribute to the successful completion of public works,
- Advise on any issues related to roads.

The main objective of FERA is to guarantee the continuous flow of resources for financing, in a timely manner, maintenance of the road network in Senegal. The Board of FERA is made up of representatives from government, transporters, users, private sector and other partners. FERA is the most autonomous entity for road maintenance in Senegal. A more detailed description of FERA is provided in the next section Financing of Maintenance.

These three entities (Directorate of Roads, AGEROUTE, and FERA) that are in-charge of road maintenance are supervised by an Oversight Council the “Conseil de Surveillance” comprising representatives from the road administration, road professionals and road users.

Financing of Maintenance

The Fund for Autonomous Road Maintenance, “Fonds d’Entretien Routier Autonome (FERA)” is the entity in charge of financing the maintenance of the road network in Senegal. FERA was created in 2007 under the law decree no: 2007-1277. The institution has a legal basis and is guaranteed financial autonomy. The mission of FERA is to mobilize sufficient resources for financing the maintenance and operation of the entire road network.

The main sources for revenues for FERA are:

- The annual budgetary allocation provided by Government and managed by the Consolidate Budget for Investments, “Budget Consolidé d’Investissement (BCI)”,

- A Tax on Road Use (TRU). This special tax is an addition to the specific tax of fuel products. It was established in 2008 by law decree after the modification of the Tax Code. The resources from this special tax are a complement to the annual budget, increasing availability and flow of additional resources,
- Additional governmental subsidies managed by the BCI.

The Tax on Road Use (TRU) is levied on three fuel products:

1. 35 FCFA (around 7 cents USD) to the super gasoline (above 90 octane), it is 5.9% with respect to the price in 2008.
2. 32 FCFA (around 6 cents USD) to the regular gasoline (below 90 octane), it is 8.5% with respect to the price in 2008.
3. 16 FCFA (around 3 cents USD) to the diesel fuel, it is 3.3% with respect to the price in 2008.

In 2011, an increase of the TRU was established by law decree, doubling the level of taxes for super gasoline, regular gasoline and diesel fuel. This resolution considerably increased revenues available to FERA. This increase was necessary to maintain the level of road financing in Senegal. Today FERA views this type of tax as providing it with a stable source of revenues.

Table 4-13 shows the actual level of collection and the forecasted collections of the TRU from 2009 to 2015.

Table 4-13 Evolution of the TRU collection in Senegal (2009-2015) (Millions of FCFA)

	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Previsions TRU	16,000	22,500	24,500	24,500	25,000	26,000	26,000
Collection TRU	11,082	12,298	21,796	21,930	25,669	27,154	29,468
Gap TRU	**-4,918**	**-10,202**	**-2,704**	**-2,570**	**+669**	**+1,154**	**+3,468**

Source: FERA

The doubling of the TRU has had an important effect on revenues since 2011 and more tax revenues are actually being collected than what was expected.

The revenues available from various sources for financing road maintenance , together with the revenue requirements for properly maintaining the road network are shown in Table 4-14. Table 4-14 shows that the available revenues are insufficient for properly maintaining the road network.

One of the innovative sources of financing being considered by FERA is to borrow money from a commercial bank to finance the funding shortfall for maintenance activities. The rationale for this is that the cost of delayed maintenance exceeds the cost of this loan. The loan itself would be guaranteed by the guaranteed revenue sources from the TRU that come directly to FERA.

Table 4-14 Sources of road financing and needs for road maintenance in Senegal (2009-2015) (Millions of FCFA)

	2009	2010	2011	2012	2013	2014	2015
Tax of road use TRU	16,000	22,500	24,500	24,500	25,000	26,000	26,000
Budget BCI	21,000	22,500	22,500	22,500	25,200	25,000	26,000
Total budget road financing	**37,000**	**45,000**	**47,000**	**47,000**	**50,200**	**51,000**	**52,000**
Needs road maintenance		**49,500**	**55,500**	**51,100**	**52,000**	**52,000**	**70,000**
Paved roads in good and fair levels	52%	60%	61.5%	62.3%	66%	71%	74%
Unpaved roads in good and fair levels	31.5%	39.4%	39.4%	41%	41.7%	43%	45%

Source: FERA

Issues in maintenance of the road network

Overloading of vehicles – Overloading of both passenger and goods vehicles is a chronic problem. According to a study carried out by the European Union, the cost of this overloading (because of faster pavement deterioration) is estimated to be 35 billion FCFA.

Dependence of government tax revenues – A significant part of the FERA budget is financed from general tax revenues allocated by the government. The volume of these funds varies from year to year creating uncertainty about the total revenues available for maintenance activities in any given year. This uncertainty makes it difficult to properly plan annual maintenance activities.

Obsolete design standards – The road network in Senegal is designed using an axle load of 10.5T / axle. This is an obsolete standard that is inadequate for the heavier multi-axle goods vehicles that use the road network in Dakar. The heavier vehicles using the road network leads to faster than expected deterioration of the pavement and this in turn means more maintenance.

Availability of materials – There is a lack of suitable local materials for road maintenance and the availability of cement is an issue. The lack of appropriate materials means that maintenance works are often delayed and more expensive than what normally should be the case.

Problems with contractors – While the local contractors are technically qualified, in practice there are problems with the quality of the works that are delivered.

Lesson Learned

Organisation of the road sector – The road sector is very well organised in terms of the structure and institutional responsibilities. Very importantly, the management and operation of the road network is managed by a Directorate of Roads, while the funding of the maintenance is provided by an independent road fund.

Innovative financing sources – The FERA is going to borrow money from a commercial bank using its guaranteed revenue sources to guarantee the loan. This is an innovative form of financing maintenance activities and can be used as an example in other parts of the world.

Road fund is focused on preventive maintenance – The focus of the road fund (FERA) is on financing preventive (routine and periodic) maintenance and this is important as it helps to reduce unnecessary expenditures because of delayed maintenance.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

While the road sector has been undergoing a lot of development and improvement, unfortunately, in many countries the problems that plagued it from more than a decade ago have still not been adequately addressed. These include:

- The lengths of the road networks in OIC Member States, relative to GDP, are quite large when compared to the US and the EU28. Except for Egypt, Gabon, Guyana, Indonesia, Iran, Iraq, Jordan, Kuwait, Lebanon, Morocco, Palestine, Qatar, Saudi Arabia, Somalia, Tunisia, and Turkey, the remaining OIC Member States are spending too much on developing their road networks. From a maintenance perspective, it is almost a given that these countries will find it very difficult in the future to find resources to properly maintain their road networks, and preserve the value of their assets.
- The density of coverage of the road networks in OIC Member States is quite low compared to the US and the EU28. Of course, this is not entirely surprising as the road networks in many of the OIC Member States are still developing and not mature. However, this observation together with the previous observation regarding the size of the road networks relative to the country's GDP suggests that the development of the road networks, within any given country, seems to be focused around providing a limited number of high quality road links. Of course, there may be very good reasons for doing this, for example, the population of a country may be clustered in a few large cities, the geography of a country may require this, or something else.
- There seems to be a clear focus in the OIC Member States on the paved road network, the share of the paved road network of the total road network is rather high in many in many OIC Member States. In fact, this share is higher than in the United States, and the European Union. The paved road network is more than 50% of the total road network in Algeria, Azerbaijan, Bahrain, Brunei, Comoros Islands, Djibouti, Egypt, Indonesia, Iran, Iraq, Jordan, Kazakhstan, Kuwait, Kyrgyz Republic, Lebanon, Lebanon, Libya, Morocco, Oman, Pakistan, Palestine, Qatar, Syria, Tajikistan, Tunisia, Turkey, United Arab Emirates, and Uzbekistan. The countries where the unpaved road networks are more than 50% of the total road network, with the exception of Afghanistan, Albania, and Bangladesh, all in Africa. Thus, the OIC countries seem to split into two groups; the CIS countries, North African and Middle Eastern countries form one group where the road network is mostly paved, and the African countries form the second group where the road network is mostly unpaved. From a road maintenance point of view this is important because unpaved roads require different and more regular maintenance than paved roads, and delaying maintenance can often mean that the benefits of unpaved roads are completely lost, often requiring expensive rehabilitation later on. On the other hand, the maintenance of paved roads is more expensive than that of unpaved roads.
- There is insufficient attention given to rural roads relative to highways and other types of paved roads. In the OIC Member States, the share of motorways and highways in the total road network is almost 12.5% of the total road network, compared to 1% and 6% for the United States and the EU28, respectively. Rural roads are often the responsibility of lower level governments, for example, provincial or municipal governments. These governments are, more often than not, ill-equipped to properly maintain rural road networks, they do not have the resources or the technical expertise to do so. Based on systematic data on the funding that is available for rural road networks, it would not be unreasonable to infer from the data and evidence that the lower level roads (secondary, provincial and rural roads) are not the priority when it comes to allocating resources. Thus, it can be concluded that the condition of rural road networks in OIC Member States leaves a lot to be desired.

- The availability and quality of the data on the condition and use of the road networks in the OIC Member States remains worrisome. Either the data is not available, or when it is available, it is either dated, it is not easily accessible, or it is not complete. Not having this basic data suggests that it would be difficult, if not impossible, for the responsible organisations to empirically support a planning process to undertake regular preventive maintenance activities.
- From the limited data and evidence that is collected on maintenance expenditures, there are two inescapable conclusions. First, given the size of the road networks in the OIC Member States, the expenditures on maintenance are much too low. And second, much of the expenditures on maintenance are classified as capital projects. The inadequate resources available for maintenance activities means that the condition of the road networks in many OIC Member States is not good and the value of these road assets will decline over time, unless remedial steps are taken. The classification of rehabilitation and reinforcement projects, usually considered to be periodic maintenance projects, as capital projects, clearly suggests that maintenance needs are not met until such time that they can no longer be deferred. This also indicates a problem with the funding that is available for maintenance, clearly it seems to be easier to get funding for capital projects than it is for maintenance activities.
- The organisation of the road sector in many OIC Member States is still not optimal, or in line with what is considered to be desirable in many other countries. For example, all too often, there is no independent road authority that handles the management and operation of road networks, there is no earmarked, or ring fenced funding for the road sector in the form of a road fund, or something similar. Only 20 of the 57 OIC Member States have a road fund. Even the OIC Member States where they have set up a road fund, it is rather unfortunate that the road fund is not performing as intended because of a lack of a sound legal and institutional framework for its existence, or because of the way in which the road fund functioning. The separation of the procurement and funding activities is an essential step in improving the performance of the road sector, and the earmarking or ring fencing of funds is essential for providing adequate resources to the road sector.
- As noted in the previous point, maintenance activities are chronically underfunded, in particular the routine and periodic maintenance activities. The maintenance needs of lower level roads (the secondary, provincial and rural roads) are also largely unmet. In many OIC Member States, the network of motorways and highways is relatively new. However, these motorways and highways will require
- Many of the organisations and institutions in the road sector are facing difficulty in attracting qualified staff with the needed set of competences. There are two reasons for this. First, these organisations are mostly governmental organisations and the salaries and benefits are similar to those offered to civil servants, the processes for hiring are equally difficult, and the possibilities for career advancement are limited. A second problem is that as the road sectors in these countries have been developing, the government finds itself competing with the private sector for the limited pool of qualified individuals, and more often than not the government is not able to compete with the private sector.
- The planning, prioritisation, budgeting, monitoring of road maintenance activities is weak, if not missing in most OIC Member States. As noted earlier, the data that is required to support the planning, prioritisation and budgeting of maintenance activities is either not available, or of poor quality. Thus, it is difficult to do this in any systematic and meaningful manner.
- The design standards in use in many of the OIC Member States are not appropriate for the type of vehicles in use today. The road networks are built according to these old design standards which are not capable of dealing with the much higher volumes of traffic and the heavier vehicles in use today. Thus, the pavement deterioration rates are higher than what

would be the case if the design standards were to reflect the current vehicle mix with heavier, multi-axle vehicles.

- Finally, linked to the condition of the road network is the incidence of overloading of heavy motor vehicles, overloading is widespread. The lack of enforcement of the weight regulations is something that contributes to the faster deterioration of the pavement and needs to be corrected.

5.2. Recommendations

Formulating recommendations for a group of countries as diverse as the OIC Member States is a challenge because there is a great deal of variation in terms of the development and maturity of the road networks, and the organisations responsible for managing and operating these networks. Nevertheless, based on the preceding analysis, a set of recommendations are formulated that should be useful regardless of where a country stands in terms of the development of its road network.

The premise underlying the recommendations is that whatever organisation is responsible for managing, operating and financing the development and maintenance of the road networks should focus on its performance, and on improving its performance. The recommendations are designed to help organisations at different stages of development to evaluate and improve their performance. This perspective is deliberately chosen rather than the more traditional recommendations based on carrying out institutional and/or financial reforms. Of course, the recommendations encompass these two important dimensions as well.

The recommendations are formulated as a set of recommendations about supporting systems and procedures that should be followed by all authorities, regardless of the level of development of the road network. The remaining recommendations are formulated as steps in four phases:

Phase 1 – Preparing the organisation for monitoring performance

Phase 2 – Monitoring and improving performance

Phase 3 – Measuring performance based on output

Phase 4 – Organisation wide performance monitoring

Supporting Systems and procedures

Use of performance indicators for decision-making - Performance monitoring implies the use of indicators and data to make decisions. Performance indicators should be defined and used in a consistent manner over time for making decisions about needs and requirements, investments, maintenance prioritization, or anything else. The advantage of using performance indicators is that it immediately increases the transparency, and by default, the accountability of those making these decisions.

Data collection – Using performance indicators requires data that is relevant, timely, and accurate. Thus, collecting and making available the relevant data should be basic requirement of organizations in the road sector. At a minimum, an organization responsible for managing and operating a road network must have an asset register, a periodic survey to collect information on the condition of its assets, and collect data on traffic volumes and vehicle mix on the road network (for this information to be useful it must be sufficiently detailed and accurate to permit forecasting of traffic volumes and vehicle mix on the road network).

Financial Management Systems – A financial management system should be required to maintain the accounts of the organization, and more importantly for producing reports linking the use of financial resources to the performance of the road assets and various activities.

Road Information System and Asset Management System – An integrated asset management system, containing all relevant data on the assets (location and other attributes, and condition and quality) should be used by the agency to maintain an up to date record on the condition of its assets. This asset management system should be linked to the financial management system so as to permit an analysis of the efficiency and effectiveness of various activities.

Project Management System – A project management system that is capable of managing and monitoring projects is essential to the efficient performance of a highway agency. This project management system needs to be able to monitor progress on projects on a daily basis, manage project risks, and resource use on the project.

Risk Management Framework – As the problems associated with natural phenomenon such as unusually heavy rainfall, extreme temperatures, flash floods seem to increasingly common, organisations need to develop a risk framework that incorporates the risks associated with these phenomenon and their potential consequences and incorporate these into their planning and budgeting.

Phase 1 – Preparing the organization for monitoring performance

This phase is intended to prepare an organization for performance based management of road networks. Thus, this phase is intended to:

- Identify the shortcoming and needs with respect to the systems and procedures noted above
- Collect needed information
- Make changes to the institutional setting, including the legal and regulatory frameworks
- Make necessary internal reforms in the organisation

In terms of the institutional setting, the following is required:

- An autonomously functioning organisation that is authorised to take all decisions that it needs to take to ensure a well-functioning road network. In other words the organisation must be independent of political and other interference.
- A clear and comprehensive mandate for the organisation that is responsible for managing and operating the road network. This mandate needs to extend beyond, for example, just the construction and maintenance of highways. It needs to included, for example, the authority for enforcing weight limits on the roads, for raising finances to finance various activities, etc.
- The various functions of the organisation such as tolling, maintenance, planning, programming and budgeting should be separated as much as possible. For example, procurement, execution, and financing should not be in the hands of the same agency.
- The funding of the organisation should be explicitly linked to targets specified in something like a Service Level Agreement (SLA) that elaborates what the organisation is expected to do with the resources allocated to it.

In terms of the internal reforms at the organisation the following is needed:

- Establishing of guidelines for identifying and assessing maintenance needs and prioritising them in such a way that the activities to meet the identified needs are clearly linked to the performance goals and targets of the organisation.
- Internal separation of functions in such a way that the monitoring is separate from the actual activities themselves. Regular internal audits of performance should also be undertaken.

Phase 2 – Monitoring and improving performance

In this phase, there are three priorities, namely ensuring:

- Human resources issues
- Involvement of stakeholders and road users, and
- Financial security for the organisation

In terms of the HR issues, the following need to be addressed:

- The availability of properly qualified staff is becoming increasingly important at organisations responsible for managing and operating road networks. For example, historically such organisations have been dominated by engineers. Now, however, in addition to engineers, these organisations also need procurement specialists, project managers, data base specialists, data collection specialists, and numerous other skills.
- Attracting and retaining this talent requires that organisations pay attention to the criteria used for employing staff (the criteria are still heavily weighted in favour engineering skills and competences), the career advancement possibilities for non-engineering staff, and the salary structure for these positions (many of these people are eminently employable in the private sector).

There are two aspects to the stakeholder involvement:

- The first concerns the contractors who execute the works that are let by the organisation. The organisation responsible for the management and operation of the road networks requires a competitive, technologically advanced group of contractors that can participate in the kinds of works that are required, using advanced contract types (for example, performance based, multi-year maintenance contracts). If the contractors are not capable of doing this, the overall performance of the road sector will remain limited. Thus, improving the capabilities of the road sector, and a programme for engaging the road sector contractors is an important part of improving the overall performance of the sector.
- The second aspect is involving the road users in the performance and functioning of the organisation. This involvement is an important way to build support for the organisation and help it in its interactions with the government in getting needed resources.

Finally, previously noted, the available resources for maintenance activities are limited and usually too little, and the level of available resources also fluctuates from year to year, making it difficult to engage in any form of serious planning. Thus, it is essential that the level of available resources is adequate, and the annual variation in available resources is not so large so as to make planning difficult. To do this three things are proposed:

- Ring-fenced or earmarked budgets. What is important is that the revenue streams for the road network should be guaranteed and at a level that is commensurate with the ambitions, objectives, and targets for the road sector. Second, the decision for funding works should be taken by a body that is independent of both political pressures and interference, as well as

independent of those taking decisions for procurement and execution of these works. Finally, as much as possible, these revenues should come from fees etc., from within the road users (for example, licence fees, a tax on fuels, or something similar).

- Adequate funding. The level of funding should be linked to the targets that have been set for the road network in terms of performance.
- Including a valuation of the value of all road assets in the books of the organisation. Estimating and setting a value of the road assets under the supervision of the organisation, and putting this on the organisation's books will make it very clear whether the organisation is maintaining, increasing, or adversely affecting the value of its assets. Making this transparent also makes it possible to demonstrate the value and benefits of preventive maintenance.

Phase 3 – Measuring performance based on outputs

The fundamental difference in this phase from the earlier phases is that now the emphasis is on realising the performance objectives in terms of the end-result, the outputs. Thus, for example, it is no longer how many kilometres of the road network have been maintained. In this phase, the focus would be on, for example, the cumulative delays resulting from maintenance works on the road network. This focus makes it important to no longer just do the maintenance, but do it in ways that minimise the interruptions and disturbances resulting from the maintenance works.

Phase 4 – Organisation wide performance monitoring

In this most mature phase, the entire organisation measures and monitors its performance at every stage of decision making, and in every decision that it takes.

The set of recommendations specified above are progressively more demanding and require increasingly bigger changes in the organisations responsible for managing road networks. These recommendations will take time to be properly and fully implemented in an organisation. However, if these recommendations are implemented in a systematic and sustained manner, it is fully expected that the concerned organisation will reap large benefits in terms of not just improved efficiency, but also effectiveness in discharging their responsibilities. Ultimately, these set of recommendations will deliver "value for money" in the roads sector.

List of References

AICD Background Paper 14 (Phase 1), (2008). the Burden of Road Maintenance: Roads in Sub-Saharan Africa; AICD Background Paper 15 (Phase 1), (200*) Financing Public Infrastructure in Sub-Saharan Africa: Patterns and Emerging Issues.

Antle, J. M., (1983). Infrastructure and aggregate agricultural productivity: International evidence. Economic Development and Cultural Change 31 (April), 609 – 619.

Baffes, J., and Shah, A., (1993). Productivity of public spending, sectoral allocation choices and economic growth. Paper presented at the 1993 Annual Meeting of American Economic Association, Anaheim, California.

Binswanger, H., Khandekar, S., and Rosenzweig, M., (1989). How infrastructure and financial institutions affect agricultural output and investment in India. World Bank Working Paper Series 163. Washington D.C., USA.

Council for Scientific and Industrial Research (2010). The condition of provincial road networks. www.csir.co.za

Deichmann, U., Fay, M., & Lall, S. V., (2000). Economic structure, productivity, and infrastructure quality in Southern Mexico. Policy Research Working Paper Series 2900. Washington D.C., World Bank.

Donnges, C., Edmonds, G., & Johannessen, B., (2007). Rural Roads Maintenance: Sustaining the Benefits of Maintaining Access, Bankgkok, Thailand, International Labour Organisation.

Easterly, W., and Rebelo, S., (1993). Fiscal policy and economic growth: An empirical investigation. Journal of Monetary Economics 32 (3) 417-458.

Fan, S., and P. G. Pardey. (1997). Research, productivity, and output growth in Chinese agriculture. Journal of Development Economics 53: 115–137.

Fan, S., and N. Rao. (2002). Public investment and poverty reduction: A synthesis of issues, methods and major findings. Mimeo. Washington, D.C.: International Food Policy Research Institute.

Fan, S., P. Hazell, and S. Thorat. (1999). Government spending, agricultural growth and poverty: An analysis of interlinkages in rural India. IFPRI Research Report No. 110. Washington, D.C.: International Food Policy Research Institute.

Fan, S., P. Hazell, and S. Thorat. (2000). Government spending, agricultural growth, and poverty in rural India. American Journal of Agricultural Economics 82 (4): 1038–1051.

Fan, S., L. Zhang, X. Zhang, and X. Ma. (2001a). Regional priorities of public investment in rural China: A country-level analysis. Report prepared for the project Priorities of Public Investments in Chinese Agriculture. Washington, D.C.: International Food Policy Research Institute.

Fan, S., C. Fang, and X. Zhang. (2001b). How agricultural research affects urban poverty in developing countries: The case of China. EPTD Discussion Paper 80. Washington, D.C.: International Food Policy Research Institute.

Fan, S., L. Zhang, and X. Zhang. (2002). Growth, inequality, and poverty in rural China: The role of public investments. IFPRI Research Report No. 125. Washington, D.C.: International Food Policy Research Institute.

Fan, S., S. Jitsuchon, and N. Methakunnavut. (2004). The importance of public investment for reducing rural poverty in middle-income countries: The case of Thailand. DSGD Discussion Paper No. 7. Washington, D.C.: International Food Policy Research Institute.

Fernald, J. G., (1999). Roads to prosperity? Assessing the link between public capital and productivity. The American Economic Review 89 (3) 619 – 638.

Foster, V., & Bieceno-Garmendia, C., (2011). Flagship Report: Africa's Infrastructure: A Time for Transformation.

Heggie, I. & Vickers, P. (1998). Commercial Management and Financing of Roads, World Bank Technical Paper, Washington DC, USA.

Howe, J., (1997), Transport for the Poor or Poor Transport. ILO , Edmonds, G., (2005). Transport, Access and the Millenium Development Goals. ILO, ASIST AP 2005.

IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

Limao, N., & Venables, A. J., (1999). Infrastructure, geographical disadvantage and transport costs. Policy Research Working Paper Series 2257. Washington, D.C.: World Bank.

Mesnard, R., (2013). An application of HDM4 V2 in the Kingdom of Morrocco.

Minten, B., & Kyle, S., (1999). The effects of distance and road quality on food collection, marketing margins, and traders' wages: Evidence from former Zaire. Journal of Development Economics 60: 467–495.

Nagaraj, R. A., Varoudakis, A., & Veganzones, M. A., (2000). Long-run growth trends and convergence across Indian states, Journal of International Development 12: 45 – 70.

New Zealand Transport Agency (2012) State Highway Asset Management Plan 2012-2015, NZTA, New Zealand.

Organisation for Economic Cooperation and Development (2001). Asset Management for the Roads Sector, Paris.

Robinson, R., (2008). Restructuring Road Institutions, Finance and Management, Volume 1: Concepts and Principles, 207-208, University of Birmingham.

Ratner, J. B., (1983). Government capital and the production function for US private output. Economic Letters 13: 213 – 217.

SANRAL (South African National Road Agency Ltd). 2004. Annual Report 2004: Sustainability Report. Pretoria, South Africa.

SANRAL (2010). Our history. http://www.nra.co.za/live/content.php?Category_ID=21

Stephan, A., (2000). Regional infrastructure policy and its impact on productivity: A comparison of Germany and Fracne, Konjuknturpolitik 46 (940) 327 – 356.

The Strategic Vision of SANRAL for the year 2010.

World Bank (1988). Road Deterioration in Developing Countries: Causes and Remedies, A World Bank Policy Study.

World Bank (1988).

World Bank (2012).

APPENDIX: STATISTICAL OVERVIEW OF INDIVIDUAL COUNTRIES

AFGHANISTAN	latest data (2000-2013)
Year	2013
Population	30,551'674
GNI per capita ($)	690
Surface (Km2)	652'860
Year	2010
Motorways (Km)	
Highways, main or national roads (Km)	16'388
Secondary or regional roads (Km)	
Other roads (Km)	6'745
Total length of roads (Km)	23,133
Paved roads (%)	36
Paved roads (Km)	8,419
Non-paved roads (Km)	14,714
Length of roads by GDP per capita (Km/$)	41
Density of roads (Km/Km2)	0.04
Year	2010
Traffic volume (Mio Veh-Km)	296
Year	2013
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	7,255
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	
Persons Injured /100,000 population	10
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	2010
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	276.01
Investment expenditures (Mio USD)	275.08
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	0.21
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	National Road Authority
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

ALBANIA	latest data (2000-2013)
Year	2013
Population	2,773,620
GNI per capita ($)	4,710
Surface (Km2)	28,750
Year	2002
Motorways (Km)	0
Highways, main or national roads (Km)	3,220
Secondary or regional roads (Km)	4,300
Other roads (Km)	10,480
Total length of roads (Km)	18,000
Paved roads (%)	39
Paved roads (Km)	7,020
Non-paved roads (Km)	10,980
Length of roads by GDP per capita (Km/$)	12
Density of roads (Km/Km2)	0.63
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	11
Persons Injured /100,000 population	90
Injury accidents /100,000 population	75
Injury accidents / 100 Million Veh-Km	
Year	2013
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)*	334.59
Investment expenditures (Mio USD)*	322.54
Maintenance expenditures (Mio USD)*	12.05
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	Albanian Road Authority - Maintained by Ndërmarrja Shtetërore Rruga-Ura
Management structure of Road Network	
Motorways	Albanian Road Authority
Highways, main or national roads	Albanian Road Authority
Secondary or regional roads	Albanian Road Authority
Other roads	Albanian Road Authority

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
** Urban roads are not included.*

ALGERIA	latest data (2000-2013)
Year	2013
Population	39,208,194
GNI per capita ($)	5,330
Surface (Km2)	2,381,740
Year	2010
Motorways (Km)	
Highways, main or national roads (Km)	29,468
Secondary or regional roads (Km)	24,108
Other roads (Km)	60,079
Total length of roads (Km)	113,655
Paved roads (%)	77
Paved roads (Km)	87,607
Non-paved roads (Km)	26,048
Length of roads by GDP per capita (Km/$)	26
Density of roads (Km/Km2)	0.05
Year	
Traffic volume (Mio Veh-Km)	
Year	2011
Inland freight transport (Mio T-Km)	3,070
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	1,822
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	12
Persons Injured /100,000 population	169
Injury accidents /100,000 population	110
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	Ministère des Travaux Publics, Direction de l'Exploitation et de l'Entretien Routiers (DEER)
Management structure of Road Network	
Motorways	
Highways, main or national roads	Direction de l'Exploitation et de l'Entretien Routiers (DEER)
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

AZERBAIJAN	latest data (2000-2013)
Year	2013
Population	9,416,598
GNI per capita ($)	7,350
Surface (Km2)	86,600
Year	2013
Motorways (Km)	
Highways, main or national roads (Km)	4,645
Secondary or regional roads (Km)	14,357
Other roads (Km)	
Total length of roads (Km)	19,002
Paved roads (%)	99
Paved roads (Km)	18,841
Non-paved roads (Km)	161
Length of roads by GDP per capita (Km/$)	2.4
Density of roads (Km/Km2)	0.22
Year	2013
Traffic volume (Mio Veh-Km)	21,587
Year	2013
Inland freight transport (Mio T-Km)	26,710
Inland passenger transport (Mio P-Km)	22,337
Road freight transport (Mio T-Km)	14,120
Road passenger transport (Mio P-Km)	21,880
Year	2013
Persons Killed / 100,000 population	12
Persons Injured /100,000 population	31
Injury accidents /100,000 population	30
Injury accidents / 100 Million Veh-Km	13
Year	2011
Government expenditures (Mio USD)	
Central	2250.46
Regional/Local	
Private sector expenditures (Mio USD)	134.65
Total expenditures (Mio USD)	2385.11
Investment expenditures (Mio USD)	2181.80
Maintenance expenditures (Mio USD)	203.30
Other expenditures (Mio USD)	
Year	
Total revenues (Mio USD)	
Authority in charge of Road Management	Ministry of Transportation - Road Transport Service (Yolnəqliyyatservis)
Management structure of Road Network	
Motorways	
Highways, main or national roads	Ministry of Transportation - Road Transport Service (Yolnəqliyyatservis)
Secondary or regional roads	Ministry of Transportation - Road Transport Service (Yolnəqliyyatservis)
Other roads	Ministry of Transportation - Road Transport Service (Yolnəqliyyatservis)

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

BAHRAIN	latest data (2000-2013)
Year	2013
Population	1,332,171
GNI per capita ($)	
Surface (Km2)	760
Year	2013
Motorways (Km)	
Highways, main or national roads (Km)	563
Secondary or regional roads (Km)	656
Other roads (Km)	3,055
Total length of roads (Km)	4,274
Paved roads (%)	83
Paved roads (Km)	3,544
Non-paved roads (Km)	730
Length of roads by GDP per capita (Km/$)	0.2
Density of roads (Km/Km2)	5.62
Year	2002
Traffic volume (Mio Veh-Km)	5,345
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	6
Persons Injured /100,000 population	190
Injury accidents /100,000 population	122
Injury accidents / 100 Million Veh-Km	
Year	2003
Government expenditures (Mio USD)	
Central	79.31
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	79.31
Investment expenditures (Mio USD)	62.53
Maintenance expenditures (Mio USD)	10.60
Other expenditures (Mio USD)	6.19
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	Ministry of Works
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

BANGLADESH	latest data (2000-2013)
Year	2013
Population	156,594,962
GNI per capita ($)	1,010
Surface (Km2)	148,460
Year	2003
Motorways (Km)	0
Highways, main or national roads (Km)	22,378
Secondary or regional roads (Km)	81,670
Other roads (Km)	135,178
Total length of roads (Km)	239,226
Paved roads (%)	10
Paved roads (Km)	22,726
Non-paved roads (Km)	216,500
Length of roads by GDP per capita (Km/$)	250
Density of roads (Km/Km2)	1.66
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2012
Persons Killed / 100,000 population	1
Persons Injured /100,000 population	1
Injury accidents /100,000 population	1
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	Roads and Highways Department - Ministry of Road Transport and Bridges
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

BENIN	latest data (2000-2013)
Year	2013
Population	10,323,474
GNI per capita ($)	790
Surface (Km2)	114,760
Year	2004
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	19,000
Paved roads (%)	10
Paved roads (Km)	1,805
Non-paved roads (Km)	17,195
Length of roads by GDP per capita (Km/$)	37
Density of roads (Km/Km2)	0.17
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2009
Persons Killed / 100,000 population	8
Persons Injured /100,000 population	46
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	2009
Government expenditures (Mio USD)	
Central	16.95
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	Ministère des Travaux Public et des Transports (MTPT)
Management structure of Road Network	
Motorways	
Highways, main or national roads	Direction de l'Entretien Routier (DER)
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

BRUNEI-DARUSSALAM	latest data (2000-2013)
Year	2013
Population	417,784
GNI per capita ($)	
Surface (Km2)	5,770
Year	2013
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	3,167
Paved roads (%)	89
Paved roads (Km)	2,831
Non-paved roads (Km)	336
Length of roads by GDP per capita (Km/$)	0.1
Density of roads (Km/Km2)	0.55
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	8
Persons Injured /100,000 population	122
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Total revenues (Mio USD)	
Authority in charge of Road Management	Department of Roads of Public Works Department (PWD) - Ministry of Development
Management structure of Road Network	
Motorways	
Highways, main or national roads	Public Works Department (PWD) - Ministry of Development
Secondary or regional roads	Public Works Department (PWD) - Ministry of Development
Other roads	Public Works Department (PWD) - Ministry of Development

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

BURKINA FASO	latest data (2000-2013)
Year	2013
Population	16,934,839
GNI per capita ($)	670
Surface (Km2)	274,220
Year	2013
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	15,304
Paved roads (%)	24
Paved roads (Km)	3,642
Non-paved roads (Km)	11,662
Length of roads by GDP per capita (Km/$)	22
Density of roads (Km/Km2)	0.06
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2011
Persons Killed / 100,000 population	1
Persons Injured /100,000 population	31
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	2009
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	206.44
Investment expenditures (Mio USD)	129.57
Maintenance expenditures (Mio USD)	76.87
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

CAMEROON	latest data (2000-2013)
Year	2013
Population	22,253,959
GNI per capita ($)	1,290
Surface (Km2)	475,440
Year	2010
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	49,751
Paved roads (%)	10
Paved roads (Km)	5,011
Non-paved roads (Km)	44,740
Length of roads by GDP per capita (Km/$)	43
Density of roads (Km/Km2)	0.10
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	5
Persons Injured /100,000 population	19
Injury accidents /100,000 population	9
Injury accidents / 100 Million Veh-Km	
Year	2007
Government expenditures (Mio USD)	
Central	527.39
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	527.39
Investment expenditures (Mio USD)	229.75
Maintenance expenditures (Mio USD)	293.38
Other expenditures (Mio USD)	4.26
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	Ministry of Public Works
Secondary or regional roads	Ministry of Public Works
Other roads	Ministry of Public Works

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank. web source: http://www.mintp.cm/fr/le-ministere/les-missions

CHAD	latest data (2000-2013)
Year	2013
Population	12,825,314
GNI per capita ($)	1,030
Surface (Km2)	1,284,000
Year	2006
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	40,000
Paved roads (%)*	1
Paved roads (Km)*	334
Non-paved roads (Km)*	33,066
Length of roads by GDP per capita (Km/$)	56
Density of roads (Km/Km2)	0.03
Year	
Traffic volume (Mio Veh-Km)	
Year	2013
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2007
Persons Killed / 100,000 population	8
Persons Injured /100,000 population	42
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	Ministère des Infrastructures, du Desenclavement et des Transports
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
web source: http://www.mcie-tchad.com/ministere/attributions-du-ministere.html
** Latest % of paved road information (2000), total road network 33,400 Km.*

COMOROS	latest data (2000-2013)
Year	2013
Population	734,917
GNI per capita ($)	840
Surface (Km2)	1,861
Year	2000
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	880
Paved roads (%)	77
Paved roads (Km)	673
Non-paved roads (Km)	207
Length of roads by GDP per capita (Km/$)	2.3
Density of roads (Km/Km2)	0.47
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2007
Persons Killed / 100,000 population	2
Persons Injured /100,000 population	19
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

COTE D,IVOIRE	latest data (2000-2013)
Year	2013
Population	20,316,086
GNI per capita ($)	1,450
Surface (Km2)	322,460
Year	2007
Motorways (Km)	142
Highways, main or national roads (Km)	7,000
Secondary or regional roads (Km)	8,240
Other roads (Km)	66,614
Total length of roads (Km)	81,996
Paved roads (%)	8
Paved roads (Km)	6,502
Non-paved roads (Km)	75,494
Length of roads by GDP per capita (Km/$)	72
Density of roads (Km/Km2)	0.25
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2008
Persons Killed / 100,000 population	4
Persons Injured /100,000 population	92
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	Ministère des Infrastructures Economiques
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
web source: http://www.infrastructures.gouv.ci/principal.php?page=4

DJIBOUTI	latest data (2000-2013)
Year	2013
Population	872,932
GNI per capita ($)	
Surface (Km2)	23,200
Year	2000
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	3,065
Paved roads (%)	45
Paved roads (Km)	1,379
Non-paved roads (Km)	1,686
Length of roads by GDP per capita (Km/$)	4
Density of roads (Km/Km2)	0.13
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	
Persons Killed / 100,000 population	
Persons Injured /100,000 population	
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

EGYPT	latest data (2000-2013)
Year	2013
Population	82,056,378
GNI per capita ($)	3,140
Surface (Km2)	1,001,450
Year	2010
Motorways (Km)	836
Highways, main or national roads (Km)	23,143
Secondary or regional roads (Km)	113,451
Other roads (Km)	
Total length of roads (Km)	137,430
Paved roads (%)	92
Paved roads (Km)	126,724
Non-paved roads (Km)	10,706
Length of roads by GDP per capita (Km/$)	49
Density of roads (Km/Km2)	0.14
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	8
Persons Injured /100,000 population	27
Injury accidents /100,000 population	19
Injury accidents / 100 Million Veh-Km	
Year	2010
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	528.97
Investment expenditures (Mio USD)	342.50
Maintenance expenditures (Mio USD)	186.44
Other expenditures (Mio USD)	0.02
Year	2010
Road Revenues (Mio USD)	
Indirect: Fuel Tax	1.23
Direct: Toll	60.12
Others	89.82
Total revenues (Mio USD)	151.17
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

GABON	latest data (2000-2013)
Year	2013
Population	1,671,711
GNI per capita ($)	10,650
Surface (Km2)	267,670
Year	2007
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	9,170
Paved roads (%)	12
Paved roads (Km)	1,098
Non-paved roads (Km)	8,072
Length of roads by GDP per capita (Km/$)	1.1
Density of roads (Km/Km2)	0.03
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2010
Persons Killed / 100,000 population	16
Persons Injured /100,000 population	36
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

GAMBIA	latest data (2000-2013)
Year	2013
Population	1,849,285
GNI per capita ($)	500
Surface (Km2)	11,300
Year	2004
Motorways (Km)	0
Highways, main or national roads (Km)	1,652
Secondary or regional roads (Km)	1,300
Other roads (Km)	790
Total length of roads (Km)	3,742
Paved roads (%)	19
Paved roads (Km)	723
Non-paved roads (Km)	3,019
Length of roads by GDP per capita (Km/$)	9
Density of roads (Km/Km2)	0.33
Year	2003
Traffic volume (Mio Veh-Km)	74
Year	2003
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	16.1
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	16.1
Year	2007
Persons Killed / 100,000 population	4
Persons Injured /100,000 population	6
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	2003
Government expenditures (Mio USD)	
Central	19.03
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	19.03
Investment expenditures (Mio USD)	18.90
Maintenance expenditures (Mio USD)	0.13
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	National Road Authority NRA
Management structure of Road Network	
Motorways	
Highways, main or national roads	National Road Authority NRA
Secondary or regional roads	National Road Authority NRA
Other roads	National Road Authority NRA

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
web source: http://www.motwi.gov.gm/national-road-authority

GUINEA	latest data (2000-2013)
Year	2013
Population	11,745,189
GNI per capita ($)	460
Surface (Km2)	245,860
Year	2012
Motorways (Km)	
Highways, main or national roads (Km)	7,625
Secondary or regional roads (Km)	15,525
Other roads (Km)	20,373
Total length of roads (Km)	43,348
Paved roads (%)*	10
Paved roads (Km)*	4,342
Non-paved roads (Km)*	40,006
Length of roads by GDP per capita (Km/$)	88
Density of roads (Km/Km2)	0.18
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2011
Persons Killed / 100,000 population	1
Persons Injured /100,000 population	
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	2009
Government expenditures (Mio USD)	
Central	10.30
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
** Latest % of paved road information (2003), total network 44,348 Km.*

GUINEA-BISSAU	latest data (2000-2013)
Year	2013
Population	1,704,255
GNI per capita ($)	590
Surface (Km2)	36,130
Year	2002
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	3,455
Paved roads (%)	28
Paved roads (Km)	965
Non-paved roads (Km)	2,490
Length of roads by GDP per capita (Km/$)	11
Density of roads (Km/Km2)	0.10
Year	2013
Traffic volume (Mio Veh-Km)	4,148
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	6
Persons Injured /100,000 population	
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

GUYANA	latest data (2000-2013)
Year	2013
Population	799,613
GNI per capita ($)	3,750
Surface (Km2)	214,970
Year	2013
Motorways (Km)	0
Highways, main or national roads (Km)	486
Secondary or regional roads (Km)	81
Other roads (Km)	889
Total length of roads (Km)	1,455
Paved roads (%)	39
Paved roads (Km)	566
Non-paved roads (Km)	889
Length of roads by GDP per capita (Km/$)	0.4
Density of roads (Km/Km2)	0.01
Year	2013
Traffic volume (Mio Veh-Km)	51,351
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	14
Persons Injured /100,000 population	
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	2013
Government expenditures (Mio USD)	
Central	39.86
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	39.86
Investment expenditures (Mio USD)	35.07
Maintenance expenditures (Mio USD)	4.80
Other expenditures (Mio USD)	
Year	2013
Road Revenues (Mio USD)	
Indirect: Fuel Tax	45.97
Direct: Toll*	2.24
Others	0.00
Total revenues (Mio USD)	48.21
Authority in charge of Road Management	Chief Roads and Bridge Office of the Ministry of Public Infrastructure
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
** PPP Berbice Bridge tolls are not included.*

INDONESIA	latest data (2000-2013)
Year	2013
Population	249,865,631
GNI per capita ($)	3,580
Surface (Km2)	1,910,930
Year	2013
Motorways (Km)	
Highways, main or national roads (Km)	38,570
Secondary or regional roads (Km)	53,642
Other roads (Km)	415,788
Total length of roads (Km)	508,000
Paved roads (%)	57
Paved roads (Km)	287,926
Non-paved roads (Km)	220,074
Length of roads by GDP per capita (Km/$)	146
Density of roads (Km/Km2)	0.27
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	11
Persons Injured /100,000 population	56
Injury accidents /100,000 population	40
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	Ministry of Public Works
Management structure of Road Network	
Motorways	
Highways, main or national roads	Ministry of Public Works
Secondary or regional roads	Provincial Public Works Offices
Other roads	Regency Public Works Offices

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

IRAN	latest data (2000-2013)
Year	2013
Population	77,447,168
GNI per capita ($)	5,780
Surface (Km2)	1,745,150
Year	2012
Motorways (Km)	2166
Highways, main or national roads (Km)	34,203
Secondary or regional roads (Km)	44,454
Other roads (Km)	195,775
Total length of roads (Km)	276,597
Paved roads (%)	64
Paved roads (Km)	176,272
Non-paved roads (Km)	100,325
Length of roads by GDP per capita (Km/$)	42
Density of roads (Km/Km2)	0.16
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2012
Persons Killed / 100,000 population	24
Persons Injured /100,000 population	384
Injury accidents /100,000 population	316
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

IRAQ	latest data (2000-2013)
Year	2013
Population	33,417,476
GNI per capita ($)	6,720
Surface (Km2)	435,240
Year	2012
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	59,623
Paved roads (%)*	86
Paved roads (Km)*	40,764
Non-paved roads (Km)*	6,636
Length of roads by GDP per capita (Km/$)	9
Density of roads (Km/Km2)	0.14
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	7
Persons Injured /100,000 population	32
Injury accidents /100,000 population	29
Injury accidents / 100 Million Veh-Km	
Year	2009
Government expenditures (Mio USD)	
Central	243.70
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
** Latest % of paved road information (1996), total road network 47,400 Km.*

JORDAN	latest data (2000-2013)
Year	2013
Population	6,459,000
GNI per capita ($)	4,950
Surface (Km2)	89,320
Year	2013
Motorways (Km)	0
Highways, main or national roads (Km)	2,754
Secondary or regional roads (Km)	1,894
Other roads (Km)	2,651
Total length of roads (Km)	7,299
Paved roads (%)	100
Paved roads (Km)	7,299
Non-paved roads (Km)	0
Length of roads by GDP per capita (Km/$)	1.4
Density of roads (Km/Km2)	0.08
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	12
Persons Injured /100,000 population	247
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

KAZAKHSTAN	latest data (2000-2013)
Year	2013
Population	17,037,508
GNI per capita ($)	11,550
Surface (Km2)	2,724,900
Year	2011
Motorways (Km)	
Highways, main or national roads (Km)	23,494
Secondary or regional roads (Km)	73,661
Other roads (Km)	
Total length of roads (Km)	97,155
Paved roads (%)	89
Paved roads (Km)	86,217
Non-paved roads (Km)	10,938
Length of roads by GDP per capita (Km/$)	9
Density of roads (Km/Km2)	0.04
Year	2011
Traffic volume (Mio Veh-Km)	706
Year	2011
Inland freight transport (Mio T-Km)	344,779
Inland passenger transport (Mio P-Km)	180,570
Road freight transport (Mio T-Km)	121,074
Road passenger transport (Mio P-Km)	163,996
Year	2011
Persons Killed / 100,000 population	19
Persons Injured /100,000 population	85
Injury accidents /100,000 population	72
Injury accidents / 100 Million Veh-Km	1,693
Year	2011
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	816.61
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	2010
Road Revenues (Mio USD)	
Indirect: Fuel Tax	178.05
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

KUWAIT	latest data (2000-2013)
Year	2013
Population	3,368,572
GNI per capita ($)	
Surface (Km2)	17,820
Year	2013
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	7,321
Paved roads (%)*	85
Paved roads (Km)*	4,887
Non-paved roads (Km)*	862
Length of roads by GDP per capita (Km/$)	0.1
Density of roads (Km/Km2)	0.41
Year	2000
Traffic volume (Mio Veh-Km) only pass cars	4,450
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	13
Persons Injured /100,000 population	266
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
** Latest % of paved road information (2004), total road network 5,749 Km.*

KYRGYZ REPUBLIC	latest data (2000-2013)
Year	2013
Population	5,719,500
GNI per capita ($)	1,210
Surface (Km2)	199,949
Year	2007
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	34,000
Paved roads (%)*	91
Paved roads (Km)*	16,835
Non-paved roads (Km)*	1,665
Length of roads by GDP per capita (Km/$)	47
Density of roads (Km/Km2)	0.17
Year	2010
Traffic volume (Mio Veh-Km)	4,336
Year	2011
Inland freight transport (Mio T-Km)	2,103
Inland passenger transport (Mio P-Km)	7,462
Road freight transport (Mio T-Km)	1,303
Road passenger transport (Mio P-Km)	7,379
Year	2011
Persons Killed / 100,000 population	18
Persons Injured /100,000 population	121
Injury accidents /100,000 population	87
Injury accidents / 100 Million Veh-Km	
Year	2011
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	188.72
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	34.03
Year	2010
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	9.53
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
** Latest % of paved road information (2000), total road network 18,500 Km.*

LEBANON	latest data (2000-2013)
Year	2013
Population	4,467,390
GNI per capita ($)	9,870
Surface (Km2)	10,450
Year	2013
Motorways (Km)	300
Highways, main or national roads (Km)	457
Secondary or regional roads (Km)	1,379
Other roads (Km)	4,550
Total length of roads (Km)	6,686
Paved roads (%)	95
Paved roads (%)*	6033
Paved roads (Km)*	318
Non-paved roads (Km)*	0.7
Density of roads (Km/Km2)	0.64
Year	
Traffic volume (Mio Veh-Km)**	
Year	
Inland freight transport (Mio T-Km)**	
Inland passenger transport (Mio P-Km)**	
Road freight transport (Mio T-Km)**	
Road passenger transport (Mio P-Km)**	
Year	2013
Persons Killed / 100,000 population	9
Persons Injured /100,000 population	89
Injury accidents /100,000 population	88
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)**	
Central	
Regional/Local	
Private sector expenditures (Mio USD)**	
Total expenditures (Mio USD)**	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)**	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)**	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
** Latest % of paved road information (1996), total road network 6,350 Km.*
*** No data available by the Central Administration for Statistics Lebanon.*

LIBYA	latest data (2000-2013)
Year	2013
Population	6,201,521
GNI per capita ($)	
Surface (Km2)	1,759,540
Year	2000
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	83,200
Paved roads (%)	57
Paved roads (Km)	47,590
Non-paved roads (Km)	35,610
Length of roads by GDP per capita (Km/$)	13
Density of roads (Km/Km2)	0.05
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2007
Persons Killed / 100,000 population	37
Persons Injured /100,000 population	118
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	2005
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	6065.09
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

MALAYSIA	latest data (2000-2013)
Year	2013
Population	29,716,965
GNI per capita ($)	10,430
Surface (Km2)	330,800
Year	2012
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	180,882
Paved roads (%)	78
Paved roads (Km)	141,195
Non-paved roads (Km)	39,687
Length of roads by GDP per capita (Km/$)	17
Density of roads (Km/Km2)	0.55
Year	
Traffic volume (Mio Veh-Km) only pass cars	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2011
Persons Killed / 100,000 population	24
Persons Injured /100,000 population	65
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	2003
Government expenditures (Mio USD)	
Central	346.56
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	346.56
Investment expenditures (Mio USD)	0.69
Maintenance expenditures (Mio USD)	340.61
Other expenditures (Mio USD)	5.26
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

MALDIVES	latest data (2000-2013)
Year	2013
Population	345,023
GNI per capita ($)	5,600
Surface (Km2)	300
Year	2005
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	88
Paved roads (%)	100
Paved roads (Km)	88
Non-paved roads (Km)	0
Length of roads by GDP per capita (Km/$)	0.03
Density of roads (Km/Km2)	0.29
Year	
Traffic volume (Mio Veh-Km) only pass cars	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2007
Persons Killed / 100,000 population	3
Persons Injured /100,000 population	
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

MALI	latest data (2000-2013)
Year	2013
Population	15,301,650
GNI per capita ($)	670
Surface (Km2)	1,240,190
Year	2013
Motorways (Km)	0
Highways, main or national roads (Km)	14,102
Secondary or regional roads (Km)	7,052
Other roads (Km)	67,870
Total length of roads (Km)	89,024
Paved roads (%)	7
Paved roads (Km)	6,209
Non-paved roads (Km)	82,815
Length of roads by GDP per capita (Km/$)	124
Density of roads (Km/Km2)	0.07
Year	
Traffic volume (Mio Veh-Km) only pass cars	
Year	2013
Inland freight transport (Mio T-Km)	5
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	4
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	3
Persons Injured /100,000 population	54
Injury accidents /100,000 population	40
Injury accidents / 100 Million Veh-Km	
Year	2013
Government expenditures (Mio USD)	
Central	71.34
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	71.34
Investment expenditures (Mio USD)	33.57
Maintenance expenditures (Mio USD)	37.77
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

MAURITANIA	latest data (2000-2013)
Year	2013
Population	3,889,880
GNI per capita ($)	1,060
Surface (Km2)	1,030,700
Year	2012
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	11,790
Paved roads (%)	36
Paved roads (Km)	4,258
Non-paved roads (Km)	7,532
Length of roads by GDP per capita (Km/$)	11
Density of roads (Km/Km2)	0.01
Year	
Traffic volume (Mio Veh-Km) only pass cars	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2012
Persons Killed / 100,000 population	4
Persons Injured /100,000 population	33
Injury accidents /100,000 population	11
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

MOROCCO	latest data (2000-2013)
Year	2013
Population	33,008,150
GNI per capita ($)	3,020
Surface (Km2)	446,550
Year	2011
Motorways (Km)	1398
Highways, main or national roads (Km)	11,364
Secondary or regional roads (Km)	10,091
Other roads (Km)	35,844
Total length of roads (Km)	58,698
Paved roads (%)	71
Paved roads (Km)	41,419
Non-paved roads (Km)	17,279
Length of roads by GDP per capita (Km/$)	19
Density of roads (Km/Km2)	0.13
Year	2006
Traffic volume (Mio Veh-Km) only pass cars	23,037
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2011
Persons Killed / 100,000 population	13
Persons Injured /100,000 population	329
Injury accidents /100,000 population	215
Injury accidents / 100 Million Veh-Km	
Year	2000
Government expenditures (Mio USD)	
Central	24.70
Regional/Local	185.29
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	209.99
Investment expenditures (Mio USD)	76.86
Maintenance expenditures (Mio USD)	108.43
Other expenditures (Mio USD)	26.08
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

MOZAMBIQUE	latest data (2000-2013)
Year	2013
Population	25,833,752
GNI per capita ($)	610
Surface (Km2)	799,380
Year	2012
Motorways (Km)	
Highways, main or national roads (Km)	10,919
Secondary or regional roads (Km)	19,412
Other roads (Km)	
Total length of roads (Km)	30,331
Paved roads (%)	21
Paved roads (Km)	6,303
Non-paved roads (Km)	24,028
Length of roads by GDP per capita (Km/$)	66
Density of roads (Km/Km2)	0.04
Year	2012
Traffic volume (Mio Veh-Km)	115,752
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2011
Persons Killed / 100,000 population	7
Persons Injured /100,000 population	24
Injury accidents /100,000 population	15
Injury accidents / 100 Million Veh-Km	
Year	2012
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	508.85
Investment expenditures (Mio USD)	360.43
Maintenance expenditures (Mio USD)	126.47
Other expenditures (Mio USD)	21.95
Year	2012
Road Revenues (Mio USD)	
Indirect: Fuel Tax	108.70
Direct: Toll	12.95
Others	100.89
Total revenues (Mio USD)	222.55
Authority in charge of Road Management	Administraçao Nacional de Estradas
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

NIGER	latest data (2000-2013)
Year	2013
Population	17,831,270
GNI per capita ($)	400
Surface (Km2)	1,267,000
Year	2013
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	19,710
Paved roads (%)	21
Paved roads (Km)	4,225
Non-paved roads (Km)	15,485
Length of roads by GDP per capita (Km/$)	47
Density of roads (Km/Km2)	0.02
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	5
Persons Injured /100,000 population	46
Injury accidents /100,000 population	36
Injury accidents / 100 Million Veh-Km	
Year	2010
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	229.77
Maintenance expenditures (Mio USD)	61.06
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

NIGERIA	latest data (2000-2013)
Year	2013
Population	173,615,345
GNI per capita ($)	2,710
Surface (Km2)	923,770
Year	2004
Motorways (Km)	0
Highways, main or national roads (Km)	15,688
Secondary or regional roads (Km)	18,715
Other roads (Km)	158,797
Total length of roads (Km)	193,200
Paved roads (%)	15
Paved roads (Km)	28,980
Non-paved roads (Km)	164,220
Length of roads by GDP per capita (Km/$)	299
Density of roads (Km/Km2)	0.21
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2010
Persons Killed / 100,000 population	3
Persons Injured /100,000 population	11
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

OMAN	latest data (2000-2013)
Year	2013
Population	3,632,444
GNI per capita ($)	
Surface (Km2)	309,500
Year	2013
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	64,051
Paved roads (%)	51
Paved roads (Km)	32,605
Non-paved roads (Km)	31,446
Length of roads by GDP per capita (Km/$)	2.9
Density of roads (Km/Km2)	0.21
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	25
Persons Injured /100,000 population	297
Injury accidents /100,000 population	216
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

PAKISTAN	latest data (2000-2013)
Year	2013
Population	182,142,594
GNI per capita ($)	1,360
Surface (Km2)	796,100
Year	2013
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	263,415
Paved roads (%)	69
Paved roads (Km)	182,900
Non-paved roads (Km)	80,515
Length of roads by GDP per capita (Km/$)	207
Density of roads (Km/Km2)	0.33
Year	2011
Traffic volume (Mio Veh-Km)	75,602
Year	2011
Inland freight transport (Mio T-Km)	179,711
Inland passenger transport (Mio P-Km)	343,384
Road freight transport (Mio T-Km)	177,954
Road passenger transport (Mio P-Km)	322,765
Year	2010
Persons Killed / 100,000 population	3
Persons Injured /100,000 population	7
Injury accidents /100,000 population	6
Injury accidents / 100 Million Veh-Km	16
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

PALESTINE	latest data (2000-2013)
Year	2013
Population	4,169,506
GNI per capita ($)	
Surface (Km2)	6,020
Year	2013
Motorways (Km)	
Highways, main or national roads (Km)	733
Secondary or regional roads (Km)	1,243
Other roads (Km)	1,545
Total length of roads (Km)	3,521
Paved roads (%)	100
Paved roads (Km)	3,521
Non-paved roads (Km)	0
Length of roads by GDP per capita (Km/$)	1.3
Density of roads (Km/Km2)	0.58
Year	
Traffic volume (Mio Veh-Km)*	
Year	
Inland freight transport (Mio T-Km)*	
Inland passenger transport (Mio P-Km)*	
Road freight transport (Mio T-Km)*	
Road passenger transport (Mio P-Km)*	
Year	2013
Persons Killed / 100,000 population	3
Persons Injured /100,000 population	183
Injury accidents /100,000 population	95
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)*	
Central	
Regional/Local	
Private sector expenditures (Mio USD)*	
Total expenditures (Mio USD)*	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)*	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)*	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
** No data available by the Palestinian Central Bureau of Statistics.*

QATAR	latest data (2000-2013)
Year	2013
Population	2,168,673
GNI per capita ($)	86,790
Surface (Km2)	11,610
Year	2013
Motorways (Km)	
Highways, main or national roads (Km)	1,018
Secondary or regional roads (Km)	967
Other roads (Km)	7,607
Total length of roads (Km)	9,592
Paved roads (%)*	90
Paved roads (Km)*	1,107
Non-paved roads (Km)*	123
Length of roads by GDP per capita (Km/$)	0.1
Density of roads (Km/Km2)	0.83
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	11
Persons Injured /100,000 population	304
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
** Latest % of paved road information (1996), total road network 1,230 Km.*

SAUDI ARABIA	latest data (2000-2013)
Year	2013
Population	28,828,870
GNI per capita ($)	26,260
Surface (Km2)	2,149,690
Year	2005
Motorways (Km)	3891
Highways, main or national roads (Km)	9,705
Secondary or regional roads (Km)	33,924
Other roads (Km)	173,852
Total length of roads (Km)	221,372
Paved roads (%)	21
Paved roads (Km)	47,529
Non-paved roads (Km)	173,843
Length of roads by GDP per capita (Km/$)	17
Density of roads (Km/Km2)	0.10
Year	2005
Traffic volume (Mio Veh-Km)	110,352
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2007
Persons Killed / 100,000 population	25
Persons Injured /100,000 population	139
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	2000
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	550.38
Investment expenditures (Mio USD)	345.87
Maintenance expenditures (Mio USD)	138.62
Other expenditures (Mio USD)	65.88
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

SENEGAL	latest data (2000-2013)
Year	2013
Population	14,133,280
GNI per capita ($)	1,050
Surface (Km2)	196,710
Year	2013
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)*	15,609
Paved roads (%)	36
Paved roads (Km)	5,604
Non-paved roads (Km)	10,005
Length of roads by GDP per capita (Km/$)	15
Density of roads (Km/Km2)	0.08
Year	2000
Traffic volume (Mio Veh-Km)	4,013
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	1
Persons Injured /100,000 population	15
Injury accidents /100,000 population	11
Injury accidents / 100 Million Veh-Km	
Year	2000
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	22.98
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	22.98
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
** National and regional roads.*

SIERRA LEONE	latest data (2000-2013)
Year	2013
Population	6,092,075
GNI per capita ($)	660
Surface (Km2)	72,300
Year	2002
Motorways (Km)	0
Highways, main or national roads (Km)	2,138
Secondary or regional roads (Km)	1,950
Other roads (Km)	7,212
Total length of roads (Km)	11,300
Paved roads (%)	8
Paved roads (Km)	904
Non-paved roads (Km)	10,396
Length of roads by GDP per capita (Km/$)	41
Density of roads (Km/Km2)	0.16
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2012
Persons Killed / 100,000 population	
Persons Injured /100,000 population	
Injury accidents /100,000 population	43
Injury accidents / 100 Million Veh-Km	
Year	2000
Government expenditures (Mio USD)	
Central	1.47
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	1.47
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	1.47
Other expenditures (Mio USD)	2.25
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

SOMALIA	latest data (2000-2013)
Year	2013
Population	10,495,583
GNI per capita ($)	
Surface (Km2)	637,660
Year	2000
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	22,100
Paved roads (%)	12
Paved roads (Km)	2,608
Non-paved roads (Km)	19,492
Length of roads by GDP per capita (Km/$)	N/A GDP
Density of roads (Km/Km2)	0.03
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2012
Persons Killed / 100,000 population	2
Persons Injured /100,000 population	16
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

SUDAN	latest data (2000-2013)
Year	2013
Population	37,964,306
GNI per capita ($)	1,550
Surface (Km2)	1,879,358
Year	2000
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	11,900
Paved roads (%)	36
Paved roads (Km)	4,320
Non-paved roads (Km)	7,580
Length of roads by GDP per capita (Km/$)	33
Density of roads (Km/Km2)	0.005
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2007
Persons Killed / 100,000 population	7
Persons Injured /100,000 population	64
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

SURINAME	latest data (2000-2013)
Year	2013
Population	539,276
GNI per capita ($)	9,370
Surface (Km2)	163,820
Year	2003
Motorways (Km)	0
Highways, main or national roads (Km)	0
Secondary or regional roads (Km)	4,304
Other roads (Km)	0
Total length of roads (Km)	4,304
Paved roads (%)	26
Paved roads (Km)	1,130
Non-paved roads (Km)	3,174
Length of roads by GDP per capita (Km/$)	1.6
Density of roads (Km/Km2)	0.03
Year	2000
Traffic volume (Mio Veh-Km)	1,380
Year	
Inland freight transport (Mio T-Km)*	
Inland passenger transport (Mio P-Km)*	
Road freight transport (Mio T-Km)*	
Road passenger transport (Mio P-Km)*	
Year	2013
Persons Killed / 100,000 population	14
Persons Injured /100,000 population	
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)*	
Central	
Regional/Local	
Private sector expenditures (Mio USD)*	
Total expenditures (Mio USD)*	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)*	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)*	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
** No data available by the General Bureau of Statistics Suriname.*

TAJIKISTAN	latest data (2000-2013)
Year	2013
Population	8,207,834
GNI per capita ($)	990
Surface (Km2)	142,550
Year	2000
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	27,767
Paved roads (%)*	83
Paved roads (Km)*	11,330
Non-paved roads (Km)*	2,370
Length of roads by GDP per capita (Km/$)	200
Density of roads (Km/Km2)	0.19
Year	2001
Traffic volume (Mio Veh-Km)	3,071
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2010
Persons Killed / 100,000 population	5
Persons Injured /100,000 population	23
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
** Latest % of paved road information (1996), total road network 13,700 Km.*

TOGO	latest data (2000-2013)
Year	2013
Population	6,816,982
GNI per capita ($)	530
Surface (Km2)	56,790
Year	2007
Motorways (Km)	0
Highways, main or national roads (Km)	3,067
Secondary or regional roads (Km)	0
Other roads (Km)	8,585
Total length of roads (Km)	11,652
Paved roads (%)	21
Paved roads (Km)	2,447
Non-paved roads (Km)	9,205
Length of roads by GDP per capita (Km/$)	27
Density of roads (Km/Km2)	0.21
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2007
Persons Killed / 100,000 population	8
Persons Injured /100,000 population	31
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	2007
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	17.13
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	17.13
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

TUNISIA	latest data (2000-2013)
Year	2013
Population	10,886,500
GNI per capita ($)	4,200
Surface (Km2)	163,610
Year	2013
Motorways (Km)	356
Highways, main or national roads (Km)	4,746
Secondary or regional roads (Km)	6,496
Other roads (Km)	7,842
Total length of roads (Km)	19,440
Paved roads (%)	78
Paved roads (Km)	15,090
Non-paved roads (Km)	4,350
Length of roads by GDP per capita (Km/$)	5
Density of roads (Km/Km2)	0.12
Year	2012
Traffic volume (Mio Veh-Km)	29,094
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	14
Persons Injured /100,000 population	124
Injury accidents /100,000 population	82
Injury accidents / 100 Million Veh-Km	
Year	2013
Government expenditures (Mio USD)	
Central	370.15
Regional/Local	45.91
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	416.06
Investment expenditures (Mio USD)	393.84
Maintenance expenditures (Mio USD)	22.23
Other expenditures (Mio USD)	
Authority in charge of Road Management	Ministère de l'Equipement, Direction de l'exploitation et de l'entretien routier
Management structure of Road Network	
Motorways	Ministère de l'Equipement, Direction de l'exploitation et de l'entretien routier
Highways, main or national roads	Ministère de l'Equipement, Direction de l'exploitation et de l'entretien routier
Secondary or regional roads	Ministère de l'Equipement, Direction de l'exploitation et de l'entretien routier
Other roads	Ministère de l'Equipement, Direction de l'exploitation et de l'entretien routier

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

TURKEY	latest data (2000-2013)
Year	2013
Population	74,932,641
GNI per capita ($)	10,970
Surface (Km2)	783,560
Year	2013
Motorways (Km)	2127
Highways, main or national roads (Km)	31,341
Secondary or regional roads (Km)	32,155
Other roads (Km)	323,043
Total length of roads (Km)	388,666
Paved roads (%)	91
Paved roads (Km)	355,220
Non-paved roads (Km)	33,446
Length of roads by GDP per capita (Km/$)	35
Density of roads (Km/Km2)	0.50
Year	2013
Traffic volume (Mio Veh-Km)	99,431
Year	2013
Inland freight transport (Mio T-Km)	235,225
Inland passenger transport (Mio P-Km)	271,953
Road freight transport (Mio T-Km)	224,048
Road passenger transport (Mio P-Km)	268,178
Year	2013
Persons Killed / 100,000 population	5
Persons Injured /100,000 population	367
Injury accidents /100,000 population	215
Injury accidents / 100 Million Veh-Km	162
Year	2013
Government expenditures (Mio USD)	
Central	6581.69
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	6581.69
Investment expenditures (Mio USD)	5785.06
Maintenance expenditures (Mio USD)	796.64
Other expenditures (Mio USD)	
Year	2013
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	449.60
Others	
Total revenues (Mio USD)	449.60
Authority in charge of Road Management	GD of Highways
Management structure of Road Network	
Motorways	GD of Highways
Highways, main or national roads	GD of Highways
Secondary or regional roads	GD of Highways
Other roads	Provincial Special Administrations, The Ministry of Forest and municipalities

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

TURKMENISTAN	latest data (2000-2013)
Year	2013
Population	5,240,072
GNI per capita ($)	6,880
Surface (Km2)	488,100
Year	2000
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	24,000
Paved roads (%)	81
Paved roads (Km)	19,488
Non-paved roads (Km)	4,512
Length of roads by GDP per capita (Km/$)	37
Density of roads (Km/Km2)	0.05
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2006
Persons Killed / 100,000 population	14
Persons Injured /100,000 population	33
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

UGANDA	latest data (2000-2013)
Year	2013
Population	37,578,876
GNI per capita ($)	550
Surface (Km2)	241,550
Year	2003
Motorways (Km)	0
Highways, main or national roads (Km)	13,620
Secondary or regional roads (Km)	27,126
Other roads (Km)	30,000
Total length of roads (Km)	70,746
Paved roads (%)	23
Paved roads (Km)	16,272
Non-paved roads (Km)	54,474
Length of roads by GDP per capita (Km/$)	300
Density of roads (Km/Km2)	0.29
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2012
Persons Killed / 100,000 population	9
Persons Injured /100,000 population	41
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

UNITED ARAB EMIRATES	latest data (2000-2013)
Year	2013
Population	9,346,129
GNI per capita ($)	
Surface (Km2)	83,600
Year	2008
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	4,080
Paved roads (%)*	100
Paved roads (Km)*	1,088
Non-paved roads (Km)*	0
Length of roads by GDP per capita (Km/$)	0.1
Density of roads (Km/Km2)	0.05
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2007
Persons Killed / 100,000 population	18
Persons Injured /100,000 population	188
Injury accidents /100,000 population	152
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.
** Latest % of paved road information (2000), total road network 1,088 Km.*

UZBEKISTAN	latest data (2000-2013)
Year	2013
Population	30,241,100
GNI per capita ($)	1,880
Surface (Km2)	447,400
Year	2000
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	81,600
Paved roads (%)	87
Paved roads (Km)	71,237
Non-paved roads (Km)	10,363
Length of roads by GDP per capita (Km/$)	146
Density of roads (Km/Km2)	0.18
Year	
Traffic volume (Mio Veh-Km)	
Year	2011
Inland freight transport (Mio T-Km)	48,583
Inland passenger transport (Mio P-Km)	75,585
Road freight transport (Mio T-Km)	26,050
Road passenger transport (Mio P-Km)	72,545
Year	2006
Persons Killed / 100,000 population	8
Persons Injured /100,000 population	
Injury accidents /100,000 population	
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.

YEMEN	latest data (2000-2013)
Year	2013
Population	24,407,381
GNI per capita ($)	1,330
Surface (Km2)	527,970
Year	2005
Motorways (Km)	
Highways, main or national roads (Km)	
Secondary or regional roads (Km)	
Other roads (Km)	
Total length of roads (Km)	71,300
Paved roads (%)	9
Paved roads (Km)	6,203
Non-paved roads (Km)	65,097
Length of roads by GDP per capita (Km/$)	86
Density of roads (Km/Km2)	0.14
Year	
Traffic volume (Mio Veh-Km)	
Year	
Inland freight transport (Mio T-Km)	
Inland passenger transport (Mio P-Km)	
Road freight transport (Mio T-Km)	
Road passenger transport (Mio P-Km)	
Year	2013
Persons Killed / 100,000 population	10
Persons Injured /100,000 population	52
Injury accidents /100,000 population	37
Injury accidents / 100 Million Veh-Km	
Year	
Government expenditures (Mio USD)	
Central	
Regional/Local	
Private sector expenditures (Mio USD)	
Total expenditures (Mio USD)	
Investment expenditures (Mio USD)	
Maintenance expenditures (Mio USD)	
Other expenditures (Mio USD)	
Year	
Road Revenues (Mio USD)	
Indirect: Fuel Tax	
Direct: Toll	
Others	
Total revenues (Mio USD)	
Authority in charge of Road Management	
Management structure of Road Network	
Motorways	
Highways, main or national roads	
Secondary or regional roads	
Other roads	

Sources: IRF World Road Statistics 2015; Road Revenues - Questionnaire WRS; Economic and demographic information WDI - World Bank.