



Kenya Roads Board



## 2nd Road Sector Investment Programme (2018 – 2022)



Final Report



**ITEC Engineering Ltd.**  
Infrastructure, Transportation & Environment  
Consulting Engineers



December 2018

# **The Republic of Kenya**

Ministry of Transport, Infrastructure, Housing & Urban  
Development

Kenya Roads Board

2<sup>nd</sup> Road Sector Investment Programme (2018 – 2022)

## **Final Report**

21<sup>st</sup> December 2018

### **Notice**

This Final Report was produced by IMES Ltd and ITEC Engineering Ltd for Kenya Roads Board (KRB) towards the Consultancy Services for Preparation of the 2<sup>nd</sup> Phase of the Road Sector Investment Programme (2018 – 2022).

## Submission Letter

**21<sup>st</sup> December 2018**

The Executive Director,  
Kenya Roads Board,  
P.O. Box 73718-00200,  
NAIROBI.

Attention: General Manager, Planning and Programming

Dear Sir,

**PROVISION OF CONSULTANCY SERVICES FOR PREPARATION OF 2<sup>nd</sup> PHASE  
OF ROAD SECTOR INVESTMENT PROGRAMME (RSIP) FOR 2015-2019**

**CONTRACT No. KRB/723/2015-2016**

**Re: SUBMISSION OF FINAL RSIP2 REPORT**

We, Infrastructure Management and Engineering Services Ltd (IMES) in Joint Venture with ITEC Engineering Ltd, are pleased to submit this revised Draft Final RSIP2 Report as the fifth deliverable for the above consultancy services.

As per the terms of reference for the assignment, this Final RSIP2 Report presents the prioritized development and maintenance interventions for the entire road network over the 5-year plan period (2018 – 2022) and describes the detailed analysis undertaken for the road sub-sector investment considerations.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'J. Odoki', is written over a light blue horizontal line.

Project Team Leader:

Prof. Jennaro Boniface Odoki

M/s Infrastructure Management and Engineering Services Ltd (IMES),  
131, Swarthmore Road,  
Selly Oak,  
Birmingham, B29 4NN,  
UNITED KINGDOM.

M/s ITEC Engineering Ltd,  
8F Sifa Towers,  
Ring Road Kilimani/Lenana Road,  
P. O. Box 3103-00100  
NAIROBI, KENYA.

## Version Control

| Issue | Purpose            | Originated    | Reviewed | Authorised | Date     |
|-------|--------------------|---------------|----------|------------|----------|
| 1.0   | Fourth Deliverable | BKY/JBO/TO/EO | TO/BKY   | JBO        | 09/03/16 |
| 2.0   | Revision           | BKY/JBO/TO/EO | TO/JBO   | JBO        | 22/05/16 |
| 3.0   | Revision           | BKY/JBO/TO/EO | TO/JBO   | JBO        | 13/11/17 |
| 4.0   | Revision           | BKY/JBO/TO/EO | TO/JBO   | JBO        | 02/08/18 |
| 5.0   | Revision           | BKY/JBO/TO/EO | TO/JBO   | JBO        | 11/09/18 |
| 6.0   | Revision           | BKY/JBO/TO/EO | TO/JBO   | JBO        | 21/12/18 |

## Table of Contents

|  |            |
|--|------------|
| <b>Submission Letter</b>   | <b>i</b>   |
| <b>Version Control</b>   | <b>ii</b>  |
| <b>Acronyms and Abbreviations</b>                                    | <b>v</b>   |
| <b>EXECUTIVE SUMMARY</b>   | <b>vii</b> |
| <b>1 Introduction</b>  | <b>1</b>   |
| 1.1 Background   | 1          |
| 1.2 The RSIP2  | 2          |
| 1.3 Structure of this Report   | 2          |
| <b>2 Policy Framework of the Transport Sector</b>                    | <b>4</b>   |
| 2.1 Background   | 4          |
| 2.2 Sustainable Development Goals (SDGs)                             | 4          |
| 2.3 The African Union Agenda 2063                                    | 6          |
| 2.4 East Africa Community Vision 2050                                | 6          |
| 2.5 National Values  | 9          |
| 2.6 Kenya Vision 2030  | 10         |
| 2.7 Integrated National Transport Policy                             | 12         |
| 2.8 National Urban Development Policy                                | 13         |
| 2.9 National Spatial Plan (NSP)                                      | 13         |
| 2.10 Transport Infrastructure Funding Policy                         | 14         |
| 2.11 Establishment of Transport Data Centre                          | 16         |
| 2.12 Road Safety   | 18         |
| 2.13 Climate Change Adaptation                                       | 19         |
| 2.14 Environmental Management and Sustainability                     | 20         |
| 2.15 Resettlement Action Plan (RAP)                                  | 24         |
| 2.16 The Occupational Health and Safety Act 2007                     | 25         |
| 2.17 County Integrated Development Plans                             | 25         |
| 2.18 Cross-Cutting Issues  | 26         |
| <b>3 Programmes and Projects</b>                                     | <b>30</b>  |
| 3.1 Background   | 30         |
| 3.2 The Jubilee Manifesto 2017                                       | 30         |
| 3.3 The “Big Four” Agenda  | 30         |
| 3.4 Bus Rapid Transit  | 31         |
| 3.5 Konza Technology City  | 32         |
| 3.6 Lamu Port South Sudan Ethiopia Transport Corridor                | 32         |
| 3.7 The Standard Gauge Railway (SGR)                                 | 33         |
| 3.8 Roads 2000 Strategy  | 34         |
| 3.9 Roads 10000 Programme  | 35         |
| 3.10 Summary on Policy and Programme Recommendations                 | 36         |
| <b>4 Management of Kenya’s Transport Sector and Roads Sub-Sector</b> | <b>37</b>  |
| 4.1 Background   | 37         |
| 4.2 Overview of the Transport Sector                                 | 37         |
| 4.3 Institutional Framework of the Roads Sector                      | 38         |
| 4.4 Kenya’s Road Network   | 42         |
| 4.5 Condition of the Road Network                                    | 43         |
| 4.6 Road Sector Investment Programme - RSIP1 (2010 – 2014)           | 49         |

|           |   |            |
|-----------|---|------------|
| <b>5</b>  | <b>Study Methodology</b>                                      | <b>53</b>  |
| 5.1       | Approach  | 53         |
| 5.2       | Methodology and Assumptions for Economic Analysis             | 55         |
| 5.3       | Analytical Tools and Data Requirements                        | 56         |
| <b>6</b>  | <b>Financing of the Road Sub-Sector</b>                       | <b>62</b>  |
| 6.1       | Background  | 62         |
| 6.2       | Funding Sources   | 62         |
| 6.3       | Other Potential Funding Sources                               | 65         |
| <b>7</b>  | <b>Strategy Analysis</b>                                      | <b>68</b>  |
| 7.1       | Background  | 68         |
| 7.2       | Approach and Methodology                                      | 68         |
| 7.3       | Budget Optimisation Methods                                   | 71         |
| 7.4       | Work Types and Budgets  | 71         |
| 7.5       | Allocation of Resources between the National and County Roads | 75         |
| 7.6       | Assessment of the RSIP2 Financing Gap                         | 77         |
| 7.7       | Sensitivity Analysis of the Available Budget                  | 80         |
| 7.8       | Conclusion  | 85         |
| <b>8</b>  | <b>Road Sector Investment Programme</b>                       | <b>86</b>  |
| 8.1       | General   | 86         |
| 8.2       | Ongoing and Committed Projects                                | 86         |
| 8.3       | Investment Alternatives                                       | 87         |
| 8.4       | Optimised 5-Year Work Programme                               | 88         |
| 8.5       | Work Programme Based on Multi-Criteria Analysis               | 109        |
| 8.6       | Link Between RSIP2 with Government Policies and Programmes    | 112        |
| <b>9</b>  | <b>Monitoring and Evaluation</b>                              | <b>113</b> |
| 9.1       | Introduction  | 113        |
| 9.2       | Performance Indicators  | 113        |
| 9.3       | Baseline Data   | 119        |
| <b>10</b> | <b>Institutional Issues</b>                                   | <b>120</b> |
| 10.1      | Background  | 120        |
| 10.2      | Assessment of RSIP Preparation Processes and Procedures       | 120        |
| 10.3      | Research and Development                                      | 122        |
| 10.4      | Recommended Thematic Research Areas for RSIP                  | 123        |
| 10.5      | Capacity Building   | 124        |
| 10.6      | Management of the Roads Sub-Sector                            | 125        |
| 10.7      | Mainstreaming of Cross-Cutting Issues                         | 125        |
| 10.8      | Funding of Other Programmes                                   | 126        |
| 10.9      | Assumptions and Risks   | 126        |
| <b>11</b> | <b>Conclusions and Recommendations</b>                        | <b>127</b> |
| 11.1      | Conclusions   | 127        |
| 11.2      | Recommendations   | 129        |
|           | <b>References</b>   | <b>131</b> |
|           | <b>Appendices</b>   | <b>132</b> |

## Acronyms and Abbreviations

|         |  |
|---------|--|
| AADT    | Annual Average Daily Traffic                                   |
| AC      | Asphalt Concrete   |
| ART     | Anti-Retroviral Therapy  |
| AU      | African Union  |
| BCC     | Behaviour Change and Communication                             |
| BPO     | Business Process Outsourcing                                   |
| BRT     | Bus Rapid Transit  |
| CBA     | Cost Benefit Analysis  |
| CDP     | County Development Profile                                     |
| CIDP    | County Integrated Development Plans                            |
| DFID    | Department for International Development of the United Kingdom |
| EAC     | East African Community   |
| GBV     | Gender-Based Violence  |
| GDP     | Gross Domestic Product   |
| HDM-4   | Highway Development and Management Tool                        |
| HQ      | Headquarters   |
| ICBTRS  | Institutional Capacity Building for Transport/ Road Sector     |
| ILO     | International Labour Organisation                              |
| IQL     | Information Quality Level                                      |
| IRDC    | Inter-Agency Research and Development Committee                |
| IRI     | International Roughness Index                                  |
| KAA     | Kenya Airports Authority                                       |
| KBRC    | Kenya Building Research Centre                                 |
| KCAA    | Kenya Civil Aviation Authority                                 |
| KeNHA   | Kenya National Highways Authority                              |
| KeRRA   | Kenya Rural Roads Authority                                    |
| KeNSRA  | Kenya National Secondary Roads Authority                       |
| KIHBIT  | Kenya Institute of Highways and Building Technology            |
| KIPPRA  | Kenya Institute for Public Policy Research and Analysis        |
| Km      | Kilometre  |
| KMA     | Kenya Maritime Authority                                       |
| KNBS    | Kenya National Bureau of Statistics                            |
| KNURA   | Kenya National Urban Roads Authority                           |
| KPA     | Kenya Ports Authority  |
| KRB     | Kenya Roads Board  |
| KRC     | Kenya Railways Corporation                                     |
| KSh.    | Kenya Shillings  |
| KURA    | Kenya Urban Roads Authority                                    |
| KWS     | Kenya Wildlife Services  |
| LAPSSET | Lamu Port Southern Sudan Ethiopia Transport Corridor           |
| MCA     | Multi - Criteria Analysis                                      |
| MDGs    | Millennium Development Goals                                   |
| mn.     | Million  |
| MOU     | Memorandum of Understanding                                    |
| MRTS    | Mass Rapid Transit System                                      |
| MT      | Motorised Transport  |
| MTP I   | 1 <sup>st</sup> Medium Term Plan                               |

|         |   |
|---------|---|
| MTP II  | 2 <sup>nd</sup> Medium Term Plan                  |
| MTRD    | Material Testing and Research Department          |
| NACC    | National AIDS Control Council                     |
| NAMATA  | Nairobi Metropolitan Area Transport Authority     |
| NCA     | National Construction Authority                   |
| NCA     | National Construction Authority                   |
| NCTIP   | Northern Corridor Transport Improvement Project   |
| NGO     | Non-Governmental Organizations                    |
| NHC     | National Housing Corporation                      |
| NIMES   | National Monitoring and Evaluation System         |
| NMT     | Non-Motorised Transport                           |
| NSP     | National Spatial Plan                             |
| NTSA    | National Transport and Safety Authority           |
| NUDP    | National Urban Development Policy                 |
| OD      | Origin Destination                                |
| PLWD    | Person Living With Disability                     |
| PPP     | Public Private Partnership                        |
| RICS    | Road Inventory & Condition Survey                 |
| RMLF    | Road Maintenance Levy Fund                        |
| RSIP    | Road Sector Investment Programme                  |
| RSIP TF | Road Sector Investment Programme Task Force       |
| RSIP1   | 1st Phase of the Road Sector Investment Programme |
| RSIP2   | 2nd Phase of the Road Sector Investment Programme |
| RTRN    | Regional Truck Road Network                       |
| RUC     | Road User Costs                                   |
| SCF     | Standard Conversion Factor                        |
| SDG     | Sustainable Development Goal                      |
| SGR     | Standard Gauge Railway                            |
| SSA     | Sub-Saharan Africa                                |
| SSATP   | Sub-Sahara Africa Transport Program               |
| ST      | Surface Treatment                                 |
| SWOT    | Strength Weaknesses Opportunities Threats         |
| TDC     | Transport Data Centre                             |
| VOC     | Vehicle Operating Costs                           |
| WHO     | World Health Organization                         |

## EXECUTIVE SUMMARY

### Vision and Objective

This 2<sup>nd</sup> Road Sector Investment Programme (RSIP2) is prepared in line with the requirements of Section 34(1) of the Kenya Roads Act, 2007 which requires the Minister in consultation with the Road Authorities and the Kenya Roads Board to prepare a road investment programme for approval by the Minister responsible for Finance. It succeeds the 1<sup>st</sup> Phase of the RSIP (2010 – 2014), which expired in June 2015 by outlining costed development and maintenance priorities for the next five years.

RSIP2 has been anchored on the long-term vision whose guiding principle is to *“Provide good roads for a globally competitive and prosperous Kenya”*, with an overall objective of *“Sustaining, affordability, expanding, efficient, safe, quality, integrated, reliable, modernization of the road network”*.

### The Road Network, Condition and Management

According to the KRB road register, the country’s total road network length is about 161,451km out of which about 40,000km belongs to the National government and the rest belongs to the County government. Only 15% of the entire network is paved while the remaining 85% is unpaved.

Based on the network condition data provided by the various agencies as at 2016, 17% of the network was in good condition, 26% was in fair condition while the remaining 56% was in poor condition. For the National roads, 31%, 43% and 26% were in good, fair and poor condition respectively, while for the County roads 12%, 19% and 68% were in good, fair and poor condition, respectively.

The 2015 Roads Register classifies the entire road network into two broad categories: National roads (Classes S, A, B, and C) and County roads (Classes D, E and other roads). The national roads are to be under the jurisdiction of: (i) National Primary Trunk Roads Authority (currently KeNHA); (ii) National Secondary Trunk Roads Authority (currently KeRRA); and, (iii) National Urban Roads Authority (currently KURA). The 47 devolved County governments are to be responsible for the management of the County road network; the Kenya Wildlife Services is responsible for roads within wildlife conservation areas; and, KRB is responsible for management of the Road Maintenance Levy Fund (RMLF).

### Development of RSIP2

The optimal road investment programme for each road agency was developed using the concept of life cycle analysis method based on engineering and economic efficiency criteria using the Highway Development and Management Model (HDM-4). The HDM-4 model was calibrated and configured to Kenyan conditions. Also, a Multi-Criteria Analysis method was applied to produce work programmes that consider

engineering, economic, social and environmental issues based on appropriate criteria and their relative importance in road investment appraisal.

This RSIP2 is aligned with existing government and international policies and programmes such as the Sustainable Development Goals, the African Union Agenda 2063, the East Africa Community Vision 2050, the Kenya Vision 2030, Integrated National Transport Policy, the Roads 2,000 Strategy, the Roads 10,000 Programme and the “Big Four Agenda”, amongst others.

### **Financing of the Road Sub-Sector**

Funding for the roads sub-sector is presently being obtained from:

1. The Exchequer or National budget;
2. Kenya Roads Board Fund (Road Maintenance Levy Fund); and,
3. Development Partners (Bilateral and Multi-lateral partners).

The National Surface Transport Funding (2016–2025) has identified a growing funding gap likely to hit KSh. 100 billion annually from 2021-2025. To this end, the Government is currently exploring other potential funding sources including:

1. Public Private Partnerships (PPP);
2. Use of Infrastructure Bonds; and,
3. Annuity Programme.

### **Strategy Analysis**

Strategy analysis was undertaken using the HDM-4 model for the entire road network with the aim of determining:

1. Assessment of the engineering and economic performance of entire road network based on the available budget and other budget scenarios;
2. Optimal allocation of resources between the National and the County road networks, and between maintenance and development works based on the available budget and other budget scenarios; and,
3. Annual budget requirement for the implementation of RSIP2.

The following optimum strategies for various budget scenarios were modelled:

1. Unconstrained Budget Scenario;
2. Desired Road Condition Mix Budget Scenario (Stretched Targets);
3. The Likely Budget Scenario (Available budgets); and,
4. Sensitivity Analysis for Available Budget.

The development and maintenance needs of the entire road network for the unconstrained scenario was based on maximizing the condition of the entire road network.

The desired road condition (stretched targets) at the end of RSIP2 period was formulated by the RSIP Task Force for all the sub-networks based on the following criteria:

1. Improve all asphaltic concrete and surface treated roads in poor condition to be in fair condition; and, 50% in fair to be in good condition;
2. Improve 50% of gravel and earth roads in poor condition to be in fair condition; and, 25% in fair condition to be in good condition; and,
3. All roads in good condition must effectively be maintained to avoid slipping back to fair/poor condition.

In the development of RSIP2, the projected available budget for the roads sub-sector, based on historical trends, was estimated at **KSh. 929.785 billion** broken down as follows:

| Type of Works  | Available Budget<br>(KSh. Billion) | RSIP2 Allocation<br>(KSh. Billion) |
|--|------------------------------------|------------------------------------|
| Maintenance  | 257.405                            | 385.315                            |
| Development  | 672.380                            | 420.876                            |
|  |                                    |                                    |
|  | <b>Sub-Total</b>                   | <b>806.191</b>                     |
| Contingency sum for administrative costs of road agencies, project preparations, emergencies, physical and price variations (10% of Sub-total) |                                    | 80.619                             |
| Provisional Sum for Urban Public Transport, Engineering Studies; and Miscellaneous capacity building services                                  |                                    | 42.975                             |
|  | <b>Grand Total</b>                 | <b>929.785</b>                     |

The results of the Strategy analysis, which is based on an optimal fund allocation criteria aligned to engineering and economic efficiency, are summarised below:

1. In the unconstrained scenario, a total of **KSh. 2.27 trillion** will be required to fully cover backlog maintenance and development works over the next 5 years. Some 80.4% of the funds will be required for development works and 19.6% for maintenance works. Also, 34% of these resources will be required for the county roads and 66% for the national road network. The financing gap for this scenario is an additional budget of **KSh. 1.47 trillion** over the current available works budget of **KSh. 0.806 trillion**;
2. To achieve the desired condition, a total financial outlay of **KSh. 1.033 trillion** will be required over the next 5-years. About 45%, 24%, 25% and 6% required for upgrading, reconstruction, periodic and routine works, respectively. Of these total financial outlay, 71% will be required for the national road network and the remaining 29% for the county road network. The financing gap is some **KSh. 227.172 billion**. However, if the estimated expenditures by County Governments on roads of about KSh. 41.157 billion per year could be factored

into the RSIP 2 then the County roads will be fully covered, and the net deficit will be **KSh. 21.387 billion**;

3. In the available budget scenario, the following are the recommendations during the RSIP2 implementation period:
  - (i). The total budget of KSh. 806.191 billion should be allocated at 22% (KSh. 175.306 billion) to the County roads and 78% (KSh. 630.885 billion) to the National roads (NPTR 39%; NSTR 25%; NPUR 12% and KWS 2% of the total);
  - (ii). The KSh. 420.876 billion development budget for upgrading, new construction and capacity improvement works should be allocated at 86% (KSh. 360.845 billion) to the National roads and 24% (KSh. 60.03 billion) to the County roads;
  - (iii). The KSh. 385.316 billion maintenance budget for rehabilitation, routine and periodic maintenance works should be allocated at 70% (KSh. 270.04 billion) to the National roads and 30% (KSh. 115.276 billion) to the County roads. The relatively high maintenance budget (48% of the total available budget) is necessary for clearing the current backlog; and,
  - (iv). The national roads maintenance budget should be allocated at 51% for the NPTR; 11% for NSTR; 6% for NPUR; and 3% for KWS.

The above budgetary allocation is based on factors that are known to cause road deterioration over time, which are: the traffic volumes and weights; the prevailing climatic conditions; and, the type of road construction. In contrast, the allocation criteria of the RMLF is not based on any scientific methodology and therefore does not reflect the road network maintenance needs based on the current road classification. The continued use of the criteria, and less than optimal allocation of resources, are the main reasons why the Fund is ineffective to keep the road network in good condition.

The outcome of using only the available budget is that the road network will get worse than the 2016 condition as shown in the table below.

| Sub-network                              | Current Condition (%) |      |      | Desired Condition (%) |      |      | Road Condition Based on Available Budgets (%) |      |      |
|--|-----------------------|------|------|-----------------------|------|------|---|------|------|
|  | Good                  | Fair | Poor | Good                  | Fair | Poor | Good  | Fair | Poor |
| National Primary Trunk Roads (NPTR)      | 50                    | 14   | 36   | 54                    | 30   | 16   | 45  | 53   | 2    |
| National Primary Urban Roads (NPUR)      | 6                     | 94   | 0    | 40                    | 60   | 0    | 23  | 31   | 46   |
| National Secondary Trunk Roads (NSTR)    | 26                    | 49   | 25   | 39                    | 49   | 12   | 22  | 56   | 22   |
| County Roads                             | 12                    | 20   | 68   | 17                    | 49   | 34   | 18  | 7    | 75   |
| Roads within Wildlife Conservation Areas | 0                     | 87   | 13   | 22                    | 71   | 7    | 2   | 2    | 96   |

Without additional budget of **KSh. 227 billion**, to achieve the stretched targets, the road network condition will be as follows:

- (i). The NPTR network in good and poor condition will drop by about 5% and 34% respectively, while that in fair condition will increase by 39%;
- (ii). NPUR network in good condition will increase from 6% to 23%, the portion in fair condition will decrease by 63% while that in poor condition will increase by about 46%;
- (iii). NSTR network in good and poor condition will drop marginally by about 4% and 3% respectively while that in fair condition will increase by about 7%;
- (iv). County road network in good and poor condition will increase by 6% and 7% respectively; and,
- (v). Roads within Wildlife Conservation Areas in poor condition will increase from 13% to 96%.

### Programme Analysis

Detailed 5-year work programmes for the five road sub-networks under the jurisdiction of National Primary Trunk Roads (NPTR), National Secondary Trunk Roads (NSTR), National Primary Urban Roads (NPUR), Roads within Wildlife Conservation Areas and County have been prepared based on optimisation of the economic benefits and considering MCA analysis.

Based on the optimised programme, the implementation of RSIP2 will involve the following:

1. Routine maintenance at a cost of KSh. 180.182 billion;
2. Periodic maintenance (overlay and reseal) of 2,600km of roads at a cost of KSh. 39.651 billion;
3. Spot gravelling of 13,000km of roads at a cost of KSh. 5.116 billion;
4. Reconstruction and rehabilitation of 2,800km of roads at a cost of KSh. 160.4 billion;
5. Upgrading (Earth to Gravel) of 6,100km of roads at a cost of KSh. 28.422 billion;
6. Upgrading (Gravel to Bitumen) of 6,700km of roads at a cost of KSh. 314.706 billion;
7. New construction and capacity improvement 350km of roads at a cost of KSh. 77.747 billion;
8. An additional financial outlay of about KSh. 42.975 billion is recommended for, amongst others, construction of public transport facilities and road management issues (e.g. research and development, road safety, feasibility and design, climate change adaptation, axle load compliance, monitoring and evaluation, traffic management, mainstreaming of cross cutting issues etc.); and,
9. Some KSh. 80.619 billion provisional sum to cover administrative costs of road agencies; project preparations; and, physical and price contingencies.

A comparison of the optimised and the MCA programme yielded the following findings:

1. The MCA method favoured improvement in roads classified as D, E and Others in the form of upgrading works whereas the economic optimisation method favoured investment in roads carrying high traffic (class A and B) in the form of periodic maintenance and capacity improvement.
2. The MCA method should be used for preparing investment programmes for County road network and intra-county work programmes.
3. The economic efficiency method should be used for preparing roads carrying medium to high traffic specifically for National Primary Trunk Roads (NPTR) and National Primary Urban Roads (NPUR) networks. The method can also be used for the reclassified National Secondary Trunk Roads (NSTR) network.
4. Work programmes for Roads within Wildlife Conservation Areas road network should be prepared using optimisation based on engineering efficiency (i.e. maximisation in reduction in IRI).

### Return on Investment

The economic benefits of implementing RSIP2 over the entire Kenyan network is computed in terms of the Net Present Value (NPV). Assuming a timely implementation of periodic and routine maintenance, an overall return on investment of **KSh. 853.58 billion** and **KSh. 5.189 trillion** over 5 and 20-year periods respectively will be realised. These benefits are expected to be derived from savings in vehicle operating costs and travel time costs.

The analysis revealed that for **every one Kenya shilling** invested in roads, the country stands to gain **one Kenya shilling and ten cents** in benefits over the 5-year period. The benefits of road investments are however long-term (15-20 years) and can therefore not be adequately quantified within such a short investment period of 5 years. Most of the benefits to be accrued from the RSIP2 are therefore outside its 5-year implementation period.

### Monitoring and Evaluation

An M&E framework for tracking the implementation progress of the proposed interventions during the RSIP2 period was developed. The framework defines both the outcomes and outputs of the RSIP2 programme. The outcomes are expected to help in achieving the broader government development objectives as outlined in the national development strategies such as the SDGs, AU Agenda 2063, EAC Vision 2050, Kenya Vision 2030 and the “Big Four” Agenda, amongst others. The outcomes are expected to focus on making road transport efficient with the aim of: (1) Increasing regional trade and tourism; (2) Boosting the growth of manufacturing sector; (3) Facilitating wholesale and retail trade; and, (4) Contributing to growth of the agriculture sector.

The outputs are expected to focus on: (1) Road maintenance (i.e. asset preservation); (2) Road development; (3) Reduction in traffic congestion; (4) Seamless interconnectivity between various modes; (5) Regional connectivity; (6) Improvement in road management programmes; and, (7) Resource mobilization. To monitor the implementation progress of these outputs, key performance targets such as the no. of km to be upgraded, no. of km to be dualled, no. of km to be maintained, no. of km to be rehabilitated, institutional capacity building, amongst others, have been developed.

An assessment of RSIP preparation processes and procedures clearly detailing the data requirements and the institution/s to be tasked with data collection was also developed. It is recommended that KRB takes the lead role in coordinating the data collation process and that a transport data centre should be established. This is a critical consideration given the data challenges that delayed the preparation of this RSIP2.

### **Institutional Issues**

A SWOT analysis of the issues that may threaten the successful implementation of RSIP2 was undertaken. The findings of the SWOT analysis revealed that some of the most serious threats to the successful implementation of RSIP2 include: (1) over-reliance on government financing for the road sector; (2) challenges in implementation of the new constitution with regard to jurisdiction; (3) influx of foreign international consulting and contracting firms locking out small indigenous firms from projects; (4) unreasonably high procurement requirements which lock-out small firms; (5) depletion of natural resources for road construction such as good quality gravel; (6) delayed payments to private firms hampering delivery of projects; and, (7) underfunding leading to project cost and time overruns. As a means of mitigating against these threats, RSIP2 recommends the following actions to be taken:

1. The Kenya Roads Bill should be enacted by parliament so that jurisdiction challenges between the national and county networks can be resolved;
2. Explore other potential funding sources such as PPPs, Infrastructure Bonds etc.;
3. Set aside funds for Research and Development (R&D) for various programmes within the roads sub-sector including research on alternative construction materials and technology;
4. Train road agency staff, contractors and consultants to enhance the capacity to deliver RSIP2;
5. Ring-fence funds for other major programmes such as Long-Term Pavement Performance Monitoring; road safety, public transport, mainstreaming of cross-cutting issues; and,
6. Review procurement practices in a bid to enhance opportunities of local firms to be involved in government projects. Some areas of serious concern include: establishing favourable payment regimes; reducing performance bond requirements; etc.;

## Key Thematic Conclusions and Recommendations

The preparation process has however been delayed by the lack of good data, mainly due to the lack of proper road management database for the county. These are summarised below:

1. **Data Management:** A particular challenge in this study was the lack of good quality data for both roads and structures. It should be noted that the accuracy and reliability of the outputs from studies such as this depends to a significant extent on the quality of the input data used in the analytical decision-making tools. It is therefore recommended that special attention should be given to ensure that data collected by consultants, KRB and its agencies is complete, fit for purpose and accurate, and that this study should be reviewed when better quality data becomes available.

It is strongly recommended that the quality and accuracy of traffic data, in particular, needs to be improved since the economic justification of most road investment projects will depend largely on traffic volumes and composition.

2. **Delivery Mechanism:** The implementation of the RSIP2 will involve the road agencies and county governments with an increased private sector participation. These institutions are expected to outsource most of these works to various consultancy and contracting firms both local and international.

The County governments need to be assisted through consultancy services to help them prioritise/optimize their road investment programmes. To do this properly, the County governments should be assisted to collect and process data into formats required for use in the relevant decision-making tools.

3. **Financing RSIP2:** Strategy analysis revealed that the resources envisioned to be allocated to the road sub-sector over the RSIP2 implementation period are inadequate and more resources will have to be marshalled over this period for the road network condition to improve. This will require exploring other potential funding sources such as PPPs; infrastructure bonds; annuity programme etc. In addition, the **KSh. 41.157 billion** per year (FY 2018 -19) spent by the County Governments on roads should be aligned to maintenance of county roads under the RSIP2 to reduce the overall funding deficit of the desired condition to **KSh. 21.387 billion**.
4. **Sustainability:** It is recommended that the impact of vehicle axles overloading on maintenance/improvement standards and the associated budget requirements and other relevant key performance indicators should be undertaken and the results used to inform the review and updating of RSIP2.

### **Overall Recommendation**

This RSIP 2 should be adopted and implemented because: (1) Its preparation involved globally approved methods of strategy and programme analyses using the renown HDM-4 model; (2) its preparation also involved widespread stakeholder consultations at three levels: Macro (National); Meso (County); and Micro (Local) levels; (3) the developed RSIP2 has linkages to Kenya's long-term development plans; and (4) its successful implementation will have an attractive return on investment of **KSh. 853.58 billion** in terms of savings in vehicle operating costs and other numerous exogenous benefits.

# 1 Introduction

## 1.1 Background

In Kenya, roads constitute the most important mode of transport since more than 93% of all freight and passenger traffic is transported by road. Kenya's public road network comprises some 161,451km out of which 14,561km is paved while 146,890km is unpaved. Given its contribution to the country's socioeconomic development and the public investment it represents, the roads network must be continuously developed, managed and maintained in a prudent and effective manner.

Section 34(1) of the Kenya Roads Act, 2007 provides that the Minister shall once in every five years, in consultation with the Road Authorities and the Kenya Roads Board cause to be prepared a road investment program for approval by the Minister responsible for finance. It further states that the Road Investment Programme (RSIP) shall outline costed development and maintenance priorities, and that annual work programmes prepared by or implemented by an Authority shall also be based on the approved RSIP. The RSIP also forms the basis for funds allocation. The 1st Phase of the RSIP (2010 – 2014) expired in June 2015.

There is currently a widespread recognition in Kenya of the importance of road development and maintenance and the value placed on the issue both by users and the wider community. There is also an increasing understanding of the serious consequences of failure to invest adequately and effectively in maintaining the national road network. For this reason, the Government of Kenya desires to have an objective and scientific system to assist decision-makers in the allocation of resources for road maintenance and development that is consistent with the actual needs of the road network. It also wants to have better appreciation of the effect of various investment levels and its long-term impact on the condition of the road network, the road users and the environment. In the allocation of resources, there is need to have a mechanism that ensures optimum and equitable distribution that avoids skewedness to any class or type of road within the network. In the face of scarce resources, the determination of road investment priorities that yield maximum returns to the economy of Kenya is also of concern to the Government.

To this end, the Kenya Roads Board entered into a contract with Infrastructure Management and Engineering Services Ltd (IMES) in Joint Venture with ITEC Engineering Ltd on 28<sup>th</sup> December 2015 for the preparation of the 2<sup>nd</sup> Road Sector Investment Programme (RSIP2) for the period 2015 – 2019. The Study commenced on 4<sup>th</sup> January 2016. The Study was carried out in liaison with a RSIP Task Force which was appointed by the Permanent Secretary of the Ministry of Transport, Infrastructure, Housing and Urban Development (MOTIHUD).

The Task Force was constituted of members selected from the following organizations:

- ) Ministry of Transport, Infrastructure, Housing and Urban Development
- ) Ministry of Finance (MOF)
- ) Kenya Roads Board (KRB)
- ) Kenya National Highways Authority (KeNHA)
- ) Kenya Rural Roads Authority (KeRRA)
- ) Kenya Urban Roads Authority (KURA)
- ) Kenya Wildlife Services (KWS)
- ) Materials Testing and Research Department (MTRD)
- ) Kenya Institute for Public Policy Research and Analysis (KIPPRA)

## 1.2 The RSIP2

This Final RSIP2 report outlines development and maintenance priorities over the next 5 years 2018 – 2022. This RSIP2 report will form the basis for approval and funding of annual work programmes prepared and implemented by the County Governments, the three Road Authorities and the Kenya Wildlife Services.

As part of the Study, the latest version of the Highway Development and Management (HDM-4) workspace was configured and calibrated to suit Kenyan conditions. This is critical for improving the accuracy and reliability of decision-making on investments in the road sector in Kenya.

This Final Report presents the prioritized development and maintenance interventions for the entire road network over the 5-year plan period (2018 – 2022). This report also describes the detailed analysis undertaken for the road sub-sector investment considerations.

## 1.3 Structure of this Report

This Final RSIP2 Report is presented in two (2) volumes as follows:

- ) Volume 1 – Final RSIP2 Report (Main Report)
- ) Volume 2 – Appendices

This Volume 1 is the **Final RSIP2 Report** which is structured into eleven sections as follows:

- ) Section 1 introduces provides the background of the assignment as well as the objectives and scope of the consultancy services;
- ) Section 2 presents an overview of the policies guiding the management of the transport sector;

- ) Section 3 presents an overview of the programmes and projects in the transport sector;
- ) Section 4 presents an overview of the transport sector including past on ongoing investment programmes in the road sub-sector;
- ) Section 5 presents the approach and methodology that was used in developing the RSIP;
- ) Section 6 presents the financing in the road sub-sector including financing sources and other potential sources;
- ) Section 7 presents the findings of the strategic analysis of Kenya's road network;
- ) Section 8 presents the findings of the optimised and prioritised 5-year work plan;
- ) Section 9 presents the monitoring and evaluation framework for the implementation of the RSIP2;
- ) Section 10 presents institutional issues affecting the road sub-sector; and,
- ) Section 11 presents conclusions and recommendations.

## 2 Policy Framework of the Transport Sector

### 2.1 Background

This Section gives an overview of both international and the Government of Kenya policies that the second five-year Road Sector Investment Programme (RSIP2) has to align itself with. This section provides a brief review of each Policy document and its relevance to the Road Sector Investment Programme (2017 – 2021) preparation.

### 2.2 Sustainable Development Goals (SDGs)

The United Nations Sustainable Development Summit for the adoption of the Agenda 2030 and the Sustainable Development Goals (SDGs) has developed seventeen (17) Universal Sustainable Development Goals, with 169 targets between them in September 2015. The SDGs are a new, universal set of goals, targets and indicators that UN member states are expected to use to frame their agendas and political policies over the next 15 years. Building on the accomplishments of their predecessors the Millennium Development Goals (MDGs), the SDGs address the most pressing global challenges of our time, calling upon collaborative partnerships across and between countries to balance the three dimensions of sustainable development - economic growth, environmental sustainability, and social inclusion.

Sustainable development is an advancement that meets the needs of the present without compromising the ability of future generations to meet their own needs. With increased demand for better roads, sustainable transport is essential to securing the “The Future We Want” that aims to eradicate absolute poverty, enable economic transformation and lift people out of poverty, advance social justice and protect the environment. Without a vigorous effort to advance sustainable transport a significant portion of the urban and rural poor will be excluded from access to good jobs and a safe and clean environment to the detriment of achieving “The Future We Want”. When designed to be inclusive, sustainable transport is a strong driver of economic growth and poverty reduction. Additionally, sustainable transport system should be affordable, convenient and safe with minimal air pollution, noise and greenhouse gas emissions.

Through efficient, safe and affordable transport services, transport contributes directly to poverty reduction by assisting low income people in the world’s fast growing regions to access jobs and services and conduct their income-earning activities safely, affordably and conveniently. Enhanced accessibility of people to jobs, education and health services in urban and rural areas is facilitated by transport efficiency improvements that reduce travel time and the cost of travel. Large and small enterprises also benefit from enhanced accessibility through improved productivity and access to a wider pool of labour that can result in expanded production, new investment and creation of new jobs.

The 17 SDGs are:

1. Ending poverty in all its forms everywhere.
2. Ending hunger, achieving food security and improved nutrition and promoting sustainable agriculture.
3. Ensuring healthy lives and promoting well-being for all at all ages.
4. Ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all.
5. Achieving gender equality and empowerment for all women and girls.
6. Ensuring availability and sustainable management of water and sanitation for all.
7. Ensuring access to affordable, reliable, sustainable and modern energy for all.
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
9. Building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation.
10. Reducing inequality within and among countries.
11. Making cities and human settlements inclusive, safe, resilient and sustainable.
12. Ensuring sustainable consumption and production patterns.
13. Taking urgent action to combat climate change and its impacts.
14. Conserving and sustainably using the oceans, seas and marine resources for sustainable development.
15. Protecting, restoring and promoting sustainable use of terrestrial ecosystems, sustainably managing forests, combating desertification, and halting and reversing land degradation and biodiversity loss.
16. Promoting peaceful and inclusive societies for sustainable development, providing access to justice for all and building effective, accountable and inclusive institutions at all levels.
17. Strengthening the means of implementation and revitalizing the global partnership for sustainable development.

Sustainable transport, motorised and non-motorised for passengers and goods, requires appropriate spatial planning, design and implementation to effectively contribute to meeting some of the SDGs. For example, urban transport requires interconnected public transit and safe pedestrian infrastructure and cycle-ways to effectively address urban poverty, social inclusion and reducing inequalities. Good infrastructure planning and maintenance can contribute to reduction of urban congestion, and savings in time, energy and money. On the other hand, rural transport is vital for enhanced agricultural production and people's access to services, including healthcare and education. Currently, the rural population are the majority that endure absolute poverty as they have no access to all-weather roads and reliable transport services. Consequently, well planned, constructed and maintained road transport infrastructure in Kenya can play a substantial role in achieving many SDGs. RSIP2 will provide the framework of doing so in a prioritised manner, clearly outlining the required interventions, budgets and time periods.

### 2.3 The African Union Agenda 2063

The AU Agenda 2063, is a 50-year strategic document rooted in Pan-Africanism and African Renaissance. It provides a robust framework for addressing past injustices and the realization of the 21<sup>st</sup> Century as the African Century.

It seeks to identify priority areas, their associated targets / expected outcomes and indicative strategies to stakeholders; highlight the fast-track programmes/ projects that will bring quick wins and generate and sustain the interest of the African citizenry in the African agenda; assign responsibilities and accountabilities to all stakeholders in the implementation, monitoring and evaluation of the plan and outline the strategies required to ensure resource and capacity availability and sustained citizen's engagement for plan execution.

One of the African Union aspiration by year 2063 is “*A prosperous Africa based on inclusive growth and sustainable development*” by connecting Africa through world-class infrastructure, including interconnectivity between island states and the mainland. The implementation of the *Yamoussoukro Declaration* is one of the strategies that will ensure improved efficiency and connections of the African aviation sector. In addition, African capitals will be connected through the Africa Integrated High Speed Train Network, Port and Shipping services during the period 2013 to 2063.

The prioritization of the development of the international road links in RSIP2 will go a long way in the realization of Agenda 2063 by opening them up for future development to high speed rail transport networks, complemented by road transport systems.

### 2.4 East Africa Community Vision 2050

The East Africa Community (EAC) is an inter-governmental organization mandated by the governments of Burundi, Kenya, Rwanda, Uganda and Tanzania to spearhead the East African economic, social and political integration agenda.

It is envisioned that by year 2050, the EAC will have been transformed into an upper–middle income region within a secure and a politically united East Africa based on the principles of inclusiveness and accountability, improved access to affordable and efficient regional transport, energy and communication network for increased competitiveness.

One of the pillars of the EAC 2050 is infrastructure development, whose target is to achieve the aim of improved accessibility for increased competitiveness. The integrated transport network is to be in full operation by 2030 with inter-operability between the land and water transport systems. The inter-operability within the transport network will reduce the distance to be covered and thus minimizing the cost of transportation. The railways network connected to the waterways will make the bulk movement of goods cost-effective and thus provide an environment for increased private sector investment.

In this regard, regional connectivity will be realized through achievements of the following targets: -

**Table 2.1: EAC 2050 Infrastructure - Regional Interconnectivity**

| Infrastructure Type                                   | 2014   | 2030   | 2050   |
|---|--------|--------|--------|
| Quantity of Regional Railway Network (Km)             | 2,254  | 2,344  | 2,438  |
| Paved Road Networks (Km)                              | 24,523 | 39,250 | 65,700 |
| Marine Port Services Network                          | 4      | 6      | 12     |
| Civil Aviation and Air Transport (number of airports) | 11     | 15     | 25     |

Source: East African Community (EAC) Vision 2050, August 2015

To reduce the transportation costs and increase the competitiveness of the region in attracting investments and doing business both within the region and beyond, an efficient, inter-operable and integrated transport systems by 2050 is crucial. This will be done by upgrading, rehabilitating and expanding of the prioritized infrastructure facilities including road, rail and ports.

The infrastructural development in the region will be aligned to the 10-year Priority Infrastructure Development Strategy; various Master Plans including the Railways Master Plan, the EAC Transport Strategy and Regional Road Sector Development Program; the Transport Facilitation Strategy; the Intermodal Transport Development Strategy; the Airports Development Strategy and the planned Maritime and Ports Development Strategy.

The principles of inter-operability (technology and operations), harmonization of standards, and joint development of supportive legal and regulatory frameworks, enhanced safety and service quality, joint resource mobilization (as in the Treaty), regional licensing of operators, capacity building and cost efficiency shall be observed and integrated in all the project designs.

The priority road transport corridors are summarised in Table 2.2 and Figure 2.1.

**Table 2.2: Prioritised EAC Road Corridors**

| Corridor Name                        | Corridor Description   | Length        |
|--------------------------------------|--|---------------|
| Northern Corridor                    | Mombasa - Voi - Eldoret - Bugiri - Kampala - Masaka - Kigali - Kibuye - Kayanza – Bujumbura/ Kigali - Gisenyi        | 1,800         |
| Central Corridor                     | Dar es Salaam - Morogoro - Dodoma - Singida - Nzega - Nyakanazi - Bujumbura/ Kigali - Gisenyi                        | 3,100         |
| TAZARA Corridor                      | Morogoro - Iringa - Mbeya - Tunduma  | 1,100         |
| Namanga Corridor                     | Iringa - Dodoma - Kalema - Arusha - Nairobi - Thika - Murang'a - Embu - Nyeri - Nanyuki - Isiolo - Marsabit - Moyale | 1,800         |
| Sumbawanga Corridor                  | Sumbawanga - Kasulu - Makamba - Nyanza Lac - Rumonge - Bujumbura   | 1,300         |
| Sirari Corridor                      | Lokichokio - Lodwar - Kitale - Bungoma - Kisumu - Kisii - Mwanza - Biharamulo  | 1,500         |
| Coastal Corridor                     | Mingoyo - Dar es Salaam; Chalinze - Vanga - Mombasa - Malindi - Lamu   | 1,500         |
| Mtwara Corridor                      | Mtwara - Mingoyo - Masasi - Tunduru - Songea - Mbamba Bay  | 800           |
| Arusha Corridor                      | Arusha- Moshi - Himo - Lushoto - A1  | 500           |
| Gulu Corridor                        | Nimule - Bibia - Gulu - Lira - Soroti - Mbale - Tororo   | 600           |
| LAPSSET                              | Lamu - Isiolo - Lodwar - Nadapal   | 1,700         |
| <b>Total Corridor Network Length</b> |  | <b>15,800</b> |



## 2.5 National Values

### 2.5.1 The Constitution of Kenya

The Constitution of Kenya was promulgated in August 2010. The constitution is citizen focused and places the wellbeing of Kenyans at the heart of all Government policies and programs. Kenya's national values, as enshrined in Article 10 of Constitution, are critical and core in the pursuit of economic, social and political aspirations of Kenyans.

The national values and principles of governance include:

- a) Patriotism, national unity, sharing and devolution of power, the rule of law, democracy and participation of the people;
- b) Human dignity, equity, social justice, inclusiveness, equality, human rights, non-discrimination and protection of the marginalised;
- c) Good governance, integrity, transparency and accountability; and
- d) Sustainable development.

All government institutions are required to ensure that public service delivery is guided by national values and principles of governance. In 2015, Sessional paper on national values and principles of governance was discussed and adopted by Parliament. The policy requires that public institutions make reports on promotion of national values.

### 2.5.2 Link Between National Values and RSIP

Periodic surveys have shown that a large number of Kenyans live in poverty. Other concerns include access to and distribution of resources and opportunities that are perceived as inequitable. The weak sense of national identity exhibited by many Kenyans is not in consonance with a stable and progressive nation. This undermines the timely achievement of the Vision 2030 goals.

Transport infrastructure sector plays pivotal role in Kenya's development agenda. In cognizance of this, the government has over the last 15 years invested heavily in road infrastructure. Despite the heavy investments, the country still faces a huge infrastructure gap – quality of the road network is poor and not equitably distributed across the country.

RSIP needs to be formulated and implemented in compliance with the Constitution and guided by the National values and principles of governance.

To mainstream national values and principles of governance, RSIP will require to be developed using objective criteria for prioritization of road programs. In this regard, a multi-criteria analytical framework will also be applied in prioritizing road projects to take into consideration economic, social, environment and other parameters.

To enhance the national values enshrined in the Constitution of Kenya, the following have been observed when preparing this RSIP2:

1. Formulation of RSIP2 was carried out in a participatory and consultative manner;
2. Prioritization under RSIP2 has set out objective criteria for allocation of road funds which is underpinned on the principles of equity, equality, inclusiveness, protection of the marginalized, social justice and sustainable development among others; and,
3. A robust monitoring and evaluation framework will be put in place to achieve accountability, good governance and transparency during the implementation of RSIP2.

## 2.6 Kenya Vision 2030

The long-term development vision of Kenya is articulated in Vision 2030. The overarching vision is to transform Kenya into a newly industrialising, “middle-income country providing a high-quality life to all its citizens by the year 2030”. The Vision is based on three “pillars”: the economic, the social and the political. The economic pillar aims to improve the prosperity of all Kenyans through an economic development programme, covering all the regions of Kenya, and aiming to achieve an average Gross Domestic Product (GDP) growth rate of 10 per cent per annum beginning by 2012<sup>1</sup>. The social pillar seeks to build a just and cohesive society with social equity in a clean and secure environment. The political pillar aims to realise a democratic political system founded on issue-based politics that respects the rule of law, and protects the rights and freedoms of every individual in the Kenyan society.

The three pillars are anchored on a number of foundations. One of them is infrastructure, which includes the transport sector. The 2030 Vision aspires for a country firmly interconnected through a network of roads, railways, ports, airports, water and sanitation facilities, and telecommunications. Investment in infrastructure is given the highest priority to ensure that the main projects under the economic pillar are implemented.

The Kenya Vision 2030 is being implemented in successive five-year Medium-Term Plans. The first plan (MTP I) covered the period 2008 – 2012, and the second (MTP II) covered the period 2013 - 2017. The MTP’s are designed to fast track Flagship Projects identified under Vision 2030, various programmes and key policies.

The main focus of MTP I was to raise the economic growth to 10 per cent and initiate the transformation envisaged in the foundations, and the economic, social and political pillars of Kenya Vision 2030. The main objective of the MTP I was to accelerate the development of effective and reliable infrastructure to promote Kenya’s competitiveness at the national, regional and global levels through improved

---

<sup>1</sup> *The real Gross Domestic Product (GDP) compared was 4.6 per cent in 2012, Statistical Abstract 2016, KNBS*

connectivity. The focus for the transport sector, among others, was on upgrading and rehabilitating the main road corridors; development of a National Spatial Plan; development and implementation of a National Integrated Transport Master Plan; construction of a new transport corridor to South Sudan and Ethiopia; development of a roads maintenance and management system; and, construction of a light rail in Nairobi and its suburbs.

During the MTP I period, some 2,200km of roads were constructed under the road expansion programme. In addition, 1,863km were rehabilitated, 2,649km of roads were placed on periodic maintenance, and 236,603km on routine maintenance. The Nairobi-Thika Super Highway and the Northern Corridor Transport Improvement Project (NCTIP) were also completed and rural roads improved through the Roads 2000 Programme (GoK, MTP I). Other achievements included: the on-going development of Lamu Port South Sudan Ethiopia Transport (LAPSSET) Corridor; an MOU was signed with Uganda on development of a standard gauge railway; finalization of the Integrated National Transport Policy; reconstitution of the National Road Safety Programme; and establishment of Kenya National Highways Authority (KeNHA), Kenya Rural Roads Authority (KeRRA), and Kenya Urban Roads Authority (KURA) to improve governance in road transport.

Over the period of MTP I implementation, findings show that economic growth dropped from 7.0% growth in 2007 to 4.6% in 2012, which was below the target of 10% by 2012. A National Spatial Plan, a National Integrated Transport Master Plan, and construction of a light rail for Nairobi and its suburbs were also not realised.

The second Medium Term Plan (MTP 2013 – 2017) was to sustain and expand physical infrastructure to ensure that it can support a rapidly-growing economy. According to the MTP II, inadequate physical infrastructure, including transport infrastructure, is one of the binding constraints on the economy. To this end, the target for the roads sub-sector was to construct and rehabilitate 5,500 km of roads. Construction/rehabilitation was to comprise of 3,825 km national trunk roads and 1,675 km County roads. About 1,700 km for Non-Motorized Transport (NMT) including paths and walkways were also being constructed in urban areas. Periodic maintenance was to be applied on 4,257 km and 1,735 km of national trunk and county roads, respectively. Some 200,000 km of roads were expected to receive routine maintenance during the MTP II period. Construction of the LAPSSET corridor was another major milestone to be achieved.

This consultancy services have reviewed the progress being made in achieving the MTP II targets and has come up with a list of completed, on-going and proposed new roads to be included in the second RSIP. The completed roads have been included in RSIP2 for maintenance, while the on-going projects are included as committed projects. This second RSIP2 therefore takes into account the achievements and challenges of MTP II, and will be expected to help in the development of MTP III (2018 – 2022) and achieving the objectives of the Kenya Vision 2030.

## 2.7 Integrated National Transport Policy

Kenya's transport policy framework is elaborated in the Sessional Paper on: Integrated National Transport Policy (MoT, November 2010). The Policy Paper, whose theme is "*Transport for Prosperity*", identifies a number of challenges inhibiting the transport sector from performing optimally its facilitative role in respect of national and regional economies.

The challenges include: (i) Poor quality of transport services; (ii) Inappropriate modal split; (iii) Unexploited regional role of the transport system; (iv) Un-integrated transport system; (v) Urban environmental pollution; (vi) Lack of an urban/rural transport policy; (vii) Institutional deficiencies; (viii) Inadequate human resource capacity; and, (ix) Lack of a Vision for the transport sector.

The Paper outlines several principle actions required to address the challenges. They include: (i) Clarification of the key stakeholder roles in the delivery and management of transport infrastructure and services; (ii) User-pays and polluter-pays principles to facilitate economic efficiency; generation of sufficient revenues to support development; operation and maintenance of transport infrastructure and services; and elimination of transport user choice distortions; (iii) Stakeholder consultation in setting of tariffs and other prices; (iv) Financing of economic infrastructure through user charging or cost recovery, and financing of social and strategic infrastructure through subsidisation on a declining basis over time; and, (v) Strengthening the regulatory framework.

The Paper proposes a new framework for transport sector management that would establish a directorate of transport, and consolidate transport functions under one Ministry, and separation of policy making, regulatory and service provision functions. It also advocates for enhancing the role of the private sector in transport infrastructure development and management, integration of Non-Motorised and Intermediate Means of Transport as part and parcel of the transport system, and lastly the consolidation of urban public transport through encouraging a shift to high occupancy vehicles.

The framework and actions outlined above have been implemented by the government over the years to various levels. The regulatory framework has been strengthened and separation of roles has been established. However, challenges of generating sufficient revenues through user charges to support development and maintenance of transport infrastructure, enhancing the role of the private sector in financing projects, and encouraging the use of high occupancy vehicles in urban areas largely remain as plans.

The objectives of this consultancy services are in line with the INTTP as this second RSIP is expected to outline priority road sections which should be constructed, rehabilitated and maintained, under given funding scenarios.

## 2.8 National Urban Development Policy

### 2.8.1 Global Policy Framework

The New Urban Agenda is a document intended to guide national and local policies on the growth and development of cities through 2036. Nearly 170 countries adopted the New Urban Agenda in October 2016 at the U.N.'s Habitat III summit on cities in Quito, Ecuador.

### 2.8.2 National Policy

The anticipated demographic, social and economic changes, brought about by rapid urbanization, have prompted the Government of Kenya (GoK) to prepare the National Urban Development Policy (NUDP), whose objectives are to strengthen urban governance and management, development planning, urban investment and the delivery of social and physical infrastructure in urban areas. The long-term goal of NUDP is to accelerate economic development, eradicate poverty, promote equity and help the nation to achieve the Vision 2030.

The NUDP identifies that infrastructure is crucial for urban areas, which are the major engines for commercial and industrial production and the main centers of innovations. Urban areas therefore play a central role in national development. For that matter, towns require appropriate quantities of quality infrastructure, which can be ensured through adequate budgetary provisions for development and maintenance.

In transportation, the NUDP lists the following challenges: (i) long travelling times, and, poor safety and security standards; (ii) high costs for both passengers and freight; (iii) limited modal integration; (iv) weak public and private institutions; (v) inappropriate modal split; and, (vi) lack of an urban transport policy.

The policy recommends, among others, that all urban areas and cities should prepare and implement an appropriate transportation strategy with emphasis on mass transport, pedestrian and cycling modes.

One of the objectives of this project is to come up with better planning of road development and maintenance that in the long term will help in reducing vehicle (transport) operating costs, and reduced road travel times due to improved road conditions, in both urban and rural areas.

## 2.9 National Spatial Plan (NSP)

### 2.9.1 Global Policy Framework

Sustainable Development Goal No. 11, seeks to make cities and human settlements inclusive, safe, resilient and sustainable. In relation to the transport sector, Target 2, reads: *By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations - women, children, persons with disabilities and older persons.*

### **2.9.2 National Policy**

Vision 2030 provides for the preparation of the National Spatial Plan and implementation of strategic development and investment plans in six metropolitan regions, with the objective of redistributing the population and creating balanced development in the country.

The Plan details the national spatial vision that will guide the long term spatial development of the country for a period of 30 years. It aims at achieving an organized, integrated, sustainable and balanced development of the country, hence informing the future use and distribution of activities and linkages.

### **2.9.3 The National Spatial Plan and RSIP**

The NSP supports the implementation of strategic national projects specifically the flagship projects spelt out under Kenya Vision 2030 by indicating their spatial locations and providing a framework for absorbing the spatial impacts of these projects.

With reference to the RSIP, the NSP provides an objective framework for prioritization of road sector investments with a view to enhancing linkages and connectivity to key activity areas in the national and regional space. Key objectives of the NSP linked to the RSIP are:

1. To create a spatial planning context that enhances economic efficiency and strengthens Kenya's global competitiveness;
2. To promote balanced regional development for national integration and cohesion;
3. To optimize utilization of land and natural resources for sustainable development;
4. To create liveable and functional Human Settlements in both urban and rural areas;
5. To secure the natural environment for high quality of life; and,
6. To establish an integrated national transportation network and infrastructure system

It is expected that with rationalization of the NSP and RSIP, there will be enhanced integration of land use and transport planning and development at the urban and rural contexts. Further, this is expected to ameliorate the economic, social and environmental costs / constraints associated with development of roads.

### **2.10 Transport Infrastructure Funding Policy**

The Integrated National Transport Policy published by the Ministry of Transport in 2010 cites funding for road infrastructure as a major challenge. Vision 2030 proposed the adoption of innovative road infrastructure financing mechanisms, majority of which the Government has already enacted the relevant laws and the required supportive regulations. These financing mechanisms include the PPP, increasing the fuel levy and the establishment and operationalization of an annuity programme.

The development of the “National Surface Transport Funding (2016 – 2025)” has affirmed the Government’s commitment to finding sustainable funding for surface transport infrastructure demands (i.e. roads, railways, ports and pipelines). The Funding Policy summarizes how charges for the use of transport infrastructure will be applied, and what other sources of public funding will be available to fund transport infrastructure. It identifies priority on new investment, development of existing infrastructure and maintenance of new and existing infrastructure. It excludes expenditure that would be managed at the County level.

The INTP proposes the adoption of the ‘user pays principle’ in transport infrastructure pricing to support cost-recovery of the provided assets. In addition, it proposes that Kenya should adopt ‘polluter pays principle’ so as to reflect on externalities such as pollution and congestion.

National road development and improvement projects requiring capital expenditure of KSh 1,100 billion have been identified for the period 2016-2025. These include:

1. PPP projects to develop, improve and maintain five key pieces of road infrastructure: Nairobi – Mombasa; Nairobi – Thika; Nairobi – Nakuru; Nairobi Southern Bypass; and the New Nyali Bridge;
2. A program to develop and pave 10,000km of Kenya’s road network;
3. Road connections required to support investment in the LAPSSET project; and,
4. Additional national, urban & rural road projects identified by respective Authorities, some of which may be progressed as PPPs.

Without action to identify new funding sources, the proposed expenditure programme will cause a funding gap to emerge immediately. The size of the funding gap would grow over the next ten years, and could be as much as KSh. 100 billion annually from 2021-2025 according to the National Surface Transport Funding (2016 – 2025).

The following Policy directions are proposed to be taken to fully finance projected road infrastructure requirements:

1. The fuel levy will be increased by 30% annually from 2017/18 to 2019/20. Thereafter it will be updated annually to take inflation into account;
2. Road tolling shall be employed on viable networks;
3. Revenue collected on behalf of Government from Road Tolls will be paid into a road toll fund, which will be established for the purpose. Monies held in this fund will be ring-fenced to meet costs associated with the provision of Toll Roads. This includes capital and maintenance costs for road and toll infrastructure, and repayment of external and Government finance used to meet such costs;
4. The Government will review and optimise its schedule of driver and vehicle licensing charges. The Government will introduce a comprehensive system of annual vehicle licensing charges applying to all motor vehicles. Charges will be designed to raise an additional KSh. 10 billion annually for road sector funding from 2017/18 onwards, taking into consideration the overall burden of licensing charges on motorists.

5. The calibration of charges between different types of vehicle will take into account the “polluter pays principle”. Charges will be updated annually to take into account inflation. They will also be reviewed periodically, in particular to assess their consistency with Kenya’s climate change obligations. Updated charges will be published in the Kenya Gazette; and,
6. An insurance premium tax at a rate of 16% will be levied on gross written insurance premiums on all motor vehicles.

The remaining funds required to meet proposed expenditure after use of toll revenue and fuel levy funds will be obtained from the Consolidated Fund.

## **2.11 Establishment of Transport Data Centre**

### **2.11.1 Global Policy Framework**

Under the World Bank-funded Sub Sahara Africa Transport Program (SSATP), the Transport Indicator Initiative was started in 2003. SSATP was requested to take the lead in coordinating and establishing a common set of key transport sector performance indicators, and to assist in building up capacity to collect the required data in a sustainable manner across SSA. The harmonized framework of transport sector indicators aims to satisfy four different purposes:

1. To measure the contribution of the transport sector to the achievement of the Millennium Development Goals (MDG’s);
2. Encourage countries, REC’s, and agencies in SSATP countries to collect a common set of data, which is needed for planning purposes;
3. Give an indication as to where intervention in the transport sector is necessary in relation to the “minimum infrastructure platform” (MIP) notion; and,
4. Allow comparison of sector performance over time and between countries.

### **2.11.2 National Data Policy Framework**

The Kenya National Bureau of Statistics (KNBS) is a semi-autonomous government agency established under the Statistics Act of 2006 with the principal role of collecting, analysing and disseminating official statistics on behalf of the Government of Kenya. The KNBS is also responsible for coordinating the country’s national statistical system and acts as the custodian of official statistical information in the country. The statistics are used by policy makers, researchers and investors alike to formulate policies and in the process enable decision making process. For the transport sector, KNBS collects broad output statistics.

As part of the 1<sup>st</sup> Medium Term Plan of the Vision 2030, the government prepared the National Monitoring and Evaluation System (NIMES). All public sector agencies are required to regularly submit reports using NIMES.

In 2014, the Ministry of Transport established a Transport Data Centre (TDC). The TDC sets out a framework for regular collection, update, analysis and dissemination of indicators focused on the transport sector performance. It aims to measure policy dimensions of transport service delivery such as access, quality, affordability, efficiency and financial sustainability at global, country/ county and project level.

### **2.11.3 Link Between Transport Data Centre(TDC) and RSIP**

The road network in Kenya constitutes one of the country's largest public investments. Hence there is need for the road network be continuously developed, managed and maintained in a prudent and effective manner.

An EU funded study called Institutional Capacity Building for Transport/ Road Sector (ICBTRS) carried out an assessment of current road maintenance and management practices in Kenya in 2015. It was noted that there exist various components of Road Asset Management Systems including:

1. A GIS based Road Inventory database (RICS) covering the entire road network which is hosted at Kenya Roads Board. Each Road Agency also maintains road inventory data covering the sub-networks they are responsible for;
2. Road maintenance system is used by the Road Agencies primarily for work planning and reporting system for RMLF funded programs; and,
3. Other data collected by Road Agencies and the MTRD include road condition and pavement strength data, traffic data and axle load data.

Although there is a vast array of transport sector indicators and other data currently available in the road sub-sector, the ICBTRS study found that the systems in use in the roads sub-sector are stand-alone (i.e. not integrated) and have limited strategic decision support capability. Also the data collected by different agencies is not consistently referenced to the RICS database and hence makes it difficult for data exchange across the various systems.

Lack of good road network data, such as road inventory and condition, traffic, and works history, makes the preparation RSIP difficult and unreliable. Availability of baseline data and indicators is therefore necessary for evidence based planning and assessment of future impacts and outcomes of RSIPs. Hence, under this RSIP, the following will be included:

1. A comprehensive monitoring and evaluation framework;
2. Proposal to set aside funds for collection, analysis and dissemination of road network data; and,
3. Recommendations to establish an integrated Road Asset Management (RAM) System linked to the TDC in order to enhance RAM in Kenya.

## **2.12 Road Safety**

### **2.12.1 Global Policy Framework**

In response to the growing epidemic of road crashes, the UN General Assembly adopted Resolution 64/255 to establish the Decade of Action for Road Safety (2011–2020). The goal is set to stabilize and reduce predicted levels of road traffic fatalities around the world by saving an estimated 5 million lives over the period.

The decade of action provides the road map for attainment of the goal by focussing on the following pillars for road safety:

1. Road Safety Management;
2. Safer Roads and Mobility;
3. Safer Vehicles;
4. Safer Road Users; and,
5. Post-crash Response.

### **2.12.2 National Policy on Road Safety**

The Integrated National Transport Policy was approved in 2010 with one key objective for the road sector being to provide increased mobility and improved accessibility to safe and secure road transport services. The National Road Safety Action Plan (NRSAP), 2009 – 2014 was formulated in 2009 to guide road safety activities, while The National Transport and Safety Authority (NTSA) was established in 2012 to harmonize the operations of the key road transport departments and help in effectively managing the road transport sub-sector and minimizing loss of lives through road crashes.

### **2.12.3 Link Between Road Safety and RSIP**

More than 1.24 million people currently die on the world's roads each year and more than 90% of fatalities occur in developing countries despite low motorization levels. An estimated 3,000 deaths from road crashes occur annually in Kenya, of which about 40% are pedestrians (NTSA, unpublished).

Road traffic injuries place a heavy burden, not only on global and national economies but also household finances. In Kenya, the economic cost of road crashes is 5.6% of the GDP, approximately KSh. 310 billion annually. The low and middle income countries lose about 5% of their GDP to road crashes (NTSA, unpublished).

With the increased investment and development of the road network system in Kenya, it is expected that road users will face increased exposure to road crashes. Other risk factors driving the exposure to road crashes are increased human population and increased level of motorization.

As noted, the extent of development of the road network is a risk factor affecting road safety. For instance, the Northern Corridor contributed 17.4% of the national fatalities between January and October 23<sup>rd</sup> 2016. It is a significant contributor to road crashes and injuries in Kenya and has a number of hazardous spots and sections.

Some of the solutions and investment to be derived through RSIP include:

1. Allocation of funds for road safety commensurate with the investment in expansion of the road network. Road safety is an expensive venture which requires sufficient funding to undertake road safety programmes;
2. Enhanced engagement and collaboration between NTSA and road authorities for better planning, design, construction and maintenance of roads through improved design standards, road safety assessments, road safety audits and black-spots treatment programmes;
3. Pursue integration of road infrastructure design with transport services and planning e.g. BRT, rail etc.;
4. Increased investment in safe infrastructure for pedestrians, non-motorized & intermediate means of transport; and,
5. Adequate identification and treatment of engineering based road crash risk factors.

### **2.13 Climate Change Adaptation**

Climate change and climate variability has emerged as a major challenge to development efforts, with a high risk that it could not only undermine past and ongoing road development efforts but also increase social problems and threaten environmental sustainability. The interaction of road development interventions with the physical and ecological environment may result into unintended consequences such as loss and degradation of natural and cultural resources, assets and biodiversity; unsustainable production and consumption of energy; and, increased vulnerability to climate change and climate variability. There is therefore need for an assessment of vulnerability to climate change as part of the environmental and social assessment process for road project investments and the resulting mitigating measures from such assessments included in the operation.

Traffic congestion increases carbon emissions along with fuel consumption, both of which are very sensitive to the type of driving that occurs. Traveling at a steady-state velocity results into much lower emissions and fuel consumption compared to a stop-and-go driving pattern. High carbon emissions contribute to climate change by causing global warming. Reduced congestion therefore results into low fuel consumption which in turn reduces carbon emissions and the other associated greenhouse gases (i.e. nitrogen oxides, sulphur oxides, hydrocarbons and particulate matter).

Road projects that are vulnerable to climate change requires detailed evaluation of climate change risks and adaptation measures. Comprehensive risk management and adaptation measures should therefore be integrated during the design and implementation of road projects. This should be preceded by the development of country specific adaptation and mitigation measures for incorporation into project design.

Amongst the proposed climate change action plans include:

1. The road projects should include tree planting at selected locations. The trees serve the dual purposes of carbon sequestration and to support conservation initiatives;
2. Enhanced investments in clean energy e.g. using solar lighting on roads;
3. Promoting sustainable transport e.g. NMTs and BRTs;
4. Building climate change resilience road infrastructure e.g. increasing the size (height and width) of road drainage structures to accommodate abnormal flooding;
5. Climate-proofing of road projects: and,
6. Undertaking comprehensive environmental impact studies that integrates the impacts of climate change on projects.

## **2.14 Environmental Management and Sustainability**

### **2.14.1 Constitution of Kenya**

Environmental rules, rights and freedom are contained in Section 42, Chapter 5 of the Constitution which states that every person has the right to a clean and healthy environment, which includes the right to:

1. have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and,
2. have obligations relating to the environment fulfilled under Article 70.

Chapter five of the Constitution covers "Land and Environment" and includes the aforementioned articles 69 and 70. The Chapter seeks to eliminate processes & activities likely to endanger the environment. Article 69 states that the State shall:

1. ensure sustainable exploitation, utilisation, management and conservation of the environmental and natural resources, and ensure the equitable sharing of the accruing benefits;
2. work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;
3. protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;
4. encourage public participation in the management, protection and conservation of the environment;
5. protect genetic resources and biological diversity;
6. establish systems of environmental and social impact assessment, environmental audit and monitoring of the environment;
7. eliminate processes and activities that are likely to endanger the environment; and,
8. utilise the environment and natural resources for the benefit of the people of Kenya.

### 2.14.2 National Policies

**Kenya Vision 2030:** The social pillar of Vision 2030 aims to build a just and cohesive society in a clean, secure and sustainable environment. Environmental protection will be paramount while undertaking the numerous planned infrastructure projects under this project.

**National Environment Action Plan:** The Environmental Management and Coordination Act (EMCA, 1999) provides for the formulation of the National, Provincial and District Environmental Action Plans after the duration of five years.

**National Environment Policy 2013:** Section 5.6 of the policy lists infrastructural development to include amongst others buildings, roads, ports, railways, ICT, pipelines, irrigation systems, airports and electricity transmission. It also emphasises that the environment aspects of such infrastructural developments are distinct and unique such as effects on flora and fauna, social and psychological disruption, vegetation clearance, excavation works and spillages during construction. This policy states that the government will:

1. Ensure Strategic Environmental Assessment (SEA), Environmental and Social Impact Assessment (ESIA), Social Impact Assessment (SIA) and Public participation in the planning and approval of infrastructural projects.
2. Develop and implement environmentally-friendly national infrastructural development strategy and action plan.
3. Ensure that periodic Environmental Audits are carried out for all infrastructural projects.

**Land Policy:** The policy postulates that to restore the environmental integrity, the government shall introduce incentives and encourage the use of technology and scientific methods for soil conservation. It further states that fragile ecosystems shall be managed and protected by developing a comprehensive land use policy bearing in mind the needs of the surrounding communities.

**Draft National Wetlands Conservation and Management Policy:** Kenya is yet to develop a comprehensive policy for conservation and management of wetlands. A Draft National Wetlands Conservation and Management Policy has however been recently developed.

### 2.14.3 International Conventions

**Ramsar Convention on Wetlands:** This is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands as a contribution towards achieving sustainable development throughout the world. The Ramsar Convention on Wetlands is primarily concerned with the conservation and management of wetlands. Parties to the Convention are also required to promote the wise use of wetlands in their territories and to take measures for their conservation by establishing nature reserves in wetlands, whether they are included in the Ramsar list or not. Kenya ratified the Ramsar Convention in June 1990.

**Convention on Biological Diversity:** The convention requires that the implementation of development projects avoid significant adverse impacts on biodiversity. The Convention requires parties to implement ESIA recommendations effectively to avoid or minimize significant adverse impacts on biodiversity. It also introduces the Strategic Environmental Assessment (SEA) to assess environmental implications of policies and programmes particularly for those with major implications on natural resource use.

### 2.14.4 Legal Framework

**Environment Management & Coordination Act (EMCA) 1999 (Amendment 2015)**  
Part II of the EMCA 1999 states that every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment. In order to partly ensure this is achieved, Part VI of the Act directs that any new programme, activity or operation should undergo an ESIA and a report prepared for submission to the National Environmental Management Authority (NEMA) who, in turn, may issue a license as appropriate. The Act also provides for the establishment of appropriate legal and institutional framework for the management of the environment.

**Environmental (Impact Assessment and Audit) Regulations, 2003**

These regulations are made under section 147 of the EMCA, 1999 (Amended 2015), and contain rules relative to content and procedures of conducting an ESIA as per section 58 of the Act. It also contains rules relative to environmental impact audits, monitoring, strategic environmental assessments and rules on other matters such as appeal and registration of information regarding environmental and social impact assessment. It states in Regulation 3 that “These Regulations shall apply to all policies, plans, programmes, projects and activities specified in Part IV, Part V and the Second Schedule of the Act.

### 2.14.5 Environmental Management Regulations

The main Environmental Management Regulations currently in use include: -

1. Environmental Management & Coordination (Conservation of Biological Diversity) Regulations 2006;

2. Environmental Management & Co-ordination (Waste Management) Regulations 2006;
3. Environmental Management and Co-ordination (Water Quality) Regulations 2006;
4. Environmental Management and Co-ordination (Wetlands, Rivers Banks, Lake Shores and Sea Shore Management) Regulations 2009;
5. Environmental Management and Coordination (Noise and Excessive Vibration Pollution) Control Regulations 2009; and,
6. Environmental Management and Co-ordination (Fossil Fuel Emission Control) Regulations 2006.

#### **2.14.6 Institutional Framework**

**National Environment Management Authority:** This is the government agency that is responsible for the implementation of all the policies relating to the environment. It was established under the Environmental Management and Co-ordination Act No. 8 of 1999 (EMCA). This agency is responsible for reviewing the ESIA reports and verifying the information in the reports. They are also responsible for overseeing and ensuring compliance to the environmental guidelines therein.

**National Environment Council:** The National Environmental Council (the Council) is responsible for policy formulation and directions for the purposes of the Act. The Council also sets national goals and objectives, and determines policies and priorities for the protection of the environment.

**Road Authorities:** These are semi-autonomous road agencies responsible for the management, development, rehabilitation and maintenance of roads. They are tasked with ensuring the implemented projects are in compliance with the provisions of the EMCA and include Kenya National Highways Authority, Kenya Urban Roads Authority and Kenya Rural Roads Authority.

**The Water Resource Management Authority:** This is a state corporation and the lead agency in water resources management. Its responsibilities include; to develop principles, guidelines and procedures for the allocation of water resources; to monitor, and from time to time re-assess, the national water resources management strategy; to receive and determine applications for permits for water use; to monitor and enforce conditions attached to permits for water use; to regulate and protect water resources quality from adverse impacts; to manage and protect water catchments in accordance with guidelines in the national water resources management strategy, to determine charges to be imposed for the use of water from any water resource; to gather and maintain information on water resources and from time to time publish forecasts, projections and information on water resources; to liaise with other bodies for the better regulation and management of water resources; to advise the Minister concerning any matter in connection with water resources.

**National Land Commission:** This is a commission which was formed under the provisions of Land Act 2012 and had the responsibility to manage public land on behalf of national and county governments, to monitor and have oversight responsibilities over land use planning throughout the country among others.

### **2.14.7 The African Development Bank (AfDB) Safeguard Standards**

The AfDB has established an Integrated Safeguard System (ISS) whose aim is for a comprehensive project review and ensuring an across the board perspective of environmental and social linkages. The ISS comprises of four components that include:

1. Integrated Safeguard Policy Statement (ISPS)
2. Operational Safeguards(OS)
3. Environmental and Social Assessment Procedures (ESAPS)
4. Environmental and Social Impact Assessments (ESIAs)

ISS encompasses five operational safeguards that address the following fields, environment, involuntary resettlement, gender, climate risk management and adaptation, civil society engagement framework, health, integrated water resources management, agriculture and rural development and poverty reduction.

The Bank also has guidelines on other safeguards including: - 1) Cooperation with Civil Society Organization; 2) Gender Guidelines in Transport Sector; and, 3) AfDB Disclosure and Access to Information

### **2.14.8 Link between RSIP and Environmental Sustainability**

RSIP2 while determining the investment needs of Kenya's road sub-sector is tasked with ensuring adequate provisions are made for the long-term environmental management and sustainability in line with laws, regulations and conventions.

## **2.15 Resettlement Action Plan (RAP)**

### **2.15.1 The Constitution of Kenya**

Section 40 of the Constitution of Kenya recognizes and protects the right to private property including land. However, Section 40(3) (b) provides that the State may take possession of private land if this is necessary for public purpose or in public interests. The Constitution also requires that compulsory acquisition be preceded by prompt payment in full of just compensation to the affected person. It also allows any person who has an interest in, or right over, that property a right of access to a court of law.

### **2.15.2 The National Land Commission Act 2012**

In road infrastructure projects, the NLC is tasked with resolving boundary disputes and acquisition of private land for road projects as provided in the Land Act 2012.

### **2.15.3 The Land Registration Act 2012**

During the RAP process, the provisions of this Act facilitates the verification of land ownership and updating the land ownership documentation arising from any land acquisition for the way leave.

### **2.15.4 The Land and Environment Court Act 2011**

The provisions of this Act assists in the resolution of any disputes relating to compensation if not solved at the project level. It allows for the forwarding of the cases for the Land and Environment Court.

### **2.15.5 The Prevention, Protection and Assistance to Internally Displaced Persons and Affected Communities Act, 2012**

Section 3 of the Act states that ‘displacement and relocation due to development projects shall only be lawful if justified by compelling and overriding public interests and in accordance with the conditions and procedures in Article 5 of the Protocol, Principles 7-9 of the Guiding Principles and as specified in sections 21-22 of this Act.

### **2.15.6 The Valuation Act**

The Act governs the formation and guidelines of valuation practices including the annual licensing and gazettelement of Valuers for practicing the profession.

### **2.15.7 Link between RSIP and RAP**

To ensure compliance with statutory obligations, provisions for RAP costs have been included in the unit work costs for road development projects.

## **2.16 The Occupational Health and Safety Act 2007**

The Act provides for development and maintenance of an effective programme of collection, compilation and analysis of occupational safety. It's meant to ensure that safety requirements during the working hours are in place and covers amongst others injuries, illnesses and disability during working hours.

## **2.17 County Integrated Development Plans**

According to Section 108 County Governments Act, each county is required to outline its development goals covering a period of five years in the form of a CIDP. The CIDP provides the overall framework for development and is geared towards coordinating development between the two levels of government.

The 1<sup>st</sup> set of CIDPs were developed to cover the period between 2013 and 2017. County governments are currently in the process of developing their 2<sup>nd</sup> CIDPs.

RSIP2 is expected to develop an prioritised road investment programme for each county to help in the planning process and the development of the 2<sup>nd</sup> CIDP.

## **2.18 Cross-Cutting Issues**

Cross Cutting issues discussed below should be taken into account for the efficient and cost-effective implementation of RSIP2, and to comply with the established laws and regulations. Ignoring some of these issues could result into extra time and extra costs that would increase road construction costs, and time, and increase the budgetary requirements to implement RSIP2. Therefore, costs for implementing and monitoring the various recommendations should be factored into the cost of implementing the programme.

### **2.18.1 Gender Mainstreaming**

The aim of gender mainstreaming is to promote gender equality in road infrastructure development by enhancing the participation of women, youth and other vulnerable groups. This is in recognition of the fact that road development projects generally do affect men, women and the youth differently since the costs and benefits accruing from such projects are borne by these socio-cultural categories differently. These socio-cultural definitions not only assign the roles and duties to be undertaken by the men, women and youth, but also define the kind of resources available for each group.

Road Agencies should carry out assessments of gender issues for every project and use the findings as the bases for project design and compensation plans with the view of enhancing gender balance. For projects that include environmental and social analysis, the gender assessment should be carried out as part of the analysis. In particular, the implementing agencies should assess the quality and relevance of gender data and performance indicators, and then develop specific pro-gender measures including the allocation of budgetary resources for equality and empowerment.

Some of the gender mainstreaming action plans should include:

1. Ensuring that hiring of unskilled or semi-skilled workers recruited from the local labour-pool is gender balanced i.e. 30% of either gender should be considered;
2. Women and Men groups are involved in resettlement planning, management and operations, and also in job creation and income generation;
3. Resettlement Action Plans should include a specific protocol specifying safeguards for the quantity of land to be allocated for women, especially widows and divorcees, to ensure they do not lose their sources of livelihoods;
4. In order to address fears entailed in relocation and issues of compensation, women, men, and the youth should be meaningfully consulted in separate groups to address their different priorities, before replacement or costs for loss of livelihood is assessed – with a view to improve their incomes and productive levels. Special attention should be paid to the needs of women, the elderly and children;

5. Land titles for resettlement plans should be either in the name of both spouses or of the single head of household, regardless of gender, if this does not conflict with laws and legislation;
6. Ensure that couples, unmarried women and elderly sons/daughters are explicitly included as eligible for compensation including compensation for loss of land, shelter, livelihoods and any other privately owned assets. Compensation payments to families should be made to both couples when this is technically feasible and socially acceptable;
7. Deliberate efforts should be made to inform/consult with women including other vulnerable groups in order to enable them participate effectively and benefit from the project;
8. Prior to implementation of the project, the recruiting team should remove barriers hindering the participation of women in road construction by having transparent recruitment procedures that includes women in the recruitment process;
9. Ensuring user-friendly roads for all members of the community by implementing designs that include foot paths and cycle tracks, public spaces, road signs, bus stops and designated places for hawkers and vendors; and,
10. Addressing the needs and constraints of women and men including measures such as establishing quotas regarding job opportunities, investment in skill training, encouraging social mobilisation for a greater voice, assigning decision-making roles for women and vulnerable groups and promoting enterprise and skills.

### **2.18.2 Gender-Based Violence**

GBV is an umbrella term for any harmful act that is perpetrated against a person's will, and that is based on socially ascribed (gender) differences between males and females.

Violence against women and girls is a global epidemic. The World Health Organization estimates that 1 in 3 (35%) of women worldwide have experienced either physical and/or sexual intimate partner violence or non-partner sexual violence in their lifetime.

Some of the GBV mainstreaming action plans include:

1. Ensuring that all transport, infrastructure and urban development initiatives adopt GBV-informed focus e.g. creating safe habitats such as restrooms can help reduce violence against women;
2. Engaging men in tackling GBV at the macro-level through awareness campaigns;
3. Consulting local women during the design of infrastructure projects to mitigate unintended consequences such as GBV backlash which may be caused by an influx of labour and income;
4. Carrying out legal rights awareness and offering legal assistance to poor women to help in bringing the perpetrators to justice and ending the cycle of impunity; and,

5. Supporting survivors especially where the implementing agencies might find themselves dealing with people who have experienced GBV.

### 2.18.3 HIV/ AIDS

The HIV/AIDS epidemic impacts on the road sector by reducing its performance and increasing its road construction costs through:

1. Reducing productivity due to AIDS-related illness (up to 6 - 8% reduction in profits has been seen in generalized epidemics). Given the high prevalence rate of HIV infection among transport workers and poor access to treatment, a significant number is likely to experience a drop in earnings and productivity as the epidemic prevails;
2. Increased costs of workers' benefits and health expenses as witnessed in countries with mature epidemics. With increasing global advocacy for treatment, the need for more expensive health care benefits which provide cover for treating AIDS-related illnesses and for anti-retroviral therapy (ART) increases road construction costs; and,
3. Increased costs of training and hiring replacements for workers lost to the disease. This occurs as a cumulative result of frequent turnover of employees due to increased illness and death from AIDS. There is also the risk of attrition in skills and expertise.

The overall aim for the implementation of the HIV/AIDS mitigation measures that focuses on awareness, prevention, training and behaviour change strategies is to reduce chances of infection and take care of the infected.

Some of the HIV/AIDS mainstreaming action plans should include:

1. All roads construction contracts should have provisions for HIV/AIDS mitigation;
2. The road contractors should be responsible for providing HIV/AIDS services;
3. Provision of HIV/AIDS services should be done through sub-consulting of CBOs/NGOs/Consultants with the approval of the implementing agencies;
4. The developed specifications should provide for evidence based programing, result based management and coordination with the NACC and Local Health Management Teams;
5. Main services to be provided in road projects should include HIV/AIDS awareness/prevention services and linkages to care and support services e.g. condom dispensing; production and dissemination of IEC materials; Behaviour Change and Communication (BCC) activities; and, counselling and testing;
6. The developed Specifications should also include periodic monitoring and evaluation. Also, mainstream HIV/AIDS reporting should be incorporated into routine reporting mechanisms;
7. HIV/AIDS awareness campaigns for workers and communities should focus on activities promoting access to health services, treatment and counselling;
8. It is of critical importance that HIV/AIDS mainstreaming be gender sensitive;

9. Have adequate funds allocated for HIV/AIDS mainstreaming. Costing for HIV/AIDS mainstreaming should not be seen as an extraordinary process since most of these costs are already defined in the routine sector budgeting process.

#### **2.18.4 Child Labour**

The Road agencies, and their Consultants, Suppliers and Contractors, should make sure they do not employ children in any manner that is economically exploitative, or that is likely to be hazardous or to interfere with the child's education or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. These should be as stipulated in national laws in compliance with the provisions of ILO Convention C138 and C182. In addition, all work should be subject to an appropriate risk assessment and regular monitoring of health, working conditions, and hours of work.

#### **2.18.5 Disability Mainstreaming**

Disability mainstreaming is a strategy for making the concerns and experiences of persons living with disabilities an integral dimension of the design, implementation, monitoring and evaluation of policies and programs in all political, economic and societal spheres. Persons living with disabilities should participate in those activities and equally benefit.

Some of the disability mainstreaming action plans should include:

1. Ensuring that the overall policy or strategy is inclusive. Policies emanating from the organisation's strategy/ policy should also be inclusive;
2. Ensuring that physical facilities and premises are accessible by internal and external clients living with disabilities;
3. Employing a work force in which at least 5% are persons living with disabilities;
4. Retaining staff who become disabled in the course of employment and offering them reasonable accommodation and adjustments;
5. Ensuring that the organization's core mandate i.e. programs, projects and activities are targeting persons living with disabilities and their concerns, throughout the entire road project life cycle;
6. Carrying out disability awareness and sensitization sessions for organization staff and empowering staff with disability (if any);
7. Developing or providing accessible and alternative material and information;
8. Prior to implementation of the project, the recruiting team should remove barriers hindering the participation PLWDs in road construction by having transparent recruitment procedures that specifically includes PLWDs in the recruitment process;
9. In order to address fears entailed in relocation and issues of compensation, PLWD should be meaningfully consulted in separate groups to address their different priorities, before replacement or costs for loss of livelihood is assessed – with a view to improve their incomes and productive levels; and,
10. Ensuring the design takes into consideration the needs of PLWDs e.g. proper foot paths and cycle tracks, public spaces, junctions, road signs, and bus stops.

## 3 Programmes and Projects

### 3.1 Background

This section presents an overview of the main programmes within the transport sector whose implementation are likely to either directly or indirectly influence the implementation of the RSIP2 programme.

### 3.2 The Jubilee Manifesto 2017

The Jubilee Manifesto is hinged on the premise of “*Continuing Kenya’s Transformation, Together*”. The manifesto outlines the ruling party’s major programmes to be implemented over the course of the next five years. The main plans envisioned for the transport sector to include amongst others:

1. Implementation of an integrated transport infrastructure system by linking production centres in the Northern Corridor, the Central Corridor and the LAPSSSET Corridor with cost-effective transport, logistics, energy and utility systems to ease trade and reduce production costs. These three corridors cover more than twenty counties and are expected to open more than 75% of the country’s land mass;
2. Construction of a rail link from Lamu to Miritini, a road from Lamu to Isiolo and completion of the development of the remaining 29 berths in Lamu port;
3. Completion of the 7,000 kilometres of road currently under construction and work with County Governments to increase the coverage of rural access roads to enable farmers to get produce to market quickly and cheaply;
4. Construction of the Mombasa-Nairobi six lane highway toll road which together with the SGR is expected to transform the 450 kilometres between the two cities into one large and vibrant economic zone;
5. Construction of the second phase of the SGR from Nairobi to Naivasha, ensuring that at least 40% of the contract value is allocated to Kenyan companies; and,
6. Installation of street lights in all urban centres to facilitate the 24-hour economy and ensure that by 2020 all Kenyans will be connected to electricity either from the national grid or an off-grid source.

### 3.3 The “Big Four” Agenda

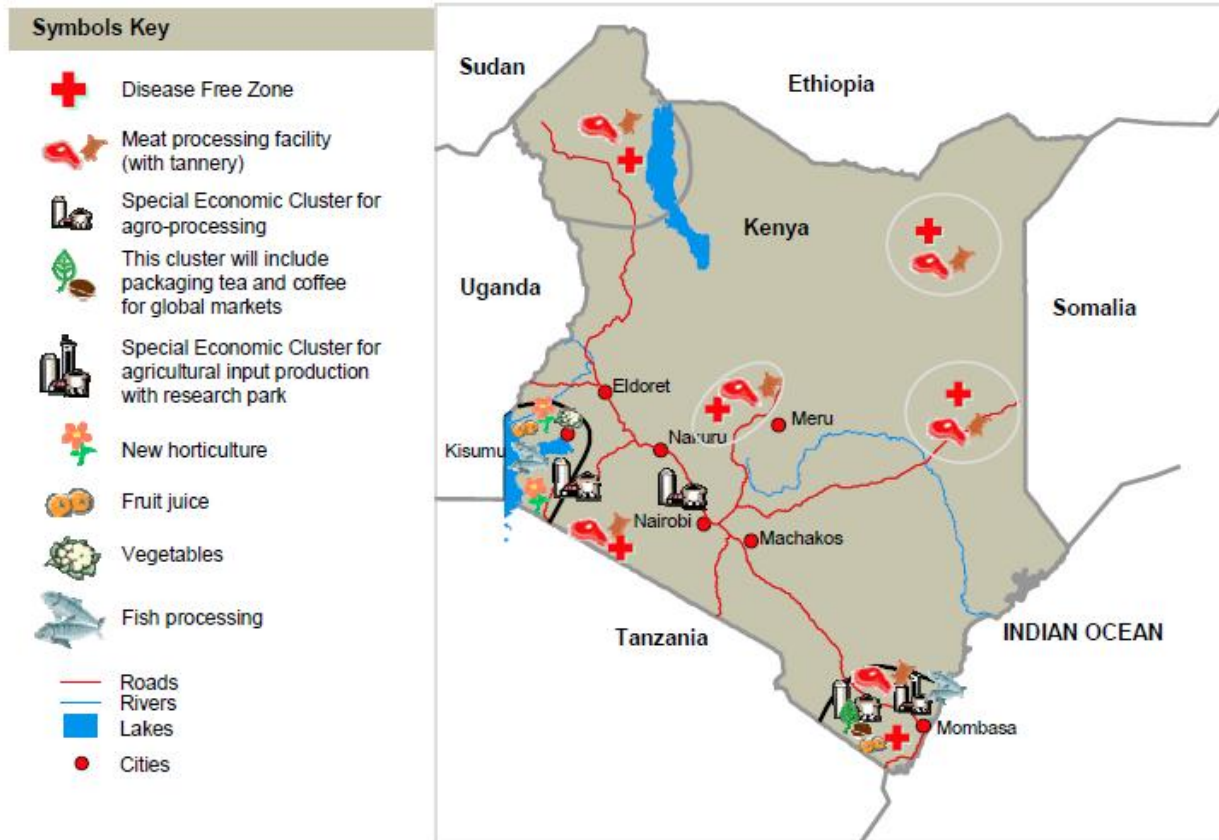
“The Big Four” plan was launched by President Uhuru Kenyatta on 12<sup>th</sup> December 2017 to guide the country’s development agenda for the period 2018-2022. The Agenda is in line with the Vision 2030 and focuses on four key areas: (i) Provision of affordable and universal healthcare; (ii) Employment creation through bolstering manufacturing; (iii) Provision of affordable and decent housing; and, (iv) Enhancing food and nutritional security.

Since more than 93% of all freight and passenger traffic is transported by roads, RSIP2 is expected to provide the prerequisite road infrastructure required to facilitate the successful implementation of the “Big Four” Agenda. These include the development

of industrial and manufacturing zones across the country as proposed in the Vision 2030. The zones are to be spread out based on regional resource endowments and shall also include agro-industrial zones involved in blending and packaging of fertilizers, teas and coffees and meat and fish processing facilities.

The figure below shows the proposed possible regional industrial and manufacturing clusters according to Vision 2030.

**Figure 3.1: Possible Regional Industrial and Manufacturing Clusters**



Source: Vision 2030

### 3.4 Bus Rapid Transit

A Bus Rapid Transit (BRT) Study for Nairobi presented a harmonised approach for the development of a Mass Rapid Transit System (MRTS) network. So far, nine BRT corridors have been identified, collapsed into five lanes and proposed for development by the MoTIHUD. The BRT feasibility study used a multi-criteria analysis and has ranked the earlier identified nine corridors into three categories (high, medium and low priority). Jogoo Road is one of the corridors with a high priority for implementation, along with Waiyaki Way, Mombasa Road and Ngong' Road. The nine corridors identified in the BRT Feasibility Study have not been changed in essence but have been linked to form a comprehensive network by pairing corridors to form cross-city lines. The study also includes an evaluation of possible transport modes and after a socio- economic and technical analysis, BRT is strongly recommended as the mode

to be adopted on all Mass Rapid Transport Study, complemented by Commuter Rail for suburban and regional connections which consist of longer trips and lower traffic demand.

Similar strategies are being adopted in the other two cities of Mombasa and Kisumu who's integrated urban development plans complemented with transport master plans are at an advanced stage.

### 3.5 Konza Technology City

This is a large technology hub planned by the Government of Kenya to be developed outside Nairobi City. Konza Technology City is a Business Process Outsourcing (BPO) project that is being marketed by the Kenyan government through the Kenya ICT Board. The project is to attract BPOs; Software developers; Data centers; Disaster recovery centers; Call centers; and, Light assembly manufacturing industries. Amongst the other infrastructure to be built at Konza include: A university campus focused on research and technology as well as hotels, residential areas, schools and hospitals. It is also intended to include a science park, a convention center, shopping malls, hotels, international schools; and, a health facility. All these must be complemented by world class infrastructure.

Konza Techno City was approved by the Parliament Account Committee and endorsed by the Kenyan Government. The project will be built 64 km south of Nairobi *en-route* to the port city of Mombasa on a 5,000 acre piece of land in Makueni County. It is estimated to cost KSh. 1.2 trillion (approx. US\$14.5bn) and is being marketed as a key driver of Kenya's national development blueprint (i.e. Kenya Vision 2030).

### 3.6 Lamu Port South Sudan Ethiopia Transport Corridor

This is one of the largest infrastructure projects in Eastern Africa which is aimed at interconnecting a tripartite of countries (i.e. Kenya, Ethiopia and South Sudan). It consists of the following infrastructure components: -

1. A new 32 berth port at Lamu (Kenya);
2. Multinational highways i.e. Lamu – Isiolo - Juba (South Sudan); Isiolo - Addis Ababa (Ethiopia); and, Lamu - Garsen (Kenya);
3. Crude oil pipeline from Lamu - Isiolo - Juba;
4. Product oil pipeline from Lamu - Addis Ababa;
5. Standard Gauge Railway lines i.e. Lamu - Isiolo – Juba; Isiolo - Addis Ababa; and, Nairobi - Isiolo;
6. International airports at Lamu, Isiolo, and Lake Turkana;
7. Resort cities at Lamu, Isiolo and Lake Turkana; and,
8. The multipurpose High Grand Falls Dam along the Tana River.

The implementation status of the highway components is as tabulated below.

**Table 3.1: LAPSSSET Highway Components Progress Status as at 2017**

| Road Section                           | Length (Km) | Estimated Cost (KSh) | Implementation status  |
|--|-------------|----------------------|--|
| <b>Lamu – Garissa</b>                  | <b>250</b>  |                      |  |
| Lot 1- Mokowe- Haruru Village          | 125         | 20.06 billion        | Designs are complete. The GoK is sourcing for funds for construction works |
| Lot 2- Haruru Village- Garissa         | 125         | 17.46 billion        |  |
| <b>Garissa – Isiolo</b>                | <b>285</b>  |                      |  |
| Lot 1- Garissa-Hagar Jerer             | 141.5       | 14.09 billion        | Construction Completed   |
| Lot 2- Hagar Jerer Road- Isiolo        | 139         | 17.08 billion        |  |
| <b>Ethiopia link (Isiolo – Moyale)</b> | <b>505</b>  |                      |  |
| Lot 1- Isiolo Merille                  | 120         | 6.32 billion         | Construction Completed   |
| Lot 2-Merille-Marsabit                 | 122         | 13.72 billion        |  |
| Lot 3-Marsabit-Turbi                   | 122         | 13.0 billion         |  |
| Lot 4-Turbi-Moyale                     | 122         | 12.06 billion        |  |
| <b>Isiolo – Nandapal</b>               |             |                      |  |
| Isiolo – Maralal- Lokori – Lokichar    | 483         | -                    | Design is on-going   |
| Lokichar – Loichangamatak              | 40          | -                    | Designs complete awaiting tendering.                                       |
| Loichangamatak – Lodwar                | 50          | 6.78 Billion         | Works tenders awarded  |
| Lodwar – Lokitang Junction             | 80          | 8.33 Billion         | Works tenders awarded  |
| Lokitang Junction- Kalobeyei           | 80          | 8.5 Billion          | Works tenders awarded  |
| Kalobeyei - Nandapal                   | 88          | 7.9 Billion          | Works tenders awarded  |

Source: KeNHA- LAPSSSET Corridor Brief Status Report (2017)

### 3.7 The Standard Gauge Railway (SGR)

The ongoing development of the SGR is geared at providing an efficient and cost effective way of transporting passengers and freight within the Northern Corridor which links Kenya, Uganda, Rwanda and Southern Sudan. Each country is tasked with developing the section of the SGR line within its borders and already Kenya has set the pace. The Kenyan section runs from Mombasa – Malaba and is being developed in two phases namely:

- ) **Phase 1 Mombasa – Nairobi:** This section is complete and that both the passenger and freight services were inaugurated May 2017.
- ) **Phase 2 (Nairobi – Malaba):** This phase has been divided into three sub phases namely: - (1) Phase 2A Nairobi – Naivasha section; (2) Phase 2B Naivasha – Kisumu section; and, Phase 2C Kisumu –Malaba section. Works has already started in phase 2A.

The overall implementation progress of the SGR network as at June 2017 is as tabulated below.

**Table 3.2: SGR Progress Status as at June 2017**

| No.          | Section                   | Implementation Status       | Km           |
|--------------|---------------------------|-----------------------------|--------------|
| 1            | Mombasa - Nairobi         | Operational (passengers)    | 472          |
| 2            | Nairobi - Naivasha        | Under construction          | 120          |
| 3            | Naivasha - Kisumu         | Financing identified        | 262          |
| 4            | Kisumu - Malaba           | Financing identification    | 107          |
| 5            | Lamu - Mariakani          | Feasibility Study completed | 325          |
| 6            | Voi - Taveta              | Feasibility Study completed | 120          |
| 7            | Lamu – Isiolo - Nakodok   | Feasibility Study completed | 1,350        |
| 8            | Nairobi – Isiolo - Moyale | Feasibility Study completed | 705          |
| 9            | Nairobi Airport           | Financing identification    | 21           |
| <b>Total</b> |                           |                             | <b>3,482</b> |

Source: Kenya Railways (June 2017): Presentation to EA Transport and Infrastructure

When complete, SGR is expected to handle about 40% of the cargo currently being handled by the Northern Corridor.

### 3.8 Roads 2000 Strategy

The Roads 2000 Strategy is a method of road development and management that ensures optimum utilization and development of locally available resources (labour, equipment and materials) where technically and economically feasible. The R2000 Strategy has been rolled out in Kenya since the mid 90's and covers the entire road network. The strategy is based on the lessons learnt from two previous<sup>2</sup> labour based programmes. The rolling out was expected to be complete by the year 2000, hence the name "Roads 2000".

Roads 2000 programme was identified in the First Medium Term Plan (2008 – 2012) as one of the flagship projects, with the objective of creating short-term labour employment for young people. By June 2010, the programme had improved more than 7,000 km of rural roads, generated about 4,7 million person-days of employment, trained 5,600 Local Resource-Based contractors and injected more than KSh. 1 billion (US\$13 million) to the rural Kenya. About 25% and 40% of the direct beneficiaries of the programme were women and youth respectively.

Between 2010 and 2012, the programme managed to improve 593 km of roads at a total cost of KSh. 974 million and created 530,740 person days of employment.

The Government, through the Road Authorities and Kenya Roads Board, continues to work closely with the County Governments and some Development Partners<sup>3</sup> to implement the strategy. During the current phase (2013 – 2017), the Government has

<sup>2</sup> Rural Access Roads Programme (RARP) in the 1970's and Minor Roads Programme (MRP) in the 1980's

<sup>3</sup> AfDB, AFD, Danida, EU, Finnish Government, KfW and SIDA

planned to use KSh. 149 billion for the implementation of the Strategy, which includes some KSh. 9.685 billion from the development partners<sup>4</sup>.

In spite of its apparent success in meeting its objectives, the R2000 strategy is not yet fully mainstreamed in regular road maintenance programmes of all road authorities, and remains donor driven. In addition, the programme is not clearly integrated into a long-term road network development plan, like the RSIP (2010 – 2014). In this RSIP, roads that would be maintained were identified using this strategy and appropriately allocated funds for them.

### 3.9 Roads 10000 Programme

In 2006, Kenya had a funding gap of US\$ 44 million per year to meet its projected transport infrastructure needs<sup>5</sup>. The report recommended that the funding gap could be addressed by raising additional finance or, by adopting lower-cost technologies or less-ambitious targets for infrastructure development. In 2014, the Government of Kenya, in line with the Vision 2030 targets, chose to address this gap by adopting the Annuity financing model of Public Private Partnership for the development of low volume roads instead of traditional mechanisms through the exchequer and RMLF. The strategy, dubbed the Roads 10,000 programme, is to upgrade some 10,000 km of roads to paved standards<sup>6</sup> and increase the paved network by 71% from 14,100 km to 24,100 km.

In the Annuity model, the contractor will design, build and maintain the roads, using his own funds or borrowed from commercial banks. A payment modality, taking into account certification of works, milestones and the assignment, will be agreed upon between the Government, contractor and commercial bank. In that arrangement, the Government will reimburse the consortium/banks at a uniform rate over an agreed period (annuity). Contractors will complete contracted works within the stipulated time, to specified quality and quantity, and undertake post-construction maintenance of the road. This model was selected because most roads in Kenya, apart from sections of the Northern Corridor (A109/104) and the Nairobi – Moyale (A2) roads, are not viable for conventional tolling.

Through this financing model, Kenya hopes to reduce road construction costs from KSh 40 million to KSh 100 million per km to KSh 20-25 million/km and KSh 50 – 80 million/km for Low-Volume rural roads and Trunk and Urban roads, respectively. These reductions are expected from savings arising from the use of appropriate designs standards, lower contract management overheads, and reduced price escalation compensation claims.

<sup>4</sup> AFD (KSh. 4.4 billion); KfW (KSh. 1.493 billion); Finland Government, PALWECO (KSh. 1.008 billion); and EU (KSh. 2.784 billion)

<sup>5</sup> *Kenya's Infrastructure: A Continental Perspective* by Cecilia M. Briceño-Garmendia and Maria Shkaratan, *The World Bank WPS 5596*, March 2011

<sup>6</sup> Through construction of the Low-Volume Sealed roads

The whole programme is estimated to cost some KSh. 260 billion and is to be implemented in three phases as follows:

- ) Phase 1: 2,000 km at KSh. 40 billion;
- ) Phase 2: 3,000 km at KSh. 60 billion; and,
- ) Phase 3: 5,000 km at KSh. 160 billion.

Implementation for the Phase 1 roads has faced some challenges but is currently on course. Implementation of the first batch of 2,000 km is at various stages.

### **3.10 Summary on Policy and Programme Recommendations**

As illustrated in Chapter 2 and this Chapter, there are presently numerous policy recommendations guiding investments in the roads sub-sector. A breakdown demonstrating the link between these policies and programmes with the final work programme is presented in Section 8.6 of this report. The key policies that have been considered include the EAC Vision 2050, LAPSET Transport Corridor development, R 10000 programme, and so on.

## 4 Management of Kenya’s Transport Sector and Roads Sub-Sector

### 4.1 Background

This section provides an overview of the management of the transport sector in Kenya, the road network and its classification and, programmes in the road sub-sector.

### 4.2 Overview of the Transport Sector

The Ministry of Transport, Infrastructure, Housing & Urban Development (MOTIH&UD) is responsible for transport policy formulation, management and overseeing the operations of all transport sector institutions under the Ministry. The transport sector in Kenya encompasses a transport system comprising of road, rail, air and maritime. The institutions falling under the Ministry include:

1. The Kenya Roads Board (KRB), Kenya National Highways Authority (KeNHA), Kenya Urban Roads Authority (KURA), Kenya Rural Roads Authority (KeRRA), National Transport and Safety Authority (NTSA), Kenya Institute of Highways and Building Technology (KIHBT), and the Nairobi Metropolitan Area Transport Authority (NAMATA), in the roads sub-sector;
2. Kenya Railways Corporation (KRC) for the rail sub-sector;
3. Kenya Civil Aviation Authority (KCAA) and Kenya Airports Authority (KAA) in the air sub-sector;
4. Kenya Ports Authority (KPA) and Kenya Maritime Authority (KMA) in the maritime sub-sector;
5. National Construction Authority (NCA), National Housing Corporation (NHC), and Kenya Building Research Centre (KBRC) in the Housing and Urban Development.

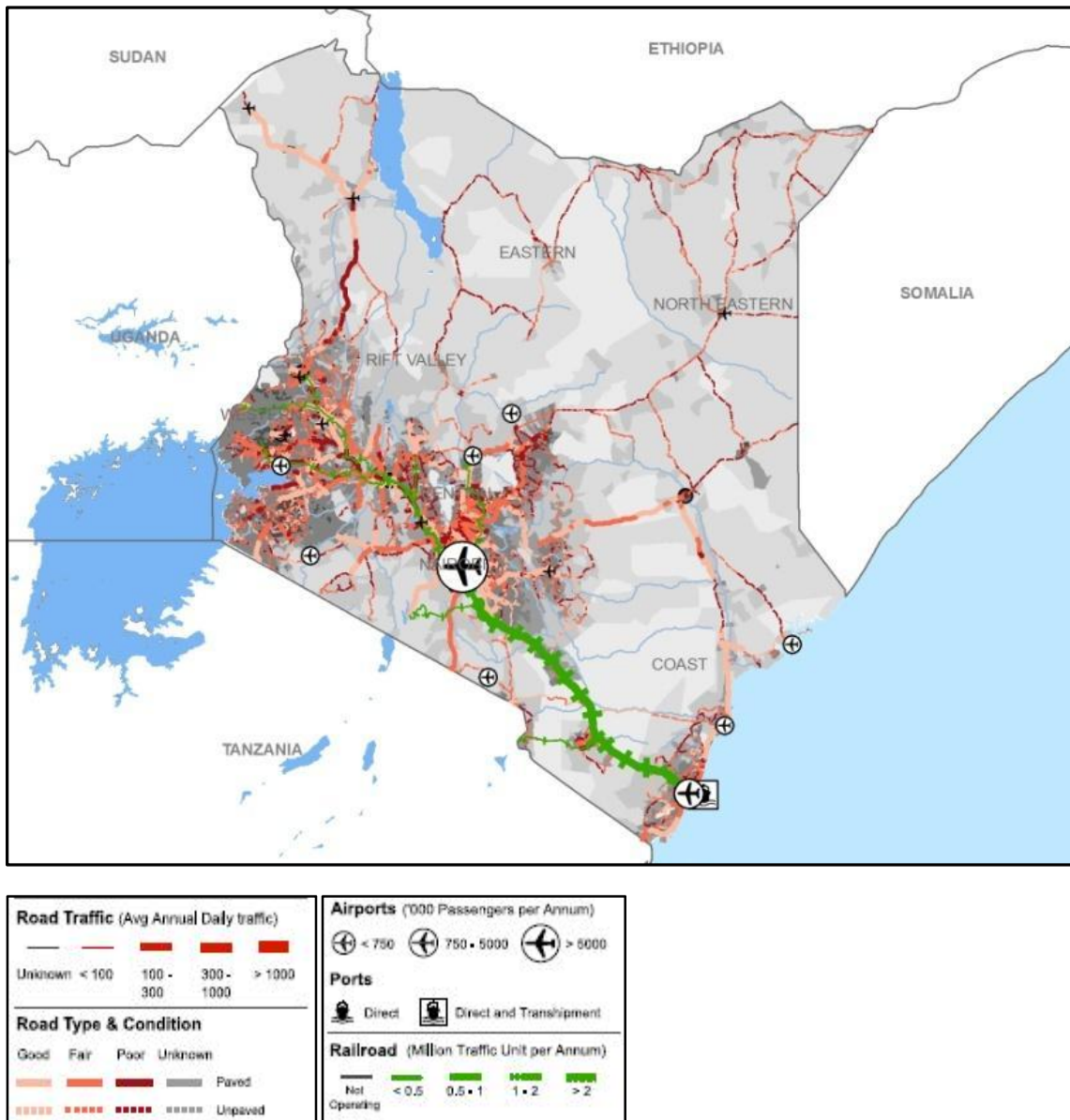
The LAPSSSET Corridor Development Authority also falls under the Ministry.

The existing infrastructure includes:

1. A sea-port at Mombasa;
2. International, national, urban and rural roads;
3. International and national airports;
4. A metre gauge railway line from Mombasa through Nairobi to Uganda, with a number of branch lines and a standard gauge railway running from Mombasa to Nairobi; and,
5. A fuel pipeline from Mombasa through Nairobi to Eldoret and Kisumu.

There is limited inland water transport in Lake Victoria. The transport infrastructure is concentrated in the south – western quadrant and along the Northern Transport Corridor (NC), which is the backbone of Kenya’s transport network (Figure 4.1).

**Figure 4.1: Transport Infrastructure Map**



Source of map: AICD Interactive Infrastructure Atlas for Kenya downloadable from: [http://www.infrastructureafrica.org/aicd/system/files/ken\\_new\\_ALL.pdf](http://www.infrastructureafrica.org/aicd/system/files/ken_new_ALL.pdf)

### 4.3 Institutional Framework of the Roads Sector

Under the 2010 Constitution of Kenya, the central government is to be tasked with the management of the national trunk roads while the 47 devolved units are to manage the county roads. The 2010 Constitution of Kenya however does not define the criteria for distinguishing between national and county roads. This has been defined in the Kenya Roads Bill 2015 which subdivides the roads into 15 different classes (Tables 4.1 and 4.2). The bill assigns seven road classes to the National Government and the remaining eight classes to the County governments.

Table 4.1 below summarises the new classification as per the gazette road register of January 2016.

**Table 4.1: Classification of Kenya’s Road Network**

| Functional System | Level Of Service Provided  | Rural Road Class | Urban Road Class |
|-------------------|--|------------------|------------------|
| <b>Arterial</b>   | Provides the highest Level of Service at the greatest permissible speed for the longest uninterrupted distance, with total control of access   | S                | -                |
|                   |  | A                | UA               |
|                   |  | B                | UB               |
| <b>Collector</b>  | Provides a lower Level of Service than arterial roads at lower permissible speeds over shorter distances, with limited access control. Meant to collect traffic from local roads and connect it with arterials | C                | UC               |
|                   |  | D                | L                |
| <b>Local</b>      | Consists of all roads not defined as arterials or collectors; primarily provides access to residential, commercial, agricultural or industrial areas with little, or no, through movement                      | E                | M                |
|                   |  | F                | N                |
|                   |  | G                | P                |

Source: Gazette Road Register (January 2016)

The detailed functional classification as per the Kenya Roads Bill 2015 is as presented in the table below.

**Table 4.2: Functional Classification of Kenya's Road Network**

| Category                       | Class | Description   |
|--------------------------------|-------|---|
| Primary National Trunk Roads   | S     | Highways connecting two or more cities meant to carry safely a large volume of traffic at the highest legal speed of operation.   |
|                                | A     | Roads forming strategic routes and corridors, connecting international boundaries at identified immigration entry and exit points and international terminals such as international air or sea ports.   |
|                                | B     | Roads forming important national routes, linking national trading or economic hubs, County headquarters and other nationally important centres to each other and to the national capital or to Class A roads.   |
|                                | H     | Urban major arterials highways meant to carry through traffic and relatively long distance traffic between widely separated parts of the city or municipality. They are required to provide mobility within an urban area as opposed to access.   |
|                                | J     | Minor arterials meant to carry traffic between different zones of the urban area and include the principal urban bus routes. They shall include, roads within economic zones that are planned by the National Government and roads within State Houses and Lodges including their access roads. They are required to provide mobility as opposed to access. |
| Secondary National Trunk Roads | C     | Roads forming important regional routes, linking County headquarters or other regionally important centres, to each other and to Class A or B roads. Required to collect regional and local traffic and channel it to class A and B roads.  |
| County Roads                   | D     | Roads linking constituency headquarters, Municipal or Town Council Centres and other towns to each other and to higher class roads. Required to collect local traffic from lower class roads and channel it to the higher class roads.  |
|                                | E     | Major Feeder Roads linking important Constituency centres to each other and meant to carry local traffic and to channel it to class D roads.  |
|                                | F     | Minor Feeder Roads linking Market Centres to each other. Meant to carry and to channel it to class E roads.   |
|                                | G     | Roads linking farms to markets and meant to carry farm produce and farm inputs traffic to and from the markets  |
|                                | K     | Urban major collector roads meant to collect traffic from the local roads and channel it to the major and minor arterial roads. The roads are meant to provide for both mobility and access.  |
|                                | L     | Urban minor collector roads meant to perform a similar function as the class K roads i.e. to collect traffic from the local roads and channel it to the arterial roads, but in a smaller catchment's area meant to collect traffic from the local roads and channel it to class K roads. The roads are meant to provide both mobility and access.           |
|                                | M     | Main business and shopping streets in the urban areas meant to provide access to commercial properties and residential areas and also cater for a high level of pedestrian traffic.   |
|                                | N     | Provide direct access to individual or group of properties, and residential areas, or to places of specific social or economic activity, including industrial and commercial areas and government institutions such as school, hospital, prisons and government housing.  |
|                                | P     | Provide direct access to groups of residential properties. This is the lowest class of public roads and therefore Class P roads will provide all other public access (e.g. access to social amenities such as schools, hospitals etc.) not provided by higher class roads.  |

Source: Kenya Roads Bill 2015

According to the bill, *National Trunk Roads* shall be defined as existing or proposed major roads linking Kenya with international borders (at identified entry and exit immigration points), main roads linking county headquarters, primary roads linking all sub-county headquarters and urban roads providing through traffic in cities and municipalities. This also includes roads that cross county boundaries, or provide service to the upper tier of the road network (Classes S, A, B and C). All other Roads are classified as *County Roads* (Classes D, E and other roads).

All the 47 County Governments have now prepared their County Integrated Development Plans (CIDPs), which have taken into account the provisions of the Constitution of Kenya 2010, Vision 2030 and its Medium-Term Plans, and the County Development Profiles (CDPs). The CIDPs contain each County's road development and maintenance priorities, among other devolved functions.

#### **4.3.1 State Department for Infrastructure**

This is one of state departments falling under the MOTIH&UD. It is responsible for amongst others: 1) Development of policy for national roads; 2) Development, standardization and maintenance of roads; 3) Mechanical and transport services; 4) Enforcement of axle load control; 5) Materials testing and advice on usage; 6) Maintenance of security roads; 7) Protection of road reserves; 8) Registration of Engineers; 9) Registration of road contractors; and, 10) Development and maintenance of air strips.

It is responsible for several institutions including: - Kenya Institute of Technology; KRB, KeNHA, KURA, KeRRA, KIHBT and Engineers Board of Kenya.

#### **4.3.2 Kenya Roads Board**

KRB was established through Kenya Roads Board Act of 1999. It is tasked with the following mandates: - 1) Administering the Road Maintenance Levy Fund (RMLF); 2) Coordinating the development, rehabilitation and maintenance of the road network; 3) Coordinating the implementation of all policies relating to the development, rehabilitation and maintenance of the road network; 4) Determine the optimal allocation of the RMLF funds or to the road agencies; 5) Monitoring the development, rehabilitation and maintenance of the Kenyan road network by the road authorities.

#### **4.3.3 Road Agencies**

The management of the road network comes under different Agencies. Table 4.3 gives the functional classes of the roads and the Agencies responsible.

**Table 4.3: Mandate and Agencies Responsible for Various Classes of Roads**

| Road Agencies                             | Mandate   | Classes    |
|---|---|------------|
| Kenya National Primary Highways Authority | Management, development, rehabilitation and maintenance of primary national trunk roads   | S, A and B |
| Kenya National Secondary Roads Authority  | Management, development, rehabilitation and maintenance of secondary national trunk roads | C          |
| Kenya National Urban Roads Authority      | Management, development, rehabilitation and maintenance of primary national trunk roads   | H and J    |

Source: Kenya Roads Bill 2015

#### 4.3.4 County Governments

The 47 devolved county governments are responsible for the management of the County Road network which is made up of road classes E and other roads.

#### 4.3.5 Nairobi Metropolitan Transport Authority

The authority is mandated to oversee the design, implementation and development of an integrated Mass Rapid Transit Network to fulfil the identified overall transport guidelines as set out, for example, in the Integrated National Transport Policy. NAMATA is to be in charge of the implementation of an integrated transport network for Nairobi and the bordering counties including Machakos, Kajiado, Murang'a and Kiambu. Based on the confirmed urban development and the resulting traffic demand, this would then result in one harmonized MRTS network, including the identification of the most appropriate mode(s). Once the MRTS network and its implementation have been approved, future projects must follow the established, standardized planning principles and technical parameters.

### 4.4 Kenya's Road Network

The road network under the jurisdiction of the various Road Agencies are given in Table 4.4.

**Table 4.4: Road Network under the Agencies**

| Sub-Network                              | Length (km) | Total Length (km) | Proportion (%) |
|--|-------------|-------------------|----------------|
| National Primary Trunk Roads (NPTR)      | 7,729       | 18,220            | 11             |
|  | 10,491      |                   |                |
| National Secondary Trunk Roads (NSTR)    | 19,529      | 19,529            | 12             |
| National Primary Urban Roads (NPUR)      | 2,620       | 2,620             | 2              |
| County Roads                             | 114,286     | 114,286           | 71             |
| Roads within Wildlife Conservation Areas | 6,562       | 6,562             | 4              |
| <b>Grand Total</b>                       |             | <b>161,217*</b>   | <b>100</b>     |

\*The above total network of 161,217km is less by about 234km against the gazetted total network length of 161,451km because it excludes parts of the LAPSET corridor, which are not yet developed.

About 71% of the total network has been assigned to the counties followed by National Secondary Trunk Roads (NSTR) and National Primary Trunk Roads (NPTR) at 12.2% and 11.3% respectively.

The surface types of the paved and unpaved segments of the road network are given in Table 4.5.

**Table 4.5: Road Network by Surface Type by Length**

| Sub-Network                              | Surface Type (km)       |                      |               |                |               | Total (km)     |
|--|-------------------------|----------------------|---------------|----------------|---------------|----------------|
|  | Asphaltic Concrete (AC) | Surface Treated (ST) | Gravel (G)    | Earth (E)      | Concrete (Co) |                |
| National Primary Trunk Roads             | 6,297                   | 2,677                | 9,100         | 147            | -             | 18,220         |
| National Secondary Trunk Roads           | 765                     | 3,157                | 3,859         | 11,748         | -             | 19,529         |
| National Primary Urban Roads             | 947                     | 220                  | 246           | 1,199          | 8             | 2,620          |
| County Roads                             | 2,452                   | 6,897                | 17,796        | 87,338         | 39            | 114,286        |
| Roads within Wildlife Conservation Areas | -                       | 8                    | 1,461         | 5,093          | -             | 6,562          |
| <b>Total</b>                             | <b>10,460</b>           | <b>12,958</b>        | <b>32,462</b> | <b>105,525</b> | <b>47</b>     | <b>161,217</b> |

Out of these total road network, almost 137,987km (85%) is unpaved, the paved segment is 24,257.9 km (15%) as per Table 4.6. Table 4.6 gives the percentages by surface types.

**Table 4.6: Percentage by Surface Type**

| Surface Type            | Length (km)    | Percentage (%) |
|-------------------------|----------------|----------------|
| Asphaltic Concrete (AC) | 10,460         | 7              |
| Surface Treated (ST)    | 12,958         | 8              |
| Gravel (G)              | 32,462         | 20             |
| Earth (E)               | 105,525        | 65             |
| Concrete (Co)           | 47             | 0.03           |
| <b>Total</b>            | <b>161,217</b> | <b>100</b>     |

From tables 4.5 and 4.6, the Kenya road network is basically unpaved. The strategy analysis will take into consideration the upgrading of the large segment of the unpaved segment of the network to paved. It will also look into the maintenance of the existing paved and the unpaved roads based on their current condition.

#### 4.5 Condition of the Road Network

The condition mix of the road network by agencies have been computed based on the following assumptions give in Table 4.7. This will simplify the estimation of the entire road network.

**Table 4.7: Assumptions for Condition Mix Computation**

| Condition                 | Assumption | Remarks   |
|---------------------------|------------|---|
| B Bad<br>B Very<br>B Poor | Poor       | Ride very rough and very uncomfortable. Unpaved roads are impassable except by 4WDs |
| B Fair                    | Fair       | Moderate roughness with slightly uncomfortable ride                                 |
| B Good<br>B Excellent     | Good       | Ride very smooth and very comfortable   |

All the road links which were not assigned any condition in the databases from the road agencies were assumed to be poor.

#### 4.5.1 National Primary Trunk Roads (NPTR) Road Condition Mix

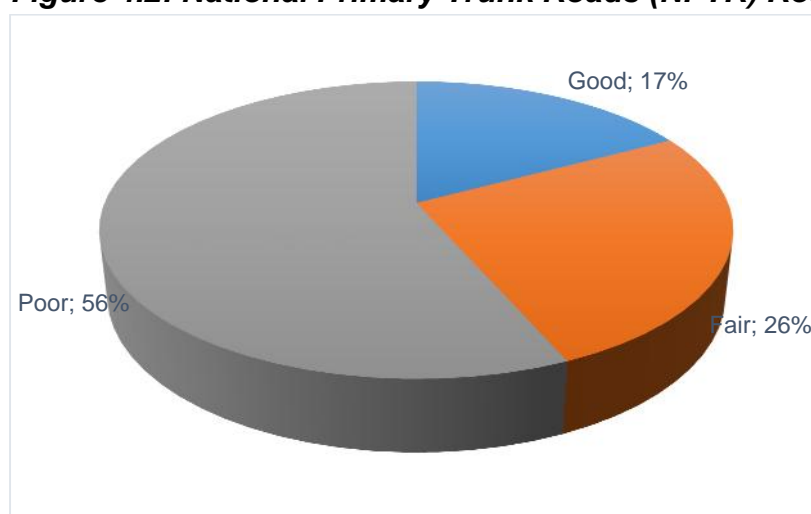
The road condition as computed for NPTR road network is given in Table 4.8.

**Table 4.8: Road Condition Mix of NPTR Network**

| Surface Type            | Total Length (km) | Good         |           | Fair         |           | Poor         |           |
|-------------------------|-------------------|--------------|-----------|--------------|-----------|--------------|-----------|
|                         |                   | km           | %         | km           | %         | km           | %         |
| Asphaltic Concrete (AC) | 6,297             | 5,813        | 92        | 340          | 5         | 144          | 2         |
| Surface Treated (ST)    | 2,677             | 2,224        | 83        | 40           | 1         | 412          | 15        |
| Gravel (G)              | 9,100             | 1,004        | 11        | 2,231        | 25        | 5,866        | 64        |
| Earth E                 | 147               | -            | 0         | -            | 0         | 147          | 100       |
| Concrete (Co)           | -                 | -            | 0         | -            | 0         | -            | 0         |
| <b>Total</b>            | <b>18,220</b>     | <b>9,041</b> | <b>50</b> | <b>2,610</b> | <b>14</b> | <b>6,569</b> | <b>36</b> |

From Table 4.8 the road condition mix of NPTR network is 50% Good; 14% Fair and 36% Poor. This is presented in Figure 4.2 as a pie chart.

**Figure 4.2: National Primary Trunk Roads (NPTR) Road Condition Mix**



#### 4.5.2 National Secondary Trunk Roads (NSTR) Road Condition Mix

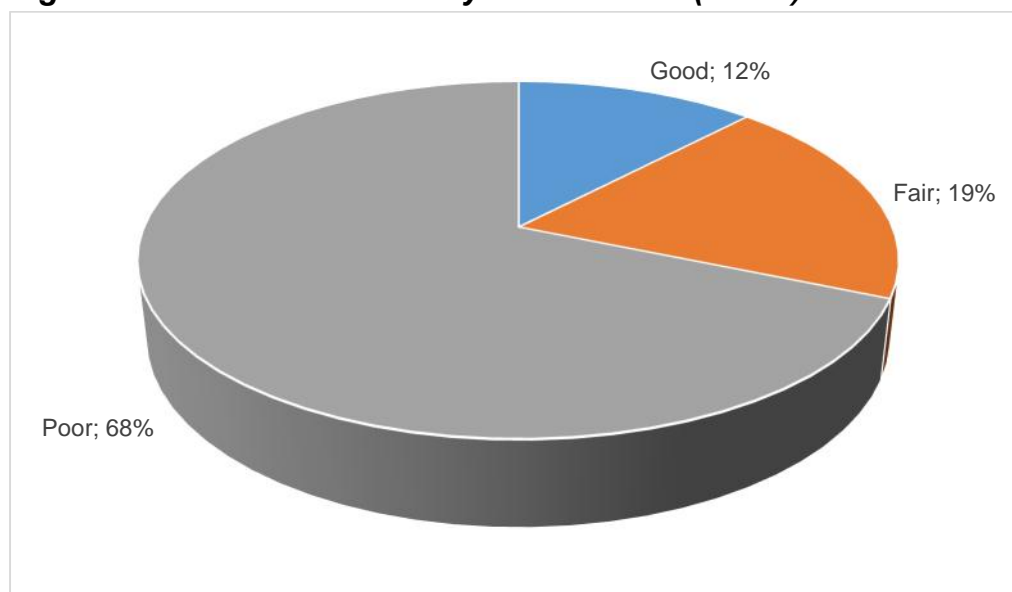
The road condition of NSTR is computed and presented in Table 4.9.

**Table 4.9: Road Condition Mix of NSTR Network**

| Surface Type            | Total Length (km) | Good         |           | Fair         |           | Poor         |           |
|-------------------------|-------------------|--------------|-----------|--------------|-----------|--------------|-----------|
|                         |                   | km           | %         | km           | %         | km           | %         |
| Asphaltic Concrete (AC) | 765               | 598          | 78        | 142          | 19        | 25           | 3         |
| Surface Treated (ST)    | 3,157             | 3,006        | 95        | 45           | 1         | 106          | 3         |
| Gravel (G)              | 3,859             | 919          | 24        | 2,328        | 60        | 613          | 16        |
| Earth E                 | 11,748            | 610          | 5         | 7,068        | 60        | 4,070        | 35        |
| Concrete (Co)           | -                 | -            | 0         | -            | 0         | -            | 0         |
| <b>Total</b>            | <b>19,529</b>     | <b>5,133</b> | <b>26</b> | <b>9,582</b> | <b>49</b> | <b>4,814</b> | <b>25</b> |

The condition mix of roads under NSTR is 26% Good; 49% Fair; 25% Poor. Total of 11,784km of NSTR portfolio are earth road representing 60% of the total network.

**Figure 4.3: National Secondary Trunk Roads (NSTR) Road Condition Mix**



#### 4.5.3 National Primary Urban Roads (NPUR) Road Condition Mix

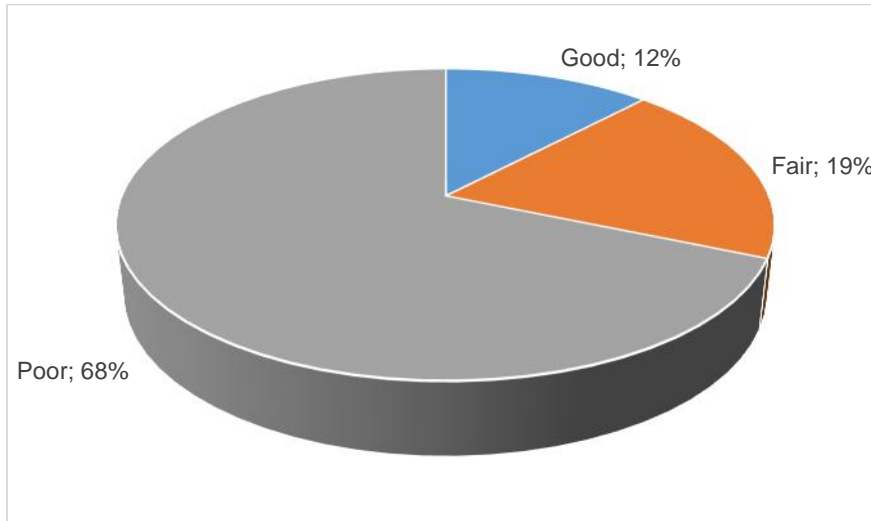
Road condition mix for NPUR is computed and presented in Table 4.10.

**Table 4.10: Road Condition Mix of NPUR Network**

| Surface Type            | Total Length (km) | Good       |          | Fair         |           | Poor     |          |
|-------------------------|-------------------|------------|----------|--------------|-----------|----------|----------|
|                         |                   | km         | %        | km           | %         | km       | %        |
| Asphaltic Concrete (AC) | 947               | 54         | 6        | 893          | 94        | -        | 0        |
| Surface Treated (ST)    | 220               | 51         | 23       | 169          | 77        | -        | 0        |
| Gravel (G)              | 246               | 37         | 15       | 209          | 85        | -        | 0        |
| Earth E                 | 1,199             | 10         | 1        | 1,189        | 99        | -        | 0        |
| Concrete (Co)           | 8                 | 5          | 0        | 3            | 0         | -        | 0        |
| <b>Total</b>            | <b>2,620</b>      | <b>157</b> | <b>6</b> | <b>2,463</b> | <b>94</b> | <b>-</b> | <b>0</b> |

The condition mix for NPUR network is 6% Good and 94% Fair. The paved segment of the network is 1,175km representing 45% and the remaining unpaved account for 55%.

**Figure 4.4: National Primary Urban Roads (NPUR) Road Condition Mix**



**4.5.4 Roads within Wildlife Conservation Areas Road Condition Mix**

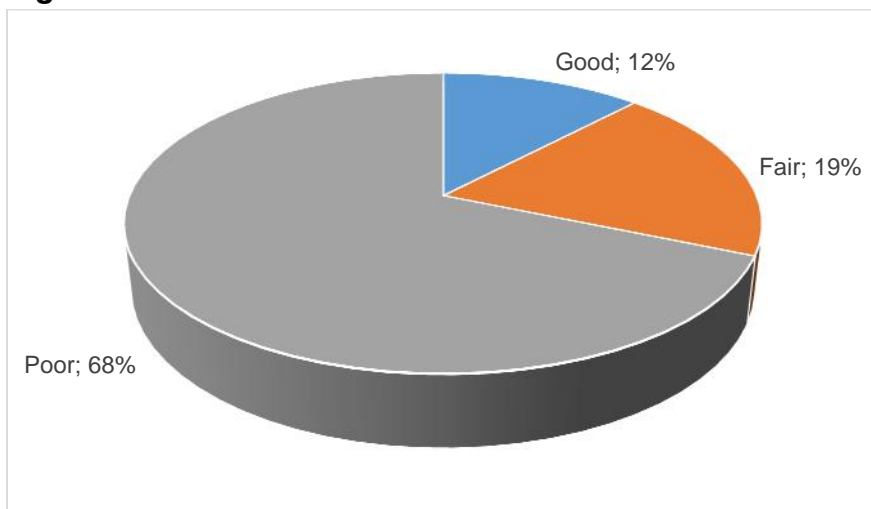
The road condition mix for Roads within Wildlife Conservation Areas is computed and presented in Table 4.11.

**Table 4.11: Road Condition Mix of Roads within Wildlife Conservation Areas Network**

| Surface Type            | Total Length (km) | Good     |          | Fair         |           | Poor       |           |
|-------------------------|-------------------|----------|----------|--------------|-----------|------------|-----------|
|                         |                   | km       | %        | km           | %         | km         | %         |
| Asphaltic Concrete (AC) | -                 | -        | 0        | -            | 0         | -          | 0         |
| Surface Treated (ST)    | 8                 | -        | 0        | 8            | 0         | -          | 0         |
| Gravel (G)              | 1,461             | -        | 0        | 1,308        | 90        | 153        | 10        |
| Earth E                 | 5,093             | -        | 0        | 4,360        | 86        | 732        | 14        |
| Concrete (Co)           | -                 | -        | 0        | -            | 0         | -          | 0         |
| <b>Total</b>            | <b>6,562</b>      | <b>-</b> | <b>0</b> | <b>5,676</b> | <b>87</b> | <b>886</b> | <b>13</b> |

Almost the entire road network of Roads within Wildlife Conservation Areas is unpaved with 13% in poor condition and the remaining 87% in fair condition.

**Figure 4.5: Roads within Wildlife Conservation Areas Road Condition Mix**



#### 4.5.5 County Road Condition Mix

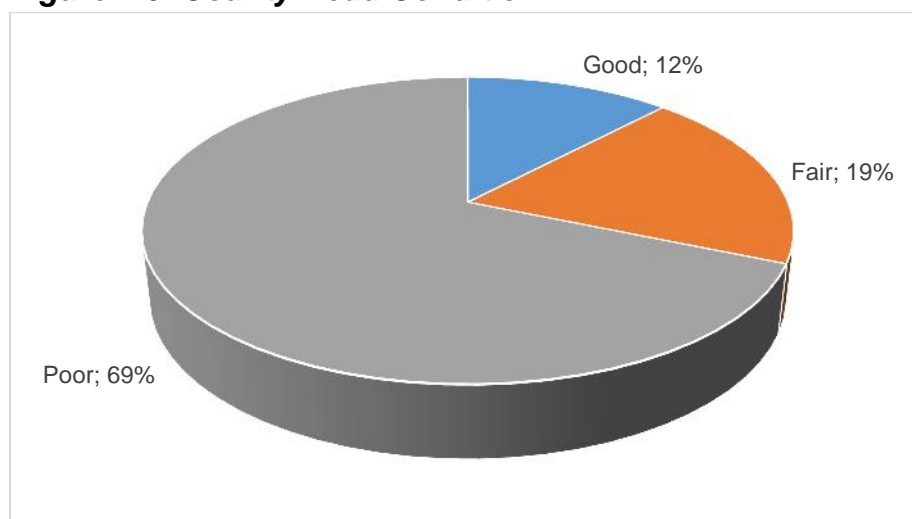
The road condition mix for County road network is computed and presented in Table 4.12.

**Table 4.12: Road Condition Mix of County Network**

| Surface Type            | Total Length (km) | Good          |           | Fair          |           | Poor          |           |
|-------------------------|-------------------|---------------|-----------|---------------|-----------|---------------|-----------|
|                         |                   | km            | %         | km            | %         | km            | %         |
| Asphaltic Concrete (AC) | 2,452             | 2,145         | 87        | 95            | 4         | 212           | 9         |
| Surface Treated (ST)    | 6,897             | 6,531         | 95        | 146           | 2         | 219           | 3         |
| Gravel (G)              | 17,796            | 2,227         | 13        | 10,769        | 61        | 4,801         | 27        |
| Earth E                 | 87,338            | 2,814         | 3         | 11,118        | 13        | 73,405        | 84        |
| Concrete (Co)           | 39                | 26            | 0         | -             | 0         | 13            | 0         |
| <b>Total</b>            | <b>114,286</b>    | <b>13,744</b> | <b>12</b> | <b>22,128</b> | <b>19</b> | <b>78,649</b> | <b>69</b> |

Almost the entire road network (92%) of the County is unpaved with 12% in poor condition and 19% in fair condition and the remaining 69% in poor condition.

**Figure 4.6: County Road Condition Mix**



#### 4.5.6 Combined Road Condition Mix

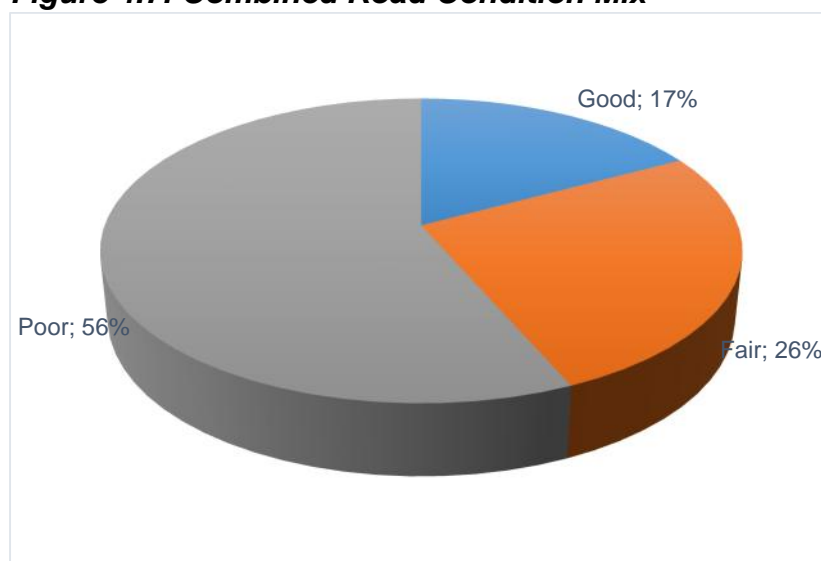
From the above computations, the national road condition mix is summarized in Table 4.13.

**Table 4.13: Combined Road Condition Mix**

| Sub-network                              | Total Length (km) | GOOD          |           | FAIR          |           | POOR          |           |
|--|-------------------|---------------|-----------|---------------|-----------|---------------|-----------|
|  |                   | km            | %         | km            | %         | km            | %         |
| National Primary Trunk Roads (NPTR)      | 18,220            | 9,041         | 50        | 2,610         | 14        | 6,569         | 36        |
| National Secondary Trunk Roads (NSTR)    | 19,529            | 5,133         | 26        | 9,582         | 49        | 4,814         | 25        |
| National Primary Urban Roads (NPUR)      | 2,620             | 157           | 6         | 2,463         | 94        | -             | 0         |
| County                                   | 114,286           | 13,744        | 12        | 22,128        | 19        | 78,649        | 69        |
| Roads within Wildlife Conservation Areas | 6,562             | 0             | 0         | 5,676         | 87        | 886           | 13        |
| <b>Combined</b>                          | <b>161,217</b>    | <b>28,075</b> | <b>17</b> | <b>42,459</b> | <b>26</b> | <b>90,918</b> | <b>56</b> |

The overall combined road network condition is at 17% Good; 26% Fair and 56% Poor (Figure 4.7 below). The strategy analysis will be based on this condition mix.

**Figure 4.7: Combined Road Condition Mix**



The condition mix of the various road surface types as at 2017 is given in Table 4.14.

**Table 4.14: 2016 Road Network Condition Mix based on Surface Type**

| Surface Type            | Total Length (km) | Good          |           | Fair          |           | Poor          |           |
|-------------------------|-------------------|---------------|-----------|---------------|-----------|---------------|-----------|
|                         |                   | km            | %         | km            | %         | km            | %         |
| Asphaltic Concrete (AC) | 10,460            | 8,611         | 82        | 1,469         | 14        | 381           | 4         |
| Surface Treated (ST)    | 12,958            | 11,812        | 91        | 409           | 3         | 737           | 6         |
| Gravel (G)              | 32,462            | 4,186         | 13        | 16,844        | 52        | 11,433        | 35        |
| Earth E                 | 105,525           | 3,434         | 3         | 23,736        | 23        | 78,355        | 74        |
| Concrete (Co)           | 47                | 32            | 67        | 3             | 6         | 13            | 27        |
| <b>Total</b>            | <b>161,217</b>    | <b>28,075</b> | <b>17</b> | <b>42,459</b> | <b>26</b> | <b>90,918</b> | <b>56</b> |

Condition mix of the unclassified and classified roads – based on their functional classes as at 2016 is given in Table 4.15 below.

**Table 4.15: 2016 Road Network Condition Mix**

| Road Class   | Total Length (km) | Good          |           | Fair          |           | Poor          |           |
|--------------|-------------------|---------------|-----------|---------------|-----------|---------------|-----------|
|              |                   | km            | %         | km            | %         | km            | %         |
| A            | 7,729             | 4,259         | 55        | 406           | 5         | 3,065         | 40        |
| B&C          | 10,491            | 4,782         | 46        | 2,204         | 21        | 3,505         | 33        |
| D&E          | 140,612           | 18,877        | 14        | 37,387        | 27        | 84,349        | 60        |
| Others       | 2,620             | 157           | 6         | 2,463         | 94        | -             | 0         |
| <b>Total</b> | <b>161,217</b>    | <b>28,075</b> | <b>17</b> | <b>42,459</b> | <b>26</b> | <b>90,918</b> | <b>56</b> |

#### 4.5.7 Infrastructure Density Distribution

Kenya has a road density of 271 km per 1,000 sq. km, which is higher than that of Tanzania of 92 km/1,000 sq. km, Ethiopia's 57 km/1,000 sq. km but lower than that of Uganda which is 323 km/1,000 sq. km.

According to the network data as of 2016, the road network is as presented below (see Table 4.16).

**Table 4.16: Road Network Distribution by Agency**

| Sub-network                              | Road Class                                    | Paved         |           | Unpaved        |           | Total (km)     |
|--|---|---------------|-----------|----------------|-----------|----------------|
|  |   | (km)          | %         | (km)           | %         |                |
| National Primary Trunk Roads (NPTR)      | A, B and C                                    | 8,973         | 49        | 9,247          | 51        | 18,220         |
| National Secondary Trunk Roads (NSTR)    | D, E and Others                               | 3,922         | 20        | 15,607         | 80        | 19,529         |
| National Primary Urban Roads (NPUR)      | Urban roads                                   | 1,175         | 45        | 1,445          | 55        | 2,620          |
| County                                   | D, E and Others                               | 9,387         | 8         | 105,134        | 92        | 114,521        |
| Roads within Wildlife Conservation Areas | Roads within national parks and game reserves | 8             | 0         | 6,554          | 100       | 6,562          |
| <b>Total</b>                             |   | <b>23,465</b> | <b>15</b> | <b>137,752</b> | <b>85</b> | <b>161,217</b> |

#### 4.6 Road Sector Investment Programme - RSIP1 (2010 – 2014)

As mandated by the Kenya Roads Act 2007, Kenya Roads Board (KRB) finalized the Road Sector Investment Programme (RSIP 2010 – 2024) in 2011 to guide the development and maintenance of the road sector. The main purpose of the RSIP was “to provide good roads for a globally competitive and prosperous Kenya”. Its specific objective was to detail country’s road network infrastructure development and maintenance needs for the medium and the long-term future.

The investment plan had road asset preservation, through routine and periodic maintenance, as its first priority; road asset restoration, through rehabilitation and reconstruction of failed road sections, as its second priority; and road improvement and development, through upgrading, capacity improvements and new construction as its third priority. The RSIP investment plan is presented in Table 4.17.

**Table 4.17: RSIP 1**

| Source of Funding        | Work Type                   | Surface Class | 2010-2014      |                | 2015-2019      |                | 2020-2024      |                  |
|--------------------------|-----------------------------|---------------|----------------|----------------|----------------|----------------|----------------|------------------|
|                          |                             |               | Km             | KSh. mn        | Km             | KSh. mn        | Km             | KSh. mn          |
| RMLF                     | Routine                     | Paved         | 11,197         | 12,645         | 16,361         | 14,387         | 28,150         | 22,772           |
|                          |                             | Unpaved       | 149,689        | 56,319         | 160,752        | 63,685         | 161,408        | 60,003           |
|                          | Periodic                    | Paved         | 4,738          | 71,914         | 10,226         | 153,384        | 17,530         | 262,948          |
|                          |                             | Unpaved       | 2,091          | 7,291          | 4,577          | 18,308         | 3,662          | 14,647           |
|                          | Rehabilitation              | Paved         |                |                | 266            | 26,570         |                |                  |
| Road management issues   | HQ                          |               | 11,035         |                | 12,500         |                | 12,500         |                  |
| <b>RMLF Total</b>        |                             |               | <b>167,715</b> | <b>159,204</b> | <b>192,181</b> | <b>289,834</b> | <b>210,749</b> | <b>372,870</b>   |
| Development              | Rehabilitation              | Paved         | 3,936          | 132,599        |                |                |                |                  |
|                          |                             | Unpaved       |                |                | -              | -              |                |                  |
|                          | Upgrade to bitumen          | Unpaved       | 3,884          | 162,574        | 4,255          | 170,208        | 5,933          | 237,323          |
|                          | Upgrade to LVSR             | Unpaved       | 1,174          | 17,620         | 5,668          | 85,013         | 7,280          | 109,206          |
|                          | Capacity Improvement        | Paved         | 81             | 31,719         | 190            | 57,000         | 240            | 72,000           |
|                          | New road construction       | Unpaved       | 206            | 26,771         | 600            | 50,000         | 700            | 47,500           |
|                          | Bridges                     | Unpaved       |                |                |                | 2,679          |                | 4,094            |
|                          | Public Transport Facilities | HQ            |                | 850            |                |                |                |                  |
|                          | Separate NMT facilities     | HQ            |                | 700            |                | 1,500          |                | 750              |
|                          | Trunk Storm-water Drainage  | HQ            |                | 650            |                | 1,500          |                | 1,500            |
| Proposed development     | HQ                          |               | 4,892          |                | 25,000         |                | 25,000         |                  |
| <b>Development Total</b> |                             |               | <b>9,281</b>   | <b>378,375</b> | <b>10,713</b>  | <b>392,900</b> | <b>14,153</b>  | <b>497,373</b>   |
| PPP                      | Capacity Improvement        | Paved         | 106            | 67,000         | 150            | 94,811         | 150            | 94,811           |
|                          | New road construction       | Paved         |                |                | 150            | 22,500         | 400            | 60,000           |
|                          | Public Transport Facilities | HQ            |                |                |                | 10,000         |                | 30,000           |
| <b>PPP Total</b>         |                             |               | <b>106</b>     | <b>67,000</b>  | <b>300</b>     | <b>127,311</b> | <b>550</b>     | <b>184,811</b>   |
| <b>Grand Total</b>       |                             |               | <b>177,102</b> | <b>604,579</b> | <b>203,194</b> | <b>809,046</b> | <b>225,452</b> | <b>1,055,626</b> |

Source: RSIP 2010 – 2024, GoK

The first phase of the RSIP, RSIP 1, ended in 2015. RSIP 1 gave priority to routine maintenance of the entire road network and planned periodic maintenance of the paved network. It was expected to reduce maintenance backlog in the classified paved network. The Table 4.18 below summarises the overall change in road condition matrix over the implementation period.

**Table 4.18: Change in Network Condition**

| Description | Road Condition in 2009 | Road Condition in 2016 |
|-------------|------------------------|------------------------|
| Good        | 11%                    | 17%                    |
| Fair        | 33%                    | 26%                    |
| Poor        | 56%                    | 56%                    |

The planned major interventions and achievements are summarized in Table 4.19.

**Table 4.19: Status of Implementation of RSIP1**

| Source of Funding | Work Type                | RSIP1 Targets (km) | RSIP1 Achievement (km) | Progress (%) | Remarks                           |
|-------------------|--------------------------|--------------------|------------------------|--------------|-----------------------------------|
| RMLF              | 1. Routine               | 160,886            | 318,858                | 198%         |                                   |
|                   | 2. Periodic              | 6,829              | 6,005                  | 88%          |                                   |
| Development       | 3. Rehabilitation        | 3,936              | 1,433                  | 36%          |                                   |
|                   | 4. Upgrade to bitumen    | 3,884              | 1,719                  | 44%          |                                   |
|                   | 5. Upgrade to LVSR       | 1,174              | 0                      | 0%           | Most likely included in (4) above |
|                   | 6. Capacity Improvement  | 81                 | 0                      | 0%           | Most likely included in (3) above |
|                   | 7. New road construction | 206                | 0                      | 0%           | Most likely included in (3) above |
| PPP               | 8. Capacity Improvement  | 106                | 0                      | 0%           |                                   |
|                   | 9. New road construction | 0                  | 0                      | N/A          | Planned for 2015-19               |

Assumptions: - 1 lane-km = 0.5km

As tabulated above, the planned works under routine and periodic maintenance were generally achieved unlike those for development projects. These could be attributed to the steady increase in RMLF collection over the intervening period which ensured the availability of funds for maintenance.

Other achievements during the implementation period include:

1. The ongoing construction of Barabara plaza along Mombasa road;
2. Construction of 202km of footpaths within urban areas by KURA;
3. Mapping of road reserves for about 4,200km of roads;
4. Construction of 3 No. OSBP and rehabilitation of weighbridges by KeNHA; and,
5. Improvement management of roads e.g. axle load monitoring study (2012-2015) and nationwide traffic counts by KRB (2014).

None of the envisioned capacity improvement PPP projects took off during the intervening period, probably due to delayed operationalisation of the PPP laws to govern the sector.

Table 4.20 below summarises the planned flagship projects under RSIP1.

**Table 4.20: Status of RSIP1 Flagship Projects**

| No. | Intervention  | Status  |
|-----|---|---|
| 1   | Completion of the 8-lane Nairobi -Thika Highway   | Complete  |
| 2   | Completion of bypasses and missing links in Nairobi totaling 207 km new road construction, increasing that total paved road network to 16,525km | -Eastern Bypass (Complete)<br>-Northern and Southern bypasses (Complete)<br>-Western By-pass (Not yet started)<br>-Construction of the Ring Road Kilimani missing links (Complete)<br>-Construction of Eastern missing links (On-going) |
| 3   | Construction of Kisumu By-pass roads  | Complete  |
| 4   | Construction of Isiolo – Merille River road   | Complete  |
| 5   | Outer Ring Road dualling  | On-going  |
| 6   | Ngong’ road dualling from Uhuru Highway to Ngong’ town  | On-going  |
| 7   | Langata road dualling from Bomas to KWS gate  | Complete  |
| 8   | Construction of Dongo Kundu bypass  | Complete  |
| 9   | Construction of Nairobi Urban Toll road.  | Contract cancelled  |

The second Phase of RSIP was envisaged to focus on upgrading the remaining unpaved national network, improvement of the urban paved road network, and capacity improvement by upgrading economically viable unpaved roads. Also, important administrative centres were to be connected to the national road network with paved roads. The projects in this phase that are on-going/complete include:

- i) Paving of several urban roads in major towns (On-going);
- ii) Paving the Merrille River to Moyale (A2) road (Complete);
- iii) Machakos Turn-off – Athi River Dualling (On-going); and,
- iv) Upgrading of Mt. Kenya and Amboseli Game Park Roads (On-going).

Most of these projects have had enormous positive impacts upon completion including reduced travel times, reduced vehicle operating costs, improved local and/or regional trade, better access to markets, improved access to vital services, opening up remote areas, improved land/property values etc. This highlights the need for increased investments in the roads sub-sector.

## 5 Study Methodology

### 5.1 Approach

This chapter describes the technical approach and methodology used by the study team in the preparation of the RSIP.

The objectives of the assignment were twofold: (1) to improve the configuration and calibration of HDM-4 for use in Kenya; and, (2) in close consultation with the RSIP Task Force, develop a detailed medium term 5-year Road Sector Investment Programme (2017 – 2021) anchored on long term sector plans and national priorities.

The approach comprises seven project deliveries packaged into two phases below:

#### **Phase 1 – Project initiation, data review, HDM-4 configuration and Calibration and producing a customised HDM-4 Workspace:**

1. Inception and Data Mapping
2. Data Review and Collection
3. Determining Equivalent Standard Axle Load Factor and HDM-4 Configuration
4. Calibration of Road Deterioration and Work Effects Models
5. Customising HDM-4 Workspace

#### **Phase 2 – Developing HDM-4 Report Templates and producing the Road Sector Investment Programme (2018 – 2022):**

1. Developing Standardised HDM-4 Report Templates for Kenya
2. Developing Road Sector Investment Programme and Training

The delivery steps/tasks under each phase are discussed in subsequent sections. The proposed methodology also includes 5 gateway approvals and continued engagement and collaboration with KRB.

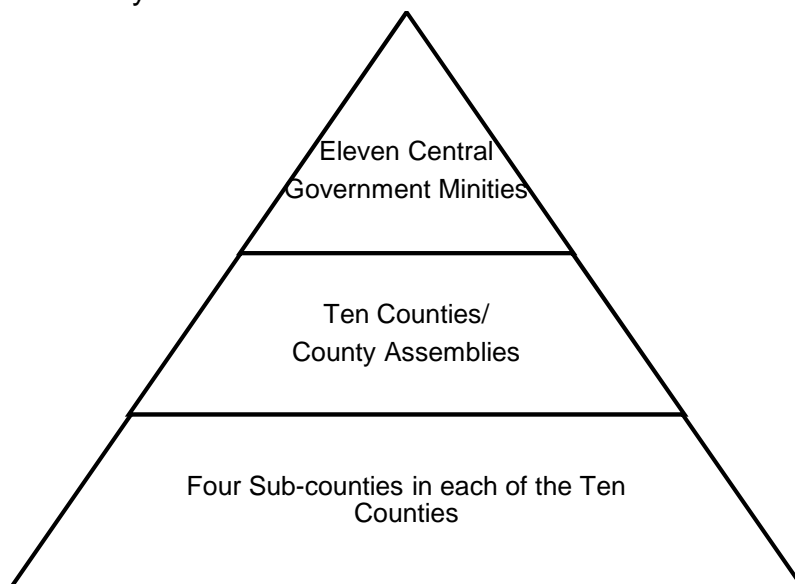
The study team applied modern experience and techniques in road management system development, and that encapsulated in road asset development and management technology, in order to provide a product that meets the aim and objectives of the study. For wider acceptance of the document, RSIP2 has also been developed in a participatory and consultative manner through the RSIP Task Force (TF), stakeholder consultations, workshops and retreats.

The RSIP TF is constituted with members selected from the following organizations: -

1. Ministry of Transport, Infrastructure, Housing & Urban Development (MOTIH&UD)
2. Ministry of Finance (MOF)
3. Kenya Roads Board (KRB)
4. Kenya National Highways Authority (KeNHA)
5. Kenya Rural Roads Authority (KeRRA)
6. Kenya Urban Roads Authority (KURA)
7. Kenya Wildlife Services (KWS)
8. Materials Testing and Research Department (MTRD)
9. Kenya Institute for Public Policy Research and Analysis (KIPPRA)

The development of RSIP2 also involved stakeholder consultations at both the national and county levels during the Multi-Criteria Analysis surveys. This has provided a unique insight into road investment impacts in road planning.

The study was conducted at three levels defined as follows:



The table below presents the data collection methods adopted at different levels including the objective of the data collection.

**Table 5.1: Data Collection and Summary Methodology**

| Level | Data collected from  | Data collection method  | Comments  |
|-------|--|---|---|
| Micro | Four sub-county communities: one off-road (or remote), one semi-remote, one on-road and one peri-urban from each county. | Focus group discussions (approximately 25-30 people). The group was represented by different social class, gender, age groups, people with physical disability, local chiefs, farmers, administrators, technicians and local professionals. The objective was to gather communities' perception on road investment impacts (benefits and costs) and to assess what weights they are prepared to attach to different types of impacts.<br><br>Both open and close ended questions were used. | <b>Off-road rural community –</b> Households having poor access to different services and facilities and at least 5 km away from an all-weather road. The access to services and facilities was interrupted during rainy season.<br><br><b>On-road rural community –</b> Households having uninterrupted year-round access to different services and facilities and the community was located on an all-weather road. |
| Meso  | Members of county assembly and county executives from the ten selected counties.   | Mainly structured interviews with both open and close ended questionnaires. The objective was to assess the county level decision makers' perception on different types of impacts (benefits and costs) and also to assess the weights they were prepared to attach to different types of impacts.  | Main focus of the interview was the Members of County Assembly and County Government officials and professionals.   |
| Macro | Central Government Officials (at different levels) from eleven selected ministries at their headquarters.                | Mainly structured interviews with both open and close ended questionnaires. The objective was to assess the strategic level decision makers' perception on different types of impacts and also to assess the weights they were prepared to attach to different type of impacts  | At least six officials (two each from low, middle and high levels) from each of the eleven government ministries were to participate.   |

## 5.2 Methodology and Assumptions for Economic Analysis

The purpose of road investment appraisal is to select projects with high economic returns. The purpose of an economic appraisal of road projects therefore is to determine how much to invest and what economic returns to expect. The size of the investment is determined by the costs of construction and annual road maintenance. The economic returns are mainly in the form of savings in road user costs due to the provision of a better road facility. These three costs together with other exogenous costs and benefits that can be directly attributed to the road project constitute what is commonly referred to as the total (road) transport cost or the whole life cycle cost. It is normal to consider such costs or benefits over an extended analysis period usually equal to a longer than the expected life of the road. For this assignment, the planning and analysis periods are 5 and 20 years, respectively.

In economic analysis costs and benefits are measured in monetary terms. All monetary values need to be expressed in economic (rather than financial) terms by

applying the standard conversion factor (SCF). Also, future costs and benefits are valued less as time progresses using the planning discount rate. Essentially, road construction and maintenance costs are compared with estimates of the direct primary benefits going to road users, using economic decision criteria including Net Present Value (NPV), Internal Rate of Return (IRR) and NPV/Capital Cost Ratio.

The primary benefits of road upgrading projects derive from: savings in maintenance expenditures; savings in vehicle operating costs; reduction in travel time to passengers and goods; reductions in the number and severity of accidents (however, due to lack of reliable road accident data this has not been considered in this assignment); salvage value of the road structure at the end of the analysis period; reduction in negative environmental effects and increase in value of goods moved.

The secondary benefits include: induced economic development, such as industrial, agricultural or tourist activities that were previously constrained by poor access; and, social benefits arising from the increased mobility of the population and improved accessibility to health, education and other services.

Economic analysis should be designed to give maximum coverage of costs and benefits. However, it is important to avoid double counting, that is, do not add primary and secondary benefits (e.g. increases in land values added to changes in transport costs). Secondary benefits are usually ignored. The Consumer surplus approach should be adequate for carrying out economic analysis.

### **5.3 Analytical Tools and Data Requirements**

#### **5.3.1 HDM-4**

The approach used for the economic analysis of roads is the cost-benefit analysis of “with” or “without project” case. The economic analysis is based on homogenous road sections, in terms of physical characteristics, traffic and road condition. HDM-4 was used as the analytical tool for this project. The HDM-4 analytical framework is based on the concept of pavement life cycle analysis, which is typically 15 to 40 years. This is applied to predict road deterioration, road works effects, road user effects and socio-economic and environmental effects, *Odoki and Kerali (2006)*. For this study, the economic analysis was conducted using HDM-4 Version 2.10.

Since HDM-4 is designed to be used in a wide range of environments, it needed to be configured to reflect the situation in Kenya. The data for this relates to traffic flows, climate zones and road types. Calibration is intended to improve the accuracy of predicted pavement performance and vehicle resource consumption. A fundamental assumption made prior to using HDM-4 is that the pavement performance models will be calibrated to reflect the observed rates of pavement deterioration on the roads where the models are applied.

The calibration data used were obtained from KRB and the National Road Authorities (KeNHA, KURA, KeRRA and KWS). The calibration data comprises calibration factors for road deterioration and road user effects models.

The main data sets required as inputs for HDM-4 analyses are categorised as follows:

1. *Road network data*: include inventory, geometry, pavement type, pavement strength, road condition
2. *Vehicle fleet data*: include vehicle physical characteristics, tyres, utilisation, loading and performance.
3. *Traffic data*: include details of traffic composition, volumes and growth rates, speed-flow types and traffic flow pattern.
4. *Road works data*: include a range of construction and maintenance work items together with their unit costs.
5. Economic analysis components and parameters

The sources of data used in the Study included the following: desk studies; KRB database; previous studies conducted in the study area; internet literature review; and, HDM-4 parameter default values.

#### **5.3.1.1 Road Network Data**

The road network is comprised of paved and unpaved. The paved roads are predominantly bituminous with surface treatment or asphalt concrete. The unpaved roads are predominantly gravel with some earth roads.

The road network structure adopted in this study is based on information from KRB and the National Road Authorities (KeNHA, KURA, KeRRA and KWS) databases. The roads were defined as a series of homogeneous road sections with unique characteristics. The major assumption made in this study was that the data used was reasonably accurate for this level of analysis. The overall confidence level in the project data used was qualitatively assessed and categorised as “Medium” for paved roads and “Low” for unpaved roads.

#### **5.3.1.2 Vehicle Fleet Data**

A representation of the vehicle fleet that for the whole country was based on grouping vehicles of similar characteristics and the types of goods they carry. This resulted in the following 10 vehicle types: (i) Cars (ii) Mini Bus (iii) Medium Bus (iv) Four-wheel Drives and Pick-up (v) Light Trucks (vi) Large Bus (vii) Medium Truck (viii) Heavy Truck (ix) Articulated Truck & Trailers and (x) Motorcycles.

The key vehicle fleet data used in this study, including time values and the economic values of vehicle resource consumption was obtained from KRB. HDM-4 default data were used where local data were not available. The values of non-work time and work time used in this study are based on international literature for the region. The

recommendation is that the same values should be used for all regions and transport modes in Kenya.

### 5.3.1.3 Traffic Data

The traffic data used in this study includes Annual Average Daily Traffic (AADT) and composition by vehicle types for each road section, and average traffic growth rate.

Three traffic growth scenarios were used:

- ) **Realistic growth (baseline)** – this traffic growth scenario considered the expected national economic growth trends as well as commercial and non-commercial developments. The annual growth rate is 6% for the first 10 years then reduces to 5% next 10 years.
- ) **Pessimistic Low growth** – this scenario assumes that traffic demand will be lower than the baseline growth rate by about 15%. The annual growth rate used is therefore 5% over the analysis period.
- ) **Optimistic High growth** – this scenario assumes that traffic demand will be higher than the baseline growth rate by about 15%. The growth rate used is therefore 6% per annum over the analysis period.

Table 5.2 summarises the adopted traffic growth rates.

**Table 5.2: Adopted Traffic Growth Rates (%) for RSIP2**

| Vehicle category              | Inter-urban Roads (A, B & C) |        |      | Minor Urban Roads |        |      | Rural Roads (D, E, SP) |        |      | Major Urban Roads/ Multilane Highways |        |      |
|-------------------------------|------------------------------|--------|------|-------------------|--------|------|------------------------|--------|------|---------------------------------------|--------|------|
|                               | Low                          | Medium | High | Low               | Medium | High | Low                    | Medium | High | Low                                   | Medium | High |
| Motorcycles                   | 3.9                          | 6.0    | 10.4 | 3.9               | 10.4   | 19.6 | 2.6                    | 3.9    | 10.0 | 9                                     | 11.0   | 19.6 |
| Cars                          | 3.9                          | 6.4    | 10.0 | 4.4               | 7.5    | 11.5 | 2.5                    | 4.4    | 8.4  | 10.0                                  | 11.0   | 11.5 |
| Pickup/Vans                   | 2.5                          | 5.8    | 10.4 | 2.5               | 6.8    | 10.4 | 1.3                    | 2.5    | 7.5  | 6.8                                   | 10.4   | 14   |
| Matatu/Minibus                | 3.5                          | 5.3    | 8.2  | 3.5               | 7.2    | 10.0 | 2.2                    | 3.5    | 7.8  | 7                                     | 12.0   | 14.5 |
| Buses                         | 3.5                          | 5.4    | 8.2  | 3.5               | 7.5    | 8.4  | 1.9                    | 3.5    | 7.5  | 3.5                                   | 7.5    | 12.0 |
| Trucks                        | 2.9                          | 5.6    | 7.8  | 3.5               | 5.7    | 8.4  | 1.9                    | 3.5    | 7.5  | 3.5                                   | 5.7    | 12.0 |
| Non-motorised Transport (NMT) | -                            | -      | -    | 2.9               | 4.3    | 6.0  | -                      | -      | -    | 2.9                                   | 4.3    | 6.0  |

Overloading on the network is an issue based on specific studies in the country. Regional freight traffic is usually carried in large double trailer, multi-axle combination, with a maximum Gross Vehicle Mass (GVM) as agreed. In order to preserve the road infrastructure and ensure reasonable usable life times, countries in the East Africa have generally agreed the axle load limits. In this study, the impacts of overloading on the network were not analysed as it falls outside the scope of work.

### 5.3.1.4 Road Works and Unit Costs

The primary source of road work types and the unit cost data was the national road authorities (KeNHA, KURA, KeRRA and KWS). Appendix C.1 presents the road work activities and the maintenance standard used for current and future periodic and routine maintenance. The unit costs of road works need to be specified in both economic and financial terms. The economic costs are used for calculating economic indicators and the financial costs are used for budgeting road authority expenditures. For road user costs, economic unit costs were specified for vehicle resource consumption and travel time.

### 5.3.1.5 Economic Analysis Components and Parameters

The study considered several periodic maintenance and improvement alternatives for each road section which were defined and each compared against the Base Case. Thus for each section, at least two alternatives were defined as follows:

- (i) *“Base Case” alternative*: aimed at preserving the existing asset using the present practice based on routine maintenance i.e. without project.
- (ii) *Periodic maintenance or improvement alternative*: aimed at resurfacing, rehabilitation, reconstruction, upgrading or capacity improvement.

For each project alternative, road work standards were defined in such a way that the objective of the alternative can be achieved. A work standard comprises one or more works item (e.g., overlay, reseal, patching), defined intervention criteria to determine the timing, design characteristics, the unit costs, and the after works effects.

### 5.3.1.6 Discount Rate and Analysis Period

The discount rate used for the analysis is 12 percent, and analysis period of 20 years starting from 2017, which was taken as the base year.

### 5.3.1.7 Salvage Value

By the end of the design life of the improved road most of the components would have low residual value. Earthwork (e.g. fills and cuts), culverts, bridges, etc. would have significant percentages of their values remaining. An assumption was made to estimate a salvage value of 10 percent of the investment cost for each road section.

### 5.3.1.8 Standard Conversion Factor

To convert financial costs into economic costs a standard conversion factor (SCF) of 0.85 was used in this Study. The SCF was derived from the following expression:

$$S = \frac{[B_{p v o a i r} + p b_{p v o a e.}]}{[(V_{o a i r} p a t i o i r) + (V_{o a e.} s m a t i o e.)]}$$

The SCF value of 0.85 was estimated using data on Kenya exports and imports from 2003 to 2014 obtained from Kenya Revenue Authority (KRA).

### 5.3.2 Multi-Criteria Analysis

MCA basically requires the clear definition of possible investment alternatives, together with the identification of the criteria and objectives under which the relative performance of the investment alternatives in achieving pre-established objectives is to be measured. Attributes are surrogate measures of performance and they may measure the achievement of objectives directly or indirectly. Thereafter, MCA requires the assignment of preferences (i.e., a measure of relative importance, or weighting) to each of the criteria. Then lastly, for each investment alternative an expected utility value (degree of attractiveness) is calculated using the data defined.

The MCA methodology used for the preparation of RSIP2 considers the following: definition of the investment alternatives, specification of objectives and criteria in a hierarchical fashion, determining the weighting factors for the criteria, modelling attributes and performance levels of each investment alternative, computation of utility indices for each investment alternative, and optimisation under budget constraints.

Several investment alternatives will be analysed to determine which is the most cost-effective to implement. An alternative is one of a set of mutually exclusive works alternatives specified as options to be analysed for a road section. For the preparation of RSIP2, the entire road network was segmented into the sections for County, National Primary Trunk Roads (NPTR), National Secondary Trunk Roads (NSTR), National Primary Urban Roads (NPUR) and Roads within Wildlife Conservation Areas. These are referred to as implementation sections in line with how road works are normally carried out by the road agencies and it automatically addresses most of the homogeneity requirements such as pavement types, traffic loading levels and pavement age. The implementation sections have been entered in HDM-4 and several investment alternatives can be assigned to a road section for analysis. This assignment necessitates determination of optimal road work standards using HDM-4 prior to applying them in subsequent economic analyses and then in MCA. Decisions can be made about which option to implement, and when is the most favourable time for implementation

The criteria and weighting factors that have been used for the preparation of RSIP2 are presented in Table 5.3. These factors have been derived as the mean over the results obtained from the three levels of investigation: macro, meso and micro. RSIP2 is a national works programme that involves the entire road network of Kenya. It is therefore only appropriate that the opinions of all the stakeholders surveyed be taken into consideration to determine the relevant criteria and their perceived weightings. This has the advantage of ensuring increased stakeholders participation in the process and wider acceptability of RSIP2.

**Table 5.3: Combined Overall Weights for Different Categories of Benefits/Costs**

| Criteria      | Macro |       |       | Meso  |       |       | Micro |       |       | Overall Mean for RSIP2 |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------------------------|
|               | Max   | Min   | Mean  | Max   | Min   | Mean  | Max   | Min   | Mean  |                        |
| Economic      | 0.667 | 0.091 | 0.443 | 0.725 | 0.055 | 0.485 | 0.778 | 0.219 | 0.557 | <b>0.495</b>           |
| Social        | 0.630 | 0.039 | 0.240 | 0.665 | 0.044 | 0.234 | 0.557 | 0.091 | 0.249 | <b>0.241</b>           |
| Environmental | 0.472 | 0.045 | 0.199 | 0.578 | 0.034 | 0.181 | 0.492 | 0.054 | 0.122 | <b>0.167</b>           |
| Others        | 0.358 | 0.039 | 0.118 | 0.540 | 0.017 | 0.100 | 0.316 | 0.035 | 0.072 | <b>0.097</b>           |

The following observations can be made from Table 5.3:

1. For all levels of investigation, respondents attached the greatest importance to economic impacts of road investment compared to the social, environmental and other impacts.
2. In absolute terms, the micro level (community) respondents attached greater importance to economic impacts compared to the meso and macro levels respondents.
3. The macro level (national) respondents attached greater importance to environmental impacts compared to the meso and micro levels respondents. The micro level (community) respondents attached the least importance to environmental impacts.
4. In absolute terms, the micro level (community) respondents attached greater importance to social impacts compared to the meso and macro levels respondents.
5. For all the four criteria, the meso level respondents attached weighting factors which were mid-way between that attached by the macro and micro levels respondents.
6. In absolute terms, the macro level (national) respondents attached the greatest weighting factor to others criteria (which are not economic, social or environmental) compared to the meso and micro levels respondents.

The measurement scale for an attribute is referred to as the performance index, which on the economic objective may be an economic indicator such as the Net Present Value (NPV). For each investment alternative and for each objective defined in the RSIP2 study, a performance index will be determined. The index indicates whether an alternative is better than another with respect to a particular objective.

The performance indices are used to calculate utility index for each alternative. The utility indices can also be used to select the best option from a set of mutually exclusive project alternatives. In such a case, the alternative with the highest utility index should be chosen. By using the utility indices and road agency costs for each section alternative, MCA is a step forward to prioritize and optimize road network investments under different budget scenarios.

## 6 Financing of the Road Sub-Sector

### 6.1 Background

Investments in the road sub-sector are still majorly from government sources. Table 6.1 below summarises expenditure in the roads sub-sector between 2011 and 2017. As shown in the table below, expenditure in the roads sub-sector has been on an upward trajectory barring declines in the years 2013/14 and 2014/15, during the advent of devolved governments.

**Table 6.1: Expenditure on Roads, 2010/11 to 2016/17 (KSh. Million)**

| Road Class                            | 2010/11       | 2011/12       | 2012/13        | 2013/14       | 2014/15       | 2015/16        | 2016/17*       |
|---------------------------------------|---------------|---------------|----------------|---------------|---------------|----------------|----------------|
| Trunk and Primary Roads (A, B &C)     | 35,747        | 44,950        | 65,152         | 43,763        | 37,792        | 51,600         | 70,300         |
| Secondary and Minor Roads (D &E)      | 8,636         | 14,032        | 14,216         | 16,784        | 12,344        | 20,492         | 45,295         |
| Miscellaneous Roads (Including Urban) | 4,254         | 14,762        | 5,126          | 3,853         | 4,698         | 15,695         | -              |
| <b>Total</b>                          | <b>48,637</b> | <b>73,744</b> | <b>84,494</b>  | <b>64,400</b> | <b>54,834</b> | <b>87,787</b>  | <b>115,595</b> |
| Recurrent (Maintenance & repair)      | 12,551        | 17,786        | 24,371         | 23,229        | 25,792        | 25,396         | 40,880         |
| <b>Grand Total</b>                    | <b>61,188</b> | <b>91,530</b> | <b>108,864</b> | <b>87,629</b> | <b>80,626</b> | <b>113,183</b> | <b>156,475</b> |

Source: Statistical Abstract 2017, KNBS. \*Provisional

As an indication, the resources that are likely to be available to implement the RSIP2 have been derived from government policy documents on the assumption that Government policy will not change and investments on roads will continue like has been in the past.

### 6.2 Funding Sources

#### 6.2.1 National Budget

Funds for the development of roads are prepared through the national budget process in the form of a three-year budget rolling programme detailing expenditure estimates called the Medium-Term Expenditure Framework (MTEF). The MTEF are further guided by the governments five-year Medium-Term Plans which are integrated with the Strategic Plans of the road agencies/sub-agencies and the Vision 2030.

#### 6.2.2 County Governments Budgets

According to the "County Budget Implementation Review Report FY2015-16" prepared by the Office of the Controller of Budget, the total annual budget for roads by all the County Governments was about KSh. 23.7 billion. This budget had grown to KSh. 41.157 billion in FY2018-19. This budget, and subsequent ones, have not been spent in line with the RSIP recommendations, and have therefore been left out in the

preparation of the RSIP2. However, a mechanism should be devised to incorporate these budgets for the implementation of the RSIP2.

### 6.2.3 Kenya Road Board Fund

Kenya Road Board Fund mostly consists of the Road Maintenance Levy Fund (RMLF) which includes both the **Fuel Levy** and **Transit Tolls**. Fuel levy is charged per litre of petrol and diesel imported into the country, while Transit Tolls are charged on foreign-registered commercial trucks exceeding 2 tonnes that ply the roads in Kenya, and are based on distance covered, axle load and country of origin of the truck.

The disbursement of the fuel levy funds is based on a legislated formula (*KRB Act 1999*) of 40% to KeNHA, 32% to KeRRA, 15% to KURA, and 1% to Kenya Wildlife Services (KWS). The remaining 10% is disbursed to the Road Agencies by KRB after receiving the Cabinet Secretary's approval in line with the Road Sector Investment Programme (Table 6.2).

The enactment of the new Constitution in 2010 devolved some of the roads that were hitherto under KeRRA and KURA to the County Governments. Pursuant to Article 203(2) of the Constitution of Kenya 2010, 15% of the RMLF that was previously allocated to KeRRA and KURA is now being allocated to the County governments.

**Table 6.2: Disbursement of RMLF to the Various Agencies/Sub-Agencies**

| Agency/Sub-Agency                       | RMLF Portion |
|---|--------------|
| KeNHA                                   | 40.0%        |
| KeRRA                                   | 21.8%        |
| County Governments                      | 15.0%        |
| KURA                                    | 10.2%        |
| KWS                                     | 1.0%         |
| 10% KRB/Allocation by Cabinet Secretary | 10.0%        |
| KRB Operations                          | 2.0%         |

The Road Maintenance Levy Fund (RMLF) constitutes the bulk of KRBF fund and has grown steadily since its inception. The enactment of the Road Maintenance Levy Fund (Imposition of Levy), Amendment Order 2016, increased the fuel levy from KSh. 12 per litre to KSh. 18 per litre.

Table 6.3 shows the historical collections and growth of road maintenance levy between 2011 and 2016.

**Table 6.3: Historical Collections and Growth of Road Maintenance Levy**

|                      | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 |
|----------------------|---------|---------|---------|---------|---------|
| Amount (KSh Million) | 24,402  | 24,814  | 27,882  | 31,709  | 49,654  |
| % Growth             | 3%      | 2%      | 12%     | 14%     | 31%     |

Source: KRB Annual Report and Financial Statements for the year ended 30th June 2016

Table 6.4 below shows details of funds disbursed from the KRBF to the various institutions for maintenance of roads in the country.

**Table 6.4: Historical Disbursement of Road Maintenance Funds (KSh Million)**

|                     | 2013/14 | 2014/15 | 2015/16 | 2016/17* | 2017/18** |
|---------------------|---------|---------|---------|----------|-----------|
| <b>Fuel Levy</b>    | 24,725  | 25,461  | 31,823  | 60,000   | 63,000    |
| <b>Transit Toll</b> | 450     | 464     | 464     | 469      | 474       |
| <b>Total</b>        | 25,175  | 25,924  | 32,287  | 60,469   | 63,474    |

Source: Economic Survey 2018. \* Provisional & \*\* Estimates

Based on historical collections, the projected collections are summarised in Table 6.5 below.

**Table 6.5: Projected RMLF Budget Per Work Category Summary (KSh. Million)**

|    | Category Of Works                                | 2017-2018     | 2018-2019     | 2019-2020     | 2020-2021     | 2021-2022     |
|----|--|---------------|---------------|---------------|---------------|---------------|
| A  | Administration (KRB & RAs)                       | 8,108         | 8,513         | 8,939         | 9,385         | 9,855         |
| B  | KRB/Min Allocation                               | 6,347         | 6,665         | 6,998         | 7,348         | 7,715         |
| C  | Roadworks (RAs)                                  |               |               |               |               |               |
| 1  | Routine Maintenance                              | 10,335        | 10,851        | 11,394        | 11,964        | 12,562        |
| 2  | Periodic Maintenance                             | 6,760         | 7,098         | 7,453         | 7,826         | 8,217         |
| 3  | Spot Improvement                                 | 6,614         | 6,944         | 7,292         | 7,656         | 8,039         |
| 4  | Performance Based Maintenance Contracts          | 5,042         | 5,294         | 5,559         | 5,837         | 6,128         |
| 5  | Annuity  | -             | -             | -             | -             | -             |
| 6  | County Governments (15%)                         | 7,875         | 8,269         | 8,682         | 9,116         | 9,572         |
| 7  | Transit Toll (KeNHA)                             | 474           | 497           | 522           | 548           | 576           |
| 8  | Reserved Fund (KeRRA)                            | 27            | 29            | 30            | 32            | 33            |
| 9  | HQs Activities-Axle Load, Emergency, RMS (KeNHA) | 2,717         | 2,853         | 2,996         | 3,146         | 3,303         |
| 10 | Annuity Fund                                     | 8,702         | 9,137         | 9,593         | 10,073        | 10,577        |
|    | <b>Total</b>                                     | <b>63,000</b> | <b>66,150</b> | <b>69,458</b> | <b>72,930</b> | <b>76,577</b> |

Source: KRB

On average, condition of the main trunk and urban road networks have improved since the fund was established, but a lot still needs to be done to bring most of the network to good condition. One major challenge is the rapid deterioration of the pavement by over-loaded trucks. Although this problem is widely acknowledged by the government and most stakeholders, enforcement of axle load laws and regulations have so far been ineffective due to widespread bribery and other forms of corruption involving officials and police manning weighbridges with the transporters.

One of the main reasons why the RMLF is not effective in keeping the road network in good condition is the allocation criteria, which is not based on any scientific methodology. The allocation criteria should be based on factors that are known to cause road deterioration over time. These are: the traffic volumes and weights, the prevailing climatic conditions, and the type of road construction. RSIP2 has developed optimal fund allocation criteria for road maintenance needs that is aligned to engineering and economic efficiency.

## 6.2.4 Development Partners

Kenya's development partners are presently segregated into two main categories, viz. 1) Bilateral partners and, 2) Multi-lateral partners. For effective coordination, alignment and harmonization of various public-sector programmes, the development partners are presently operating under an umbrella body known as the Aid Effectiveness Kenya (AEK), which is chaired by the National Treasury.

The AEK serves to ensure that development policies and strategies of the development partners are anchored on Kenya's long-term development plans, such as the Vision 2030.

Table 6.6 below shows the total aid flows to Kenya between 2009 and 2014. The total aid flows to Kenya rose steadily between 2009 and 2013 before declining in the year 2014. Going forward, aid flows are expected to remain steady in the medium term.

**Table 6.6: Aid Flows\* to Kenya, 2009-2014 (USD million)**

|  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  |
|--|-------|-------|-------|-------|-------|-------|
| ODA Net Total (All development partners) | 1,776 | 1,625 | 2,481 | 2,653 | 3,312 | 2,665 |
| ODA Net Total (Multilateral)             | 547   | 464   | 912   | 979   | 1,284 | 1,055 |

Sources: OECD Development Assistance Committee 2016

Notes: 1. ODA: Official Development Assistance; 2. \* Net disbursements

The adopted budgets in the preparation of this RSIP document are presented in Section 7.3 of the report. They were derived from forecasted past historical expenditures and government policy papers.

## 6.3 Other Potential Funding Sources

### 6.3.1 Public Private Partnerships (PPP) Programme

PPP programmes are intended to help promote investments in the infrastructure market by the private sector in Kenya. To achieve this, the government enacted the PPP Act in December 2012, which became effective on the 8<sup>th</sup> February 2013. The National PPP Regulations were later gazetted on the 24<sup>th</sup> December 2014. The act bestowed the task of overall coordination, promotion and oversight of PPP projects to the National Treasury, through the PPP Unit.

Several pipeline PPP Projects have been approved by the PPP Committee and are presently at various stages of implementation. Some of the main projects under the road sub-sector include: -

1. The proposed development of a 2<sup>nd</sup> Nyali Bridge connecting the Mombasa Island with the North mainland by KURA;
2. The proposed dualling of 485km Mombasa - Nairobi Highway by KeNHA;

3. The proposed Operation and Maintenance (O&M) scheme of the 50km Nairobi - Thika Road by KeNHA;
4. The proposed Operation and Maintenance (O&M) scheme of the 28.6km Nairobi Southern Bypass by KeNHA; and,
5. The proposed dualling of the 157 km Nairobi – Nakuru Road by KeNHA.

### **6.3.2 Infrastructure Bonds**

This is whereby the government floats medium to long-term bonds in the stock market to finance infrastructure projects in the country. A 15-year bond worth 30-billion-shilling was successfully floated by the CBK in October 2016 to finance various infrastructure projects. Infrastructure bonds allow the government to tap into the readily available capital in the stock markets.

### **6.3.3 Use of Build Operate Transfer (BOT) Funding Mechanisms**

This involves road projects often dubbed “publicly owned but privately operated”. In this form of project financing, the public sector awards a concession to a private firm to finance, design, construct, operate, and maintain a road for a given concession period during which the proponent is expected to recover its investments from the revenues generated by the project.

Presently, BOT projects are predominately in the energy sector with none yet to be implemented in the roads sector.

### **6.3.4 Annuity Programme**

The annuity programme was launched by President Uhuru Kenyatta in June 2014 with the aim of providing the prerequisite capital required by the government to plug the ever-widening funding gap in the infrastructure sector. The Government of Kenya intended to build 10,000 km of roads within the next 5 years.

The annuity programme seeks to employ private funding for the design, financing and construction of roads where a contractor is required to carry out the design and construction within a stipulated time not exceeding 3 years, and delivering roads that meet given quality output specifications. The contractor will be expected to maintain the road for a maximum period of 8 years before reverting the asset back to the government.

The annuity plan targets the improvement of 10,000km of roads and was to be implemented in 3 phases between the 2014/15 and the 2016/17 financial years as summarised in the table below.

**Table 6.7: Annuity Programme Targets**

| No. | Financial Year | Target  |
|-----|----------------|---|
| 1   | 2014/15        | Complete 2,000 km of small roads  |
| 2   | 2015/16        | Complete 3,000 km of roads (consisting of 80% small roads and 20% highways) |
| 3   | 2016/17        | Complete 5,000 km of roads  |

The project is being implemented by the Ministry of Transport and Infrastructure, Housing and Urban Development through the Kenya National Highways Authority, Kenya Rural Roads Authority and Kenya Urban Roads Authority.

The annuity programme was however recently downscaled by the government over concerns about inflated construction costs that were submitted by most potential contractors. Only a few projects are now planned to be implemented.

## 7 Strategy Analysis

### 7.1 Background

This chapter describes the finding of the strategy analysis of the entire road network for Kenya which was undertaken using the HDM-4 strategy analysis module.

The main objectives of this Strategy Analysis are: -

1. Analysing, reviewing and refining the maintenance and road improvement policies / standards for paved and unpaved roads in Kenya;
2. Determine the optimal allocation of resources between the National and the County road networks;
3. Determine the maintenance and development needs of entire road network segregated into various budget heads including development, reconstruction, periodic and routine maintenance;
4. Assess the annual budget requirement over the RSIP2 implementation period;
5. Determine the optimal allocation of resources between maintenance and development works; and,
6. Assess the engineering and economic performance of entire road network based on the available budget and other budget scenarios.

### 7.2 Approach and Methodology

#### 7.2.1 Development of Homogeneous Sections

The entire network was categorized into homogeneous section based on the key attributes tabulated in Table 7.1 below:

**Table 7.1: Matrix for Development of Homogeneous Sections**

| Surface Type            | Traffic    | Road Condition | Road Class | Climate Zone            |
|-------------------------|------------|----------------|------------|-------------------------|
| Asphaltic Concrete (AC) | High (H)   | Good (G)       | A          | Arid (A)                |
| Surface Treated (ST)    | Medium (M) | Fair (F)       | B          | Semi-Arid (SA)          |
| Gravel (G)              | Low (L)    | Poor (P)       | C          | Sub-Humid Coastal (SHC) |
| Earth (E)               |            |                | D          | Sub-Humid Dry (SHD)     |
|                         |            |                | E          | Sub-Humid Wet (SHW)     |
|                         |            |                | G, etc.    | Humid (H)               |

For example, a typical homogeneous section for all “Asphaltic Concrete (AC) roads with High traffic (H) in Good Condition (G) of functional class (A) and in Sub–Humid-Dry climate zone (SHD) shall be depicted as **AC-H-G-A-SHD**.

The strategy analysis considered all the road homogeneous sections regardless of road agencies. The reason is to ensure all homogeneous road section are evaluated on the same merit as per their attributes.

Homogeneous sections for asphaltic concrete, surface treated, gravel and earth roads are provided in Appendix A1. Also, the homogenous sections for the various agency networks is provided in Appendix A2.

### **7.2.2 Definition of Input Data and Road Network Generation**

From the matrix in Table 7.1, the respective road networks for all the road agencies were categorized into homogeneous sections based on aggregate data described in Appendix A1. The appendices include: (1) Representative average vehicle composition on Kenyan roads (Table A1.1); (2) Representative average vehicle traffic volumes on Kenya roads (Table A1.2); (3) Adopted traffic growth rates (%) for RSIP2 for the period 2018-2022 (Table A1.3); (4) Riding quality data (Table A1.4); and (5) Speed flow data (Table A1.5).

### **7.2.3 Derivation of Optimum Maintenance Standards for Homogeneous Sections**

Standards refer to the targets or levels of conditions and response that a road authority aims to achieve based upon engineering, economic and environmental considerations. These can be applied in practical situations in order to meet specific objectives which are related to functional characteristics of the road network system.

A standard is defined by a set of operations with definite intervention criteria to determine when to carry them out. In general terms, intervention levels define the minimum level of service that is allowed and is consistent with the objective of the investment plan.

This assignment necessitated determination of optimal road work standards using HDM-4 prior to applying them in subsequent analyses. The objective was to determine the optimal standards for different homogeneous road sections in terms of economic efficiency criteria. The homogeneous road sections were assigned number of candidate standards (as investment alternatives) to each section from which the optimal one was selected.

### **7.2.4 Definition of Maintenance and Improvement Standards**

HDM-4 works on the basis of strategies for each homogeneous section whether representative or physical, sub-divided into standards and works. Each strategy contains one or more than one maintenance standard alone or combined with one or more than one improvement standard.

Each of the maintenance or improvement standards includes a number of works, some of which are responsive and some scheduled.

This section describes the Maintenance and Improvement (M&I) standards defined for Kenya and the criteria used to trigger works under each standard. An assessment of current road maintenance and improvement practice was carried and wherever possible these standards have been integrated within the proposed M&I standards.

Maintenance and improvements standards were defined in accordance with road type per agency, condition, traffic, road width and environment. The M&I vary with the variation of these criteria.

The M&I standards and their unit costs defined for the various road types of roads are provided in Appendix C1.

## 7.2.5 Formulation of Strategies for HDM-4 Application

Following the definition of maintenance and improvement standards, strategies were evolved by combination of these standards for application in the HDM-4 analysis. Appendix B gives the details of strategies and contents of each strategy applied to the respective homogeneous sections. The evolution of the strategies was based on road conditions and traffic levels presented below.

### 7.2.5.1 Sections in Good Condition

All homogeneous sections pertaining to the various classes of road which are in good condition irrespective of traffic will be considered for Routine Maintenance. Routine Maintenance activities considered for Kenya's road network are Pothole Patching, Edge Breaks, Drainage Works and Miscellaneous activities such as bush clearing, desilting and shoulder repairs etc.

However homogeneous section whose average roughness values are at the threshold of moving into fair will further be considered for periodic maintenance. Those homogeneous sections which are likely candidates for periodic, priority will be given to sections with high traffic, then medium and low traffic in that order.

### 7.2.5.2 Sections in Fair Condition

Roads in Fair condition are most likely candidates for periodic maintenance. Overlay was the main periodic maintenance activity for asphaltic concrete roads, while resealing was scheduled for surface treated (ST) roads. Two types of resealing were considered based on the traffic levels. For High and Medium traffic, resealing thickness will be 13mm with shape correction. While for low trafficked ST roads it will be 6mm thickness without shape correction.

### 7.2.5.3 Sections in Poor Condition

For the unpaved road, spot gravelling will be the main activity for homogeneous sections with medium and low traffic. Unpaved sections with high traffic depending on the road class, apart from spot gravelling will be considered for upgrading to bituminous roads. Earth roads will normally receive grading and reshaping under routine maintenance.

Homogeneous sections with low traffic were not considered for investment unless it is due to the poor road condition.

Homogeneous sections in poor condition are ready candidates for major rehabilitation and reconstruction. However, homogeneous sections with high to medium traffic will be given priority over sections with low traffic.

### 7.2.5.4 Upgrading of Homogenous Sections

The main objective of upgrading homogeneous sections is to reduce maintenance cost. It was mainly focussed on unpaved roads to paved roads based on traffic thresholds. The selection of candidate roads will be based on returns over analysis period of 20 years.

Most of the National Secondary Trunk Roads (NSTR) roads have not been engineered and therefore will have to be constructed to the required standards. KeRRA roads with medium traffic will be assessed for upgrading from earth to gravel and those with gravel surface and high traffic will be considered for upgrading to bituminous standards.

### 7.2.5.5 Widening of Homogeneous Sections

The volume-capacity ratio will be main determinant for widening roads. The widening will pertain mainly to the National Primary Urban Roads (NPUR) and National Primary Trunk Roads (NPTR) road network especially for sections with high traffic volumes.

The strategy analysis will be carried out for the Homogeneous Sections under the respective surface type e.g. Asphaltic Concrete (AC), Surface Treated (ST), Gravel (G) and Earth (E).

The strategies used in HDM-4 analysis for each of the homogeneous section are given in Appendix C.1.

## 7.3 Budget Optimisation Methods

In HDM-4 there are two budget optimisation methods that provide the facility to select road sections that can be included within a specified budget in order to achieve the objective of the investment plan to be prepared. These optimisation methods are based on the following two objective functions:

1. Maximisation of net present value i.e. *Economic Efficiency Method*; and,
2. Maximisation of road condition improvement i.e. *Engineering Based Method*.

The *Economic Efficiency Method* was used to select the optimum results under the various budget scenarios. The objective of using this method is to maximise the economic benefits using the incremental NPV/Cost ratio. It is the selection of that combination of investment options on sections that maximises NPV/cost for the selected sections in the road network subject to the sum of the investment costs being less than the budget available.

The *Engineering Based Method* was used to assess the actual maintenance and development needs under unconstrained scenario. The objective is to analyse selected improvement options to establish a spectrum of interventions that can improve the current condition of the network to the required condition mix that was set out to be achieved at the end of the analysis period. Therefore, only interventions that give the lowest IRI for the period and for a specified budget are selected as the optimum alternative for a particular homogenous section.

## 7.4 Work Types and Budgets

The HDM-4 strategy analysis tool was used to derive optimum maintenance and improvement strategies for each representative homogeneous section of the road network. The outputs of this phase does not include identifying specific work programmes but rather optimum strategies which are then used to identify specific work programmes based on identified budgets.

The following optimum strategies for various budget scenarios were then modelled:

5. Unconstrained Budget Scenario;
6. Desired Road Condition Mix Budget Scenario (Stretched Targets);
7. The Likely Budget Scenario (Available budgets); and,
8. Sensitivity Analysis for Available Budget.

### 7.4.1 Unconstrained Budget Scenario

In order to determine the development and maintenance needs of the entire road network, the engineering based method of optimisation was used. The objective was to maximize the road condition of the entire network.

Table 7.2 presents the unconstrained development and maintenance needs of the road network.

**Table 7.2: Road Network Needs for Various Agencies (5-Year Unconstrained)**

| Sub-Network  | Activity                            | Work Type       | Length (km)    | Financial Cost (KSh. Millions) |                |
|--|-------------------------------------|-----------------|----------------|--------------------------------|----------------|
| County   | Development                         | Rehabilitation  | 13,914         | 304,610                        |                |
|  |                                     | Upgrading       | 5,609          | 172,911                        |                |
|  |                                     | <b>Total</b>    | <b>19,524</b>  | <b>477,521</b>                 |                |
|  | Periodic Works                      | Overlay         | 601            | 6,089                          |                |
|  |                                     | Spot gravelling | 622,843        | 224,248                        |                |
|  |                                     | Resealing       | 7,693          | 21,914                         |                |
|  |                                     | <b>Total</b>    | <b>195,147</b> | <b>252,251</b>                 |                |
|  | Routine Works                       | Routine         |                | 43,340                         |                |
|  |                                     | <b>Total</b>    | <b>-</b>       | <b>43,340</b>                  |                |
|  | National Primary Trunk Roads (NPTR) | Development     | Rehabilitation | 6,039                          | 170,255        |
| Upgrading  |                                     |                 | 15,647         | 486,495                        |                |
| <b>Total</b>   |                                     |                 | <b>21,686</b>  | <b>656,750</b>                 |                |
| Periodic Works   |                                     | Overlay         | 7,119          | 74,380                         |                |
|  |                                     | Spot gravelling | 6,160          | 3,209                          |                |
|  |                                     | Resealing       | 452            | 1,253                          |                |
|  |                                     | <b>Total</b>    | <b>9,419</b>   | <b>78,841</b>                  |                |
| Routine Works  |                                     | Routine         |                | 10,095                         |                |
|  |                                     | <b>Total</b>    | <b>-</b>       | <b>10,095</b>                  |                |
| National Secondary Trunk Roads (NSTR)                  |                                     | Development     | Rehabilitation | 2,434                          | 61,524         |
|  | Upgrading                           |                 | 3,468          | 106,181                        |                |
|  | <b>Total</b>                        |                 | <b>5,903</b>   | <b>167,705</b>                 |                |
|  | Periodic Works                      | Overlay         | 448            | 3,081                          |                |
|  |                                     | Spot gravelling | 90,923         | 32,258                         |                |
|  |                                     | Resealing       | 5,496          | 15,865                         |                |
|  |                                     | <b>Total</b>    | <b>33,220</b>  | <b>51,203</b>                  |                |
|  | Routine Works                       | Routine         |                | 7,117                          |                |
|  |                                     | <b>Total</b>    | <b>-</b>       | <b>7,117</b>                   |                |
|  | National Primary Urban Roads (NPUR) | Development     | Rehabilitation | 1,438                          | 46,705         |
| Upgrading  |                                     |                 | 2,699          | 81,161                         |                |
| <b>Total</b>   |                                     |                 | <b>4,137</b>   | <b>127,865</b>                 |                |
| Periodic Works   |                                     | Spot gravelling | 490            | 160                            |                |
|  |                                     | Resealing       | 89             | 245                            |                |
|  |                                     | <b>Total</b>    | <b>236</b>     | <b>405</b>                     |                |
| Routine Works  |                                     | Routine         |                | 2,089                          |                |
|  |                                     | <b>Total</b>    | <b>-</b>       | <b>2,089</b>                   |                |
| Roads within Wildlife Conservation Areas               |                                     | Development     | Upgrading      | 13,124                         | 400,668        |
|  |                                     |                 | <b>Total</b>   | <b>13,124</b>                  | <b>400,668</b> |
|  | Routine Works                       | Routine         |                | -                              |                |
|  |                                     | <b>Total</b>    | <b>-</b>       | <b>-</b>                       |                |
| <b>Total for Development</b>                           |                                     |                 | <b>64,374</b>  | <b>1,830,509</b>               |                |
| <b>Total for Maintenance (Periodic+ Routine Works)</b> |                                     |                 | <b>238,022</b> | <b>445,341</b>                 |                |
| <b>Grand Total</b>                                     |                                     |                 | <b>302,396</b> | <b>2,275,851</b>               |                |

From the above table a total of **KSh. 2.276 trillion** will be required to fix the backlog of maintenance and development works over the next 5-years with 80.4% of the funds being required for development works and 19.6% for maintenance works. Also, 34% of these resources are required for the county road network with 66% being required for the national road network.

#### 7.4.2 Desired Road Condition Mix Budget Scenario

Given the current budgetary constraints, it would be difficult to mobilize the KSh. 2,276 billion financial outlay identified in Section 7.4.1 above. Progressive road condition targets, referred to as “stretched” targets, were developed by the RSIP2 Task Force for the end of RSIP2 implementation period based on the following criteria:

1. Improve all asphaltic concrete and surface treated roads in poor condition to be in fair condition; and, 50% in fair to be in good condition;
2. Improve 50% of Gravel and Earth roads in poor condition to be in fair condition; and, 25% in fair condition to be in good condition; and,
3. All roads in good condition must effectively be maintained to avoid slipping back to fair/poor condition.

Based on the above criteria, the desired condition mix at the end of the RSIP2 is given in Table 7.3 below.

**Table 7.3: Desired Condition Mix of Kenya at the end of RSIP2**

| Surface Type                             | Total Length (km) | Good          |           | Fair          |           | Poor          |           |
|--|-------------------|---------------|-----------|---------------|-----------|---------------|-----------|
|  |                   | km            | %         | km            | %         | km            | %         |
| National Primary Trunk Roads (NPTR)      | 18,220            | 9,777         | 54        | 5,458         | 30        | 2,986         | 16        |
| National Secondary Trunk Roads (NSTR)    | 19,529            | 7,551         | 39        | 9,555         | 49        | 2,423         | 12        |
| National Primary Urban Roads (NPUR)      | 2,620             | 1,042         | 40        | 1,578         | 60        | 0             | 0         |
| County                                   | 114,286           | 18,903        | 17        | 56,518        | 49        | 38,865        | 34        |
| Roads within Wildlife Conservation Areas | 6,562             | 1,458         | 22        | 4,674         | 71        | 430           | 7         |
| <b>Combined</b>                          | <b>161,217</b>    | <b>38,622</b> | <b>24</b> | <b>77,476</b> | <b>48</b> | <b>44,497</b> | <b>28</b> |

Optimisation using the engineering based method was then used to determine the financial outlay that would be required to achieve the above stretched targets. The findings are as tabulated below.

**Table 7.4: Road Network Needs for Various Agencies (Desired Condition) KSh Billion**

| Sub - Network                         | Year         | Development    |   | Maintenance    |                | Total            |
|---------------------------------------|--------------|----------------|---|----------------|----------------|------------------|
|                                       |              | Upgrading      | New Construction/<br>Capacity Improvement | Periodic       | Rehabilitation |                  |
| County                                | 2018         | 31,094         | 7,932                                     | 126,431        | 8,479          | 173,936          |
|                                       | 2019         | 20,729         | 3,302                                     | 245            | 8,782          | 33,058           |
|                                       | 2020         | 0              | 496                                       | 2,646          | 8,857          | 11,999           |
|                                       | 2021         | 0              | 108                                       | 58,402         | 8,545          | 67,055           |
|                                       | 2022         | 0              | 1,042                                     | 454            | 8,954          | 10,450           |
|                                       | <b>Total</b> |                | <b>51,823</b>                             | <b>12,880</b>  | <b>188,178</b> | <b>43,617</b>    |
| National Primary Trunk Roads (NPTR)   | 2018         | 152,094        | 82,752                                    | 4,132          | 1,317          | 240,295          |
|                                       | 2019         | 101,396        | 25,701                                    | 0              | 1,545          | 128,642          |
|                                       | 2020         | 0              | 18,213                                    | 4,921          | 1,772          | 24,906           |
|                                       | 2021         | 0              | 11,634                                    | 3,065          | 1,667          | 16,366           |
|                                       | 2022         | 0              | 11,232                                    | 372            | 2,339          | 13,943           |
|                                       | <b>Total</b> |                | <b>253,490</b>                            | <b>149,532</b> | <b>12,490</b>  | <b>8,640</b>     |
| National Secondary Trunk Roads (NSTR) | 2018         | 24,506         | 2,467                                     | 22,521         | 1,328          | 50,822           |
|                                       | 2019         | 16,337         | 1,644                                     | 1,635          | 1,407          | 21,023           |
|                                       | 2020         | 0              | 0   | 537            | 1,871          | 2,408            |
|                                       | 2021         | 0              | 0   | 10,382         | 1,389          | 11,771           |
|                                       | 2022         | 0              | 0   | 1,893          | 1,454          | 3,347            |
|                                       | <b>Total</b> |                | <b>40,843</b>                             | <b>4,111</b>   | <b>36,968</b>  | <b>7,449</b>     |
| National Primary Urban Roads (NPUR)   | 2018         | 28,168         | 29,506                                    | 790            | 93             | 58,557           |
|                                       | 2019         | 18,779         | 19,671                                    | 80             | 109            | 38,639           |
|                                       | 2020         | 0              | 22,774                                    | 9.7            | 136            | 22,920           |
|                                       | 2021         | 0              | 9,566                                     | 640            | 149            | 10,355           |
|                                       | 2022         | 0              | 0   | 204            | 130            | 334              |
|                                       | <b>Total</b> |                | <b>46,947</b>                             | <b>81,517</b>  | <b>1,724</b>   | <b>617</b>       |
| Roads within Wildlife Conservation    | 2018         | 43,527         | 0   | 7,040          | 447            | 51,014           |
|                                       | 2019         | 29,018         | 0   | 92             | 1,549          | 30,659           |
|                                       | 2020         | 0              | 0   | 0              | 1,622          | 1,622            |
|                                       | 2021         | 0              | 0   | 6,911          | 472            | 7,383            |
|                                       | 2022         | 0              | 0   | 202            | 1,654          | 1,856            |
|                                       | <b>Total</b> |                | <b>72,545</b>                             | <b>0</b>       | <b>14,245</b>  | <b>5,744</b>     |
| <b>Grand Total</b>                    |              | <b>465,648</b> | <b>248,040</b>                            | <b>253,605</b> | <b>66,067</b>  | <b>1,033,360</b> |

From the table above, a total of KSh. 1.033 trillion will be required to meet the stretched maintenance and development work targets over the next 5-years with about 45%, 24%, 25% and 6% required for upgrading, Rehabilitation, periodic and routine works respectively. Of these total financial outlay, 71% shall be required for the national road network with the remaining 29% being required for the county road network.

### 7.4.3 The Likely Budget Scenario

In the development of RSIP2 programme, the projected development and maintenance budgetary allocations for the roads sub-sector based on historical trends have been estimated at KSh. 929.785 billion over the next 5-years as tabulated below.

**Table 7.5: Projected RSIP2 Budgets (KSh. Millions)**

| Works        | 2017/2018         | 2018/2019         | 2019/2020         | 2020/2021         | 2021/2022         | Total             |
|--------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Development  | 148,851.7         | 130,593.7         | 147,342.8         | 156,772.5         | 166,040.5         | <b>749,601.31</b> |
| Maintenance  | 32,490.4          | 34,285.3          | 35,986.6          | 37,772.8          | 39,648.2          | <b>180,183.29</b> |
| <b>Total</b> | <b>181,342.12</b> | <b>164,879.03</b> | <b>183,329.43</b> | <b>194,545.35</b> | <b>205,688.67</b> | <b>929,784.60</b> |

From the projected expenditure, a total of about **KSh. 460.85 billion** is already committed to various projects. This translates to uncommitted expenditure of **KSh. 468.93 billion (KSh. 288.747 billion** for development and **KSh. 180.183 billion** for maintenance) over the next 5 years. Some **KSh. 80.619 billion** was set aside from the uncommitted budget to cover emergencies, physical and price variations. An additional financial outlay of KSh. 42.975 billion is recommended for, amongst others, construction of public transport facilities and road management issues such as: research and development; road safety; feasibility and design projects; climate change adaptation; axle load compliance; monitoring and evaluation; traffic management and mainstreaming of cross cutting issues.

The total allocation for the various works in the RSIP2 is therefore **KSh. 806.191 billion**.

### 7.5 Allocation of Resources between the National and County Roads

Using the remaining available budget of **KSh. 806.191 billion**, the optimal allocation of resources between the National and County Roads was undertaken. In order to equitably allocate budget to the National and County roads, the HDM-4 optimization analysis was carried out over the RSIP2 period using the Engineering Based Method of optimisation. The allocation of resources between the National and County Governments by various work types was determined and is given in Table 7.6 below.

**Table 7.6 Allocation of Budget between National and County Roads (KSh. million)**

| SUB-NETWORK                              | MAINTENANCE    |                           |                | DEVELOPMENT     |                   |   | TOTAL          |                |
|--|----------------|---------------------------|----------------|-----------------|-------------------|---|----------------|----------------|
|  | Routine        | Rehabilitation & Periodic | Overall        | Upgrading       |                   | New Construction & Capacity Improvement |                | Overall        |
|  |                |                           |                | Earth to Gravel | Gravel to Bitumen |   |                |                |
| <b>County</b>                            | 115,276        | 0                         | 115,276        | 24,931          | 35,099            | 0                                       | 60,030         | <b>175,306</b> |
| <b>% allocation</b>                      | <b>64</b>      | <b>0</b>                  | <b>30</b>      | <b>88</b>       | <b>11</b>         | <b>0</b>                                | <b>14</b>      | <b>22</b>      |
| <b>National</b>                          | 64,906         | 205,134                   | 270,040        | 3,491           | 279,607           | 77,747                                  | 360,845        | <b>630,885</b> |
| <b>% allocation</b>                      | <b>36</b>      | <b>100</b>                | <b>70</b>      | <b>12</b>       | <b>89</b>         | <b>100</b>                              | <b>86</b>      | <b>78</b>      |
| <b>Total</b>                             | <b>180,182</b> | <b>205,134</b>            | <b>385,316</b> | <b>28,422</b>   | <b>314,706</b>    | <b>77,747</b>                           | <b>420,876</b> | <b>806,191</b> |
| <b>National Breakdown</b>                |                |                           |                |                 |                   |   |                |                |
| National Primary Trunk Roads (NPTR)      | 24,168         | 170,687                   | 194,855        | 0               | 78,249            | 42,259                                  | 120,508        | <b>315,364</b> |
| <b>% allocation</b>                      | <b>13</b>      | <b>83</b>                 | <b>51</b>      | <b>0</b>        | <b>25</b>         | <b>54</b>                               | <b>29</b>      | <b>39</b>      |
| National Secondary Trunk Roads (NSTR)    | 23,716         | 17,620                    | 41,336         | 699             | 160,345           | 0                                       | 161,044        | <b>202,379</b> |
| <b>% allocation</b>                      | <b>13</b>      | <b>9</b>                  | <b>11</b>      | <b>2</b>        | <b>51</b>         | <b>0</b>                                | <b>38</b>      | <b>25</b>      |
| National Primary Urban Roads (NPUR)      | 7,429          | 16,753                    | 24,182         | 0               | 41,014            | 35,488                                  | 76,501         | <b>100,683</b> |
| <b>% allocation</b>                      | <b>4</b>       | <b>8</b>                  | <b>6</b>       | <b>0</b>        | <b>13</b>         | <b>46</b>                               | <b>18</b>      | <b>12</b>      |
| Roads within Wildlife Conservation Areas | 9,593          | 73                        | 9,666          | 2,792           | 0                 | 0                                       | 2,792          | <b>12,459</b>  |
| <b>% allocation</b>                      | <b>5</b>       | <b>0</b>                  | <b>3</b>       | <b>10</b>       | <b>0</b>          | <b>0</b>                                | <b>0.7</b>     | <b>2</b>       |
| <b>Total</b>                             | <b>64,906</b>  | <b>205,134</b>            | <b>270,040</b> | <b>3,491</b>    | <b>279,608</b>    | <b>77,747</b>                           | <b>360,845</b> | <b>630,886</b> |

The following are the recommendations over the RSIP2 implementation period:

1. The total budget of KSh. 806.191 billion should be allocated at 22% (KSh. 175.306 billion) to the County roads and 78% (KSh. 630.885 billion) to the National roads (NPTR 39%; NSTR 25%; NPUR 12% and KWS 2% of the total);
2. The KSh. 420.876 billion development budget for upgrading, new construction and capacity improvement works should be allocated at 86% (KSh. 360.845 billion) to the National roads and 24% (KSh. 60.03 billion) to the County roads;
3. The KSh. 385.316 billion maintenance budget for rehabilitation, routine and periodic maintenance works should be allocated at 70% (KSh. 270.04 billion) to the National roads and 30% (KSh. 115.276 billion) to the County roads. The relatively high maintenance budget (48% of the total available budget) is necessary for clearing the current backlog; and,
4. The national roads maintenance budget should be allocated at 51% for the NPTR; 11% for NSTR; 6% for NPUR; and 3% for KWS.

The relatively high rehabilitation and periodic maintenance budget of KSh. 205.1 billion (25% of total budget) is necessary to clear backlog maintenance, after which the routine maintenance component will be expected to rise.

## 7.6 Assessment of the RSIP2 Financing Gap

### 7.6.1 Financing Gap for the Unconstrained Analysis

The findings of the 5-year unconstrained budget presented in Table 7.2 was compared with the current 5-year actual budget to establish the financing gap for development and maintenance works. The results are presented in Tables 7.7 to 7.9 below.

The largest deficit in terms of development works is for the NPTR, followed by roads within wildlife conservation areas, and the county roads as tabulated below.

**Table 7.7: Summary of Financing Gaps Based for Development Works**

| Sub-Network                              | 5-Year Unconstrained Budget (KSh. Million) | 5-Year Actual Budget (KSh. Million) | Financing Gap (KSh. Million) |
|--|--|-------------------------------------|------------------------------|
| County                                   | 477,521                                    | 60,030                              | -417,491                     |
| National Primary Trunk Roads (NPTR)      | 656,750                                    | 120,508                             | -536,242                     |
| National Secondary Trunk Roads (NSTR)    | 167,705                                    | 161,044                             | -6,661                       |
| National Primary Urban Roads (NPUR)      | 127,865                                    | 76,501                              | -51,364                      |
| Roads within Wildlife Conservation Areas | 400,668                                    | 2,792                               | -397,876                     |
| <b>Total</b>                             | <b>1,830,509</b>                           | <b>420,876</b>                      | <b>-1,409,633</b>            |

*Deficit (-); Excess (+)*

The overall deficit for the development works is KSh. 1.41 trillion with the largest deficit being for the NPTR at KSh. 536.24 billion.

**Table 7.8: Summary of Financing Gaps for Maintenance Works**

| Sub-Network                              | 5-Year Unconstrained Budget (KSh. Million) | 5-Year Actual Budget (KSh. Million) | Financing Gap (KSh. Million) |
|--|--|-------------------------------------|------------------------------|
| County                                   | 295,591                                    | 115,276                             | -180,315                     |
| National Primary Trunk Roads (NPTR)      | 88,936                                     | 194,855                             | 105,919                      |
| National Secondary Trunk Roads (NSTR)    | 58,320                                     | 41,336                              | -16,984                      |
| National Primary Urban Roads (NPUR)      | 2,494                                      | 24,182                              | 21,688                       |
| Roads within Wildlife Conservation Areas | 0  | 9,666                               | 9,666                        |
| <b>Total</b>                             | <b>445,342</b>                             | <b>385,315</b>                      | <b>-60,027</b>               |

*Deficit (-); Excess (+)*

The total deficit for maintenance works is KSh. 60 billion with the largest deficit being for the County roads at KSh. 180.32 billion. The surplus resources for NPUR and roads within wildlife areas could be attributed to the assumptions made with respect to the future allocation of budgets.

The combined overall summary of the financing gaps for the various sub-networks based on unconstrained analysis is as tabulated below.

**Table 7.9: Overall Summary of Financing Gaps Based on Unconstrained Analysis**

| Agency                                   | 5-Year Unconstrained Budget (KSh. Million) | 5-Year Actual Budget (KSh. Million) | Financing Gap (KSh. Million) |
|--|--|-------------------------------------|------------------------------|
| County                                   | 773,112                                    | 175,306                             | -597,806                     |
| National Primary Trunk Roads (NPTR)      | 745,686                                    | 315,364                             | -430,322                     |
| National Secondary Trunk Roads (NSTR)    | 226,025                                    | 202,379                             | -23,646                      |
| National Primary Urban Roads (NPUR)      | 130,359                                    | 100,683                             | -29,676                      |
| Roads within Wildlife Conservation Areas | 400,668                                    | 12,459                              | -388,209                     |
| <b>Total</b>                             | <b>2,275,851</b>                           | <b>806,191</b>                      | <b>-1,469,660</b>            |

*Deficit (-); Excess (+)*

As summarised in Table 7.9, in order to clear the current maintenance and development needs backlog, an additional budget of **KSh. 1.47 trillion** will be required (i.e. 182% of the current budget).

### 7.6.2 Financing Gap for the Stretched Targets

Again, the findings of the 5-year desired budget presented in Table 7.6 was compared with the current 5-year actual budget to establish the financing gap for development, periodic and routine works. The results are presented in Tables 7.10 to 7.12 below.

For the stretched targets, the largest deficit in terms of development works is for NPTR followed by NPUR.

**Table 7.10: Summary of Financing Gaps for Development Works**

| Sub-Network                              | 5-Year Stretched Budget (KSh. Millions) | 5-Year Actual Budget (KSh. Millions) | Financing Gap (KSh. Millions) |
|--|---|--------------------------------------|-------------------------------|
| County                                   | 64,703                                  | 60,030                               | -4,673                        |
| National Primary Trunk Roads (NPTR)      | 403,022                                 | 120,508                              | -282,514                      |
| National Secondary Trunk Roads (NSTR)    | 44,954                                  | 161,044                              | 116,090                       |
| National Primary Urban Roads (NPUR)      | 128,464                                 | 76,501                               | -51,963                       |
| Roads within Wildlife Conservation Areas | 72,545                                  | 2,792                                | -69,753                       |
| <b>Total</b>                             | <b>713,688</b>                          | <b>420,876</b>                       | <b>-292,812</b>               |

Deficit (-); Excess (+)

The overall deficit for development works is KSh. 292.812 billion with the largest deficit being for NPTR at KSh. 282.514 billion. Again, the surplus resources for NPUR could be attributed to the assumptions made with respect to the future allocation of budgets.

**Table 7.11: Summary of Financing Gaps for Maintenance Works**

| Sub-Network                              | 5-Year Stretched Budget (KSh. Millions) | 5-Year Actual Budget (KSh. Millions) | Financing Gap (KSh. Millions) |
|--|---|--------------------------------------|-------------------------------|
| County                                   | 231,796                                 | 115,276                              | -116,520                      |
| National Primary Trunk Roads (NPTR)      | 21,130                                  | 194,855                              | 173,725                       |
| National Secondary Trunk Roads (NSTR)    | 44,416                                  | 41,336                               | -3,080                        |
| National Primary Urban Roads (NPUR)      | 2,342                                   | 24,182                               | 21,840                        |
| Roads within Wildlife Conservation Areas | 19,991                                  | 9,666                                | -10,325                       |
| <b>Total</b>                             | <b>319,675</b>                          | <b>385,315</b>                       | <b>65,640</b>                 |

Deficit (-); Excess (+)

The combined overall summary of the financing gaps for the various sub-networks based on desired targets is as tabulated below.

**Table 7.12: Overall Summary of Financing Gaps Based on Desired Targets**

| Sub-Network                              | 5-Year Stretched Budget (KSh. Millions) | 5-Year Actual Budget (KSh. Millions) | Financing Gap (KSh. Millions) |
|--|---|--------------------------------------|-------------------------------|
| County                                   | 296,499                                 | 175,306                              | -121,193                      |
| National Primary Trunk Roads (NPTR)      | 424,152                                 | 315,364                              | -108,788                      |
| National Secondary Trunk Roads (NSTR)    | 89,370                                  | 202,379                              | 113,009                       |
| National Primary Urban Roads (NPUR)      | 130,806                                 | 100,683                              | -30,123                       |
| Roads within Wildlife Conservation Areas | 92,536                                  | 12,459                               | -80,077                       |
| <b>Total</b>                             | <b>1,033,363</b>                        | <b>806,191</b>                       | <b>-227,172</b>               |

Deficit (-); Excess (+)

In order to achieve the stretched targets, an additional budget of **KSh. 227.172 billion** will be required (i.e. additional 28% of the current budget). However, if the estimated expenditures by County Governments on roads of about **KSh. 23.7 billion per year** could be factored into the RSIP 2 then the County roads will be fully covered, and the net deficit will be **KSh. 108.672 billion**.

## 7.7 Sensitivity Analysis of the Available Budget

The objective of this sensitivity analysis is to assess the performance of the available budget in improving the condition of the various road networks for the analysis period. Since there is a targeted condition to be achieved, various scenarios have been assessed to see the level of budget application that can achieve an acceptable performance. At the end of the analysis, for all the different networks and scenarios, the following are expected to be achieved:

1. The condition trend at the end of 2022;
2. The optimum strategies and specific works; and,
3. The financial requirements or investment profile.

This will help establish the adequacy of the budget in selecting optimum strategies for targeted condition at the end of year 2022. The budget scenarios considered are;

1. Scenario 1: 150% of the available budget;
2. Scenario 2: 125% of the available budget;
3. Scenario 3: 100% of the available budget;
4. Scenario 4: 90% of the available budget; and,
5. Scenario 5: 75% of the available budget.

The actual estimated budgets for the scenarios are as shown in Appendix E1.

### 7.7.1 Sensitivity Analysis for National Primary Trunk Roads (NPTR)'s Budgets

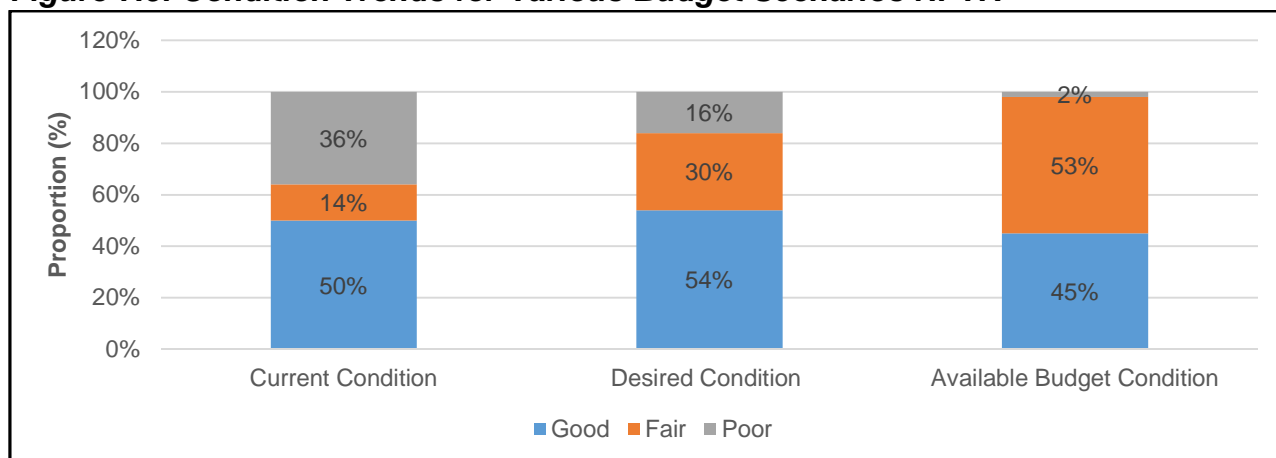
The condition mix under the various budget scenarios for NPTR is presented in Table 7.13, with details given in Appendix E2.

**Table 7.13: Results of Condition Mix for NPTR**

| Scenario                                 | Good       | Fair       | Poor       |
|--|------------|------------|------------|
| <b>Current Condition</b>                 | <b>50%</b> | <b>14%</b> | <b>36%</b> |
| <b>Desired Condition</b>                 | <b>54%</b> | <b>30%</b> | <b>16%</b> |
| 150% of Available                        | 52%        | 46%        | 2%         |
| 125% of Available                        | 48%        | 50%        | 2%         |
| <b>100% of Available (Actual Budget)</b> | <b>45%</b> | <b>53%</b> | <b>2%</b>  |
| 90% of Available                         | 44%        | 53%        | 3%         |
| 75% of Available                         | 42%        | 55%        | 3%         |

Figure 7.5 shows the condition trends for current, desired and available budget scenarios for NPTR.

**Figure 7.5: Condition Trends for Various Budget Scenarios NPTR**



National Primary Trunk Roads (NPTR)'s network in good and poor condition will drop by about 5% and 34% respectively, while that in fair condition will increase by 39%. The results show that the available budgets for NPTR are insufficient and will therefore result into deterioration of some roads from good condition to fair condition at the end of the RSIP2 implementation period.

### 7.7.2 Sensitivity Analysis for National Primary Urban Roads (NPUR)'s Budgets

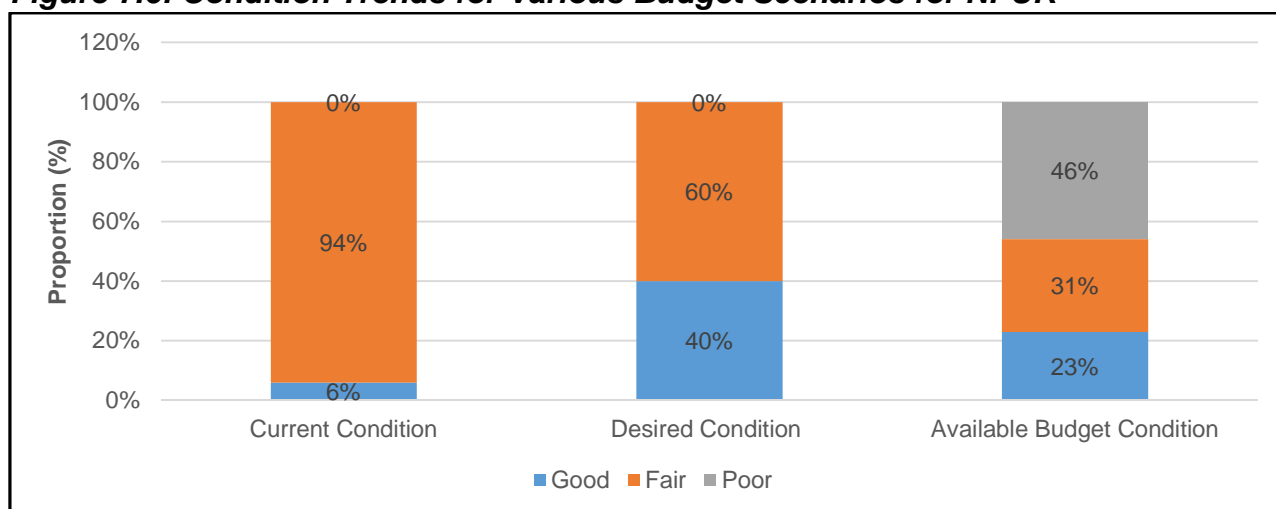
The condition mix under the various budget scenarios for the NPUR are presented in Table 7.14 and Figure 7.6, with details given in Appendix E2.

**Table 7.14: Results of Condition Mix for NPUR**

| Scenario                                 | Good       | Fair       | Poor       |
|--|------------|------------|------------|
| <b>Current Condition</b>                 | <b>6%</b>  | <b>94%</b> | <b>0%</b>  |
| <b>Desired Condition</b>                 | <b>40%</b> | <b>60%</b> | <b>0%</b>  |
| 150% of Available                        | 28%        | 30%        | 42%        |
| 125% of Available                        | 26%        | 31%        | 43%        |
| <b>100% of Available (Actual Budget)</b> | <b>23%</b> | <b>31%</b> | <b>46%</b> |
| 90% of Available                         | 22%        | 30%        | 48%        |
| 75% of Available                         | 21%        | 29%        | 50%        |

Figure 7.6 shows the condition trends for current, desired and available budget scenarios for NPUR.

**Figure 7.6: Condition Trends for Various Budget Scenarios for NPUR**



NPUR's network in good condition will increase from 6% to 23%, the portion in fair condition will decrease by 63% while that in poor condition will increase by about 46%. Again this shows that the available budgets for NPUR are insufficient and will therefore result into an increase in the proportion of their network in poor condition at the end of the RSIP2 implementation period.

### 7.7.3 Sensitivity Analysis for National Secondary Trunk Roads (NSTR)'s Budgets

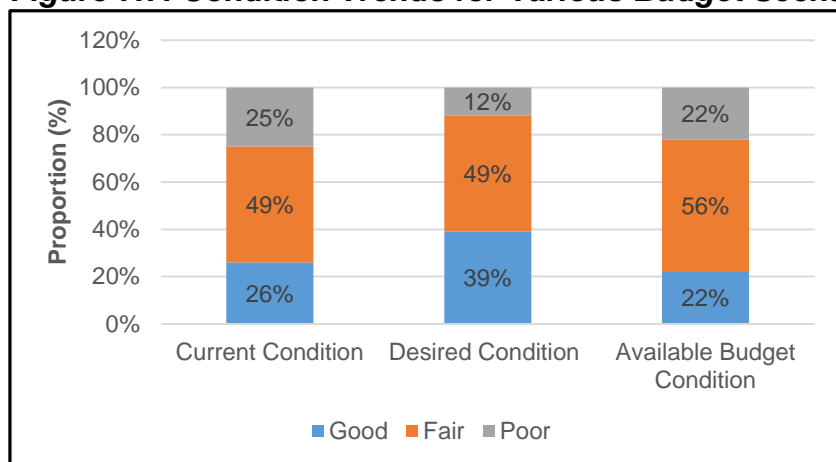
The condition mix under the various budget scenarios for the NSTR are presented in Table 7.15 and Figure 7.7, with details given in Appendix E2.

**Table 7.15: Results of Condition Mix for NSTR**

| Scenario                                 | Good       | Fair       | Poor       |
|--|------------|------------|------------|
| <b>Current Condition</b>                 | <b>26%</b> | <b>49%</b> | <b>25%</b> |
| <b>Desired Condition</b>                 | <b>39%</b> | <b>49%</b> | <b>12%</b> |
| 150% of Available                        | 26%        | 55%        | 19%        |
| 125% of Available                        | 23%        | 57%        | 20%        |
| <b>100% of Available (Actual Budget)</b> | <b>22%</b> | <b>56%</b> | <b>22%</b> |
| 90% of Available                         | 21%        | 57%        | 22%        |
| 75% of Available                         | 21%        | 52%        | 27%        |

Figure 7.7 shows the condition trends for current, desired and available budget scenarios for NSTR.

**Figure 7.7: Condition Trends for Various Budget Scenarios for NSTR**



NSTR's network in in good and poor condition will drop marginally by about 4% and 3% respectively while that in fair condition will increase by about 7%.

#### 7.7.4 Sensitivity Analysis for County Roads Budget

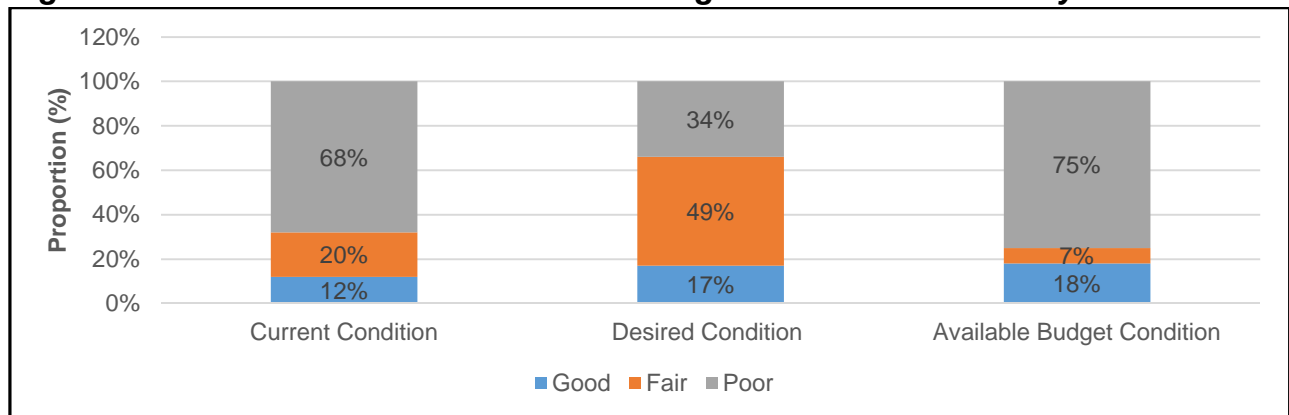
The condition mix under the various budget scenarios for the Counties are presented in Table 7.16 and Figure 7.8, with details given in Appendix E2.

**Table 7.16: Results of Condition Mix for County Roads**

| Scenario                                 | Good       | Fair       | Poor       |
|--|------------|------------|------------|
| <b>Current Condition</b>                 | <b>12%</b> | <b>20%</b> | <b>68%</b> |
| <b>Desired Condition</b>                 | <b>17%</b> | <b>49%</b> | <b>34%</b> |
| 150% of Available                        | 28%        | 10%        | 62%        |
| 125% of Available                        | 25%        | 11%        | 64%        |
| <b>100% of Available (Actual Budget)</b> | <b>18%</b> | <b>7%</b>  | <b>75%</b> |
| 90% of Available                         | 18%        | 5%         | 77%        |
| 75% of Available                         | 17%        | 5%         | 78%        |

Figure 7.8 shows the condition trends for current, desired and available budget scenarios for County.

**Figure 7.8: Condition Trends for Various Budget Scenarios for County**



County's network in good and poor condition will increase by 6% and 7% respectively. Also, a 50% increase in the available budgets for counties will see an increase in the portion of their network condition in good condition by 16% and a decrease in the portion of their network in poor condition by about 6%.

#### 7.7.5 Sensitivity Analysis for Roads within Wildlife Conservation Area's Budgets

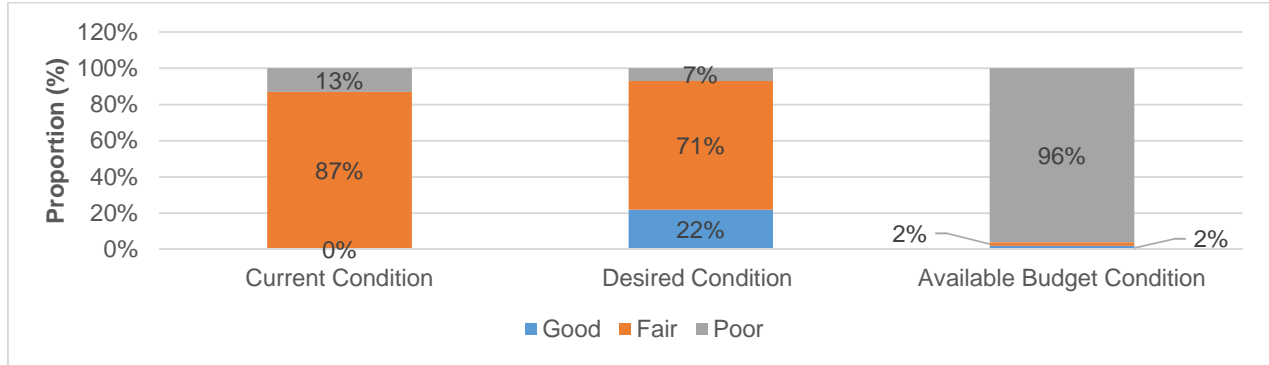
The condition mix under the various budget scenarios for the Roads within Wildlife Conservation Areas are presented in Table 7.17 and Figure 7.9, with details given in Appendix E2.

**Table 7.17: Results of Condition Mix for Roads within Wildlife Conservation Areas**

| Scenario                                 | Good       | Fair       | Poor       |
|--|------------|------------|------------|
| <b>Current Condition</b>                 | <b>0%</b>  | <b>87%</b> | <b>13%</b> |
| <b>Desired Condition</b>                 | <b>22%</b> | <b>71%</b> | <b>7%</b>  |
| 150% of Available                        | 2%         | 6%         | 92%        |
| 125% of Available                        | 2%         | 5%         | 93%        |
| <b>100% of Available (Actual Budget)</b> | <b>2%</b>  | <b>2%</b>  | <b>96%</b> |
| 90% of Available                         | 2%         | 2%         | 96%        |
| 75% of Available                         | 2%         | 2%         | 96%        |

Figure 7.9 shows the condition trends for current, desired and available budget scenarios for Roads within Wildlife Conservation Areas.

**Figure 7.9: Condition Trends for Various Budget Scenarios for Roads within Wildlife Conservation Areas**



Roads within Wildlife Conservation Area’s network the portion of the network in poor condition is likely to increase by about 83% over the RSIP2 implementation period based on the available budgets.

## 7.8 Conclusion

The strategy analysis revealed that the current budgets as proposed are likely to result into the deterioration of part of the network from good to fair condition and also from fair to poor condition at the end of the RSIP2 implementation period. A total of KSh. 2.27 trillion will be required to fix the backlog of maintenance and development works over the next 5-years. This translates to an additional budget of KSh. 1.47 trillion over the current available budgets of KSh. 0.806 trillion. The stretched targets on the other hand will require a total financial outlay of KSh. 1.033 trillion over the next 5-years.

The analysis shows that more resources should be channelled towards maintenance and development works within the roads sub-sector.

## 8 Road Sector Investment Programme

### 8.1 General

This chapter describes the preparation of a 5-year road sector investment programme for the entire country. The life cycle analysis method based on economic efficiency criteria was used to prepare optimal road investment programme for each road agency. The multi-criteria analysis method was applied to produce work programmes that considered engineering, economic, social and environmental issues based on the results of a separate study conducted in Kenya to determine appropriate criteria and their relative importance in road investment appraisal (KRB, 2016).

The objective of RSIP2 was to prepare for funding a prioritised list of road sections that have been identified to be in need of periodic maintenance, some form of rehabilitation, capacity improvement, upgrading from unsealed to bituminous standard or upgrading from earth to gravel standard during the next 5-year planning period.

The analysis considered all the sections from the entire national road network designated under National Primary Trunk Roads (NPTR), National Primary Urban Roads (NPUR), National Secondary Trunk Roads (NSTR), County and Roads within Wildlife Conservation Areas. The AADT and composition observed on each road section was specified together with details of the particular road section. The annual traffic growth rate used for the baseline analysis is discussed in Chapter 5. The work programming procedure involved definition and assignment of work standards to the road sections, generation of the unconstrained work programme on the basis of economic efficiency, optimisation under specified budget constraints, inclusion of ongoing and committed projects, and finally generation of reports. This procedure was followed sequentially, although iteration between the above tasks was done in order to review previously specified data. Multi-criteria analysis was then performed using the unconstrained work programme produced on the basis of engineering efficiency to maximize improvement in the road network condition.

The expected benefits of the work programmes produced include enhancing coordination of road programmes in the country by bringing these programmes into a single framework; and assisting development partners to identify projects and programmes aligned to their transport sector priorities.

### 8.2 Ongoing and Committed Projects

There are ongoing and committed projects scheduled within the RSIP2 period that are included in the 5-year investment work programme of each road agency. The types of ongoing and committed works are mainly upgrading of unsealed roads to bitumen standard and rehabilitation of existing paved roads.

The procedure for defining the data for ongoing projects involved separating the work into two parts as follows: that which has already been completed and that which should be completed within the 5-year programme period.

A length adjustment factor was then determined and used for estimating the cost of completing the outstanding works for each ongoing scheme.

The outlay of committed and ongoing projects between the period 2017/18 and 2020/21 are detailed in the subsequent sections.

### **8.3 Investment Alternatives**

Several alternatives were defined for each road section by logically combining the work standards. A works standard refers to the targets or levels of conditions and response that a road agency aims to achieve. Road agencies set up different standards that can be applied in practical situations in order to meet specific objectives which are related to functional characteristics of the road network system. A standard is defined by a set of work activities with definite intervention criteria to determine when to carry them out. In general terms, intervention levels define the minimum level of service that is acceptable to the roads agency.

For each road section, a base case alternative and five investment alternatives were defined for analysis. For paved roads, the base case comprised a work standard for routine maintenance only, and this included patching, edge repair, crack sealing, drainage maintenance, and miscellaneous works activities together with the unit costs. The investment alternative included work standards such as LVSR, resealing, overlays, rehabilitation/reconstruction, and capacity improvement, and the above routine maintenance standard.

For unpaved roads, the base case comprised a work standard for routine maintenance only, and this included grading, spot gravelling, drainage maintenance, and miscellaneous works activities together with the unit costs. The investment alternative included the above routine maintenance standard plus work standards that include spot gravelling, upgrading of unsealed roads to bitumen standard, and upgrading of earth roads to gravel standard.

The data described above was entered in HDM-4 and analysed to produce the 5-year work programme. The result of the analysis undertaken is presented in Section 8.4 for optimised work programme based on economic efficiency criterion. The result of MCA based work programme, conducted outside HDM-4, is presented in Section 8.5.

## 8.4 Optimised 5-Year Work Programme

### 8.4.1 General

The detailed optimised 5-year work programmes for the five road sub-networks under the jurisdiction of National Primary Trunk Roads (NPTR), National Secondary Trunk Roads (NSTR), National Primary Urban Roads (NPUR), Roads within Wildlife Conservation Areas and County are given in Appendix F. These optimised work programmes comprise Ongoing Projects (OP), Committed Projects (CP), Periodic Maintenance (PM), Upgrading Projects (UP) and Capacity Improvements (CI). The financial requirement for these work categories is referred to as the Capital Expenditure.

For each road agency the optimised work programme has annual total cost that is within the specified annual budget ceilings of current/expected budget scenario. The road sections are listed chronologically (by year) in accordance with the incremental benefit/cost ranking index and by work category. It is envisaged that all road sections that are not listed in any year of the 5-year planning period will receive adequate routine maintenance in that particular year. The financial requirement for this routine maintenance works is referred to as the recurrent expenditure.

### 8.4.2 Summary Result of RSIP2 for the Entire Kenyan Road Network

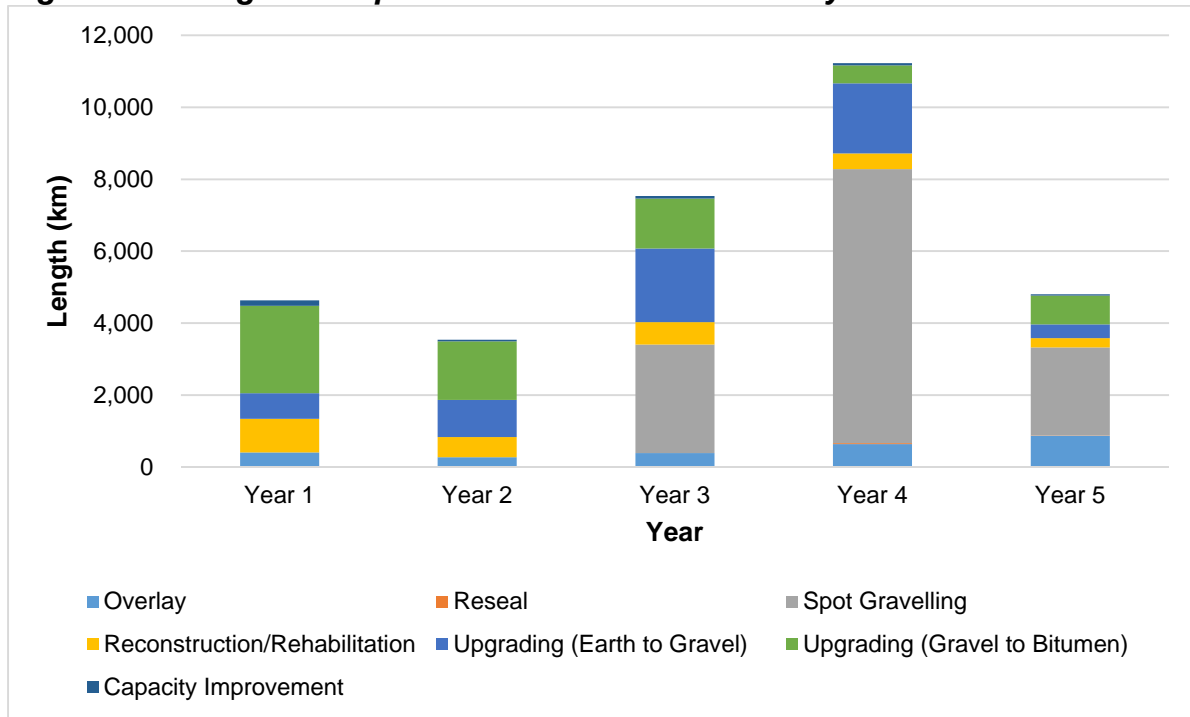
The key performance indicators of the results of RSIP2 are presented in this section. The road centre-line length of annual capital works is presented in Table 8.2 by budget status, works class and works type.

**Table 8.2: Length of Capital Works for the Entire Kenyan Road Network**

| Budget Status        | Works Class          | Works (Treatment) Type        | Length (km) |        |        |        |            |               |
|----------------------|----------------------|-------------------------------|-------------|--------|--------|--------|------------|---------------|
|                      |                      |                               | Year 1      | Year 2 | Year 3 | Year 4 | Year 5     | Total         |
| Uncommitted          | Periodic Maintenance | Overlay                       | 395         | 280    | 392    | 642    | 877        | <b>2,584</b>  |
|                      |                      | Reseal                        | 0           | 0      | 0      | 28     | 9          | <b>37</b>     |
|                      |                      | Spot Gravelling               | 0           | 0      | 3,012  | 7,610  | 2,439      | <b>13,061</b> |
|                      | Rehabilitation       | Reconstruction/Rehabilitation | 1           | 54     | 229    | 113    | 257        | <b>654</b>    |
|                      | Development          | Upgrading (Earth to Gravel)   | 711         | 1,027  | 2,046  | 1,950  | 386        | <b>6,121</b>  |
|                      |                      | Upgrading (Gravel to Bitumen) | 189         | 267    | 102    | 77     | 606        | <b>1,241</b>  |
| Capacity Improvement |                      | 0                             | 0           | 0      | 29     | 41     | <b>71</b>  |               |
| Ongoing & Committed  | Periodic Maintenance | Overlay                       | 16          | 2      | 0      | 0      | 0          | <b>18</b>     |
|                      |                      | Reseal                        | 0           | 0      | 0      | 0      | 0          | <b>0</b>      |
|                      |                      | Spot Gravelling               | 0           | 0      | 0      | 0      | 0          | <b>0</b>      |
|                      | Rehabilitation       | Reconstruction/Rehabilitation | 930         | 503    | 401    | 325    | 0          | <b>2,158</b>  |
|                      | Development          | Upgrading (Earth to Gravel)   | 0           | 0      | 0      | 0      | 0          | <b>0</b>      |
|                      |                      | Upgrading (Gravel to Bitumen) | 2,239       | 1,368  | 1,277  | 420    | 192        | <b>5,496</b>  |
| Capacity Improvement |                      | 152                           | 43          | 50     | 31     | 0      | <b>275</b> |               |

Figure 8.1 presents a bar chart diagram showing the yearly capital works and length of roads for the combined ongoing/committed budget and uncommitted budget.

**Figure 8.1: Length of Capital Works for the Entire Kenyan Road Network**



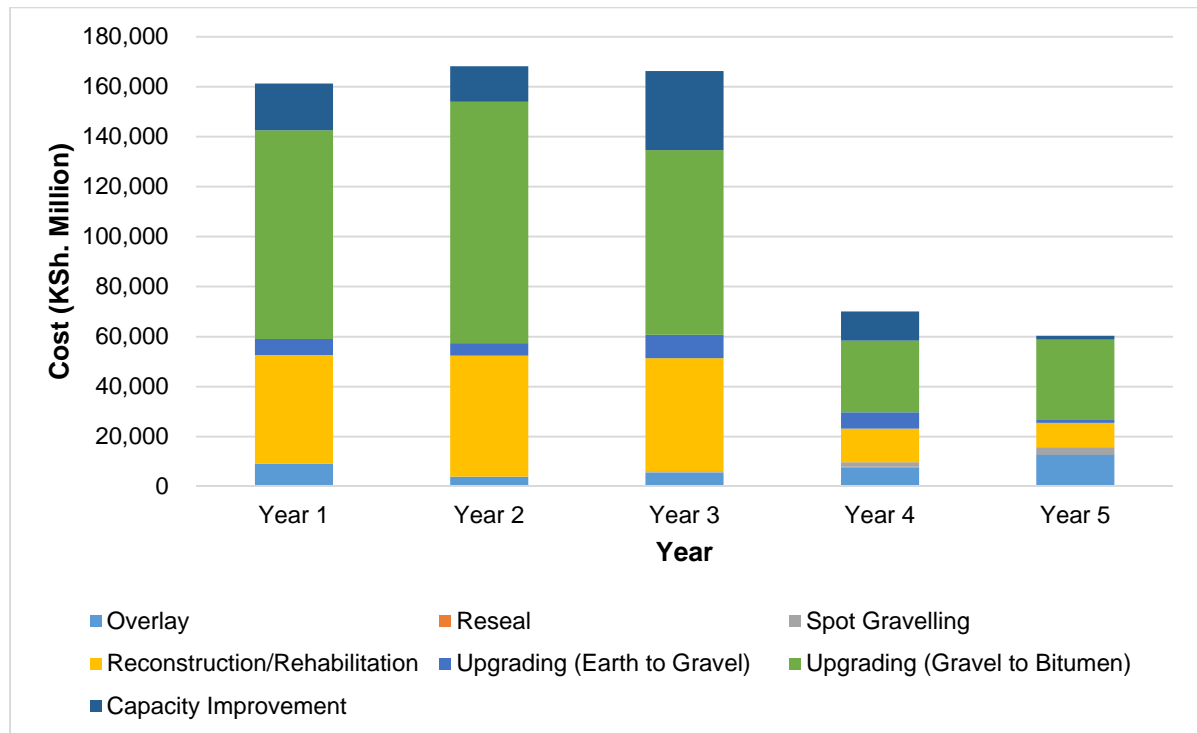
The annual costs of capital works are presented in Table 8.3 by budget status, works class and works type.

**Table 8.3: Costs of Capital Works for the Entire Road Network**

| Budget status        | Works Class          | Treatment Type                | Capital Costs (KSh. Million) |                |                |               |               | Total          |
|----------------------|----------------------|-------------------------------|------------------------------|----------------|----------------|---------------|---------------|----------------|
|                      |                      |                               | Year 1                       | Year 2         | Year 3         | Year 4        | Year 5        |                |
| Uncommitted          | Periodic Maintenance | Overlay                       | 8,169                        | 3,912          | 5,588          | 7,683         | 12,948        | <b>38,301</b>  |
|                      |                      | Reseal                        | 0                            | 0              | 0              | 270           | 34            | <b>304</b>     |
|                      |                      | Spot Gravelling               | 0                            | 0              | 577            | 1,770         | 2,769         | <b>5,117</b>   |
|                      | Rehabilitation       | Reconstruction/Rehabilitation | 85                           | 2,272          | 7,837          | 3,826         | 9,782         | <b>23,802</b>  |
|                      | New Development      | Upgrading (Earth to Gravel)   | 5,121                        | 4,972          | 9,346          | 6,589         | 1,103         | <b>27,131</b>  |
|                      |                      | Upgrading (Gravel to Bitumen) | 14,383                       | 15,513         | 5,765          | 5,217         | 23,664        | <b>64,542</b>  |
| Capacity Improvement |                      | 0                             | 0                            | 2,157          | 1,438          | 1,524         | <b>5,118</b>  |                |
| Ongoing/Committed    | Periodic Maintenance | Overlay                       | 927                          | 119            | 0              | 0             | 0             | <b>1,047</b>   |
|                      |                      | Reseal                        | 0                            | 0              | 0              | 0             | 0             | <b>0</b>       |
|                      |                      | Spot Gravelling               | 0                            | 0              | 0              | 0             | 0             | <b>0</b>       |
|                      | Rehabilitation       | Reconstruction/Rehabilitation | 43,470                       | 46,147         | 37,306         | 9,640         | 0             | <b>136,564</b> |
|                      | New Development      | Upgrading (Earth to Gravel)   | 1,291                        | 0              | 0              | 0             | 0             | <b>1,291</b>   |
|                      |                      | Upgrading (Gravel to Bitumen) | 69,055                       | 81,028         | 68,156         | 23,409        | 8,518         | <b>250,165</b> |
| Capacity Improvement |                      | 18,806                        | 14,143                       | 29,472         | 10,208         | 0             | <b>72,629</b> |                |
| <b>Total</b>         |                      |                               | <b>161,307</b>               | <b>168,106</b> | <b>166,204</b> | <b>70,050</b> | <b>60,342</b> | <b>626,011</b> |

Figure 8.2 presents a bar chart diagram showing the annual costs of capital works for combined ongoing/committed budget and uncommitted budget.

**Figure 8.2: Costs of Capital Works for the Entire Kenyan Road Network**



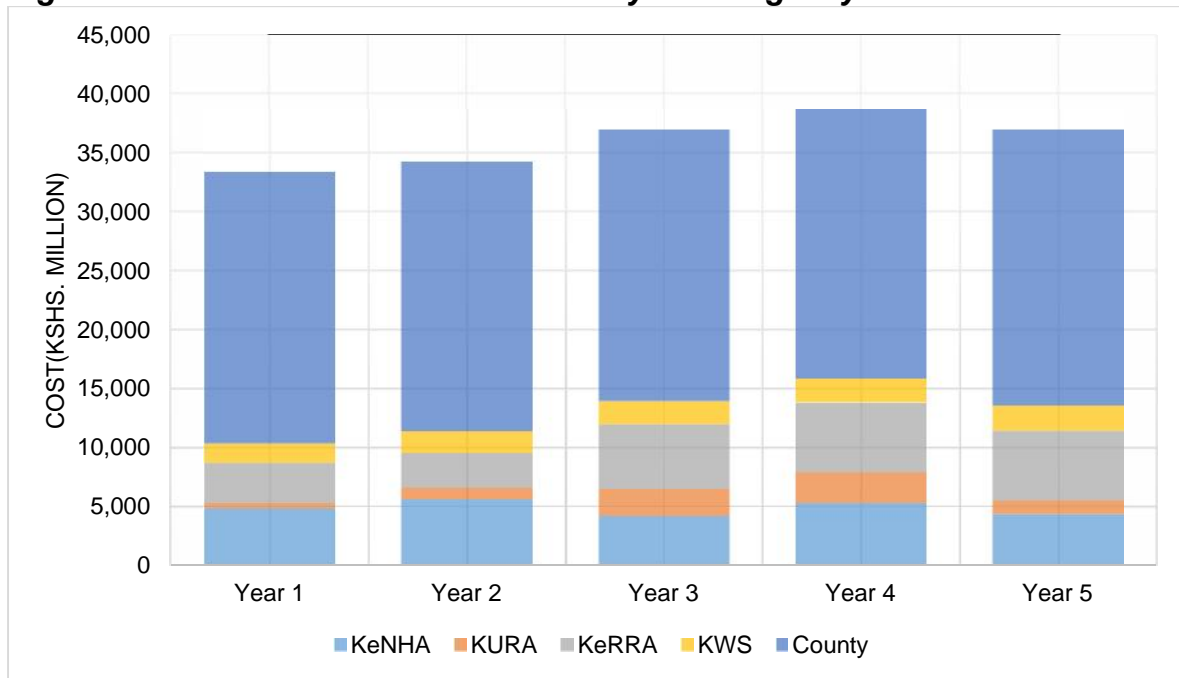
From strategy analysis, the routine maintenance needs were estimated at KSh. 180.182 billion against the estimated total budgetary allocation of KSh. 193.2 billion. The annual costs of recurrent works are presented in Table 8.4 by sub-networks.

**Table 8.4: Recurrent Costs from Strategy Analysis for Routine Maintenance by Road Network**

| Sub-network                              | Recurrent Costs for Routine Maintenance (KSh. Million) |               |               |               |               | Total          |
|--|--|---------------|---------------|---------------|---------------|----------------|
|  | Year 1   | Year 2        | Year 3        | Year 4        | Year 5        |                |
| National Primary Trunk Roads (NPTR)      | 4,799  | 5,587         | 4,166         | 5,285         | 4,331         | <b>24,168</b>  |
| National Primary Urban Roads (NPUR)      | 455  | 959           | 2,283         | 2,605         | 1,127         | <b>7,429</b>   |
| National Secondary Trunk Roads (NSTR)    | 3,415  | 2,96          | 5,502         | 5,901         | 5,936         | <b>23,713</b>  |
| Roads within Wildlife Conservation Areas | 1,657  | 1,831         | 1,954         | 2,041         | 2,110         | <b>9,594</b>   |
| County                                   | 23,028   | 22,874        | 23,048        | 22,871        | 23,455        | <b>115,277</b> |
| <b>Total</b>                             | <b>33,354</b>  | <b>34,211</b> | <b>36,953</b> | <b>38,704</b> | <b>36,959</b> | <b>180,182</b> |

Figure 8.3 illustrates how routine maintenance costs depend on road length and road class.

**Figure 8.3: Routine Maintenance Costs by Road Agency**



The percentage split of the Kenyan road network by surface class between paved and unpaved roads is given in Table 8.5 for the current status and for the situation after completing implementation of RSIP2.

**Table 8.5: RSIP2 Effect on Percentage Split between Paved and Unpaved Roads**

| Sub-network                              | Road Length (Km) | Current Status |             | At the end of RSIP2 |             |
|--|------------------|----------------|-------------|---------------------|-------------|
|  |                  | Paved (%)      | Unpaved (%) | Paved (%)           | Unpaved (%) |
| National Primary Trunk Roads (NPTR)      | 18,220.3         | 49.3           | 50.7        | 57.2                | 42.8        |
| National Secondary Trunk Roads (NSTR)    | 19,528.6         | 20.1           | 79.9        | 31.9                | 68.1        |
| National Primary Urban Roads (NPUR)      | 2,619.7          | 44.8           | 55.2        | 64.1                | 35.9        |
| Roads within Wildlife Conservation Areas | 6562.1           | 0.1            | 99.9        | 0.1                 | 99.9        |
| County                                   | 114,286          | 8.3            | 91.7        | 10.4                | 89.6        |
| <b>Entire Kenyan Road Network</b>        | <b>161,217</b>   | <b>14.6</b>    | <b>85.4</b> | <b>18.8</b>         | <b>81.2</b> |

Implementation of RSIP2 will affect the road condition of each of the five subnetworks. On average, there will be winners and losers at the end of the 5-year planning period as summarised in Table 8.6. Details of the average changes in road condition are given for each road agency in the subsequent sub-sections. Overall, there will be an improvement in the condition of the entire Kenyan road network.

**Table 8.6: RSIP2 Effect on the Kenyan Sub-Networks Condition**

| Paved Roads Subnetwork Average Condition                           |                                 |   | Unpaved Roads Subnetwork Average Condition                   |   |  |
|--|---------------------------------|---|--|---|--|
| Improved   | No change                       | Worse   | Improved   | No change   | Worse  |
| National Primary Trunk Roads (NPTR)<br><i>Fair to Good</i>         | County<br><i>Generally Fair</i> | National Secondary Trunk Roads (NSTR)<br><i>Fair to Poor</i>    | National Primary Trunk Roads (NPTR)<br><i>Poor to Fair</i>   | County<br>Remains Poor  | National Primary Trunk Roads (NPTR)<br><i>Fair to Poor</i> |
| National Primary Urban Roads (NPUR)<br><i>Poor tending to Fair</i> |                                 | Roads within Wildlife Conservation Areas<br><i>Fair to Poor</i> | National Secondary Trunk Roads (NSTR)<br><i>Poor to Fair</i> | Roads within Wildlife Conservation Areas<br><i>Remains Poor</i> |  |

Ideally, the Government should aim to improve the road network condition, or at worst, maintain the existing road condition. From the results in Table 8.6, the Government should consider allocating more funds to the paved network of National Secondary Trunk Roads (NSTR) and Roads within Wildlife Conservation Areas, and the unpaved National Primary Trunk Roads (NPTR) network.

### 8.4.3 Return on Investment (ROI)

Road user costs comprise vehicle operating costs (VOC), travel time costs (TTC) and accident costs. Undiscounted savings in VOC and savings in TTC have been calculated over the 5-year RSIP period.

The economic benefits, expressed in terms of Net Present Value (NPV), of implementing RSIP2 over the entire Kenyan road network is calculated over 20-year analysis period. The results of savings in VOC, savings in TTC, the NPVs and NPV/Capital Cost for RSIP2 are summarised in Table 8.7 for all the road agencies and for the entire road network. It is assumed that these amounts of NPV given in Table 8.6 will be realized when timely implementation of periodic and routine maintenance are applied over the 20-year analysis period.

Overall, there is an attractive positive return to invest in RSIP2 of **KSh. 853.58 billion** and **KSh. 5.189 trillion** over the 5 and 20-year periods respectively.

**Table 8.7: RSIP2 Economic Performance Indicators**

| Road Agency                              | Savings in VOC<br>(Over RSIP2 period<br>in KSh Million) | Savings in TTC<br>(Over RSIP2 period<br>in KSh Million) | NPV<br>(Over the 20-year<br>analysis period in<br>KSh Million) | NPV/Capital<br>Cost Ratio |
|--|---|---|--|---------------------------|
| National Primary Trunk Roads (NPTR)      | 506,223   | 130,345   | 4,441,096  | 15.17                     |
| National Secondary Trunk Roads (NSTR)    | 18,148  | 5,102   | 77,353   | 4.14                      |
| National Primary Urban Roads (NPUR)      | 37,467  | 7,359   | 306,549  | 11.8                      |
| Roads within Wildlife Conservation Areas | 5,971   | 2,169   | 20,136   | 7.1                       |
| County                                   | 108,403   | 32,393  | 343,920  | 3.9                       |
| <b>Total*</b>                            | <b>676,212</b>  | <b>177,368</b>  | <b>5,189,054</b>   | <b>12.1</b>               |

\*Entire Kenyan Road Network

The ROI has also been expressed in terms of the amount of return for every shilling invested in RSIP2 using the expression:

$$\text{ROI} = \frac{\text{Savings in VOC} + \text{Savings in TTC}}{\text{Road Agency Costs (RAC)}}$$

The analysis has revealed that for **every one shilling invested in roads**, the country **stands to gain one shilling and ten cents in benefits** during the RSIP2 implementation period. However, benefits of road investments are long-term (15-20 years) and can therefore not be adequately quantified within such a short investment period of 5 years. Most of the benefits to be accrued from the RSIP2 are therefore outside its 5-year implementation period. The 1.10 ROI however shows that the investment costs would have been recouped within the 5-year implementation period.

#### 8.4.4 Result of National Primary Trunk Roads (NPTR) Optimised Work Programme

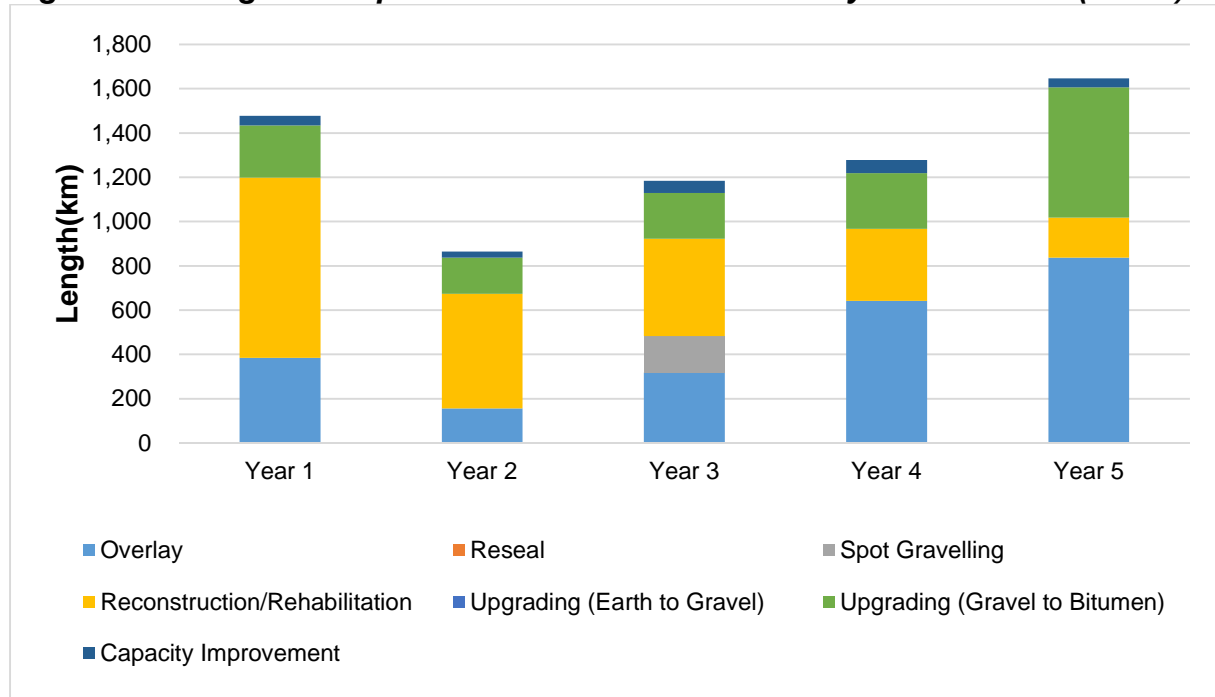
The key performance indicators for NPTR RSIP2 can be summarised under headings of works length, costs, road condition, road user costs and net economic benefits. The road centre-line length of annual capital works is presented in Table 8.8 by budget status, works class and works type.

**Table 8.8: Length of Capital Works for NPTR**

| Budget Status        | Works Class          | Works (Treatment) Type         | Length(km) |        |        |        |            | Total        |
|----------------------|----------------------|--------------------------------|------------|--------|--------|--------|------------|--------------|
|                      |                      |                                | Year 1     | Year 2 | Year 3 | Year 4 | Year 5     |              |
| Uncommitted          | Periodic Maintenance | Overlay                        | 384        | 156    | 318    | 642    | 837        | <b>2,337</b> |
|                      |                      | Reseal                         | 0          | 0      | 0      | 0      | 0          | <b>0</b>     |
|                      |                      | Spot Gravelling                | 0          | 0      | 163    | 0      | 0          | <b>163</b>   |
|                      | Rehabilitation       | Reconstruction/ Rehabilitation | 0          | 54     | 63     | 0      | 181        | <b>298</b>   |
|                      | Development          | Upgrading (Earth to Gravel)    | 0          | 0      | 0      | 0      | 0          | <b>0</b>     |
|                      |                      | Upgrading (Gravel to Bitumen)  | 14         | 14     | 0      | 53     | 588        | <b>669</b>   |
| Capacity Improvement |                      | 0                              | 0          | 29     | 29     | 41     | <b>100</b> |              |
| Ongoing & Committed  | Periodic Maintenance | Overlay                        | 0          | 0      | 0      | 0      |            | <b>0</b>     |
|                      |                      | Reseal                         | 0          | 0      | 0      | 0      |            | <b>0</b>     |
|                      |                      | Spot Gravelling                | 0          | 0      | 0      | 0      |            | <b>0</b>     |
|                      | Rehabilitation       | Reconstruction/ Rehabilitation | 814        | 464    | 377    | 325    |            | <b>1,981</b> |
|                      | Development          | Upgrading (Earth to Gravel)    | 0          | 0      | 0      | 0      |            | <b>0</b>     |
|                      |                      | Upgrading (Gravel to Bitumen)  | 222        | 149    | 208    | 199    |            | <b>777</b>   |
| Capacity Improvement |                      | 43                             | 28         | 25     | 31     |        | <b>127</b> |              |

Figure 8.4 presents a bar chart diagram showing the annual capital works length for combined ongoing/committed budget and uncommitted budget.

**Figure 8.4: Length of Capital Works for National Primary Trunk Roads (NPTR)**



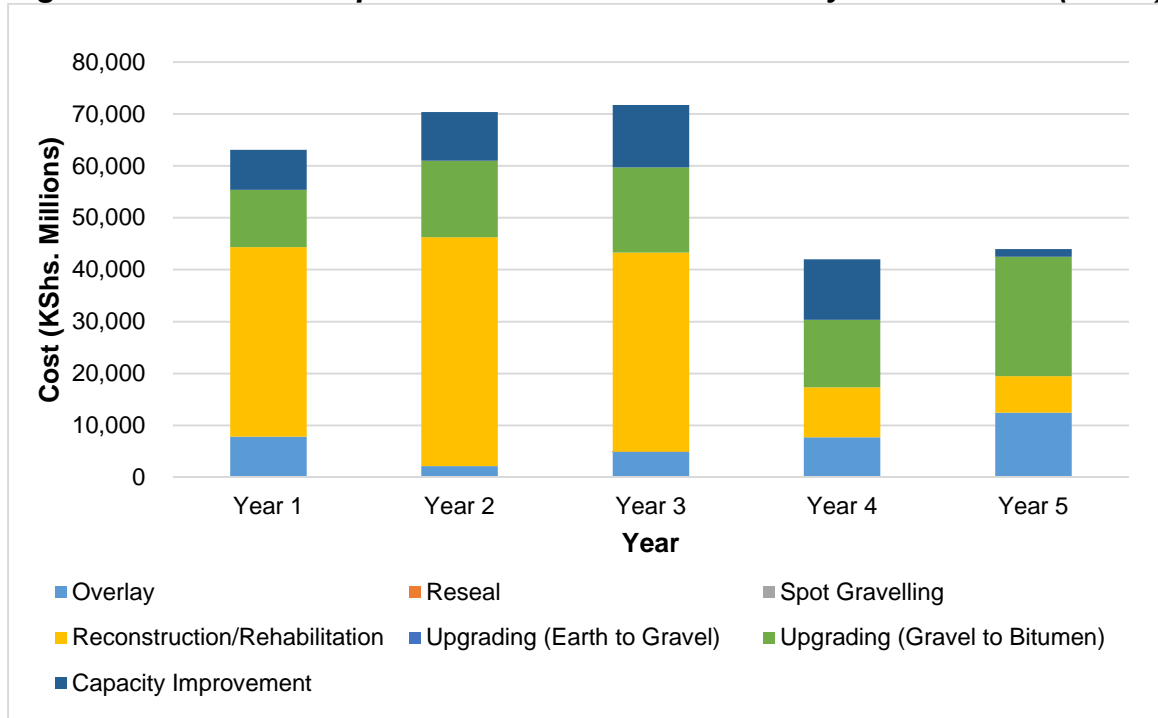
The annual costs of capital works are presented in Table 8.9 by budget status, works class and works type.

**Table 8.9: Costs of Capital Works for National Primary Trunk Roads (NPTR)**

| Budget Status        | Works Class          | Treatment Type                | Capital Costs (KSh. Millions) |               |               |               |               | Total          |
|----------------------|----------------------|-------------------------------|-------------------------------|---------------|---------------|---------------|---------------|----------------|
|                      |                      |                               | Year 1                        | Year 2        | Year 3        | Year 4        | Year 5        |                |
| Uncommitted          | Periodic Maintenance | Overlay                       | 7,839                         | 2,175         | 4,874         | 7,683         | 12,446        | 35,017         |
|                      |                      | Reseal                        | 0                             | 0             | 0             | 0             | 0             | 0              |
|                      |                      | Spot Gravelling               | 0                             | 0             | 40            | 0             | 0             | 40             |
|                      | Rehabilitation       | Reconstruction/Rehabilitation | 0                             | 2,272         | 2,269         | 0             | 7,040         | 11,581         |
|                      |                      | Upgrading (Earth to Gravel)   | 0                             | 0             | 0             | 0             | 0             | 0              |
|                      | Development          | Upgrading (Gravel to Bitumen) | 1,063                         | 709           | 0             | 4,007         | 22,989        | 28,768         |
| Capacity Improvement |                      | 0                             | 0                             | 2,157         | 1,438         | 1,524         | 5,118         |                |
|                      |                      |                               |                               |               |               |               |               |                |
| Ongoing & Committed  | Periodic Maintenance | Overlay                       | 0                             | 0             | 0             | 0             |               | 0              |
|                      |                      | Reseal                        | 0                             | 0             | 0             | 0             |               | 0              |
|                      |                      | Spot Gravelling               | 0                             | 0             | 0             | 0             |               | 0              |
|                      | Rehabilitation       | Reconstruction/Rehabilitation | 36,503                        | 41,803        | 36,103        | 9,640         |               | 124,049        |
|                      |                      | Upgrading (Earth to Gravel)   | 0                             | 0             | 0             | 0             |               | 0              |
|                      | Development          | Upgrading (Gravel to Bitumen) | 9,972                         | 14,048        | 16,422        | 9,039         |               | 49,481         |
| Capacity Improvement |                      | 7,722                         | 9,343                         | 9,869         | 10,208        |               | 37,141        |                |
| <b>Total</b>         |                      |                               | <b>63,099</b>                 | <b>70,350</b> | <b>71,734</b> | <b>42,015</b> | <b>43,999</b> | <b>291,195</b> |

Figure 8.5 presents a bar chart diagram showing the annual costs of capital works for combined ongoing/committed budget and uncommitted budget.

**Figure 8.5: Costs of Capital Works for National Primary Trunk Roads (NPTR)**



The percentage split of NPTR road network by surface class between paved and unpaved roads at the beginning and end of RSIP2 is given in Table 8.5.

The implementation of RSIP2 will improve the NPTR paved road network by reducing the average roughness from about 4 IRI to 3.2 IRI at the end of the 5-year planning period. For unpaved roads the average roughness will increase slightly from about 13 IRI to 13.8 IRI at the end of the 5-year planning period. This is mainly due to the annual increase in traffic levels on these unpaved roads, and reflects the effect of insufficient funding provided for the KeNHA road network.

Over the 5-year planning period, the total savings in vehicle operating costs (VOC) over NPTR road network is estimated at KSh. 506.223 billion; and the total savings in travel time cost (TTC) is estimated at KSh. 130.345 billion. The net economic benefits that will result from implementing RSIP2 over the 20-year analysis period is estimated at KSh. 4.441 trillion (Table 8.7). This amount of net benefit assumes that timely implementation of periodic and routine maintenance will be applied over the 20-year analysis period.

### 8.4.5 Result of National Secondary Trunk Roads (NSTR) Optimised Work Programme

The key indicators for NSTR RSIP2 can be summarised under headings of works length, costs, road condition, road user costs and net economic benefits.

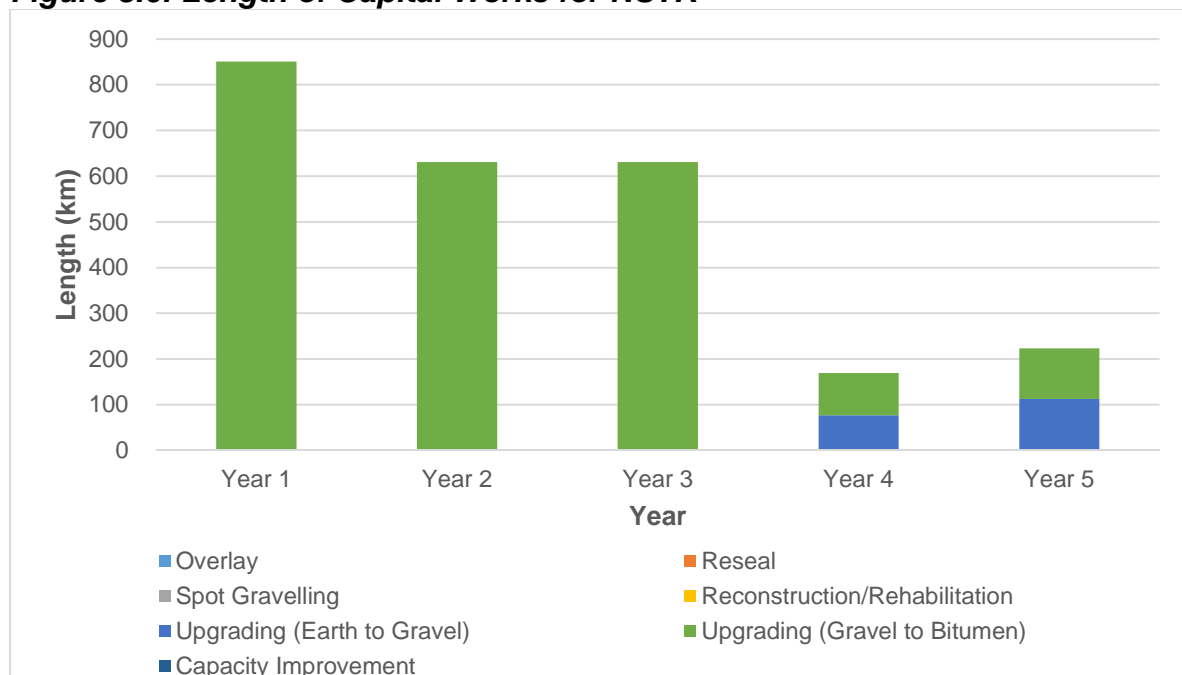
The road centre-line length of annual capital works is presented in Table 8.10 by budget status, works class and works type.

**Table 8.10: Length of Capital Works for NSTR**

| Budget status         | Works Class          | Treatment Type                | Length(km) |        |        |        |        |       |
|-----------------------|----------------------|-------------------------------|------------|--------|--------|--------|--------|-------|
|                       |                      |                               | Year 1     | Year 2 | Year 3 | Year 4 | Year 5 | Total |
| Uncommitted           | Periodic Maintenance | Overlay                       | 0          | 0      | 0      | 0      | 0      | 0     |
|                       |                      | Reseal                        | 0          | 0      | 0      | 0      | 0      | 0     |
|                       |                      | Spot Gravelling               | 0          | 0      | 0      | 0      | 0      | 0     |
|                       | Rehabilitation       | Reconstruction/Rehabilitation | 0          | 0      | 0      | 0      | 0      | 0     |
|                       |                      | Upgrading (Earth to Gravel)   | 0          | 0      | 0      | 77     | 112    | 189   |
|                       | Development          | Upgrading (Gravel to Bitumen) | 0          | 0      | 0      | 0      | 18     | 18    |
| Capacity Improvement  |                      | 0                             | 0          | 0      | 0      | 0      | 0      |       |
| Committed/<br>Ongoing | Periodic Maintenance | Overlay                       | 0          | 0      | 0      | 0      | 0      | 0     |
|                       |                      | Reseal                        | 0          | 0      | 0      | 0      | 0      | 0     |
|                       |                      | Spot Gravelling               | 0          | 0      | 0      | 0      | 0      | 0     |
|                       | Reconstruction       | Reconstruction/Rehabilitation | 0          | 0      | 0      | 0      | 0      | 0     |
|                       |                      | Upgrading (Earth to Gravel)   | 0          | 0      | 0      | 0      | 0      | 0     |
|                       | Development          | Upgrading (Gravel to Bitumen) | 851        | 631    | 631    | 93     | 93     | 2,299 |
| Capacity Improvement  |                      | 0                             | 0          | 0      | 0      | 0      | 0      |       |

Figure 8.6 presents a bar chart diagram showing the annual capital works length for combined ongoing/committed budget and uncommitted budget.

**Figure 8.6: Length of Capital Works for NSTR**



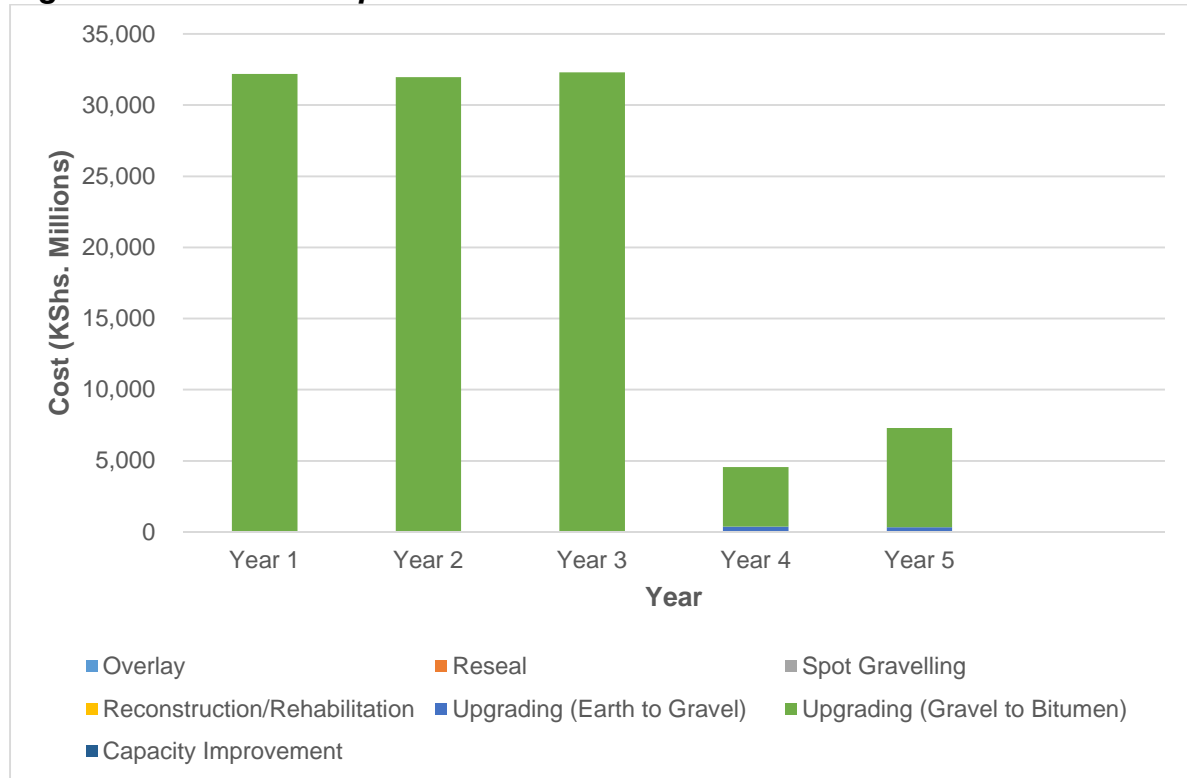
The annual costs of capital works are presented in Table 8.11 by budget status, works class and works type.

**Table 8.11: Costs of Capital Works for NSTR**

| Budget status         | Works Class          | Treatment Type                | Capital Costs (KSh. Million) |               |               |              |              | Total          |
|-----------------------|----------------------|-------------------------------|------------------------------|---------------|---------------|--------------|--------------|----------------|
|                       |                      |                               | Year 1                       | Year 2        | Year 3        | Year 4       | Year 5       |                |
| Uncommitted           | Periodic Maintenance | Overlay                       | 0                            | 0             | 0             | 0            | 0            | 0              |
|                       |                      | Reseal                        | 0                            | 0             | 0             | 0            | 0            | 0              |
|                       |                      | Spot Gravelling               | 0                            | 0             | 0             | 0            | 0            | 0              |
|                       | Reconstruction       | Reconstruction/Rehabilitation | 0                            | 0             | 0             | 0            | 0            | 0              |
|                       | Development          | Upgrading (Earth to Gravel)   | 0                            | 0             | 0             | 368          | 331          | 699            |
|                       |                      | Upgrading (Gravel to Bitumen) | 0                            | 0             | 0             | 0            | 675          | 675            |
| Capacity Improvement  |                      | 0                             | 0                            | 0             | 0             | 0            | 0            |                |
| Committed/<br>Ongoing | Periodic Maintenance | Overlay                       | 0                            | 0             | 0             | 0            | 0            | 0              |
|                       |                      | Reseal                        | 0                            | 0             | 0             | 0            | 0            | 0              |
|                       |                      | Spot Gravelling               | 0                            | 0             | 0             | 0            | 0            | 0              |
|                       | Reconstruction       | Reconstruction/Rehabilitation | 0                            | 0             | 0             | 0            | 0            | 0              |
|                       | Development          | Upgrading (Earth to Gravel)   | 0                            | 0             | 0             | 0            | 0            | 0              |
|                       |                      | Upgrading (Gravel to Bitumen) | 32,201                       | 31,969        | 32,299        | 4,198        | 6,294        | 106,961        |
| Capacity Improvement  |                      | 0                             | 0                            | 0             | 0             | 0            | 0            |                |
| <b>Total</b>          |                      |                               | <b>32,201</b>                | <b>31,969</b> | <b>32,299</b> | <b>4,566</b> | <b>7,300</b> | <b>108,335</b> |

Figure 8.7 presents a bar chart diagram showing the annual costs of capital works for combined ongoing/committed budget and uncommitted budget.

**Figure 8.7: Costs of Capital Works for NSTR**



The percentage split of NSTR road network by surface class between paved and unpaved roads at the beginning and end of RSIP2 is given in Table 8.5.

The implementation of RSIP2 will not improve the NSTR paved road network as the average roughness will increase from about 6 IRI to 7 IRI at the end of the 5-year planning period. For unpaved roads the average roughness will reduce slightly from about 14.5 IRI to 13.5 IRI at the end of the 5-year planning period. This reflects the effect of insufficient funding provided for the National Secondary Trunk Roads (NSTR) paved road network.

Over the 5-year planning period, the total savings in vehicle operating costs (VOC) over National Secondary Trunk Roads (NSTR) road network is estimated at KSh 18.148 billion; and the total savings in travel time cost (TTC) is estimated at KSh 5.102 billion. The net economic benefits that will result from implementing RSIP2 over the 20-year analysis period is estimated at KSh 77.353 billion (Table 8.7). This amount of net benefit assumes that timely implementation of periodic and routine maintenance will be applied over the 20-year analysis period.

#### 8.4.6 Result of National Primary Urban Roads (NPUR) Optimised Work Programme

The key indicators for NPUR RSIP2 can be summarised under headings of works length, costs, road condition, road user costs and net economic benefits.

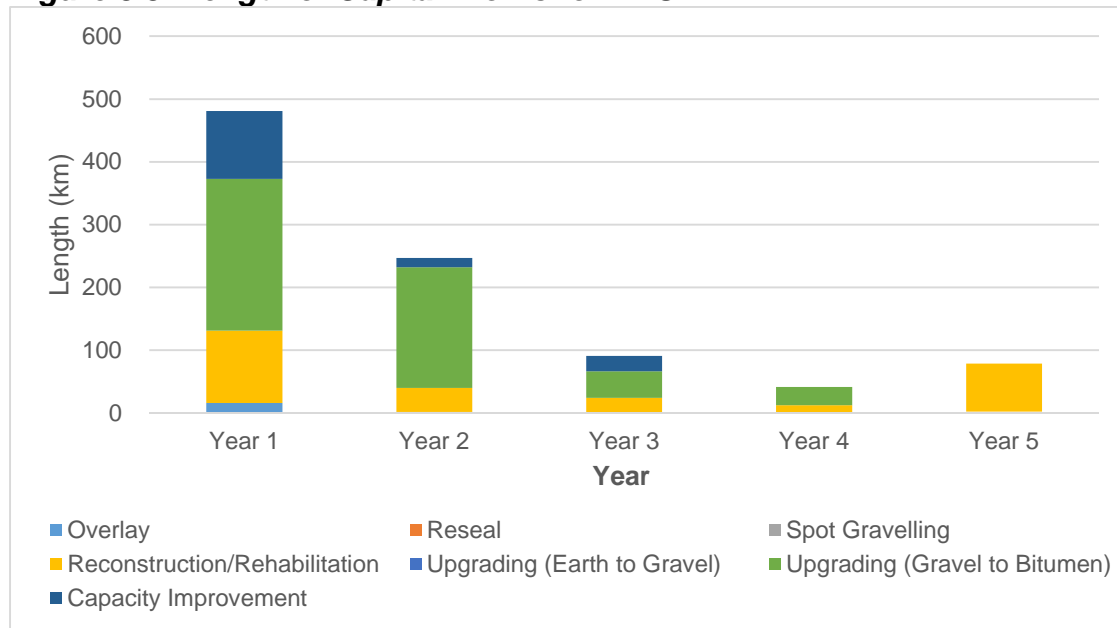
The road centre-line length of annual capital works is presented in Table 8.12 by budget status, works class and works type.

**Table 8.12: Length of Capital Works for NPUR**

| Budget Status         | Works Class          | Works (Treatment) Type         | Length(km)                    |        |        |        |        |       |     |
|-----------------------|----------------------|--------------------------------|-------------------------------|--------|--------|--------|--------|-------|-----|
|                       |                      |                                | Year 1                        | Year 2 | Year 3 | Year 4 | Year 5 | Total |     |
| Uncommitted           | Periodic Maintenance | Overlay                        | 0                             | 0      | 0      | 0      | 0      | 0     |     |
|                       |                      | Reseal                         | 0                             | 0      | 0      | 0      | 0      | 0     |     |
|                       |                      | Spot Gravelling                | 0                             | 0      | 0      | 0      | 7      | 7     |     |
|                       | Reconstruction       | Reconstruction/ Rehabilitation | 0                             | 0      | 0      | 12     | 76     | 89    |     |
|                       |                      | Development                    | Upgrading (Earth to Gravel)   | 0      | 0      | 0      | 0      | 0     | 0   |
|                       |                      |                                | Upgrading (Gravel to Bitumen) | 0      | 0      | 0      | 0      | 0     | 0   |
|                       | Capacity Improvement | 0                              | 0                             | 0      | 0      | 0      | 0      |       |     |
| Ongoing and Committed | Periodic Maintenance | Overlay                        | 16                            | 2      | 0      | 0      |        | 18    |     |
|                       |                      | Reseal                         | 0                             | 0      | 0      | 0      |        | 0     |     |
|                       |                      | Spot Gravelling                | 0                             | 0      | 0      | 0      |        | 0     |     |
|                       | Reconstruction       | Reconstruction/ Rehabilitation | 115                           | 38     | 24     | 0      |        | 178   |     |
|                       |                      | Development                    | Upgrading (Earth to Gravel)   | 0      | 0      | 0      | 0      |       | 0   |
|                       |                      |                                | Upgrading (Gravel to Bitumen) | 242    | 192    | 42     | 29     |       | 504 |
|                       | Capacity Improvement | 108                            | 15                            | 25     | 0      |        | 148    |       |     |

Figure 8.8 presents a bar chart diagram showing the annual capital works length for combined ongoing/committed budget and uncommitted budget.

**Figure 8.8: Length of Capital Works for NPUR**



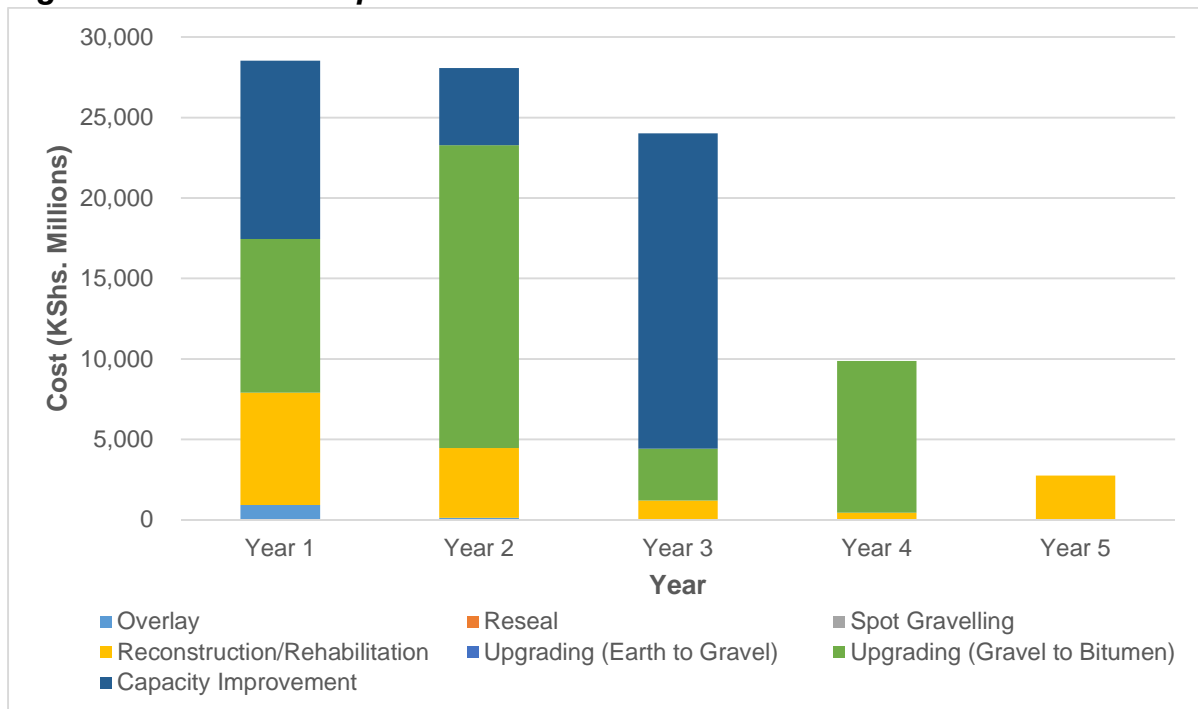
The annual costs of capital works are presented in Table 8.13 by budget status, works class and works type.

**Table 8.13: Costs of Capital Works for NPUR**

| Budget Status         | Works Class          | Treatment Type                | Capital Costs (KSh. Millions) |               |               |              |          | Total         |
|-----------------------|----------------------|-------------------------------|-------------------------------|---------------|---------------|--------------|----------|---------------|
|                       |                      |                               | Year 1                        | Year 2        | Year 3        | Year 4       | Year 5   |               |
| Uncommitted           | Periodic Maintenance | Overlay                       | 0                             | 0             | 0             | 0            | 0        | 0             |
|                       |                      | Reseal                        | 0                             | 0             | 0             | 0            | 0        | 0             |
|                       |                      | Spot Gravelling               | 0                             | 0             | 0             | 0            | 2        | 2             |
|                       | Reconstruction       | Reconstruction/Rehabilitation | 0                             | 0             | 0             | 448          | 2,741    | 3,190         |
|                       | New Development      | Upgrading (Earth to Gravel)   | 0                             | 0             | 0             | 0            | 0        | 0             |
|                       |                      | Upgrading (Gravel to Bitumen) | 0                             | 0             | 0             | 0            | 0        | 0             |
| Capacity Improvement  |                      | 0                             | 0                             | 0             | 0             | 0            | 0        |               |
| Committed/<br>Ongoing | Periodic Maintenance | Overlay                       | 927                           | 119           | 0             | 0            |          | 1,047         |
|                       |                      | Reseal                        | 0                             | 0             | 0             | 0            |          | 0             |
|                       |                      | Spot Gravelling               | 0                             | 0             | 0             | 0            |          | 0             |
|                       | Reconstruction       | Reconstruction/Rehabilitation | 6,967                         | 4,345         | 1,203         | 0            |          | 12,515        |
|                       | New Development      | Upgrading (Earth to Gravel)   | 0                             | 0             | 0             | 0            |          | 0             |
|                       |                      | Upgrading (Gravel to Bitumen) | 9,551                         | 18,822        | 3,211         | 9,430        |          | 41,014        |
| Capacity Improvement  |                      | 11,084                        | 4,800                         | 19,603        | 0             |              | 35,488   |               |
| <b>Total</b>          |                      |                               | <b>28,530</b>                 | <b>28,086</b> | <b>24,017</b> | <b>9,430</b> | <b>0</b> | <b>90,063</b> |

Figure 8.9 presents a bar chart diagram showing the annual costs of capital works for combined ongoing/committed budget and uncommitted budget.

**Figure 8.9: Costs of Capital Works for NPUR**



The percentage split of NPUR road network by surface class between paved and unpaved roads at the beginning and end of RSIP2 is given in Table 8.5.

The implementation of RSIP2 will improve the condition of NPUR paved roads by reducing the average roughness from about 15 IRI to 11 IRI at the end of the 5-year planning period. For unpaved roads the average roughness will reduce slightly from about 16 IRI to 15 IRI at the end of the 5-year planning period.

Over the 5-year planning period, the total savings in vehicle operating costs (VOC) over NPUR road network is estimated at KSh. 37.467 billion; and the total savings in travel time cost (TTC) is estimated at KSh. 7.359 billion. The net economic benefits that will result from implementing RSIP2 over the 20-year analysis period is estimated at KSh. 306.549 billion (Table 8.7). This amount of net benefit assumes that timely implementation of periodic and routine maintenance will be applied over the 20-year analysis period.

### 8.4.7 Result of Roads within Wildlife Conservation Areas Optimised Work Programme

The key indicators for Roads within Wildlife Conservation Areas RSIP2 can be summarised under headings of works length, costs, road condition, road user costs and net economic benefits.

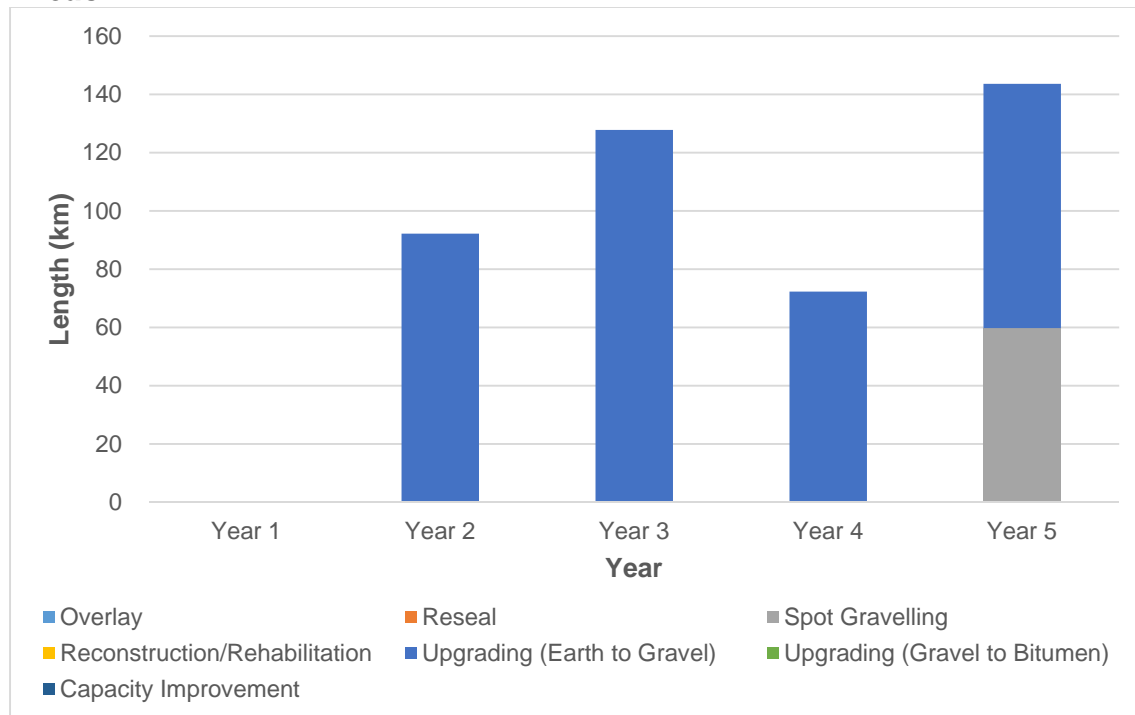
The road centre-line length of annual capital works is presented in Table 8.14 by budget status, works class and works type.

**Table 8.14: Length of Capital Works for Roads within Wildlife Conservation Areas**

| Budget status | Works Class          | Treatment Type                 | Length (km) |        |        |        |        |       |
|---------------|----------------------|--------------------------------|-------------|--------|--------|--------|--------|-------|
|               |                      |                                | Year 1      | Year 2 | Year 3 | Year 4 | Year 5 | Total |
| Uncommitted   | Periodic Maintenance | Overlay                        | 0           | 0      | 0      | 0      | 0      | 0     |
|               |                      | Reseal                         | 0           | 0      | 0      | 0      | 0      | 0     |
|               |                      | Spot Gravelling                | 0           | 0      | 0      | 0      | 60     | 60    |
|               | Reconstruction       | Reconstruction/ Rehabilitation | 0           | 0      | 0      | 0      | 0      | 0     |
|               |                      | Upgrading (Earth to Gravel)    | 0           | 92     | 128    | 72     | 84     | 376   |
|               | Development          | Upgrading (Gravel to Bitumen)  | 0           | 0      | 0      | 0      | 0      | 0     |
|               |                      | Capacity Improvement           | 0           | 0      | 0      | 0      | 0      | 0     |

Figure 8.10 presents a bar chart diagram showing the annual capital works length for combined ongoing/committed budget and uncommitted budget.

**Figure 8.10: Length of Capital Works for Roads within Wildlife Conservation Areas**



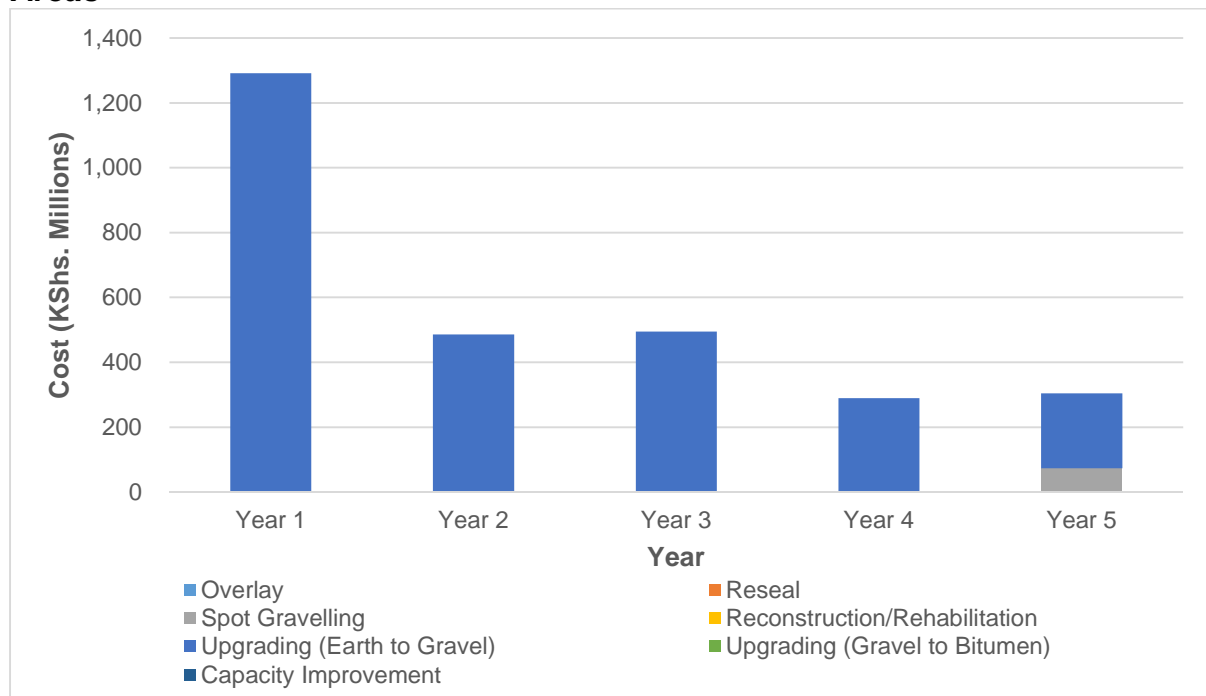
The annual costs of capital works are presented in Table 8.15 by budget status, works class and works type.

**Table 8.15: Costs of Capital Works for Roads within Wildlife Conservation Areas**

| Budget status         | Works Class          | Treatment Type                | Capital Costs (KSh. Millions) |        |        |        |        |       |
|-----------------------|----------------------|-------------------------------|-------------------------------|--------|--------|--------|--------|-------|
|                       |                      |                               | Year 1                        | Year 2 | Year 3 | Year 4 | Year 5 | Total |
| Uncommitted           | Periodic Maintenance | Overlay                       | 0                             | 0      | 0      | 0      | 0      | 0     |
|                       |                      | Reseal                        | 0                             | 0      | 0      | 0      | 0      | 0     |
|                       |                      | Spot Gravelling               | 0                             | 0      | 0      | 0      | 73     | 73    |
|                       | Reconstruction       | Reconstruction/Rehabilitation | 0                             | 0      | 0      | 0      | 0      | 0     |
|                       |                      | Development                   | Upgrading (Earth to Gravel)   | 0      | 486    | 495    | 290    | 230   |
|                       |                      | Upgrading (Gravel to Bitumen) | 0                             | 0      | 0      | 0      | 0      | 0     |
|                       | Capacity Improvement | 0                             | 0                             | 0      | 0      | 0      | 0      |       |
| Committed/<br>Ongoing | Periodic Maintenance | Overlay                       |                               |        |        |        |        | 0     |
|                       |                      | Reseal                        |                               |        |        |        |        | 0     |
|                       |                      | Spot Gravelling               |                               |        |        |        |        | 0     |
|                       | Reconstruction       | Reconstruction/Rehabilitation |                               |        |        |        |        | 0     |
|                       |                      | Development                   | Upgrading (Earth to Gravel)   | 1,291  |        |        |        |       |
|                       |                      | Upgrading (Gravel to Bitumen) |                               |        |        |        |        | 0     |
|                       | Capacity Improvement |                               |                               |        |        |        | 0      |       |

Figure 8.11 presents a bar chart diagram showing the annual costs of capital works for combined ongoing/committed budget and uncommitted budget.

**Figure 8.11: Costs of Capital Works for Roads within Wildlife Conservation Areas**



The percentage split of Roads within Wildlife Conservation Areas road network by surface class between paved and unpaved roads at the beginning and end of RSIP2 is given in Table 8.5.

Over the 5-year planning period, the implementation of RSIP2 will not improve the condition of Roads within Wildlife Conservation Areas paved roads, albeit this being a very small percentage of the entire Roads within Wildlife Conservation Areas road network length. For unpaved roads the average roughness will reduce but the roads will remain generally in poor condition over the 5-year planning period. This reflects the effect of insufficient funding provided for the Roads within Wildlife Conservation Areas road network.

Over the 5-year planning period, the total savings in vehicle operating costs (VOC) over Roads within Wildlife Conservation Areas road network is estimated at KSh 5.971 billion; and the total savings in travel time cost (TTC) is estimated at KSh 2.169 billion. The net economic benefits that will result from implementing RSIP2 over the 20-year analysis period is estimated at KSh 20.136 billion (Table 8.7).

#### 8.4.8 Result of County Optimised Work Programme

The key indicators for County RSIP2 can be summarised under headings of works length, costs, road condition, road user costs and net economic benefits.

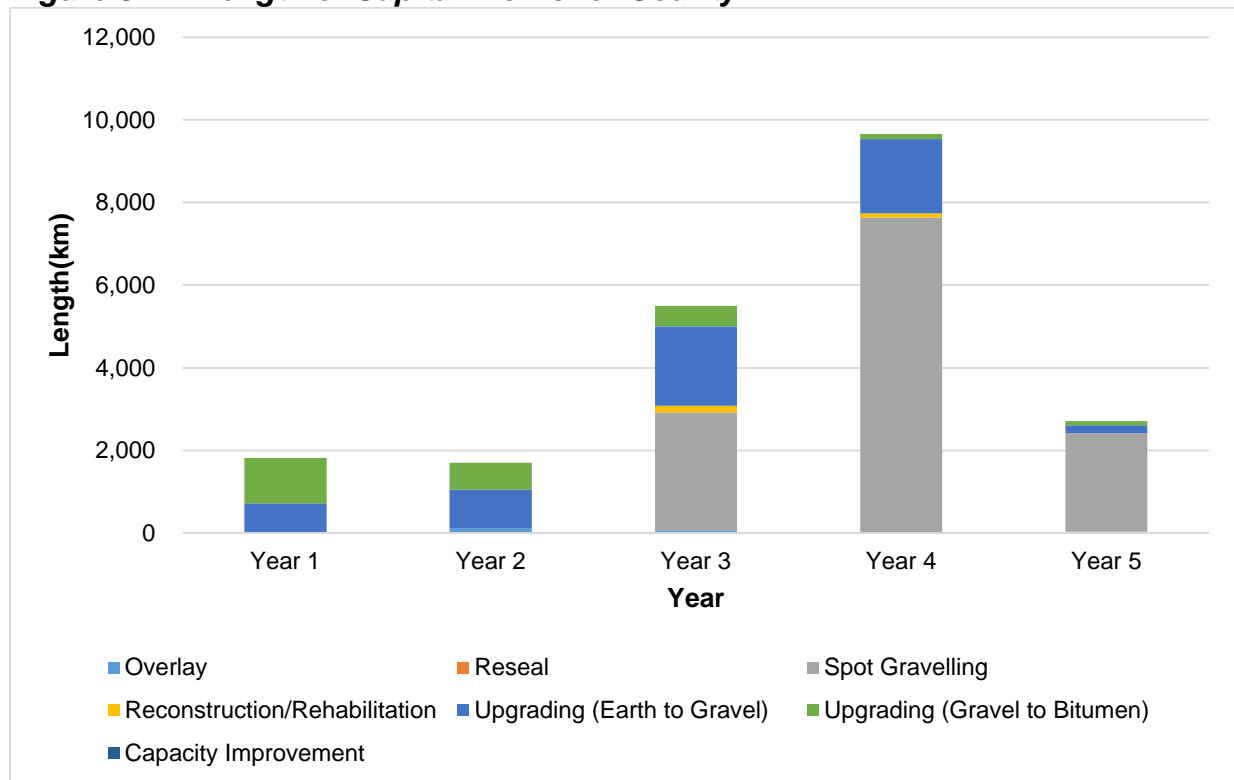
The road centre-line length of annual capital works is presented in Table 8.16 by budget status, works class and works type.

**Table 8.16: Length of Capital Works for County**

| Budget Status         | Works Class          | Works (Treatment) Type         | Length(km) |        |        |        |        | Total         |
|-----------------------|----------------------|--------------------------------|------------|--------|--------|--------|--------|---------------|
|                       |                      |                                | Year 1     | Year 2 | Year 3 | Year 4 | Year 5 |               |
| Uncommitted           | Periodic Maintenance | Overlay                        | 10         | 124    | 73     | 0      | 40     | <b>247</b>    |
|                       |                      | Reseal                         | 0          | 0      | 0      | 28     | 9      | <b>37</b>     |
|                       |                      | Spot gravelling                | 0          | 0      | 2,848  | 7,610  | 711    | <b>11,169</b> |
|                       | Reconstruction       | Reconstruction/ Rehabilitation | 1          | 0      | 166    | 100    | 0      | <b>267</b>    |
|                       | Development          | Upgrading (Earth to Gravel)    | 711        | 935    | 1,918  | 1,801  | 190    | <b>5,555</b>  |
|                       |                      | Upgrading (Gravel to Bitumen)  | 175        | 253    | 102    | 24     | 0      | <b>555</b>    |
| Ongoing/<br>Committed | Periodic Maintenance | Overlay                        | 0          | 0      | 0      | 0      | 0      | <b>0</b>      |
|                       |                      | Reseal                         | 0          | 0      | 0      | 0      | 0      | <b>0</b>      |
|                       |                      | Spot Gravelling                | 0          | 0      | 0      | 0      | 0      | <b>0</b>      |
|                       | Reconstruction       | Reconstruction/ Rehabilitation | 0          | 0      | 0      | 0      | 0      | <b>0</b>      |
|                       | Development          | Upgrading (Earth to Gravel)    | 0          | 0      | 0      | 0      | 0      | <b>0</b>      |
|                       |                      | Upgrading (Gravel to Bitumen)  | 925        | 396    | 396    | 99     | 99     | <b>1,916</b>  |

Figure 8.12 presents a bar chart diagram showing the annual capital works length for combined ongoing/committed budget and uncommitted budget.

**Figure 8.12: Length of Capital Works for County**



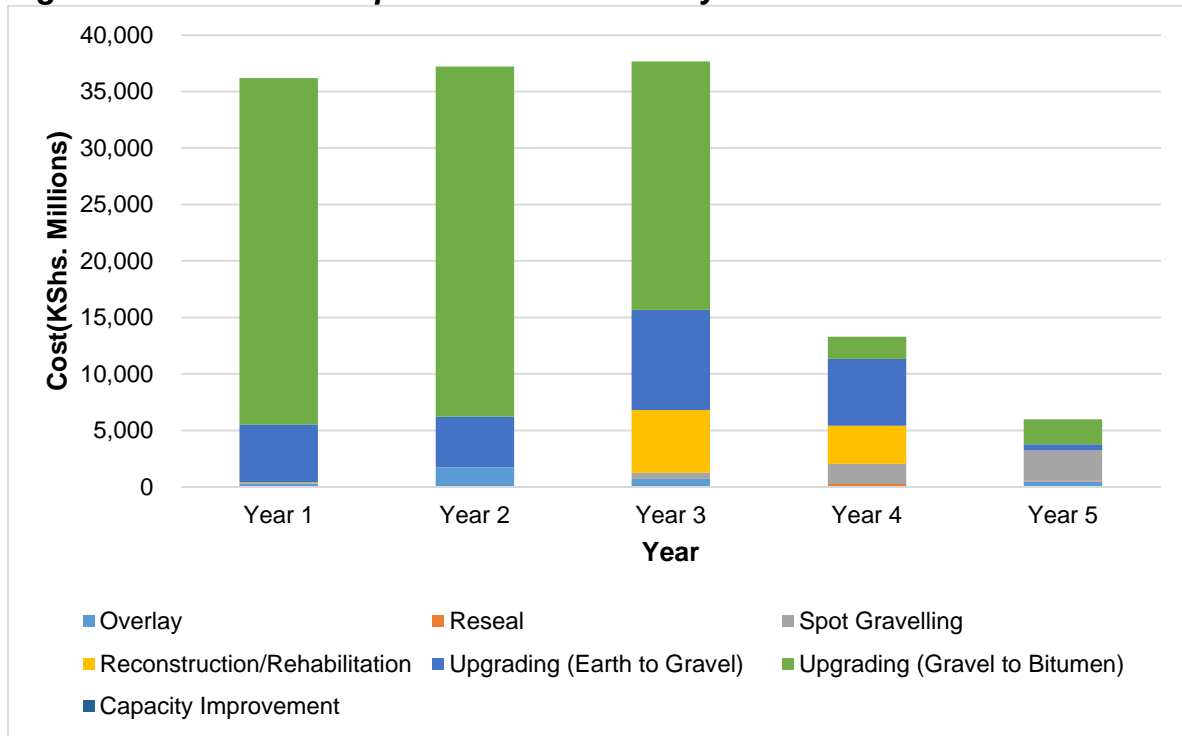
The annual costs of capital works are presented in Table 8.17 by budget status, works class and works type.

**Table 8.17: Costs of Capital Works for County**

| Budget Status         | Works Class          | Treatment Type                | Capital Costs (KSh. Millions) |               |               |            |              | Total         |
|-----------------------|----------------------|-------------------------------|-------------------------------|---------------|---------------|------------|--------------|---------------|
|                       |                      |                               | Year 1                        | Year 2        | Year 3        | Year 4     | Year 5       |               |
| Uncommitted           | Periodic Maintenance | Overlay                       | 329                           | 1,737         | 715           | 0          | 502          | <b>3,283</b>  |
|                       |                      | Reseal                        | 0                             | 0             | 0             | 270        | 34           | <b>304</b>    |
|                       |                      | Spot Gravelling               | 0                             | 0             | 537           | 1,770      | 2,694        | <b>5,001</b>  |
|                       | Reconstruction       | Reconstruction/Rehabilitation | 85                            | 0             | 5,569         | 3,377      | 0            | <b>9,031</b>  |
|                       | Development          | Upgrading (Earth to Gravel)   | 5,121                         | 4,486         | 8,851         | 5,931      | 541          | <b>24,931</b> |
|                       |                      | Upgrading (Gravel to Bitumen) | 13,320                        | 14,804        | 5,765         | 1,210      | 0            | <b>35,099</b> |
| Capacity Improvement  |                      | 0                             | 0                             | 0             | 0             | 0          | <b>0</b>     |               |
| Committed/<br>Ongoing | Periodic Maintenance | Overlay                       | 0                             | 0             | 0             | 0          | 0            | <b>0</b>      |
|                       |                      | Reseal                        | 0                             | 0             | 0             | 0          | 0            | <b>0</b>      |
|                       |                      | Spot Gravelling               | 0                             | 0             | 0             | 0          | 0            | <b>0</b>      |
|                       | Reconstruction       | Reconstruction/Rehabilitation | 0                             | 0             | 0             | 0          | 0            | <b>0</b>      |
|                       | Development          | Upgrading (Earth to Gravel)   | 0                             | 0             | 0             | 0          | 0            | <b>0</b>      |
|                       |                      | Upgrading (Gravel to Bitumen) | 17,331                        | 16,189        | 16,224        | 741        | 2,224        | <b>52,709</b> |
| Capacity Improvement  |                      | 0                             | 0                             | 0             | 0             | 0          | <b>0</b>     |               |
| <b>Total</b>          |                      |                               | <b>17,331</b>                 | <b>16,189</b> | <b>16,224</b> | <b>741</b> | <b>2,224</b> | <b>52,709</b> |

Figure 8.13 presents a bar chart showing the annual costs of capital works for combined ongoing/committed budget and uncommitted budget.

**Figure 8.13: Costs of Capital Works for County**



The percentage split of County road network by surface class between paved and unpaved roads at the beginning and end of RSIP2 is given in Table 8.5.

The implementation of RSIP2 with the current/expected budget scenario will basically maintain the condition of County paved roads at the same average roughness level between 6.4 and 6.8 IRI over the 5-year planning period. For unpaved roads the average roughness will also be maintained at the same level of about 15.4 IRI over the 5-year planning period.

Over the 5-year planning period, the total savings in vehicle operating costs (VOC) over the County road network is estimated at KSh. 108.403 billion; and the total savings in travel time cost (TTC) is estimated at KSh. 32.393 billion. The net economic benefits that will result from implementing RSIP2 over the 20-year analysis period is estimated at KSh. 343.920 billion (Table 8.7). This amount of net benefit assumes that timely implementation of periodic and routine maintenance will be applied over the 20-year analysis period.

The optimised work programmes for each individual county are presented in Appendices F1 and F2 and are as summarised Table 8.18 below.

**Table 8.18: RSIP2 Development Allocations per County (KSh. Million)**

| County          | 2018    | 2019    | 2020    | 2021    | 2022  | Total           |
|-----------------|---------|---------|---------|---------|-------|-----------------|
| Baringo         | 2,938.1 | 2,498.6 | 1,097.6 | 215.3   | 197.9 | <b>6,947.4</b>  |
| Bungoma         |         | 252.0   | 212.5   | 103.3   |       | <b>567.8</b>    |
| Bomet           | 598.0   | 720.7   | 777.9   | 149.8   | 131.2 | <b>2,377.6</b>  |
| Busia           | 156.7   | 200.8   | 585.2   | 297.9   | 126.0 | <b>1,366.6</b>  |
| Embu            | 558.8   | 517.1   | 1,295.4 | 576.4   | 55.3  | <b>3,003.0</b>  |
| Elgeyo Marakwet | 323.6   | 380.1   | 381.0   | 105.8   |       | <b>1,190.5</b>  |
| Garissa         | 379.6   | 253.1   | 58.3    |         |       | <b>691.0</b>    |
| Homa Bay        | 910.6   | 1,097.4 | 1,150.6 | 132.7   | 140.7 | <b>3,431.9</b>  |
| Isiolo          |         | 160.6   | 192.0   | 280.0   |       | <b>632.6</b>    |
| Kajiado         | 3,382.2 | 2,088.2 | 628.5   | 393.0   |       | <b>6,491.8</b>  |
| Kakamega        | 640.3   | 537.2   | 842.8   | 270.8   | 33.3  | <b>2,324.3</b>  |
| Kiambu          | 2,824.7 | 4,279.0 | 2,316.6 | 677.5   | 418.8 | <b>10,516.6</b> |
| Kericho         | 968.0   | 1,472.1 | 1,239.2 | 32.6    | 169.6 | <b>3,881.5</b>  |
| Kirinyaga       | 740.9   | 963.1   | 772.0   | 196.4   |       | <b>2,672.4</b>  |
| Kisumu          |         | 634.3   | 422.9   | 18.6    |       | <b>1,075.9</b>  |
| Kwale           | 131.9   | 105.6   | 151.3   | 30.3    | 42.9  | <b>462.1</b>    |
| Kilifi          | 1,227.0 | 1,166.3 | 483.3   | 114.4   | 376.5 | <b>3,367.6</b>  |
| Kisii           | 2,601.6 | 2,976.5 | 1,556.6 | 83.4    | 319.2 | <b>7,537.4</b>  |
| Kitui           | 159.5   | 71.7    | 354.6   | 336.2   | 98.5  | <b>1,020.5</b>  |
| Laikipia        | 306.7   | 358.6   | 1,267.2 | 571.8   |       | <b>2,504.2</b>  |
| Lamu            | -       | -       | -       | -       | -     | <b>0</b>        |
| Marsabit        |         |         | 6.8     |         |       | <b>6.8</b>      |
| Mombasa         | 294.1   | 228.1   | 446.8   |         | 10.1  | <b>979.0</b>    |
| Machakos        | 47.6    | 203.9   | 1,040.4 | 852.1   | 206.6 | <b>2,350.6</b>  |
| Mandera         |         |         | 176.6   | 147.8   |       | <b>324.4</b>    |
| Migori          | 89.3    | 107.6   | 289.7   | 149.9   |       | <b>636.5</b>    |
| Muranga         | 949.4   | 711.2   | 1,365.0 | 556.9   | 343.8 | <b>3,926.4</b>  |
| Meru            | 1,820.9 | 1,983.4 | 4,962.5 | 4,225.9 | 110.5 | <b>13,103.2</b> |
| Makueni         |         | 2,011.6 | 1,557.2 | 175.5   |       | <b>3,744.3</b>  |
| Nairobi         | 305.7   | 211.3   | 75.7    | 3.2     | 47.1  | <b>642.9</b>    |
| Nandi           | 1,532.8 | 1,460.0 | 1,438.9 |         | 21.7  | <b>4,453.4</b>  |
| Nyandarua       | 1,158.9 | 1,013.0 | 1,038.3 | 453.0   |       | <b>3,663.1</b>  |
| Nyeri           | 1,850.0 | 1,199.3 | 2,896.4 | 19.2    | 520.5 | <b>6,485.5</b>  |
| Nakuru          | 1,287.3 | 106.6   | 742.4   | 923.6   | 388.6 | <b>3,448.4</b>  |
| Narok           |         |         | 423.8   | 377.5   | 15.6  | <b>817.0</b>    |
| Nyamira         | 788.6   | 792.8   | 613.7   | 33.9    | 73.6  | <b>2,302.6</b>  |
| West Pokot      | 968.2   | 853.5   | 855.4   | 106.1   | 135.3 | <b>2,918.6</b>  |
| Samburu         | 39.9    | 26.6    |         | 25.5    | 127.8 | <b>219.8</b>    |
| Siaya           | 452.3   | 577.2   | 857.6   | 225.9   |       | <b>2,113.0</b>  |
| Tana River      |         |         | 113.8   |         |       | <b>113.8</b>    |
| Tharaka Nithi   | 1,286.7 | 1,260.7 | 1,224.3 | 96.8    | 130.7 | <b>3,999.4</b>  |
| Trans Nzoia     | 1,271.1 | 846.0   | 61.8    | 68.5    | 13.1  | <b>2,260.4</b>  |
| Turkana         | 1,027.9 | 685.3   | 61.5    |         | 643.5 | <b>2,418.2</b>  |
| Taita Taveta    | 851.8   | 567.9   |         | 10.9    | 635.8 | <b>2,066.4</b>  |
| Uasin Gishu     | 387.0   | 15.2    | 605.0   | 174.6   | 27.1  | <b>1,208.8</b>  |
| Vihiga          | 351.1   | 1,237.5 | 1,021.6 | 87.2    | 65.8  | <b>2,763.3</b>  |
| Wajir           | 577.3   | 384.9   |         |         | 368.6 | <b>1,330.7</b>  |

From the optimised work programme based on economic efficiency, no development project was prioritised for Lamu county owing to its relatively short road links and low traffic volumes. The county shall therefore be allocated routine maintenance instead.

The routine and periodic maintenance requirements per county derived from unconstrained analysis are as tabulated below.

**Table 8.18: RSIP2 Maintenance Needs per County (KSh. Million)**

| County          | 2018                |                      | 2019                |                      | 2020                |                      | 2021                |                      | 2022                |                      | Total Costs |
|-----------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|-------------|
|                 | Routine Maintenance | Periodic Maintenance | Routine Maintenance | Periodic Maintenance | Routine Maintenance | Periodic Maintenance | Routine Maintenance | Periodic Maintenance | Routine Maintenance | Periodic Maintenance |             |
| Baringo         | 829.2               | 2,110.9              | 836.1               | 590.3                | 837.3               | 1,110.9              | 816.6               | 873.3                | 846.5               | 1,301.4              | 10,152.4    |
| Bungoma         | 370.3               | 4,032.4              | 350.1               | 0.0                  | 351.1               | 257.4                | 352.0               | 204.7                | 433.2               | 2,657.5              | 9,008.6     |
| Bomet           | 490.3               | 1,155.2              | 482.0               | 0.0                  | 482.5               | 309.2                | 483.0               | 454.1                | 487.6               | 808.6                | 5,152.4     |
| Busia           | 276.8               | 652.4                | 273.3               | 6.3                  | 274.8               | 834.8                | 276.5               | 103.6                | 284.1               | 471.3                | 3,453.8     |
| Embu            | 390.1               | 125.4                | 389.7               | 24.2                 | 392.1               | 707.5                | 394.6               | 159.5                | 397.2               | 87.8                 | 3,068.1     |
| Elgeyo Marakwet | 278.1               | 1,514.3              | 268.0               | 0.0                  | 268.4               | 473.6                | 268.8               | 195.5                | 271.3               | 1,060.0              | 4,597.9     |
| Garissa         | 348.1               | 1,210.4              | 352.7               | 0.0                  | 353.3               | 58.3                 | 347.6               | 46.3                 | 355.8               | 847.3                | 3,919.8     |
| Homa Bay        | 264.3               | 3,203.2              | 255.2               | 0.0                  | 255.6               | 632.7                | 256.0               | 120.9                | 257.5               | 2,246.4              | 7,491.8     |
| Isiolo          | 1,113.4             | 377.1                | 1,112.0             | 0.0                  | 1,112.8             | 0.0                  | 1,113.8             | 1,088.0              | 1,114.6             | 750.2                | 7,781.9     |
| Kajiado         | 1,270.1             | 1,299.2              | 1,301.9             | 13.4                 | 1,313.6             | 316.4                | 1,284.8             | 795.4                | 1,343.5             | 912.2                | 9,850.6     |
| Kakamega        | 440.8               | 1,897.0              | 430.2               | 0.0                  | 431.2               | 563.9                | 432.4               | 302.3                | 445.2               | 1,327.9              | 6,270.9     |
| Kiambu          | 830.7               | 3,389.4              | 833.8               | 171.8                | 880.2               | 350.2                | 887.1               | 412.4                | 884.4               | 2,308.2              | 10,948.3    |
| Kericho         | 307.6               | 294.8                | 302.7               | 39.4                 | 302.7               | 1,113.5              | 304.4               | 622.2                | 302.7               | 221.3                | 3,811.2     |
| Kirinyaga       | 342.6               | 1,990.4              | 346.8               | 14.4                 | 350.8               | 130.2                | 347.3               | 101.8                | 363.3               | 1,435.3              | 5,422.9     |
| Kisumu          | 227.4               | 122.6                | 233.0               | 13.1                 | 233.8               | 57.2                 | 231.9               | 93.4                 | 242.7               | 111.9                | 1,566.9     |
| Kwale           | 508.5               | 1,137.4              | 506.4               | 0.0                  | 505.0               | 272.1                | 512.1               | 353.7                | 513.1               | 796.2                | 5,104.5     |
| Kilifi          | 470.3               | 3,916.5              | 468.1               | 0.0                  | 469.7               | 0.0                  | 464.2               | 168.7                | 473.0               | 2,711.5              | 9,142.1     |
| Kisii           | 587.4               | 2,000.9              | 569.4               | 44.4                 | 574.0               | 836.2                | 576.8               | 206.0                | 578.1               | 1,493.7              | 7,467.0     |
| Kitui           | 1,036.2             | 2,950.9              | 1,030.2             | 531.7                | 1,033.5             | 98.9                 | 1,036.9             | 152.8                | 1,040.5             | 1,782.1              | 10,693.7    |
| Lamu            | 120.9               | 123.7                | 120.1               | 12.9                 | 120.5               | 0.0                  | 124.0               | 19.6                 | 121.2               | 114.7                | 877.6       |
| Laikipia        | 430.4               | 860.6                | 428.5               | 119.0                | 437.8               | 384.3                | 439.2               | 160.8                | 431.7               | 640.1                | 4,332.4     |
| Marsabit        | 534.5               | 9,047.2              | 492.5               | 0.0                  | 493.5               | 6.8                  | 494.6               | 47.7                 | 495.7               | 6,333.0              | 17,945.4    |
| Mombasa         | 74.1                | 32.0                 | 86.8                | 0.0                  | 83.1                | 446.8                | 92.8                | 13.3                 | 101.2               | 11.2                 | 941.3       |
| Machakos        | 785.6               | 727.9                | 786.8               | 78.9                 | 794.3               | 642.9                | 812.1               | 228.1                | 805.3               | 723.1                | 6,385.0     |
| Mandera         | 640.5               | 0.0                  | 667.9               | 0.0                  | 669.3               | 176.6                | 642.5               | 421.1                | 672.4               | 0.0                  | 3,890.4     |
| Migori          | 226.4               | 828.8                | 224.1               | 0.0                  | 225.0               | 10.5                 | 226.0               | 73.5                 | 228.5               | 589.9                | 2,632.7     |
| Muranga         | 1,044.6             | 659.9                | 1,033.1             | 0.0                  | 1,034.3             | 4,346.4              | 794.0               | 686.9                | 1,115.8             | 461.9                | 11,176.9    |
| Meru            | 809.7               | 666.7                | 803.9               | 18.1                 | 815.6               | 3,800.0              | 812.9               | 4,212.3              | 833.4               | 512.0                | 13,284.7    |
| Makueni         | 1,006.2             | 1,998.9              | 1,011.8             | 59.9                 | 1,029.8             | 4.8                  | 1,033.1             | 204.1                | 1,021.1             | 1,629.8              | 8,999.4     |
| Nairobi         | 21.5                | 231.7                | 22.5                | 0.0                  | 23.6                | 186.0                | 25.8                | 0.0                  | 26.4                | 99.2                 | 636.8       |
| Nandi           | 462.8               | 1,076.9              | 457.7               | 42.7                 | 457.7               | 818.4                | 457.7               | 245.7                | 459.1               | 753.9                | 5,232.7     |
| Nyandarua       | 876.9               | 1,772.9              | 869.4               | 30.7                 | 878.3               | 422.4                | 879.2               | 708.2                | 887.5               | 1,295.2              | 8,620.5     |
| Nyeri           | 619.8               | 1,234.9              | 591.9               | 5.2                  | 587.0               | 10,465.3             | 593.1               | 213.9                | 592.1               | 872.0                | 15,775.2    |
| Nakuru          | 1,073.4             | 3,262.4              | 1,056.1             | 87.3                 | 1,068.4             | 1,422.7              | 1,076.1             | 1,329.4              | 1,086.1             | 2,721.0              | 14,182.8    |
| Narok           | 682.1               | 1,365.3              | 674.9               | 0.0                  | 676.8               | 1,440.3              | 678.8               | 286.1                | 683.4               | 955.7                | 7,443.5     |
| Nyamira         | 289.6               | 160.7                | 287.1               | 10.0                 | 287.0               | 986.2                | 288.6               | 165.3                | 288.8               | 138.6                | 2,901.9     |
| West Pokot      | 239.3               | 2,243.0              | 231.0               | 0.0                  | 231.5               | 0.0                  | 231.9               | 151.4                | 232.4               | 1,570.1              | 5,130.6     |

| County       | 2018                |                      | 2019                |                      | 2020                |                      | 2021                |                      | 2022                |                      | Total Costs      |
|--------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|----------------------|------------------|
|              | Routine Maintenance | Periodic Maintenance | Routine Maintenance | Periodic Maintenance | Routine Maintenance | Periodic Maintenance | Routine Maintenance | Periodic Maintenance | Routine Maintenance | Periodic Maintenance |                  |
| Samburu      | 328.5               | 0.0                  | 329.4               | 0.0                  | 330.3               | 0.0                  | 331.3               | 30.5                 | 332.2               | 91.1                 | <b>1,773.3</b>   |
| Siaya        | 440.9               | 1,177.9              | 437.7               | 24.6                 | 438.6               | 994.7                | 445.0               | 268.8                | 449.1               | 895.8                | <b>5,573.0</b>   |
| Tana River   | 430.5               | 620.6                | 430.9               | 0.0                  | 431.8               | 113.8                | 432.7               | 50.8                 | 434.8               | 586.5                | <b>3,532.5</b>   |
| Tharka Nithi | 203.7               | 892.3                | 205.1               | 24.4                 | 214.4               | 5.0                  | 216.0               | 18.1                 | 210.1               | 662.5                | <b>2,651.4</b>   |
| Trans Nzoia  | 259.1               | 1,155.0              | 252.2               | 33.2                 | 261.7               | 472.5                | 262.7               | 62.5                 | 259.2               | 865.4                | <b>3,883.4</b>   |
| Turkana      | 685.9               | 2,876.9              | 672.5               | 141.4                | 675.6               | 61.5                 | 704.9               | 2.4                  | 682.1               | 2,249.5              | <b>8,752.5</b>   |
| Taita Taveta | 600.1               | 239.4                | 603.7               | 7.0                  | 608.0               | 0.0                  | 613.9               | 90.4                 | 617.2               | 180.0                | <b>3,559.7</b>   |
| Uasin Gishu  | 564.8               | 1,273.2              | 548.4               | 28.2                 | 551.4               | 6,172.1              | 556.6               | 88.7                 | 569.1               | 803.7                | <b>11,156.3</b>  |
| Vihiga       | 134.0               | 540.7                | 132.4               | 12.3                 | 135.5               | 480.9                | 136.7               | 78.9                 | 137.8               | 400.9                | <b>2,190.1</b>   |
| Wajir        | 640.4               | 874.2                | 642.6               | 0.0                  | 646.9               | 0.0                  | 651.3               | 0.0                  | 656.0               | 611.9                | <b>4,723.2</b>   |
| <b>Total</b> | <b>24,608.3</b>     | <b>69,323.8</b>      | <b>24,442.8</b>     | <b>2,184.6</b>       | <b>24,629.9</b>     | <b>41,984.1</b>      | <b>24,440.1</b>     | <b>16,313.3</b>      | <b>25,063.9</b>     | <b>50,099.3</b>      | <b>303,090.1</b> |

## 8.5 Work Programme Based on Multi-Criteria Analysis

### 8.5.1 General

The detailed multi-criteria based 5-year work programmes for the five road sub-networks under the jurisdiction of National Primary Trunk Roads (NPTR), National Secondary Trunk Roads (NSTR), National Primary Urban Roads (NPUR), Roads within Wildlife Conservation Areas and County are given in Appendix G.

These MCA based work programmes comprise Ongoing Projects (OP), Committed Projects (CP), Periodic Maintenance (PM), Upgrading Projects (UP) and Capacity Improvements (CI). The financial requirement for these work categories is referred to as the Capital Expenditure. For each road agency the MCA work programme has annual total cost that is within the specified annual budget ceilings of current/expected budget scenario. The road sections are listed chronologically (by year) in accordance with the utility ranking index and by work category. It is assumed that all road sections that are not listed in any year of the 5-year planning period will receive adequate routine maintenance in that particular year. The financial requirement for this routine maintenance works is referred to as the Recurrent Expenditure.

The calculation of the utility indices was based on road class. The higher road classes were assigned lower attribute values for social benefits than the lower road classes. This was based on the results obtained from a separate study titled *Consultancy Services to Carry out Multi-Criteria Analysis for Preparation of 2nd Phase of Road Sector Investment Programme*. The final report of the study (KRB, 2017) provides details of the calculations of utility index and how this was used in the preparation of RSIP2.

### 8.5.2 Comparison of MCA Programmes and Optimised Programmes

The work programmes produced from the economic efficiency analytical method (i.e. based on maximisation of NPV) and from the MCA method used in this study are summarised in Tables 8.19 to 8.24. The two methods differ in their ranking of the projects. For example, the first-ranked road section from the economic point of view may not be ranked first under MCA with reference to the selected set of objectives and their assigned relative weights. This is because of the requirement to achieve all the defined objectives, rather than economic only, on the basis of the pre-established preferences within a unified analytical framework. The projects included in the MCA work programme are chosen in the light of competing and conflicting priorities. Therefore, a constraint in programme budget would mean that the list of projects that qualify for funding based solely on an economic objective may not necessarily be the same as those that would qualify based on an MCA approach.

**Table 8.19: Comparison of MCA Programme Vs Optimised Programme for the entire Country by Works Length**

| Works Class          | Works Type                     | MCA Program Length km |        |        |        |        |              | Optimised Program Length km |        |        |        |        |               |
|----------------------|--------------------------------|-----------------------|--------|--------|--------|--------|--------------|-----------------------------|--------|--------|--------|--------|---------------|
|                      |                                | Year 1                | Year 2 | Year 3 | Year 4 | Year 5 | Total        | Year 1                      | Year 2 | Year 3 | Year 4 | Year 5 | Total         |
| Periodic Maintenance | Overlay                        | 107                   | 127    | 20     | 274    | 152    | <b>680</b>   | 411                         | 281    | 392    | 642    | 877    | <b>2,603</b>  |
|                      | Reseal                         | 0                     | 0      | 0      | 0      | 0      | <b>0</b>     | 0                           | 0      | 0      | 28     | 9      | <b>37</b>     |
|                      | Spot Gravelling                | 0                     | 263    | 23     | 40     | 850    | <b>1,177</b> | 0                           | 0      | 3,013  | 7,610  | 2,440  | <b>13,063</b> |
| Reconstruction       | Reconstruction/ Rehabilitation | 938                   | 531    | 647    | 439    | 179    | <b>2,734</b> | 931                         | 557    | 629    | 438    | 257    | <b>2,812</b>  |
| Development          | Upgrading (Earth to Gravel)    | 0                     | 126    | 206    | 96     | 150    | <b>578</b>   | 711                         | 1,027  | 2,046  | 1,950  | 386    | <b>6,120</b>  |
|                      | Upgrading (Gravel to Bitumen)  | 2,337                 | 1,340  | 1,269  | 592    | 840    | <b>6,378</b> | 2,429                       | 1,636  | 1,379  | 496    | 798    | <b>6,738</b>  |
|                      | Capacity Improvement           | 152                   | 43     | 47     | 23     | 62     | <b>327</b>   | 152                         | 43     | 79     | 60     | 41     | <b>375</b>    |

**Table 8.20: Comparison of MCA Programme Vs Optimised Programme for KenHA by Works Length**

| Works Class          | Works Type                     | MCA Program Length km |        |        |        |        |              | Optimised Program Length km |        |        |        |        |              |
|----------------------|--------------------------------|-----------------------|--------|--------|--------|--------|--------------|-----------------------------|--------|--------|--------|--------|--------------|
|                      |                                | Year 1                | Year 2 | Year 3 | Year 4 | Year 5 | Total        | Year 1                      | Year 2 | Year 3 | Year 4 | Year 5 | Total        |
| Periodic Maintenance | Overlay                        | 91                    | 125    | 20     | 230    | 152    | <b>618</b>   | 384                         | 156    | 318    | 642    | 837    | <b>2,337</b> |
|                      | Reseal                         | 0                     | 0      | 0      | 0      | 0      | <b>0</b>     | 0                           | 0      | 0      | 0      | 0      | <b>0</b>     |
|                      | Spot Gravelling                | 0                     | 0      | 3      | 0      | 137    | <b>140</b>   | 0                           | 0      | 163    | 0      | 0      | <b>163</b>   |
| Reconstruction       | Reconstruction/ Rehabilitation | 823                   | 493    | 623    | 379    | 41     | <b>2,359</b> | 814                         | 518    | 440    | 325    | 181    | <b>2,278</b> |
| Development          | Upgrading (Earth to Gravel)    | 0                     | 0      | 0      | 0      | 0      | <b>0</b>     | 0                           | 0      | 0      | 0      | 0      | <b>0</b>     |
|                      | Upgrading (Gravel to Bitumen)  | 320                   | 144    | 199    | 366    | 560    | <b>1,589</b> | 236                         | 163    | 208    | 252    | 588    | <b>1,447</b> |
|                      | Capacity Improvement           | 43                    | 28     | 23     | 23     | 62     | <b>179</b>   | 43                          | 28     | 55     | 60     | 41     | <b>227</b>   |

**Table 8.21: Comparison of MCA Programme Vs Optimised Programme for National Secondary Trunk Roads (NSTR) by Works Length**

| Works Class          | Works Type                     | MCA Program Length km |        |        |        |        |              | Optimised Program Length km |        |        |        |        |              |
|----------------------|--------------------------------|-----------------------|--------|--------|--------|--------|--------------|-----------------------------|--------|--------|--------|--------|--------------|
|                      |                                | Year 1                | Year 2 | Year 3 | Year 4 | Year 5 | Total        | Year 1                      | Year 2 | Year 3 | Year 4 | Year 5 | Total        |
| Periodic Maintenance | Overlay                        | 0                     | 0      | 0      | 20     | 0      | <b>20</b>    | 0                           | 0      | 0      | 0      | 0      | <b>0</b>     |
|                      | Reseal                         | 0                     | 0      | 0      | 0      | 0      | <b>0</b>     | 0                           | 0      | 0      | 0      | 0      | <b>0</b>     |
|                      | Spot Gravelling                | 0                     | 0      | 0      | 17     | 0      | <b>17</b>    | 0                           | 0      | 0      | 0      | 0      | <b>0</b>     |
| Reconstruction       | Reconstruction/ Rehabilitation | 0                     | 0      | 0      | 0      | 0      | <b>0</b>     | 0                           | 0      | 0      | 0      | 0      | <b>0</b>     |
| Development          | Upgrading (Earth to Gravel)    | 0                     | 0      | 0      | 0      | 144    | <b>144</b>   | 0                           | 0      | 0      | 77     | 112    | <b>189</b>   |
|                      | Upgrading (Gravel to Bitumen)  | 851                   | 631    | 631    | 93     | 111    | <b>2,317</b> | 851                         | 631    | 631    | 93     | 111    | <b>2,317</b> |
|                      | Capacity Improvement           | 0                     | 0      | 0      | 0      | 0      | <b>0</b>     | 0                           | 0      | 0      | 0      | 0      | <b>0</b>     |

**Table 8.22: Comparison of MCA Programme Vs Optimised Programme for National Primary Urban Roads (NPUR) by Works Length**

| Works Class          | Works Type                     | MCA Program Length km |        |        |        |        |       | Optimised Program Length km |        |        |        |        |       |
|----------------------|--------------------------------|-----------------------|--------|--------|--------|--------|-------|-----------------------------|--------|--------|--------|--------|-------|
|                      |                                | Year 1                | Year 2 | Year 3 | Year 4 | Year 5 | Total | Year 1                      | Year 2 | Year 3 | Year 4 | Year 5 | Total |
| Periodic Maintenance | Overlay                        | 16                    | 2      | 0      | 25     | 0      | 43    | 16                          | 2      | 0      | 0      | 0      | 18    |
|                      | Reseal                         | 0                     | 0      | 0      | 0      | 0      | 0     | 0                           | 0      | 0      | 0      | 0      | 0     |
|                      | Spot Gravelling                | 0                     | 0      | 0      | 0      | 0      | 0     | 0                           | 0      | 0      | 0      | 7      | 7     |
| Reconstruction       | Reconstruction/ Rehabilitation | 115                   | 38     | 24     | 12     | 76     | 265   | 115                         | 38     | 24     | 12     | 76     | 265   |
| Development          | Upgrading (Earth to Gravel)    | 0                     | 0      | 0      | 0      | 2      | 2     | 0                           | 0      | 0      | 0      | 0      | 0     |
|                      | Upgrading (Gravel to Bitumen)  | 242                   | 192    | 42     | 29     | 0      | 505   | 242                         | 192    | 42     | 29     | 0      | 505   |
|                      | Capacity Improvement           | 108                   | 15     | 25     | 0      | 0      | 148   | 108                         | 15     | 25     | 0      | 0      | 148   |

**Table 8.23: Comparison of MCA Programme Vs Optimised Programme for Roads within Wildlife Conservation Areas by Works Length**

| Works Class          | Works Type                     | MCA Program Length km |        |        |        |        |       | Optimised Program Length km |        |        |        |        |       |
|----------------------|--------------------------------|-----------------------|--------|--------|--------|--------|-------|-----------------------------|--------|--------|--------|--------|-------|
|                      |                                | Year 1                | Year 2 | Year 3 | Year 4 | Year 5 | Total | Year 1                      | Year 2 | Year 3 | Year 4 | Year 5 | Total |
| Periodic Maintenance | Overlay                        | 0                     | 0      | 0      | 0      | 0      | 0     | 0                           | 0      | 0      | 0      | 0      | 0     |
|                      | Reseal                         | 0                     | 0      | 0      | 0      | 0      | 0     | 0                           | 0      | 0      | 0      | 0      | 0     |
|                      | Spot Gravelling                | 0                     | 263    | 20     | 20     | 713    | 1,017 | 0                           | 0      | 0      | 0      | 60     | 60    |
| Reconstruction       | Reconstruction/ Rehabilitation | 0                     | 0      | 0      | 0      | 0      | 0     | 0                           | 0      | 0      | 0      | 0      | 0     |
| Development          | Upgrading (Earth to Gravel)    | 0                     | 126    | 206    | 96     | 1      | 429   | 0                           | 92     | 128    | 72     | 84     | 376   |
|                      | Upgrading (Gravel to Bitumen)  | 0                     | 0      | 0      | 0      | 0      | 0     | 0                           | 0      | 0      | 0      | 0      | 0     |

**Table 8.23: Comparison of MCA Programme Vs Optimised Programme for County by Works Length**

| Works Class          | Works Type                     | MCA Program Length km |        |        |        |        |       | Optimised Program Length km |        |        |        |        |        |
|----------------------|--------------------------------|-----------------------|--------|--------|--------|--------|-------|-----------------------------|--------|--------|--------|--------|--------|
|                      |                                | Year 1                | Year 2 | Year 3 | Year 4 | Year 5 | Total | Year 1                      | Year 2 | Year 3 | Year 4 | Year 5 | Total  |
| Periodic Maintenance | Overlay                        | 0                     | 0      | 0      | 0      | 0      | 0     | 10                          | 124    | 73     | 0      | 40     | 247    |
|                      | Reseal                         | 0                     | 0      | 0      | 0      | 0      | 0     | 0                           | 0      | 0      | 28     | 9      | 37     |
|                      | Spot Gravelling                | 0                     | 0      | 0      | 3      | 0      | 3     | 0                           | 0      | 2,847  | 7,610  | 2,370  | 12,827 |
| Reconstruction       | Reconstruction/ Rehabilitation | 0                     | 0      | 0      | 47     | 62     | 109   | 1                           | 0      | 166    | 100    | 0      | 267    |
| Development          | Upgrading (Earth to Gravel)    | 0                     | 0      | 0      | 0      | 4      | 4     | 711                         | 935    | 1,918  | 1,801  | 190    | 5,555  |
|                      | Upgrading (Gravel to Bitumen)  | 925                   | 396    | 396    | 105    | 170    | 1,992 | 1,101                       | 650    | 498    | 123    | 99     | 2,470  |
|                      | Capacity Improvement           | 0                     | 0      | 0      | 0      | 0      | 0     | 0                           | 0      | 0      | 0      | 0      | 0      |

The main observations arising from comparison of the two methods and this study in general are as follows:

1. The MCA method favoured improvement in roads classified as D, E and Others in the form of upgrading works whereas the economic optimisation method favoured investment in roads carrying high traffic (class A and B) in the form of periodic maintenance and capacity improvement.
2. The MCA method should be used for preparing investment programmes for County road network and intra-county work programmes.
3. The economic efficiency method should be used for preparing roads carrying medium to high traffic specifically for National Primary Trunk Roads (NPTR) and National Primary Urban Roads (NPUR) road networks. The method can also be used for the reclassified National Secondary Trunk Roads (NSTR) road network.
4. Work programmes for Roads within Wildlife Conservation Areas road network should be prepared using optimisation based on engineering efficiency (i.e. maximisation in reduction in IRI).

### 8.6 Link Between RSIP2 with Government Policies and Programmes

As illustrated in Chapters 2 and 3, there are presently numerous policy recommendations guiding investments in the roads sub-sector. The RSIP TF has harmonised the HDM-4 programme output with some of these policies and programmes as summarised in the Table below and detailed in Appendix I.

**Table 8.24: Link between RSIP2 with various Policies and Programmes**

| No. | Policy/Programme                               | Length (km) | Estimated Cost (KSh. millions) | Remarks  |
|-----|--|-------------|--------------------------------|--|
| 1   | EAC Vision 2050                                | 2,053       | 138,707                        | ) Includes Northern, Namanga, Sirari and Coastal Corridors.<br>) Corridors part of the EARNP   |
| 2   | Kenya Vision 2030/Big Four Agenda              | 2,201       | 139,478                        | ) Includes Northern, Namanga and Sirari Corridors. Also covers the A3 Thika- Garissa Road.<br>) Corridors also part of Big Four Agenda |
| 3   | LAPSSET /Jubilee Manifesto 2017                | 418         | 38,722                         | ) Also part of EAC Vision 2050 and Kenya Vision 2030   |
| 4   | Roads 10,000 Programme/ Jubilee Manifesto 2017 | 3,439       | 253,948                        | ) Includes the LVSR  |

## 9 Monitoring and Evaluation

### 9.1 Introduction

Continuous M&E of RSIP2 will be required to ensure the timely implementation of the proposed interventions in a bid to ensure that the intended objectives are met. It will be carried out at phased intervals as detailed in the Logical Framework described in the section below.

As a cue, the proposed M&E must address the challenges that faced RSIP1 M&E framework. These challenges included, amongst others:

1. Lack of sector-wide collaborative approach with regard to data collection. This has been contributed by the lack of central depository where all industry players can store and retrieve data;
2. Inadequate allocation of resources for M&E programmes within the road authorities;
3. Lack of well-defined baseline indicators for future M&E review; and,
4. Lack of awareness coupled with poor training of staff on M&E programmes.

### 9.2 Performance Indicators

The RSIP will be monitored at three levels i.e. the National, Project and Activity levels.

At the National level, the government's national development strategies such as the SDGs, AU Agenda 2063, EAC Vision 2050, Kenya Vision 2030 and the "Big Four" Agenda amongst others shall be implemented.

At the Project level the main monitoring indicators will be to evaluate the achievement of project objectives and how those achievements could be sustained during and over the design life of the investment.

At the Activity level the performance of the implementing entities will be monitored through efficient reporting, procurement, management and supervision of the road contracts.

Based on this strategy, a Logical Framework for the RSIP2 as given in Table 9.1 was developed.

**Table 9.1: Logical Framework for RSIP2**

| Objectives   | Key Performance Indicators   | Monitoring and Evaluation   | Critical Assumptions  |
|--|--|---|---|
| <b>1. Overall Objectives</b>   | <b>Outcome Indicators</b>  | <b>Sector/Country Reports:</b>  |   |
| <p><b>Vision</b> - Deploy world class road infrastructure for global competitiveness/ providing good roads for a globally competitive and prosperous Kenya</p> | <ul style="list-style-type: none"> <li>) Improved ranking in terms of ease of doing business from No. 80 (June 2017) to No. 50 (June 2022)</li> <li>) 20% increase in transit cargo to land-locked neighbouring countries through Mombasa Port</li> <li>) Establishment of 9 No. industrial and manufacturing cluster zones across the country</li> <li>) 10% increase in average household income</li> <li>) 10% reduction in employment rate</li> <li>) 20% increase in agricultural production</li> </ul> | <ul style="list-style-type: none"> <li>) Ease of Doing Business Ranking by the World Bank</li> <li>) Transport statistics at Port of Mombasa and border posts</li> <li>) Economic Surveys by KNBS</li> <li>) Household Surveys by KNBS</li> </ul> | <ul style="list-style-type: none"> <li>) Continued improvement in the environment for economic growth.</li> <li>) Government remains committed to support new and on-going sector related activities</li> <li>) Factors of VOC, other than those related to road condition, do not increase.</li> </ul> |
| <b>2. Specific Objectives</b>  | <b>Outcome Indicators</b>  | <b>Programme Reports:</b>   |   |
| <p>Make road transport efficient</p>   | <ul style="list-style-type: none"> <li>) Improvement in the overall road condition from 17% Good, 26% Fair and 56% Poor to 24% Good, 48% Fair and 28%.</li> <li>) 20% reduction in travel time.</li> <li>) 20% reduction in transport costs.</li> </ul>  | <ul style="list-style-type: none"> <li>) Carry out road roughness measurement across the network.</li> <li>) Travel time and delay surveys in major towns.</li> <li>) VOC surveys across the country.</li> </ul>                                  | <ul style="list-style-type: none"> <li>) Government commitment to implement road maintenance management system.</li> <li>) Government to release road maintenance funding as per approved budget on time.</li> </ul>  |

| Objectives  | Key Performance Indicators  | Monitoring and Evaluation   | Critical Assumptions   |
|---|---|---|--|
| <b>3. OUTPUTS</b>                                     | <b>OUTPUTS INDICATORS</b>   |   |  |
| <b>3.1 Output 1</b>                                   |   |   |  |
| Routine and periodic maintenance                      | <ul style="list-style-type: none"> <li>) Routine maintenance of 161,451.80 km of roads</li> <li>) Periodic maintenance (i.e. overlay and reseal) of 2,600km of roads</li> <li>) Spot Gravelling of 13,000km of roads</li> </ul> | <ul style="list-style-type: none"> <li>) Progress Reports (Monthly, Quarterly &amp; Annual)</li> <li>) Project Completion Reports</li> <li>) Mid-term RSIP Reports prepared by KRB</li> </ul> | <ul style="list-style-type: none"> <li>) Adequate performance of consultants and contractors</li> <li>) Government to release road maintenance funding as per approved budget on time</li> <li>) Timing of donor funding in phase with programme requirements</li> </ul> |
| Eliminate backlog maintenance                         | <ul style="list-style-type: none"> <li>) Reconstruction and rehabilitation of 2,800km of roads</li> </ul>   |   |  |
| <b>3.2 Output 2</b>                                   |   |   |  |
| New construction/Upgrading                            | <ul style="list-style-type: none"> <li>) Upgrading (Gravel to Bitumen) of 6,700km of roads</li> <li>) Upgrading (Earth to Gravel) of 6,100km of roads</li> </ul>  | <ul style="list-style-type: none"> <li>) Progress Reports (Monthly, Quarterly &amp; Annual)</li> <li>) Project Completion Reports</li> <li>) Mid-term RSIP Reports prepared by KRB</li> </ul> | <ul style="list-style-type: none"> <li>) Government commitment to funding RSIP2 as planned</li> <li>) Increased efficiency and transparency in procurement and contract management</li> </ul>  |
|   |   |   |  |
| <b>3.3 Output 3</b>                                   |   |   |  |
| Capacity improvement                                  | <ul style="list-style-type: none"> <li>) Capacity Improvement(Dualling) 350km of roads</li> <li>) Construction of interchanges/Improvement of junctions</li> </ul>  | <ul style="list-style-type: none"> <li>) Progress Reports (Monthly, Quarterly &amp; Annual)</li> <li>) Project Completion Reports</li> <li>) Mid-term RSIP Reports prepared by KRB</li> </ul> | <ul style="list-style-type: none"> <li>) Government commitment to funding RSIP2 as planned</li> <li>) Increased efficiency and transparency in procurement and contract management</li> </ul>  |
|   |   |   |  |
| <b>3.4 Output 4</b>                                   |   |   |  |
| Integration of roads with other transport modes       | <ul style="list-style-type: none"> <li>) Construction of 10 no. intermodal stations</li> </ul>  |   | <ul style="list-style-type: none"> <li>) Government commitment to funding RSIP2 as planned</li> <li>) Increased efficiency and transparency in procurement and contract management</li> </ul>  |
| Construction of NMT facilities                        | <ul style="list-style-type: none"> <li>) Construction of 1,000 km of footpaths/cycle tracks</li> <li>) Construction of 50 no. of footbridges</li> </ul>   |   |  |
| Construction of public transport in major urban areas | <ul style="list-style-type: none"> <li>) Construction of BRT/LRT lines within Nairobi town</li> </ul>   |   |  |
| <b>3.5 Output 5</b>                                   |   |   |  |
| Increased regional trade and tourism                  | <ul style="list-style-type: none"> <li>) At least 20% increase regional trade</li> <li>) At least 20% increase in number of tourists from the EAC countries</li> </ul>  | <ul style="list-style-type: none"> <li>) Economic Surveys by KNBS</li> </ul>  | <ul style="list-style-type: none"> <li>) Continued commitment of the countries to regional integration.</li> </ul>   |
| Growth of manufacturing sector                        | At least 20% output from the manufacturing sector   |   |  |
| Facilitation of wholesale and retail trade            | At least 20% growth in intra-county trade   |   |  |
| Growth of agriculture                                 | At least 20% growth in local agribusiness in Kenya  |   |  |
| Equity  | Marginalisation funds for road construction implemented in disadvantaged counties   |   |  |

| Objectives                            | Key Performance Indicators  | Monitoring and Evaluation   | Critical Assumptions   |
|---------------------------------------|---|---|--|
| <b>3.6 Output 6</b>                   |   |   |  |
| Design standards                      | ) All the current Kenyan design standards updated   | ) Audit Reports<br>) Signed Contracts<br>) Accident statistics from NTSA<br>) Management Reports<br>) Training Reports<br>) Periodic ad hoc axle load surveys by the road corridors<br>) Progress Reports (Monthly, Quarterly & Annual) | ) Effective Road Management System put in place by MoTIHUD<br>) Continued Government of Kenya commitment to institutional reforms in the road sector<br>) Coordination of implementation of components by KRB<br>) Efficient Monitoring by KRB<br>) Proper implementation of the transport policies adopted by Kenya.<br>) Strict enforcement of axle load laws.<br>) Weighbridges installed in all major road corridors |
| R&D dissemination                     | ) Increase number of R&D programmes in the sector by 50%  |   |  |
| Improved road safety                  | ) Reduce number of blackspots across the country by 100%<br>) 50% of all public transport drivers sensitized on road safety   |   |  |
| Capacity building                     | ) 500 staff-weeks of training in road management, M&E, financial management, procurement of Road Agency staff<br>) Training of 50% of all small contractors<br>) Training of 500,000 youths on labour-based construction techniques       |   |  |
| Climate resilient roads               | ) Guidelines for design of Climate resilient roads prepared   |   |  |
| Feasibility & design reports          | ) All feasibility and design reports validated by 2021  |   |  |
| Axle load compliance                  | ) Reduce current rate of overloading by haulage trucks by 50%   |   |  |
| Mainstreaming of cross cutting issues | ) 500,000 people (50% women) involved in road construction sensitized on HIV/AIDS, social impacts etc.  |   |  |
| <b>3.7 Output 7</b>                   |   |   |  |
| Resource mobilization                 | ) 2 No. of infrastructure bonds floated<br>) 1,000km of roads undertaken under PPP framework<br>) 2,000km of roads procured under annuity programme<br>) 1000km of roads undertaken using Build Operate Transfer (BOT) funding mechanisms | ) Disbursement reports<br>) Audit Reports<br>) Progress Reports (Monthly, Quarterly & Annual)<br>) Mid-term RSIP Reports prepared by KRB  |  |

From the Logical Framework, the proposed RSIP2 logic tree was evolved as per Table 9.2 below. The logic tree outlines the ultimate goal of the RSIP2 investment; the set of objectives to be achieved; the expected output to be undertaken to measure the achievement of the respective objectives; and, the investment activities to be carried out under each output.

**Table 9.2: Problem Tree for RSIP2**

|                                    |   |  |   |  |   |   |   |
|------------------------------------|---|--|---|--|---|---|---|
| <b>Vision</b>                      | Deploy world class road infrastructure for global competitiveness/ providing good roads for a globally competitive and prosperous Kenya         |  |   |  |   |   |   |
| <b>Overall Objective</b>           | Sustaining, affordability, expanding, efficient, safe, quality, integrated, reliable, modernization of road network                             |  |   |  |   |   |   |
| <b>General Objectives</b>          | Road maintenance (Asset Preservation)   | Road development   | Reduce traffic congestion                           | Seamless interconnectivity between various modes (e.g. MRTS, NMT, SGR)   | Regional connectivity and enhancement of trade by inter-connecting economic and social centres  | Road management   | Resource mobilization to bridge funding gap                               |
| <b>Specific Objective</b>          | Make road transport efficient (e.g. reduce transport costs and travel times)  |  |   |  |   |   |   |
| <b>Outputs</b>                     | -Routine and periodic maintenance<br>-Eliminate backlog maintenance   | New construction, upgrading, bridges and structures                      | Capacity improvement /expansion                     | Integration of roads with other transport modes, construction of NMT and public transport in major urban areas | -Increased regional trade and tourism<br>-Growth of manufacturing sector<br>-Facilitation of wholesale and retail trade<br>-Growth of agriculture | -Design standards<br>-R&D dissemination<br>-Improved road safety<br>-Capacity building<br>-Climate resilient roads<br>-Feasibility & design reports<br>-Axle load compliance<br>-Mainstreaming of cross cutting issues etc.   | Funding gap   |
| <b>RSIP2 Investment Activities</b> | -Routine maintenance.<br>-Reconstruction and rehabilitation.<br>-Periodic maintenance.<br>-Re-gravelling/ Spot-gravelling.<br>-R2000 programme. | -Upgrading Earth to Gravel.<br>-Upgrading to bitumen standards.<br>-LVSR | -Dualling of roads<br>-Construction of interchanges | -Construction of NMT footpaths.<br>- Construction of footbridges.<br>-Construction of MRTS within Nairobi.     | -Construction of regional road corridors.   | -Updating design standards.<br>-R&D in the road sector.<br>-Training of agency staff, consultants and contractors.<br>-Development of Guidelines for design of climate resilient structures.<br>-Installation of weighbridges in new corridors.<br>- Mainstreaming of cross cutting issues etc. | -Infrastructure bonds.<br>- PPP projects.<br>- Annuity programme<br>-etc. |

### **9.3 Baseline Data**

Due to the lack of centralised data base for collating the baseline data, KRB should undertake a consultancy for populating the baseline data for RSIP2 M&E.

## 10 Institutional Issues

### 10.1 Background

The challenges inhibiting efficient roads management and better service delivery were identified in the Sessional Paper on Integrated National Transport Policy (MoT, November 2010). Several policy action points to address these challenges were also proposed in this policy paper.

### 10.2 Assessment of RSIP Preparation Processes and Procedures

The RSIP development is a multidisciplinary process which is dependent on the input from various stakeholders. The preparation process is a data intensive activity which requires continuous data collection in properly prescribed formats. This therefore calls for seamless coordination and collation of data amongst the various institutions involved in the roads sub-sector.

Table 10.1 below summarises some of main RSIP data requirements and the institutions that should provide data.

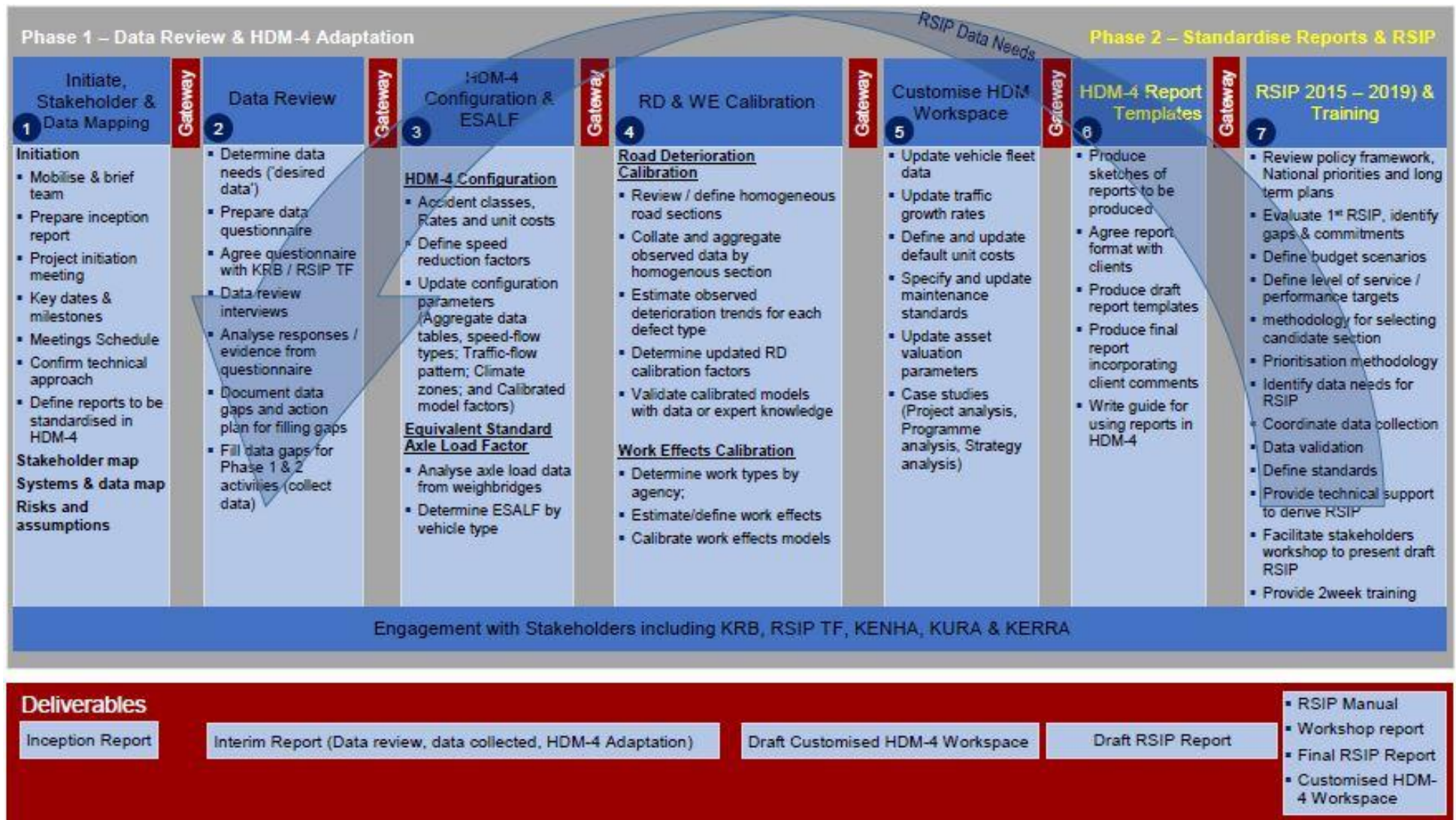
**Table 10.1: RSIP Preparation Data Requirements and the Suggested Sources**

| No. | Required Data   | Suggested Sources  |
|-----|---|--|
| 1   | Accident Classes, Rates and Costs                                 | NTSA and Kenya Police  |
| 2   | Climatic Data   | Kenya Meteorological Organization                                |
| 3   | Budget Information  | MoTI&UD, Controller of Budget and County Governments             |
| 4   | Road Inventory and Condition Data                                 | KRB, KeNHA, KURA, KeRRA, KWS and County Governments              |
| 5   | Vehicle Mass and Axle Load Data                                   | KRB, KeNHA, KURA, KeRRA and KWS                                  |
| 6   | Traffic volumes and Traffic growth rates                          | KRB, KeNHA, KURA, KeRRA, KWS, County Governments, KIPPRA and KRA |
| 7   | Unit costs of road works  | KRB, KeNHA, KURA, KeRRA and KWS                                  |
| 8   | Maintenance standards   | KRB, KeNHA, KURA, KeRRA, KWS and County Governments              |
| 9   | Asset valuation parameters  | KRB, KeNHA, KURA, KeRRA, KWS, KIPPRA and KNBS                    |
| 10  | Vehicle fleet characteristics and resource consumption unit costs | KRB  |
| 11  | Road Deterioration and Work Effects                               | KeNHA, KURA, KeRRA, KWS and MTRD                                 |
| 12  | Construction Quality Indicators                                   | MTRD   |

In the RSIP preparation process, the parent Ministry (MoTI&UD) should be tasked with policy development and sector overview. The road agencies and county governments should be tasked with continuous data collection and implementation of the RSIP programmes while KRB should play a M&E role while coordinating the RSIP implementation. MTRD should ensure quality outputs are achieved as defined in the RSIP work standards.

Figure 10.1 below shows various stages for the development of the RSIP 2.

Figure 10.1: RSIP Preparation Process and Procedures



## 10.3 Research and Development

### 10.3.1 Policy Framework

Despite being touted as being one of the cornerstones of attaining the Vision 2030, there is still very intermittent research currently being undertaken in the roads sub-sector. To this end, the *Science, Technology and Innovation Act (ST&I), 2013* was passed by parliament in a bid to promote research and innovation.

The Act postulated the establishment of the National Commission for Science, Technology and Innovation (NACOSTI) to promote, coordinate and regulate the progress of R&D in the country. The Act also postulated the establishment of the Kenya National Innovation Agency (KENIA) and the National Research Fund (NRF) with funds for the NRF being set at 2% of GDP plus other such monies in form of donations, endowments, grants or gifts.

Under the current policy, research institutes are to be hosted by the respective sector ministries with funding only being disbursed from the NRF for research areas prioritized by NASCOTI. Allocation of funds for the NRF has increased over time from KSh. 250 million in 2008/09 to about KSh. 497 million in the fiscal year 2015/16. This is still way below the KSh. 100 billion required by the Ministry for Education, Science and Technology to establish a national research system that will meet the socio-economic and industrial needs of the country (*Business Daily 27/8/2014*).

Sessional Paper No. 10 of 2010 noted the glaring lack of a focal point to coordinate and disseminate research findings in the transport sector as a major bottleneck hindering research activities in the transport sector. The paper therefore recommended the establishment of a National Transport Research Institute (NATRI) to undertake research within the transport sector.

Sessional Paper No. 5 of 2006 on the other hand recommended the restructuring of the MTRD into Semi-Autonomous Government Agency (SAGA) so as to enable it to effectively meet its mandate with regard to material testing and research.

### 10.3.2 Current Research Set-up in the Roads Sector

Currently most of the research going in the roads sector are being undertaken by the MTRD of the MoTIHUD with regard to construction materials, pavement design and development of construction specifications, quality control, and post construction evaluation of roads. The MTRD however has low capacity and inadequate funding to effectively carry out its mandates.

The Kenya Roads Board also established an Inter-Agency Research and Development Committee (IRDC) in 2013 to coordinate research activities in the roads sub-sector. The committee had representatives from institutions, professional practitioners and academia amongst other players in the road sub-sector and, was tasked with providing technical and logistical oversight for research activities in the sub-sector. The IRDC has however since been disbanded and replaced by an internal committee at the Kenya Roads Board.

The proposed reforms in the R&D sector such as the formation of the NATRI and the transformation of MTRD into a SAGA are still not complete and funding to the NRF is still way below the proposed threshold hence hampering research activities.

### 10.3.3 Ongoing Research Activities in the Roads Sector

Amongst the on-going/planned research activities include:

- (1) The 2nd Phase of the Cobblestones Research Trails on Ngong - Oloolua Road (1.0km). The research is aimed at establishing the construction costs of the technology and is to be implemented by KeRRA in collaboration with MTRD and KIHBT. Bids were advertised in November 2016 and the construction is yet to start.
- (2) The International Conference on Transport and Road Research which was held in March 2016 with the aim of enhancing coordination of research efforts, encouraging dissemination of research findings and promoting the uptake of research findings. The conference was held in coordination with AFCAP and MTRD.
- (3) Research on the state and properties of underlying volcanic soil that caused fissures along Mai Mahiu - Narok Road in Kenya during the long rain season of February to May 2012. The research is being undertaken by the University of Nairobi in collaboration with MTRD.
- (4) An innovative research on the design and development of equipment to fast track mixing of emulsion treated base and sub base materials in R2000 projects. The design aims to standardize the quality of mixed material with special applicability to the Low Volume Seal projects currently ongoing in the country. The design is being undertaken by JKUAT in consultation with Norken International Consultants.
- (5) Field Trials on Hydraulic Road Binders (HRBs) following a position paper presented by Norken/Bamburi during the 1<sup>st</sup> ITRARR conference. It is proposed that field trials be undertaken to validate the findings of the laboratory trials and following conclusion of the field trials, specifications be drawn for the use of HRBs in stabilization of capping and pavement layers for road works in Kenya.

### 10.4 Recommended Thematic Research Areas for RSIP

Based on the foregoing, some of the research areas recommended for future improvement of RSIP:

1. Long-Term Pavement Performance - to help in better calibration of the pavement deterioration model for Kenya; and,
2. Research on low-cost road construction techniques using locally available materials.

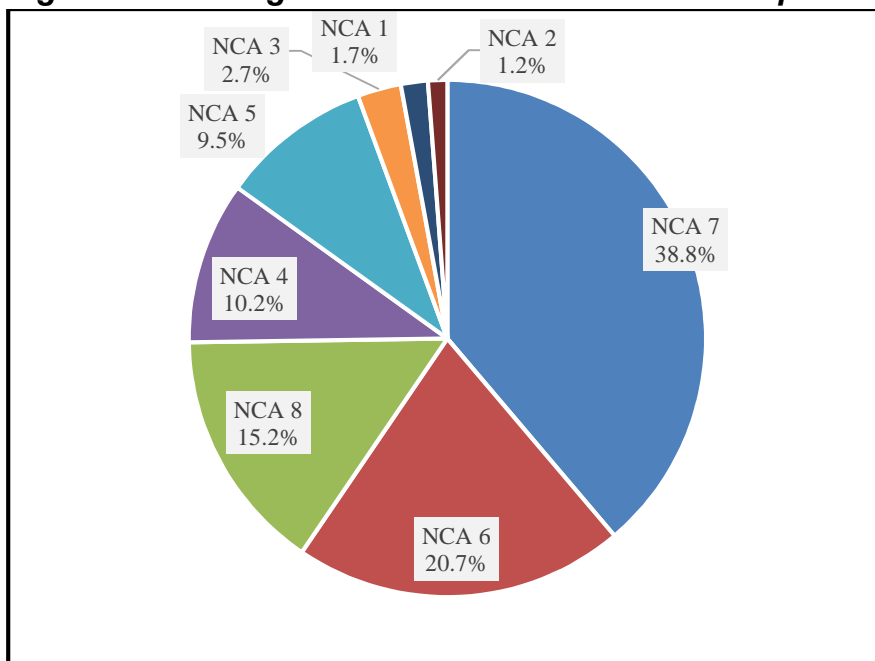
### 10.5 Capacity Building

The 2<sup>nd</sup> Medium Term Plan for the period between 2013 and 2017, had set out an ambitious target of building human capacity in the infrastructure sector by training about 3,500 officers over its 5-year implementation period. This was necessitated by the skill gaps that had been identified by the INTP, 2010.

There has also been steady growth in the contracting capacity within the road construction industry primarily due to the influx of foreign multinational construction companies into the Kenyan market. This has seen the number of registered road contractors rising from about 1,621 in 2011 to about 6,863 by June 2015.

The road construction contractors are segregated into various categories (NCA 1 to NCA 8, with NCA 1 being the large contracting firms) and are as summarised in Figure 10.1 below.

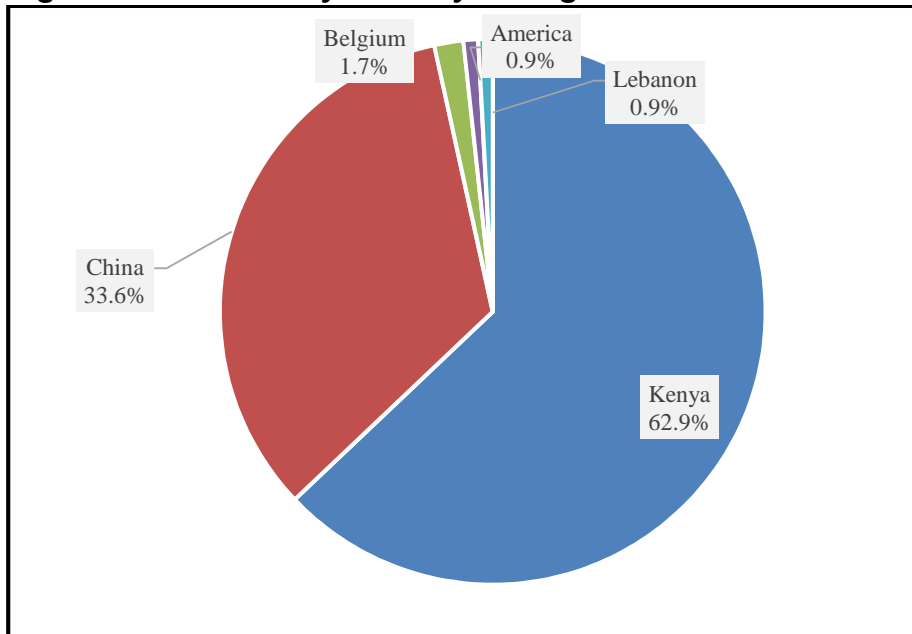
**Figure 10.1: Categories of Road Construction Companies**



Source: The Kenya Gazette, Vol. CXVIII-No. 41, 15<sup>th</sup> April 2016

Figure 10.1 shows that the majority of the gazetted contractors belong to the lower cadres ranging from NCA 6 to 8 (i.e. 74.7%). It is also important to point out that since 2014, registration of foreign contractors is restricted to category NCA 1 only. From the data, there were 116 NCA 1 registered road contractors, out of which 73 and 39 were Kenyan and Chinese, respectively. Two were from Belgium, and one each from USA and Lebanon (Figure 10.2).

**Figure 10.2: NCA 1 by Country of Registration**



Source: *The Kenya Gazette, Vol. CXVIII-No. 41, 15<sup>th</sup> April 2016*

With the influx of foreign multinational contracting firms, a majority of which are locally incorporated, there is adequate capacity to deliver the RSIP2 programme. Training of local contractors to improve their competitiveness should also be prioritised.

Moreover, capacity building should focus on training of road agency staff and consultants in a bid to enhance the capacity to deliver the RSIP2 programme.

### 10.6 Management of the Roads Sub-Sector

The enactment of a new constitution in the year 2010 postulated a two-tier system for managing the country's road network between the National and the County governments. The 2010 constitution however did not define the criteria for distinguishing between national and county roads, which were to be defined through the enactment of a roads bill by parliament. This led to the development of the Kenya Roads Bill 2015, which has since been superseded by the Kenya Roads Bill 2017. Enactment of the bill into law is expected to resolve the jurisdiction challenges between the various networks.

### 10.7 Mainstreaming of Cross-Cutting Issues

RSIP2 has also proposed the setting aside of funds for mainstreaming of cross-cutting issues such as climate change mitigation, prevention of HIV/AIDS and negative social issues, increasing women and youth participation in the sector and mitigation against environmental impacts, amongst others.

## 10.8 Funding of Other Programmes

RSIP2 has also proposed the setting aside of funds for other programmes including: -  
 1) Improvement of public transport system in major towns; 2) Improvement of road safety; and, 3) Acquisition of right of way, amongst others.

## 10.9 Assumptions and Risks

The successful implementation of RSIP2 is hinged on various assumptions some of which may threaten its successful implementation. A SWOT analysis of these issues is presented in Table 10.2.

**Table 10.2: SWOT Analysis**

| <b>Strengths</b>   | <b>Weaknesses</b>  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Steadfast investment commitment by the government in road infrastructure</li> <li>2. Anchoring road sub-sector investments to long-term government development policies e.g. Kenya Vision 2030</li> <li>3. Increased fund allocation through the RMLF</li> <li>4. Clear regulating framework with well-defined legal mandates for the road sector</li> </ol>   | <ol style="list-style-type: none"> <li>1. Weak regulation of the construction industry</li> <li>2. Low contracting capacity</li> <li>3. Poor road management systems hindering budgeting, planning, programming and monitoring</li> <li>4. Poor management of contracts leading to claims</li> </ol>   |
| <b>Opportunities</b>   | <b>Threats</b>   |
| <ol style="list-style-type: none"> <li>1. Continued financial support from development partners</li> <li>2. Partnership with international firms offering opportunities for technology transfer</li> <li>3. Availability of various financing options e.g. annuity, infrastructure bonds etc.</li> <li>4. Devolution of road management up to county level</li> <li>5. Continued research on cost-effective road construction techniques</li> <li>6. Involvement of the private sector in road financing through models such as PPP</li> </ol> | <ol style="list-style-type: none"> <li>1. Over-reliance on government financing for the road sector</li> <li>2. Challenges in implementation of the new constitution with regard to jurisdiction</li> <li>3. Influx of foreign international firms locking out small indigenous firms</li> <li>4. Stringent procurement requirements which lock-out small firms</li> <li>5. Depletion of natural resources for road construction such as gravel</li> <li>6. Underfunding leading to project cost overruns</li> <li>7. Delayed disbursement of project funds</li> </ol> |

Source: Annual Reports Prepared by the Various Road Agencies

## 11 Conclusions and Recommendations

### 11.1 Conclusions

This report described the preparation of Road Sector Investment Plan to assist KRB and road agencies to determine the technical needs, understand the risks and recommend the investment required for GoK to attain its goals to reduce transport costs and travel time and improve road safety on the Kenyan road network. The intention is that this RSIP2 will be used to drive all investment in the road sector in the next 5 years.

The report discussed the approach and methodology used for this assignment, the underpinning assumptions, the analytical tools used together with their input data requirements. It presented optimised 5-year work programmes of physical investments for maintenance and development of roads for National Primary Trunk Roads (NPTR), National Secondary Trunk Roads (NSTR), National Primary Urban Roads (NPUR), Roads within Wildlife Conservation Areas and County road networks. These work programmes comprise ongoing projects, committed projects, periodic maintenance, reconstruction/rehabilitation, upgrading projects, and capacity improvements projects; and were produced taking into account current budget commitments and forecast expenditure ceilings. The expected benefits of the work programmes produced include enhancing coordination of road programmes in the country by bringing these programmes into a single framework; and assisting development partners to identify projects and programmes aligned to their transport sector priorities.

The study also identified needed policy measures at the strategic level; determined the optimal allocation of resources between the National Roads and County Roads; determined the maintenance and development road network needs; determined the optimal allocation of resources between road maintenance and road development; and estimated the road total asset value.

The main conclusions of the report are as follows:

1. The total investment (i.e. capital and recurrent) required for RSIP2 is estimated at KSh. 929.785 billion over the 5-year planning period: KSh. 806.191 billion for development and maintenance; KSh. 80.619 billion for physical and price contingencies; and KSh. 42.975 billion provisional sum for research studies and capacity building of the roads sub-sector.
2. The HDM-4 economic efficiency optimisation method was used to prepare the optimised road investment programmes. The total length of the entire road network is 161,451 kilometres. The percentage split of the Kenyan road network by surface class between paved and unpaved roads at the start of RSIP2 is 14.6% paved and 85.4% unpaved; after a successful implementation of RSIP2 the percentage split will change to 18.8% paved and 81.2% unpaved.

3. Implementation of RSIP2 will affect the road condition of each of the five sub-networks. On average, National Primary Trunk Roads (NPTR) paved roads condition will improve from Fair to Good and the unpaved roads condition will worsen from Fair to Poor; National Primary Urban Roads (NPUR) paved roads condition will improve from Poor towards Fair and the unpaved roads condition improves from Poor to Fair; National Secondary Trunk Roads (NSTR) paved roads condition worsens from Fair to Poor and the unpaved roads condition improves from Poor to Fair; Roads within Wildlife Conservation Areas roads condition will remain Poor; County paved roads condition will remain in Fair and unpaved roads condition will remain Poor. Ideally, the Government should aim to improve the road network condition, or at worst, maintain the existing road condition. From the results obtained from this study, the Government should consider allocating more funds to the paved network of NSTR and Roads within Wildlife Conservation Areas, and the unpaved NPTR network.
4. The economic benefits, expressed in terms of Net Present Value (NPV), of implementing RSIP2 over the entire Kenyan road network is calculated over 20-year analysis period. The results of savings in Vehicle Operating Costs (VOCs), savings in Travel Time Costs (TTCs), the NPVs and NPV/Capital Cost for RSIP2 are summarised in Table 8.6 for all the road agencies and for the entire road network. It is assumed that these amounts of NPV given in Table 8.6 will be realized when timely implementation of periodic and routine maintenance are applied over the 20-year analysis period. Overall, there is an attractive positive return to invest in RSIP2 of KSh. 853.58 billion and KSh. 5.189 trillion over the 5 and 20-year periods, respectively. It has computed that for **every one shilling invested in roads, the country stands to gain one shilling and ten cents in benefits.**

Although the Terms of Reference for this assignment did not include strategic network analysis in the scope of services, it was found appropriate that this report should cover the entire Kenyan road network and therefore include strategic analysis.

The key findings from the strategic analysis are as follows:

1. A total of **KSh. 2.27** trillion will be required to fix the backlog of maintenance and development works over the next 5-years. This translates to an additional budget of **KSh. 1.47 trillion** over the current available budgets of **KSh. 806.19 billion**. Without the additional budget, the National Primary Trunk Roads (NPTR) and National Secondary Trunk Roads (NSTR) networks in good condition will marginally deteriorate to fair condition, and the current roads in poor condition will become fair. The networks for National Primary Urban Roads (NPUR), Roads within Wildlife Conservation Areas and County Governments will generally deteriorate to poor condition.
2. About 30% of the total budget should be allocated to the County roads and 70% be allocated to the National roads over the RSIP2 implementation period. The

budget for national roads is to be further sub-divided into the four sub-networks at a proportion of 39%, 15%, 2% and 14% for National Primary Trunk Roads (NPTR), National Primary Urban Roads (NPUR), Roads within Wildlife Conservation Areas and National Secondary Trunk Roads (NSTR), respectively.

3. About 72% of the available resources should be allocated to development works (i.e. reconstruction, upgrading works and new construction/ capacity improvement), with the remaining proportion being used for maintenance works (i.e. routine and periodic maintenance works, and spot gravelling).

## 11.2 Recommendations

### 1. Data Management

A particular challenge in this study was the lack of good quality data for both roads and structures. It should be noted that the accuracy and reliability of the outputs from studies such as this depends to a significant extent on the quality of the input data used in the analytical decision-making tools. It is therefore recommended that special attention should be given to ensure that data collected by consultants, KRB and its agencies is complete, fit for purpose and accurate, and that this study should be reviewed when better quality data becomes available.

It is strongly recommended that the quality and accuracy of traffic data, in particular, needs to be improved since the economic justification of most road investment projects depend largely on traffic volumes and composition.

### 2. Delivery Mechanism

The implementation of the RSIP2 will involve the road agencies and county governments with an increased private sector participation. These institutions are expected to outsource most of these works to various consultancy and contracting firms both local and international.

For the successful implementation of RSIP2, the Kenya Roads Bill 2017 should be enacted into law in a bid to resolve the jurisdiction challenges between the national and county networks. Moreover, there should also be timely disbursement of project funds so as to hasten the delivery of projects.

County governments on the other hand need to be assisted through consultancy services to help them prioritise/optimize their road investment programmes. To do this properly, the County Governments should be assisted to collect and process data into formats required for use in the relevant decision-making tools.

### **3. Financing RSIP2**

The strategy analysis has revealed that the resources envisioned to be allocated to the road sub-sector over the RSIP2 implementation period are inadequate and more resources will have to be marshalled over this period for the road network condition to improve. This will require exploring other potential funding sources such as Public Private Partnerships (PPPs); infrastructure bonds; annuity programme; etc.

### **4. Sustainability**

It is also recommended that analysis of the impact of vehicle axles overloading on maintenance/improvement standards and the associated budget requirements and other relevant key performance indicators should be undertaken, and the results used to inform the review and updating of RSIP2.

## References

1. Ministry of Roads (May 2011). Road Sector Investment Programme & Strategy 2010 – 2024. (Republic of Kenya).
2. Ministry of Transport (November 2010). Integrated National Transport Policy. (Republic of Kenya).
3. Ministry of State for Planning, National Development and Vision 2030. (2008). Kenya Vision 2030 - First Medium Term Plan (MTP) 2008 – 2012: A Globally Competitive and Prosperous Kenya. (Republic of Kenya).
4. Ministry of Devolution and Planning. (2013). Kenya Vision 2030 - Second Medium Term Plan (MTP) 2013 – 2017: Transforming Kenya: Pathway to Devolution, Socio-Economic Development, Equity and National Unity. (Republic of Kenya).
5. Economic Survey Reports by the Kenya National Bureau of Statistics.
6. Kenya Roads Board (June 2015). Annual Report and Financial Statements for the year ended 30th June 2015. (Republic of Kenya).
7. County Budget Implementation Review Report FY2015-16, Office of the Controller of Budget, GOK.

## Appendices