EFFICIENCY OF THE SYSTEM OF ROAD MAINTENANCE IN UGANDA:
A CASE STUDY OF MUNICIPAL COUNCILS

MARCH 2015
AUDITOR GENERAL’S MESSAGE
31st March 2015

The Rt. Hon. Speaker of Parliament
Parliament of Uganda
Kampala

REPORT OF THE AUDITOR GENERAL ON EFFICIENCY OF THE SYSTEM OF ROAD MAINTENANCE IN UGANDA: A CASE STUDY OF MUNICIPAL COUNCILS

In accordance with Article 163 (3) of the Constitution. I hereby submit my report on the audit undertaken on Efficiency of the System of Road Maintenance in Uganda: A case Study of Municipal Councils.

My office intends to carry out a follow – up at an appropriate time regarding actions taken in relation to the recommendations in this report.

I would like to thank my staff who undertook this audit, the consultants from the Swedish National Audit Office for the technical Support provided and the staff of Uganda Road Fund and the Municipal councils for the assistance offered to my staff during the period of the audit.

John F. S. Muwanga
AUDITOR GENERAL
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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CARs</td>
<td>Community Access Roads</td>
</tr>
<tr>
<td>DAs</td>
<td>Designated Agencies</td>
</tr>
<tr>
<td>DEA</td>
<td>Data Envelopment Analysis</td>
</tr>
<tr>
<td>DRCs</td>
<td>District Roads Committee</td>
</tr>
<tr>
<td>DUCAR</td>
<td>District Urban and Community Access Roads</td>
</tr>
<tr>
<td>FMC</td>
<td>Fund Management Committee</td>
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<td>FY</td>
<td>Financial Year</td>
</tr>
<tr>
<td>GAPR</td>
<td>Government Annual Performance Report</td>
</tr>
<tr>
<td>IPF</td>
<td>Indicative Planning Figures</td>
</tr>
<tr>
<td>KCCA</td>
<td>Kampala Capital City Authority</td>
</tr>
<tr>
<td>MoFPED</td>
<td>Ministry of Finance, Planning and Economic Development</td>
</tr>
<tr>
<td>MoWT</td>
<td>Ministry of Works and Transport</td>
</tr>
<tr>
<td>MC</td>
<td>Municipal Council</td>
</tr>
<tr>
<td>RUCs</td>
<td>Road User Charges</td>
</tr>
<tr>
<td>TSUs</td>
<td>Technical Support Units</td>
</tr>
<tr>
<td>UNRA</td>
<td>Uganda National Roads Authority</td>
</tr>
<tr>
<td>USMID</td>
<td>Uganda Support to Municipal Infrastructure Development Program Project</td>
</tr>
<tr>
<td>URF</td>
<td>Uganda Road Fund</td>
</tr>
<tr>
<td>VOC</td>
<td>Vehicle Operating Costs</td>
</tr>
<tr>
<td>DMUs</td>
<td>Decision Making Units</td>
</tr>
<tr>
<td>RAMPS</td>
<td>Rehabilitation and Maintenance Planning System</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

In 2010, the Uganda Government established the Uganda Road Fund (URF), with an overall purpose of ensuring that all public roads are maintained at all times through the provision of adequate and stable financing for routine and periodic maintenance undertaken by designated agencies.

Proper road maintenance contributes to reliable transport at reduced cost as there is a direct link between road condition and vehicle operating costs (VOC). Given that the current levels of funding for road maintenance are far below the maintenance needs of the road network, it is necessary to ensure that the available resources are utilized efficiently in order to achieve improvements in the quality of the network. It was on this basis that the Office of the Auditor General undertook this audit with the objective of assessing the extent to which the system of road maintenance by URF facilitates efficient road maintenance in the municipal councils.

KEY FINDINGS

The audit identified some areas that require improvement in order to improve the efficiency of the systems of road maintenance in Uganda.

- The cost estimates for the maintenance works for the years under review were not based on the recommended unit cost or the guidelines issued by the URF at the planning stage. Most of the municipalities applied unit costs that were higher than those recommended for periodic and routine mechanized maintenance while the rates used for routine mechanized maintenance were lower than those recommended.

- The URF guidelines were not properly followed as some Municipal Councils (MCs) did not plan for routine manual maintenance at all yet this intervention prolongs the serviceability of the roads. In addition, the municipalities did not indicate in their work plans when their roads last received periodic treatment though the guidelines for FY 2011/12 specified that such information be indicated.

- It was noted that there were major differences/variations in unit costs for similar interventions across the municipalities that could not be explained by topography and climatic differences.

- The current formula used for the allocation of funds does not take into account some factors that are considered critical for a more efficient road maintenance system. Such factors include length of road network, road condition and traffic volume.

- The efficiency scores of the Municipal councils measured through Data Envelopment Analysis (DEA) technique showed inefficiencies (deviation from the frontier) ranging from 19% to 1440%. The results were found to be extremely high compared to previous studies conducted on efficiency of road maintenance in other countries using DEA; which range from 40% to 60% inefficiency. These
scores point to the fact that the road maintenance data submitted to the URF is not credible and therefore cannot be used to measure and monitor efficiency regardless of the tool used.

**KEY RECOMMENDATIONS**

- The URF should ensure that the training of all agencies in the use of the Unit Cost Model for estimation of maintenance costs is prioritized and support is readily available in the use of the model for the staff at the municipal councils to ensure adoption and continuity in the use of the model.

- Monitoring/assessment of periodic maintenance activities should be emphasized and prioritized by URF for effective planning of maintenance activities by the municipal councils.

- The URF should expedite the process of updating the Unit Cost Model and ensure its timely roll out to all the municipalities to aid the cost estimation process during planning. URF should expedite the investigations regarding the relationship between the amount of money spent and the road length maintained to ensure inefficiencies within the system and thus wastages or resource are identified and corrective action taken.

- The URF should pursue the formation of DRCs across all designated agencies, and through continuous sensitization, emphasize to the DRCs the importance of their role in the road maintenance process to ensure that they are actively and effectively involved in the planning process. The URF should provide for channels of communication/interaction with the DRCs to ensure that they understand their role and how road maintenance planning should be carried out to ensure their effective participation.

- The process of setting up Technical Support Units (TSUs) in the regions to train staff at the municipalities should be finalized and the Accounting Officers and Municipal Engineers should be engaged in order to capture all their skills gaps to ensure that the training is effective. In addition, URF should ensure a robust follow-up mechanism is put in place to facilitate collection of the necessary data to be used in efficient allocation of funds for road maintenance.

- Uganda Road Fund should ensure that all municipalities account for funds received in a format that is consistent and similar with all necessary variables filled to allow for proper comparisons across agencies. URF should establish mechanisms to ensure that all data submitted by municipalities is verified for data errors, inconsistencies and factual errors.

- The URF should strengthen coordination efforts with MoWT in as far as ensuring that:

- Information about the road networks such as: road network inventory, road network condition and the equipment owned by designated agencies is maintained and kept up to date.
• The data collected is readily availed to URF to help facilitate decision-making on allocation of funds to the designated agencies.

• URF should prioritize and strengthen its M&E function if an effective assessment of performance of the municipalities in utilization of the URF funds towards road maintenance is to be done.

OVERALL AUDIT CONCLUSION

Owing to the current levels of funding for road maintenance which falls short of the maintenance needs, it is important that the available resources are utilized efficiently by the designated agencies.

URF has put in place a system of planning, execution and reporting of road maintenance activities by municipalities. However, as a result of municipalities using various methods and not the uniform method stipulated by the URF, and disregarding the planning guidelines, in some instances, wide variations in cost estimation have resulted.

The allocation formula being used does not take into consideration the factors as required in section 22(2) of the URF Act and therefore does not allow for efficient allocation of funds to the Municipalities. These factors include: condition of the roads, length of the road network and traffic volumes.

With this, and coupled with inaccuracies in the data the municipalities provide to URF, and a weak monitoring and evaluation system, URF may not be in position to ascertain and monitor the efficiency of road maintenance activities in the municipalities and thus improve performance in the road maintenance system.

As the URF Act (2008) is operationalized to allow URF collect and utilize the Road User Charges (RUCs), it is anticipated that the URF will be able to mobilize much more funds for road maintenance. It is, therefore, important that the URF puts in place and enforces systems to enforce the efficient utilization of resources.
CHAPTER ONE
CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

In 2010, Government of Uganda established the Uganda Road Fund (URF), with an overall purpose of ensuring that all public roads are maintained at all times through the provision of adequate and stable financing for routine and periodic maintenance undertaken by designated agencies.

The road network funded by the URF is 78,000km of roads made up of: 21,000km of national roads under the management of Uganda National Roads Authority (UNRA); 1,100km of Kampala Capital City Authority (KCCA) roads; 18,500km of district roads; 4,000km of urban roads managed by town councils; 3,400km of urban roads managed by municipal councils; and 30,000km of Community Access Roads (CARs) managed by sub-counties.

1.2 MOTIVATION

Road maintenance is essential in order to: preserve the road in its originally constructed condition; protect adjacent resources and user safety; and provide efficient, convenient travel along the route. In spite of the indisputable importance of roads, they are poorly managed and maintained. Despite the huge backlog, Government expenditure on routine and periodic road maintenance is still far too little compared to that of road construction/development. This has resulted in diminution in the value of billions of shillings invested in construction due to the rapid deterioration of the network, high vehicle operating costs and other maintenance costs.

In addition, proper road maintenance contributes to reliable transport at reduced cost as there is a direct link between road condition and vehicle operating costs (VOC). An improperly maintained road can also represent an increased safety hazard to the user, leading to more accidents, with their associated human and property costs. Furthermore, an improperly maintained road leads to losses for the economy as a whole as people and goods spend much time and money in transit.

The Uganda Road Fund invested a total of UGX 914 billion in road maintenance activities during the three years under review (2011/2012, 2012/2013 and 2013/2014), with a total of 4,565km of roads maintained. Despite the increasing investment, there are reports and persistent public outcry about the poor state of roads and the deteriorating quality of works being executed.

The physical and financial performance reports of designated agencies in FY 2011/12 revealed the following issues: budget indiscipline, poor absorption of road maintenance funds, inaccuracies in reporting, lethargy of Designated Agencies (DAs) in complying with reporting requirements, widely varying unit costs, risk of loss of funds through end of year procedures, and grave underperformance of periodic maintenance works.

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1Roads & Highways Construction and Maintenance, FAO
2Government Annual Performance Report FY 2011/12 – Volume 1
The URF monitoring reports noted gross inconsistencies between the progress reported in the quarterly reports submitted to URF and the findings on the ground\textsuperscript{5}. There was also reported lethargy in implementing the force account policy arising from inadequate understanding and appreciation of the issued implementation guidelines. Other issues that were reported by the URF include: shortcomings in costing of works and diversion of funds meant for road maintenance.

The road maintenance needs in Uganda cannot be met due to limited resources, for example for FY 2011/2012, the total maintenance needs from the agencies was UGX 413.95bn, and the budget provided by the Ministry of Finance, Planning and Economic Development (MoFED) was UGX280.95bn, indicating a 32% deficit. Given that the current levels of funding for road maintenance are far below the maintenance needs of the road network, it is necessary to ensure that the available resources are utilized efficiently in order to achieve improvements in the quality of the network.

It is against this background that an independent assessment of the systems of road maintenance employed by Uganda Road Fund (URF) was undertaken to ascertain the extent to which efficiency can be delivered in the road maintenance activities in the municipalities.

1.3 DESCRIPTION OF THE AUDIT AREA

1.3.1 General Description

The cardinal role of URF is to be a facilitator of road maintenance by ensuring predictable financing for maintenance programmes undertaken by designated agencies.

The fund commenced operations in January 2010 by assuming responsibility to disburse UGX 116 billion appropriated by Parliament for maintenance of public roads during the second half of FY 2009/10.

The funds may be applied, as stipulated in Section 22 of the Act, towards: routine and periodic maintenance of public roads, roads safety costs, operation expenses of UNRA, administration expenses of URF, research in road works, and such activities relevant to the maintenance of public roads as determined by the Board.

The road network funded by the URF is made up of 78,000km of roads under management of different designated agencies.

1.3.2 Legal Framework

The Uganda Road Fund (URF) was established by an Act of Parliament with an overall purpose of ensuring that all public roads are maintained at all times through the provision of adequate and stable financing for routine and periodic maintenance undertaken by designated agencies.

The Fund derives its mandate from Sections 21 and 22 of the URF Act. Accordingly, it is mandated to collect and disburse Road User Charges (RUCs) to finance agreed annual road maintenance programmes enshrined in performance agreements.

\textsuperscript{5}URF Monitoring Report Q2, FY 2012/2013
1.3.3 Vision Statement of the Uganda Road Fund
To provide “Adequate, reliable, timely and sustainable financing for road maintenance for a safe and efficient network”

1.3.4 Mission Statement of the Uganda Road Fund
The mission of URF is “to administer and manage the fund with prudence, integrity and transparency in a commercial, cost effective and efficient manner so that appropriate road user charges are collected efficiently and allocated according to true needs for adequate funding of routine and periodic maintenance of all public roads”.

1.3.5 Goal
The objective of the fund is:

- to finance the routine and periodic maintenance of public roads in Uganda;
- to ensure that public roads are maintained at all times; and
- to advise the Minister, in consultation with the Minister responsible for roads and the Minister responsible for local governments on:-
  (i) The preparation and efficient and effective implementation of the Annual Road Maintenance Programme; and
  (ii) The control of overloading of vehicles on public roads.

1.4 MAIN ACTIVITIES OF THE UGANDA ROAD FUND
The activities carried out under the Uganda Road Fund include the following:

- Planning, budgeting and disbursement of funds for planned road maintenance activities by the designated agencies that receive funding from the URF.
- Monitoring and supervision of road maintenance activities by the designated agencies.

1.4.1 Linkages between the Key players
The Uganda Road Fund is headed by a Board of 7 members that administer the Fund through the Secretariat with an Executive Director appointed by the Board. The Executive Director and Departmental Managers constitute the Fund Management Committee (FMC), which is the top policy and administrative organ reporting to the Board. The designated agencies execute road maintenance with funding from the URF under guidance from the Fund and Ministry of Works and Transport. The linkages are shown in Figure 1 below.
1.5 FUNDING

The funding by URF to the municipal councils during the Financial Years 2011/12 to 2013/14 amounted to UGX40.9 billion as shown in Table 1 below.

Table 1: Funding to MCs for the Financial Years 2011/12, 2012/13 and 2013/14

<table>
<thead>
<tr>
<th>Municipal council</th>
<th>2011/2012</th>
<th>2012/2013</th>
<th>2013/2014</th>
<th>Cumulative Total funding</th>
</tr>
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<tr>
<td>Arua</td>
<td>576,894,557</td>
<td>578,706,966</td>
<td>578,706,966</td>
<td>1,734,308,489</td>
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<tr>
<td>Entebbe</td>
<td>1,050,056,257</td>
<td>1,013,391,570</td>
<td>1,013,391,570</td>
<td>3,076,839,397</td>
</tr>
<tr>
<td>FortPortal</td>
<td>576,596,377</td>
<td>581,682,242</td>
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<td>1,739,960,861</td>
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<tr>
<td>Gulu</td>
<td>1,100,847,333</td>
<td>1,092,765,143</td>
<td>1,092,765,143</td>
<td>3,286,377,619</td>
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<tr>
<td>Jinja</td>
<td>1,065,174,305</td>
<td>1,005,560,449</td>
<td>1,005,560,449</td>
<td>3,076,295,203</td>
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<tr>
<td>Kabale</td>
<td>553,190,251</td>
<td>628,734,051</td>
<td>628,734,051</td>
<td>1,810,658,353</td>
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<td>Lira</td>
<td>885,124,225</td>
<td>989,031,092</td>
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<td>2,863,184,409</td>
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<td>Masaka</td>
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<td>1,975,349,645</td>
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<td>Mbale</td>
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<td>Mbarara</td>
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<td>Moroto</td>
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<td>Soroti</td>
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<td>Tororo</td>
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<td>Kasese</td>
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<td>590,738,237</td>
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<td>Iganga</td>
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<td>Ntungamo</td>
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<td>463,098,894</td>
<td>1,274,069,268</td>
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<td><strong>Total</strong></td>
<td><strong>13,105,809,724</strong></td>
<td><strong>13,907,025,000</strong></td>
<td><strong>13,907,025,000</strong></td>
<td><strong>40,919,859,724</strong></td>
</tr>
</tbody>
</table>

Source: Road fund releases to municipal councils
1.6 AUDIT OBJECTIVE
The main objective of the audit was to assess the extent to which the system of road maintenance by URF facilitates efficient road maintenance in the municipal councils.

1.7 AUDIT QUESTIONS
a) Are the systems for planning, execution and reporting by municipalities adequate in ensuring that road maintenance is efficient?

b) Does the current funding allocation system in the URF allow for efficient allocation of resources for road maintenance?

c) Does the data provided by the municipalities allow the URF to monitor the efficiency and performance of road maintenance?

1.8 AUDIT SCOPE
The audit focused on road maintenance activities funded by the Uganda Road Fund, at the URF headquarters in Kampala and the 22 Municipalities as shown in Appendix I, and covered the 4,000 km of urban roads managed by these municipalities over the three financial years: 2011/2012, 2012/2013 and 2013/2014.
CHAPTER TWO
AUDIT METHODOLOGY AND THEORETICAL FRAMEWORK

2.1 AUDIT METHODOLOGY

The audit was carried out in accordance with the International Organization of Supreme Audit Institutions (INTOSAI) Performance Auditing Standards and Value for money (VFM) Auditing guidelines prescribed in the Office of the Auditor General (OAG) VFM audit manual. The standards require that the audit is planned in a manner which ensures that an audit of high quality is carried out in an economic, efficient and effective way and in a timely manner.

2.1.1 Data Collection Methods

The following data collection methods were used to obtain audit evidence.

Documentation review

Documents from the URF were reviewed in order to gain an in-depth understanding of the road maintenance process. The documents reviewed are shown in Appendix II.

Interviews

Interviews were conducted with management and officers of the URF, and with the technical staff of the Municipal Councils involved in road maintenance, to corroborate information obtained from document reviews. The list of people interviewed is attached as Appendix III.

Observation/Site Inspections

Field visits were carried out in 11 of the 22 municipalities (50%) to understand the road networks at the Municipal Councils.

In order to address the audit questions, the following section details the methodology employed:

2.2 Are the systems for planning, execution and reporting by municipalities adequate in ensuring that road maintenance is efficient?

Some of the key documents reviewed included: The Uganda Road Fund Act (2008) that provides the legal framework under which the URF operates, budgeting guidelines to the designated agencies from the URF, and annual work plans so as to determine how the agencies come up with the annual maintenance budgets.

The execution and reporting of road maintenance activities was assessed from the quarterly financial and physical progress reports. Assessment of the completeness and accuracy of the reported progress was made based on the reporting formats specified in the URF manuals.
2.3 Does the current funding allocation system in the URF allow for efficient allocation of resources for road maintenance?

The URF Act and URF planning and programming manual was reviewed to establish how funds are supposed to be allocated to the municipal councils, and to understand the factors that are considered in the allocation of resources. The allocation process employed by the URF was reviewed to assess whether it complies with the stipulated procedures and considerations (factors), and whether it compares well with international practice.

2.4 Does the data provided by the municipalities allow the URF to monitor the efficiency and performance of road maintenance?

In order to assess whether the available data is sufficient for monitoring of efficiency by the URF, the audit attempted to measure the relative efficiency of the road maintenance activities of municipal councils (MCs), using the data submitted to URF. Efficiency can be measured through stochastic frontier analysis (parametric) or through non-parametric analysis. Parametric approaches determine the best practice frontier on the basis of a specific functional form using econometric techniques. In the present analysis, the audit used the non-parametric approach, Data Envelopment Analysis (DEA) to obtain efficiency indices.

2.4.1 Theoretical Framework for DEA

DEA is a benchmarking technique which compares different entities called Decision Making Units (DMUs) considering resources used and services provided. A DMU could either be a firm or an organization, as in this case. In a DEA analysis, efficiency refers to the DMU’s success in producing as large output as possible from a given set of inputs (output based) or uses the least amount of resources to meet a target in production (input based). The technique identifies the most efficient units or best practice units and the inefficient units in which real efficiency improvements are possible. A detailed theoretical framework is attached as shown in Appendix IV.

In assessing the efficiency of road maintenance at the MCs, the efficient DMUs are those that are maintaining more length of roads than other MCs at a given level of expenditure.

2.4.2 Previous Studies

Previous research has been done on the use of DEA for measurement of efficiency of road maintenance. Details of the research, the applied models and results are attached in Appendix V.

2.4.3 The DEA Model

The models that can be applied for efficiency measurement are either input or output oriented models. Input oriented measures target how much resources can be reduced for a given amount of production (i.e. maintaining the output levels). Output oriented measures target how much more can be produced from a given amount of resources (maintaining the resources).

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6The DEA framework was introduced by Farrell(1957) and extended to situations with multiple inputs and outputs by Charnes, Cooper and Rhodes (1978), Measuring the efficiency of decision making units, CCR 1978 (page 429)
The output oriented model was considered to be the most suitable due to the fact that the DMUs are in the public sector and thus with set budgets. The level of road maintenance does not cover the whole length of the network due to constrained resources; it is therefore more desirable/meaningful that the available resources should be used to achieve more production.

2.4.4 The Data Set

For the measurement of the (relative) efficiency of decision-making units (here: municipal councils) an appropriate set of input and output combinations was determined first. The inputs and outputs were then used to construct a best practice frontier - that is a frontier which includes the most efficient decision-making units.

Inputs and Outputs

To allow the audit team make comparisons between municipalities, a list of common inputs and outputs were identified to ensure homogeneity.

The following inputs were considered in measurement of efficiency:

- Expenditure on road maintenance, bridges and road safety works, administration and supervision using funds from the URF.
- Expenditure on equipment repairs; the municipalities employ similar equipment in the maintenance of roads and therefore the types and number of equipment were not considered.

Outputs

The output considered was the length of roads in kilometers (km) maintained annually by the municipalities using funds from URF.

The data was collected on the selected inputs (expenditure) and outputs (total length maintained) for each intervention from the quarterly financial and physical progress reports. Data preparation involved manual entry of data into excel sheets from accountability reports, checking for data accuracy by cross checking with data obtained from different sources, that is, soft copy data versus manual data in files. Cross-checking of figures from summary sheets with those in back-up documents was also carried out. Where discrepancies were found between summary sheets and back-up sheets, the data in back-up sheets was used.

2.4.5 Data Analysis

The data was exported from Microsoft Excel into STATA 12 and summary statistics were obtained in order to determine the sensitivity and accuracy of the data.

Data Sensitivity Analysis

The reliability of the data depends on the data distribution characteristics: data points clustered tightly together will give comfort to the user whereas users will treat dispersed data with more caution [especially if the variance cannot be causally explained].

In the data sets prepared in the course of this audit, data points were generally clustered around a central point but with some outliers. It was found that the costs incurred in road
maintenance for certain interventions in certain municipalities were much higher than in other municipalities. Further inquiries were made to the URF to ensure that correct data had been captured. It was found that the data was correct; some municipalities spend much more on road maintenance due to higher costs of inputs. Special cases include Jinja and Bushenyi MCs which spend considerably much higher for mechanized maintenance of paved roads and unpaved roads, respectively.

**Descriptive Statistics**

Descriptive statistics were used to describe the basic features of the data in the study. They provided simple summaries about the sample and the measures and simple graphics analysis.

**2.4.6 Data Envelopment Analysis**

The inputs and outputs were used to construct a best practice frontier - that is, a frontier which includes the most efficient municipal council. Subsequently, the (relative) efficiency of the other municipalities lying below the best practice frontier was determined by measuring the deviation from this frontier. Frontiers were estimated using non-parametric Data Envelopment Analysis to obtain efficiency indices.

The analysis initially used a base set of inputs and outputs, with further inputs added during successive trials. The base set of inputs and outputs comprises total cost for maintenance and kilometers maintained, respectively. During successive trials, other costs were added, that is, equipment repairs, administration and costs for District Roads Committees (DRCs).

When considering the efficiency of specific interventions, for example, periodic maintenance, there were inputs (costs) which could not be easily broken down for that particular intervention. These inputs included equipment repair costs, administration costs, DRCs, cross cutting issues, hire of equipment and road safety. These costs were, therefore, included in all the models of the various interventions.
CHAPTER THREE
CHAPTER THREE

SYSTEMS AND PROCESS DESCRIPTION FOR ROAD MAINTENANCE ACTIVITIES

3.1 SYSTEMS DESCRIPTION

3.1.1 Roles And Responsibilities Of Key Players

Transport Sector Working Group (SWG)

The SWG acts as a forum for coordination of programmes and actions of leading institutions in the sector. Such institutions include: Ministry of Works and Transport (MoWT), Ministry of Finance, Planning and Economic Development (MoFPED), Ministry of Local Government (MoLG), URF, UNRA, Development Partners (DPs), Civil Aviation Authority (CAA), and Uganda Railways Corporation (URC). The sector working group forum routinely meets to discuss and influence policy direction in the sector.

Ministry of Finance, Planning and Economic Development (MoFPED)

The Minister is responsible for:

- making regulations in consultation with the Board and the Minister responsible for roads, for the better carrying into effect the purposes of the URF Act,
- designating local governments and urban councils as agencies for the URF,
- appointment of the members of the URF Board,
- determining road user charges on advice of the Board,
- approving performance statements, and
- approving the estimates of income and expenditure as approved by the Board.

Ministry of Works and Transport (MoWT)

The Minister for roads is mandated under Section 28 of the Act to present URF’s plans to Parliament. Other roles include:

- Review of the Annual Road Expenditure Programme.
- Review of Performance statements.
- Review of investment plans of the Fund’s surplus income.
- Policy formulation for the URF by nominating a representative on the Board.
- Develop and promote policies, laws, engineering specifications, standards, manuals and guidelines on roads and bridges.
- Monitor the performance of the Uganda National Roads Authority.
- Prepare guidelines for the maintenance of district, community access roads, national roads and bridges.
- Carry out capacity building in Local Governments on development and maintenance of transport infrastructure, and monitoring their performance.
- Formulate policy guidelines on roads and bridges management.
- Provide technical guidance to Local Governments on matters of road transport infrastructure.
- Enforce technical specifications, standards and regulations on roads and bridges,
- Develop and promote policies, laws and construction standards for the construction and maintenance of public structures in the country, and
- Coordinate the regional mechanical workshops (Bugembe, Gulu, Mbarara)

**The Uganda Road Fund Board**

The Board is responsible for the general management of the Fund. Specific functions include:

- To administer and manage the Fund;
- To recommend to the Minister of Finance, appropriate levels of the road user charges, fines, levies or any other sums to be collected under the URF Act and paid into the Fund;
- To advise on arrangements for collecting road user charges to minimise avoidance and evasion;
- To provide guidance and establish procedures to be followed in the preparation of the annual road maintenance programme by the designated agencies;
- To establish procedures for disbursing funds for the annual road maintenance programme;
- To prepare and submit to the Minister of Finance, audited annual accounts of the Fund; and
- To publish periodic reports on the activities and achievements of the Fund and make the reports available to the general public.

**The Board Secretariat**

The Secretariat is headed by an Executive Director appointed by the Minister of Finance, Planning and Economic Development. The Executive Director is responsible for:

- Implementation of the policies and programmes of the Board and reporting on them to the Board and ensuring that the agreed objectives, targets and service standards are met;
- Proper management of the funds and property of the Board;
• Organization and control of the staff of the Board;
• Development of an operating plan to guide the Board in achieving its objectives;
• Cooperation with other lead agencies and organizations in the roads sector;
• Development of an economic, efficient and cost effective internal management structure;
• Providing advice as required on all matters which fall within the area of the Board’s responsibility.

Ministry of Local Government
The Ministry of Local Government, in addition to its policy guidance role, has the following responsibilities in road maintenance:
• Provide leadership to the URF by nominating a representative on the Board;
• Ensure adequate capacity exists at the municipalities to safely, efficiently and effectively utilize URF funds;
• Coordinate the development of work plans for District, Urban and Community Access Roads (DUCAR).

Designated Agencies
The role of the designated agencies is to plan for and maintain the categories of roads specified in the notice of designation.

The designated agencies include: Uganda National Roads Authority (UNRA) in charge of national roads maintenance, 112 District Local Governments, 27 urban councils responsible for the maintenance of District, Urban and Community Access roads (DUCAR) and Kampala Capital City Authority responsible for maintenance of city roads. The network of the municipalities forms part of the urban roads of the DUCAR network. The total road network of the municipalities is 4,000km.

District Road Committees (DRCs)
The DRCs provide overall oversight in the preparation of plans for district, urban and community access roads in liaison with the Ministry of Works and Transport.

3.2 DESCRIPTION OF THE ROAD MAINTENANCE PROCESS

3.2.1 Planning
URF issues Indicative Planning Figures (IPFs) to agencies which trigger the planning process that leads to the compilation of the One Year Road Maintenance Plan (OYRMP). URF also issues guidelines on the scope and fundable activities for the Financial Year. The planning process for districts is detailed below:
• Uganda Road Fund will release indicative planning figures and planning templates to designated agencies with a request for work plans, procurement plans and estimates for expenditures.
The Municipal Councils together with their local leaders identify roads that need maintenance and send them to the District Roads Committee (DRC) that meets to compile and prioritise roads to be maintained that financial year. The Municipal Engineer develops a work plan and budget that is sent to the Town Clerk and district council for approval.

Depending on the scope of works, availability of funds, presence of the equipment and the technical expertise, the engineer will choose to either use force on account or contract as a means of implementing the work plan. This annual maintenance plan is prepared and submitted to the Uganda Road Fund (URF) at least three months before the start of the financial year.

After receiving all the approved annual maintenance plans from the 139 designated agencies, the URF then prepares the annual road expenditure plan which is then reviewed and approved by the Board. The Board then develops 1, 3 and 5 year horizons and an annual road expenditure programme to be financed from the fund. It is then presented to the Minister responsible for roads for approval.

The Minister responsible for roads tables the Road Maintenance Plan and Performance Statement\(^7\) in Parliament within 28 days of receipt or Board approval thereof.

Agencies access funds quarterly upon submitting quarter work plans, full accountability of the previous quarter funding and signed performance agreements between the agencies and URF.

3.2.2 Estimation of Physical and Financial Needs

The designated agencies prepare the 1, 3 and 5- year rolling maintenance plans for their network as an input that seeks to influence the global expenditure plan of the Fund that translates into tariff levels for Road User Charges (RUCs). This is done in accordance with Section 42 of the URF Act.

In addition to rolling maintenance plans, agencies prepare yearly and quarterly road maintenance work plans against which funding requirements are determined and consolidated into a One Year Road Maintenance Program (OYRMP) by the URF Secretariat.

Work plans contain maintenance activities to be carried out, cost and time schedules for implementing the maintenance activities.

Based on the available funding, the programming department allocates funds to the various agencies in accordance with the agreed allocation formula. Prior to allocation of funds to agencies for subsequent quarters, the programming department undertakes a detailed review of the physical accountabilities from the various road fund designated agencies.

\(^7\)This document combines the Annual Road Expenditure Programme with the One Year Road Maintenance Plan. Road Maintenance budget planning and implementation May 2011 page 7
3.2.3 Disbursements

The funding levels agreed between the DAs and URF are disbursed quarterly upon receipt and satisfactory evaluation of agency quarter work plans. Releases are made against fulfilment of the following:

- satisfactory physical & financial accountability;
- signed performance agreements;
- satisfactory work plans; and
- evidence of receipt of funds disbursed.

3.2.4 Monitoring of maintenance activities by the Uganda Road Fund

Monitoring is carried out on a quarterly basis to track revenue and expenditure of the Fund, condition of the road network and trends, while evaluation is carried out on the physical and financial performance of the designated agencies against Key Performance Indicators.

In addition, URF carries out two midyear reviews in order to issue agency ceilings for the following year and also give opportunity to the different agencies and stakeholders to discuss the Road Maintenance Plan for the following year.

3.2.5 Reporting of Road Maintenance Activities by the Municipal Councils

The Municipal councils are mandated to report on the progress of road maintenance activities on quarterly basis. The reports include the physical and financial progress of their activities. The reports must capture information on road maintenance activities as:

- Routine manual maintenance: drainage works, culvert cleaning, grass cutting and debris removal.
- Routine mechanized maintenance: pothole patching, grading, spot regravelling and drainage works.
- Periodic maintenance: sealing, shoulder regravelling, shoulder sealing, major drainage works, edge repairs, regravelling, grading.
- Road safety activities: erection of sign posts, treatment of black spots, installation of foot bridges, realignment.
- Bridge maintenance: concrete repairs, steel repairs/painting, signage, element replacements, embankment reconstruction, guard rail repairs, clearance of river channels to aid water flow.

It is a requirement that the reports be submitted by the 15th of the first month of the next quarter as they are a prerequisite for receipt of funds of the following quarter. In addition, the Head of engineering works in the municipal council, who is also the Municipal Engineer, is mandated to supervise and monitor the road maintenance activities and ensure accurate data capture of the activities carried out.
CHAPTER FOUR
CHAPTER FOUR

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents findings, conclusions and recommendations on the efficiency of the systems of road maintenance in Municipal councils.

4.1 PLANNING, EXECUTION AND REPORTING OF ROAD MAINTENANCE ACTIVITIES

4.1.1 Estimation of maintenance costs by municipal councils

Section 49(f) of the URF Act requires the Minister (MoFPED), in consultation with the Minister for works and transport, to formulate regulations on procedures for determination of road maintenance budgets. According to the Road Fund guidelines, the designated agencies should include in the work plan, the build-up of costs for road maintenance.

A unit cost study was carried out by the URF in order to develop a reliable cost base to properly account for geographic, environmental, market related factors and the delivery method for routine and periodic road maintenance of public roads in Uganda. This cost base was built into a computer model that was to be used by designated agencies in developing their annual road maintenance programmes.

In the planning guidelines from URF to the designated agencies for FY 2013/2014, it was stipulated that, in order to maximize value from the available limited resources, unit costs of key works activities would be guided by the Unit Cost Study Report which is hosted on the URF website.

However, a review of the work plans submitted by the municipalities revealed that cost estimates for the works were not based on the recommended unit costs; most of the municipalities applied unit costs that were higher than those recommended for periodic and routine mechanized maintenance while the unit costs for routine manual maintenance were lower than those recommended in the unit cost study report.

This was caused by variations in the basis for cost estimates as revealed from interviews conducted with the officers at the municipalities; it was noted, through interviews, that some municipalities were using historical costing for the works, while others applied the same rate every Financial Year. This can lead to wastage of resources as higher costs are incurred by some MCs to achieve the same outputs. Further, the cost build up is not included in the work plans and therefore cannot be reviewed by the URF.

As a result of municipalities not using a uniform method to estimate costs, it was noted that the unit costs (that is cost per km) for road maintenance for the three interventions varied widely across the municipalities. The summary showing the ranges of unit costs for FY 2012/2013 and 2013/2014 for the different interventions is given in Table 2 below.
Table 2: Unit costs of road maintenance for municipal councils for FY 2012/2013 and 2013/2014

<table>
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<tbody>
<tr>
<td>Routine Manual Paved</td>
<td>900,031</td>
<td>2,455,625</td>
<td>219,792</td>
<td>13,609,143</td>
</tr>
<tr>
<td>Routine Manual Unpaved</td>
<td>320,000</td>
<td>64,360,300</td>
<td>150,039</td>
<td>2,010,413</td>
</tr>
<tr>
<td>Routine Mechanized Paved</td>
<td>400,000</td>
<td>7,425,333</td>
<td>464,571</td>
<td>714,285,714</td>
</tr>
<tr>
<td>Routine Mechanized Unpaved</td>
<td>140,768</td>
<td>1,500,000</td>
<td>797,402</td>
<td>19,103,712</td>
</tr>
<tr>
<td>Periodic Paved</td>
<td>151,191,442</td>
<td>705,034,018</td>
<td>9,615,385</td>
<td>593,647,833</td>
</tr>
<tr>
<td>Periodic Unpaved</td>
<td>1,015,291</td>
<td>498,897,095</td>
<td>922,703</td>
<td>69,215,946</td>
</tr>
</tbody>
</table>

Source: OAG analysis of quarterly physical and financial progress reports for FY 2012/13 and 2013/2014

Management Response

URF is in the process of preparing to undertake training of all agencies in the use of the Unit Cost Model (UCM). This has now been budgeted to take place in FY 2015/16. Furthermore, URF plans to update the data for UCM so that it has a wide coverage. For consistence, the rates will be compared with those provided by the Ministry of Works and Transport (MoWT) and those being used under the World Bank funded project titled: Uganda Support to Municipal Infrastructure Development program project (USMID) in municipalities.

Audit Response

Without a common basis for estimation of road maintenance costs and non-inclusion of the cost build up by the municipalities in their work plans, URF is not able to review and therefore assess the reasonableness of the estimated costs submitted by the municipalities and thus wastage of resources may go undetected.

Recommendation

The URF should ensure that:

- Training of all agencies in the use of the Unit Cost Model is prioritized and support is readily available in the use of the model for the staff at the municipal councils to ensure adoption and continuity in the use of the model
- All municipalities include cost build-ups as attachments to their work plans.

4.1.2 Adherence to URF planning guidelines

According to the Costing principle/hierarchy given in the guidelines to implementing agencies for FY 2013/2014, each District, Urban and Community Access Road (DUCAR) Designated Agency should apply its available ceiling, such that the cost of routine manual maintenance is covered 100%, followed by routine mechanized maintenance to the maximum extent possible and the balance to periodic maintenance.
Furthermore, the guidelines for FY 2011/2012 specified that for periodic maintenance, the agencies should indicate the last time the section received periodic treatment. This is meant to facilitate the URF in preparing maintenance and expenditure plans and performance statements in response to Sections 23 to 26 of the URF Act.

The specified intervals for period maintenance interventions (heavy grading and re-gravelling) as guided by the MoWT are: a three-year interval on roads with traffic volume of more than 70 vehicles per day (vpd) and five years on roads with traffic volume of less than 70 vpd.

Review of the work plans revealed that the costing hierarchy was not properly followed as some MCs namely, Iganga and Jinja did not plan for routine manual maintenance at all in FY 2012/2013 and 2013/2014, respectively. It was also noted that the work plans for the 3 years under review did not indicate the period when periodic maintenance was last done. This was caused by lack of scrutiny of the work plans by the DRCs and weaknesses in the monitoring function undertaken by the URF, which lacks the capacity to check that the work plans submitted are in line with the guidelines.

The purpose of the routine manual maintenance, which is to prolong the serviceability of the roads, was therefore undermined. When not done, it leads to deterioration of roads and hence the need for costly interventions.

Failure to provide such information about when the roads last received periodic maintenance interventions makes it impossible to monitor the frequency and thus effectiveness of the intervention. For instance, through physical inspection, it was observed that Eden Road in Gulu MC which had been funded for periodic maintenance in FY 2013/2014 was undergoing rehabilitation in FY 2014/2015. This implies that the intervention in the prior year had no impact on the condition of the road, which is not expected of periodic maintenance.

**Management Response**

As part of the budgeting planning guidelines to be used in FY 2015/16, it will be categorically stated that as part of the workplan approval process, DRCs ensure that the URF planning guidelines are adhered to.

URF has previously placed emphasis on UNRA in assessing the progress of periodic maintenance works. However, commencing FY 2015/16, URF will expand the coverage to include municipalities.

**Audit Response**

Clearly, there has been minimal monitoring by the Uganda Road Fund to ensure that the URF guidelines are adhered to by the municipal councils in the process of planning for and implementation of road maintenance activities, which limits the ability of URF to effectively make assessment on the performance of the maintenance interventions carried out.

**Recommendations**

- The URF should provide for channels of communication/interaction with the DRCs to ensure that they understand their role and how road maintenance planning should be carried out to ensure their effective participation.
- Monitoring/assessment of periodic maintenance activities should be emphasized and prioritized by URF for effective planning of maintenance activities by the municipal councils.
4.1.3 Differences in unit costs across agencies for similar interventions

Road maintenance works of a similar nature, that is, using the same intervention, generally require the same resources (equipment, manpower, materials) and their costs are therefore expected to be within similar ranges. However, it was noted that there were major differences in unit costs for similar interventions across the municipalities, that could not be explained by topography and climatic differences. The unit costs for the three interventions were plotted to compare these unit costs across municipalities as shown in Figures 2 to 4.

Routine Manual Maintenance for unpaved roads (Figure 2)

Figure 2: Showing the unit rate for maintenance of unpaved roads using routine manual intervention

A BAR CHART SHOWING THE UNIT RATE FOR MAINTENANCE OF UNPAVED ROADS USING ROUTINE MANUAL INTERVENTION.

Figure 2 above shows the variation of unit costs for routine manual maintenance of unpaved roads. The municipalities of Mbarara, Fort Portal and Soroti were spending significantly more than other municipalities like Bushenyi, Masindi and Kasese for carrying out similar work, with similar challenges and similar equipment.

Routine Mechanized Maintenance (Figure 3)

Paved Roads (Figure 3a)
From **Figure 3a**, the unit cost of routine mechanized maintenance for Jinja is much higher compared to other MCs carrying out similar activities. The officers at Jinja MC attributed this to the fact that they procure materials at extremely high costs compared to other MCs. It was not clear why the suppliers in Jinja charge exorbitant prices for materials. When Jinja MC is excluded from the analysis, the plot is as shown in **Figure 3b** below:

**Figure 3b**: Showing the unit rate for maintenance of paved roads using routine mechanized intervention - Jinja excluded

From **Figure 3b**, when Jinja is excluded, it shows less variation of unit costs with Masindi MC maintaining roads at a much lower cost than the rest of the municipalities.
Unpaved Roads (Figure 3c)

Figure 3c: Showing the unit rate for maintenance of unpaved roads using routine mechanized intervention.

From Figure 3c showing routine mechanized maintenance of unpaved roads, Busia maintained its unpaved roads at a much higher cost than the other municipalities indicating that Busia was spending more for similar works being undertaken by other municipalities.

Periodic Maintenance (Figure 4)

Paved Roads (Figure 4a)
Figure 4a: Showing the unit rate for maintenance of paved roads using periodic intervention

Figure 4a shows the unit costs for periodic maintenance of paved roads for the various municipalities, with Bushenyi using the highest unit cost per km maintained and Fort Portal using a much lower unit cost than all the other municipalities.

Unpaved roads (Figure 4b)
For periodic maintenance of unpaved roads, Figure 4b above shows that Ntungamo and Lira apply unit costs that are much higher than the rest while Bushenyi, Hoima, Soroti and Tororo apply much lower unit costs. Busia, Entebbe, Iganga, Jinja, Masindi and Mbale MCs did not have data for this activity.

Comparison was further made between the actual costs for force account operations of periodic road maintenance in the MCs and the unit costs recommended in the Unit Cost Study Report of 2012. The comparison was made for the FY 2013/2014 when the MCs were supposed to apply the Unit Cost Model (UCM) in coming up with cost estimates (refer Appendix VII).

It was noted that the variation of the actual unit costs for periodic maintenance of unpaved roads from the recommended unit costs ranged from 220% to 2610%, Fort Portal MC maintained at a rate which is 48% below the recommended unit rate. On the other hand, the variation of the actual unit costs for periodic maintenance of paved roads from the recommended unit costs ranged from 8.4% to 105%. Eleven (11) MCs were maintaining roads at unit costs below those recommended; ranging from 19% to 97% below the recommended rates. The variation of the actual unit costs for routine mechanized maintenance from the recommended unit costs ranged from 395% to over 100,000% as shown in Appendix VII.

Through interviews conducted with municipality engineers and officers at the Uganda Road Fund, the differences in costs were caused by the differences in the prices of materials quoted by suppliers and high equipment maintenance costs.

There are significant differences in unit costs across municipalities for similar interventions.
that have not been investigated by the Uganda Road Fund. Such an investigation would also ensure that those municipalities that are maintaining roads at lower costs are used as benchmarks for others.

Further analysis of the relationship between the cost of road maintenance and the length of roads maintained using Pearson’s correlation coefficient showed that the relationship between the amount of money spent on the periodic maintenance of unpaved roads and the length of road maintained is negative. This implies that an increase in funding will not lead to an increase in the length of roads maintained. This could also be attributed to the variations in unit costs.

The high variations in unit costs for the same interventions and in similar geographical locations implies that those maintaining at very high costs are not using their resources efficiently.

Audit Response

The unit costs of road maintenance by the municipal councils varied widely across the municipalities for the same interventions and within the same geographical locations. The URF did not carry out its role of monitoring road maintenance expenditure to ensure value for money.

Recommendations

- The URF should expedite the process of updating the Unit Cost Model and ensure its timely roll out to all the municipalities to aid the cost estimation process during planning.
- URF should expedite the investigations regarding the relationship between the amount of money spent and the road length maintained to ensure inefficiencies within the system and thus wastages of resources are identified and corrective action taken.
- URF should strengthen the system of monitoring road maintenance expenditure.

Management Response

As part of the budget guidelines for FY 2015/16, it shall be categorically stated that MCs budget within the suggested UCM estimates. Variations to this will require special permission from URF with the agency providing justification.

URF plans to update the data for UCM such that it has a wide coverage. For consistency, the rates will be compared with those provided by MoWT and those being used under the World Bank funded USMID project in municipalities.

Commencing FY 2015/16, URF will monitor the inputs and outputs used for carrying out road maintenance and investigate any negative relationships between the inputs and outputs to improve efficiency. For routine mechanization, further investigation will be made into the amount of money spent on maintenance of unpaved roads and road length maintained.

4.1.4 Expenditure on District Road Committees (DRCs)

The planning guidelines to designated agencies state that all annual work plans prepared by agencies should be accompanied by a minute of the DRC meeting approving the work plans before submission to URF. In addition, the districts and municipals should make specific budgetary provisions to cater for the DRC operational costs as indicated in the guideline.

However, all the work plans reviewed did not have the minutes of approval meetings from the DRCs yet signed DRC meeting minutes could help to authenticate the credibility of data sent to URF and help influence equitable allocation of funds by URF to the designated agencies. Through
discussions at the audit exit meeting, it was noted that the lack of DRC approvals was caused by inadequacies in the provisions in the Act regarding the members who comprise the DRC: the Town Clerks, who are the accounting officers of the MCs are not members of this committee. In other MCs, the DRCs had not been formed and could therefore not approve work plans.

It was further noted that the municipalities of Mukono and Arua where DRCs have not been formed also budgeted for and included expenditure on DRCs in their DRCs quarterly physical and financial accountabilities.

Where the DRCs have not been formed, there are challenges of prioritizing roads which may lead to duplication of maintenance efforts by the municipalities if the work plans are not scrutinized by independent parties. Duplication of maintenance activities was noted in the work plans for 8 municipalities in 2013/2014 and 5 municipalities for 2012/2013 as shown in Appendix VIII). The duplication involves planning for routine mechanized maintenance and periodic maintenance of the same roads in the same financial year.

Audit Response

The DRCs have not carried out their role in ensuring proper planning for road maintenance activities and this, coupled with inadequate enforcement by URF of planning and budgeting guidelines, has resulted in inefficient planning and duplication and wastage of resources.

Recommendation

The URF should pursue the formation of DRCs across all designated agencies, and through continuous sensitization, emphasize to the DRCs the importance of their role in the road maintenance process to ensure that they are actively and effectively involved in the planning process.

4.2 ALLOCATION OF FUNDS FOR ROAD MAINTENANCE

Section 22 [2] of the Road Fund Act states that allocations from the Fund to the designated agencies should be based, among other factors, on the conditions of the public roads, maintenance requirements, the length of the road network and the relevant volume of traffic; or derived from an approved maintenance management tool. The two most significant parameters for the allocation of road maintenance funds are traffic and road length.

- Traffic needs to be considered in terms of both volume and loading\(^8\).
- The most trafficked roads generate most revenue for the road fund and equally should get higher allocations.
- Road length should be included in the formula to reflect maintenance requirements in terms of extent of the road network.

\(^8\)Budget Allocation Formula Study Final Report
Review of the formula being used to allocate funds to designated agencies for the three financial years revealed that the factors being considered to allocate funds to different agencies include population, surface area and previous asphalt allocation.

First stage allocation of funds to the different categories of roads is done on an arbitrary basis that seeks to fund maintenance of national roads as fully as possible and allocates remaining funds to district, urban and community access roads on the basis of a formula similar to those previously adopted by the Ministry of Finance, Planning and Economic Development.

Second stage allocation of funds, in particular, to municipalities takes into consideration the previous asphalt and population of the municipality (Refer to Appendix IX). The current formula used does not take into consideration factors such as the condition of the roads, the length of the road network and traffic volume as prescribed in the Act.

The non application of the stipulated factors in the allocation of funds is partly attributed to the fact that municipalities do not have records of the required data and they lack capacity to collect it. This is due to the fact that they are not using Rehabilitation and Maintenance Planning Systems (RAMPS); the planning tool that incorporates such information. Interviews with the municipal officials in charge of road maintenance revealed that they had not been trained in the use of RAMPS and therefore could not apply it.

The failure to use all the stipulated factors in the allocation formula may not allow resources to be allocated adequately across designated agencies in meeting actual road maintenance needs. In the case of municipalities, it was noted that:

- Although the population of the Municipality can be used as a proxy for road utilization, it does not give a true representation of the volume of traffic since it does not consider income level of the population in order to assess the affordability of using motorized transport by the population.
- The allowance for previous asphalt does not give a true reflection of the length of road network within a municipality since municipalities have a significant component of gravel roads which is not considered in this component.
- The urban road formula may be biased against the new or more rapidly expanding urban areas since the formula includes “previous asphalt” component and not present and future projected asphalt requirements.

The allocation formula being used does not take into consideration all the factors as required in section 22(2) of the URF Act and therefore does not allow for efficient allocation of funds to the Municipalities.

**Management Response**

The URF is in the process of setting up Technical Support Units (TSUs) in the regions and they shall be used in training municipality engineers and oversight on planning and project implementation.

**Audit Response**

The allocation of funds to the municipal councils in the years under study did not take into consideration all the factors (road condition, traffic volume and length of the road network) as required in section 22(2) of the URF Act and therefore did not allow for efficient allocation of funds to the Municipalities.
Recommendation

The process of setting up TSUs in the regions to train staff at the municipalities should be finalized and the Accounting Officers and Municipal Engineers should be engaged in order to capture all their skills gaps to ensure that the training is effective. In addition, URF should ensure that a robust follow up mechanism is put in place to facilitate the collection of the necessary data to be used in efficient allocation of funds for road maintenance.

The allocation formula that takes into account all the factors specified in the URF Act should be adopted and used to allocate resources for road maintenance.

4.3 ASSESSMENT AND MONITORING OF EFFICIENCY OF ROAD MAINTENANCE BY URF

Due to constraints in funding of road maintenance activities, the funds made available to designated agencies should be utilized efficiently in order to obtain maximum benefit. It is therefore important that URF establishes proper systems for evaluation and monitoring the efficiency with which the agencies utilize the funds.

As part of this audit, the Data Envelopment Analysis model (as described in section 2.4) was used to measure the relative efficiency of road maintenance activities undertaken by the municipalities, using the data maintained by the URF for purposes of monitoring the efficient use of resources allocated to those agencies.

4.3.1 Results of Data Envelopment Analysis

Using the DEA output oriented model, with variable returns to scale, the results of DEA analysis were obtained using the datasets for 2012/13 and 2013/14 after adjusting for outliers using moving averages. The datasets for 2011/2012 could not be used because they are not disaggregated into routine manual, routine mechanized and periodic maintenance. The efficiency scores for the different municipalities are shown in Table 3 below.
Table 3: Efficiency scores using the output model with variable returns to scale

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<thead>
<tr>
<th>Municipality</th>
<th>Efficiency Score (F_i(y,x_{V,S}))</th>
<th>Inefficiency, %</th>
<th>Municipality</th>
<th>Efficiency Score (F_i(y,x_{V,S}))</th>
<th>Inefficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arua</td>
<td>2.76</td>
<td>176</td>
<td>LIRA</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>Bushenyi</td>
<td>1.00</td>
<td>-</td>
<td>MASAKA</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>Busia</td>
<td>12.24</td>
<td>1124</td>
<td>MASINDI</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>Entebbe</td>
<td>1.45</td>
<td>45</td>
<td>MBALE</td>
<td>8.29</td>
<td>729</td>
</tr>
<tr>
<td>Fortportal</td>
<td>1.00</td>
<td>-</td>
<td>MBARARA</td>
<td>3.85</td>
<td>285</td>
</tr>
<tr>
<td>Gulu</td>
<td>1.00</td>
<td>-</td>
<td>MOROTO</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>Hoima</td>
<td>1.48</td>
<td>48</td>
<td>MUKONO</td>
<td>1.24</td>
<td>24</td>
</tr>
<tr>
<td>IGANGA</td>
<td>1.00</td>
<td>-</td>
<td>NTUNGAMO</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>JINJA</td>
<td>1.00</td>
<td>-</td>
<td>RUKUNGIRI</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>KABALE</td>
<td>1.79</td>
<td>79</td>
<td>SOROTI</td>
<td>2.70</td>
<td>170</td>
</tr>
<tr>
<td>KASESE</td>
<td>1.19</td>
<td>19</td>
<td>TORORO</td>
<td>1.00</td>
<td>-</td>
</tr>
</tbody>
</table>

From Table 3 above, the range of inefficiency (deviation from the frontier) was from 19% to 1,124%. The results were found to be extremely high compared to those from previous studies conducted on efficiency of road maintenance in other countries using DEA. Results for inefficiencies from previous research range from 40% to 60% inefficiency.

We further ran two models under the constant returns to scale to compare results. It is expected that the municipalities which are inefficient under the input or output oriented models should be similar in both models. The results of the analysis using the input oriented model showed a different case, where municipalities that had been inefficient in one model were efficient in another and vice versa.

For this reason, the results of the model could not be used as a measure of efficiency because of the large variations in the data. The high variations were to a large extent attributed to incomplete, inconsistent, and inaccurate reporting of performance by the municipal councils. The results of this analysis point to the fact that it is not possible for the URF to measure efficiency regardless of the tools used due to shortcomings in data quality and availability as further discussed below.

4.3.2 Completeness of data

The municipalities are required to report progress of the road maintenance activities on quarterly basis. The reports should include the physical and financial progress of their activities, and should be submitted by the 15th of the first month of the next quarter.

Through review of the quarterly progress reports, we noted that there was missing data for some MCs in different years and therefore their performance could not be assessed against those that had fully submitted. The following accountability reports were not submitted for the years as shown in Table 4 below.
Table 4: Missing Accountability Reports

<table>
<thead>
<tr>
<th>Financial Year</th>
<th>Submitted Quarterly Reports</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| 2011/2012      | 45 out of 88                | • Some reports submitted do not have information on length maintained.  
• Data for routine maintenance not disaggregated into manual and mechanized.  
• No physical accountability provided. |
| 2012/2013      | 55 out of 88                | Only 12 municipalities provided physical accountability. |
| 2013/2014      | 77 out of 88                | Data was reported in better format and disaggregated into the 3 interventions of periodic, routine mechanized and routine manual |

Source: OAG analysis of quarterly reports

This was caused by weaknesses in enforcement and lack of penalty measures from the URF for those municipalities that do not submit accountability for the funds received.

**Management Response**

As part of the triggers for releasing funds for subsequent quarters, URF shall ensure that satisfactory physical and financial reports are provided to URF prior to releases. This issue will also be emphasized in the planning and budgeting guidelines.

**Audit Response**

The absence of progress reports and submission of incomplete data makes it difficult for the URF to monitor expenditure and physical progress and therefore effectively plan for road maintenance activities.

**Recommendation**

In order to ensure that all progress reports are submitted and are complete in every detail of data required for decision making, the URF should develop a mechanism for regularly checking the progress reports for completeness.

**4.3.3 Non-Representative Data**

The forms for reporting maintenance of works require the municipal councils to input the length of road maintained. However, this was found to be unrealistic in instances where the road works activity carried out did not specifically relate to length of road maintained but other aspects such as pothole patching which is best captured in form of square meters of works carried out. Besides, because potholes do not appear uniformly for all roads, it is therefore necessary that the total area of potholes patched is reported on rather than the whole length of the road. The effect of reporting pothole patching by length is that the municipality which patches fewer potholes than one which patches less for the same length of road will appear more efficient causing distortion of data.
Management Response
This has been noted and changes will be made in the reporting formats. However, the existing forms allow for agencies to input (specify) other works.

Audit Response
The current format of reporting progress for pothole patching on paved roads does not indicate the extent (quantity) of works done and it is therefore not possible to assess the reasonableness of expenditure on this activity.

Recommendation
The municipal engineers should be consulted during the revision of reporting formats so that all the common works in road maintenance are provided for to remove any ambiguities during the planning, execution and reporting of road maintenance activities.

4.3.4 Data Accuracy
The data obtained from the accountability reports from the municipal councils was mostly inaccurate as the values were not consistent in the different tables within the report; the summary sheets and their backup sheets contained different data on the outputs achieved in the various quarters. This was noted in 98% of all quarterly reports submitted for FY 2012/2013. In addition, inconsistencies were observed in the reporting formats; the data required in the template formats and the data captured in the accountability reports varied across municipalities. This therefore puts to question the integrity of the data that is regularly submitted to the Uganda Road Fund and is an indication of a general lack of quality assurance by the municipal councils and the URF. The consistent errors in reporting were attributed to lack of scrutiny of accountability documents by the URF.

Management Response
All municipalities will be notified to use the same reporting formats and of recent the reporting has improved and consistent forms are used.

Audit Response
Owing to the differences in data reported in the progress reports, the data submitted by the municipal councils is inaccurate and therefore cannot be relied on to measure efficiency of road maintenance.

Recommendations
• Verification of data in the progress reports should be expedited as planned and quality assurance mechanisms emphasized by the URF to ensure accurate reporting.
• The reporting templates should be designed such that summary sheets are able to automatically capture data from backup sheets to avoid data duplication and inconsistencies in data capture.

4.3.5 Road Network and Equipment Inventory
The District Roads Manuals from the Ministry of Works and Transport (Volume 1, Manual B) require the MCs to maintain updated data on the road inventory, network condition and the equipment owned by the MCs. The following weaknesses in the information relating to the key aspects that would facilitate efficient decision-making when allocating resources to the MCs to enable them carry out road maintenance activities were noted:
The road network inventory maintained by the URF is incomplete; for instance, the road network for Arua, Gulu and Iganga is not broken down into paved and unpaved lengths.

The data provided did not have indicators on the state of the roads prior to a decision being undertaken by the municipal councils on the type of road maintenance intervention to be undertaken such as routine manual, routine mechanized or periodic maintenance.

Indicators for the state of the road before maintenance was not collected by the municipalities and thus not availed for audit. Such parameters would explain the rationale against the choice of type of road intervention carried out by the municipality and the scope of works to be undertaken to ensure an efficient relationship between the costing and the scope of works being undertaken by the municipalities. Without such information, it is not possible for those providing oversight to review and comment on whether these specific interventions [routine manual, routine mechanized or periodic maintenance] were the most appropriate to be undertaken by the municipal councils.

The road maintenance equipment inventory maintained by the URF is incomplete; the inventory is only for 12 (55%) of the municipalities and it is outdated as it was submitted in January 2011. This inventory may not accurately reflect the current state of road equipment at the MCs since more equipment has since been procured and distributed to the MCs.

The lack of data was attributed to failure by the URF to enforce data collection and reporting by the municipal councils and lack of capacity at the MCs to collect the data.

The lack of necessary data limits URF in making informed decisions about the efficiency of road maintenance activities in the municipalities.

Management Response

URF will liaise with MoWT to obtain road condition data for all designated agencies as collection of qualitative data on road condition is a mandate of MoWT; however, currently, there is an on-going consultancy for data collection.

As part of the annual work plan submissions, municipalities are now required to provide an inventory of their road maintenance equipment; however, going forward municipalities will be required to provide the aforesaid data on a quarterly basis.

Audit Response

The Uganda Road Fund does not maintain updated road condition and equipment inventory data. This has limited its ability to efficiently plan for road maintenance since road condition is the biggest indicator of maintenance needs and maintenance cannot be carried out if the municipal councils do not have functional equipment.
Recommendation

The URF should strengthen coordination efforts with MoWT in as far as ensuring that:

- Information about the road networks as: road network inventory, road network condition and the equipment owned by designated agencies is maintained and kept up to date.
- The data collected is readily availed to URF to help facilitate decision-making on allocation of funds to the designated agencies.
- The URF should facilitate the municipal councils to ensure that they can collect and update the required data and enforce compliance by the MCs.

4.3.6 Monitoring & Evaluation of the performance of road maintenance

According to the URF manuals, the Board is supposed to monitor and evaluate the performance of designated agencies against clear performance agreements between the designated agencies and URF; this activity is carried out by the Monitoring and Evaluation Department of the URF. The Board specifically focuses on the following factors: the number of kilometers of road which changed from fair to good condition; reduction in roughness (of how much and for how many kilometers). This is done through outcome based performance agreements with designated agencies.

Although URF conducted monitoring and evaluation activities, review of the performance reports for FY 2013/14 submitted by URF, revealed that the format of reporting neither gave an indication of how many kilometers of road changed from fair to good condition nor the reduction in roughness (as measured by the International Roughness Index) of how much and for how many kilometers. In an attempt to assess the annual maintenance targets, we attempted to compare the planned length to be maintained as presented in the annual workplans against the actual reported maintained length as presented in the accountability and physical progress reports. However, the audit team noted inconsistencies in the accountability and physical progress reports in that the reported lengths on the summary sheet did not tally with the reported lengths in the backup sheets. The reported progress in the summary sheets compared to the backup sheets for FY 2013/2014 is shown in Table 5 below:

Table 5: Reported progress in summary and backup sheets for FY 2013/2014
### FY 2013/14

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Reported length in summary sheet (Km)</th>
<th>Reported length in backup sheets (Km)</th>
<th>Variation (Km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arua</td>
<td>118.1</td>
<td>120.7</td>
<td>- 2.60</td>
</tr>
<tr>
<td>Bushenyi</td>
<td>219</td>
<td>219</td>
<td>-</td>
</tr>
<tr>
<td>Busia</td>
<td>45.64</td>
<td>45.64</td>
<td>-</td>
</tr>
<tr>
<td>Entebbe</td>
<td>143.4</td>
<td>129.7</td>
<td>13.70</td>
</tr>
<tr>
<td>Fortportal</td>
<td>79.53</td>
<td>74.33</td>
<td>5.20</td>
</tr>
<tr>
<td>Gulu</td>
<td>55.21</td>
<td>28.01</td>
<td>27.20</td>
</tr>
<tr>
<td>Hoima</td>
<td>210</td>
<td>206</td>
<td>4.00</td>
</tr>
<tr>
<td>Iganga</td>
<td>157.95</td>
<td>158.92</td>
<td>- 0.97</td>
</tr>
<tr>
<td>Jinja</td>
<td>2.02</td>
<td>3.67</td>
<td>- 1.65</td>
</tr>
<tr>
<td>Kabale</td>
<td>35.478</td>
<td>16.43</td>
<td>19.05</td>
</tr>
<tr>
<td>Kasese</td>
<td>551.05</td>
<td>537.45</td>
<td>13.60</td>
</tr>
<tr>
<td>Lira</td>
<td>95.38</td>
<td>89.38</td>
<td>6.00</td>
</tr>
<tr>
<td>Masaka</td>
<td>118.69</td>
<td>88.06</td>
<td>30.63</td>
</tr>
<tr>
<td>Masindi</td>
<td>904.1</td>
<td>856.9</td>
<td>47.20</td>
</tr>
<tr>
<td>Mbale</td>
<td>85</td>
<td>0</td>
<td>85.00</td>
</tr>
<tr>
<td>Mbarara</td>
<td>89.91</td>
<td>96.45</td>
<td>- 6.54</td>
</tr>
<tr>
<td>Moroto</td>
<td>65.13</td>
<td>202.1</td>
<td>- 136.97</td>
</tr>
<tr>
<td>Mukono</td>
<td>403.4</td>
<td>425.7</td>
<td>- 22.30</td>
</tr>
<tr>
<td>Ntungamo</td>
<td>0</td>
<td>113.1</td>
<td>- 113.10</td>
</tr>
<tr>
<td>Rukungiri</td>
<td>178</td>
<td>139.6</td>
<td>38.40</td>
</tr>
<tr>
<td>Soroti</td>
<td>Data not available</td>
<td>Data not available</td>
<td></td>
</tr>
<tr>
<td>Tororo</td>
<td>266.65</td>
<td>266.35</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Source: OAG Analysis of quarterly progress reports

Table 5 shows that for FY 2013/2014, more MCs reported more kilometers in summary sheets as compared to backup sheets ranging from 0.3km to 85km. Furthermore, fewer MCs reported less kilometers in summary sheets as compared to backup sheets ranging from 0.97km to 136.97km. We attributed the above differences to data entry errors by municipalities; and the failure by URF to verify the data and accountabilities provided to them before release of funds owing to the limited capacity of its monitoring and evaluation function as exemplified below:

- Critical and overstretched staffing at the URF Secretariat: the Monitoring and Evaluation (M&E)Department is small with a structure of three (3) staff, and only two posts are filled; this limits the scope of sampling both in geographical spread and extent of coverage of monitoring activities;

- Whereas the URF outsources the M&E function to private consultants, their scope in terms of geographical spread and extent of coverage is also inadequate due to delays in their procurement as reported in the quarterly monitoring report for Quarter 2 for FY 2012/2013.
**Management Response**

URF has noted this and is in the process of strengthening the M&E function.

**Recommendation**

- The URF should task the Accounting officers of the municipalities to:
  - Prioritize maintenance of equipment for road maintenance; pursue recruitment and retention of skilled staff to operate road equipment so as to enhance the performance of road maintenance.
  - Report their actual progress and expenditure accurately in order to monitor performance and therefore plan for future interventions.
- URF should prioritize and strengthen its M&E function if an effective assessment of the performance of the municipalities in utilization of the URF funds towards road maintenance is to be done.

**OVERALL AUDIT CONCLUSION**

Owing to the current levels of funding for road maintenance which falls short of the maintenance needs, it is necessary to ensure that the available resources are utilized efficiently by the designated agencies.

URF has put in place a system of planning, execution and reporting of municipalities. However, as a result of municipalities using various methods and not the uniform method of URF provided for, and disregarding the planning guidelines, in some instances, wide variations in cost estimation have resulted.

The allocation formula being used does not take into consideration the factors as required in section 22(2) of the URF Act and therefore does not allow for efficient allocation of funds to the Municipalities. These factors include: condition of the roads, length of the road network and traffic volumes.

With this, and coupled with inaccuracies in the data the municipalities provide to URF, and a weak monitoring and evaluation system, URF may not be in position to ascertain and monitor the efficiency of road maintenance activities in the municipalities and thus improve performance in the road maintenance system.

As the URF Act (2008) is operationalised to allow URF collect and utilize the Road User Charges (RUCs), it is anticipated that the URF will be able to mobilize much more funds for road maintenance. It is, therefore, important that the URF puts in place and enforces systems to enforce the efficient utilization of resources.
Glossary of Terms

**Routine Maintenance** is the maintenance required continually on every road, whatever its engineering characteristic or traffic volume. Examples include grass cutting, drain clearing, re-cutting ditches, culvert maintenance, road sign maintenance, etc. Routine maintenance can be carried out using manual or mechanized methods.

**Periodic Maintenance** is maintenance required only at intervals of several years. Examples include: resealing (surface dressing, slurry sealing, fog spray, etc., re-gravelling shoulders, road surface marking. It may be carried out using manual and mechanized methods.

Design standards for a new road construction are based on the expectation that necessary maintenance will be carried out periodically to deal with the inevitable deterioration caused by traffic loading, climate effects and other deleterious influences. Consequently, road maintenance is a fundamental necessity, as important as the original road provision.

**Rehabilitation And Maintenance Planning System (RAMPS)**

RAMPS is a computer software package that was developed by MoWT to facilitate effective planning of rehabilitation and maintenance works on District Roads, and possibly at some later date for community access roads (CARs), throughout Uganda.

The four principal elements of RAMPS include -

a) Planning; determination of prioritised district road rehabilitation and maintenance needs including global costs of all interventions,

b) Programming; based on actual fund availability, determination of final priorities, selection and timing of operations/activities, etc.

c) Implementation; based on choice of implementation technology, work scheduling and allocation of resources, and

d) Monitoring & Reporting; assessing performance in terms of output, quality and costs of works enabling the updating of global costing and other data and preparation of Quarterly Progress Reports (QPRs).

---

1MoWT District Roads Manuals, Volume 1 [Planning Manuals], Manual C [RAMPS]
APPENDIX I: Municipalities Studied

<table>
<thead>
<tr>
<th>SN</th>
<th>Municipality</th>
<th>SN</th>
<th>Municipality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arua</td>
<td>12</td>
<td>Lira</td>
</tr>
<tr>
<td>2</td>
<td>Bushenyi</td>
<td>13</td>
<td>Masaka</td>
</tr>
<tr>
<td>3</td>
<td>Busia</td>
<td>14</td>
<td>Masindi</td>
</tr>
<tr>
<td>4</td>
<td>Entebbe</td>
<td>15</td>
<td>Mbari</td>
</tr>
<tr>
<td>5</td>
<td>Fort Portal</td>
<td>16</td>
<td>Mbarara</td>
</tr>
<tr>
<td>6</td>
<td>Gulu</td>
<td>17</td>
<td>Moroto</td>
</tr>
<tr>
<td>7</td>
<td>Hoima</td>
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<td>Mukono</td>
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<td>Iganga</td>
<td>19</td>
<td>Ntungamo</td>
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<td>Jinja</td>
<td>20</td>
<td>Rukungiri</td>
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<td>Soroti</td>
</tr>
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<td>11</td>
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<td>22</td>
<td>Tororo</td>
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</table>

APPENDIX II: Documents reviewed during the Audit

<table>
<thead>
<tr>
<th>S/n</th>
<th>Document</th>
<th>Purpose of the Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>URF Act (2008)</td>
<td>To understand/ascertain the legal framework under which the URF operates, their roles and responsibilities, the key players in road maintenance</td>
</tr>
<tr>
<td>2</td>
<td>Budgeting guidelines and Annual Work plans</td>
<td>To understand/ascertain how the implementing agencies come up with the annual road maintenance budgets, the basis for budgeting</td>
</tr>
<tr>
<td>3</td>
<td>URF Manuals</td>
<td>To understand/ascertain how URF operates, the guidelines to Das on road maintenance</td>
</tr>
<tr>
<td>4</td>
<td>Study on the budget allocation formula</td>
<td>To understand/ascertain how the budget allocation formula was developed, the factors considered during allocation</td>
</tr>
<tr>
<td>5</td>
<td>Quarterly accountability reports for 22 municipalities</td>
<td>To understand/ascertain the amount of money spent on road maintenance, the total length of roads maintained in a year, the adequacy of the reporting framework to aid decision making by the URF</td>
</tr>
<tr>
<td>6</td>
<td>Monitoring reports</td>
<td>To understand/ascertain the performance of the MCs in road maintenance over the years</td>
</tr>
<tr>
<td>7</td>
<td>District Roads Manual of the MoIT</td>
<td>To understand/ascertain the guidelines for planning, budgeting and execution of road maintenance works, the key resources (inputs) necessary for road maintenance</td>
</tr>
<tr>
<td>8</td>
<td>Unit Cost Study Report (July 2012)</td>
<td>To understand/ascertain the process of estimating the costs of road maintenance</td>
</tr>
</tbody>
</table>
APPENDIX III: List of People Interviewed

<table>
<thead>
<tr>
<th>Sn</th>
<th>Officer Interviewed</th>
<th>Designation/Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Eng Michael Odongo</td>
<td>Executive Director/ URF</td>
</tr>
<tr>
<td>2</td>
<td>Eng. Andrew Kagoda</td>
<td>Manager, M&amp;E/ URF</td>
</tr>
<tr>
<td>3</td>
<td>Eng. Andrew Naimanye</td>
<td>Manager, Planning and Programming/ URF</td>
</tr>
<tr>
<td>4</td>
<td>Mr. Joseph Etiang</td>
<td>Manager, Internal Audit/ URF</td>
</tr>
<tr>
<td>5</td>
<td>Mr. Haruna</td>
<td>Assistant Engineer/ Mukono MC</td>
</tr>
<tr>
<td>6</td>
<td>Eng. Mukibi</td>
<td>Municipal Engineer/ Entebbe MC</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Assistant Engineer/ Arua MC</td>
</tr>
<tr>
<td>8</td>
<td>Eng. Odonga</td>
<td>Municipal Engineer/ Gulu MC</td>
</tr>
<tr>
<td>9</td>
<td>Ms. Sarah Adong</td>
<td>Assistant Engineer/ Lira MC</td>
</tr>
<tr>
<td>10</td>
<td>Eng. Anthony Okucu</td>
<td>Municipal Engineer/ Lira MC</td>
</tr>
<tr>
<td>11</td>
<td>Eng. Silver</td>
<td>Principal Municipal Engineer / Mbarara MC</td>
</tr>
<tr>
<td>12</td>
<td>Mr. Stephen Bwambale</td>
<td>Assistant Engineer / Kasese MC</td>
</tr>
<tr>
<td>13</td>
<td>Mr. Saidi</td>
<td>Ag. Municipal Engineer/ Jinja MC</td>
</tr>
<tr>
<td>14</td>
<td>Eng. Kasata</td>
<td>Municipal Engineer / Mbale MC</td>
</tr>
</tbody>
</table>

APPENDIX IV: Theoretical Framework for Data Envelopment Analysis (DEA)

Introduction

Despite the increasing investment in road maintenance in Uganda, the road network remains inadequate, given that the growth of traffic exceeds the growth of roads and that insufficient maintenance is leading to deterioration of the state of roads. The relationship between the maintenance level of service and the budget requirements (i.e. efficiency of road maintenance) needs more investigation.

There are numerous ways to increase the standard of the roads. One way is to allocate more resources. Another way is to increase efficiency within the organization that is to increase its production by simply increasing its efficiency, without absorbing further resources.

Farrel (1957) developed a model for that purpose, for modeling productive efficiency and it’s called Data Envelopment Analysis (DEA).

DEA includes multiple inputs (resources) and multiple dimensions of what is produced (outputs) which typically are the case for public production. In the model units/firms are referred to as Decision Making Units (DMUs). Decision making units can also be, as in this case, municipalities or in a competitive environment firms etc.

Motivation for using DEA

The Municipal Councils lack market prices for their services; the unit costs for maintenance vary across the municipalities. A common way of measuring productivity in public sectors, when market prices are lacking, is by dividing physical output by physical input. However, when there are many outputs and inputs, managers of public sector agencies prefer multiple output/input ratios, each of which tells a different story [Hjalmarsson et al 1996]. In that case no robust conclusions can be drawn on the performance on any particular agency, in comparison to others of the same nature. It is in this respect that the DEA approach could assist in aggregating several measures so that a single indicator for an agency’s performance is obtained.
The Model

The models that can be applied for efficiency measurement are either input or output oriented models. Input oriented measures target how much resources can be reduced for a given amount of production (i.e. maintaining the output levels). Output oriented measures target how much more can be produced from a given amount of resources (maintaining the resources).

The output oriented model was considered to be the most suitable due to the fact that the DMUs are public sector with set budgets. The level of road maintenance does not cover for the whole length of the network due to constrained resources; it is therefore more desirable/meaningful that the available resources should be used to achieve more production. Figure 1 below illustrates how the output oriented model constructs the frontier of DMUs based on their outputs for a given level of inputs.

**Figure 1: Output measure of Technical Efficiency**

From Figure 1 above, all the DMUs on the frontier (line E-A-B-D) have maximum production for the given resources; and are therefore considered to be efficient. If the DMU lies along the frontier, it means that it is impossible to increase production without increasing the resources. However it is possible to produce less than the maximum amount which is illustrated by point C.

In order to obtain potential improvement in production for the inefficient DMU C, the following process is undertaken:

Total production for C is represented by line O-C and C-C* is the potential for improvement in efficiency.
### APPENDIX V: Previous Studies in DEA

<table>
<thead>
<tr>
<th>Research Area</th>
<th>Author</th>
<th>Inputs</th>
<th>Outputs</th>
<th>DEA Model</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency measurement of maintenance of paved lanes</td>
<td>Ozek et al, March 2012</td>
<td>expenditure, total paved lane area, regional effect variable</td>
<td>change in condition of paved lanes</td>
<td>Input oriented, Variable Returns to Scale</td>
<td>The range of efficiency scores was 11-98%</td>
</tr>
<tr>
<td>Measuring the efficiency of highway maintenance contracting strategies: A bootstrapped non-parametric meta-frontier approach</td>
<td>Saeideh Fallah-Fini &amp; others (2011)</td>
<td>Maintenance expenditure</td>
<td>Lane miles served, Change in pavement condition</td>
<td>Output oriented, Variable Returns to Scale</td>
<td>The range of efficiency scores was 56-100%</td>
</tr>
<tr>
<td>Comprehensive framework for the Efficiency measurement of road maintenance strategies using DEA</td>
<td>Mehmet Egemen Ozek, 2007</td>
<td>Cost of maintaining bridges, Regional effect variable, Total area served</td>
<td>Change in overall bridge condition</td>
<td>Input Oriented</td>
<td>All DMUs had scores of 100% implying that improvements cannot be achieved by comparing them to each other</td>
</tr>
<tr>
<td>Measuring the Economic efficiency of producing of producing rural road services</td>
<td>Steven C Deller &amp; Carl H Nelson (1990)</td>
<td>Labor, road graders, single-axle trucks and surfacing material</td>
<td>Mileage</td>
<td>Input oriented</td>
<td>The range of efficiency scores was 42-92%</td>
</tr>
<tr>
<td>A DEA Model For Measuring the Relative Efficiency of Highway Maintenance Patrols</td>
<td>Wade D. Cook &amp; others (1990)</td>
<td>Total expenditure (M), Average pavement condition rating</td>
<td>Assignment size factor, Average traffic serviced</td>
<td>Input oriented</td>
<td>The range of efficiency scores was 61.9-100%</td>
</tr>
<tr>
<td>Measuring dynamic efficiency of highway maintenance operations</td>
<td>Saeideh Fallah-Fini &amp; others (2013)</td>
<td>Maintenance budget</td>
<td>Improvement in road condition</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX VI: Key URF Institutional Stakeholders

(Source: URF OYRMP & AREP 2010/11)
APPENDIX VII: Comparison of Actual Unit Costs with those recommended by URF

<table>
<thead>
<tr>
<th>Municipal Council</th>
<th>Periodic Unpaved</th>
<th>Recommended for Class B- medium grading</th>
<th>% Variance</th>
<th>Periodic paved</th>
<th>Recommended for class II</th>
<th>% Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arua</td>
<td>96,922,418</td>
<td>20,404,588</td>
<td>375</td>
<td>34,255,075</td>
<td>30,505,706</td>
<td>12.3</td>
</tr>
<tr>
<td>Busia</td>
<td>593,647,833</td>
<td>21,908,471</td>
<td>2,610</td>
<td>922,703</td>
<td>32,648,127</td>
<td>-97.2</td>
</tr>
<tr>
<td>Entebbe</td>
<td>389,172,000</td>
<td>19,012,173</td>
<td>1,947</td>
<td>28,197,993</td>
<td>33,033,262</td>
<td>8.4</td>
</tr>
<tr>
<td>Fort Portal</td>
<td>9,615,385</td>
<td>18,568,086</td>
<td>-48</td>
<td>20,260,350</td>
<td>19,970,423</td>
<td>-59.4</td>
</tr>
<tr>
<td>Gulu</td>
<td>206,604,861</td>
<td>20,404,588</td>
<td>913</td>
<td>24,647,460</td>
<td>30,505,706</td>
<td>-19.2</td>
</tr>
<tr>
<td>Hoima</td>
<td>22,201,261</td>
<td>19,012,173</td>
<td>1,296</td>
<td>33,033,262</td>
<td>33,033,262</td>
<td>105.9</td>
</tr>
<tr>
<td>Iganga</td>
<td>265,366,358</td>
<td>19,012,173</td>
<td>1,371</td>
<td>32,648,127</td>
<td>32,648,127</td>
<td>8.4</td>
</tr>
<tr>
<td>Jinja</td>
<td>445,550,256</td>
<td>19,012,173</td>
<td>2,243</td>
<td>33,033,262</td>
<td>33,033,262</td>
<td>105.9</td>
</tr>
<tr>
<td>Kabale</td>
<td>322,293,402</td>
<td>21,908,471</td>
<td>1,744</td>
<td>35,391,517</td>
<td>32,648,127</td>
<td>8.4</td>
</tr>
<tr>
<td>Kasese</td>
<td>187,298,824</td>
<td>22,201,261</td>
<td>2,243</td>
<td>32,648,127</td>
<td>32,648,127</td>
<td>8.4</td>
</tr>
<tr>
<td>Lira</td>
<td>204,004,588</td>
<td>19,012,173</td>
<td>1,371</td>
<td>32,648,127</td>
<td>32,648,127</td>
<td>8.4</td>
</tr>
<tr>
<td>Masaka</td>
<td>122,493,750</td>
<td>18,568,086</td>
<td>560</td>
<td>28,197,993</td>
<td>28,197,993</td>
<td>-59.1</td>
</tr>
<tr>
<td>Masindi</td>
<td>22,201,261</td>
<td>19,012,173</td>
<td>1,399</td>
<td>33,033,262</td>
<td>33,033,262</td>
<td>105.9</td>
</tr>
<tr>
<td>Mbale</td>
<td>285,000,000</td>
<td>19,012,173</td>
<td>2,243</td>
<td>33,033,262</td>
<td>33,033,262</td>
<td>105.9</td>
</tr>
<tr>
<td>Mbarara</td>
<td>70,055,059</td>
<td>21,908,471</td>
<td>1,399</td>
<td>32,648,127</td>
<td>32,648,127</td>
<td>8.4</td>
</tr>
<tr>
<td>Moroto</td>
<td>20,737,705</td>
<td>19,012,173</td>
<td>1,399</td>
<td>33,033,262</td>
<td>33,033,262</td>
<td>105.9</td>
</tr>
<tr>
<td>Mukono</td>
<td>151,564,000</td>
<td>18,568,086</td>
<td>716</td>
<td>28,197,993</td>
<td>28,197,993</td>
<td>8.4</td>
</tr>
<tr>
<td>Ntungamo</td>
<td>21,908,471</td>
<td>69,215,946</td>
<td>112.0</td>
<td>32,648,127</td>
<td>32,648,127</td>
<td>8.4</td>
</tr>
<tr>
<td>Rukungiri</td>
<td>21,908,471</td>
<td>12,356,393</td>
<td>112.0</td>
<td>32,648,127</td>
<td>32,648,127</td>
<td>8.4</td>
</tr>
<tr>
<td>Soroti</td>
<td>19,012,173</td>
<td>5,173,098</td>
<td>84.3</td>
<td>33,033,262</td>
<td>33,033,262</td>
<td>8.4</td>
</tr>
<tr>
<td>Tororo</td>
<td>19,012,173</td>
<td>9,743,590</td>
<td>70.5</td>
<td>33,033,262</td>
<td>33,033,262</td>
<td>8.4</td>
</tr>
</tbody>
</table>
APPENDIX VIII: Duplication of Maintenance Activities in Work plans

<table>
<thead>
<tr>
<th>MUNICIPALITY</th>
<th>ROADS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 2013/2014</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tororo</td>
<td>Multiple</td>
<td>Duplication of roads in routine mechanized and routine manual; the description of activities was the same</td>
</tr>
<tr>
<td>Mukono</td>
<td>Kame paved Road</td>
<td>No defined category of works for routine manual, both sealing in periodic maintenance and patching on similar road in routine mechanized</td>
</tr>
<tr>
<td>Moroto</td>
<td>Lomillo Road, Narwosi</td>
<td>Grading both periodic maintenance and routine mechanized</td>
</tr>
<tr>
<td>Mbarara</td>
<td>Bulemba Road</td>
<td>Duplication in routine mechanized and periodic maintenance; also included in routine manual</td>
</tr>
<tr>
<td>MasakaWW</td>
<td>Ssenyange</td>
<td>Duplication</td>
</tr>
<tr>
<td>Iganga</td>
<td>ObojaDrive</td>
<td>Funds re-appropriated by Council</td>
</tr>
<tr>
<td>Hoima</td>
<td>Multiple</td>
<td>Re-gravelling earth roads, interventions unrelated to class of road</td>
</tr>
<tr>
<td>Fortportal</td>
<td>Government Avenue, Nyaika Avenue, Mill Lane</td>
<td>Both periodic maintenance and routine mechanized</td>
</tr>
</tbody>
</table>

FY 2012/2013

| Tororo         | Forest Road                    | Has interventions for both paved and unpaved roads                     |
| Mbarara        | Bulemba Road, NtareRoad        |                                                                        |
| Hoima          |                                | Interventions out of range of the class of road that is gravelling for earth roads |
| Busia          | Multiple                       | Interventions out of scope of periodic maintenance and costs relatively high; probably other interventions done not the ones listed |
| Bushenyi       | Kanyamabona-Kihesi/Kanyamabona-Kamira-Kihesi | Probable duplication                                                  |

APPENDIX IX: Current Funds Allocation Formula

\[
A_x = P_{Asp} + (Z - P_{Asp}) \times \frac{P_x}{\Sigma P}
\]

Where:

- \( A_x \) = Allocation to agency \( X \)
- \( P_{Asp} \) = Allowance for previous asphalt
- \( P_x \) = Population of agency \( X \)
- \( \Sigma P \) = Total population of all agencies
- \( Z \) = Total allocation available
EFFICIENCY OF THE SYSTEM OF ROAD MAINTENANCE IN UGANDA: A CASE STUDY OF MUNICIPAL COUNCILS