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Research on New Asset Management Approaches for Maintaining and Improving Local Road Access

Inception Report

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Abstract

The Africa Community Access Programme (AFCAP) is funding a research and capacity building project on asset management for rural roads. The purpose of the project is to achieve economic and social benefits for local communities in rural areas as a result of improved performance in road asset management.

Three countries from sub-Sahara Africa will participate in the project. A fourth country, with established rural asset management systems, will provide a benchmark for best practice. If the project is successful it is expected that there will be subsequent phases which will enable the participation of additional countries.

The project will provide technical assistance to achieve improvements in asset management performance on a selected network of rural roads within each participating country. The performance will be measured against a new specification for rural road asset management that will be developed as part of the study. Measurements will also be taken of the road network condition and the impact of the road condition on the rural economy. These data will be discussed with road sector stakeholders in the project areas and in regional meetings of the participating countries. They will be used as part of an influencing strategy to achieve home-grown and sustainable improvements to the management of rural roads.

The Inception Report summarises the initial findings of the research team concerning the development of tools required for measuring performance in rural road asset management, identification of participating countries and the likely contribution of the project to the ReCAP Log Frame performance indicators. It follows the Mobilisation Report, which was submitted in December 2015. The Mobilisation Report included a summary of meetings held with the Client and within the technical assistance team during the mobilisation phase, the revised approach and methodology for the project as proposed by the Consultant, and changes to the professional team.

Key Words

Rural Roads, Maintenance, Asset Management, Capacity Development

Acronyms, Units and Currencies

$	United States Dollars
AFCAP	Africa Community Access Partnership
AM	Asset Management
ARMFA	African Road Maintenance Fund Association
ASCAP	Asia Community Access Partnership
BADEA	Arab Bank for Economic Development in Africa.
CDS	Civil Design Solutions
DFID	Department for Further International Development
DM	District Municipality
GDP	Gross Domestic Product
GPS	Global positioning system
IAMM	Infrastructure Asset Management Manual
ILO	International Labour Organization
IQL	Information Quality Level
LVR	Low Volume Road
PMU	Project Management Unit
PMO-RALG	Prime Minister's Office – Regional and Local Government
RAI	Rural Access Index
RECAP	Research for Community Access Partnership
RI	Roughton International
SDG	Strategic Development Goal
UK	United Kingdom (of Great Britain and Northern Ireland)
UKAid	United Kingdom Aid (Department for International Development, UK)
UoB	University of Birmingham

Contents

1 Executive Summary

The Africa Community Access Programme (AFCAP) is funding a research and capacity building project on asset management for rural roads. The purpose of the project is to achieve economic and social benefits for local communities in rural areas as a result of improved performance in road asset management. Cardno has signed a contract with Roughton International Limited (RIL) to provide technical input and project management services for the project. The project is being managed by the AFCAP Project Management Unit (PMU).

Three countries from sub-Sahara Africa will participate in the project, however it is proposed that a fourth country or region, with established rural asset management systems, will provide a benchmark for best practice. If the project is successful it is expected that there will be subsequent phases which will enable the participation of additional countries.

It is evident from initial discussions and feedback from key informants that there are very few examples of sustainable rural road asset management programmes currently operational in sub-Sahara Africa. Rural road maintenance tends to be characterised by inadequate human resources and funding, reliance on inappropriate technologies, poor quality control, mismanagement and corruption. Where examples of good practice exist they tend to be on donor-funded programmes with high levels of technical assistance, but these initiatives tend to flounder when the donor support is withdrawn.

As a result of the low existing capacity and dearth of examples of good practice, a highly innovative approach will be required to achieve meaningful results. It will be necessary to build a maintenance culture in the participating countries. This will be achieved through an evidence-based approach to changing the mind set of policy makers and targeted technical assistance at the implementation level. The performance of the participating roads agencies will be measured against a new specification for rural road asset management that will be developed as part of the study. Measurements will be taken of the road network condition and the impact of the road condition on the rural economy. These data will be discussed with road sector stakeholders in the project areas and in regional meetings of the participating countries. They will be used as part of an influencing strategy to achieve home-grown and sustainable improvements to the management of rural roads.

The project is currently in the Formulation Phase. This phase is expected to be complete by April 2016. If the Formulation Phase is successful the project will proceed to Implementation. The overall duration of the project is 27 months, but it is expected that more time will be required to achieve meaningful results, given the low starting point.

The following activities have been carried out subsequent to the submission of the Mobilisation Report:

- Preparation of a questionnaire on existing road maintenance arrangements, which was sent to informants in several countries in order to gather more data on the status quo.
- Preparation of a draft letter for the AFCAP PMU to invite AFCAP participating countries to submit their proposals for participation in the project.
- Submission of a concept note for a workshop on the draft implementation proposals to the International Conference on Transport and Road Research planned for Mombasa, Kenya from 15th to 17th March 2016.
- Submission of abstracts for two technical papers to the Mombasa conference.
- Team meetings in Harare between the Team Leader, the Road Maintenance Expert and Trainer, and the Road Condition Monitoring Expert.
- Skype meeting between the Team Leader and the Rural Transport Economist.
- Email correspondence with World Bank experts on existing examples of "good practice" in rural road maintenance.
- Initial review of relevant literature on rural road asset management including a visit to Zambia to review the sustainability of the World Bank funded OPRC road maintenance contracts and other aspects of rural road maintenance.
- Planning for a visit to Ekiti State in Nigeria to visit a DFID-funded rural roads capacity development project but delayed due to non-availability of visas from the Nigeria embassy in Harare.
- Meeting in Cape Town with representatives of the Western Cape Department of Transport and Public Works to discuss their current approaches to road asset management and their participation in the project.
- Preparation of a draft Specification for Rural Road Asset Management and initial proposals for monitoring the condition of roads, road asset value, and socio-economic impact of road access.

The following are planned activities for the remainder of the Formulation Phase:

- Completion of the literature review, including field visits to Nigeria and (possibly) Kenya to analyse in detail existing rural road asset management arrangements.
- Team meeting in Dar es Salaam on 11th and 12th February to discuss all project activities, including participation by Tanzania Road Fund Board, Tanroads and PMO-RALG to establish current status of road asset management in Tanzania.
- Discussions with the Africa Road Maintenance Fund Association (ARMFA) as a possible institutional home for the Project Implementation Team
- Further development of the draft Specification for rural road asset management;

- Development of draft methodologies for assessing the condition of rural roads and the road asset value;
- Developing draft indicators of the social and economic impact of rural roads;
- Presentation of the draft project design recommendations at the 'International Conference on Transport and Road Research' planned for Mombasa, Kenya from 15th to 17th March 2016;
- Review of requests submitted by AFCAP participating countries to participate in the project.
- Preparation of the Design Report (draft and final).

2 Background to Project

2.1 Consultancy Contract

Cardno Emerging Markets is managing a programme of Research for Community Access (ReCAP) on behalf of the Department for International Development (DFID). The programme includes research and capacity building activities in Africa (Africa Community Access Programme – AFCAP) and Asia (Asia Community Access Programme – ASCAP). Cardno has signed a contract with Roughton International Limited (RIL) of UK to provide consultancy services for the delivery of a regional research project on improved management of rural roads. The consultancy contract is for a five month period covering the formulation and detailed design of the project. If the Formulation Phase is successful the project will proceed to implementation.

This report covers the activities carried out since the mobilisation of the consultancy team and the initial discussions with the Client. It includes:

- Initial findings of the desk study and review of existing rural roads asset management practice and recommendations for selection of the participating countries.
- A schedule of tasks for the remainder of the assignment and methodologies for carrying out these tasks.
- The first draft of the Specification for Rural Road Asset Management.
- A review of the likely contribution of the project to the ReCAP Log Frame indicators.
- Composition of the project formulation team and key dates for deliverables.

2.2 Comments on the Terms of Reference

The original name of the project is 'Research on New Asset Management Approaches for Maintaining and Improving Local Road Access". The objective, as described in the TORs, was to "identify, test, document and disseminate an improved approach, or approaches, including institutional arrangements, for an approach to asset management for the maintenance and improvement of local access to rural areas in sub-Saharan Africa". However, the analysis of existing maintenance arrangements in several countries in Africa carried out in the first two months of the project (see Chapter 5) has shown that a wider and more holistic approach will be needed to address the significant challenges of maintaining rural roads. A revised approach is therefore recommended that focusses more on achieving improved **performance** in road asset management than on testing approaches to road asset management. The revised approach is described in the Mobilisation Report and summarized below in Chapter 3. It is encapsulated in a suggested new name for the project, namely 'Economic Growth through Effective Road Asset Management (GEM)'. A new purpose statement is proposed, along with a new set of objectives.

The proposed change in approach to the project will affect the methodology and outputs of the Implementation Phase (as set out in the TORs). It does not affect the TOR requirements for the Formulation Phase, which remain as:

- Selection of the geographical research areas
- Identification of the research project partners
- Establishing a technical steering group
- Finalisation of the detailed project design.

3 Project Approach and Methodology

3.1 Purpose

The purpose of the project is to achieve economic and social benefits for local communities as a result of improved performance in road asset management.

The ultimate beneficiaries of the project are rural communities in sub-Sahara Africa.

3.2 Objectives

The objectives of the project are as follows:

1. Review literature and reports on existing and recent road management and maintenance programmes and identify 'what works' and 'what doesn't work' in the type of environment likely to be encountered in the project area.
2. Develop a specification for road asset management appropriate to sub-national rural road networks and apply it in selected project areas.
3. Develop simple and appropriate tools for monitoring road condition and apply them in the project areas.
4. Develop simple indicators of economic and social impact of rural roads and monitor them in the project areas.
5. Achieve incremental (and measurable) improvements to asset management performance in the project areas.

3.3 Approach

The approach to the project is intended to foster self-reliance in road agencies in the project areas and encourage greater accountability to road users and other sector stakeholders. It provides flexibility and space for the participating road agencies and their stakeholders to determine their own destinies. The approach focuses more on improved performance in road asset management than on any specific or pre-conceived road asset management systems or institutional, management and funding arrangements. Support to this process will be provided through demand-led technical assistance funded by UK Aid through AFCAP.

3.4 Project Phases

The project is being implemented in phases. The current consultancy contract covers the 5-month Formulation Phase. During this phase the project team is required to develop a detailed methodology for implementation of the project. If the Formulation Phase is successful it will be followed by the Implementation Phase. This will include periodic monitoring of asset management performance in the participating project areas, sharing of the outcome of the monitoring between the project areas and technical assistance to improve current practices. Dissemination of the research findings will take place in parallel with the implementation and at the end of the project.

Project Objective 1 (Desk Study) will be achieved during the Formulation Phase. Objectives 2 to 4 will be partially achieved during the Formulation Phase. Performance targets for the fifth objective will be developed during the Formulation Phase and realised during the Implementation Phase.

The likely contribution of the project to the ReCAP log frame indicators are summarised in Chapter 11.

4 Activities for the Formulation Phase

The following is a summary of activities being carried out during the Formulation Phase.

- Conduct a review of literature and reports on existing and recent road management and maintenance programmes and identify 'what works' and 'what doesn't work' in the type of environment likely to be encountered in the project area. Visit a sample of project sites to verify data provided in the literature.
- Hold discussions with the African Road Maintenance Fund Association (ARMFA) as a possible institutional home for the proposed Project Implementation Team (PIT), which will comprise representatives from each participating area. (Meeting scheduled for 26th February in Addis Ababa).
- Develop a Specification for Rural Road Asset Management which is appropriate to sub-national road agencies in Africa.
- Establish detailed methodologies for the measurement of rural road condition and road asset value.
- Establish appropriate indicators for economic impacts of rural roads and agree the method of collecting the required data.
- Present the project design at a stakeholder workshop to be held in conjunction with the 'International Conference on Transport and Road Research' to be held in Mombasa, Kenya, from 15th to 17th March 2016.
- Agree with the AFCAP PMU an appropriate mechanism for selecting regions to participate in the project; prepare a draft agreement / MOU which will be signed by the selected countries and the AFCAP PMU at the start of the Implementation Phase.

5 Maintenance of Rural Roads in Africa - Initial Findings

5.1 Overview

Many African countries gained independence in the late 1950s and 1960s. This resulted in a shift in policy from the provision of roads mainly for strategic and military reasons to the provision of roads for national development. There was a marked increase in road construction and by the end of 1980 over 2 million kilometres of roads had been constructed in Sub Saharan Africa with an estimated asset value of US$150 billion (World Bank, 1995). Unfortunately this expansion of the network did not take into account the limitation of national governments to sustain the recurrent maintenance requirements. The World Bank estimates that by 2000 over 33% of the asset value had been lost due to lack of routine and periodic maintenance.

Institutional reforms implemented under the Road Management Initiative (RMI), which started in the mid-I990s, resulted in the establishment of road maintenance funds in many countries and semi-autonomous roads authorities. This resulted in improved the maintenance of national roads but less impact at a sub-national level on rural road networks. Funding to maintenance continues to be inadequate and there are severe capacity constraints in roads agencies and the private sector.

The following case studies summarise the current arrangements for road maintenance in several countries and regions in Africa. The purpose is not to provide a comprehensive description of rural road maintenance arrangements in each country, but to identify any common themes including “what works” and “what is less successful”. This will inform the further development of the methodology for the implementation phase of this project and the selection process for the participating countries. A more detailed description of the country programmes and the outcome of the desk study will be included in the Design Report of the Formulation Phase.

5.2 Ethiopia

Rural accessibility in Ethiopia is low. It is estimated that only 10% of the rural population live within 2 kilometres of an all-weather road (Vivien et al, 2010). In 2010 the Ethiopian government, through the Growth and Transformation Plan (2010 -2015), directed that all the villages (kebeles) should be connected by an all-weather road. In response to this the government launched the Universal Rural Road Access Programme (URRAP) which aimed to construct more than 70,000 km of gravel access roads over a five year period. The cost of the programme exceeds US$1 billion. The programme of road works is being managed by the regional roads authorities under the coordination of the Ethiopia Roads Authority (ERA) and has achieved an impressive output of new roads.

The dramatic expansion of the rural road network in Ethiopia has, however, not been matched by development of a corresponding system for maintenance of the roads. The responsibility for rural roads falls under the wereda administrations but the weredas lack capacity to manage the roads and receive no funding allocations from either the central government, regional government or the Road Fund. Currently there is no national strategic plan in place for the establishment of a viable road maintenance system with sustainable long term funding. Given the difficult terrain and climatic conditions in much of Ethiopia it is expected that the lack of maintenance will lead to an accelerated decline in the condition of the network.

5.3 Malawi

The Malawi economy is strongly dependent on agriculture and therefore on reliable access to rural areas. Several rural road initiatives have been made in support of agriculture from the 1970s. These include the District Road Improvement and Maintenance Programme (DRIMP-World Bank), Village Access Roads and Bridges Assistance Unit (VARBAU-World Bank), Malawi Social Action Fund road works (MASAF-World Bank, DFID), Public Works Programme (PWP-EU), Income Generating Public Works Programme (IGPWP-EU), Agriculture Sector Wide Support road component (ASWAp-World Bank) and the Rural Infrastructure Development Programme (RIDP-EU). All the above programmes had one thing in common: they tended to be donor driven, including parallel management arrangements (Project Management Units), and resulted in limited local ownership and a consequent lack of maintenance of the completed roads. The construction and rehabilitation programmes did not develop the institutional, human and capital capacity to maintain the road infrastructure. The district councils in Malawi are responsible for district roads under the government's decentralisation policy but they do not receive regular allocations for maintenance from the road fund (Human Dynamics, 2015).

Maintenance initiatives established under projects such as IGPWP and RIDP as part of their exit strategies have received some support from the government, but none of these programmes has managed to establish an effective national strategy for rural road maintenance. Most of the road maintenance is organised by the Malawi Road Authority, with ad hoc interventions on district roads when funds permit.

5.4 Mozambique

Road maintenance in Mozambique is organised at provincial level by provincial "delegations" of National Road Administration (ANE). The ANE delegations are supported by private consulting firms who assist with the management of the annual work programmes. The annual programme is coordinated by the Directorate for Maintenance (DIMAN) at ANE Head Office and is funded by the Road Fund. All of the works are contracted to the private sector

following the disbanding of the government force account operation (ECMEP) in the early 2000s. ANE is responsible for the maintenance of all classified roads.

The provincial maintenance programme is relatively well funded (approximately US$10 million per province per annum) and there have been significant improvements in the standard of maintenance in the past decade. However, the current strategy to let multiple short duration (mainly one year) maintenance contracts to a large number of small contractors is inefficient and is not contributing to long term development of capacity in the sector. The management of a large number of small maintenance contracts requires a full procurement department within ANE at provincial level, which may not be necessary if there were only a few maintenance contracts in the province and they were for longer duration. ANE also maintains a substantial complement of technical staff at provincial level, notwithstanding the services of the provincial consultants. In addition to this the Road Fund now has its own provincial delegations. All of these staff need offices and vehicles etc. Funds spent on management are not available for maintaining roads (Mott MacDonald, 2015). Meanwhile there have been reports of road works paid for at provincial level but either not completed on site or completed to a low standard[1].

Non-classified feeder roads are maintained by the district administrations. They receive direct (but small) allocations from the Road Fund and are authorised to let their own maintenance contracts. Most of the works at district level include spot improvements and minor repairs. Technicians employed by the district receive technical support from the ANE provincial delegations.

5.5 Tanzania

The maintenance of higher level rural roads in Tanzanian is the responsibility of the Tanzania National Roads Agency (TANROADS), which was established in 1997 as part of institutional reform in the road sector. TANROADS is an implementing agency reporting to the Ministry of Infrastructure Development[2], which is responsible for policy formulation and monitoring. TANROADS is responsible for a network of trunk roads and regional roads comprising 28,510 km of which about 4,100 km is paved. All maintenance works are contracted out and managed by the TANROADS Regional Managers.

The district road network in Tanzania comprises about 56,000 km and is the responsibility of district councils. The district councils are required to adhere to uniform procedures for planning their maintenance programmes and funding applications. This process is

[1] Author's personal experience.

[2] It is noted that there have been frequent changes in the name of the responsible ministry in recent years.

coordinated by an infrastructure unit in the PMO-RALG[3]. PMO-RALG uses information from the districts to prepare the annual work programme and enters into a performance agreement with the Road Fund Board on behalf of the districts (IT Transport, 2010).

The management of road maintenance at the district level is constrained by several factors. An institutional assessment carried out in 2010 identified the following constraints from the perspective of the District Engineers:

- Limited budget and unsteady flow of funds
- Political interference
- Lack of motivated staff (low salary; lack of accommodation)
- Lack of equipment
- Erosion problems
- Lack of gravel material.

The 2010 study found that maintenance works were mainly carried out by contractors using large equipment. There were no small scale contractors that had been awarded significant road maintenance contracts in the study area. Communities were involved only in a passive manner, for example through providing materials for road works when required. Some people from the district had attended training in labour based technology in road maintenance, but most had never been awarded any contracts.

PMO-RALG conducted a research project on alternative and improved district road maintenance systems between 2010 and 2012. The project was supported by AFCAP. The methodology included implementing different forms of contract for maintenance in three different districts. The results and key findings were as follows (IT Transport, 2013):

- Community contracts for routine maintenance (Mpwapwa Districts) were the most successful of the alternative road maintenance systems tested.
- Longer term maintenance contracts would provide more continuous attention to the maintenance of roads than the short duration contracts currently used.
- The procurement process for the maintenance contracts was affected by bureaucratic delays and staffing problems. This resulted in significant delays. Any gains achieved through improved forms of contract were small compared with potential gains that could be achieved through improved efficiency and reducing the bureaucratic delays in the institutions responsible for implementing district road maintenance contracts, primarily the district councils.

[3] Prime Minister's Office - Regional and Local Government.

5.6 Uganda

Uganda received significant funding from the AfDB and BADEA[4] in the 1990s under the Uganda Strategy for Rural Feeder Roads Rehabilitation and Maintenance Programme. This was aimed at improving rural access as a catalyst to agricultural production. The programme was managed centrally by the Ministry of Works and Transport (MOWT). By 2004 the rural feeder roads had improved significantly from 15% to 60% in good condition. Following this major investment in rural roads a Strategy for Sustainable Maintenance of District and Urban Roads (DUCAR) was launched.

The 2004 Government "Strategy for Sustainable Maintenance of District, Urban and Community Access Roads (DUCAR)". It envisaged a reliance on private contractors for maintenance of the DUCAR network with the contractors engaged by the local authorities. This strategy was supported by development partners, in particular DANIDA, who made considerable investments in capacity development in the MOWT, district local government and the training of small contractors. The DUCAR strategy was, however, undermined by inadequate budget allocations to support the maintenance works and local authority revenue streams were cut by the abolition of the Graduation Tax in the mid-2000s. The policy of the government to create new districts through sub-division further reduced revenue for individual councils, and reduced their capacity to support a basic establishment for road maintenance.

In 2008 the government then decided to change its approach to the maintenance of district roads through the reintroduction of force account. This included the establishment in each district of a unit for light road maintenance works and Zonal District Roads Regravelling units, which would act as plant hire organisations for the districts. The government also decided to reintroduce direct labour road gangs for routine maintenance of district roads and districts were advised to prepare for the recruitment of the workforce, procurement of tools and implements and the construction of road camps.

The government's decision to strengthen district force account was in response to the continued poor condition of district roads and demonstrated a lack of confidence in the private sector to implement the works efficiently and at cost effective rates. It also reflected a lack of confidence in the capacity of district road agencies to act as the client for road maintenance works under commercial contracting arrangements. However the new policy tended to undermine gains that had been made in recent years with the training and establishment of local contracting firms and the promotion of labour based techniques for district road construction and regravelling. It did not acknowledge that some districts already operated road construction equipment, yet their roads were in poor condition as a result of

[4] Arab Bank for Economic Development in Africa.

insufficient funds for purchase off fuel, lubricants and spare parts, lack of capacity to maintain construction equipment and abuse of equipment and illegal hiring to the private sector (Parsons Brinckerhoff, 2010). It also seemed to contradict the government's Construction Industry Policy which aimed to reduce direct labour units employed by government to 10% , leaving the 90% of all work implemented by the private sector by 2013 (Govt. of Uganda, 2008)

By 2015 district local government councils continued to manage the classified rural road network (and some non-classified roads), with the rest of the non-classified road under sub-county local government. However the government is discussing the formation of DUCA – District, Urban, Community and Access Roads Authority, which would centralise the management of the non-national roads. This may reveal an ongoing concern at central level concerning the standard of district road maintenance. The districts and sub-counties receive direct allocations for road maintenance from the Road Fund but the roads are reported to be in "fair" and "poor" condition[5].

5.7 Zambia

A large part of the Zambia road network was constructed in the early 1960s following independence, and during a period when the Zambian economy was performing well supported by the copper revenue. Nationalization of the mines in 1972 triggered a decline in economic performance and the increase in oil prices in the 1970s further worsened the situation. Roads that had been constructed during the economic boom did not receive maintenance and this resulted in significant deterioration. A road condition survey in 1995 showed that 95% of rural feeder roads were in poor condition (RDA, 2014).

In the late 1990s and 2000s the government established a National Road Fund Agency (NFRA) and the Road Development Agency (RDA). The focus of these agencies was the rehabilitation of roads constructed in the 1960s and new construction. In the 2000s the RDA commissioned maintenance contracts on higher traffic rural roads using the Output and Performance Based Contract (OPRC) specification and with support from the EU and World Bank. Whilst successful in achieving improved road conditions for the duration of the project neither the EU nor World Bank funded initiative contributed to the development of a sustainable national strategy for rural road maintenance (NTU, 2007; Crown Agents, 2009). Meanwhile the responsibility for district roads has been delegated to District Councils, who tend to prioritize urban streets. There are no allocations from the NRFA specifically for rural roads.

The literature review and discussions in Zambia highlighted the following situation prevailing in Zambia:

[5] Project internal sources.

- The procurement of services for construction and maintenance is affected by bureaucracy resulting in delays in implementing the projects
- Private sector capacity to implement and supervise road works is limited resulting in poor quality work being produced by contractors and paid for by government
- There is a general lack of maintenance culture for roads in Zambia
- Inadequate funding and unclear institutional arrangements for the management of rural feeder roads has exacerbated the problem of lack of maintenance.

5.8 Zimbabwe

The major rural roads construction project was carried out in Zimbabwe following Independence in 1980. The construction programme was co-funded by the government of Zimbabwe and Germany. The construction work was carried out using plant hired from the private sector and government equipment through force account. The programme started in 1985 with a national road network planning and economic evaluation exercise that identified and prioritised a core rural road network of 25,000km. All 60 district councils in Zimbabwe were involved in this process, but it was decided that this network would be managed centrally. The prioritization process used a socio economic planning procedure linked mainly to agricultural outputs.

The project included:

- Establishment of a Road Engineering Division headquartered in Harare to carry out the construction works
- Development of a road maintenance system.

The road maintenance system divided the road network into small manageable units of between 150 -200km. These units were provided with a dedicated allocation of funds from the state budget based on the length of roads to be maintained. The unit also received a full complement of equipment comprising a tractor, towed grader, trailer and a water bowser. The unit was allocated personnel specific to the network under its geographic boundary and a Road Unit Supervisor. A total of 204 units were formed and the programme recorded significant success during the 15 years of implementation (1985 -1999). This was primarily due to the following reasons:

- Rural roads were managed by a separate entity from the one looking after the national trunk roads; this organisation was a semi-autonomous government department which enjoyed relative independence.
    - The road construction funded by the donor had a number of conditions:
    - The government of Zimbabwe had to spend 100% of the money required for construction, and then upon producing proof of expenditure and related progress, the donor refunded 80% of the money. The up-front funding and 20%

government net contribution forced the government to take ownership of the programme.
    - The provision of funds for construction in the following year was based on the condition that adequate maintenance funding for the roads constructed in the previous year were fully provided through the government recurrent budget.
- A comprehensive staff development exercise was conducted during the inception phase to "qualify" personnel for their roles.
- The use of low cost intermediate equipment made road maintenance affordable and efficient.
- The parcelling out of roads into smaller units with a full complement of equipment, funding and personnel assisted with the overall management of the scheme.

At the end of 2000, which coincided with the end of the programme, the Zimbabwe currency started to lose value against major currencies. The roads had reached their design life of 15 years and periodic maintenance work was required across the network. The equipment was reaching the end of its life: the tractors had clocked more than 10 000 hours, and the donor funding ceased. Declining government salaries resulted in staff turnover and the organisation lost its institutional memory. Roads started to deteriorate due to lack of maintenance. The government abandoned the tractor based maintenance approach and ordered motorized graders to carry out road maintenance. By 2010 the tractor based maintenance system was no longer effective and was replaced by expensive, inappropriate heavy graders. The administration perceived that motorized graders were more efficient and faster than the tractor drawn graders. The allocations from the Road Fund were not sufficient to sustain the operations and the system collapsed.

5.9 Western Cape Province of South Africa

The Western Cape province of South Africa offers an example of good practice in management of rural roads on the continent. Situated in the south western corner of the continent, it is the fourth largest province in South Africa both in size and population. The province has a gravel road network of some 10,500 km[6]. The management of these roads is under the responsibility the Department of Transport and Public Works in the Government of the Western Cape. The provincial government recognises the importance of roads to support local economic development and the maintenance of roads receives high-level political support. The Department is well funded by regular allocations from the provincial treasury (annual budget R3.1 billion[7]). It has managed to retain a cadre of experienced and dedicated

[6] In addition to a paved road network of 7,000km. The Province also has about 15,000km of "other" roads with known locations but receive no regular attention from the Province.

[7] Currently equivalent to about US$200 million.

staff who operate in a business-like manner and share a vision to provide a world-class service to the public.

Road maintenance is guided by a strategic plan and programme of works for an annual and five year programme. A relatively sophisticated asset management system has been installed as an important tool for the road network managers. Road condition and traffic counts are collected routinely and stored in an Oracle database with all road assets spatially referenced and linked to display information through a GIS. Sources for gravel wearing course material are closely managed. Economic and preservation analyses are used to distribute the available funding to different major activities and to provisionally prioritise activities. Final prioritisation of periodic maintenance (reseals) is done in consultation with District Municipalities (DM). Regravelling, upgrading and rehabilitation priorities are determined in consultation with the DMs as well as communities. The system is managed by a team of project managers, district engineers and technicians each with a well-defined set of roles and responsibilities. Regular checks and evaluations of the programme are carried out with independent performance assessments.

The bulk of maintenance on the gravel road network is carried out by in-house force account units. It has been found that prices submitted by private contractors are competitive for routine maintenance works. The in-house units are also seen as an important training ground for staff. Capacity development of staff is an ongoing priority for the Department with technical staff encouraged to spend time on the roads.

5.10 Summary of Findings

The summary of country programmes for rural road maintenance is not exhaustive but provides a picture of the current situation prevailing in sub-Sahara Africa. Supplementary information obtained from Ghana and Sierra Leone presents similar trends. The conclusions are as follows:

- There are very few examples of sustainable rural road asset management programmes currently operational in sub-Sahara Africa; systems tend to be focussed on preparing and implementing an annual work programme rather than any longer term strategic plan.
- Governments still tend to pay more attention to construction of roads than maintenance; many countries have not yet developed a culture for maintenance.
- Funding for maintenance has improved in recent years with the establishment of road funds, but priority tends to be given to maintenance of the national trunk road networks. There is still a general lack of political will to provide funding for road maintenance.

- The improvement of funding is not always reflected in improved maintenance due to inefficiencies in the organisations responsible for organising maintenance, failure to utilise available resources in the most effective way, and lack of accountability.
- Political interference is common and invariably undermines the efficiency and effectiveness of sector organisations. Corruption is a significant factor affecting performance in the sector.
- Governments are grappling with their policies on decentralisation of road maintenance. Most countries are now following a policy of decentralisation of service delivery in key sectors, but the most effective rural roads maintenance programmes have been those that are managed centrally. The lack of clear policy on decentralisation results in unclear roles and responsibilities for sector institutions.
- Contracting out of road maintenance has not led to capacity development in the private sector. The small size of contracts is not attractive to bigger players and small firms cannot invest in staff development. The most effective rural roads maintenance programmes have been those that are implemented though force account.
- Where examples of good practice exist they tend to be on donor-funded programmes with high levels of technical assistance, but these initiatives tend to flounder when the donor support is withdrawn.

The Western Cape in South Africa offers a good example of a well-managed road network. The overall commitment to provide value to road users sets the tone and presents clear guidelines for the expected outputs. The system follows a well-planned and systematic approach that examines the technical and administrative requirements for the implementation of works. The road management team in the Western Cape uses sound engineering methods that yield good results. The system provides a good bench mark for improving maintenance regimes in other countries within and beyond Sub Saharan Africa.

6 Specification for Rural Road Asset Management

6.1 Introduction

The following is the first draft of the Specification for Rural Road Asset Management, which will be used by the participating road agencies to assess their own performance in asset management.

6.2 Definitions

A variety of organisations have defined asset management in general and road asset management in particular. Two useful ones for the consideration of a rural road asset management specification are those given by the British Standards Institution in its Publically Available Specification (PAS 55) on the management of all types of asset, and that defined in the International Asset Management Manual (IIMM, 2011).

PASS 55 defines asset management as (BSI 2004):

"Systematic and co-ordinated activities and practices through which an organisation optimally manages its physical assets, and their associated performance, risk and expenditures over their life-cycle for the purposes of achieving its organisational strategic plan."

Accordingly PASS 55 describes a holistic approach which recognises the linkages between asset management activities and practices, the performance of the assets and the strategic plan of the organisation (i.e. the road administration).

IIMM (2011) also recognises the need to associate asset management with performance and business practices, but perhaps gives more emphasis to the stakeholder and considers sustainability in its description of the objective of asset management:

"The objective of asset management is to meet a required level of service, in the most cost effective manner, through the management of asset for present and future customers".

From these definitions it is clear that a road asset management specification needs to consider the policy of the road administration (which in turn should consider government policy), customer needs through defined levels of service for road assets, the resources (physical and human), processes and tools required (and available) to monitor and meet these levels of service, and mechanisms for planning for the future and for dealing with unexpected impacts on the road infrastructure.

6.3 Basic and advanced asset management

Road asset management can be considered in terms of basic and advanced activities. Basic road asset management is associated with meeting minimum statutory obligations and

organisational requirements for financial planning and reporting. It requires (Robinson, 2008):

- Identifying levels of service (which should be linked to policy)
- Predicting demand (i.e. levels of non-vehicular and vehicular traffic and associated axle loads)
- Assessing condition and monitoring performance
- Maintenance and its management
- Financial management
- Preparing an asset management plan (for incremental improvement)

Advanced asset management builds on basic asset management and aims to optimise activities and programmes to realise levels of service. The advanced approach therefore requires a refined approach which incorporates a more sophisticated analysis of current and future asset condition and performance, considering total transport life-cycle costs, customer expectations, the environment, current and future demand, risks, treatment options and asset value among others. Advanced asset management may therefore be seen to require more detailed datasets with a higher degree of granularity and basic asset management. In addition to the basic requirements mentioned above, advance asset management also requires (IIMM, 2011 and Robinson, 2008):

- Failure mode analysis
- Risk assessment and management
- Demand management
- Optimised decision making (including consideration of social, political, environmental and economic costs)
- Valuation

For rural road asset management it may be considered sufficient for a road administration to seek to achieve some level of basic asset management.

6.4 Asset Management and Business Processes

Rural road asset management is associated with the physical road infrastructure and it therefore needs to be considered within the context of the road administration's wider activities. It should support and be consistent with the administration's management systems for human, knowledge, financial and intangible assets, and road asset management policies and strategies for rural roads should be a holistic component of the administration's corporate policies and strategies. Accordingly, rural road asset management should be fully integrated within the road administration's management activities and should provide a mechanism for realising the administration's goals in the context of the rural road physical infrastructure (Robinson, 2008).

Road asset management can be seen to operate at three levels, strategic (planning), tactical (programming) and operational (preparation and operations management) (Robinson, 2008). Figure 1 shows how a road administration's policy and strategy can be realised at the three levels of management, together with the associated management activities, the information systems that may be used to support these activities and the associated data requirements. At the strategic level of management the road administration's vision and mission are expressed in the corporate plan as part of strategic planning activities. These can be supported by strategic, or network level, planning tools which utilize summary data to determine, for example, current and future funding requirements to achieve the administration's vision associated with its road infrastructure. Vision and mission statements need to be translated to objectives and performance indicators at the tactical level of management and are expressed via a business plan. The associated road asset management activities can be supported using network to project level tools, using data at an appropriate level, which help to manage the process of ensuring that strategic targets for road network performance are realised at the operational level. In terms of policy, operational management is associated with defining standards and intervention levels for road asset condition. Strategies are developed, by using these to assess road asset condition at the project level via an operational plan supported by project level management tools which make use of detailed comprehensive data sets to plan physical maintenance, renewal and development work activities. Figure 1 also depicts the physical works and other operational activities which realise the management aspects described.

6.5 Determining an appropriate specification

IIMM (2011) defines 17 asset management activities which considered together enable holistic asset management. For each management activity IIMM (2011) introduces the concept of a Maturity Index by which an organisation's level of asset management can be assessed according to one of four levels, "minimum", "core", "intermediate (defined as "mature" herein) and "advanced". The maturity index, taking into consideration the definitions of basic and advance road asset management above, has been refined herein and used as a framework to develop a specific specification for rural road asset management. The guidelines described in IIMM (2011) have been embellished and tailored for rural roads using a variety of sources including three Overseas Road Notes (ORNs), namely ORN 1 (TRRL, 1987), ORN 7 (TRL, 1988) and ORN 20 (TRL, 2003). Other references used for this purpose include Robinson (2008), and Eaton and Beaucham (1992). The framework is presented in Table 1 below. All four levels of maturity are shown in Table 1, however it is likely that a rural road administration could reasonably be expected to reach the "core" level. A number of activities defined in IIMM (2011) have not been included for simplification. One activity, "Service Delivery Mechanisms" has been included, however it is recognised that in the final version of this specification it may be excluded since it has the potential to add confusion.

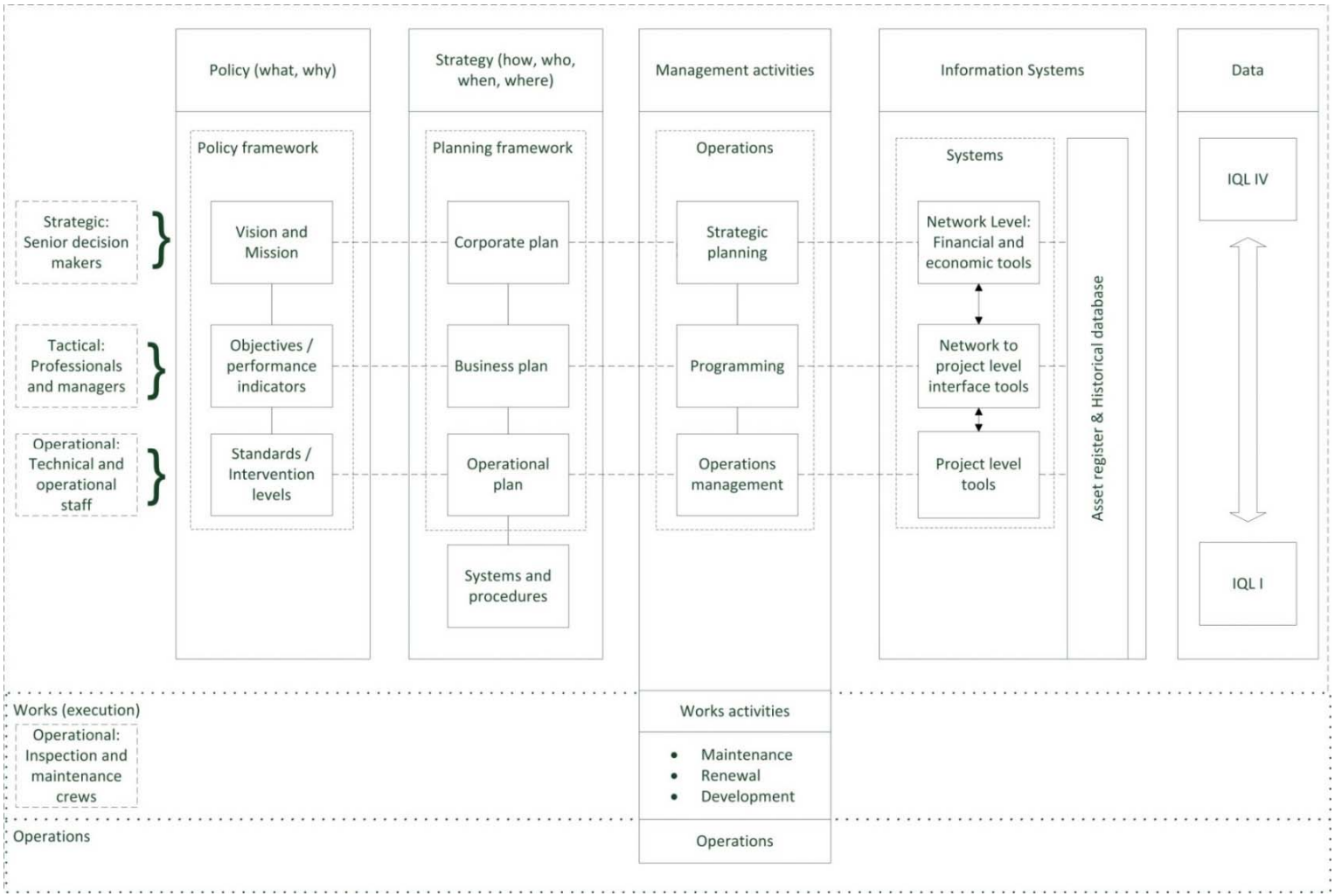

Figure 1: Road asset management framework (adapted from Robinson, 2008)

Table 1: Rural Road Asset Management Specification (adapted from IIMM, 2011)

Level of maturity					
Item (IIMM ref)[8]	**Component**	**Minimum**	**Core**	**Mature**	**Advanced**
1 (2.1)	AM Policy Development	Informal expression of road administration expectations regarding AM Policy	Defined policy statements for all significant AM activities including: Operations, maintenance (incl. inspections), renewal, development (constructions) and disposal (decommissioning). Clear linkages to road administration goals Policy supported by high level action plans with defined responsibilities for delivery.	AM Policy and Strategy reviewed and adopted annually by an Executive Team. Expectations of each activity area defined with detailed action plans, resources, responsibilities and time frames.	AM Policy and Strategy fully integrated into the road organisation's business processes and subject to annual audit, review and updating procedures.
2 (2.2)	Levels of service and performance management	Contribution of the road network to road administration's objectives defined. Basic levels of service with respect to World Bank's Rural Access Index (RAI)[i] have been defined. World Bank Information Quality Level (IQL) IV[ii]	Customer Groups defined and requirements informally understood Levels of service and associated performance measures for: o RAI o Road Condition Index RCI (for engineered earth, gravel and sealed roads; e.g. % of roads above a threshold) (See item 5)	Customer Group needs analysed Costs to deliver alternative key levels of service assessed. Customers are consulted on RAI and RCI levels of service and options.	Levels of service consultation strategy developed and implemented. Technical and customer levels of service are integral to decision making and business planning.

8 IAMM – Reference to relevant section in the Infrastructure Asset Management Manual (IAMM, 2011)

			o Annual reporting against performance targets for RAI and RCI (IQL III)		
3 (2.3)	Demand Forecasting	Basic forecast of traffic demand (vehicles per day) on a Route basis (i.e. roads between centres of population), based on a moving- observer count method measuring traffic, experienced staff predictions, with consideration of known past demand trends and likely future growth patterns. IQL IV	Traffic demand to be broken down in terms of heavy vehicles/ non-heavy vehicles. Forecasts based on traffic counts carried out within the last 5 years and on robust projection of a primary demand factor (e.g. GDP, changes in land use). IQL III	Traffic demand forecasts on a section basis and based on mathematical analysis of historical trends and primary demand factors (country GDP and significant changes in land use within road catchment). IQL II	As for "mature" plus risk assessment of different demand scenarios. IQL I
4 (2.4)	Asset Register Data	Basic road inventory system consisting of: Basic network referencing system based on the basis of Routes (i.e. length of road between centres of population, to the nearest km) Item inventory recording Basic road surface type (earth, gravel or sealed) by Route and length within each Route(to nearest km) Number and location of bridges (referenced in terms of the Route) Information stored in a spreadsheet	As for Minimum plus: Referencing system has greater granularity on the basis of carriageway Sections which have homogenous characteristics (1 km lengths) with respect to traffic, construction type (earth, gravel, sealed), environment (rainfall, vertical profile) Road classification system in place (e.g. A, B, E roads) Expected service life of basic asset types known (to the nearest year) Replacement cost of principal assets known (carriageway (including shoulders), bridges, culverts, drains)	As for Core plus: Referencing system based on sub-sections (homogenous sections of 200 m lengths) Item inventory records soil, gravel and seal types (e.g. cinder gravel, Otta seal). Established system of systematic and documented road condition data collection in place for all principal assets (see Item 5) on a sub-section basis. Traffic survey on the basis of Routes every 5 yrs, updated as described in Item 3.	As for Core plus: GPS based referencing system. Probabilistic deterioration models for carriageway, bridges and culverts. Information on maintenance / renewal history (type and cost) / construction records Complete database for principal assets; minimal assumption for non-principal assets IQL I data

		May be based on broad assumptions or incomplete data (data reliability "D", see [iii]). The concept of data confidence[iii] (reliability and accuracy) has been developed and is used to classify data. IQL IV data	IQL III data	High level of confidence in inventory and condition data for principal assets (carriageway, bridges, culverts, drains) data Data to IQL II-III	
5 (2.5)	Asset Condition Assessment	Condition assessment at route level via visual inspection. Data reported in terms of good, fair, poor. Assessment required for carriageway and bridges Pavement strength to be inferred from visual assessment condition data. Senior / experienced staff judgement to decide good, fair and poor levels for each principal asset type IQL IV	Condition assessment programme in place for principal assets (carriageway, shoulders, bridges, culverts, side drains) by homogenous Section asset group. Based on Coarse Visual Inspection (CVI)[iv], via windscreen survey in a slow moving vehicle for sealed roads. Unsealed Road Condition Index (URCI)[v] for engineered earth & gravel roads For gravel roads, gravel loss is estimated from historical records Summary pavement strength index (1 to 5) determined from construction records. Frequency of inspection determined as a function of road classification (see item 4). Assets to be ranked on a scale of 1 (= poor) to 5 (= good). Ratings to be based	All inspections to be on a sub-section basis. Frequency of all surveys to be associated with road classification (see item 4). Windscreen survey of all earth and gravel roads following routine maintenance (visual survey at IQL-II/III) to determine condition as follows: Earth & gravel roads, as for "Core". For gravel roads, measurement of gravel loss Detailed Visual Inspection (DVI)[vi] of sealed roads. Carriageway deflection using non-destructive methods to determine summary data for individual pavement layers (via e.g. Falling Weight	As for Mature, with the following modifications Earth and roads, as for "Mature" but also to include measurement of roughness (IRI) Sealed roads as for "Mature", but also to include roughness (IRI) and deflection measurements to obtain detailed data for individual pavement layers (FWD,). Frequency of condition measurement to be determined as a function of road class and pavement design life. In addition to general visual inspection of bridges and culverts, routine major inspections should take place every 3 years (or following floods). These should provide more detailed reports (IQL 1) of bridge and culvert condition.

			on defined standards (e.g. ORN1 (TRL, 1987)). Data management standards and process documented. Programme for data improvement developed. IQL III	Deflectometer (FWD), Benkleman beam), or via field shear test (e.g. Cone Penetrometer) Inspection of shoulder condition (rating 1 to 5) Shoulder condition (rating of 1 to 5) Routine general visual inspection of bridges and culverts annually (following ORN 7 (TRL, 1988)) to determine provision of drainage/blockage, condition of surface, parapets, railings and guard rails, expansion joints (if they occur), main beams, girders, trusses and bracings, abutments, wing walls and retaining walls. Embankments and fill in front of embankments should also be inspected. Visual side drain integrity (rating of 1 to 5). All inspection frequencies to be determined as a function of road classification or traffic. Data management processes fully integrated into business processes Data validation processes in place IQL II-III	Reviews of programme suitability carried out every 3-5 years. IQL I

6(3.1)	Decision Making	AM decisions based mainly on staff judgement and agreed road administration priorities	For major projects and programmes formal decision making techniques, based on multi-criteria analysis (i.e. consideration of economic, social and environmental costs and benefits) are used including; Upgrading the road network (e.g. upgrading earth roads to gravel roads) Carriageway reconstruction schemes	Formal decision making and prioritisation techniques are applied to all maintenance (see item 9) and capital principal asset programmes within each main budget category. Principal assumptions and estimates are tested for sensitivity to results	As for Mature, however the framework allows for maintenance, renewal and upgrading projects to be optimised across all activity areas. Formal risk based sensitivity analysis is carried out.
7(3.2)	Operational Planning	Operational responses to emergency related closure of roads or bridges resulting from traffics accidents or force majeure are understood by road administration staff, but plans may not be well documented and are mainly reactive in nature. Traffic is measured for some routes by is not routinely analysed.	Emergency response plan is developed for closure of principal assets. Demand management is considered for road sections where overloading is a problem. Asset utilization (traffic) is measured on a Section basis	Emergency response plan is updated every 3 years. Safety of infrastructure in relation to traffic assessed, including black spot analysis, remedial works design and layout and traffic management measures. Environmental impact of roads assessed including noise pollution and chemical pollution in surface water running from roads Asset utilization is measured for roads and bridges on a sub-section basis.	Operational plans analysed, tested and improved every 3 years. Formal debriefs to appropriate staff occur after severe damage to road (e.g. washout) or bridge (e.g. traffic strike) Asset utilization efficiency (traffic divided by capacity) is analysed annually for all principal assets. Road use costs are assessed and for a variety of road users Operational programmes are analysed using cost-benefit analysis techniques.
8 (3.3)	Maintenance Planning	An understanding of how asset functions relate to organizational objectives. Compliant with legislation and regulations	Maintenance prioritized according to road classification and safety requirements Asset condition used to identify and prioritize maintenance of principal assets	Periodic maintenance interventional levels for strengthening of sealed roads to be determined by cost benefit analysis as a function of traffic levels, construction type and environment (rainfall, longitudinal gradient)	Periodic maintenance interventional levels for gravel roads (regrading) and sealed roads (resealing) established by multi-criteria analysis , which considers economic, social and environmental costs and benefits, as a function of traffic levels, construction type and

		Maintenance records kept	in danger of collapse (primarily bridges and culverts). Strategy for routine maintenance of assets established Earth & gravel roads (grading) Sealed roads (patching and crack sealing) Culverts (cleaning & debris removal) Side drains (cleaning & debris removal) Strategy for periodic maintenance of gravel (grading) & sealed roads (re-sealing) and bridges developed. Maintenance objectives with respect to principal assets established and measured	Maintenance prioritisation a function of traffic levels and weighted level of defectiveness Major failure modes of all principal assets understood Maintenance planning software implemented	environment (see for example Integrated Rural Accessibility Planning[vii] in Road Note 20) Multi criteria analysis used to prioritise maintenance of principal assets Root cause analysis for major recurring faults in principal assets Procurement models fully explored
9 (3.4)	Capital Works Planning	Schedule of proposed capital projects (and costs) in place based on staff judgement of future requirements, taking into consideration government policy and political drivers.	Projects have been identified using information from a wide range of sources including operational staff, estimates of service lives (see item 4), traffic demand modelling and accident analysis (see item 7). Capital projects for the next 2-5 years are fully scoped and costs estimated.	As for "Core", plus formal options analysis has been carried out for projects in the 3-5 year planning horizon. Major capital projects for the next 10 years are conceptually identified and broad multi-criteria socio-political-economic benefit estimates have been carried out.	Long term capital investment programmes are developed using advanced decision making techniques.
10 (3.5)	Financial and Funding Strategies	Principal assets re-valued in compliance with financial reporting and accounting standards / requirements.	10+ yr financial forecasts based on current AMP outputs	10+ yr financial forecasts based on current comprehensive AMPs with detailed supporting assumptions	10+ yr financial forecasts based on current comprehensive advanced AMPs with detailed supporting assumptions and high confidence in accuracy

		10 year financial forecasts based on extrapolation of past trends and broad assumptions about the future.	Significant assumptions are specific and well-reasoned. Expenditure captured at a level suitable for strategic AM planning	Significant assumptions are specific and well reasoned. Expenditure captured at a level suitable for tactical AM programming. Financial modelling provides sensitivity analysis by principal homogenous asset group for expenditure as a function of the provision of level of service (RAI and ride quality (IRI)	Advance financial modelling provides sensitivity analysis, demonstrable whole life costing and cost analysis for level of service options (RAI and ride quality (IRI)).
11 (4.1)	AM Teams	AM allocated to one or two dedicated members of staff who have appropriate experience.	Coordination of different AM roles across the road administration occurs through a Steering Group or Committee (see Figure 1). AM training occurs for primary staff. The executive team have considered options for AM functions and structures.	All staff in the organisation understand their roles in AM, it is defined in their job descriptions, and they receive appropriate training. Dedicated roles prescribed for strategic AM planning (senior decision makers), tactical AM planning (professionals and managers) and operational (technical & operational staff) (see Figure 1).	A formal AM capacity building programme is in place and routinely monitored. AM structure (see Figure 1) has been formally reviewed.
12 (4.2)	AM Plans	Plan contains basic information on assets, service levels, planned works and financial forecasts (5-10 yrs and future improvements. IQL IV	As for Minimum plus executive summary, description of services and principal assets, top down condition and performance description, future demand forecasts, description of AM processes; 10 year financial forecast, 2 year AM improvement plan IQL III-IV	As for Core, plus analysis of asset condition and performance trends (past/ future), effective road user engagement in setting levels of service. IQL II-III	As for Mature, plus evidence of programmes driven by comprehensive ODM techniques and level of service / cost trade off analysis. Improvement programmes largely complete with focus on ongoing maintenance of current practice. IQL I-II

13 (4.3)	Information Systems	Asset register in place which can record core attributes of principal assets as described under item 4.1 Data to IQL IV	Asset register in place which can record attributes of principal assets as described under item 4.2 Road user request tracking and planned maintenance functionality enabled System enables manual reports for valuation, renewal forecasting Compatible with Programming level management and with data to IQL III	More automated analysis reporting on a wider range of information including as described under item 4.3 Key operations, scheduled maintenance prioritised, backlog maintenance requirements, unplanned maintenance and condition and performance information held. IQL II	Strategic planning, programming, preparation and operations management functionality fully integrated. Economic, financial, principal asset and road user service systems fully integrated all advanced AM functions are enabled.
14 (4.4)	Service Delivery Mechanisms	Service delivery roles clearly allocated (internal and external) generally following historic approaches. Roads managed and financed by a national body or traditional district council. Roads typically looked after by the district works department and are financed through the district council budget (local revenues, plus grants from central government).	Roads managed and financed by a central government roads department. Roads are looked after by a special-purpose rural roads department (i.e., either a free-standing central government department or part of a central local government department). Roads are financed through the central government budget and the staff form part of the national civil service. Some contracts in place for external provision. Core functions outlined.	Internal service level agreements in place with internal service providers. Contracting approaches for road maintenance reviewed to identify best delivery mechanism Tendering/ contracting policy in place Competitive tendering practices applied Funds typically come through the ministry of local government.	All potential service delivery mechanisms reviewed and formal analysis carried out Risks, benefits and costs of various outsourcing options are considered, including contracting out of management and maintenance of roads. Funds typically come from a national road fund,

Notes

(i) Rural Access Index

Rural Access Index (RAI) was developed by the World Bank and measures the rural population who live within 2 kms (20-25 minutes of walking time) from an all season road as a proportion of the total rural population. It is designed to be a metric which demonstrates (and measures) the vital importance of access in poverty reduction, and was developed to inform policies and strategies so that development considers the needs, equitably, of the rural population (Roberts et al., 2004).

(ii) Information Quality Levels

The concept of Information quality levels (IQLs) was introduced by the World Bank to assist with determining the appropriate level of data detail to be used for road management. The IQL concept recognises that the level of data required for management depends on the management function for which it will be used. As the management process moves from strategic planning through programming and preparation to operations the resolution of the data required increases, albeit the extent of its network coverage decreases. Accordingly, the IQL concept defines the appropriate quality of the information that each management activity requires (Patterson and Scullion, 1990). Such an approach provides a framework for the collection and use of appropriate data in a consistent manner and helps to ensure that only the required amount of data is obtained to make appropriate decisions for a particular level of management (Robinson, 2008). Table 2 describes the four IQLs and the associated data collection characteristics.

Table 2: Information Quality Levels (after Robinson, 2008)

Information quality level (IQL)	Description	Data collection
IQL – I	• Most detailed and comprehensive • Mainly used for research programmes	• Short lengths or isolated samples measured using specialised equipment • Tends to be slow
IQL – II	• Detailed • Typically used for o Project design o Supervision o testing	• Limited lengths using semi-automated methods • Full network coverage is possible using advanced automation at high speed
IQL – III	• Summary details and categorised or aggregated values • Typically used for o Programming and budget preparation o Preliminary design	• Full coverage of network using high-speed low-accuracy, semi-automated methods • Network sampled manually at slow speed • Processed from other data
IQL - IV	• Most summary coarse • Typically used for o Strategic planning o Network statistics	• Full coverage of network using • Manual (windshield survey at medium speed • Low accuracy, semi-automated methods

		• Processed form other data

(iii) Data Confidence

A data confidence grading system such as that described in the IIMM and shown in Table 3 can be used to describe data accuracy and confidence (IIMM, 2011).

Table 3: Information Quality Levels (IIMM, 2011)

Confidence Grade	Description
A Highly reliable	Data based on sound records, procedure, investigations and analysis, documented properly and recognised as the best method of assessment. Method of data capture fully repeatable and reproducible. Dataset complete and estimated to be accurate ±2%
B Reliable	Data based on sound records, procedure, investigations and analysis, documented properly but has minor shortcomings, for example some data is old, some documentation is missing and/or reliance is placed on unconfirmed reports or some extrapolation. Method(s) of data capture are repeatable and reproducible. Dataset is complete and estimated to be accurate ±25%
C. Uncertain	Data based on sound records, procedure, investigations and analysis which are incomplete or unsupported, or extrapolated from a limited sample for which grade A or grade B data are available. Dataset is substantially completed but up to 50% is extrapolated data and accuracy is estimated ±40%
D Very uncertain	Data based on unconfirmed verbal reports and/or cursory inspection and analysis. Datasets may not be fully complete and most data is estimated or extrapolated. Accuracy ±40%
E Unknown	None or very little data held.

(iv) Coarse Visual Inspection (CVI)

The Coarse Visual Inspection (CVI) is a UK Pavement Management System (UKPMS) defined inspection procedure for road pavement surfaces (UKPMS, 2008a). The procedure is designed to be undertaken from a slow moving vehicle and records visual information associated with the length defect edge defects, kerb defects, off-carriageway defects, longitudinal and transverse joint defectiveness (where appropriate), lane length defects carriageway, major cracking, rutting, count defects transverse cracks and transverse joint defectiveness.

(v) Unsurfaced Road Condition Index (URCI)

The URCI is based on the visual assessment of seven distress types which commonly occur on unsurfaced roads (Eaton and Beaucham, 1992). It has been developed by the U.S. Army Corps of Engineers as means to assess the overall condition of unsurfaced roads, determine maintenance and renewal requirements and prioritise road sections requiring treatment. The distress types considered, measured using a low, medium, high rating, are:

- The road cross section (in terms of water ponding on the road surface)

- Drainage (in terms of water and vegetation in side drains)
- Corrugation (as a function of the depth of corrugation)
- Dust (in relation to an estimate of the severity of dust cloud thrown up by a passing vehicle)
- Potholes (in terms of depth and diameter)
- Ruts (as a function of the depth of ruts)
- Loose aggregates (the size and volume of loose aggregates occurring on carriageway and shoulder).

(vi) Detailed Visual Inspection (DVI)

The UKPMS Detailed Visual Inspection (DVI) records measured areas or lengths for a wider range of more closely defined defects (than for CVI), aggregated within short sub-sections. The DVI is intended to be used where more detailed information is required to support and validate treatment decisions and scheme identification. Distress types considered include wheel track cracking, carriageway cracking, chip loss, fretting, fatting, subsidence, rutting, transverse/ reflection cracking, edge deterioration, block deterioration, joint deterioration and seal deterioration (UKPMS, 2009b).

(vii) Integrated Rural Accessibility Planning (IRAP)

IRAP is a planning tool which can be used to prioritise rural investment by taking into account the requirements of rural households (TRL, 2003). Such needs include access to facilities such as health services, markets, water supply, schools etc. One aspect of IRAP, the prioritization procedure can be used to prioritise rural road maintenance expenditure and is a function of socio-economic benefit (determined from a simple rating system) by the costs of the road scheme.

7 Measurement of Road Condition

7.1 Introduction

It has now been generally accepted that roads are assets and they should be considered in the same manner as other traditionally visible assets such as equipment, plant, buildings, large dams, etc. Efficient and effective management of road assets is of fundamental importance to achieve the planned outputs of road authorities or agencies. The benefits will eventually accrue to the road users and the general economy.

Significant efforts have been made to develop appropriate road asset performance indicators that assist decision makers at various levels. Ultimately the trends in the indicators over time can be used to assess the effectiveness of policy as they measure impacts, outputs and outcomes relating to decisions made. They help to quantify the degree to which objectives have been achieved, and to identify any constraints that are impeding the achievement of objectives [Robinson, 1998].

It is now common practice in functioning and well developed road authorities or agencies to define the required level of service for the different classes of roads under their jurisdiction. For gravel roads the following service level criteria are used: road usability, average travel speed, road user comfort and durability. Compliance targets, methods of measurement and monitoring frequency are then set and agreed upon.

For gravel roads, compliance criteria can be based on: interruption to traffic, average speed, rut depths, corrugation amplitude, roughness, degradations of road surface, gravel loss, condition of road signage, vegetation height, usable road width, drainage, etc.

7.2 Purpose

Condition monitoring and asset valuation as a component of the project will provide a non-subjective indicator of performance of the participating road agencies. It will also contribute to the quantification of economic and social benefits that will accrue to local communities as a result of improved performance in road asset management.

7.3 Objective

Over many years various tools have been developed to measure the condition of all classes of roads. The emphasis has been to move towards automation of data collection and analysis and this has resulted in highly sophisticated tools which on the whole are very expensive to procure and operate, especially for road authorities or agencies in Africa. Hence, whilst benefiting from the elaborate systems developed to date, the objective of this component of the project is to develop simple and appropriate tools for road condition data collection and analysis for use in generating selected performance indicators.

7.4 Methodology

For this component of the project the following specific activities will be undertaken:

- Review of literature on research and development work already done on asset management frameworks and systems in Africa and worldwide.
- Develop a simple and appropriate method of determining the asset value of a road network, with the following physical components to be valued: roadway, earthworks, gravel, culverts, bridges, road signs, ancilliaries such as guardrails.
- Propose components of asset management reports that will appeal to most stakeholders including: politicians, communities, management, technocrats and operational personnel.
- Select service level criteria to be considered for adoption for monitoring the performance of gravel roads, with the following will be considered: roughness, passability, travel speed, gravel thickness, usable road width, vegetation encroachment, condition of drainage facilities.
- Review simple technology options for collecting road condition data, including using mobile phones and GPS devices,
- Prepare a methodology for collecting data in the field, including preliminary guidelines for the operation of the selected equipment.
- Develop or select appropriate computerized methods (Excel macros, algorithms, mapping, etc) for data analysis.
- Field testing and calibration of the system under a range of road conditions including variable terrain, higher and lower traffic roads etc.
- Analysis of data collected in the field and finalisation of selection of service level criteria to be adopted.
- Preparing recommendations for adoption of the system on a wider scale and/or areas for further research.

8 Monitoring Economic and Social Impacts of Rural Roads

8.1 Introduction

Poor access is a major constraint to economic growth in Sub-Saharan Africa (SSA). According to Rural Access Index (RAI) global tables, World Bank 2007, just about 35% of rural population in SSA live within 2 kilometres of an all-season road. Decision making for investment in rural areas (in agriculture and other economic activities) depends on whether the place is accessible or not. Poor quality rural roads influence production costs upwards by constraining availability of inputs, as well as limiting supply of transport as a result of increased vehicle operating costs and consequently transportation costs. This results in lowering of revenues and profits for locally produced goods thus perpetuating economic decline and poverty. On the other hand efficient and reliable rural transport infrastructure (rural roads, tracks, footpaths) and services have a positive impact on economic and social wellbeing of communities. Good roads improve conditions for economic growth by lowering transport costs and enabling mobility of people and goods, as well as improving access to social and economic opportunities, e.g. employment.

A study in Uganda estimated that spending US$10,000 (2013 prices) on rural roads would lift 261 people out of poverty. Furthermore, improving existing accessible roads can lead to up to 50% reduction in transport tariffs. Improved rural roads were estimated to lead to a 27% increase in agricultural output in Ethiopia (Hine et al, 2015a).

Based on the fact that a significant proportion of rural population in SSA is engaged in agriculture, improving rural roads plays a major role in facilitating bulk transportation of farm produce by truck in order to gain from the economies of scale. From the AFCAP funded study on ‘Overcoming the First Mile’ , the analysis of modal differences in transport costs revealed that in Kenya back-loading costs 16 times as much per km as movement by truck. In Tanzania head/back-loading costs 23 times as much per km as movement by truck. The study concluded that, to overcome the challenges there are huge opportunities to raise farmers’ incomes by a substantial amount if commodities can be loaded on to a truck close to the harvest location and take the produce directly to market, if farmers work together to achieve load consolidation (Hine et al, 2015b).

The level of accessibility and mobility in/and to an area also influences social and welfare status of a community. For example, poor access to education or health services constrains opportunities for local communities, and especially women to gain education and skills that are necessary for socioeconomic advancement. Nevertheless there is need for further research for evidence to substantiate the economic and social impacts of rural roads improvement and effective road asset management.

8.2 Study Approach

This part of the study phase is intended to define an approach for measurement of economic and social impacts of rural roads improvement. The process will be undertaken in close collaboration with participating countries in order to tap into/and match with available and potential capacities for impact evaluation in these countries. It will require definition of appropriate performance indicators, and the method of collecting the required data to gauge the performance of rural roads network condition on the rural economy and social welfare.

Purpose: To achieve economic and social benefits for local communities in rural areas as a result of improved performance in road asset management.

Specific objective: Develop simple indicators of economic and social impact of rural roads and monitor them in the project areas.

Key elements of the study component are:

- General framework for evaluating social and economic impacts of rural roads will be aligned with respective government policies, strategies and development objectives for rural roads and related transport in participating countries. This will enable results to contribute in future development planning and investment decisions for rural roads. A common platform of selected key indicators relevant for all participating countries will be sought to enable comparison of socioeconomic impacts of rural roads among countries, as well as to align with Sustainable Development Goals (SDG) targets for rural access and mobility. In this respect it will be possible to measure on a periodic basis how rural roads in various countries are contributing to the achievement of SDGs.
- Definition of appropriate performance indicators and targets for economic and social impact of rural roads. These will include output indicators (e.g. length of rural road improved) and outcome indicators (condition/level of service) that are directly related to road network performance. Others are transport related indicators, e.g. vehicle operating costs, availability of/and change in transport modes, availability of public transport and usage, transport time, fares on public transport, freight transport cost. For comparison, specific social and economic indicators will be defined in connection with project areas and communities that will be directly served by improved road network. Economic indicators will include agricultural transport costs (per ton-km), extent of damage of goods being transported on the road, employment opportunities, and others for key economic activities in specific areas. One could also consider post-harvest losses against what is produced to establish relationship with road condition. Unless resources and time permit, measurement of income indicators will be outside the scope of this study. Social indicators will include access to education (e.g. school enrolment and attendance), access to/and use of health facilities, and availability of emergency transport.

- Definition of data requirements for each indicator and the method of data collection, e.g. surveys, traffic counts, focus group discussions, etc. In order to establish the baseline situation for assessing the socio-economic impacts of road improvement the study will rely on both primary sources and historical /secondary baseline data. The search and analysis of impacts of road condition improvement will be conducted in the road project area, with the local communities and others (e.g. transporters) that are likely to be influenced directly by road improvement. The road's zone of influence for data collection purposes will be clearly defined. It is possible to demarcate a catchment area as a zone of influence, e.g. 2 ~ 5km from the road. Notably, a rural road's improvement can have multiplier effects or impacts beyond the intended locality or zone of influence. However, projects have to be followed long enough to allow robust measurement of such impacts, which cannot be guaranteed within the scope of this study.
- Definition of appropriate analysis framework for social and economic impacts of rural roads. Simple cross-sectional approaches that can be understood and handled by the local counterparts in participating countries will be used as the method of analysis of socio-economic impacts of road improvements. The study will address mainly the short-term and intermediate impacts, as it can be difficult to determine the nature of long-term impacts of rural roads improvement, some of which are likely to evolve with time. Particular reference will be made to Prof. Wynand Steyn's Caltrans project study that evaluated economic effect of road condition for tomato industry by determining the extent of damages and associated costs in relation to road roughness.

9 Country Selection

It was agreed during the Mobilisation Phase that all current AFCAP participating countries (including new entrants) will be eligible to participate in the project. The key criteria for participation are:

1. Commitment to provide the required resources and data in the project area;
2. Willingness to be open and transparent with the dissemination of the outcome of the periodic reviews of road agency performance.

It is recommended that the selection process should result in a reasonable geographical spread of countries in Sub-Sahara Africa. The selection should also include project areas with differing environments within which maintenance is carried out; albeit significant variation between countries is already inherent in existing arrangements.

A draft letter of invitation was prepared for the AFCAP PMU to send to each country. The draft letter solicits information concerning a rural road network proposed by the country to be included in the project and the capacity of the agency currently responsible for the network. The applicants would be required to state reasons why they believe their country, and the particular region, ought to be included in the project.

Subsequently the AFCAP PMU requested a summary of existing knowledge of rural roads asset management practice in African countries before deciding how to proceed with the country selection. This information is provided in this report. From our analysis there are no compelling reasons to select one country above another in terms of their current asset management practice. All countries that have been considered are at an early stage of adopting professional asset management systems, aside from South Africa. Therefore we confirm our recommendation that the AFCAP participating countries should all be given an opportunity to demonstrate their understanding of the project and their willingness to participate through an open invitation for proposals.

10 Log Frame Indicators

An initial assessment has been made of the likely contribution of the project to the ReCAP log frame indicators. This assessment is summarized in the Table 4. Milestone 2 will apply if the project is restricted to the current duration of 27 months. The achievement of the Milestone 3 targets assumes that the project timeframe will be extended.

Table 4: Summary of Log Frame Indicators and Targets

INDICATOR	Milestone 1 (July 2016)	Milestone 2 (July 2017)	Milestone 3 (July 2018)	Assumptions
Outcome Indicator 1				
SUSTAINABILITY: Partner Government and other financiers co-funding research with ReCAP. Contribution in kind (K) relates to funding of trial sections, staff time, to funding of research programme core costs, research contracts, dissemination and training. Core contributions (C) relates capacity building and knowledge management.	K = £10,000	K = £20,000	K = £30,000	Participating countries allocate two staff-months per annum to data collection plus vehicle and allowances
	C = 0	C = 0	C = 0	
Outcome Indicator 2				
Concrete examples of change (applied or formally adopted), influenced by ReCAP research that will be applied to km of road in focus countries. Note: km of road lifespan of ReCAP influenced incorporates road programmes that are planned and designed based on ReCAP guidelines. Implementation does not necessarily have to occur during lifespan of ReCAP.	0 km	600 km	1,200 km	Improved maintenance on (average) network of 400 km in 3 countries. Improvements on only 50% after first round of performance monitoring.
Outcome Indicator 3				
Number of citations in academic articles of ReCAP articles and/or working papers, conference papers etc.	2	4	6	2 papers at Mombasa conference and 4 in subsequent conferences.

INDICATOR	Milestone 1 (July 2016)	Milestone 2 (July 2017)	Milestone 3 (July 2018)	Assumptions
Output Indicator 1.1				
LVRR: Number of peer reviewed papers generated from ReCAP supported or related LVRR research projects made available in open access format.	2	4	6	2 papers at Mombasa conference and 4 in subsequent conferences.
Output Indicator 1.2				
TS: Number of peer reviewed papers generated from ReCAP supported or related transport services research projects made available in open access format.	0	1	2	Papers on economic indicators relates to transport services.
Output Indicator 1.3				
ENGINEERING Research: National policies, manuals and guidelines and document outputs fully incorporated into Government/Ministerial requirements, specifications and recommended good practice that have been modified or introduced as a result of ReCAP engineering research (including climate change adaptation and AFCAP and SEACAP adaptations)	0	1	3	Improved asset management practice adopted in 3 countries by 2018.
Output Indicator 1.4				
TRANSPORT SERVICES Research: National policies, regulations and/or practices for rural transport services modified or introduced as a result of ReCAP research (including road safety and gender and AFCAP and SEACAP research)	0	0	0	Currently not part of project objectives.
Output Indicator 1.5				
Cost Benefit Analysis conducted to determine cost effectiveness of the solutions proposed based	0	0	4	Cost benefit analysis carried out on maintenance

INDICATOR	Milestone 1 (July 2016)	Milestone 2 (July 2017)	Milestone 3 (July 2018)	Assumptions
on ReCAP research, conducted on a whole of life road cost basis.				investments in 4 countries.
Output Indicator 1.6				
LVRR and TS information generated for dissemination, and disseminated, that is not peer reviewed. Total to include research papers, final research reports, workshop reports, manuals and guidelines	4	8	12	Country performance reports prepared and disseminated locally and in PIT.

Output Indicator 2.1				
Research capacity: Proportion of research projects undertaken by country-based African/ Asian experts or institutions taking lead roles.	0.8	0.8	0.8	All researchers based in Africa except UoB staff.
Output Indicator 2.2				
Number of research projects managed through National Research Centres and supported by ReCAP funding for technical assistance and capacity building. Operational-initiating, carrying out and producing papers from research projects.	0	0	0	Links established to national research centres but not directly involved.
Output Indicator 2.3				
Number of research projects with female researcher inputs at senior technical level.	1	1	1	Min 2 females on research team.

Output Indicator 3.1				
Research centres in partner countries are linked to an electronic repository for rural transport knowledge.	0	0	0	Not part of project objectives.

INDICATOR	Milestone 1 (July 2016)	Milestone 2 (July 2017)	Milestone 3 (July 2018)	Assumptions
Output Indicator 3.2				
ReCAP generated knowledge presented and discussed at high level international development debates and conferences. Cumulative targets where high level = multilateral such as UN, IFIs, AU, ECOWAS, SAARC or other similar inter-ministerial level.	0	0	1	AFCAP PMU will identify appropriate forum.
Output Indicator 3.3				
ReCAP generated knowledge disseminated through dedicated training and workshops, virtually or physical, that are positively rated by participants. Cumulative number of workshops organised by ReCAP.	4	8	12	Workshops in each participating country and regional PIT meetings. Additional dissemination workshops at regional conferences.

11 Time Frame and Professional Team (Formulation Phase)

The consultancy contract signed by Roughton International Ltd is for the five month Formulation Phase. The implementation and ultimate expansion and roll-out of the project will depend on development of a viable project design. In particular the project can only proceed to implementation if there is a clear demand and commitment to participate by at least three AFCAP member states.

Key dates for the Formulation Phase are as follows:

- Submission of Inception Report: 23rd January 2016
- Team meeting in Dar es Salaam: 11th and 12th February 2016
- Submission of draft Design Report: 11th March 2016
- Participation in International Conference on Transport and Road Research: 15th to 17th March 2016
- Submission of Final Design Report: 23rd April 2016.

Changes were agreed to the research team during the Mobilisation Phase. The team members and their inputs for the Formulation Phase are summarised in Table 5.

Table 5: Professional Inputs for the Formulation Phase

Post	Expert	Input
Team Leader	Rob Geddes	1.6 months
Deputy Team Leader/ Social Development Adviser	Liezl Coetzee	0.6 months
Institutional and Financing Expert	Mike Pinard	0.8 months
Road Maintenance Expert and Trainer	Kingstone Gongera	1.8 months
Asset Management Expert	Michael Burrow	1.0 months
Road Condition Monitoring Expert	Charles Bopoto	1.2 months
Rural Transport Economist	Camilla Lema	1.0 month
Field Researchers (UoB PhD Students)	Robert Kakiiza (Uganda) Peter Kome (Sierra Leone) Dickson Ndlhovu (Zambia) Possible additions[9]: Adwoa Okyere (Ghana) Robert Ndumia (Kenya).	Will be consulted on project design issues.

[9] UoB has submitted a proposal to AFCAP PMU to include two additional PhD students in the project with matching funding from the university

Post	Expert	Input
Other Experts	Gerrie van Zyl Robert Petts Harold Bofinger Ramsey Neseyif Gumel Ghataora	1.0 months
Total		9.0 months

The work plan for the remainder of the Formulation Phase is summarised in Figure 2. All team members will provide input in their respective fields at each stage of the assignment.

Activity	Feb 2016				March 2016				April 2016			
Preparations for team meeting												
Team meeting in Dar es Salaam												
Preparation of draft Design Report												
International Conference on Transport and Road Research												
Preparation of Final Design Report												

Figure 2: Work Plan for Formulation Phase

Annex A: Attendance at Meeting held at the Western Cape Government Offices on 13th January 2016

Name	Position	Email
Les Sampson	ReCAP Infrastructure Research Manager	Les.sampson@cardno.uk.com
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