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## Establishment of a Road Research Centre in Mozambique / Recommendations on Institutional Structures for the Road Research centre

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January 2013

CONTRACT REF NO. AFCAP/MOZ/092/B



**This project was funded by the Africa Community Access Programme (AFCAP) which promotes safe and sustainable access to markets, healthcare, education, employment and social and political networks for rural communities in Africa.**

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This material has been funded by UKaid from the Department for International Development, however the views expressed do not necessarily reflect the department's or the managing agent's official policies.

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### Report summary

The Mozambican Roads Administration (ANE) has embarked on a project to establish a Road Research Centre (RRC) in Mozambique aiming to provide the basis for improving the long-term capacity to undertake relevant, high quality research relating to the road sector of Mozambique. This project forms part of the Africa Community Access Programme (AFCAP), which is a research programme supported by the Department of International Development (DFID) of the Government of the United Kingdom and managed by Crown Agents Ltd on behalf of DFID. CSIR, in association with LNEC has been commissioned by Crown Agents to provide Technical Assistance for phase 2 A of the project, which aims to address institutional issues relating to the RRC, draft a strategic research plan and develop a 5-year business plan for the RRC. In this report, appropriate institutional structures for undertaking research are presented. It addresses the following: (i) the Terms of Reference for a functioning Road Research Steering Committee (RRSC) and Road Research Technical Committee (RRTC), as well as an overview of the outcomes of the inaugural meetings of both of these committees; (ii) the institutional location of the RRC within the structures of ANE; (iii) the physical location of the RRC in Mozambique; (iv) laboratory support for a functioning RRC; and (v) Staffing of the RRC. All items, with the exception of the last item ("Staffing of the RRC"), have been discussed and agreed with ANE, and presented to the RRTC, whilst items (i) and (ii) have been endorsed by the RRSC.

## Table of Contents

List of Abbreviations	(iii)
List of Figures	(iv)
Abstract	(v)

## Page

<b>1. Introduction</b>	<b>1</b>
<b>2. Terms of Reference for a Functional Road Research Steering Committee and a Road Research Technical Committee</b>	<b>2</b>
2.1 Development of the Terms of Reference	2
2.2 First meeting of the RRSC	3
2.3 First meeting of the RRTC	7
<b>3. Institutional Location of the Road Research Centre</b>	<b>10</b>
3.1 Proposed Institutional Location of the RRC based on Prior Meetings and Workshops	10
3.2 Decision taken in January 2014	16
3.3 Recommendations on Institutional Location of the Road Research Centre	17
<b>4. Physical location of the Road Research Centre</b>	<b>19</b>
4.1 Final Report of Phase 1	19
4.2 Meetings held with ANE during November and December 2013	19
4.3 Advantages and disadvantages associated with the physical location of the RRC	19
4.4 Recommendations	20
<b>5. Laboratories Supporting the Activities of the Road Research Centre</b>	<b>21</b>
5.1 Synthesis of previous discussions and visits	21
5.2 Overview of Available Facilities for Use in a Research Environment	24
5.3 Critical Assessment of Current Facilities	25
5.4 Recommendations on the Physical Location of Laboratories	25
<b>6. Staffing of the Road Research Centre</b>	<b>26</b>
6.1 Introduction	26
6.2 Preliminary skills that might be required	26
6.3 Research Career Ladder	27
<b>7. Summary of Decisions Taken and Recommendations</b>	<b>28</b>

## Appendices

## Page

<b>Appendix A/Agenda for the Inaugural Meeting of the Road Research Steering Committee (RRSC)</b>	<b>29</b>
<b>Appendix B/Outline of the RRC Business and Research Plan</b>	<b>31</b>
<b>Appendix C/Agenda for the Inaugural Meeting of the Road Research Technical Committee (RRTC)</b>	<b>33</b>

## List of Abbreviations

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AFCAP	:	Africa Community Access Programme
ANE	:	Administração Nacional de Estradas
CBR	:	California Bearing Ratio
CSIR	:	Council for Scientific and Industrial Research
DFID	:	Department of International Development
DIAFI	:	Direcção de Administração e Finanças
DIMAN	:	Direcção de Manutenção
DIPLA	:	Direcção de Planificação
DIPRO	:	Direcção de Projectos
EU	:	European Union
FE	:	Fundo de Estradas
GIS	:	Geographic Information System
INATER	:	Instituto Nacional dos Transportes Terrestre
ISuTeC	:	Instituto Superior de Transportes e Comunicações
JICA	:	Japan International Cooperation Agency
LEM	:	Laboratório de Engenharia de Mozambique
LNEC	:	Laboratório Nacional de Engenharia Civil
MOPH	:	Ministry of Public Works and Housing
MoU	:	Memorandum of Understanding
R&D	:	Research and Development
RDI	:	Research, Development and Implementation
RRC	:	Road Research Centre
RRSC	:	Road Research Steering Committee
RRTC	:	Road Research Technical Committee
UCS	:	Unconfined Compressive Strength
UEM	:	Universidade Eduardo Mondlane

List of Figures	Page
Figure 1: Institutional location of the RRC under DIPRO	13
Figure 2: Institutional location of the RRC under DIMAN	14
Figure 3: Institutional location of the RRC as a cross-cutting entity	14
Figure 4: Recommended Institutional Structure for the RRC (version in Portuguese)	18

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## Abstract/

The Mozambican Roads Administration (ANE) has embarked on a project to establish a Road Research Centre (RRC) in Mozambique aiming to provide the basis for improving the long-term capacity to undertake relevant, high quality research relating to the road sector of Mozambique. This project forms part of the Africa Community Access Programme (AFCAP), which is a research programme supported by the Department of International Development (DFID) of the Government of the United Kingdom and managed by Crown Agents Ltd on behalf of DFID.

CSIR, in association with LNEC has been commissioned by Crown Agents to provide Technical Assistance for phase 2 A of the project, which aims to address institutional issues relating to the RRC, draft a strategic research plan and develop a 5-year business plan for the RRC.

In this report, appropriate institutional structures for undertaking research are presented. It addresses the following:

- i. The Terms of Reference for a functioning Road Research Steering Committee (RRSC) and Road Research Technical Committee (RRTC), as well as an overview of the outcomes of the inaugural meetings of both of these committees;
- ii. The institutional location of the RRC within the structures of ANE;
- iii. The physical location of the RRC in Mozambique;
- iv. Laboratory support for a functioning RRC; and
- v. Staffing of the RRC.

All items listed above, with the exception of the last item (“Staffing of the RRC”), have been discussed and agreed with ANE, and presented to the RRTC, whilst items (i) and (ii) have been endorsed by the RRSC.

## 1. Introduction

The Mozambican Roads Administration (ANE) has embarked on a project to establish a Road Research Centre (RRC) in Mozambique. This project forms part of the Africa Community Access Programme (AFCAP), which is a research programme supported by the Department of International Development (DFID) of the Government of the United Kingdom and managed by Crown Agents Ltd on behalf of DFID.

The overall objective of the project is to provide the basis for improving the long-term capacity in Mozambique to undertake relevant, high quality research relating to the road sector of Mozambique. CSIR in association with LNEC has been commissioned by Crown Agents to provide Technical Assistance for the Establishment of the RRC.

Phase 1 of this project, namely the *Development of Road Research Strategy* has been successfully completed. The objective of Phase 2 is to proceed with the establishment of the Road Research Centre.

Phase 2 consists of the following two sub-Phases:

- i. Phase 2A: To address institutional issues relating to the RRC, draft a strategic research plan and develop a 5-year business plan for the RRC;
- ii. Phase 2B: To establish the RRC, including its *capacitation* in terms of human resources, research infrastructure as well as the required supporting systems, and its *operationalization* in terms of human resource development and the activation of research projects, in line with the RRC business plan developed in Phase 2A.

In a previous report “Inception Report for Phase 2A”, submitted in November 2013, the general objectives of Phase 2 were outlined, as well as the specific objectives of Phase 2A.

In a subsequent report, issued in January 2014, an overview of previous and ongoing road/transport research in Mozambique was presented. This report also included a preliminary identification of research needs based on the analysis of feedback received on a research needs questionnaire distributed to relevant stakeholders.

In this report, appropriate institutional structures for undertaking research are presented. It addresses the following:

- i. The Terms of Reference for a functioning Road Research Steering Committee (RRSC) and Road Research Technical Committee (RRTC), as well as an overview of the outcomes of the inaugural meetings of both of these committees (Chapter 2);
- ii. The institutional location of the RRC within the structures of ANE (Chapter 3);
- iii. The physical location of the RRC in Mozambique (Chapter 4);
- iv. Laboratory support for a functioning RRC (Chapter 5); and
- v. Staffing of the RRC (Chapter 6)

All items listed above, with the exception of the last item (“Staffing of the RRC”), have been discussed and agreed with ANE, and presented to the RRTC, whilst items (i) and (ii) have been endorsed by the RRSC.

## **2. Terms of Reference for a Functional Road Research Steering Committee and a Road Research Technical Committee**

### **2.1 Development of the Terms of Reference**

#### **2.1.1 Road Research Steering Committee**

Meetings were held between ANE and the AFCAP Project Team during November and December 2013 to develop and agree on the Terms of Reference for the Road Research Steering Committee (RRSC).

The role and responsibilities of the RRSC would be to:

- Steer the establishment and operations of the RRC and assess the adoption of 'good governance' principles;
- Endorse priority research, development and implementation projects recommended by the RRTC and identify and/or endorse allocation of funding to projects;
- Support the appointment of project champions and teams;
- Provide overarching project management and output quality reviews;
- Monitor effective technology transfer and implementation of outcomes.

It was recommended that the RRSC should be convened at least once a year, but probably more frequently during the establishment phase of the Road Research Centre.

In December 2013, it was agreed that the RRSC should be constituted, and it was recommended that its membership should consist of senior representatives of the following organisations:

- ANE;
- LEM;
- the Roads Fund (FE);
- the Ministry of Public Works and Housing (MOPH);
- the Road Traffic and Safety Board (INATER);
- The Mozambican Council of Engineers; and
- Representatives of developing partners, such as the African Development Bank, the World Bank, the EU, JICA and DFID.

#### **2.1.2 Road Research Technical Committee**

Similar to the RRSC, meetings were held between ANE and the AFCAP Project Team during November and December 2013 to also develop and agree on the Terms of Reference for the Road Research Technical Committee (RRTC).

The role and responsibilities of the RRTC would be to:

- Advise on Research, Development and Implementation (RDI) needs and priorities;
- Assist with technology foresight studies;
- Advise on strategic plans and research portfolio plans for the RDI programme;
- Assist with project portfolio analysis;
- Assist in review of research proposals in line with the strategy;
- Assist in the review of outputs and outcomes of RDI projects;
- Assist in assessing the impact of RDI activities.



It was recommended that the RRTC should be convened at least twice a year, but probably more frequently during the establishment phase of the RRC.

In December 2013, it was agreed that the RRTC should be constituted. It was recommended that its membership should consist of the following individuals and representatives of organisations:

- RRC Director (once appointed);
- Carlos Quadros;
- Fernando Leite;
- ANE Directors of DIPRO and DIMAN;
- LEM;
- Victor Rangel of COTOP;
- Calado Ouana of ANE;
- Representative of the cement industry;
- Adeline Serage of Road safety;
- Eugenio Abubakar of Ceta;
- Representative of the Ministry of Public Works and Housing;
- Representatives of the Municipalities of Maputo and Beira; and
- Provincial representatives.

It was also agreed that the first meeting of the RRTC will be held in January 2014.

## 2.2 First meeting of the RRSC

The first meeting of the RRSC was held on 30 January 2014, one day after the first meeting of the Road Research Technical Committee (RRTC) was held. The meeting was attended by the following Committee members representing their organisations:

Name	Title	Organisation
Atanasio Mugonhe	Director General	ANE
Cecilio Grachane	Presidente do Conselho de Administracao	Fundo de Estradas (FE)
Jaime Matsinhe	Director	DNMC – MOPH
Henrique Filimone	Director General	LEM
Silvestre Elias	Director (representing the RRC)	ANE DIMAN

Apologies were received from the following organisations:

- Instituto Nacional dos Transportes Terrestres (INATER)
- Ordem dos Engenheiros de Moçambique

Representatives of the Development Partners were not invited to the first meeting of the RRSC, but they will be invited to all future meetings.

The agenda of the RRSC meeting is attached as Appendix A. In view of the fact that this was the inaugural meeting of the RRSC and that no chairperson had yet been appointed, the meeting was facilitated by Maria Lurdes Antunes and Eduardo Fortunato of the AFCAP Project Team. The meeting was held in Portuguese so as to set a precedent for all future meetings of the RRSC. The two other members of the AFCAP Project Team, namely Benoit Verhaeghe and Philip Paige-Green also attended the meeting as observers and to provide support if needed.

The following was agreed at the meeting:

***Terms of Reference of the RRSC:***

The RRSC accepted the Terms of Reference proposed by the AFCAP Project Team. These are listed here again for convenience:

- To steer the establishment and operations of the RRC and assess the adoption of ‘good governance’ principles;
- To endorse priority research, development and implementation projects recommended by the RRTC and identify and/or endorse allocation of funding to projects;
- To support the appointment of project champions and teams;
- To provide overarching project management and output quality reviews;
- To monitor effective technology transfer and implementation of outcomes.

***Chairperson and membership of the RRSC:***

The members of the RRSC agreed that both the ANE Director responsible for the Road Research Member and the Chairperson of the RRTC should also be members of the RRSC. They also agreed that the organisation GESTRAD should be represented on the RRSC. [In February 2014, the AFCAP Project Team was informed that the Development Partners (e.g. African Development Bank, the World Bank, the EU, JICA and DFID) will be invited as members of the RRSC to attend the second meeting of the RRSC.]

Mr Henrique Filimone, Director of LEM, was appointed Chairperson of the RRSC. Mr Hilário Tayob of ANE DIPRO, who was appointed Chairperson of the RRTC the day before, was nominated to act as the Secretary of the RRSC.

***Frequency of RRSC meetings:***

The members of the RRSC were of the opinion that one meeting per annum would not be sufficient. It would pose the risk of losing momentum. Hence, they agreed that the RRSC should be convened at least twice per year, and probably more frequently during the establishment of the RRC.

Similarly, they were of the opinion that the RRTC should be convened at least three times per year and, again, probably more frequently during the establishment of the RRC.

***Strategic Research Plan for the Road Research Centre:***

The process used to derive the priority road research needs for Mozambique, including the research needs questionnaire and prioritisation of research needs by the RRTC, was presented to the RRSC. The following research priorities were tabled for endorsement by the RRSC:

- Analysis of the effects of traffic overloading on pavement performance;
- Implementation of a national / regional strategy for vehicle overloading control;
- Drafting of a manual for the design of surface seals;

- Mapping of natural materials for road construction and development of a database:
  - Pilot project in one specific region;
  - Expansion to other regions;
- Specifications for the use of local/appropriate materials in road construction;
- Protocols for improving the proficiency of material testing laboratories (repeatability and reproducibility studies);
- Protocols for the systematic collection and recording of data captured during road construction, including quality control data, and development of a database;
- Further exploitation of results from previous research projects and practical implementation of results;
- Standard specifications for road works in Mozambique; and
- Manuals for road design.

The RRSC endorsed the list of research priorities, but also recommended that the following two additional research needs be included in the list:

- Development of a road asset register; and
- Development of a design catalogue for small structures.

The proposed layout for the Road Research Strategic Plan, presented and approved by the RRTC, was also endorsed by the RRSC. The structure for the Plan is shown below:

### **Road Research Strategic Plan**

1. Introduction
  - 1.1 Purpose of the Road Research Technical Committee
  - 1.2 Strategic direction
  - 1.3 Objectives and methodology
2. Identified needs and broad research areas
  - 2.1 Needs identified from questionnaire survey
  - 2.2 Broad research areas
3. Prioritisation of research needs and research projects
  - 3.1 Prioritisation by the Road Research Technical Committee
  - 3.2 Mapping of past activities and gap analysis
  - 3.3 Prioritised list of projects
4. Execution plan for prioritised projects
  - 4.1 Outline proposals for prioritised projects
  - 4.2 Detailed proposals for 'quick win' research projects
5. Implementation plan

**Business plan for the Road Research Centre:**

The RRSC endorsed the proposed layout of the business plan (see Appendix B). The AFCAP Project Team then presented some aspects of the business plan, including:

- The proposed vision, mission, goals and strategic objectives of the RRC (see below);
- Resources required for the RRC;
- Funding of research;
- Strategic relationships and linkages;
- Knowledge transfer.

**Vision**

To be the premier research and development centre providing scientific, engineering and technological leadership to the Mozambican government and industry for attaining a network of good quality and safe roads, offering a high level of satisfaction to its users and becoming a reference for southern Africa

**Mission**

Through research, development and implementation of research outcomes, to enhance connectivity and ensure the transportation of people, goods and services in a safe, economic and sustainable manner, contributing to economic, social and cultural development

**Goal and Strategic Objectives**

The goal of the Road Research Centre (RRC) is to serve the road engineering needs of the public and private sector of Mozambique through the development, application and dissemination of new knowledge, and the development of human capital. It will strive to provide practical, innovative, cost-effective Research and Development (R&D) based solutions that:

- address the current and future road infrastructure needs of the country and the region;
- support sustainable development and asset preservation; and
- enhance socio-economic impact and industry competitiveness.

It will provide innovative engineering solutions for the design, construction, maintenance and management of road infrastructure assets based on basic and applied research supporting the provision of a sustainable and cost-effective road network.

In order to achieve these goals over the next three years, the RRC will focus on:

**Science, Engineering and Technology (SET) Base**

- Developing a road research agenda for the country, guided by the RRSC and endorsed by the RRSC;
- Establishing (year 1), strengthening (year 2) and broadening (year 3 and beyond) the SET base of the RRC in line with the research priorities of the country and in support of the service delivery priorities of government;
- Investing in the establishment of the required research infrastructure to support the research agenda;

***Human Capital Development***

- Attracting, nurturing and retaining local capacity to undertake research;
- Establishing a research career ladder for staff of the RRC;
- Developing and implementing capacity building programmes to develop research skills and establish a research culture;
- Cooperating with universities, offering opportunities for students to participate in the research programme of the RRC.

***Relevant Knowledge Generation and Transfer***

- Developing innovative local, cost-effective solutions for local problems;
- Adapting appropriate solutions from elsewhere to satisfy local conditions;
- Coordinating long-term, demand-driven research activities to maximise benefits to the country;
- Drafting and/or updating of guidelines, norms and standards;
- Establishing an information resource centre to house, inter alia, local and international conference proceedings, research reports, technical guidelines, norms and standards;
- Managing technology transfer through press releases, publications, lectures, workshops, seminars and conferences in order to advance knowledge within the roads sector (RRC website?);
- Assessing the contribution and impact of the activities and outcomes of the RRC on economic growth, poverty reduction and social development through improvements made in design, construction, maintenance and management of road assets.

***General***

- Establishing sustainable (i.e. long term) local sources for funding of research, including funding allocations from construction and maintenance projects to be earmarked for the construction of experimental sections;
- Establishing strong linkages with relevant stakeholders nationally, and liaising and entering into cooperation agreements with similar road research centres internationally.

The RRSC was very appreciative of the progress made thus far. Since there was a lot of information to digest, they recommended that discussions on the business plan be postponed to the next RRSC meeting to be held in March 2014. They also recommended that the next draft version of the business plan be sent to the members one week ahead of the next meeting of the RRSC so that it can be studied by its members prior to the meeting.

**2.3 First meeting of the RRTC**

The first meeting of the RRTC was held on 29 January 2014, one day before the first meeting of the Road Research Steering Committee (RRSC) was held. The meeting was well attended (30 members). The following members and organisational representatives were present:

- Silvestre Elisas (Direção de Manutenção da ANE)
- Adérito Guilamba (Direção de Projetos)
- Miguel Coanai (Direção de Planificação da ANE)

- Delegados provinciais da ANE
- Adeline Serage, Calado Ouana, César Macuacua, Evaristo Mussupai e Hilário Tayob (ANE);
- Laboratório de Engenharia de Moçambique (LEM);
- INATER
- Fernando Leite (ISuTeC);
- Universidade Eduardo Mondlane (UEM)
- Associação Moçambicana de Consultores
- Cimentos de Moçambique
- Federação Moçambicana de Empreiteiros
- Município de Maputo
- Eugenio Abubakar (CETA);
- Carlos Quadros (TÉCNICA);
- Victor Rangel (COTOP);
- CONSULTEC
- CPG
- SCOTT WILSON
- STANGE

One apology was received: Prof Fernando Leite (ISuTeC)

The agenda of the RRTC meeting is attached as Appendix C. In view of the fact that this was the inaugural meeting of the RRTC and that no chairperson had yet been appointed, the meeting was facilitated by Maria de Lurdes Antunes and Eduardo Fortunato of the AFCAP Project Team. The meeting was held in Portuguese so as to set a precedent for all future meetings of the RRTC. The two other members of the AFCAP Project Team, namely Benoît Verhaeghe and Philip Paige-Green also attended the meeting as observers and to provide support if needed.

In terms of the structure, purpose and leadership of the RRTC, the following was agreed at the meeting:

- That the proposed Terms of Reference for the Committee (cf. section 2.1.2) be accepted as is without change;
- That the RRTC membership was acceptable as is, but other persons who are willing to contribute to the RRTC would still be welcome. It was also suggested that representatives from the Mineral Resources Ministry and from the Technology Centres be invited to become members of the RRTC;
- That, after having been voted in, Mr Hilário Tayob of ANE DIPRO becomes the Chairperson of the RRTC;
- That the RRTC will hold at least two meetings annually, but will be convened more regularly during the establishment phase of the RRC (note: subsequently, the RRSC recommended that the RRTC should convene at least three times per year).

The primary focus of the meeting was to determine and prioritise the research needs. After a presentation on past research conducted in or for Mozambique, and an overview of the research needs identification process (e.g. research needs questionnaire) and its outcomes, the RRTC identified 10 high-priority projects (cf. Section 2.2).

The RRTC also approved the proposed layout for the road research strategic plan (cf. Section 2.2), as well as the proposed format for Research Proposals shown below:

### Format for Research Proposals

- 1 BACKGROUND
- 2 PROBLEM STATEMENT
- 3 PROJECT OBJECTIVES
- 4 EXPECTED BENEFITS
- 5 METHODOLOGY
- 6 DELIVERABLES
- 7 IMPLEMENTATION OF FINDINGS
- 8 PROJECT PLAN
  - 8.1 TIMELINE OR GANTT CHART
  - 8.2 PROJECT COSTS
  - 8.3 PROJECT TEAM/PERSONNEL
  - 8.4 CASH FLOW OR PAYMENT SCHEDULE

### **3. Institutional Location of the Road Research Centre**

#### **3.1 Proposed Institutional Location of the RRC based on Prior Meetings and Workshops**

##### **3.1.1 Final Report of Phase 1**

At the Final Workshop of Phase 1, held on 8 February 2013, consensus was reached that the RRC should be based in ANE, but with strong involvement from LEM. ANE expressed their commitment to host the RRC within ANE's institutional structures.

At the same workshop, consensus was also reached that the RRC should have a cross-cutting function, supporting all ANE Directorates on an equitable basis (i.e. not under the control of one Directorate of ANE), and that the Centre should report directly to the Director General of ANE.

However, it was also agreed that the RRC should start small (i.e. 5 to 10 staff members) and that it should expand and grow over time.

##### **3.1.2 Meetings held with ANE during November 2013**

###### **3.1.2.1 Project Inception meeting held between ANE and AFCAP Project Team**

The decision to house the RRC within the structures of ANE was confirmed at the Project Inception Meeting of Phase 2A. However, contrary to the recommendations made at the Final Workshop of Phase 1, it was deemed impractical to institute the RRC as a cross-cutting entity reporting directly to the Director General. The following two reasons were cited:

- i. The current Rules and Regulations of ANE do not make provision for the establishment of such an entity. It would take a considerable amount of time to revise the Articles and to get them approved by the Council of Ministers; and
- ii. Housing the RRC as a cross-cutting initiative with direct reporting lines to the Director General might overburden his office.

It was therefore deemed more appropriate to locate the RRC within the structures of DIPRO, since the ANE's Rules and Regulations pertaining to DIPRO's Department of Studies and Projects tended to be more aligned with the purpose and objectives of the RRC.

It was also noted that, since both DIMAN and DIPRO will be represented on the Road Research Technical Committee (RRTC) and the Road Research Steering Committee (RRSC), there will be sufficient safeguards to ensure that the RRC will operate across organisational boundaries and serve the overall research and development needs of ANE.

###### **3.1.2.2 Meeting held with Director of DIMAN**

At the follow-up meeting held with the Director of DIMAN, it was stated that DIMAN was not overly concerned about the potential institutional location of the RRC in DIPRO, provided that strong links were established between DIMAN and the RRC. However, the responsibilities of each Directorate and their Departments should be clearly defined with respect to communication and the execution of the research and development agenda. It would also be important to ensure that the research results are shared with all ANE Directorates.

It was also noted that the RRC should be branded as the 'ANE Road Research Centre', and not as an entity under a particular Directorate.

###### **3.1.2.3 Preliminary recommendations based on meetings held during November 2013**

The feedback received from the Directors of DIPRO and DIMAN all pointed towards an agreement to establish the RRC under DIPRO. In order to verify whether this would be feasible from an institutional perspective, the Rules and Regulations of ANE dated October 2011 were consulted. They stipulate the functions and responsibilities of



the Director General and those of the Directorates. A summary of the functions and responsibilities of each Directorate is provided below:

**Directorate Planning (DIPLA):**

- Planning the needs and demands of the road network in terms of construction, rehabilitation, repair and maintenance;
- Ensure that the strategic planning of the road network is in place;
- Carry out the collection and analysis of statistical data relating to inventories of roads, condition of roads, including passability and traffic;
- Keep updated register of roads and issue periodic information about the classified road network;
- Prepare plans and annual budgets in coordination with other Directorates;
- Manage the processes of international cooperation;
- Keep updated register of projects;
- Propose the classification of new roads in accordance with their importance and interaction within the socio-economic context of the country;
- Manage the team of specialists at the service of the Directorate, ensuring the relevant transfer of technologies;
- Propose a plan for the vocational training of personnel of the Directorate.

**Directorate Projects (DIPRO):**

- Prepare and execute projects for construction, improvement and rehabilitation of roads and bridges as defined in the annual plan;
- Develop and disseminate technical standards for construction and rehabilitation of roads and bridges;
- Monitor the supervision of road works and bridges;
- Administer contracts for works and provision of services;
- Manage programmes for road improvements;
- Manage the team of specialists at the service of the Directorate, ensuring the relevant transfer of technologies;
- Propose a plan for the vocational training of personnel of the Directorate.

**Directorate Maintenance (DIMAN):**

- Develop and disseminate technical standards for periodic and routine road maintenance;
- Develop and manage road safety systems, in cooperation with other entities and manage systems for traffic load control;
- Ensure that the maintenance of classified roads is done in accordance with the standards laid down by ANE;
- Develop and implement maintenance programs for roads and bridges, in liaison with the Provincial delegations of ANE, ensuring asset preservation and protection;
- Manage the team of specialists at the service of the Directorate, ensuring the relevant transfer of technologies;
- Propose a plan for the vocational training of personnel of the Directorate.

**Directorate Administration & Finance (DIAF):**

- Prepare budgets and their respective reports, and accounts of ANE;

- Ensure proper financial management;
- Ensure the proper management of cultural heritage;
- Manage the team of specialist in the service of the Directorate, ensuring the relevant transfer of technologies;
- Organise the process of human resource management;
- Develop and implement ANE's strategy for vocational training, materialized into annual training plans;
- Create effective mechanisms for technology transfer from experts at the service of ANE, both at central and provincial level;
- Manage the general archives.

From the above summaries, it is clear that all Directorates have a responsibility towards the training of personnel and the transfer of technology. However, only the Rules and Regulations of the Directorate Projects and the Directorate Maintenance make specific reference to activities that are associated with research and development ("Develop and disseminate technical standards").

Each Directorate is supported by a number of Departments. The Department that is most aligned with the objectives of the RRC is the Department of Studies and Projects under the Directorate Projects. The functions and responsibilities of this Department include, inter alia:

- Following-up research on new materials and their application, including the construction of experimental sections;
- Performing research studies on roads and bridges;
- Promoting and investigating the use of new chemical stabilisers used in the improvement of material quality;
- Producing norms and standards for the construction, maintenance and rehabilitation of roads;
- Creating and maintaining a national materials database.

Hence, in accordance with the current Rules and Regulations of ANE dated October 2011, the Department of Studies and Projects under DIPRO would conceivably provide the best institutional location for the RRC. This agrees with what was stated at the meetings held with DIPRO and DIMAN in November 2013.

Although it was recommended that the RCC should be established under DIPRO, the AFCAP Project team was of the opinion that one should:

- Explore alternative institutional locations, and their implications in terms of the current Rules and Regulations;
- Further debate and resolve potential issues relating to both horizontal cooperation and communication (i.e. between Directorates) and vertical communication (i.e. between the head of the RRC operating at a (sub)Departmental level, the Director of DIPRO and the Director General of ANE); and
- Discuss the branding of the RRC both inside and outside the institutional structures of ANE.

### **3.1.3 Meetings held with ANE during December 2013**

During December 2013, further meetings were held between ANE and the AFCAP Project Team to confirm the recommendations made in November 2013, namely that DIPRO was considered to be the most appropriate location for the RRC, on the basis of the current Rules and Regulations of ANE.

In the meeting held with the Director General of ANE, he pointed out that a review was underway and that some changes could be made to the regulatory rules. He further suggested that the RRC could also be established under

DIMAN, based on their focus on rural roads and prior research undertaken by DIMAN in this field. The decision on the final location of RRC should be based on its functionality.

Concerns about horizontal cooperation and communication were also raised. It was important to avoid creating walls and introducing “competition” between the Directorates for services rendered by the RRC.

It was agreed that the institutional location of the RRC would require further discussion with ANE. It was proposed that the advantages and disadvantages of the following three options be debated in a workshop between ANE and the AFCAP Project Team: (i) institutional location of the RRC under DIMAN; (ii) under DIPRO; and (iii) as an independent, stand-alone and cross-cutting entity in ANE.

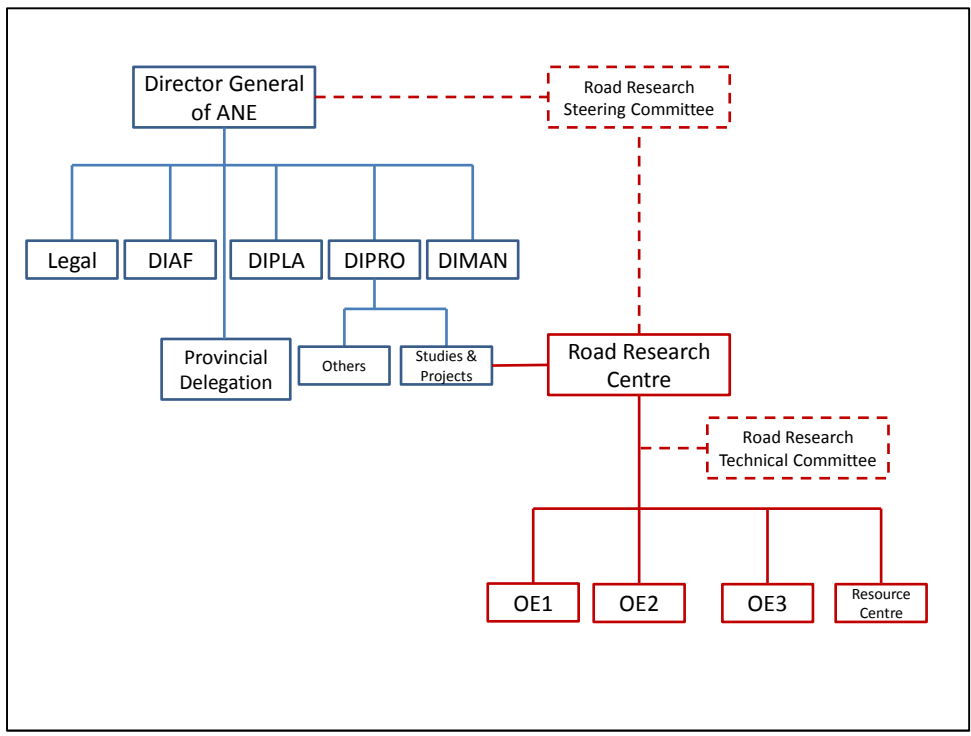
In addition, these discussions should also deal with the issue of the branding of the RRC both inside and outside the institutional structures of ANE. It was considered important that the RRC should have high visibility and possibly also its own logo.

**3.1.4 Critical Assessment of Recommended Options**

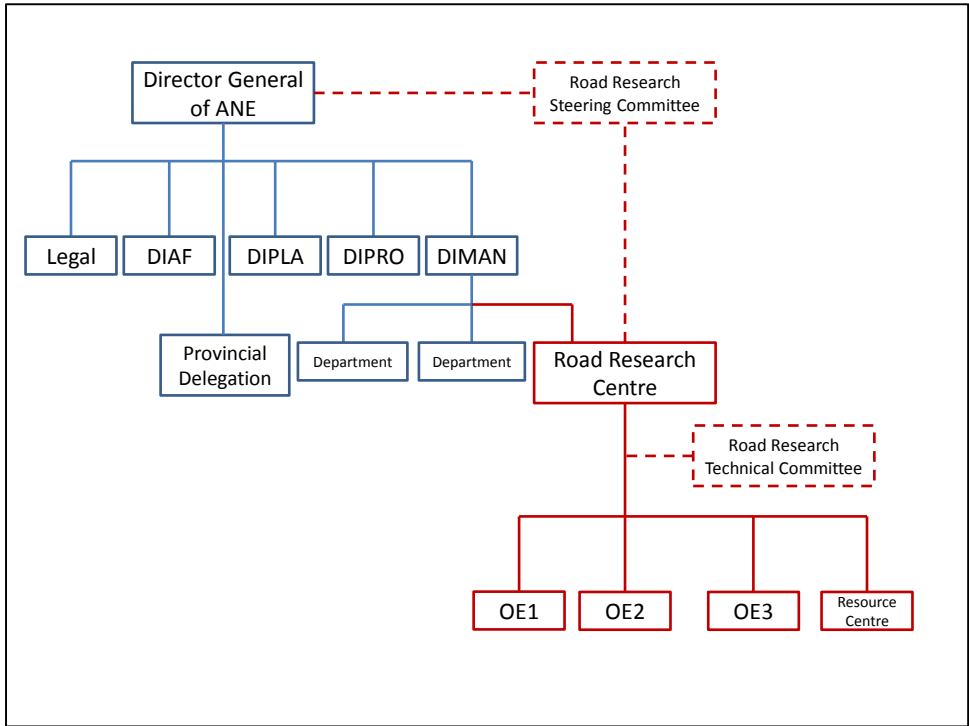
Based on discussions held with ANE during 2013, three potential institutional structures should be considered:

- Institutional location of the RRC under DIPRO (see Figure 1);
- Institutional location of the RRC under DIMAN (see Figure 2); and
- Institutional location of the RRC as a cross-cutting entity (see Figure 3).

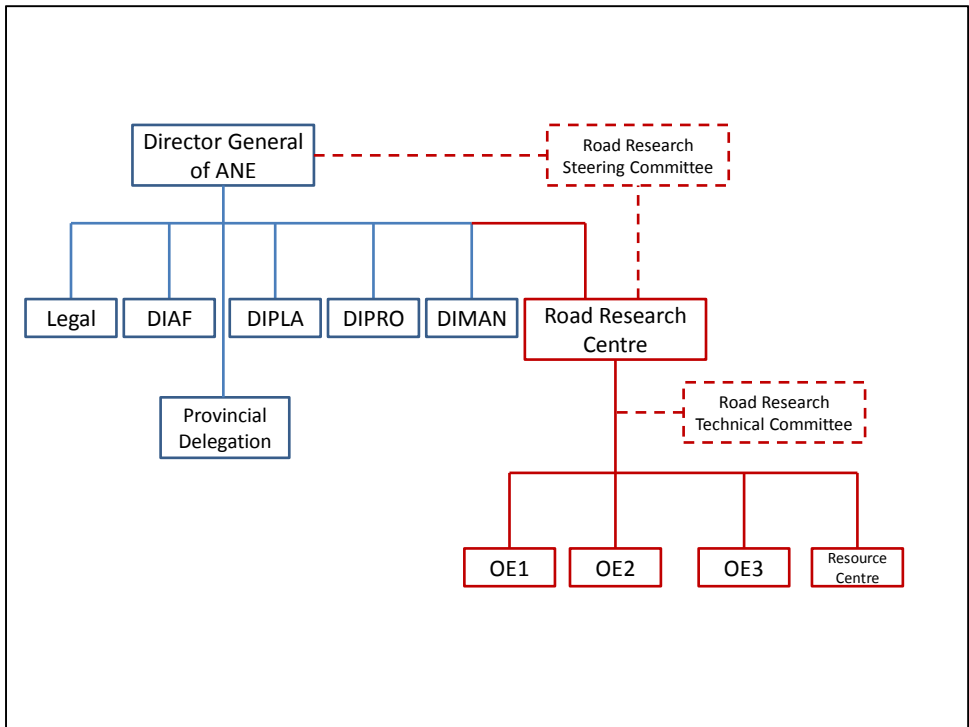
The location of the RRTC and the RRSC and their relationship to the RRC are also shown in Figures 1 to 3.



**Figure 1: Institutional location of the RRC under DIPRO**



**Figure 2: Institutional location of the RRC under DIMAN**



**Figure 3: Institutional location of the RRC as a cross-cutting entity**

Two of the options recommend that the RRC be established under a Directorate, namely DIPRO or DIMAN (see Figures 1 and 2). In broad terms, the advantages and disadvantages of an institutional location under either Directorate will be fairly similar. Hence, these two options should be compared against the third option, namely to establish the RRC as a cross-cutting entity.

#### 3.1.4.1 Institutional location of the RRC under a Directorate

##### Advantages:

- Easier to implement from a regulatory perspective:
  - Good alignment between DIPRO's current Rules and Regulations and the aims and objectives of the RRC;
  - Some alignment between ANE's Rules and Regulations and the aims and objectives of the RRC (not as clear cut as for DIPRO);
- Good track record of R&D conducted under and/or managed by DIMAN;
- Direct buy-in from either DIPRO or DIMAN to support R&D of the RRC in line with their needs;
- No senior person required to manage the centre initially – manager would report to a Head of Department or Director of one of the Directorates;
- Lower profile, operating under the protection of a Directorate which would act as an incubator, which might have positive attributes, especially when starting small;
- Less pressure on the RRC and their researchers to demonstrate immediate impact, more time to incubate and grow from humble beginnings;
- Less formal relationships with available laboratories and in-field resources.

##### Disadvantages:

- Potentially creating a bias towards serving the research needs of DIPRO or DIMAN;
- Potential for competition between Directorates for services rendered by the RRC;
- Research Career Ladder may not be aligned with ANE's staffing structure – limited career growth opportunities for technical staff unless they move out of the RRC;
- Visibility of the RRC to outside world – potential constraints in branding the RRC as an ANE entity;
- Potential constraints in establishing relationships with external stakeholders;
- Difficult to justify the need for a high-level RRSC to steer an entity at (sub-)department level;
- Significant energy required to properly brand the RRC as a cross-cutting ANE entity;
- Require additional administration and management to enable the RRC to operate as a cross-cutting entity;
- Limited accountability for R&D operations, investments in resources, technology transfer, information sharing, etc (accountability limited to the level of the Directorate?);
- May restrict the growth of the RRC (dictated by budget restrictions at Directorate level);
- Information Resource Centre located within a Directorate instead of centrally, which might impact on serving the information needs of all Directorates on an equitable basis.

#### 3.1.4.2 Institutional location of the RRC as a cross-cutting entity in ANE

##### Advantages:

- Better definition of the role of the RRSC if the RRC is established as a cross-cutting initiative reporting directly to the Director General of ANE;

- If the Rules and Regulations of ANE can be adapted to reflect the functions and responsibilities of the RRC, this would allow for slightly different rules and regulations to be implemented to account for the different nature of activities undertaken by a research centre;
- Facilitates direct interaction between the RRC and all ANE Directorates, as well as communication between the RRC and external stakeholders;
- Greater visibility of the RRC to the outside world, placing a greater responsibility on the RRC to deliver on their mandate;
- Ability to interact directly with the membership of the RRSC and to formulate a road research strategy in consultation with the RRSC;
- The RRC would be able to serve the research needs of all ANE Directorates – no bias;
- Better able to manage potential competition between Directorates for services rendered by the RRC;
- Better understanding of funding requirements and financial accountability;
- Funding easier to “ring-fence”;
- Easier to budget and to control and manage expenditure;
- The RRC’s Research Career Ladder can be more easily aligned with ANE’s staffing and remuneration structure;
- Better growth opportunities for RRC researchers, providing incentives to staff to improve their technical abilities and deliver quality outputs;
- Management of the RRC focused on delivery of the research, development and implementation plan for the Centre;
- Easier to establish and manage relationships with outside suppliers, including testing laboratories;
- Information resource centre would be established and managed centrally, able to provide information services to all ANE Directorates on an equitable basis and also to support the information needs of government and industry.

**Disadvantages:**

- Rules and Regulations of ANE would have to be adapted to reflect the functions and responsibilities of the RRC;
- Greater pressure on RRC staff to achieve results and demonstrate impact, requiring dedicated efforts to instil the right research culture and to resource the RRC adequately and appropriately from the start.

### **3.2 Decision taken in January 2014**

The advantages and disadvantages of either establishing the RRC under a Directorate or as a cross-cutting entity were tabled and discussed with the Director General of ANE and representatives of DIMAN and DIPRO, including the Director of DIMAN and the Acting Director of DIPRO, on 28 January 2014.

Following discussion, the Director General made the decision that the RRC will be located under DIMAN for the following reasons, which the AFCAP Project Team supported:

- The RRC will start small with less than 10 researchers. Hence, it is better to incubate the RRC under the protection of an existing Directorate;
- The size of the RRC does not justify the formation of a new cross-cutting entity at Directorate level since it will also require significant changes to be made to the Rules and Regulations of ANE. Changes to be made at Departmental level are easier to implement;

- DIMAN has a track record of research. The momentum built thus far should be maintained within this Directorate;
- The RRC would directly report to the Director of DIMAN. Hence, there is no need to appoint a person in a senior position to lead the Centre.

It was also noted that as the RRC expands and grows, to the extent that it would no longer be practical to house the Centre under DIMAN (i.e. when the disadvantages start to outweigh the advantages), the RRC could either become a cross-cutting entity and yield the benefits outlined in Section 3.1.4.2, or be established as an independent organisation outside the structures of ANE. The Director General of ANE recommended that this evolutionary process should be addressed in a 10-year strategic plan for the RRC.

The decision by ANE to house the RRC in DIMAN was presented to the RRSC on 30 January 2014. MOPH expressed some concerns about the proposed location, but after explaining the reasoning behind this decision, MOPH accepted the proposed institutional location of the RRC.

### 3.3 Recommendations on Institutional Location of the Road Research Centre

Following various discussions held between ANE and the AFCAP Project Team, as well as internal discussions within ANE, the decision was made to locate the RRC in DIMAN, which was then also endorsed by the RRSC. This institutional location would yield the following benefits:

- No need to change the Rules and Regulations of ANE. Changes made at Departmental level are easier to implement;
- Further building on the good track record of R&D conducted under and/or managed by DIMAN;
- No senior person required to manage the centre initially – the manager of the Centre (if required) would report to the Director of DIMAN, or the Director would assume direct responsibility for the Centre;
- The RRC would be operating under the protection of the Directorate, which would act as an incubator. This has its advantages, especially when starting small;
- Less pressure on the RRC and their researchers to demonstrate immediate impact. There is more time available for the Centre to incubate and to grow from a small base;
- Less formal relationships have to be established with available laboratories and in-field resources.

As indicated by the Director General of ANE and also supported by the RRSC, the RRC is expected to expand and grow over time. In future, its size may necessitate the RRC to become a cross-cutting entity or to be established as an independent organisation outside the structures of ANE. The Director General of ANE recommended that this evolutionary process should be addressed in a 10-year strategic plan for the RRC.

Some of the concerns expressed – such as potential for competition between Directorates for services rendered by the RRC; potentially creating a bias towards serving the research needs of one Directorate; visibility to the outside world and significant effort required to properly brand the RRC as an cross-cutting ANE entity; additional administration and management required to enable the RRC to operate as a cross-cutting entity; and potential constraints in establishing relationships with external stakeholders – have to a fair extent been alleviated by:

- Having successfully instituted both the RRTC and RRSC, with representation of the wider industry as well as key stakeholders in their membership base, providing guidance and steering the activities of the RRC;
- The RRTC identifying the road sector's research needs and the RRSC endorsing them;
- Mr Henrique Filimone, Director of LEM, chairing the RRSC;
- Having a representative from ANE DIPRO, namely Mr Hilário Tayob, appointed as the Chair of the RRTC; and
- Mr Hilário Tayob of ANE DIPRO being assigned to be the secretary of the RRSC.

Also, with both the RRTC and the RRSC performing an oversight role, there will be pressure on the RRC to deliver, and it will have to assume accountability for both its operations and deliverables.

The Portuguese version of the recommended institutional structure is shown in Figure 4 below:

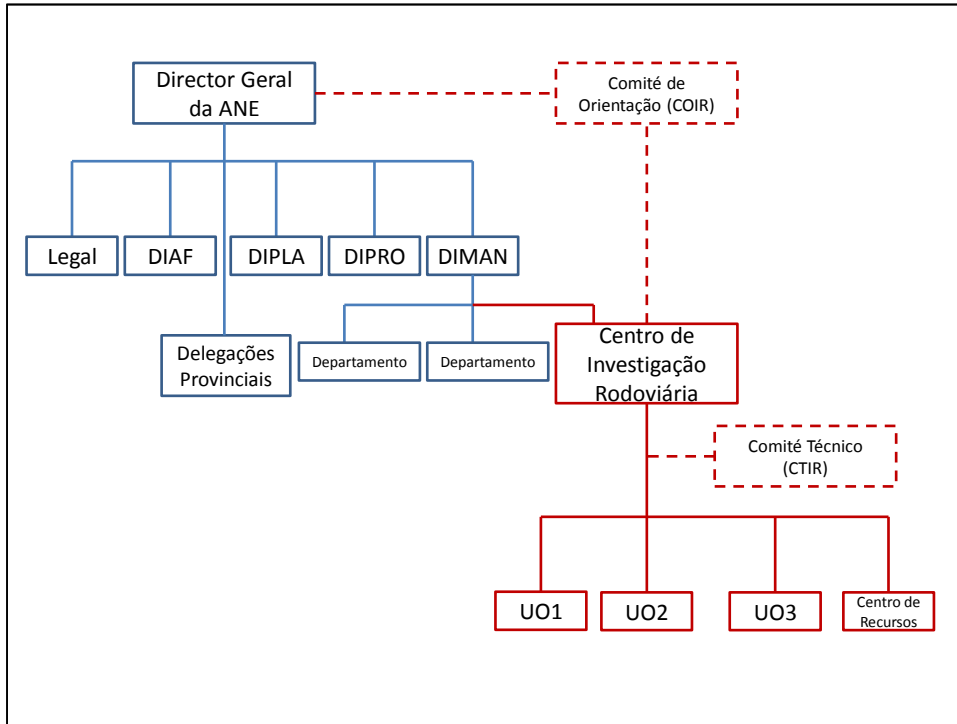


Figure 4: Recommended Institutional Structure for the RRC (version in Portuguese)



## **4. Physical location of the Road Research Centre**

### **4.1 Final Report of Phase 1**

At the Final Workshop of Phase 1, held on 8 February 2013, consensus was reached that the RRC should start small (i.e. no new buildings would be required initially). It was also stated that: “It was recognised that the most important aspect of establishing the RRC is to form a professional and dedicated unit. The accommodation of this unit is less important, and in the short term it can be housed within ANE’s present offices”.

In terms of physical location, three potential sites were suggested: Chimoio, Maputo and Nampula.

### **4.2 Meetings held with ANE during November and December 2013**

At the Project Inception meeting held in November 2013, ANE reported that they had established new facilities in Nampula (laboratories and office space). Good facilities are thus available in Nampula. DIMAN noted that one should consider establishing the RRC outside Maputo (e.g. Nampula), especially from a political perspective since regionalisation is becoming increasingly more important.

Although Nampula could be considered as an alternative location for the RRC, it was recommended that Maputo should become the preferred location for the initial establishment of the RRC, both from a human resource and RRC marketing perspective. As the RRC develops and expands, consideration should be given to establishing a satellite office of the RRC in Nampula.

In meetings held with the Director General during December 2013, he confirmed that the general inclination on the physical location is Maputo.

### **4.3 Advantages and disadvantages associated with the physical location of the RRC**

#### **4.3.1 Advantages**

- Maputo/Matola has the largest concentration of the population in Mozambique making the location central to the most densely populated urban area
- The ANE head office with the associated support structures is situated here already
- Maputo is most convenient and economical in terms of logistics for attending meetings, and other professional gatherings
- The largest concentration of tertiary students occurs in Maputo
- Facilities and logistics for post-graduate studies would be simpler and cheaper
- The main LEM laboratory is based in Maputo
- The majority of committee (RRSC and RRTC) members are based in the Maputo area
- Attendance of meetings in Maputo will minimise time involvement by the Committee members
- It is more likely that skilled staff will be retained in a large urban area with the necessary social and logistical support structures (Wi-fi, access to bookshops and advanced computing facilities, etc.)

#### **4.3.2 Disadvantages**

- Experimental sites in the central and northern areas will require further travel
- No regional distribution of highly skilled researchers will take place in the short term
- Regionalism will be affected resulting in the north feeling that they are being “left out”

#### **4.4 Recommendations**

The above advantages and disadvantages associated with the physical location of the RRC in Maputo were tabled to the RRSC. After some discussion, it was generally accepted that the preferred location of the RRC, especially during the initial years of its establishment, should be Maputo. However, as the RRC expands and grows, a more central location such as Chimoio could be considered or a separate branch centre could be opened.

In a follow-up meeting held with Mr S. Elias, the Director of DIMAN and under whom the RRC will reside, he confirmed that the RRC will be physically located on the premises of ANE in Maputo, and that once the Project Team has specified the layout and office requirements for the RRC, a suitable location on the ANE premises will be sought. He also noted that DIMAN will most likely move to a new building that is currently being erected on the ANE premises in Maputo, offering an opportunity for the RRC to occupy the current building of DIMAN which is situated close to both the Central and the Provincial laboratory.

## 5. Laboratories Supporting the Activities of the Road Research Centre

### 5.1 Synthesis of previous discussions and visits

One of the key issues to be resolved in Phase 2A was the operational issues including facilities and essential laboratory testing services supporting the RRC. These have been discussed on a number of occasions as summarised below.

#### 5.1.1 Meetings held in November 2013

##### 5.1.1.1 Meeting with LEM

At a meeting held with LEM during November 2013, the following was noted:

##### ***LEM historical background:***

LEM started as a research institution mainly addressing road construction issues and later extended its activities to buildings and geotechnics. In its early life, LEM had a close relationship with the existing National Road Directorate (presently ANE), following up major road projects, taking part in quality control and performing research on new materials.

Later on, as ANE started to outsource most of the activities related to project design, project execution and quality control, the cooperation between the two organisations diminished.

##### ***LEM present situation:***

At present LEM has eleven people working in the roads division in Maputo and another four in the Beira laboratory. The Maputo team includes one researcher and ten technicians, all who are claimed to have good experience.

LEM is an organ of State reporting directly to the Ministry of Public Works and Housing (MOPH). Financing the operations of LEM comes primarily from the State budget, but they are funded through contracts also. The main problem they are facing is the lack of financial autonomy, which compromises flexibility in decision making (e.g. appointment of new staff, attendance of conferences).

##### ***Road research funding:***

LEM would like to expand their Roads Division in order to play an active role in research activities relating to new road projects.

At present, the Roads Fund (FE) is contributing to LEM's budget on an annual basis.

##### ***LEM Facilities:***

LEM's testing facilities include testing equipment for bitumen, asphalt, cement, concrete, aggregates and soils. The asphalt laboratory has recently been upgraded and is equipped for standard binder and asphalt testing. The aggregate and soils laboratory is in the process of being improved, also for standard testing. Similarly, the soil geotechnics laboratory is being upgraded and will be equipped for both shear and triaxial testing.

The cement and concrete laboratories are operational, and there are also plans to accredit the cement laboratories.

LEM are of the opinion that they are well positioned, from a laboratory perspective, to complement and support the activities of the RRC. According to LEM, an executive decision has been made to locate the RRC within the structures of ANE, but this should not prevent LEM from playing an active role in the operations of the RRC. The fact that this executive decision was made was, in a sense, a wake-up call for LEM to improve their operational support to the roads sector.

### 5.1.1.2 Meetings with ANE

LEM's involvement in the RRC was revisited, taking into consideration the Memorandum of Understanding (MoU) signed between ANE and LEM concerning the "transfer" of the provincial laboratories from ANE to LEM. There is a need for greater clarification on the legal and practical implications of this MoU. Overall, LEM would be expected to complement the activities of the RRC.

The RRC should have a local presence. Hence, testing facilities should also be located in the Provinces. The ANE Provincial laboratories should play this role in the RRC.

It was not possible to visit ANE's Central Laboratory. However, a visit was made to the ANE Provincial Laboratory. This laboratory is equipped for standard testing of road construction materials.

### 5.1.2 Meetings held with LEM in December 2013

The AFCAP Project Team met with Mr Cumbane. Mr Cumbane indicated that he could only discuss issues in general terms as he was only one of the senior technical officials. It was agreed that a meeting with a more senior person was necessary to make decisions regarding the cooperation between the proposed RRC and LEM. The following issues were covered:

#### ***LEM staff development:***

LEM has a cooperation agreement with LNEC. Under this cooperation, LNEC offers training to LEM through a staff exchange programme.

#### ***Cooperation between ANE and LEM:***

- The current Memorandum of Understanding between ANE and LEM was for 3 years and has now elapsed. However, it has been extended (with effect from March 2013 for another 3 years). Non-implementable clauses were removed from the agreement.
- Less than 20 per cent of current LEM work is on roads. Most of the work is on buildings, dams, etc. Concrete testing appears to be their biggest current activity.
- LEM and ANE teams have conducted several field investigations together.
- LEM was required to carry out quality control and monitoring of all road works. This has not happened, contributing to the low percentage of road related work.
- Clauses in the Memorandum of Understanding between ANE and LEM should be re-assessed to take into account the formation of the RRC and its requirements.
- The Director General of ANE has tasked a team to provide feedback on how the Memorandum of Understanding is being implemented. LEM is responsible for providing feedback on how the relationship/agreement is working. A report is required after each project.
- It is recommended that the AFCAP Project Team assesses the current Memorandum of Understanding to take into account its impact on the relationship between LEM and ANE/RRC.

#### ***LEM funding:***

- A lump sum grant is received from MOPH. Ministry funding covers main operational costs, but not research and Human Capital Development. LEM used to get about 5 per cent of the budget for all projects, but this arrangement has since stopped. Currently, only private clients are a source of additional funding through laboratory and on-site testing services. Lack of additional funding constrains additional work, research, and attendance of meetings/conferences.

**Relationship with RRC:**

- Mr Jaime Matsinhe of MOPH, which oversees both ANE and LEM, wants to be involved through the RRC development process – it was suggested that he becomes a member of the RRSC [note: he is a confirmed member of the RRSC].
- Budgeting for RRC projects would require taking care of some funding for LEM to cover additional costs related to the cooperation.
- LEM could provide services such as field work, special testing and additional calibration, etc. Initially LEM may operate as a commercial laboratory for RRC (Mr Cumbane’s personal opinion). This will, however, depend on the Memorandum of Understanding concluded between RCC and LEM.
- Initially, use can be made of a price list as a commercial laboratory would do. The provision of services to RRC would not be aimed at making profit from RRC, but should cover the additional costs in providing the services.
- Alternatively, the Memorandum of Understanding between LEM and RRC can be used. There was, however, a query whether the Memorandum of Understanding should continue to be between ANE and LEM or RRC and LEM.
- One of the main contributions by LEM would be to increase laboratory testing capacity when required.

**5.1.3 Laboratory visits during December 2013**

The AFCAP Project Team was only able to visit the LEM and ANE Central laboratory. None of the laboratories in academic institutions could be visited as they were already closed for the December recess and the ANE Maputo “province” laboratory was not mentioned at all during the discussions.

**LEM laboratory:**

- **Space and capacity:** It is a large facility and well laid out, with lots of space for expansion. The equipment is generally old, but a large box of new equipment was being unpacked at the time of the visit. The facility is capable of carrying out routine soil and aggregate tests as well as triaxial and consolidation tests. An old flame photometer and Atomic Absorption apparatus are used in the chemistry laboratory. In most soil analysis laboratories, modern Induction Coupled Plasma (ICP) equipment has replaced such old methods. A local facility for X-ray fluorescence analysis is available.
- **Standards for testing:** Various standards are being used. For instance, it was observed that the Casagrande dish was from Italy and new ones appear to be EN standard. The rubber base is probably more aligned with BS standard than ASTM. However, use is mostly made of ASTM, AASHTO and TMH 1 test methods. The Marshall design method is still being used.
- **Typical work:** Typical routine tests are carried out. A lot of concrete testing work was going on, due to extensive building construction in and around Maputo. Very little testing for road related work was in progress.

**ANE Central laboratory :**

- **Space and capacity:** Three shipping containers are used as facilities for the Central Laboratory. One container is used as an office. Basic tests are carried out, including grading, Atterbergs, UCS and CBR. However, most of the compression machines/presses are not working. Equipment is acquired from projects, but most of the equipment stays in the provinces where projects are being carried out.
- **Inventory of equipment:** An update of the inventory for the equipment under the administration of ANE is almost complete and Mr Tayob will forward the electronic version to the AFCAP Project Team within a week
- **Standards for testing:** Various standards are used. The lack of uniformity in test equipment is a concern as different types of equipment are used on different projects.

- **Typical Work:** Mostly routine testing such as grading analysis, compaction and CBR. Use is made of the LEM laboratory or the tests are carried out in site laboratories. ANE has worked together with LEM on field investigation projects. Problem with staffing: used to have at least 3 people, currently only one technician at the Central Laboratory since the MoU with LEM.

## 5.2 Overview of Available Facilities for Use in a Research Environment

### 5.2.1 ANE Laboratories

The current ANE laboratory in Maputo is rather rudimentary and not conducive to carrying out successful research. Neither the space, equipment nor the staff complement (bearing in mind that the majority of the current staff are seconded to site laboratories) are appropriate for supporting research projects requiring material testing.

The possibility of making use of the apparently better-equipped provincial laboratories has been raised. However, for research involving material testing it is essential that the researchers have easy and regular access to the laboratories, as many of the projects will require the actual daily observation of the tests in progress, modification of methods as tests proceed and the need for interim results as they are produced (e.g. daily changes in mass during durability studies). A close interaction with the laboratory testers is usually required. This would not be possible in laboratories that are not located on site or very close to the researchers' offices.

At the first meeting of the RRTC, a quick informal survey was undertaken to identify the type of equipment available and the number of technicians and assistant-technicians available in ANE's Central and Provincial laboratories. The results are shown below. It shows that all ANE laboratories are able to perform standard tests, but that a number of the laboratories require interventions (i.e. upgrading and/or calibration) to become fully functional.

Laboratory	Equipment	Human resources
ANE – Central	Standard - Needs upgrading	5
Cabo Delgado	Standard - Needs calibration	4
Niassa	Equipment expected shortly	2
Nampula	Standard	5
Zambézia	Standard - Needs calibration	4
Tete	Needs upgrading	4
Manica	Standard, needs calibration	4
Inhambane	Standard	3
Gaza	Standard	4
Maputo	Standard	3

### **5.2.2 LEM Laboratories**

The LEM laboratories appear to be spacious and well-equipped with competent material testers in the Maputo facility. Some of the equipment appears to be aged, but regular maintenance and calibration is apparently carried out. The facility is close enough to the ANE offices to allow ongoing (even daily) interaction between the material testers and the researchers from the RRC. There is also the satellite laboratory in Beira where routine testing of materials from experimental sections in the central and northern areas can be carried out to minimise the transportation of large volumes of material to Maputo. Only sufficient sample to carry out specialised or modified testing would thus need to be conveyed to Maputo.

The MoU and current agreement between ANE and LEM, in which individual tests are not paid for directly (apparently there is a regular (monthly) lump-sum payment from ANE to LEM to cover such testing) appears to be working effectively, with no necessity for authorisation from senior officials or management in order to proceed with testing. Should LEM be requested to carry out field testing or sampling for a research project, the additional costs (excluding manpower/time costs) incurred for travelling and subsistence would apparently be recoverable from ANE. This would need to be quantified and built into project proposals.

The LEM laboratory has facilities for many other test procedures outside the normal soil/aggregate/binder testing carried out in most road material testing facilities. This is particularly useful in a research environment, where testing of water, pedological properties and other non-typical material properties are often required for detailed material analysis purposes.

LEM has a standard price list for all testing carried out and although no direct charges are currently involved for material testing, it is important in preparing project proposals to quantify the cost of the material testing for later cost/benefit analyses.

### **5.3 Critical Assessment of Current Facilities**

The LEM facilities are suitable for the RRC, possibly with limited upgrading and checking of equipment. However, the existing MoU should be carefully reviewed to optimise the cooperation between the RRC (an organ of ANE) and LEM. With time, and depending on the types of research project that are approved, more specialised equipment may need to be acquired. The costs of such equipment should be included in the project proposals as part of the overall project costs.

### **5.4 Recommendations on the Physical Location of Laboratories**

Initially, the LEM laboratory as it currently exists (with minor calibration and upgrading of equipment) should prove adequate for the RRC.

## 6. Staffing of the Road Research Centre

### 6.1 Introduction

In this Chapter, some preliminary considerations for the staffing of the RRC are presented. They are only preliminary because the AFCAP Project Team would first have to develop detailed proposals for priority research projects as well as outline proposals for other research projects, which would enable the team to better understand the actual staffing requirements of the RRC.

As was noted in this report, the RRC is intended to start small (5 to 10 staff members) but expected to grow in future. This growth, and the implication thereof on staff requirements, will be addressed in the Business Plan of the RRC for which a draft will be prepared by end February 2014.

### 6.2 Preliminary skills that might be required

In Chapter 2 of this report, the list of priority research projects identified by the RRTC was presented. These are listed here again for convenience:

- Analysis of the effects of traffic overloading on pavement performance;
- Implementation of a national / regional strategy for vehicle overloading control;
- Drafting of a manual for the design of surface seals;
- Mapping of natural materials for road construction and development of a database:
  - Pilot project in one specific region;
  - Expansion to other regions;
- Specifications for the use of local/appropriate materials in road construction;
- Protocols for improving the proficiency of material testing laboratories (repeatability and reproducibility studies);
- Protocols for the systematic collection and recording of data captured during road construction, including quality control data, and development of a database;
- Further exploitation of results from previous research projects and practical implementation of results;
- Standard specifications for road works in Mozambique; and
- Manuals for road design.

The RRSC recommended that the following two additional projects be added to the list:

- Development of a road asset register; and
- Development of a design catalogue for small structures.

Based on a rudimentary first-level assessment of the above research projects, the following competences and/or services might be required in order to execute these projects:

- Civil engineering (road/pavement/traffic/structural);
- Geotechnical engineering / engineering geology; and
- Information technology (GIS/database/software development technology).



The actual competences required for the establishment of the RRC, as well as the number of staff members with these competences, will be identified once the project proposals for the above priority projects have been completed.

### 6.3 Research Career Ladder

It is proposed that the RRC introduces a research career ladder to support career development and to underpin a reward and recognition system for those staff whose role is to generate new knowledge: they undertake predominantly directed basic and applied research, and experimental development.

Research and experimental development comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, and the use of this stock of knowledge to devise new applications. A researcher, in this context, is a person whose primary duty it is to perform research and/or experimental development and transfer these findings effectively.

The proposed career ladder for researchers could have four clear rungs. These are:

- **Candidate Researchers** – researchers who would be required to work under supervision;
- **Researchers** – competent professionals who work independently within a given field;
- **Senior Researchers** – seasoned professionals with a track record in research and development, who are able to guide others and lead projects; and
- **Principal Researchers** – specialists whose sustained track record has led to widespread recognition within their field, and who are able to lead research and development programmes (groups of related projects), often integrating approaches across fields.

The use of titles by researchers should be formally subject to their placement on the above ladder. These titles should be used in external correspondence and on business cards.

The position of a researcher on the proposed career ladder will be based on a number of important inputs and outputs. Each of the inputs and outputs will be defined in broad terms with regard to levels of capability, and capability indicators will be suggested to help in the assessment of the capability of an individual. A researcher's position on the ladder will be established by determining the weighted sum of their levels of competence with regard to inputs and outputs.

The inputs could include:

1. Required qualifications; and
2. Leadership and the ability to provide strategic direction to R&D activities.

The outputs could include:

1. Knowledge generation and dissemination;
2. Human capital development; and
3. Generating impact.

Each of the inputs and outputs would contribute to an overall score against which the appropriate rung for any given researcher would be determined. Remuneration levels would be according to the different rungs.

## **7. Summary of Decisions Taken and Recommendations**

The institutional structures for the Road Research Centre, based on the proposed strategic plan and meetings of the RRSC and RRTC can thus be summarised as follows:

1. The RRC will be situated within ANE, as a separate operating unit under DIMAN.
2. The RRC will report directly to the Director of DIMAN.
3. The RRC will initially be housed in the DIMAN offices in Maputo with the possibility of moving or establishing a branch in Chimoio later.
4. Centrally, the LEM laboratories will be used for the majority of laboratory testing related to the projects. ANE's provincial laboratories will be used for routine testing of materials obtained from nearby sources. For this, minor upgrading, calibration and reviews of equipment condition and specifications will need to be carried out. The Memorandum of Understanding signed between ANE and LEM will have to be adjusted to accommodate the Road Research Centre.
5. A number of project proposals (including budgets) will be prepared for a range of projects selected on the basis of a questionnaire and approved by the RRTC and RRSC. Once the project proposals have been developed, a manpower resource plan will be prepared.

A Business Plan for the Road Research Centre will be developed which will incorporate the above recommendation and decisions. This Business Plan will be submitted to the RRSC and will be discussed at the next meeting of the RRSC to be held on 20 March 2014.

**Appendix A/Agenda for the Inaugural Meeting of the Road Research  
Steering Committee (RRSC)**

**AGENDA FOR THE INAUGURAL MEETING OF THE ROAD RESEARCH STEERING COMMITTEE (RRSC)**

Date: 30 January 2014

Time: 09h00

Venue: ANE Boardroom

1. Welcome and Apologies
2. Implementation Plan for the Establishment of the Road Research Centre
3. Role and Responsibilities of the RRSC
  - 3.1 Agreement on the Terms of Reference for the RRSC
  - 3.2 Membership of the RRSC
  - 3.3 Appointment of Chairperson for the RRSC
  - 3.4 Frequency of RRSC Meetings
  - 3.5 Relationship between the RRSC and the RRTC
4. Research Priorities
  - 4.1 Process Followed for Identification of Research Needs
  - 4.2 Research Priorities: Recommendations of the RRTC
  - 4.3 Research Priorities: Endorsement by the RRSC
  - 4.4 Way Forward: Drafting of Road Research Strategic Plan
5. Establishment of the Road Research Centre
  - 5.1 Vision, Mission, Goals and Strategic Objectives
  - 5.2 Physical Location of the Road Research Centre
  - 5.3 Resourcing the Road Research Centre
  - 5.4 Funding of Research
  - 5.5 Strategic Relationships and Linkages
  - 5.6 Knowledge Transfer
6. Way Forward: Drafting of 5-year Business Plan for the Road Research Centre
7. Any Other Business
8. Date of Next Meeting
9. Closure

## Appendix B/Outline of the RRC Business and Research Plan

## Outline of RRC Business and Research Plan

- Vision
- Mission
- Value proposition
- Scope, goals and strategic objectives
- Governance
  - Policies and Legislative Mandate
  - Situational analysis
  - Operational Structure
    - Cross-cutting Organisational & Reporting Structure
    - RRC Organogram
    - Shared Resources (Finance, HR, facilities)
  - Strategic oversight, relationships and linkages
    - Role and responsibilities of the RRSC
  - Sources of Funding
    - Grant funding for establishment of RRC
    - Ring-fenced funding for operations of RRC
    - Other (potential) sources of income
  - Targets and Key Performance Indicators
- Operations
  - Human Resources
    - Short- and long-term staffing requirements
    - Research career ladder and remuneration structure
    - Skills development plan
  - Research Infrastructure
    - Research equipment
    - Research facilities
    - Supporting infrastructure (IT, library, archives)
  - Research, Development and Implementation Plan
    - Role and responsibilities of the RRTC
    - Short-Term Research Activities (“quick wins”)
    - Strategic longer-term research needs
  - Safety, Health, Environment and Quality (SHEQ) management
- Strategic relationships and linkages
- Technology Transfer
  - Road Pavements Forum
  - Seminars/workshops on new manuals, guidelines and standards
  - Demonstration projects
  - Information centre
- Operational budgets

**Appendix C/Agenda for the Inaugural Meeting of the Road Research  
Technical Committee (RRTC)**

**AGENDA FOR THE INAUGURAL MEETING OF THE ROAD RESEARCH TECHNICAL COMMITTEE (RRTC)**

Date: 29 January 2014

Time: 09h00

Venue: ANE Conference Centre

1. Welcome and Apologies
2. Implementation Plan for the Establishment of the Road Research Centre
3. Role and Responsibilities of the RRTC
  - 3.1 Agreement on the Terms of Reference for the RRTC
  - 3.2 Membership of the RRTC
  - 3.3 Appointment of Chairperson for the RRTC
  - 3.4 Frequency of RRTC Meetings
  - 3.5 Relationship between the RRTC and the RRSC
4. Research Needs Determination
  - 4.1 Overview of Past Research Undertaken in Mozambique
  - 4.2 Road Research Priorities Identified from Questionnaire
  - 4.3 Prioritisation of Research Needs by RRTC
    - 4.3.1 Additional Research Needs
    - 4.3.2 Prioritisation of 'Quick Win' Projects
    - 4.3.3 Prioritisation of Longer-Term Research Projects
5. Way Forward
  - 5.1 Drafting of Road Research Strategic Plan
  - 5.2 Format of Research Proposals
  - 5.3 Mapping of Required Resources in line with Research Priorities
6. Any Other Business
7. Date of Next Meeting
8. Closure





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