

# Development and Support to the Implementation of a Strategy for the Establishment of a Road Research Centre in South Sudan

Final Report



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## Contents

<b>Abstract</b> .....	<b>vi</b>
<b>Key words</b> .....	<b>vi</b>
<b>Acronyms, Units and Currencies</b> .....	<b>vii</b>
<b>Executive summary</b> .....	<b>viii</b>
<b>1 Introduction</b> .....	<b>13</b>
1.1 Project purpose .....	13
1.2 Rationale for building local research capacity .....	13
1.3 Methodology and approach .....	15
1.4 Scope of work .....	16
1.5 Purpose of document .....	16
<b>2 Meeting national development objectives</b> .....	<b>17</b>
2.1 Introduction.....	17
2.2 Vision of the Government of South Sudan .....	17
2.3 Existing policy setting .....	18
<b>3 Current operational environment for road research capacity building</b> .....	<b>22</b>
3.1 Introduction.....	22
3.2 Operational description.....	22
<b>4 Framework for road research strategy</b> .....	<b>26</b>
4.1 Introduction.....	26
4.2 Vision .....	26
4.3 Mission .....	26
4.4 Core values .....	27
4.5 Situational assessment .....	27
4.6 Goal and objectives of road research strategic plan .....	29
4.7 Key issues.....	29
<b>5 Action plans</b> .....	<b>30</b>
5.1 Planning .....	30
5.2 Governance .....	30
5.3 Legal establishment.....	32
5.4 Staff complement .....	32
5.5 Research infrastructure .....	34
5.6 Research priority areas.....	35
5.7 Human capital development .....	36
5.8 Partnerships and collaboration .....	37
5.9 Product and services.....	38
5.10 Monitoring and evaluation .....	38
<b>6 Funding mechanism</b> .....	<b>40</b>
6.1 Potential funding .....	40
6.2 Sustainability strategy .....	41
<b>7 Implementation time-frame</b> .....	<b>43</b>
7.1 Start-up phase .....	44
7.2 Institutional establishment.....	45
7.3 Infrastructure development .....	47
<b>8 Institutional re-alignment</b> .....	<b>51</b>

8.1	Interim operational structure.....	51
8.2	Research management and administration .....	52
8.3	Operational model.....	54
8.4	Operational structure.....	54
<b>9</b>	<b>Risk factors.....</b>	<b>57</b>
<b>10</b>	<b>Key performance indicators .....</b>	<b>59</b>
10.1	Introduction.....	59
10.2	Strategic key areas.....	59
<b>11</b>	<b>Resource and potential funding allocation .....</b>	<b>71</b>
11.1	Annual operational expenses .....	71
11.2	Operational expenses .....	71
11.3	Estimated global start-up costs .....	72
11.4	Indirect expenses.....	74
11.5	Potential funding allocation and mobilization.....	75
<b>12</b>	<b>Institutional commitment .....</b>	<b>76</b>
<b>13</b>	<b>Next step.....</b>	<b>77</b>
13.1	TASK 1: Human Capital Development .....	77
13.2	TASK 2: Infrastructure Capacity Development .....	78
13.3	TASK 3: Competency-Based Training Programmes .....	78
13.4	TASK 4: Data Management Systems.....	78
13.5	TASK 5: Knowledge Management Service Centre .....	79
13.6	Main cost component and budget .....	79
<b>Annex 1</b>	<b>Structure for Ministry of Roads and Bridges .....</b>	<b>83</b>
<b>Annex 2</b>	<b>Equipment condition inventory .....</b>	<b>84</b>
<b>Annex 3</b>	<b>Group research areas prioritisation during stakeholder workshop 1 .....</b>	<b>87</b>
<b>Annex 4</b>	<b>Terms of reference for the Road Research Technical Committee (RRTC) .....</b>	<b>88</b>
<b>Annex 5</b>	<b>Terms of reference for the Road Research Steering Committee (RRSC) .....</b>	<b>89</b>
<b>Annex 6</b>	<b>Costs for refurbishment .....</b>	<b>90</b>
<b>Annex 7</b>	<b>Concept notes.....</b>	<b>92</b>

## Tables and Figures

Table 1	MRB Draft Strategic Plan (2013-2018) research implementation matrix .....	23
Table 2	Priority areas: Directorate of Materials and Research .....	25
Table 3	Research priority areas .....	36
Table 4	Start-up phase time-frame .....	45
Table 5	Institutional establishment time-frame .....	46
Table 6	Infrastructure development time frame .....	48
Table 7	Research capability development and technology transfer .....	49
Table 8	Key risks and control measures .....	58
Table 9	Key strategic area: Human capital development .....	60
Table 10	Key strategic area: Research capability development .....	62
Table 11	Key strategic area: Infrastructure development .....	64
Table 12	Key strategic area: Partnership and collaboration .....	66
Table 13	Key strategic area: Financial sustainability .....	67
Table 14	Research project prioritisation for full proposal development .....	68
Table 15	Target SET key performance indicators .....	69
Table 16	SET staffing levels .....	70
Table 17	Estimated annual staff cost: GBP (SSP) .....	71
Table 18	Annual operational expenses .....	72
Table 19	Estimated start-up budget .....	74
Table 20	Projected indirect expenses .....	74
Table 21	Funding allocation 2018/2019 FY .....	75
Figure 1	Potential road corridors and project sections .....	14
Figure 2	Policy framework for the establishment of the Road Research Centre .....	26
Figure 3	Current site and location of CML building .....	34
Figure 4	Disbursement model of revenue from oil for infrastructure development .....	41
Figure 5	Time line for institutional development .....	44
Figure 6	Interim operational structure .....	51
Figure 7	Research management committees .....	52
Figure 8	Interim research management structure .....	53
Figure 9	Operational model .....	54
Figure 10	The operational model of the RRC as a semi-autonomous institution .....	56
Figure 11	The overall governance structure .....	56

## Abstract

The primary purpose of this project was to support the establishment of a Road Research Centre (RRC) in South Sudan, to ensure sustainable road research capacity that will effectively contribute to the development of the road sector and accelerate national development strategy of the country.

The Africa Community Access Partnership (AfCAP) agreed to provide the necessary technical support to the Ministry of Roads and Bridges (MRB) for the implementation of the activities necessary for the development of institutional set up and a strategic plan for implementation of road research.

This Strategic Plan has been developed based on contributions from technical experts from key stakeholder institutions through consultative meetings throughout the project implementation phase, and discussions at a consultative workshop that took place on 30<sup>th</sup> October, 2019. It is the document that will guide the establishment of the Road Research Centre in South Sudan,

## Key words

Capacity building, road research, strategic plan

### Research for Community Access Partnership (ReCAP)

#### Safe and sustainable transport for rural communities

ReCAP is a research programme, funded by UK Aid, with the aim of promoting safe and sustainable transport for rural communities in Africa and Asia. ReCAP comprises the Africa Community Access Partnership (AfCAP) and the Asia Community Access Partnership (AsCAP). These partnerships support knowledge sharing between participating countries in order to enhance the uptake of low cost, proven solutions for rural access that maximise the use of local resources. The ReCAP programme is managed by Cardno Emerging Markets (UK) Ltd.

[www.research4cap.org](http://www.research4cap.org)

## Acronyms, Units and Currencies

AfCAP	Africa Community Access Partnership
AfDB	African Development Bank
AsCAP	Asia Community Access Partnership
CML	Central Materials Laboratory
CSIR	Council for Scientific and Industrial Research
DFID	Department for International Development
DMR	Directorate of Materials and Research
GBP	United Kingdom Pound (1 GBP = 391 SSP, as at 27 September 2019)
JICA	Japan International Cooperation Agency
MRB	Ministry of Roads and Bridges
ORM	Office of Road Monitoring
RA	Roads Authority
RRC	Road Research Centre
ReCAP	Research for Community Access Partnership
RRSC	Road Research Steering Committee
RRTC	Road Research Technical Committee
RRTT	Road Research Task Team
RSBP	Road Sector Business Plan
RSDP	Road Sector Development Plan
RSP	Road Sector Programme
SPA	Strategic Priority Area
SO	Strategic Objective
SSDP	South Sudan Development Plan
SSRA	South Sudan Road Agency
TRL	Transport Research Laboratory
UNOPS	United Nations Office for Project Services
USAID	United States Agency for International Development
WFP	World Food Programme

## Executive summary

The primary purpose of this project was to support the establishment of a Road Research Centre (RRC) in South Sudan, to ensure sustainable road research capacity that will effectively contribute to the development of the road sector and accelerate national development strategy.

The Africa Community Access Partnership (AfCAP) agreed to provide the necessary technical support to the Ministry of Roads and Bridges (MRB) for the implementation of the activities necessary for the development of institutional set up and a strategic plan for implementation of road research.

As part of the process of developing the strategy for research, a consultative approach was necessary, to gather the opinions of stakeholders and their suggestions, in order to ensure that the strategy is responsive to the national needs.

This Strategic Plan has been agreed following a consultative workshop on 30 October 2019, at which the Draft Strategic Plan, developed with contributions from technical experts from key stakeholder institutions, was presented, discussed and recommendations made. The Draft Strategic Plan set out the following:

- The policy framework for the development of the strategy
- A statement of the vision and mission of the Road Research Centre (RRC);
- Goals and objectives for the RRC;
- Institutional framework, setup and functions of RRC that best serves government's development objectives;
- Identification of important issues influencing road sector research needs;
- An assessment of the current road research culture and environment;
- Specific strategies and actions to undertake in order to establish the RRC and build research capacity;
- Identification of research infrastructure needs both current and future;
- Investments requirement for the laboratory and information centre infrastructure needs
- Priority research projects that best serve government's policy objectives based on consensus with key road sector stakeholders;
- Required funding for operationalisation of the RRC and the identified research projects, including potential sources of funding.
- Action plans for the establishment of the RRC

The strategic research objectives and direction of the RRC are guided by the **policy framework** for the development of the strategy for the establishment of the Road Research Centre in South Sudan as shown below:



The **Vision and Mission** should articulate the aims of the RRC and also reflect responsiveness to the national agenda in the area of road transportation development as well as set out the future aspirations for the road research capacity building programme. The following is proposed:



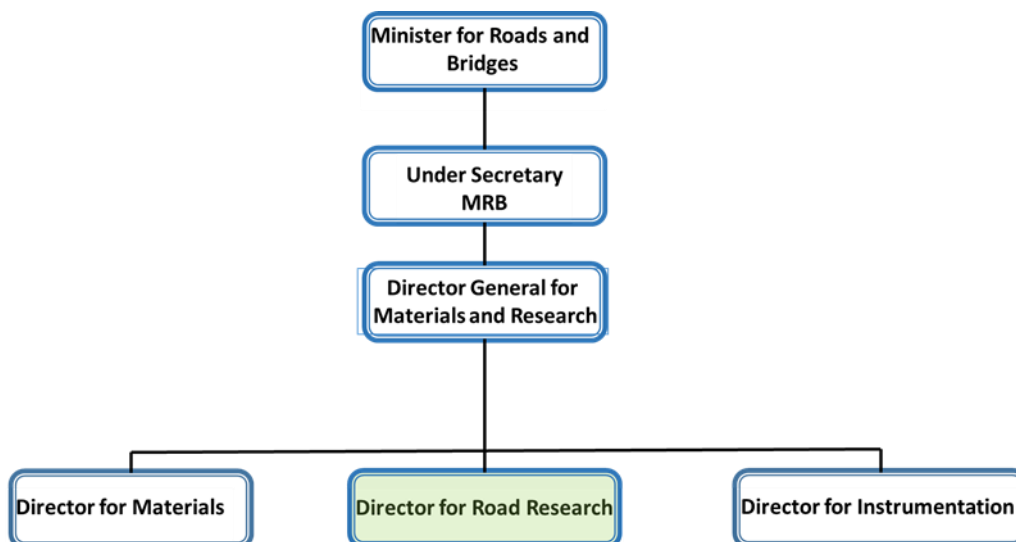
Vision: *Excellence in road sector research, innovation and development, for a safe, secure and efficient road network needed for prosperity of the Republic of South Sudan*

Mission: *A centre that conducts research, develops human capital to support building high quality, safe and cost effective and inclusive roads that equally service the population of the Republic of South Sudan.*

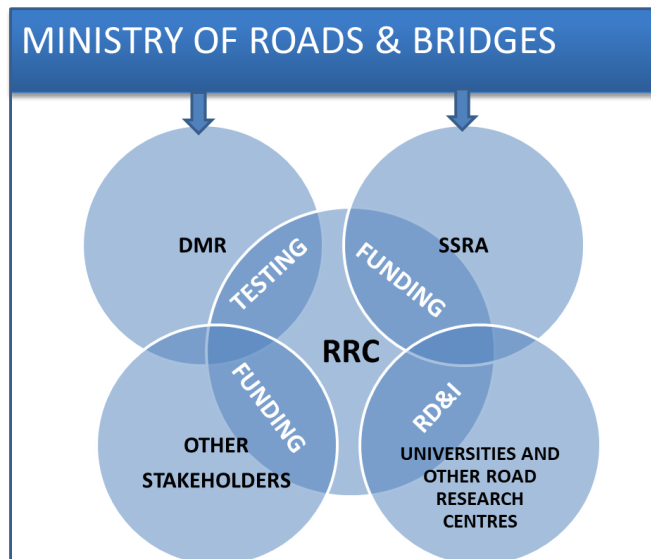
**Key issues:** The RRC is to prioritise focus on the overarching areas of research, development and innovative solutions to respond to the different challenges in the road sector:

- Research that deals with government-identified priorities to support the generation of relevant knowledge and solutions for the road sector. Road construction materials shortage and improved rural access as a priority.
- Skills development for sustainable road research and innovation
- Capacity of the states /private sector in testing and calibration equipment
- Development of standards, testing manuals and specifications
- Data generation and availability for development and maintenance of road infrastructure
- Institution and programmes for training materials technologists and road supervisors

**Institutional re-alignment,** provides for the following interim operationalization structure:



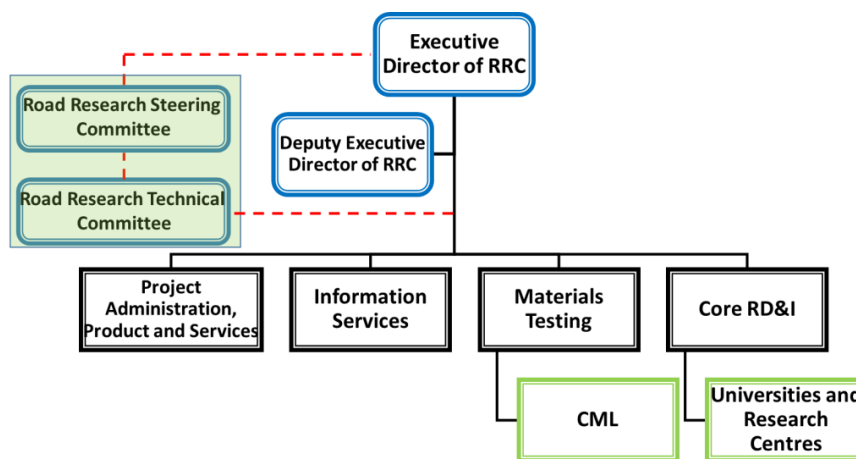
**The operationalization model** for the RRC involves linkage to South Sudan Road Agency (SSRA) for both financial and technical support, the Directorate for Materials and Research for laboratory testing and with direct staff involvement of the universities and other research centres for collaborative implementation of research development and innovation activities. This arrangement provides the pathway for the RRC to grow into a semi-autonomous and to diversify access to funding sources. The ultimate goal is that the RRC will move out of Ministry of Roads and Bridges (MRB) to its own premises in the future.



DMR: Directorate for Materials and Research  
 RRC: Road Research Centre  
 SSRA: South Sudan Road Authority

### Operationalization structure for the semi-autonomous RRC

It is envisaged that in year 3 of its establishment, the RRC will be located in its own premises and become a stand-alone entity. The RRC will be headed by an Executive Director, who will provide road research leadership assisted by a Deputy and four (4) Heads of functional Area/Unit. The Executive Director, the Deputy and Heads of functional Areas/Units and the Administrators shall constitute the Management Team of the RRC. The proposed structure within which the RRC will operate as a semi-autonomous institution is presented below:



**Action plans** for the implementation of the strategic plan to establish the RRC cover the following components: governance; staff complement; infrastructure; research; human capital development; and products and services.

**Funding sources** are proposed to ensure financial sustainability of the Road Research Centre and sustainable quality road research in South Sudan. A model is proposed for accessing the oil for infrastructure revenue to support road research.

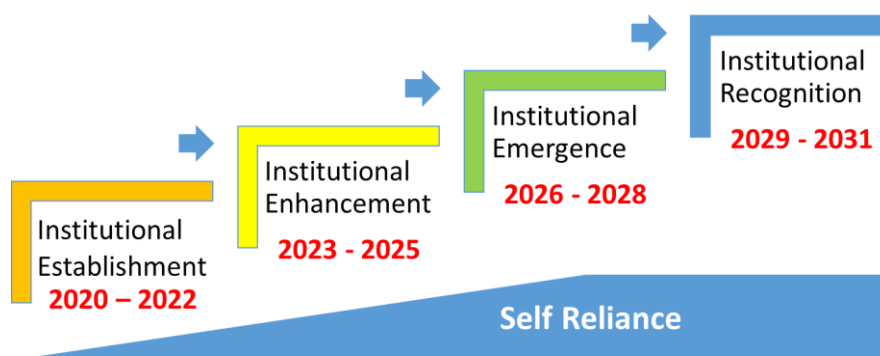
**Research prioritisation:** Priority research areas/themes were identified through consultations involving a broad-based stakeholder representation during the workshop 1. From the list of top 20 topics provided by the workshop groups, the CSIR undertook a further ranking process, and the following are the identified top ten research areas:

1. Soils and materials for road construction, including alternative road construction materials
2. Stabilisation techniques and cost effectiveness
3. Hydrological impact of the environment
4. Soil classification and properties analysis
5. Pavement design standards appropriate for the type of vehicles in use in the country
6. Database and mapping of materials distribution in South Sudan
7. Community participation and engagement in road projects – sensitisation of material extraction requirements in the area
8. Establishment of cost regimes of projects
9. Road traffic and safety management ( incorporating Transport services and gender mainstreaming)
10. Legal axle load control and enforcement

With the current trend of research in the area of climate resilient and adaptation and their effect on road infrastructure development it was expected that this should be one of the priority research area.

**Future steps for the institutional development:**

The RRC will evolve through phases of development as it matures to a well-established research institution and achieve self-reliance. The time-line for the different phases leading to institutional recognition is depicted below:



**Time-line for the start-up phase:** A detailed time-line is set out for the major actions required to implement this Strategic Plan for the establishment of the RRC and its operationalization. The MRB should establish an interim Road Research Task Team (RRTT) to coordinate the process with membership representation by Director General for Materials and Research, Directorate for Planning and Policy Formulation, Directorate for roads and Bridges, Legal Advisor, Directorate for Administration and Finance at MRB and Executive Director of SSRA. The RRTT should have the responsibility to manage the process of putting things in place for the establishment of the RRC, instituting legal and regulatory framework for the institutional establishment of the RRC in the first 4 months. The proposal is that the Under Secretary of MRB chairs the RRTT.

The time-line for the start-up phase, first six months, is as follows:

Activity	Actioned by	Deadline
Establish the Road Research Task Team (RRTT) to coordinate the process of establishing the RRC.	Under Secretary 6 Jan 2020	31 Jan 2020
Initiate the upgrading programme for CML as per inventory process undertaken. Procurement of basic standard laboratory equipment	DG for DMR 1 Jan 2019	31 Jan 2020
The RRTT to provide input in the recruitment process of the Head of RRC, Deputy Head and research staff, including approval of job descriptions	Under Secretary 1 Feb 2020	28 Feb 2020
Initiate recruitment of Head of RRC	RRTT 1 Feb 2020	28 Feb 2020

Activity	Actioned by	Deadline
Establish land ownership for the purpose of constructing the RRC	RRTT 1 Feb 2020	28 Feb 2020
Seek legal opinion and advice for guidance in establishing RRC under the special schedule for autonomy and make recommendations to the Minister of MRB	RRTT 1 Mar 2020	30 Mar 2020
Study visit by Director General of Directorate for Materials and Research and the new Head of RRC to an ISO accredited research laboratory (2 weeks)	Under Secretary 1 Apr 2020	30 Apr 2020
Establish funding model for research, including access to the revenue from the 10 000 barrels/day oil.	Head of RRC 1 Apr 2020	30 Apr 2020
Establish RRSC and RRTC to prioritise research projects and to select the first series of priority projects for funding in the next Financial Year	Head of RRC 1 April 2020	30 Apr 2020
Source Technical Assistance to design and initiate capacity building programmes for staff to nurture research development.	Head of RRC 1 April 2020	30 Jun 2020
Source Technical Assistance to develop or adopt guidelines for a research policy and mentorship programmes	Head RRC 1 Apr 2020	30 Jun 2020
Develop or adopt products and services policy to guide the management thereof, including publicising, promoting RRC's research, nationally and internationally	Head of RRC 1 Apr 2020	30 Jun 2020
Conduct survey on implementation of training programmes for the road sector	Head of RRC 1 Apr 2020	30 Jun 2020
Initiate recruitment process of research staff	1 May 2020	31 Jul 2020

The **establishment of the Road Research Centre** will contribute to national development objectives and will create a platform for access to information on road research outcomes, to help foster a knowledge-based road sector. Institutional commitment by the MRB, as the implementing line Ministry, is required to ensure the successful establishment of the RRC. However, Technical Assistance is required to support the implementation this Strategic Plan and operationalize the RRC.

# 1 Introduction

## 1.1 Project purpose

South Sudan embarked on a process to establish a Road Research Centre (RRC). The initiative was initially started in 2013, when AfCAP commissioned Transport Research Laboratory (TRL) of UK to provide technical assistance to the South Sudan Ministry of Transport, Roads and Bridges (MTRB) to develop road research capacity in the Directorate of Materials and Research (DMR). The process of this initiative was interrupted due to security concerns in the country. The Government of South Sudan through the Ministry of Roads and Bridges (MRB), now responsible for the construction of roads and bridges throughout the country, requested for support to undertake the next steps to achieve the objective of establishing the RRC. As part of its applied research and capacity-building objective, AfCAP agreed to provide the necessary technical support to the MRB for implementation of the activities necessary to achieve the key objectives and strategies to establish the RRC.

The technical assistance was provided to enable the process of developing and implementing the strategy for the establishment of the RRC. This included the definition of the institutional and organisational structures, vision, mission and goals, human capital development, research priorities and action plans for the establishment of the RRC.

## 1.2 Rationale for building local research capacity

The Ministry of Roads and Bridges Draft Strategic Plan 2013 – 2018<sup>1</sup>, shows that the road network in South Sudan was estimated at 12,642 km in 2005, consisting of 7,369 km of interstate roads, 1,451 km of state primary roads and 3,822 km of state secondary roads. Most of these roads are unpaved. The 2011-2016 South Sudan Development Plan (SSDP), takes cognisance of the importance of transport infrastructure as a vital driver of the nation's economy. It provides plans to be implemented in order to remove impediments to transport infrastructure development and achieve the country's economic development objectives by initially focusing on renewed rural development and diversifying into broader private sector development.

One of the areas of action prioritised in the SSDP is ***the extending and upgrading transport infrastructure, especially roads. This is critical to connect farmers to markets and includes plans to asphalt 700km of trunk roads and 1000km linking major towns, expand the feeder road network, and strengthen maintenance for all roads.*** The challenge the country faces is the delivery of a road network at a level of service that meets the country's requirements, including upgrading unpaved rural roads to bitumen standard. Innovative solutions are required to address these challenges.

According to the Road Sector Development Plan (2016)<sup>2</sup>, 19 road corridors were identified as potential priority corridors. These were further sub-divided into 62 smaller project sections as shown in Figure 1. The RSDP survey data results show that 54 percent of the total road length is "Earthen" road type and 46 percent are "Gravel/Murram". This means that the entire road network of South Sudan is either "Earth" or "Gravel". The study points out that the 193 km road from Juba to Nimule was recently paved as a chip seal surface.

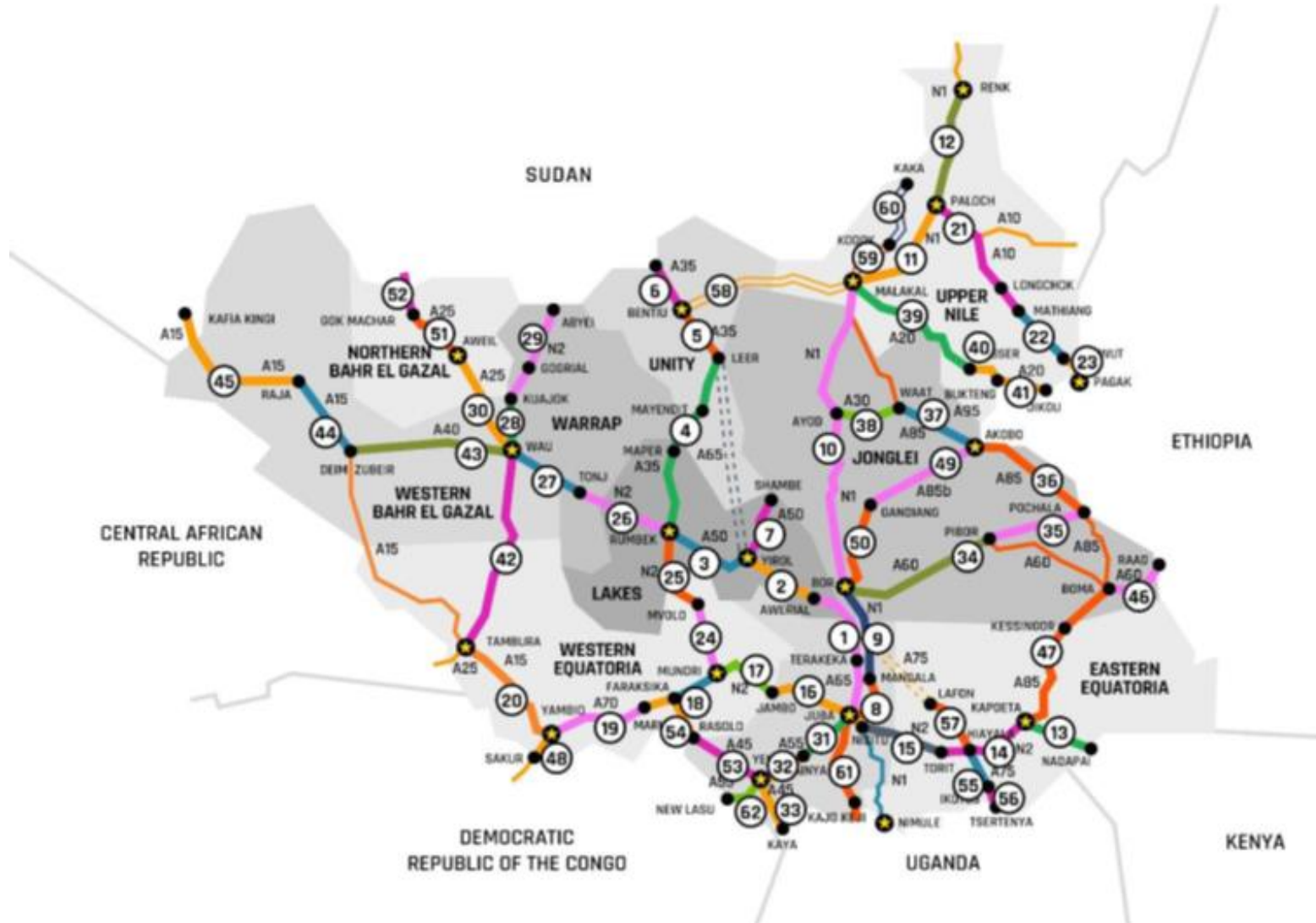
The challenge the country faces is the delivery of a road network at a level of service that meets the country's requirements, including upgrading the enormous unpaved rural roads to bitumen standard. Innovative solutions are required to address these challenges.

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<sup>1</sup> Draft Strategic Plan 2013 - 2018. Republic of South Sudan, Ministry of Roads and Bridges.

<sup>2</sup> Road Sector Development Plan (RSDP), South Sudan Rural Roads Project (SSRRP). UNOPS, South Sudan Operations Centre, September 2016.

Figure 1 Potential road corridors and project sections



Source: UNOPS, Road Sector Development Plan.

According to the Road Sector Business Plan (RSBP), <sup>3</sup>the total project costs for all sections is an estimated \$1.477 billion. The expectation is that MRB, as the line Ministry responsible for the construction of roads and bridges throughout the Republic of South Sudan, should respond to the national priority and do more in improving the country's road network. The improvement of the country's network will support government's strategy (Vision 2040, National Development Plan) and policy (Transportation Policy), and MRB will fulfil its mandate according to the Ministry's own strategic plan (2013 -2018).

The expectation is that MRB, as the line Ministry responsible for the construction of roads and bridges throughout the Republic of South Sudan should respond to the national priority and do more in improving the country's road network. The improvement of the country's network will support government's strategy (Vision 2040, National Development Plan) and policy (Transportation Policy), and MRB will fulfil its mandate according to the Ministry's own strategic plan (2013 -2018).

One of the key actions in the Ministry's strategic plan (2013-2018), included the recommendation to undertake research on alternative construction methods. The strategic plan, therefore takes cognisance of the importance of research. Research development and innovation in the design and provision of roads is crucial in order to find solutions for the road sector, and provide the rural population the opportunity to participate in meaningful agricultural activities and to have easier access to markets.

There is an urgent need for establishing the appropriate institutional set up and developing sustainable capacity for undertaking research in the country. However, it requires the development of a Strategic Plan to provide a framework for the establishment of a RRC. AfCAP, through this project is providing the necessary technical support to the Ministry of Roads and Bridges (MRB) for implementation of the activities to develop sustainable road research capacity in the country. The expectation is that the built research capability will generate the knowledge that should be transformed into actionable ideas for the country's road infrastructure development.

### 1.3 Methodology and approach

As provided in the Terms of Reference, the overall objective of this assignment was to assist the MRB, in collaboration with key stakeholder organisations, with the institutional set up for and to develop a strategic plan for implementation of road research. The project is to be implemented in two phases:

1. Phase 1 – *Development of a Strategic Plan.*
2. Phase 2 – *Establishment of the RRC.*

#### 1.3.1 Development of the strategic plan

Phase 1 of the project is the current phase and is undertaken through two main stages. Firstly, a situational analyses assessment, followed by the development of the strategic plan, presented in this document.

**The situational analysis** involved document review and stakeholder consultation process achieved through consultative meetings and interviews and a workshop. During the meetings and interviews, the same specific directed questions are put to the stakeholders to solicit their perception and suggestions on the following:

- (i) institutional arrangements for the establishment of the RRC;
- (ii) laboratory and ICT infrastructure;
- (iii) collaborative activities or relationship between key stakeholder organisations in the transport sector in the country with MRB and DMR specifically;
- (iv) research culture in the country;
- (v) research funding mechanism; and
- (vi) priority research areas.

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<sup>3</sup> Road Sector Business Plan. South Sudan Rural Roads Project (SSRRP), UNOPS South Sudan Operations Centre, September 2016.

The situational analysis and subsequent stakeholder workshop assisted in identifying crucial issues and the findings set the guidance for the **development of the Strategic Plan** for the establishment the RRC. This includes the definition of the institutional and organisational structures, vision, mission and goals. In addition, the plan addresses requirements for human capital development, facilities and other organisational, operational and financial requirements for the effective operation of the RRC. These aspects of the Strategic Plan are the enablers for the development of sustainable research capacity and the delivery of road research.

### 1.3.2 Establishment of the RRC

The establishment of the RRC will be undertaken in Phase 2 and will be directed by the Strategic Plan to operationalise the proposed RRC. It will involve putting in place systems for the implementation of the action plans, including planning, prioritisation and coordination of road research projects aimed at fostering innovation in different areas of the road sector to respond to the objectives of the national strategy and policies.

### 1.4 Scope of work

The project was focused on the following areas:

- Case for research
- Existing institutional framework for road research and policy environment
- Optimal institutional arrangement for undertaking road research
- Funding for research
- Strategy to facilitate the establishment and operationalization of Road Research Centre.

The development of the strategy and support to the establishment of a Road Research Centre include addressing the institutional relationships between the various key stakeholders, who play a significant role in the country's road sector and are more likely to contribute towards the sustainability of the road research capacity building and functioning of the Road Research Centre.

### 1.5 Purpose of document

This document sets out, the case for research capacity building in the road sector, institutional framework and outlines steps for the Ministry of Roads and Bridges towards achieving the ultimate goal of establishing a Road Research Centre. The baseline information established during the stakeholder consultation process, revealed that there are currently institutional arrangements that potentially can support the intended initiative of building road research capacity in the country. The consultation process provided the opportunity to understand the different standpoint and perception on the current situation, related to road research capability and institutional arrangements in the country. Significant gaps with respect to research capability and infrastructure have been identified during the consultation process.

The document sets out the overall framework for a road research strategy and approach to road research capacity building. The development of the document is informed by taking cognisance of the different key stakeholder perception on different aspects of the initiative to establish the Road Research Centre.



## 2 Meeting national development objectives

### 2.1 Introduction

A number of documents were reviewed to gather information that assisted in establishing the country's vision, policies, legal framework considerations, the national challenges and institutional mandates, as reflected in the sections below.

### 2.2 Vision of the Government of South Sudan

The longer-term aspirations for South Sudan are guided by Vision 2040<sup>4</sup>, which sets out a comprehensive vision and agenda for the country. The outcome of this document review is aimed at integrating and linking the research activities of the RRC to the national aspirations in order to contribute towards achieving effective economic development objectives in alignment with the Vision 2040. This will assist the Project Team to prepare a responsive Strategic Plan. The overall objective in the review is to assess which priorities are already reflected in the National Development Framework and more specifically to:

- Identify which national targets and indicators for road transport are already reflected within the national development documents namely, Vision 2040, South Sudan Development Plan and Road Sector Strategic Plans,
- Based on the key consultations, to explore, the challenges, gaps, and opportunities to implement the road research agenda, with addition of new areas not found in the available documentation.

The National Vision 2040 identifies the following four pillars that constitute a set of national priority programmes to which government resources will be focused:

1. Governance
2. Economic development
3. Social and human development
4. Conflict prevention and security.

The Economic Development Pillar, essential to the future prosperity of South Sudan, covers the overarching priority area for road transport infrastructure that is relevant to the project objectives, as identified by the two key excerpts:

- ***Road transport and infrastructure development that will provide opportunities in isolated regions and create a national market, and on providing social infrastructure development, including particularly water resource management and sanitation services.***
- ***Rural transformation and developing economic activities that will contribute immediately to the quality of life of most South Sudanese.***

The South Sudan Development Plan (SSDP) builds on the Vision 2040 and sets the framework for national development over the coming years. The strategic objective of the SSDP is to increase mobility of persons and goods and it calls for focused funding for improving and expanding road infrastructure. The expected outcomes of the SSDP with respect to roads transport infrastructure, linked to the Transport Sector Policy, are as follows:

- ***Improved transport reliability, levels of service and efficiency to enhance economic growth.***
- ***Enhanced access to local and international markets***
- ***Improved interstate, trunk and feeder roads,***
- ***Improved routine maintenance on sustainable basis and***
- ***Improved roads safety provision to reduce accidents and their derived human and economic costs.***

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<sup>4</sup> South Sudan Vision 2040

A road research agenda should be responsive to the above key priority areas to assist in achieving the national aspirations as outlined in the National Vision 2040. It is anticipated that the Strategic Plan for establishment of sustainable road research capacity will align its objectives with these national priorities in order to drive growth and development goals in the country.

The Transport Sector Policy<sup>5</sup> is the key sector document that defines the overall policy objectives of the roads and the transport sector and for the development of the strategy for the implementation of the national agenda.

## **2.3 Existing policy setting**

### **2.3.1 National Transport Sector Policy**

It should be noted that, the National Transport Policy document was developed and published in 2007 under the then Ministry of Transport and Roads and is due for revision. However, it provides the necessary background to the hierarchical framework for the sector. It defines the transport system of South Sudan, which consists of four major modes namely: roads, railways, inland water (river transport), and air transport. The National Transport Sector Policy outlines specific goals for each of the transport systems.

As such, the Transport Sector Policy promotes a multi-modal approach, to allocate available resources among the various transport modes so that the resultant modal mix meets transport requirements at optimum cost to both the provider and the user.

This document indicates the importance of how devoting more resources to the transport sector will improve mobility in rural areas through the promotion of the use of appropriate means and modes of transport. It is for ensuring the provision of coordinated transport services.

Sub-sector policies address specific objectives of the National Transport Sector Policy. However, roads as a sub-sector of the transport system are the focus of this project. In dealing with critical key road issues in South Sudan, Road Infrastructure sub-sector policy is considered key for the implementation of the strategy to provide a sustainable road transport network for the country. The following are the other sub-sector policies on road transport system:

- Road Freight Transport,
- Road Passenger Transport Services
- Road Traffic Management and Safety
- Non-Motorized and Intermediate Means of Transport.

The Road Infrastructure sub-sector policy is the key policy to provide guidance in the development of the Strategic Plan on the establishment of the RRC in relation to the delivery and provision of sustainable road transport network. However, it should not be considered in isolation. It must be linked to the other sub-sector policies for the strategic plan to be more responsive to the country's transport key challenges.

### **2.3.2 Sub-sector Policy on Road Infrastructure**

Its overall objective is the development of road infrastructure, which is to provide an integrated, efficient, reliable, and commercially sustainable road transport network that improves access and communication, reduces transport costs and provides for the safe and efficient movement of people and goods in an environmentally sustainable manner. One of the sub-sector policy is on non-motorized and intermediate means of transport, thus the road network is to include adequate provision for the non-motorized transport.

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<sup>5</sup> Transport Sector Policy for the Ministry of Transport and Roads Government of Southern Sudan, October 2007

### 2.3.2.1 *Specific objectives of the sub-sector Policy on Road Infrastructure*

The specific objectives of the Road Infrastructure sub-policy include:

- *Maintain, rehabilitate, improve and construct roads in order to ensure improved accessibility and minimise road transport costs. Higher priority will be given to the prime routes linking the States capitals and other urban and population centres.*
- *Establish appropriate standards for road design and construction.*
- *Preserve investments through sustainable maintenance management of road network and efficient axle load control.*
- *Establish appropriate road institutions that includes roads agencies and roads board, and road councils.*
- *Create a sustainable system for domestic financing and management of the road network e.g. through fuel level and other road user charges, establishment of road agencies and road fund administration.*
- *Take measures to develop the domestic consulting and contracting industry.*
- *Improve accessibility in the rural areas with emphasis on feeder roads leading to productive areas.*
- *Upgrade and construct roads to open up agricultural areas and promote national and regional transportation exploiting the strategic geographical positioning of South Sudan in the region.*
- *Ensure environmental and safety concerns are adequately addressed in the design, rehabilitation and maintenance of roads.*

The sub-sector policy on Road Infrastructure makes specific recommendations in each of the following areas, in order to achieve the above stated objective goals:

1. *Establishing the institutions to manage road infrastructure*
2. *Development and maintenance of roads infrastructure*
3. *Prioritization and sequencing of the road network development*
4. *Project design*
5. *Contracting strategy*
6. *Financing the development and maintenance of roads*
7. *Establishment of financial management, accounting and reporting system*
8. *Road works standards*
9. *Material testing*
10. *Information and management systems*
11. *Human resource development in the roads infrastructure sector.*

### 2.3.2.2 *Institutional establishment for the management and financing of road network*

In order to create a management system for the road network, recommendation one of the sub-sector policy, as listed above, provided institutional framework for establishing the following agencies at different levels of Government:

- South Sudan Roads Board (SSRB)
- South Sudan Road Agency (SSRA)
- State Road Agencies
- Urban Roads Agencies
- County Road Agencies

The establishment of the Road Fund Administration (RFA) is for creating a sustainable system for financing of the road network. Only the SSRA is a fully established autonomous body corporate. It has an Executive Director (ED) and the Board in place. RFA and the other agencies are yet to be established.

The SSRA, which was set up by Act of Parliament in July 2011, has the following primary responsibility:

- *Development and maintenance of Interstate Roads*
- *Development and maintenance of International Roads; and*
- *Development and maintenance of roads of national importance*

This gives a perspective of the institutional arrangements and the agencies that will play a crucial role in the management of the road network. The expectation is that the RRC will establish strong linkages with these agencies as they become more established, and they, in turn will ultimately play a role in influencing the decision-making process on prioritization and implementation of national research projects as key stakeholders.

### *2.3.2.3 Identified medium term priorities for road network development*

The sub-sector Road Infrastructure policy identifies the following as key activities for road network development in the medium term:

1. Institute and promulgate a clear and detailed set of standards for road design, construction and maintenance for each of the different levels of road.
2. Enact legislation and establish institutions to ensure efficiency, accountability and the participation of road user groups, including the key sectors and agencies that depend on the roads, in their monitoring and management.
3. Build public and private sector capacity to implement and manage the roads sector.
4. Identify and commence the process of rehabilitating and developing the primary road network.
5. Establish mechanisms for adequate and sustained financing for road maintenance.
6. Install axle load control, the legislation and enforcement mechanisms to protect the roads from undue damage.
7. Promote the active participation of the private sector, particularly labour-based system contractors (these goals can also provide constructive employment for large numbers of ex-combatants).

In order to effectively implement these priority activities, the interventions to provide solutions and decision-making process require systematic gathering of good quality information through well-executed research programmes. However, priority activity (3), underlines the need to build capacity to implement and manage the road sector. Although not explicitly stated this ideally includes implementing research programmes in the road sector. There is therefore a need to develop a road research strategic plan, in order to address the lack of capacity.

### **2.3.3 Road sector Policy**

This project is aimed at providing the means through which the Strategic Plan for road research capacity building, should be developed, which responds to the national strategic objective goals. In order to enhance the quality of policy and decision-making and planning regarding road research, a specific national policy or strategy should provide the required guidance in the establishment of the relevant institution. The National Transport Policy does not specifically address the implementation of road research studies under the Road Infrastructure sub-sector policy.

The National Transport Policy was developed under the then Ministry of Transport and Roads before the establishment of the specific Ministry for road infrastructure development (the current Ministry of Roads and Bridges). The road sector specific policy is therefore drawn up and implemented by the Ministry of Roads and Bridges.

The Road Sector Development Plan<sup>2</sup>, developed under the South Sudan Rural Roads Project (SSRRP) by UNOPS identifies strategic priorities and resources for transport sector development and operational needs for short, medium and long-term government's developmental goals. The Road Sector Development Plan is aimed at providing the base for all future budget allocation discussions, including planning for road maintenance. A number of initiatives are proposed for the development and maintenance of the South Sudan road network.

The objective of the Ministry is ***to develop, maintain, rehabilitate, and improve roads and bridges in order to ensure improved accessibility and minimize road transport costs.***

The overall road sector policy objective, in the development of road infrastructure is ***to provide an integrated, efficient, reliable, and commercially sustainable road network that improves access and communication, reduces transport costs and provides for the safe and efficient movement of people and goods in an environmentally sustainable manner.*** The policy framework also recognizes the need for the network to include adequate provision for the non-motorized transport.

#### ***2.3.3.1 Road sector priority areas***

There are ten priority areas identified in the policy document with outlined strategic objectives towards achieving the stated goals :

1. Policies to guide Roads Infrastructure Development
2. Establishing Sectoral Institutions to manage Roads Infrastructure
3. Development and Maintenance of Roads Infrastructure
4. Financing the Development and Maintenance of Roads
5. Establishing Road Works Standards
6. Establishing Information and Management Systems
7. Human Resource Development (HRD) in the Ministry
8. Cross-Cutting Issues
9. Establishing linkages and networks with other institutions/stakeholders public, private sector, development partners, civil society organizations, communities etc.
10. Establish Monitoring and Evaluation (M&E) System for the Sector.

## 3 Current operational environment for road research capacity building

### 3.1 Introduction

The process of information gathering provided a better understanding of the road sector. It also assisted in identifying gaps that, if not addressed, can negatively influence the implementation of the policy and strategy on road research capacity building. This section therefore deals with aspects that should be considered in developing the road research Strategic Plan, based on the reviewed relevant sector documents, and experiences and opinions shared by key stakeholders during the consultative meetings.

Information gathering was undertaken through review of key documents relating to national strategy, policies, research reports and other studies on rural access improvement programmes. Meetings and interviews of key stakeholders provided insight to their perceptions on a variety of issues related to the establishment of the RRC.

This included: views on the existing national policy plans and strategies; institutional framework and administrative set up in the road sector; training institutions playing a role in capacity building for the road sector; availability and capacity of road construction materials testing facilities; road research capacity and institutional cooperation; level of laboratory equipment and staff contingent to support future research activities.

The key strategic and policy documents designed to lead the country towards attainment of the development goals and relevant to this project were reviewed and are highlighted in the Preliminary Finding Report<sup>6</sup>. The benchmarking with established Road Research Centres, assisted in categorizing the identified issues, by key elements that are considered crucial for an effective implementation of the road research strategy. These elements are presented in sections 6 and 7 and if not addressed properly, will affect functionality of the established Road Research Centre and impact on the expected outcomes and benefits of building road research capacity.

### 3.2 Operational description

The following sections present the identified issues with respect to required institutional framework and organizational setup that need to be addressed to ensure effective functionality and sustainability of the RRC. These objectives include the identification of the challenges that the road transport sector faces in South Sudan and which the RRC can address through research.

#### 3.2.1 Strategic objectives of Ministry of Roads and Bridges

The stated strategic objectives are:

1. Develop, maintain, rehabilitate, and improve roads and bridges in order to ensure improved accessibility and minimize road transport costs. Higher priority will be given to the prime routes linking South Sudan to other countries, states capitals and other urban and population centres;
2. Plan, develop and maintain national highways in the Republic of South Sudan;
3. Establish improved standards for design and construction;
4. Develop standard specifications for roads and bridges in the Republic of South Sudan;
5. Preserve investments through sustainable maintenance management of roads network and efficient axle load control;

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<sup>6</sup> Mgangira, M.B and Anochie-Boateng, J. Council for Scientific and Industrial Research (CSIR), (2019). Development and Support to the Implementation of a Strategy for the Establishment of a Road Research Centre in South Sudan. Preliminary Findings Report, AfCAP/SSD/2164A. London: ReCAP for DFID

6. Establish appropriate road and bridges institutions that include Road Authorities, Road board and Road Councils;
7. Create a sustainable system for domestic financing and management of road network, e.g., through fuel levy and other road user charges, establishment of Road Authorities and Road Fund Administration;
8. Take measures to develop the domestic consulting and contracting industry;
9. Improve accessibility in the rural areas with emphasis on feeder roads leading to productive areas;
10. Upgrade and construct roads and bridges to open up agricultural areas and promote national and regional transportation exploiting the strategic geographical positioning of the Republic of South Sudan in the region;
11. Ensure environmental and safety concerns are adequately addressed in the design, rehabilitation and maintenance of roads and bridges.
12. Establish technical engineering schools.

The decision-making process to implement some of the strategic objectives will require the collection of quality and reliable data. Long-term collection of reliable data is also required in order to, for example, improve development of road infrastructure for the country's road network, including improvement of accessibility in the rural areas with emphasis on feeder roads and integrated transport infrastructure.

Strategic objective (6), **establish appropriate road and bridges institutions that include Road Authorities, Road board and Road Councils**, is evidence of MRB having the mandate to establish institutions. Establishment of an appropriate institution that will implement the required interventions for addressing some of the above strategic goals is needed.

The implementation matrix of the Draft Strategic Plan (2013-2018)<sup>7</sup> of MRB, specifically for research, focuses on conducting research on materials and pavements. The strategic objective is to conduct research on soils and pavements. Table 4 shows the implementation Matrix.

**Table 1 MRB Draft Strategic Plan (2013-2018) research implementation matrix**

Strategies	Key activities	Time Frame (Target Date)
Recruit and Train Research staff.	Liaise with administration to recruit	October 2013
Establish Suitable Centre for testing material	<ul style="list-style-type: none"> <li>• Mobilize resources</li> <li>• Construct the centre</li> <li>• Procure and install Equipment</li> </ul>	July 2015
Liaise with Higher Learning Institution and other Stakeholders	<ul style="list-style-type: none"> <li>• Identify learning institutions and stakeholders</li> <li>• Liaise with institutions for research</li> </ul>	October 2014
Coordinate the research studies	<ul style="list-style-type: none"> <li>• Identify learning institutions and stakeholders</li> <li>• Identify Research needs</li> <li>• Engage the institutions</li> <li>• Coordinate research studies</li> </ul>	October 2016

Having the strategic plan and framework has not translated into its implementation. The establishment of an institutional framework is the first and urgently required step towards the development and establishment of the RRC in the country. It is priority for South Sudan, as the establishment of the RRC to conduct road research and the generation of knowledge, will facilitate informed decision-making process and the adoption of appropriate and innovative solutions. This should lead to improved standards and methods for the design, construction and maintenance of the road network.

<sup>7</sup> Draft Strategic Plan (2013-2018). Ministry of Roads and Bridges. Republic of South Sudan

Because of the existing strategic objectives stated above, it can be said with current motivation and initiatives, that this may be sufficient to proceed with institutional framework development for the establishment of the RRC. The above strategic objectives should guide the development of the new Strategic Plan for the establishment of the RRC.

### 3.2.2 Institutional structure

The national institutional framework within which the RRC is to be established, was agreed, at the first stakeholder workshop held in Juba on the 20<sup>th</sup> June, 2020, to start as a semi-autonomous entity under MRB. Details of the discussed options can be found in **Section 5 Institutional options for road research capacity building** of the **Preliminary Report**<sup>8</sup>. In this setup, it should be ensured that the delivery of research is aligned with the strategic objectives of the Ministry of Roads and Bridges, and national regulations and applicable laws. Successful implementation of the road research capacity building programme will however, depend on institutional structures that facilitate the allocation of resources to support implementation of the strategic objective of building sustainable road research capacity.

#### 3.2.2.1 Structure of Ministry of Roads and Bridge

The MRB's organisational structure will provide both institutional and functional framework for implementation of the national strategic plan for the road infrastructure development. The institutional structure of MRB, shows that it comprises of four directorates namely:

- i. Directorate of Road and Bridges
- ii. Directorate of Administration and Finance
- iii. Directorate of Materials and Research
- iv. Directorate of Planning and Policy Formulations.

The overall structure for the MRB is shown in Annex 1. It shows the key elements and linkages between the Directorates and the SSRA. However, it is evident that the key Directorate that would support road research capacity building is the Directorate of Materials and Research. The Directorate of Materials and Research and its key elements are highlighted in red.

#### 3.2.2.2 Directorate of Materials and Research

The Directorate of Materials and Research is responsible for ensuring quality control in the construction of roads and bridges by contractors. Development of sustainable road research capacity requires strategic planning and implementation of activities appropriate for South Sudan. Therefore, the process requires adoption of national strategies to guide the development of a strategic plan. The Draft Strategic Plan (2013-2018) of the MRB, provides insights into the priority areas for each directorate. It is therefore envisaged that the activities that the Directorate of Materials and Research will undertake, should promote road research capacity building and the development of a strategic plan for the establishment of the RRC. The strategic plan for establishing RRC should also be guided by the critical issues and priority areas identified in the Draft Strategic Plan (2013-2018) as presented in Table 2.

Having the strategic plan and framework has not translated into its implementation. The establishment of an institutional framework is the first and urgently required step towards the development and establishment of the RRC in the country. It is priority for South Sudan as the establishment of the RRC to conduct road research and the generation of knowledge, will facilitate informed decision-making process and the adoption of appropriate and innovative solutions. This should lead to improved standards and methods for the design, construction and maintenance of the road network.

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<sup>8</sup> Mgangira, M.B and Anochie-Boateng, J Council for Scientific and Industrial Research (CSIR), (2019). Development and Support to the Implementation of a Strategy for the Establishment of a Road Research Centre in South Sudan. Preliminary Report, AfCAP/SSD/2164A. London: ReCAP for DFID.



**Table 2 Priority areas: Directorate of Materials and Research**

Priority area		Strategic objectives	
SPA1	Conducting Research in material of Roads and Bridges	SO1	To conduct research on materials and manuals for roads and bridges constructions
SPA2	Institutional Building	SO2	To enhance the capacity of the states /private sector in testing and calibrating equipment
SPA3	Development of Standards and Specifications	SO3	To develop standards testing manuals and specifications
SPA4	Road's database production	SO4	To make available data for development and maintenance of roads and bridges infrastructure
SPA5	Legislation for establishment of institution for training materials technicians and road supervisors	SO5	To formulate and enact policy for establishing the institution

### 3.2.3 Management of research

There exists a national body for managing research. The mandate to map the country's research needs is with the National Research Council (NRC), under the Ministry of Education, Science and Technology. The establishment of the NRC was gazetted on 10 February 2009 by an Act "The Southern Sudan Research Council Act, 2007"<sup>9</sup>. It is supposedly to be responsible for reviewing and approving all research proposals throughout the country. Its functions include formulating a comprehensive policy and designing programmes for scientific, engineering and technological research and directing *its implementation to ensure efficiency and effectiveness in the management and utilization of human, natural and material resources*. During the consultative phase, it was established that it is not yet operational. There was no administrative staff in place to manage the NRC.

### 3.2.4 Collaboration

A sequence of consultations with the major stakeholders followed by a consultative workshop confirmed that there exists relationships between MRB and all national transport sector key stakeholder organisations. The collaboration is not only in terms of the partnership during execution of projects but also involved coming together to discuss diverse key national issues in the development of the road sector, for example through the Feeder Road Steering Committee. This committee used to provide the opportunity of bringing together Government and the donor community. However, it needs reviving and strengthening. More details on the types of collaboration between MRB and all national transport sector key stakeholder organisations are presented in the Preliminary Findings Report.

The following stakeholder organisations were consulted and have established relationship with MRB:

- ABMC (a construction company)
- College of Engineering and Architecture at the University of Juba
- Engineering Council of South Sudan
- European Union (EU)
- Japan International Cooperation Agency (JICA)
- South Sudan Roads Authority
- The World Bank
- United Nations Office for Project Services (UNOPS)
- United States Agency for International Development (USAID)
- World Food Programme (WFP)

There exists willingness and initiatives to collaborate with MRB and this is critical to the institutional sustainability of the envisaged RRC.

<sup>9</sup> ACTS SUPPLEMENT to The Southern Sudan Gazette No. 1 Volume I dated 10<sup>th</sup> February, 2009

## 4 Framework for road research strategy

### 4.1 Introduction

The focus is to establish an institution that will fulfil government’s policy objective in the road sector with a clear legislative mandate. The stakeholders at the first consultative workshop generally supported the structure that will ensure the most practical autonomy of the RRC in the long-term. Taking into account the political-economy dynamics, hosting the RRC under MRB, in the meantime, is realistic and has a realistic chance of successful implementation. The ultimate decision rests with the Ministry of Roads and Bridges.

Section 4.2.1 established that existing policy might be sufficient to proceed with institutional framework development for the establishment of the RRC. The Vision of the Government of South Sudan, the National Transport Policy, the Road Sector Policy and Ministry of Roads and Bridges Policy Document and Strategic Plan (2013-2018) set the policy framework for the preparation of the strategy for the establishment of the Road Research Centre in South Sudan. Figure 2 shows the context of the strategy for the establishment and development of the RRC. The institutional framework is to support the development process and implementation of the strategic plan for building sustainable road research capacity in South Sudan.

Figure 2 Policy framework for the establishment of the Road Research Centre



### 4.2 Vision

The vision and mission should articulate the aims of the RRC, but also reflect responsiveness to the national agenda in the area of road transportation development. The following is proposed:

***Excellence in road sector research, innovation and development, for a safe, secure and efficient road network needed for prosperity of the Republic of South Sudan.***

### 4.3 Mission

The following is proposed:

***A centre that conducts research, develops human capital to support building high quality, safe and cost effective and inclusive roads that equally service the population of the Republic of South Sudan.***

#### 4.4 Core values

The following Core Values are consistent with what the MRB stands for and aligned with those of benchmarked research institutions:

- Good Governance and Leadership;
- Transparency and Accountability;
- Honesty, Trust and Integrity;
- Efficiency, effectiveness, professionalism and ethical research practices;
- Gender balance;
- Teamwork and collective responsibility;
- Innovation/creativity and responsiveness to environmental changes

#### 4.5 Situational assessment

The national stakeholder consultative process helped to understand the current institutional arrangement, research culture and capability as well as infrastructure and resources for research in the road sector. Significant gaps exist across the thematic areas as follows:

- a. **Lack of research administration and management:** There are no research committees within MRB to manage project prioritisation of the research programmes. The research committees are supposed to set the strategic direction for research, develop and coordinate research programmes. The expectation is that academic institutions should provide research management models. A form of a research committee exists at the College of Engineering and Architecture at the University of Juba, mostly for providing funding for student projects, but structures and processes to support management and implementation of research programmes are weak.
- b. **Lack of governance and regulatory research capacity:** At the national level, This Act provides for the establishment and management of the Southern Sudan Research Council as an independent public institution. The NRC is mandated to map the country's research needs. As at June 2019, no administrative staff was in place to operationalise and manage the NRC. Research systems are fragmented and there is lack of research infrastructure at the University of Juba. The university is the environment where research culture should be mature. However, there is lack of research culture due to lack of adequate funding for research and low motivation at the University of Juba. Funding for research is barely be enough to cover simple basic research.
- c. **Inadequate research infrastructure capacity:** Basic testing equipment for road construction materials testing is available at the Central Materials Laboratory, with one additional established private laboratory. There is also lack of information management systems. The College of Engineering and Architecture at the University of Juba does not have a functional laboratory facility and efficiently functioning information management system either. Adequacies/inadequacies were established with respect to the existing CML facility in terms of the following:
  - **Equipment:** Apart from having highly qualified and skilled personnel, proper management of laboratory equipment, inclusive of maintenance and calibration requirements are the most important aspects for a facility that must serve as a research laboratory. An inventory was undertaken of existing equipment. There is a mix of old and new equipment with capability to undertake basic testing, but has not been calibrated over last six years. Equipment is considered inadequate to support requirements of a research laboratory and as a reference laboratory. The frequency or how often the piece of equipment will need to be recalibrated is based on its stability and manufacturer's recommendations. Equipment has not been calibrated for more than six years. There is no service provider in the country to calibrate equipment.
  - **Facility:** The existing CML building's capacity is considered inadequate
  - **Personnel:** Review of the quantity and capability of the existing personnel at CML to perform in a research laboratory environment. Considered adequate but will require further training
  - **Site:** The current site of CML is located on the same site with SSRA, with other Ministry buildings is considered appropriate for the needs of the modern comprehensive laboratory facility.

- **Space:** The existing CML was also reviewed in terms of the quantity of space for the requirements of a modern comprehensive laboratory facility and considered inadequate, but provides for easy flow of material delivery, but not the storage area.
  - **Systems:** The operational conditions of mechanical (airflow), electrical and plumbing systems require refurbishing. There are no fire prevention system, extractors or fans or air conditioners and electricity and water supply is unreliable for sustained operations. Currently water is drawn from a water bowser into buckets for use in the lab, inappropriate for sample washing and cleaning effectiveness.
- d. **Lack of practical experience, mentors and role models within the research environment:** The South Sudan trials programme were undertaken by the MRB in cooperation with, and funded by, USAID. UNOPS, under contract to USAID. The project involved the design, construction and performance monitoring of a total of 18 trial sections and one control section along the existing Rajaf-Gumbo road. The programme offered an opportunity to build research skills and with mentorship produce high quality research and solutions for improving the rural road network.
  - e. **Lack of research leadership:** The expectation is that academically based lecturers should provide research leadership in the country. Road research output is minimal. Available record of road research outputs shows that it was produced entirely by international experts. A number of research outputs and examples of research uptake related to low volume road pavement design exist, produced by AfCAP and UNOPS under contract to USAID. The local experts identified key challenges and research priority areas in the road sector during the consultative meetings and workshop. The development of local research capacity is required to provide local solutions.
  - f. **Limited human capacity with research knowledge and skills within MRB:** The MRB through DMR has the responsibility for undertaking research on road and bridge materials. The lack of skills and capacity have resulted in limited attention being paid to research, apart from the project done with UNOPS. The establishment of a well-resourced RRC with skilled personnel in undertaking research as envisaged in this Strategic Plan should lead to more research and better research output levels in the sector.
  - g. **Lack of funding for research at DMR and very little research funding at the University of Juba:** There is currently no budget line for research under DMR. Staff from the Department of Civil Engineering at the College of Engineering and Architecture at the University of Juba, have very limited access to research funding. There is no research Chair in the Department of Civil Engineering. Improved institutional relationship between the College of Engineering and Architecture at the University of Juba and MRB, should lead to more research and better research output levels in the sector.
  - h. **Local institutional cooperation and collaboration exists:** Cooperation exists between the MRB and the key stakeholders, but currently to a limited level. The only collaborative example of a research project was the trials programme along the Rajaf-Gumbo road undertaken by the MRB in cooperation with UNOPS under USAID contract. The cooperation mechanism between the universities and the RRC in future needs to be formally established to strengthen and improve the institutional relationship and promote sustainability of research collaboration.
  - i. There is **lack of standardised training/qualifications** to produce appropriately trained technicians or technologists for road construction materials testing. There is also lack of standardised curricula at institutions of higher learning.
  - j. **Capacity to attract national partnerships** in the implementation of the strategy to build road research capacity in the country is demonstrated by the enthusiasm of the participants during the consultative meetings and the stakeholder workshop. Potential exists for involving a range of stakeholder.
  - k. **Relevance and necessity:** The RRC is to provide innovative solution for sustainable development in the road sector, improved accessibility in rural areas to respond to the national agenda priorities from Vision 2040.

- I. **Availability of land:** The establishment of a modern facility will require additional land. The site where CML is currently located has ample land for construction of the new facility

## 4.6 Goal and objectives of road research strategic plan

### 4.6.1 Goal

The goal of the Road Research Strategic Plan for South Sudan is to provide guidance for the establishment of an institution focused primarily on the delivery of research projects, professional services, and capacity building to sustain road sector performance.

### 4.6.2 Objectives

The Road Research Strategic Plan for South Sudan is to provide an over-arching strategy dedicated to research on all matters related to, road design, construction, maintenance and rehabilitation, road asset management, and operation:

- Define responsibilities and scope for the various role-players in the planning, coordination of the establishment of the RRC and subsequent planning and undertaking of research in the road sector;
- Determine research funding options in the road sector;
- Provide strategy certainty with a clear regulatory framework for road research management;
- Directives for monitoring, evaluation and reporting of road research and monitoring effectiveness of management environment of technology transfer and implementation of outcomes;
- Optimise research infrastructure and human capital development in the road sector, including training of laboratory personnel;
- Guidance for the provision of services for quality control of construction projects and Technical Audits.

## 4.7 Key issues

The RRC is to prioritise focus on research, development and innovative solutions to respond to the different challenges in the road sector as identified in the Strategic Plan and mandated to the Directorate of Materials and Research, aimed at supporting the development of a better road network and access for all citizens of the Republic of South Sudan.

1. Research that deals with government-identified priorities to support the generation of relevant knowledge and solutions for the road sector. Road construction materials shortage and improved rural access as a priority.
2. Skills for sustainable road research and innovation
3. Capacity of the states /private sector in testing and calibrating equipment
4. Standards testing manuals and specifications
5. Data availability for development and maintenance of road infrastructure
6. Legislation for establishment of institution for training materials technologists and road supervisors

## 5 Action plans

The purpose of this section is to expand on objectives and set out the actions required to realise the strategic ideas. Strategy statements on governance, infrastructure for research, human capital development, research priority and innovation and funding are to guide the process and are consolidated into the activities for implementing the Strategic Plan.

### 5.1 Planning

In view of the limited capacity within MRB to conduct road research and the limited laboratory and information technology infrastructure, the recommended approach during the workshop was to develop the RRC incrementally over the years. An organizational structure is required, to internally coordinate the initial activities and managing the different processes to ensure there are no delays. An incremental development or staged approach allows each phase to be refined further based on lessons being learnt and experience gained during the implementation of the Strategic Plan.

A political and institutional platform is required to support the process of establishing the RRC. The appropriate political institution is MRB. The MRB should establish an interim Road Research Task Team (RRTT) to coordinate the process with membership representation by Director General for Materials and Research, Directorate for Planning and Policy Formulation, Directorate for roads and Bridges, Directorate for Administration and Finance at MRB and Executive Director of SSRA. The SSRA and the State Ministries of Infrastructure (SMOI) are the expected service deliverers of the research, and should therefore be included on the onset. They can also be considered as funding partners, particularly SSRA and the SMOI as strategic partners whose commitment to the establishment of the RRC is crucial to generate the national buy-in of the importance of research in the road sector. The proposal is that the Under Secretary of MRB chairs the RRTT. In the meantime, the primary responsibility for preparing plans for the establishment of the RRC shall rest with the RRTT. The Directorate for Materials and Research through the RRTT should provide input based on this Strategic Plan.

### 5.2 Governance

The RRTT should have the responsibility to manage the process of establishing the RRC, instituting legal and regulatory framework for the institutional establishment of the RRC, eventually to operate as an autonomous entity business like road research entity. The envisaged model is for the RRC to have autonomy in its day-to-day operations and create its own budget. The RRTT should also establish the required regulatory requirements to introduce the position and appoint the individual with appropriate qualifications to head the RRC.

A structure should be established to manage research projects and to support road research capacity building with collaboration of key stakeholders. Drawing from regional experience on the establishment of Road Research Centres under AfCAP, the institutional arrangements with relevant stakeholders should be strengthened to allow for collaborative planning and implementation of road research. The RRTT should establish two committees: Road Research Steering Committee (RRSC) and the Road Research Technical Committee (RRTC), for the purpose of setting the research agendas, priority setting and allocation of available research funds, research needs assessments and informing the activities undertaken by researchers. The committees should be organized at a national level.

The proposal is that initially, the RRTT nominates or invites individuals to the RRTC and RRSC. Once constituted the committees can extend membership invitation to other institutions as deemed necessary.

The Road Research Steering Committee (RRSC) will be responsible for research agendas, priority setting, coordinating, planning, programming and allocation of available funding. The RRSC will have advisory powers to provide strategic direction to ensure the RRC carries out relevant research, aligned with the national strategy and operates effectively. The RRSC should also provide leadership on resource mobilisation activities to generate the resources required to support research. The RRSC will exercise the responsibility of overall coordination, direction, development and approval of research projects.

Once established the RRSC should play a role in strengthening the NRC. Chapter VI of the Southern Sudan Research Council Act 2007 deals with Specialised Committees. One of these committees is the **Science and Technology Research Committee**, envisaged to be concerned with research in all aspects of science, engineering and technology. The RRSC should become a member of this Committee.

The Road Research Technical Committee (RRTC) is to provide advice to the RRSC on the nature and scope of research projects and capacity building activities to be undertaken in the road sector. The RRTC will influence the planning of research activities provide direction and development of projects as well as required capacity building.

Based on the results from the group discussions during the stakeholder consultation workshop, consideration for representation on the RRSC should be from the following institutions:

- Ministry of Roads and Bridges
- Ministry of Finance and Economic Planning
- Ministry of Higher Education
- Ministry of Housing Physical Planning
- Ministry of Physical Infrastructure
- National Research Council
- South Sudan Engineering Council
- South Sudan Roads Authority
- University of Juba - College of Engineering and Architecture

Consideration for representation on the RRTC should be from the following institutions:

- Ministry of Roads and Bridges
- Construction industry
- State Ministries of Physical Infrastructure
- South Sudan Engineering Council
- University of Juba - College of Engineering and Architecture

The structure for the management of research is presented in section 9.4

- Governance action plan activities to address:**
- **The establishment of Road Research Steering Committee (RRSC) and the Road Research Technical Committee (RRTC) for the management of road research**

**Strategic statement 1:** The MRB assumes responsibility for overarching policies and strategic planning to delegate the RRC the task of drawing up short and long-term road research plans for the country through an Act of Parliament. Establishment of RRTC confirmed.

**Strategy statement 2:** Establish RRTC and RRSC to ensure research by the RRC planned, managed and undertaken to respond to national development needs and initiatives.

**Strategy statement 3:** The RRC uses research as a tool to support the implementation of improved rural access development through innovative solutions

**Strategy statement 4:** The RRC through research to support implementing programmes that will improve the efficiency and operational safety in the road transport sector.

**Strategy statement 5:** The RRC to support State Ministries of Physical Infrastructure if they decide to undertake and implement research findings within the structures of the state road agencies.

**Strategy statement 6:** The RRC to generate knowledge and solutions for addressing road construction materials shortage while conserving natural resources.

### 5.3 Legal establishment

While there exists the Directorate of Materials and Research and there is mention of establishing an institution for research in the Draft Strategic Plan (2013-2018) of MRB, it is yet to be established. This strategic plan fosters the first stage of the road sector institutional re-alignment in South Sudan to achieve this goal. Formulation and enactment of policy for establishing the RRC is required.

In order to give the Road Research Centre some legal force and to secure stable financing for road research, the Parliament of the Government of South Sudan will have to enact an Act for the establishment of a centre to spearhead road research. A Road Research Act should be formulated, enacted by the Parliament of South Sudan, to provide for the establishment of the RRC, its incorporation, financing, management and regulations of research in the road sector. The RRTT will most likely need the support of the Parliamentary Committee for Physical Infrastructure to achieve this strategic action plan.

Considering the country's economic and socio-political realities, the proposal is to establish the RRC as a public entity, but under a special schedule that will allow for some autonomy in terms of the applicable Act. The legal opinion should clarify issues pertaining to responsibilities and interrelationship with both MRB and SSRA as well the departments of civil engineering in the universities and accountabilities for individuals and groups involved with the RRC.

#### Legal establishment action plan activities to address:

- Investigate laws, government policies that will impact on the establishment of the RRC and its mandate
- Requirements for the enactment of an Act for the establishment of the RRC

**Strategy statement 7:** The RRTT seeks legal opinion and advice for guidance in ensuring that the establishment of the RRC is under the special schedule for autonomy and provision of special training programmes for the road sector.

**Strategic statement 8:** The RRTT submits recommendations to the Minister of MRB, based on the legal opinion and advice for the attention of the Parliamentary Committee for Physical Infrastructure.

**Strategy statement 9:** The MRB to mandate RRC to conduct road research and its functions stipulated in the Road Research Act to ensure a clear legislative mandate.

### 5.4 Staff complement

A dedicated and combination of quality and experienced staff is key to the production of quality research. It is an essential input in order to achieve the required outcomes and for research to have the necessary impact. The preliminary findings from the situational assessment showed that MRB does not have research capability and no research output exemplar from academia could be provided in the area of road infrastructure. There are skills and staff gaps within the Directorate for Materials and Research (DMR) in the Ministry Roads and Bridges to conduct high-level research. The indicated qualifications of the existing staff reveal the need for recruiting staff with the skill sets required for conducting research. Only 2 out of the 14 staff members possess at least a bachelor's degree qualification.

However, the current number of technicians within DMR is considered adequate to undertake laboratory work in the interim. The team of technical personnel in the laboratory is competent in conducting standard routine pavement material testing, but require experience in a research laboratory environment.

Three components of staff envisaged and to be recruited incrementally is as follows:

#### 1. Administration and support services

The idea is initially to have administrative shared services within MRB, until a fully-fledged RRC is established.



## 2. Researchers and technologists

There is inadequate numbers of individuals to conduct road research. Initially, a number of researchers will form the core of researchers focusing on specific research core projects in the priority research areas. The implementation of the strategy will require the correct growth level of personnel resources with maturity of the RRC. The RRC can collaborate with academic institutions, forming special teams to undertake research on a specific theme and encourage staff to pursue academic studies that would enhance their skills, and make the RRC more visible in the country. In this approach, the staff component working on research projects is flexible, dependent on the activities to be conducted and expertise required for the individual projects.

The recruitment of the following staff:

- Executive Director of the RRC to lead research development and innovation (RD&I), minimum of MSc, preferably PhD in Civil Engineering. The expectation is that the individual will be a researcher with minimum of 10 years' experience, and will not only manage but also generate research outputs.
- Deputy Executive Director, minimum of BSc in Civil Engineering with at least 10 years of experience. It is expected that the individual will have a experience in laboratory management.
- Senior researchers (x 2), minimum of MSc in Engineering /related Applied Science
- Researcher, minimum of BSc in Engineering.
- Senior Technician, minimum of Diploma in Civil Engineering with at least 10 years of experience in laboratory and field materials testing

As indicated above, the current number of technicians at CML is considered adequate to ensure continuity and to support the research work in the initial phase of the RRC. These capabilities are to be maintained, but as indicated earlier will require further training once the modern and comprehensive facility is completed. There is need to review the laboratory staff complement in anticipation of its increased workload as the RRC matures.

Key to attracting and retaining high quality researchers is to implement special conditions-of-service. It may be necessary to provide some form of additional financial incentive.

## 3. Professional service provider

The idea is to have a staff component that focuses on research strategic development and the provision of professional services and ensure research products/outputs are delivered efficiently and effectively by the Project Administrator.

From the current staff profile within DMR and MRB, it is clear that a staffing strategy for RRC is required. Researchers are required in order for the future RRC to produce the required research outputs effectively. This should be the responsibility of the Head of Research Development and Innovation (R&DI), once appointed as envisaged to be the Head of the RRC.

### Staff complement action plan activities to address:

- Assessment of quality of existing staff for research
- Current and required staff for conducting quality research
- Support and career development, recruitment and retention strategy
- Determination of competitive salary levels

**Strategy statement 10:** Recruit Head of RRC and qualified research staff.

## 5.5 Research infrastructure

Research infrastructure includes the laboratory facilities and information and communication centre. These are also required inputs for a research centre to generate knowledge and for the purpose of storing and managing the generated knowledge respectively. The situational assessment established that the level of laboratory infrastructure capacity at the Central Materials Laboratory (CML) under the Directorate of Materials and Research (DMR) at the Ministry of Roads and Bridges and at the College of Engineering and Architecture at the University of Juba are inadequate. The College of Engineering and Architecture of University of Juba does not have a functional laboratory facility both do not have an information centre.

The obvious choice as the main laboratory that can support research in the interim is the CML. It has four rooms (standard room size) for three sections of material testing; (1) foundation/soil testing, (2) aggregate and concrete testing, and (3) asphalt materials testing. Proper accommodation and working environment in a laboratory includes controlled areas, such as location of sample curing tanks, effective segregation of test areas, and adequate storage areas in accordance to the requirements of ISO 17025. Adequate and environmentally friendly working space for personnel to carry out the testing is essential. The existing practice of drawing water from a water bowser into buckets for use in the lab is inappropriate for sample preparation and cleaning of the working places in the lab.

The proposed new development of establishing a Road Research Centre, requires the appropriate infrastructure capacity. The current facility requires upgrading to improve both the staff-working environment and testing capacity. Annex 2 shows the status of the equipment in the laboratory. A modern and comprehensive materials laboratory is to be established for the testing of materials used in road works and as a research laboratory.

It is essential that the established facility also meets the requirements for quantity and quality of physical space. The infrastructure development needs to make provision for the laboratory, but also adequate office space and an Information Services centre. The Information Services centre is to support the product and services section responsible for knowledge management and dissemination of information related to road research activities.

Figure 3 shows the site and location of the CML building in relation to the location of the SSRA. The area next to the CML building is available and more than adequate for expansion to accommodate a new and moderate size RRC. The area marked is over 7000 sq. m. However, establishment of land ownership is an outstanding issue and it will now become the responsibility of the RRTT to establish whether the land is indeed available for this purpose.

**Figure 3** Current site and location of CML building



Source: Digital Globe/Google Earth

During the consultation, an assessment was undertaken to establish the status of the equipment in terms of functionality.

The action plan should therefore address the identified inadequacies.

**Research infrastructure action plan activities to address:**

- Personnel
- Building capacity
- Capital equipment
- Laboratory capacity
- Laboratory QA/QC schemes and proficiency programmes

**Strategy statement 11:** The RRTT to establish land ownership, for the construction of the RRC.

**Strategy statement 12 (a):** Upgrade CML in the interim as per inventory process undertaken and procure basic standard laboratory equipment.

**Strategy statement 12 (b):** Establish a modern and comprehensive materials laboratory facility. The facility is for the testing of materials used in road works and is to act as both a research and reference laboratory for the country. As an advanced facility, it should have Laboratory Information Management System for the purpose of good practice of collecting and data storage to ensure the laboratory is ISO compliant.

**Strategy statement 13:** Establish an Information Services centre for knowledge management, information storage and dissemination to provide easy access to information on road research activities.

## 5.6 Research priority areas

The consultations to establish priority research areas involved a broad-based stakeholder representation to ensure inclusiveness and take into account the unique aspects and realities of the country in the road sector. The initial high number of highly rated topics reported in the **Preliminary Findings Report** was to allow for sector crosscutting topics. The suggested priority research areas were subjected to a ranking process at the consultative workshop. Participants at the workshop were divided in four groups and each group was asked to list top 20 project topics. These were reported in the **Workshop 1 Report**. The CSIR then selected the top ten common topics across the groups, shortlisted in Annex 3. From the top ten in each group, the CSIR selected the most common ten topics as the research areas with the greatest payoff for inclusion in the Strategic Plan.

The research areas are a combination of those identified in the MRB strategy document and those resulting from the key stakeholders' consultation if not already identified. They seek to address the national challenges in the sector and contribute towards the national development needs and initiatives. The top ten research focus areas are listed in Table 3. The stakeholder workshop on 30 October 2019, recommended to incorporate transport services to key research areas and gender mainstreaming.

**Table 3 Research priority areas**

Ranking	Research area
1	Soils and materials for road construction, including alternative road construction materials
2	Stabilisation techniques and cost effectiveness
3	Hydrological impact of the environment
4	Soil classification and properties analysis
5	Pavement design standards appropriate for the type of vehicles in use in the country
6	Database and mapping of materials distribution in South Sudan
7	Community participation and engagement in road projects – sensitisation of material extraction requirements in the area
8	Establishment of cost regimes of projects
9	Road traffic and safety management
10	Legal axle load control and enforcement

The core outcome of Phase 2 is the establishment of the RRC through the implementation of the action plans as outlined in this Strategic Plan. Activities will include development of concept notes for the implementation of the research projects identified as high-priority projects from the above priority areas and recommended by the RRTC to the Road Research Steering Committee (RRSC) for approval.

The implementation of the research projects will form part of the performance indicators of the RRC. The research projects are to be selected under the annual research development programme (ARDP) which will serve as the work plan for RRC. The inclusion of any project in the ARDP shall be based on the simple principle of necessity. The ARDP shall form the backbone of the RRSC, as it will have the responsibility of defining the national road research programmes, in order to effectively, respond to the needs of the country.

The Indicators used to assess performance are identified in section 6.10. The research programme should also partly drive the human capital and infrastructure development plans within the RRC. It should also shape the narrative on training programmes at tertiary institutions, in particular supporting the development of programmes at technical colleges for the development of technologists and technicians.

#### Research priority areas action plan activities to address:

- Research prioritisation by the RRTC and RRSC
- Concept note development and proposals for high priority research topics
- Administration of collaborative research projects

**Strategy statement 14:** RRTC and RRSC to prioritise research projects for funding in the following Financial Year and identification of collaborative research projects.

**Strategy statement 15:** RRC to implement priority research projects identified by RRTC and RRSC and through technical assistance develop concept notes for the design, conceptualization and the implementation of the identified high-priority research projects. However, initial concept notes are provided in Annex 3.

**Strategy statement 16:** Develop guidelines for undertaking research through technical assistance.

## 5.7 Human capital development

The research environment requires particular skills and experience to undertake quality research. However, as indicated in section 6.3, personnel in the research environment have three components, thus human capital development for road research is not limited to research skills development only. The current team of technical personnel in the laboratory is competent in conducting typical pavement material testing, but require appropriate skills for a research laboratory environment. Secondment of Director General of Directorate for Materials and Research to an ISO accredited research laboratory is recommended to provide the DG the opportunity to learn about the management, procedures and processes and equipment in a research laboratory environment.

A specific capacity building and skills development plan is required to provide guidance on RRC staff requirements and processes for their appointment. Once recruited, researchers should remain excellent and competent in specific fields and therefore be supported to ensure continuous personal and career growth through staff development schemes. These schemes should form part of the capacity building and skills development plan and will usually include mentoring, in-house training, secondments, shadowing and further education programmes.

The RRC is also to include assessment and development of programmes focused on road sector and support to the establishment of enhanced post-secondary institutions for technologists in the country.

**Human capital development action plan activities to address:**

- Career development plan to improve scientific competence of newly recruited staff
- Development of policy on gender parity
- Development of plans for nurturing and development of appropriate specific research skills
- Development and implementation of research mentorship programme
- Development of appropriate training programmes for laboratory personnel
- Development of appropriate training courses/programmes for the road sector

**Strategy statement 17:** Design capacity building and skills development plans for staff to nurture appropriate research development. The RRC will achieve this through technical assistance.

**Strategy statement 18:** Support and facilitate research skills development programme for its staff. The RRC should undertake this in partnership with other regional RRC and international research institutions in the area of road transport infrastructure.

**Strategy statement 19:** Develop appropriate competency-based training programmes to enhance capacity for the road sector. The RRC must liaise with higher learning institutions, Ministry of Higher Education, Science and Technology, ECSS and other key stakeholders.

**Strategy statement 20:** Train all relevant personnel working in the laboratory for the research environment and be registered experts in the relevant ISO Standards.

## 5.8 Partnerships and collaboration

Partnerships and collaboration agreements promote research capability and develop research profile, sharing of experiences for individual researchers and visibility for the organisation. Cooperation at the local level exists between the MRB and some of the key stakeholders, but currently to a limited level. This situation is to be improved. Joint research programmes can be undertaken with academic staff and students by offering them the opportunity to use the infrastructure facilities for experimental part of their research.

No cooperation agreements exists between DMR or MRB and other regional or international research centres. The establishment and participation in regional and international partnerships contributes to enhanced and sustainable research capacity building. Individual researchers can create collaborative relationships through established institutional agreements.

**Partnership and collaboration action plan activities to address:**

- Development of cooperation agreements to strengthen
  - relationship with local academic institutions
  - relationship with other research centres
  - relationship with local key stakeholders

**Strategy statement 21:** Foster linkages and strengthen institutional arrangements with academic institutions and other relevant stakeholders to allow for collaborative planning and implementation of road research in the country.

**Strategy statement 22:** Build local, national and international collaborative network by involving other RRC established under the ReCAP and establish experience sharing processes.

**Strategy statement 23:** Establish regional agreements with other RRC for research collaboration as well as mentorship and secondments where necessary.

## 5.9 Product and services

This requires the establishment of a section responsible for among others, research contract administration, developing, managing and coordinating the RRC research programme; facilitating implementation; technology transfer; and identifying best practices, establishing platforms for exchange of ideas and disseminating information related to research activities to improve the knowledge base and capacity of the road sector. The product and services will include guide strategy development within MRB and SMOI and institutional capacities in the road sector. The aim is to improve impact and awareness on research across the road sector. Consultancy and professional services involving technical audits post-construction. It can also support the proposed Office of Road Monitoring, which is supposed to have the job of assembling comprehensive data to determine whether best value for money is being achieved on project. The RRC will through such services support local capacity in the road sector.

### Products and services action plan activities to address:

- Development and implementation of policies for the provision of professional and laboratory services for income generation
- Information dissemination/publication mechanism on research outcomes and provided services

**Strategy statement 24:** Provide support to Government in reviewing and improve enforcement of all provisions of the existing legislation to improve efficiency in the overloading law enforcement.

**Strategy statement 25:** Provide laboratory services, including acting as national reference laboratory as a source of additional funding.

**Strategy statement 26:** Develop and manage competency-based training programmes for the road sector

**Strategy statement 27:** Develop or adopt policy to guide the management of consultancy professional services.

**Strategy statement 28:** Develop and implement policy on publicising, promoting RRC's research, nationally and internationally and establishing an Information Services Centre for research outputs and technical publications.

## 5.10 Monitoring and evaluation

The long-term goal is to have a well-established RRC in South Sudan, the process towards achieving this goal should be monitored, and the outcomes evaluated. Monitoring and evaluation will guide the implementation and review of the strategy on a continuous basis by establishing to what extent the implementation of the Strategic Plan is successful. This is necessary to help identify problem areas and improve the planning and management of the process at different stages of establishing the RRC and its development. It will ensure that the process of building road research capacity is effective and on track.

The outcomes and impact of the road research capacity building initiative will depend on how successful the strategic plan is implemented and an appropriate assessment is required. By assessing critical indicators and key performance indicators, the effectiveness of establishing the RRC can be evaluated.

The overall responsibility for monitoring the progress on the strategic plan and evaluating the outcomes shall rest with the Head of the RRC. As the RRC grows, the position of a Deputy should be created and that office should be responsible for monitoring capacity building and product and services, while a third position of Project Administrator should be created to be responsible for monitoring governance, management, finance

and resource utilization. The Head of the RRC will then specifically be responsible for monitoring research, product and services and resource mobilization.

Monitoring can be achieved through annual and quarterly progress reports against set targets. Progress monitoring should be against research key performance indicators, such as project milestone plans and budgets and aspects of capacity building, and should at least include the following:

- to what extent did the initiative to establish the RRC influence change in the road sector;
- number of proposals submitted to potential funders in response to strategic intent of providing solutions that enable improved and equal access to socio-economic services;
- number of needs statements submitted to the MRB;
- to what extent RRC activities are reflected in strategic plans of MRB and SSRA;
- to what extent the research is translated into guidelines/design manuals;
- to what extent were research results embedded and disseminated to the road sector;
- number of staff trained to enhance research skills and career path development;
- number of research reports completed each year;
- number of journal articles each year;
- percentage of administrative costs to overall research funding;
- percentage of projects completed on-time and within budget;
- number of projects and amount of funding per project.

Some of the above performance indicators are only applicable in the mature phases of the RRC. Expectation of research outputs without mentoring and collaboration in the first two to three years is not realistic.

## 6 Funding mechanism

### 6.1 Potential funding

The successful implementation of the road research capacity-building programme and the establishment of the RRC requires adequate, predictable and sustainable funding. Discussions during the consultative meetings revealed that current expenditure and donor support in South Sudan is focusing on alleviating the humanitarian crisis and the provision of primary education (together with primary health). Until the situation improves, the expectation is that funding for research will remain constrained. The budget allocated to the operations of the DMR is inadequate, let alone to deliver on quality research.

The RRC should be in a position to generate external funds from its operations to sustain itself in the long term. The goal is therefore to have alternative sources of funding research, ensuring that the RRC is less dependent on external support. There are various opportunities proposed by stakeholders to address the funding requirements in order to ensure long-term financial sustainability of the RRC. The suggestions by the stakeholders are presented in the Preliminary Findings Report. This section consolidates the proposed alternative revenue sources.

- **Rendering of professional services.** This should include utilisation of the expertise within RRC to support national sectoral policy and strategy development, provide independent technical advice and audits to both public and private sectors, including forensic investigations.
- **Procurement of long-term projects in collaboration with university staff.** Approaching both local private sector and Development Partners such as DIFD, EU, JICA, USAID and World Bank, for gaining financial assistance to support specific integrated research programme initiative by both the RRC and the universities is more likely to be supported.
- **Grants:** obtained from specific sources including Development Partners by being involved in their specific projects in the focus areas related to the road sector development. The RRC can also be funded through a system of research grants from the other Ministries during their infrastructure development projects.
- **International collaborative research:** Opportunities to participate in collaborative projects within the AfCAP programme. There are prospects of accessing and securing basic institutional funding.
- **Laboratory and information services,** including acting as national reference laboratory, providing testing services at nominal charges to other government departments, the SSRA and the private sector as well as a repository centre for road sector information.
- **Levy collection,** charging a road research levy on road construction projects, requires regulatory framework. However, the RSDP's prioritised phased road sector improvement associated budget over the period 2017-2027 indicates that *all funds collected from road user charges will need to be directly applied to road maintenance and not development.*
- **Other sources** include rental of equipment and royalties in the long-term. Effective and efficient use of resources, including outsourcing rather recruiting. Sharing of human resources with SSRA and the College of Engineering and Architecture at University of Juba.

During the first stakeholder consultative workshop, on 20 June 2019, the then Minister for Roads and Bridges stated "reforms are underway and that the Government of South Sudan had adopted the policy of oil for development and that the cabinet had approved revenue from 30,000 barrels per day to be for infrastructure, especially for the roads and other development. The proposed utilisation of 30 000 barrels/day of oil for infrastructure development, of which 10 000 barrels/day is to be channelled to a specific account for roads is a reality". This should provide a source of funding to an autonomous oriented Road Research Centre.

In an attempt to give the Road Research Centre some legal force and to secure stable financing for road research, the Parliament of the Government of South Sudan will have to enact an Act for the establishment

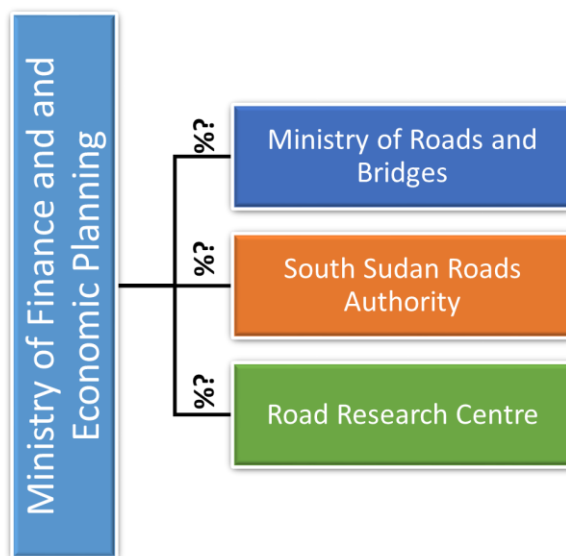


of the Road Research Centre. The Act should in addition provide for the ring fencing a proportion from the revenue from the 10 000 barrels/day oil, possibly through a special dispensation.

**The disbursement process of the revenue from oil for infrastructure development:**

No details are yet available on how the revenue will be administered, managed and controlled. In the absence of detailed knowledge of the criteria for disbursing the money collected from the revenue of oil for development earmarked for roads, the Consultant proposes disbursement process that requires the establishment of a direct deposit from the revenue from the oil for roads into the RRC account shown in Figure 4 to ensure the funds do not come through MRB or SSRA, but dedicated for the RRC. This should mitigate the constraints in effective implementation of the road research reform program. In the absence of adequate information, no percentages are provided.

**Figure 4 Disbursement model of revenue from oil for infrastructure development**



It is however, recognised that the final decision shall be made by the Ministry of Finance and Economic Planning on written disbursement rules by MRB. It will become much clearer once the political considerations are taken into account and decision is made public.

**6.2 Sustainability strategy**

The goal is to ensure longer-term financial stability, so that the RRC is established on a financially secure basis. The strategy is to seek the securement of multi-year projects in addition to a confirmed source of income. The long-term goal is that the RRC should make its own separate budget and the appointed Head of RRC as the Accounting Officer for the RRC submits the **annual budget** directly to the Ministry for the Minister to table it to the Council of Ministers and Parliament. The RRC will then be funded through a system of a research grant.

**Fencing** or creating **dedicated financing** from a portion of the revenue from oil for development will make funds available for road research. However, sufficient funds have to be provided to operate, conduct research, acquire and maintain infrastructure to deliver quality research. The funds should not only just be pledged through the MRB budget, but should be accrued to the RRC, and independently audited. As a country that is coming out of conflict, research may be seen as competitive area of scarce resources. In the absence of dedicated funding for research, the developing sustainable research capacity will be a stillbirth concept.

**Funding action plan activities to address:**

- **Development of funding mechanism**
- **Regulatory framework to source and access revenue from the oil for road infrastructure development**

**Strategy statement 29:** The RRC to establish funding mechanism to ensure sustainability and the required supporting regulatory framework.

**Strategy statement 30:** Enactment of Road Research Act to provide for the ring fencing of a proportion of the revenue from the 10 000 barrels/day oil for road research possibly through a special dispensation.

## 7 Implementation time-frame

This section provides the time-lines for the implementation of the key activities guided by the strategic statements in order to establish and operationalize the RRC. The long-term strategic plan is for the RRC to achieve self-reliance over time. It is envisaged that this can be implemented incrementally in phases, rolled out over a period of 10-years as the RRC evolves into a recognised institution among road research centres, regionally and internationally.

The institutional development towards achieving self-reliance is schematically presented in Figure 5, showing the different phases. The strategic objectives are to be translated into actionable activities under the different phases of institutional development.

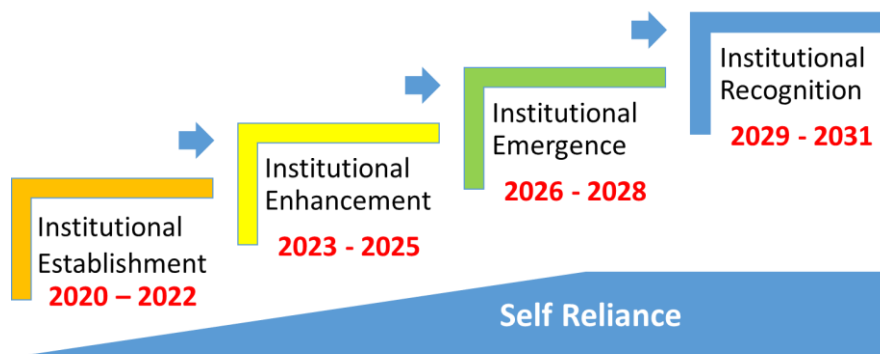
**Phase 1: Institutional establishment:** This Phase will involve the activities to put in place a functional entity for building road research capacity in the country. This will involve the activities required for restructuring DMR to establish the RRC and research management and implementation systems. The activities are presented in tables 4 and 5. The Strategic Plan has a three-year span and should be reviewed in the third year. Review, monitoring and evaluation of the strategic plan are key elements for successful implementation of the institutional establishment towards a well-recognised RRC that delivers high quality research outcomes in the medium to long term.

**Phase 2: Institutional enhancement:** This phase will focus on activities to strengthen the RRC to build quality road research capacity through the development of documentation aligned to staff development, knowledge transfer and laboratory quality management systems. It will also cover a number of actions to develop a modern laboratory facility and information services unit as well as the monitoring and evaluation of the experimental and Long-Term Pavement Performance (LTPP) sections. The provision of consulting services will form part of priority areas to be initiated under this phase. Main actions are presented in tables 5 and 6.

**Phase 3: Institutional emergence** is the phase in which the consolidation of research capacity will take place and at this stage it is envisaged that the RRC will have been fully established as a semi-autonomous entity. The research administration cycle of, Research Planning - Funding – Implementation - Evaluation is fully established, demonstrating maturity of an upcoming research centre. It is anticipated that this will be the focus area in the 5 to 10 year horizon of the RRC development process. Based on the evaluation, the value of research generated by the RRC should be highlighted. The RRC should start functioning as a fully-fledged research centre with its own branding by the end of 2023 and nationally receiving recognition.

**Phase 4: Institutional recognition:** The research capability development should bear fruits and during this phase, technology transfer activities will dominate with the RRC pursuing the research agenda that fulfils its mandate of undertaking research that responds to the needs of the country and as well as play a role internationally. The RRC is expected to achieve self-reliance and become a recognised road research institution within the region and internationally. It is anticipated that this will be achieved in 10 years of the development process. At this stage, the RRC is expected to establish itself as a credible organisation with outputs based on quality research and internationally peer-reviewed. The outputs should receive recognition from local and international peers.

Figure 5 Time line for institutional development



### 7.1 Start-up phase

The initial start date is assumed 1 January 2020. The focus is on activities that should be undertaken to enable the initial steps in the establishment of the RRC and to register its presence in the country. The executing agency will be the MRB through the RRTT and will provide the over-arching leadership of the process. The RRTT will provide this leadership during the first four (4) months. The implementing officer for the activities related to institutional development will be the Under Secretary of MRB until the individual to head RRC is appointed.

The first tasks for the RRTT is the confirmation of the appropriate regulatory framework, initiation of the process of enactment of the Act for the establishment of the RRC, the approval of the job description and the appointment of the individual to head the RRC. This is to ensure that the individual takes responsibility of implementing the process of the establishment of the RRC. Since the interim arrangement is to host the RRC within MRB, the proposal is that the head of the RRC will assume the title of Director for Research Development and Innovation. However, the term Head of RRC is used in the action plan. The appointment of the individual to this position is to be in accordance with the provisions of the regulatory framework, but take cognisance of the temporariness of the RRC within MRB.

The status of equipment at CML clearly shows there will be a need to procure small equipment at CML as early as possible.

The timing of some of the activities is subject to review as they are dependent on the internal processes within MRB and are therefore to be reviewed during the institutional establishment phase.

The strategic statements are translated into the activities. The link between the activities and the strategic statements is illustrated in table 4 (indicated as S.S # in the table). The indicated deadlines in the following tables are the proposed last date the activity should have been started and not end of activity.

**Table 4 Start-up phase time-frame**

Activities	Actioned by	Deadline
Establish the Road Research Task Team (RRTT) to coordinate the process of establishing the RRC.	Under Secretary 6 Jan 2020	31 Jan 2020
Initiate the upgrading programme for CML as per inventory process undertaken. Procurement of basic standard laboratory equipment	DG for DMR 1 Jan 2019	31 Jan 2020
The RRTT to provide input in the recruitment process of the Head of RRC, Deputy Head and research staff, including approval of job descriptions	Under Secretary 1 Feb 2020	28 Feb 2020
Initiate recruitment of Head of RRC	RRTT 1 Feb 2020	28 Feb 2020
Establish land ownership for the purpose of constructing the RRC	RRTT 1 Feb 2020	28 Feb 2020
Seek legal opinion and advice for guidance in establishing RRC under the special schedule for autonomy and make recommendations to the Minister of MRB	RRTT 1 Mar 2020	30 Mar 2020
Initiate study visit arrangements for Director General of Directorate for Materials and Research and the new Head of RRC to an ISO accredited research laboratory (2 weeks)	Under Secretary 1 Apr 2020	30 Apr 2020
Establish funding model for research, including access to the revenue from the 10 000 barrels/day oil.	Head of RRC 1 Apr 2020	30 Apr 2020
Initiate the establishment of the RRSC and RRTC to prioritise research projects and to select the first series of priority projects for funding in the next Financial Year	Head of RRC 1 April 2020	30 Apr 2020
Source Technical Assistance to design and initiate capacity building programmes for staff to nurture research development.	Head of RRC 1 April 2020	30 Jun 2020
Source Technical Assistance to develop or adopt guidelines for a research policy and mentorship programmes	Head RRC 1 Apr 2020	30 Jun 2020
Initiate the development or adoption of products and services/consultancy policy to guide the management thereof, including publicising, promoting RRC's research, nationally and internationally	Head of RRC 1 Apr 2020	30 Jun 2020
Initiate process to conduct survey on implementation of competency-based training programmes for the road sector	Head of RRC 1 May 2020	30 Jun 2020
Initiate recruitment process of research staff	1 May 2020	31 Jul 2020

## 7.2 Institutional establishment

Following the Start-up phase, the focus will be on undertaking activities aimed at putting in place systems and procedures for efficient and effective implementation of the Strategic Plan. Ideally, the first two years are to be used for strengthening road research capacity building initiative through the development of documentation aligned to governance, staff development, funding mechanism, knowledge management and laboratory quality management systems. It will also cover establishment of agreements with both regional and international road research institutions. Initiation and implementation of training programmes will start with advertisement of the programmes.

Due to the interim nature of the structure, initial proposed developments at CML by the Head of the RRC will be undertaken with approval by the DG for the Directorate for Materials and Research. The objective of the study visit by Director General of Directorate for Materials and Research and the new Head of RRC to an ISO accredited research laboratory is to provide an understanding of the management of the laboratory in a research environment and an appreciation of the type of equipment and laboratory set up. This is to ensure

familiarity with research laboratory environment and provide them with the knowledge to enable them make informed decisions during the development of the infrastructure development for the new modern and comprehensive laboratory.

**Table 5 Institutional establishment time-frame**

Activities	Actioned by	Deadline
Initiate the annual research development programme (ARDP) and initiate at least the first two research projects	Head of RRC, RRTC and RRSC 1 Jun 2020	30 Jun 2020
Design and implementation of individual staff development schemes to build the required research skills set locally	Head of RRC 1 Jun 2020	31 Aug 2020
Develop a Laboratory Strategic Plan (LSP).	DG of DMR and Head of RRC 1 Jun 2020	31 Aug 2020
Strengthen required skills specifically for laboratory personnel.	DG of DMR and Head of RRC 1 July 2020	30 Sept 2020
Development and implementation of Information Management Systems enhance data collection and storage and efficient dissemination of research results.	Head of RRC and DG of DMR 1 July 2020	30 Sept 2020
Establish standardised operational procedures for regulating everyday management of the laboratory, ensure Quality Assurance systems towards accreditation	DG for DMR and Head of RRC 1 Jul 2020	30 Sept 2020
Recruitment/appointment process of Deputy Head of RRC	DG for DMR and Head of RRC 1 Aug 2020	30 Oct 2020
Implement at least two new research projects, through the Technical Assistance support by AfCAP under a mentorship programme.	Head of RRC, RRTC and RRSC 1 Oct 2020	30 Nov 2020
Develop Course Design Plan and project schedule for training programmes, based on results of the survey, undertaken in start-up Phase.	Head of RRC November 2020	31 Jan 2021
Monitor existing LTPP trial sections, established under AfCAP Contract SS2163A ( X2 per year)	Deputy Head of RRC, respective researchers 1 Feb 2021	28 Feb 2021
Draw-up formal agreements and partnerships with other emerging Road Research Centres in the region and international road research institutions and laboratories.	Deputy Head of RRC 1 Feb 2021	31 Mar 2021
Evaluation of research projects and decision on new series of research projects.	Head of RRC, RRTC and RRSC 1 March 2021	31 Mar 2021
Implement at least three new research projects.	Deputy Head of RRC, RRTC and RRSC 1 Apr 2021	30 Apr 2021
Initiation (advertise) and implementation of training programmes	Deputy Head of RRC 1 May 2021	30 Jun 2021
Evaluation of research projects and decision on new series of research projects through the ARDP	Head of RRC, RRTC and RRSC.	30 Jun 2021

Activities	Actioned by	Deadline
	1 Jun 2021	
Monitor existing LTPP trial sections (x2 per year)	Deputy Head of RRC, respective researchers 1 Jul 2021	31 Jul 2021
Implementation of training programmes	Deputy Head of RRC 1 Jul 2021	30 Sep 2021

### 7.3 Infrastructure development

This action plan is for developing infrastructure to enable immediate serviceability of the existing facility and the designing and construction of a modern comprehensive laboratory facility, within the compound where CML currently is located. The facility is to provide laboratory and field-testing in support of the research agenda of the RRC. It will be expected to test, calibrate and verify precision instruments, gauges, scientific apparatus and other laboratory and field measurement equipment to ensure compliance. As such, the laboratory should have competent personnel and the right equipment. Personnel will be required to operate the advanced equipment and will require office space with proximity to the testing areas and workspace support areas will be required.

During the consultation, an assessment was undertaken to establish adequacy/inadequacy with respect to the existing CML facility. The action plan should therefore address these inadequacies in the interim. Taking cognisance of the existing infrastructure to support research, the existing CML facility should be refurbished to provide a safe and healthy working environment.

For the long-term infrastructure development plan, establishment of a Project Steering Committee (PSC) for the construction of the modern and comprehensive laboratory is proposed. The PSC will have the responsibility of guiding and monitoring the progress of the action plan for infrastructure development as well as oversee and manage the move to the new facility once completed. Project PSC is to be served by the Head and Deputy of RRC, DG for DMR, Under Secretary for MRB, Directorate for Planning and Policy Formulation, Directorate for Roads and Bridges, Directorate for Administration and Finance at MRB and Executive Director of SSRA. The Under Secretary should chair the PSC and will discuss and review design alternatives with the external professional services team. External professional services team to comprise of architects, engineers and funding organisation.

Confirmation of availability of funding is required in order to initiate the procurement of the works to develop the research infrastructure. Engineers estimate will provide the initial indicative cost. The establishment of the estimated cost will form part of the action plan. The final project cost determination will be through the prices received from the contractors at tender or bidding stage.

**Table 6 Infrastructure development time frame**

Activities	Actioned by	Deadline
Procure contractor services for the refurbishment of the existing CML facility	DG for MDR 1 Mar 2020	30 Mar 2020
Installation of support electricity supply system(Generator)	1 Mar 2020	30 Mar 2020
Initiate the establishment of the Project Steering Committee	Head of RRC 1 May 2020	30 May 2020
Initiate the project preparation for the construction of new RRC facility, that includes a modern and comprehensive materials laboratory	Head of RRC and PSC 1 June 2020	30 Jun 2020
Handing over the details of construction work to engineer for preparation of estimate	Head of RRC and PSC, 1 Jun 2020	30 Jun 2020
Final confirmation of source of construction funds	Under Secretary and PSC 1 July 2020	31 July 2020
Fund transfer for the construction works	Under Secretary and PSC 1 Aug 2020	31 Aug 2020
Invitation to tender and short-listing	Head of RRC and PSC 1 Sep 2020	30 Sep 2020
Initiate contract negotiations with contract award and start date is issued.	Head of RRC and PSC 1 Oct 2020	31 Oct 2020
General contractor issues contracts to subcontractors where necessary	Head of RRC 1 Nov 2020	30 Nov 2020
General contractor submits shop drawings and equipment specifications for review.	Head of RRC and PSC 1 Nov 2020	30 Nov 2020
Approval of established construction site requirements	Head of RRC and PSC 1 Nov 2020	30 Nov 2020
Project meeting on beginning of site work	Head of RRC and PSC 1 Nov 2020	30 Nov 2020
Project meeting on beginning of foundations laying	Head of RRC and PSC 1 Dec 2020	31 Jan 2020
Project meeting on beginning of upper structure construction	Head of RRC and PSC 1 Feb 2021	28 Feb 2021
Procurement of equipment and furniture for the new laboratory and the Information Services Centre, linked to status of construction stage	Head of RRC and PSC 1 Mar 2021	31 Mar 2021
Completion of construction of modern laboratory	Head of RRC and PSC 1 May 2021	31 May 2021
Recruitment of Information Services staff	Head of RRC 1 May 2021	31 May 2021
Arrangement and installation of equipment for laboratory and for newly constructed Information Services Centre	Head of RRC and PSC	30 Jun 2021



Activities	Actioned by	Deadline
	1 Jun 2021	
Initial equipment calibration	Head of RRC, DG of DMR 1 Jun 2021	30 Jun 2021
Commission the facility	1 Jul 2021	31 Jul 2021

At this stage, the focus is towards achieving self-reliance and become a recognised road research institution within the region and internationally. The main actions for the period are as follows.

**Table 7 Research capability development and technology transfer**

Activities	Actioned by	Deadline
Monitor existing LTPP trial sections (x2 per year)	Deputy Head of RRC and respective researchers 1 Feb 2022	28 Feb 2022
Review research administration policy, including implementation practices	Head of RRC 1 Mar 2022	30 Mar 2022
Evaluation of research projects, overall implementation of Strategic Plan (2020 – 2022) and decision on new series of research projects/programme.	Head of RRC, RRTC and RRSC 1 Mar 2022	30 Mar 2022
Call for new research ideas from all stakeholders and develop research ideas in collaboration with SMOI	Deputy Head of RRTC 1 Apr 2022	30 Apr 2022
Initiate and launch new sector training and support programmes (based on needs of industry and requirements)	Head of RRC 1 Apr 2022	30 Apr 2022
Collect responses and prioritise research ideas	Head of RRC, RRTC 1 May 2022	31 May 2022
Present prioritised research to stakeholders at the national workshop	Head of RRC, RRTC 1 Jun 2022	30 Jun 2022
Review priority research topics and develop problem statements for submission to RRSC	Head of RRC and RRTC 1 Jul 2022	31 Aug 2022
Monitor existing LTPP trial sections (x2 per year)	Deputy Head of RRC 1 July 2022	28 Jul 2022
Approval of new research programme for implementation (2023 – 2025).	Head of RRC and RRSC 1 Aug 2022	31 Aug 2022
Implement of at least three new research projects.	Deputy Head of RRC 1 Sep 2022	30 Sep 2022
Development of guidelines and manuals based on generated knowledge (lab and LTPP).	Head of RRC and respective researchers 1 Mar 2023	31 Mar 2023
Evaluation of research projects (annual)	Head of RRC 1 March 2023	31 Mar 2023

Activities	Actioned by	Deadline
Assessment of RRC impact on the road sector	Head of RRC and RRSC 1 Apr 2023	30 Apr 2030
Branding of the RRC as a fully established semi-autonomous entity.	Head of RRC 1 May 2023	30 May 2023

The main actions for the Phase 3: **Institutional emergence** period 2026 – 2028 are as follows

- Review of training programmes for institutional development in the road sector;
- Implementation of new series of research projects under new research programme to address new challenges encountered by the road sector in the country;
- Establishing critical consultancy services;
- Monitoring of LTPP sections;
- Developing human resources to support SMOI to initiate research projects in respective States;
- Monitoring and evaluation of the series of research projects;

The main actions for the Phase 4: **Institutional recognition** period 2029 – 2031 are as follows:

- Implementation of new cycle of training programmes;
- Implementation of new series of research projects under a new research programme;
- Creating new research positions
- Development of guidelines and manuals
- Conduct consultancy services;
- Monitoring of LTPP sections;
- Support to SMOI to complete research projects;
- Review institutional strategy
- Monitoring and evaluation of series of research projects

## 8 Institutional re-alignment

### 8.1 Interim operational structure

Based on the existing institutional arrangement, three possible arrangements, for the administration and management of road research capacity building, were presented for consideration at the workshop on 20 June 2019. Stakeholders generally supported the structure that will ensure the most practical autonomy of the RRC in the long-term, but it was also acknowledged and agreed that hosting it under MRB in the meantime, is more practical and realistic.

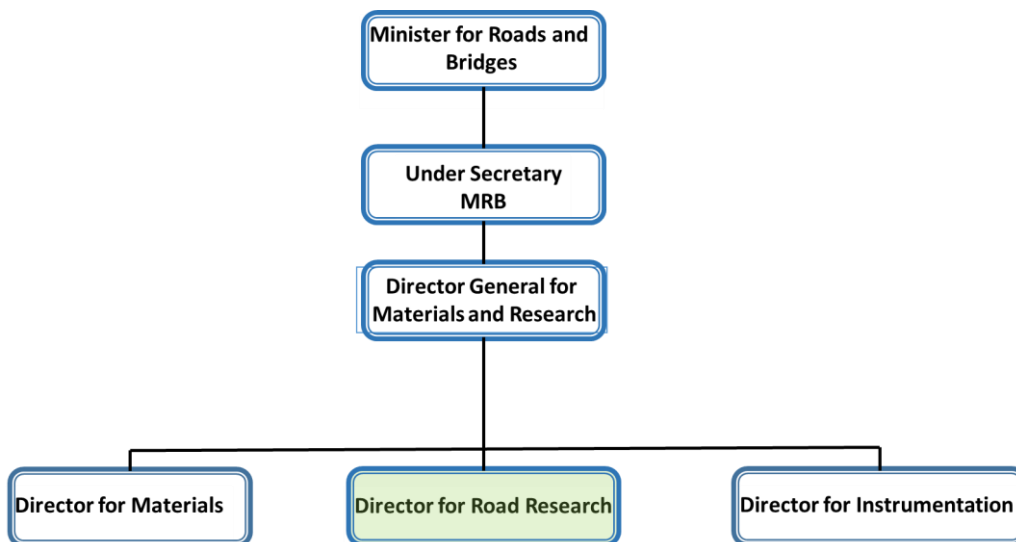
The plan is to manage the RRC through the DMR of MRB and be an integral part of the MRB structure for the first 3 years. The Institutional Establishment phase and the management of the RRC will be governed by the existing MRB systems. However, the intended goal of establishing the RRC with some autonomy and greater accountability requires a separate regulation from the provision as a Department or Directorate under the MRB. It should have clearly defined functional responsibilities to fulfil its mandate in order to effectively respond to the road sector needs

In addition, as a research entity, the organizational structure should support the development of an enabling environment for knowledge generation, professional growth of the research staff, special conditions-of-service and institutional financial stability. This is to be investigated by the RRTT and recommendations made accordingly as part of the start-up phase of the Strategic Plan.

Figure 6 shows the existing and interim operational structure. Currently there is no one occupying the position of Director for Research to manage research. The DG for the DMR with RRTT will manage the appointment of the new Head of research during the start-up phase. As an interim arrangement, the new Head of the RRC will report to the DG for DMR. The appointed person will assume direct responsibility for the process to establish the RRC. It is suggested that the position should not necessarily be given the title of Director, to highlight the special provision of the RRC in the structure.

The new impetus is the operationalisation of the RRC, enhanced management and administration of research, which is currently non-existent.

Figure 6 Interim operational structure



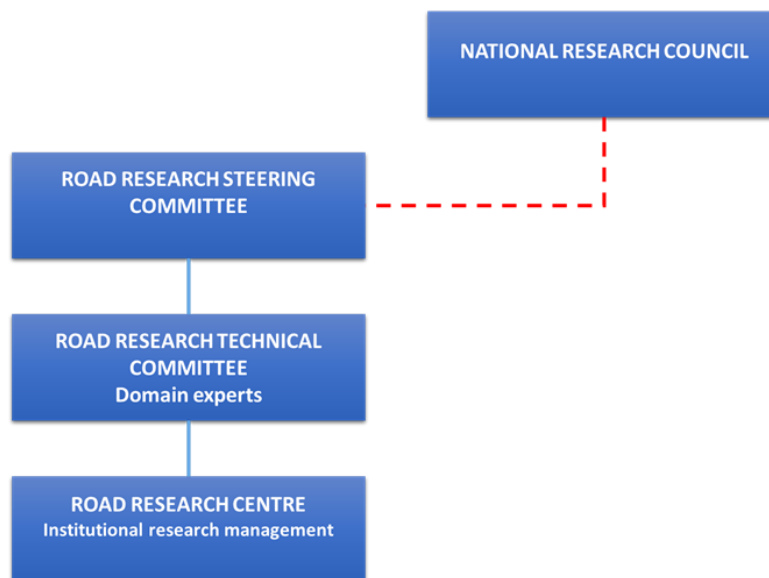
## 8.2 Research management and administration

A structure is required to effectively manage and implement research. This will provide the momentum of research project implementation and for elevating the importance of research within the DMR and the country. The implementation of research should be managed in an integrated manner, guided by the institutional framework. Several models exist for this purpose and the establishment of research technical and steering committees is the most common.

Figure 7 shows the proposed structure for managing research. The monitoring and evaluation of research is at different levels, starting within the RRC at the institutional level, and externally through the Road Research Technical Committee (RRTC) and the Road Research Steering Committee (RRSC). The first stakeholder workshop, identified key member representatives for each committee, see section 6.2

At the RRC level, individual researchers will be responsible for developing innovative, knowledge-based solutions, applying and transferring knowledge and technologies to address the needs of the road sector on matters related to the design, construction, maintenance and management of transport infrastructure. They will formulate research proposals in response to the annual call for proposals to research programmes. The researchers submit the different research projects to the RRTC for evaluation to ensure transparent and collective decision-making processes around the prioritisation of research areas.

Figure 7 Research management committees



The RRTC will provide research leadership in establishing national research/development agendas and in sustaining research, capability, assisting with the review of research proposals in line with the proposed research strategy, provide advice to Road Research Steering Committee (RRSC).

The membership of the RRTC should be from the following stakeholder institutions/organizations and the DG for Materials and Research may preside over the RRTC, but any other individual, preferably from the science, engineering and technology domain should be eligible:

**Ministry of Roads and Bridges**  
**Ministry of Transport.**  
**Construction industry**  
**State Ministries of Physical Infrastructure (one representative)**  
**South Sudan Engineering Council**  
**South Sudan Roads Authority (SSRA),**  
**One academic institutional representation, at Head of Department level (Civil Engineering).**

*The Director for Research as well as the Directors for Materials and Instrumentation are core members of the RRTC.*

The RRSC leads the planning process to approve the upcoming yearly projects and three-year research programmes. It will have the responsibility to develop its own planning processes, examine and scrutinize the annual budget and endorse the estimates of research programmes and project costs recommended by RTC. It will have advisory powers to provide strategic direction to ensure the RRC carries out relevant research, aligned with the national strategy. It will also act as the advisory committee to the Roads Board on road research at the national level. The expectation is that the RRSC will play the key role of resource mobilization for road research, as members of RRSC will be expected to serve as representatives of the RRC providing a connection with members of a broader society.

The membership of the RRSC should be from the following stakeholder institutions/organizations and the Undersecretary may preside over the RRSC, but any other individual at a decision making level, from these key stakeholder institutions should be eligible to preside over the RRSC:

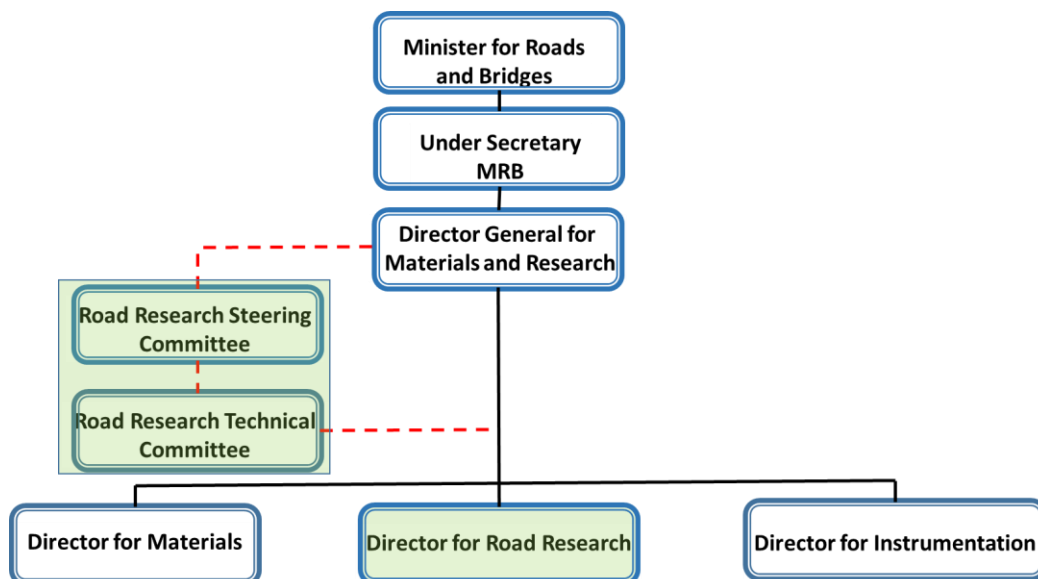
- Ministry of Roads and Bridges
- Ministry of Finance and Economic Planning
- Ministry of Higher Education
- Ministry of Housing Physical Planning
- State Ministries of Physical Infrastructure
- Ministry of Transport
- National Research Council
- South Sudan Engineering Council
- South Sudan National Bureau of Standards
- South Sudan Roads Authority
- Academic institutions, at the level of Dean (Faculty of Engineering/Head of Civil Engineering)

A single representation is proposed for the State Ministries of Physical Infrastructure on the RRSC and that representation/attendance of meetings should be rotated among the states. The RRSC will eventually make the decision to be able to invite specific individual experts to the Committee in the SET domain, from SMOI, SSRA, government departments, private sector, implementing agency executives and development partner organisations. The RRSC should determine the frequency of their meetings, but at least at least twice a year.

The linkage to the institutional political platform is through the office of the Minister for Roads, Bridges, and the Parliamentary Committee for Physical Infrastructure.

Figure 8 shows the interim overall structure with research committees. The draft Terms of Reference for both the RRTC and RRSC are provided in Annex 4 and 5 respectively.

**Figure 8 Interim research management structure**

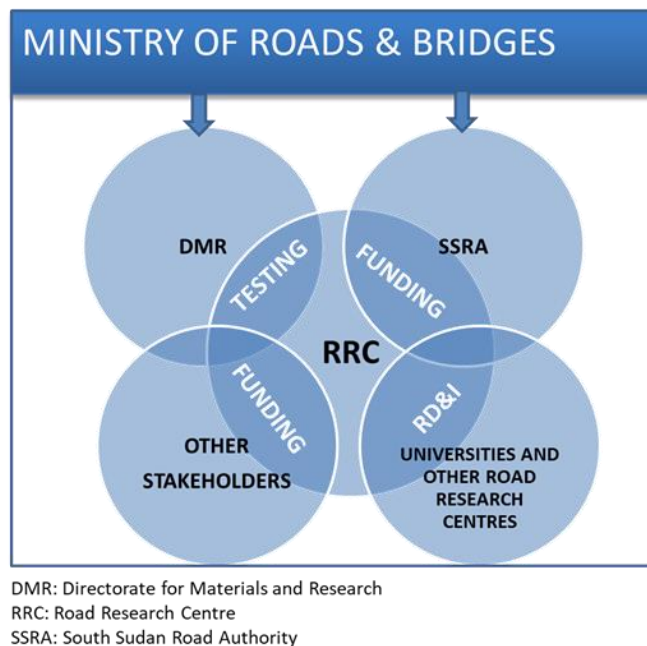


### 8.3 Operational model

The operationalization model for the RRC involves linkage to SSRA for both financial and technical support, the Directorate for Materials and Research for laboratory testing and with direct staff involvement of the universities and other research centres for collaborative implementation of research development and innovation activities. The arrangement shown in Figure 9 provides the pathway for the RRC to grow into a semi-autonomous and to diversify access to funding sources.

The partnerships with Development Partners will be important during the Institutional Establishment and Institutional Emergence phases to enhance the capacity of the RRC through the provision of technical assistance to support the Head of RRC and staff in the implementation of specific KAIs in the Strategic Plan.

Figure 9 Operational model



### 8.4 Operational structure

This section describes the framework within which the RRC will operate as a semi-autonomous Institution under the Ministry for Roads and Bridges. It sets out the management of the RRC and the responsibilities of those involved in its management. It is envisaged that in year 3 of its establishment, the RRC will be located in its own premises and become a stand-alone entity.

As per proposed structure shown in Figure 10, the Head of RRC, who will provide road research leadership assisted by a Deputy and four (4) Heads of functional Area/Unit, will head the RRC. The number and responsibilities of the Areas/Units may be reviewed as the RRC grows with sufficient capacity to deliver on its mandate of conducting road research. As the RRC matures, more functional areas/units may be added as the need arises. The Head of the RRC, the Deputy and Heads of functional Areas/Units and the Administrators shall constitute the Management Team of the RRC. The broad functions of each functional Unit are summarized below.

During the workshop on 30 October 2019, it was agreed that the Head of the RRC as a semi-autonomous institution, should have the designation of **Executive Director** to be consistent with other organisations in the country. He/she shall be appointed from amongst persons who have at least a PhD, have had experience and shown capacity in matters relating to institutional, and research project administration and management and training. He/she shall be responsible for the day-to-day management of the RRC and will have the administrative, financial and technical powers required for the performance of the work of the RRC and implementation and the overall monitoring and evaluation of this Strategic Plan. Through the technical assistance programme, he/she will initiate policies and framework documents on all matters related to

research staff, the operation and management of the RRC. Thus: (i) assist in the identification of areas of training or development to build capability and performing individuals and teams, within the RRC and the road sector in general, (ii) recruit, train, develop and motivate a team of researchers and technicians to ensure the delivery of high quality research outputs and enable their career growth through creation of opportunities and (iii) optimize team and individual performance through mentorship, training and appraisal systems.

The position of the **Deputy** should be established for someone to deputise the Head of RRC. The Deputy may be appointed by the Board if it considers desirable for the discharge of the purposes of the RRC and the appointment shall be upon such terms and conditions as the Board may determine, subject to the approval of the Minister. The Deputy will be delegated to lead on capacity building, professional services and consultancies and training and improvement of the RRC facilitates.

**Research Development and Innovation:** The main function of the Head of Research Development & Innovation will be to coordinate, monitor and evaluate implementation of research projects within the RRC and support the development of the strategic plan. As the RRC develops, specific Research Groups will be established under the functional Area/Unit of RD&I and will be led by the Head of Research Development & Innovation. The portfolio will be responsible for the development and implementation of processes and guidelines that inform the conduct of research and development.

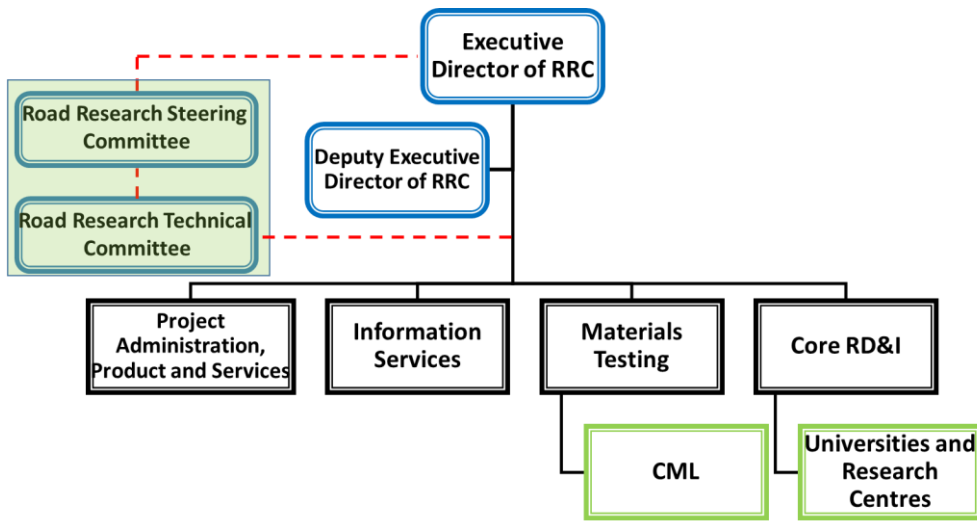
**Materials Testing:** will provide advanced material testing laboratory services, conducting tests on road construction materials for researchers as well as the road sector at large, including, government departments, State road authorities, construction groups and consultants.

**Information Services and Communication:** The overall responsibility of the Information Services Unit will be to store research data/information and facilitate access to the data/information to support the delivery of research and professional services by the RRC staff. The Unit will also disseminate information to the public on research outputs of the RRC. The Head of Information Services will be responsible for information management within the RRC, therefore develop, and implement information management, procedures and standards, for maintaining the RRC research and consultancy services records management plan. In order to optimise resources, the Unit should also support technical information needs of MRB and SSRA.

**Project Administration, Product and Services:** will be responsible for the administration and management of the provision of professional services and consultancies and ensure research products/outputs are delivered efficiently and effectively. This portfolio will also manage the relationship of the RRC with major stakeholders. In the absence of any appointment of the lead person, the Deputy Head of the RRC will be responsible for the provision of expertise on administration and human capital development, planning, monitoring and evaluation of projects. Otherwise, the portfolio is to be led by a specific individual and supported by two Administrators as follows:

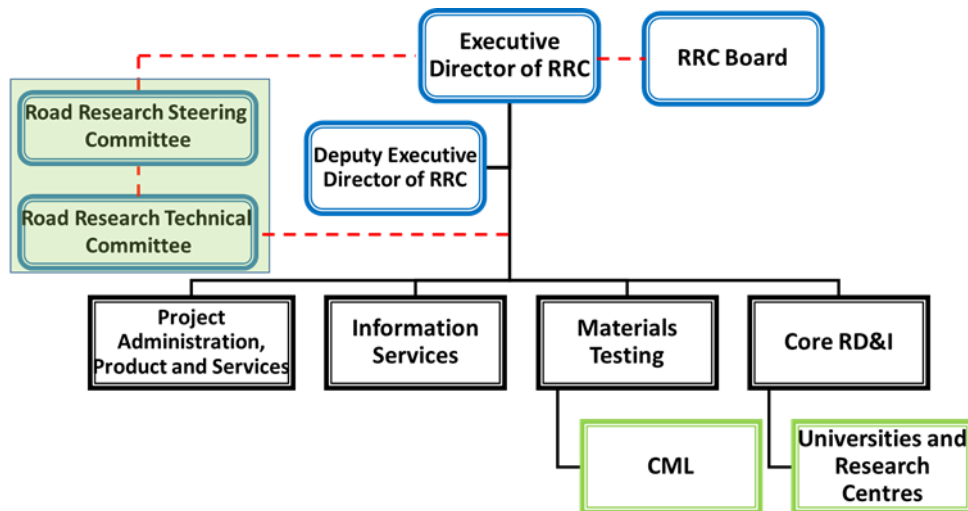
- Administration and Human Capital Development Administrator will be responsible for monitoring finance; staff resource maintenance and governance
- Project Administrator, responsible for Products and Services, providing support to project delivery timeliness of projects, contract management and resource utilization
- The Administrative Assistant will be responsible for providing daily administrative support at the RRC

Figure 10 The operational model of the RRC as a semi-autonomous institution



As the RRC emerges into a semi-autonomous institution, it should have its own Board. The proposal is that the operations of the RRC should be governed as shown in Figure 11, which is subject to any special or general directions of the Minister of Roads and Bridges and to be stipulated in the Road Research Act, yet to be enacted. The Board will approve the research programmes as proposed by the RRSC, establish, and approve the human resources policy for the RRC. The Board should assist in identification and acquisition (when appropriate) of external funding and resources to support the RRC.

Figure 11 The overall governance structure



The proposal is that the Board shall consist of:

- public officer of the rank of Undersecretary appointed by the Minister of Roads and Bridges and whom the Minister shall designate as Chairman of the Board;
- the Undersecretary who shall be the Vice-Chairman;
- the Undersecretary to the Minister of Finance and Economic Planning
- the Undersecretary to Ministry of Education, Science and Technology;
- the Secretary for Economic Planning and Development;
- the Executive Director, South Sudan Road Authority
- the Head of the National Research Council
- the Dean of Engineering of the University of Juba or any other academic institution



## 9 Risk factors

A number of factors will influence the effectiveness and success in the establishment of the RRC and the building of research capacity. One of the factors is the lack of clarity on the land ownership to construct the new and comprehensive laboratory facility to house the RRC that will create difficulties and hurdles in the establishment of the RRC facility. There are other risk factors to be considered and responses should be developed to mitigate the impact of these risks. The major risk factors and the corresponding mitigation strategies are outlined in the table 8 below.

Table 8 Key risks and control measures

Risk	Risk rating	Effects of Risk	Control to be instituted	Implementing officer
Lack of clarity on land ownership	High	Delay in establishment of RRC	Legal advice sought and provided	DG for DRM
Slow initiation of the RRTT	High	Delay in establishment of RRC	Early engagement between DG and Undersecretary	Undersecretary
Lack of funding for the RRC	High	Delay in establishment of RRC	Submit proposal to international development partners	DG for DRM
Lack of capacity within MRB to manage the initial implementation stages of the strategy	High	Progress hindered	Tap into local expertise outside MRB	DG for DRM
			Submit request for Technical Assistance to ReCAP	Head of RRC
Inadequate commitment by stakeholders	Medium	Inefficiency and ineffectiveness in research delivery	Research Steering Committee members to be senior official from stakeholder institutions	Deputy Head of RRC
				Head of RD&I
Inadequate funding for research	Medium	Low level delivery on research capacity building	Establish multiple sources of funding through research proposals and consultancy service in addition to RF funding once established	Head of RRC
Lack of capacity to undertake the research programme	High	low research outputs and inability to address national needs	Provide on-going professional development of staff in the planning and conducting of research programmes	Deputy Head of RRC
			Secondment of staff to regional and international research institutions	Head of RRC
			Appointment of researchers from outside South Sudan if not locally available on fixed-term contracts to transfer skills	Head of RRC
Relationship with key stakeholders, the MRB and SSRA not managed properly	Medium	Capacity of RRC to influence national policy and research agenda diminished	Establish strong relationship with MRB and SSRA through regular interaction	Head of RRC
Delay in research infrastructure delivery including equipment procurement	High	Inability to deliver on road research outputs and capacity building within the timeline	Establish Project Steering Committee with monthly review on progress	Head of RRC
			Utilise laboratory equipment and services rendered by the CML	Deputy Head of RRC

## 10 Key performance indicators

### 10.1 Introduction

The focus of the first 3 years of the strategic plan is on the establishment and operationalization of the RRC and setting out research priorities for the first 10 years. The effective implementation of the strategic key areas will ensure that the RRC develops into a leading centre of excellence in road research and innovation and a provider of relevant professional services and training to the road sector. Section 8 presented the time-lines for the different activities; this section presents the measure of success for the specific strategic key areas.

### 10.2 Strategic key areas

1. **Research development**, to increase research capability in the country and to ensure national and in the long-term, international visibility through conducting quality research that is responsive to the needs of the country and the road sector at large.
2. **Human Capital Development**, aimed at strengthen research capacity in order to develop high level of expertise and ensure a quality research workforce at the RRC and in the road sector in general through development of competency-based training activities.
3. **Infrastructure development**, to ensure sustainable quality research outputs and provide shared research facilities with academic institutions, with state-of-the-art equipment;
4. **Financial sustainability**, identifying and mobilization of additional sources of research funding. Without adequate funding, research activities will be constrained.

#### 10.2.1 Short to medium term

Tables 9 to 11 present activities to be actioned from 6 months to 2 years.

**Table 9 Key strategic area: Human capital development**

<b>Year</b>	<b>Key strategic activity</b>	<b>Measure of success</b>	<b>By whom</b>
2020/2021	<p><b>Strengthen research capacity</b></p> <ul style="list-style-type: none"> <li>Establish the Road Research Task team (RRTT), with the responsibility to provide input in the appointment process of Head of RCC</li> <li>Assess internal staff within MRB for the position before open advertisement</li> <li>Advertise and recruit if necessary</li> </ul>	<p>RRTT in place by 31 January 2020 Head of RRC appointed by April 2020 (Final approval dependent on MRB appointment process)</p>	<p>Undersecretary DG for DMR</p>
	<p>Assessment of current staff CML staff if they meet requirements for conducting quality research</p>	<p>Assessment completed by 28 February 2020</p>	<p>DG for DMR</p>
	<p><b>Appointment of initial RRC staff</b></p> <ul style="list-style-type: none"> <li>Advertise for staff and produce a shortlist for positions if internal staff not qualified</li> <li>Interview potential candidates</li> <li>Appoint professional/research staff as proposed in section 6.4</li> </ul>	<p>Staff complement of 4 appointed by 31 August 2020</p>	<p>DG for DMR</p>
	<p><b>Support and career development, to ensure continuous personal and career growth</b></p> <ul style="list-style-type: none"> <li>Develop research staff induction and career ladder programme</li> <li>Develop programme for research skills development</li> <li>Design and initiate capacity building programme for staff to nurture research development, including long-term training plans</li> <li>Study visit to road research institutions by Head of RRC</li> </ul>	<p>Study visit to research institution by DG for DMR and new Head of RRC by 31 May 2020 Develop support and career development plans by 31 December 2020 Induction programme validated and in place by 31 December 2020 Training course material for short term internal training in place by 31 December 2020 Individual staff development schemes in place by 31 December 2020 Research skills development programme in place by 31 December 2020 Research skills training service provider identified and appointed by 31 January 2021 Initiation of training programme with international research centres by March 2021</p>	<p>DG for DMR Head of RRC Head of RRC Head of RRC Head/Deputy of RRC Head/Deputy of RRC</p>
2020/2022	<p><b>Laboratory personnel capacitation to support the objective of establishing a modernised materials research laboratory</b></p>	<ul style="list-style-type: none"> <li>Skills audit completed by February 2020</li> </ul>	

Year	Key strategic activity	Measure of success	By whom
	<ul style="list-style-type: none"> <li>• Conduct a skills audit of laboratory personnel</li> <li>• Enhance in-house training by develop training programme to address specific skills deficiencies for new laboratory personnel</li> <li>• Identify internationally recognised and ISO 17025 accredited research laboratory and arrange for secondment of Laboratory Manager</li> <li>• Identify service provider for training (Assumed with support through Technical Assistance from AfCAP).</li> </ul>	<ul style="list-style-type: none"> <li>• Local hands-on training conducted to upgrade skills of existing laboratory staff by June 2020</li> <li>• Secondment of Senior Laboratory Technician to internationally recognised and ISO 17025 accredited research laboratory by September 2020</li> </ul>	
	<p><b>Competency-based Training programmes to enhance the road-sector capacity</b></p> <ul style="list-style-type: none"> <li>• Appoint local consultant to conduct survey on implementation of appropriate and industry-driven training programmes/curriculum, develop training material and mode of training delivery</li> <li>• Integrated focused skills development programmes – which includes technical training, validated industry-driven programme/curriculum</li> <li>• Develop or adopt consultancy policy to guide management thereof</li> </ul>	<ul style="list-style-type: none"> <li>• Consultancy policy in place by July 2020</li> <li>• Local consultant to conduct survey appointed by 31 August 2020</li> <li>• Report on survey finding submitted by 28 February 2021</li> <li>• Training programmes implemented in collaboration with the universities, based on industry-driven demand by February 2022</li> </ul>	<p>Head of RRC Deputy Head of RRC</p>

**Table 10 Key strategic area: Research capability development**

Year	Key strategic activity	Measure of success	By whom
2020/2021	<p><b>Nurture research leadership</b></p> <ul style="list-style-type: none"> <li>Develop or adopt research policy and guidelines for mentorship programmes</li> <li>Promote mentoring programme to all staff</li> </ul>	<ul style="list-style-type: none"> <li>Research mentoring programme implemented by 31 March 2021</li> <li>At least one research skills development workshop organised for all research staff by 30 April 2021</li> <li>Research proposals submitted by mentees, as part of the training, meet all quality requirements. Assessed and reported by mentor by end May 2020</li> </ul>	Head of RRC
2020/2021	<p><b>Road Research coordination</b></p> <ul style="list-style-type: none"> <li>Establish Road Research Advisory committees (Road Research Technical Committee and Road Research Steering Committee)</li> <li>Nominate and invite road sector stakeholders to serve in the Research Technical Committee and Research Steering Committee from institutions listed in section 9.3</li> <li>Support and inform government decision making on operationalisation of the National Research Council</li> </ul>	<ul style="list-style-type: none"> <li>RRC established in the interim within the DMR by 31 January 2020</li> <li>RRTC constituted by 30 June 2020, initiation should have started in April 2020.</li> <li>RRSC constituted by 30 June 2020, initiation should have started in April 2020.</li> <li>Holds first meeting of RRTC by 26 June 2020, guided by expert Consultant</li> <li>Hold first meeting by end 31 July 2020 guided by expert Consultant</li> <li>The annual research development programme (ARDP) is established by July 2020</li> <li>Motivation for strengthening the National Research Council submitted by August 2020</li> </ul>	Head of RRC
2020/2022	<p><b>Research prioritisation to increase research impact</b></p> <ul style="list-style-type: none"> <li>Develop detailed proposals for identified priority projects for submission to RRTC</li> <li>Implementation of at least three priority projects approved by RRSC, subsequently implement according to prevailing needs.</li> <li>Long-term monitoring of trial sections as ongoing activity for the next five years</li> </ul>	<ul style="list-style-type: none"> <li>At least one proposal submitted to RRTC by 1<sup>st</sup> June 2020.</li> <li>At least one project in active development by August 2020 following approval by RRSC with support from expert Consultant</li> <li>At least 90% of implemented projects in the first cycle (2021/2022), completed on time, thereafter 100% successfully completed on time</li> </ul>	Deputy Head of RRC and RD&I

Year	Key strategic activity	Measure of success	By whom
	<ul style="list-style-type: none"> <li>• Identify new projects in line with priority areas decided during the stakeholder workshop and develop proposals for submission to RRTC</li> <li>• These projects aim to make a difference to the road sector by being responsive to the needs of the country and providing appropriate solutions.</li> </ul>	<ul style="list-style-type: none"> <li>• At least 60 – 75% stakeholder satisfaction with research outcomes in the first cycle, 2021/2022 thereafter at least 80%.</li> <li>• 100% of new project proposals approved</li> </ul>	

**Table 11 Key strategic area: Infrastructure development**

<b>Year</b>	<b>Key strategic activity</b>	<b>Measure of success</b>	<b>By whom</b>
2020/2021	<p><b>Building</b></p> <ul style="list-style-type: none"> <li>• Commission RRC in temporary facility within DMR</li> <li>• Establish Project Steering committee (PSC) for the construction of the modernised permanent facility</li> <li>• Establish funding for construction of modernised facility</li> <li>• Let a contract for the detailed design of new comprehensive laboratory research facility, prepare ToRs and tender document for construction of the facility</li> </ul>	<ul style="list-style-type: none"> <li>• RRC established in the interim within the DMR by 31 January 2020</li> <li>• PSC in place by 30 June 2020</li> <li>• Availability of funding confirmed by 31 August 2020</li> <li>• Detail designs approved and contractor appointed to start construction by March 2019</li> <li>• Engineer’s construction estimates prepared by 31 August 2020</li> </ul>	<p>DG for DMR PSC Leader PSC Leader</p>
2020/2021	<p><b>Upgrade existing facility (CML), expand and acquire capital equipment for new facility</b></p> <ul style="list-style-type: none"> <li>• Acquire and commission small equipment to supplement current CML equipment.</li> <li>• Refurbish the existing facility</li> </ul> <p>Procure various major equipment. Assumed with advisory support through Technical Assistance from AfCAP, but timing linked to progress on construction of new facility.</p>	<ul style="list-style-type: none"> <li>• Small equipment procured by 30 March 2020</li> <li>• Procurement plan of various major equipment in place by March 2021</li> <li>• Various major equipment procured in time for commissioning in new facility and calibrated ready for use by June 2021</li> </ul>	<p>DG for DMR Head of RRC Head of RRC</p>
2020/2021	<p><b>Laboratory QA/QC schemes and proficiency programmes</b></p> <ul style="list-style-type: none"> <li>• Establish quality control scheme of ISO 9001, Quality Management Systems (QMS), and ISO 17025 to meet requirements for quality assurance and. Assumed with support through Technical Assistance from AfCAP.</li> </ul>	<ul style="list-style-type: none"> <li>• Laboratory standard operational procedure documents in place by February 2021</li> </ul>	<p>Head of RRC</p>
2020/2021	<p><b>Information management for the purpose of good practice of collecting and storing laboratory data</b></p> <ul style="list-style-type: none"> <li>• Develop an electronic job and materials management system for the administration of incoming work. Linked to the knowledge management system.</li> </ul>	<ul style="list-style-type: none"> <li>• Laboratory information management system developed and implemented by February 2021</li> </ul>	<p>Deputy Head of RRC</p>
2020/2021	<p><b>Knowledge management to provide easy access to the road research information</b></p> <ul style="list-style-type: none"> <li>• Develop information services associated with research management for the processing and knowledge sharing</li> <li>• Develop internal and external web based knowledge portals</li> </ul>	<ul style="list-style-type: none"> <li>• Information accessibility plan is implemented</li> <li>• Interactive web page in place by July 2021</li> <li>• Fully functional knowledge information management centre by July 2021, but linked to completion of facility</li> </ul>	<p>Deputy Head of RRC</p>



Year	Key strategic activity	Measure of success	By whom
	<ul style="list-style-type: none"> <li>Formulate publication plan to increase the visibility and impact of research output</li> </ul>		
2021/2023	<p><b>Knowledge transfer to increase public awareness and access to road research information</b></p> <ul style="list-style-type: none"> <li>Develop and implement policy on publicising, promoting RRC’s research, nationally and internationally</li> <li>Organise research dissemination workshops initially and upgrade to conferences</li> <li>Promote research article publication for refereed conferences and journals by all staff</li> <li>Solicit research articles and produce newsletter</li> <li>Transfer and implementation of research output road sector support programmes</li> </ul>	<ul style="list-style-type: none"> <li>At least one newsletter end 30 September 2021 and one each quarter thereafter</li> <li>One research dissemination workshop (“Open Day”) in the first two years and upgraded to a bi-annual conferences by October 2021</li> <li>Mechanisms to monitor information access and determine accessibility in place by March 2023</li> </ul>	

Table 12 Key strategic area: Partnership and collaboration

Year	Key strategic activity	Measure of success	By whom
2021/2023	<p><b><i>Foster linkages with local and international academic institutions and industry</i></b></p> <ul style="list-style-type: none"> <li>Establish formal agreements to develop strong long term partnerships</li> </ul>	<ul style="list-style-type: none"> <li>At least 2 MOUs by July 2021</li> <li>At least 4 MOUs by August 2023</li> <li>Arranged study period for RRC staff at host universities for advanced qualifications by January 2022</li> <li>Implement at least one collaborative research project by September 2023</li> </ul>	Deputy Head of RRC
	<p><b><i>Foster relationships with other research institutions</i></b></p> <ul style="list-style-type: none"> <li>Establish long term partnerships with other emerging Road Research Centres in the region and international road research institutions and laboratories</li> <li>Manage MoUs and collaborations</li> </ul>	<ul style="list-style-type: none"> <li>Arranged secondment/training of researchers and new laboratory staff</li> <li>Implement at least one collaborative research project by September 2023</li> </ul>	Deputy Head of RRC

Table 13 Key strategic area: Financial sustainability

Year	Key strategic activity	Measure of success	By whom
2020/2023	<p><b>Securing funding</b></p> <p>Prepare and motivate increased budget for funding research next financial year</p> <ul style="list-style-type: none"> <li>• Motivate funding for constructing and equipping the new facility</li> <li>• Seek the securement of multi-year projects that create some longer term financial stability in collaboration with academic institutions</li> <li>• Plan for special budget for long-term monitoring of trial sections as it will be ongoing activity and should be budgeted for yearly until 2024.</li> <li>• Increased research funding from levy on road construction projects</li> <li>• Support and inform government decision making on operationalisation of the Road Fund</li> <li>• Provision for the ring fencing of a proportion of the revenue from the 10 000 barrels/day oil for road to support road research possibly through a special dispensation.</li> </ul>	<ul style="list-style-type: none"> <li>• Budget in place, for new financial year</li> <li>• Commitment by MRB on increased funding for research, including annual LTPP budget, by 30 June 2020</li> <li>• Confirmed budget for new facility by 30 August 2020</li> <li>• Confirmation sought on potential for accessing revenue from the 10 000 barrels/day oil for roads by July 2020</li> <li>• Legal framework document for introducing road research levy on road construction projects completed by 31 July 2020</li> <li>• Application for introducing road research levy on road construction projects and access to the funds, submitted by August 2020 delivering value</li> <li>• Formulate a national long-term research funding project proposal in collaboration with academic institutions by 28 February 2021</li> <li>• Motivation to access Road fund budget for research submitted by August 2021</li> </ul>	Head of RRC

## 10.2.2 Priority projects

Some of the identified research topics can be categorised as research focus areas while others can be categorised as research topics. The priority research areas or topics require development of detailed proposal. The development of the proposals is considered a key performance indicator. While no scheduling of the projects is provided, indicative project, duration, estimated costs are provided, but should be reviewed during the preparation of the detailed project proposals, to be undertaken during RRC establishment process, through a Technical Assistance. Table 14 shows the agreed list of priority projects. Initial concept notes have been provided for project titles highlighted in green and are presented in Annex 7.

**Table 14 Research project prioritisation for full proposal development**

Ranking	Research area	Project title	Length (Months)	Indicative Budget (GBP)
1	Soils and materials for road construction, including alternative road construction materials	Performance of problem soils and countermeasures	18	150 000
		Use of local materials	6	35 000
		Identification of potential sources of materials for road construction, including alternative road construction materials	12 - 36	215 000
2	Stabilisation techniques and cost effectiveness	Identification of suitable and cost-effective soil stabilisers for use as cement replacements	24	160 000
		Investigation of the appropriate use of lime, cement and proprietary brand stabilisers	24	120 000
3	Hydrological impact of the environment	Development of project area hydrological characteristics	6	68 000
		Improvements to design of drainage structures and catchment delineation in flat terrain	6	55 000
4	Soil classification and properties analysis	Natural materials characterisation Linked to project 6	6	33 000
5	Pavement design standards appropriate for the type of vehicles in use in the country	Investigation of different pavement performances	12	98 000
		Road design optimization	12	130 000
		A synthesis of road design standards for South Sudan	6	55 000
6	Database and mapping of materials distribution in South Sudan	Mapping of natural materials location for road construction and development	12 - 36	135 000
7	Community participation and engagement in road projects – sensitisation of material extraction requirements in the area	Development of community awareness framework for road construction projects	6	35 000
8	Establishment of cost regimes of projects	Causes of cost overruns of works contracts	12	110 000
		Causes of escalating project costs (tender stage)	6	35 000
		Evaluation of productivity rates of road construction equipment	6	35 000

Ranking	Research area	Project title	Length (Months)	Indicative Budget (GBP)
9	Road traffic and safety management	Implementation of monitoring and evaluation procedures on safety measures applied to the road infrastructure	6	65 000
10	Legal axle load control and enforcement	Assessing the impact of overloading on the network	6	65 00
		Analysis of the effects of traffic overloading on pavement performance	6	37 000
		Implementation of a national strategy for axle load control and enforcement	12	66 000

### 10.2.3 Medium to long-term

This section presents activities to be actioned from 18 months onwards to 5 years. The measure of performance for a research institution is in its science, engineering and technology (SET) outputs. Considering that the RRC will be a new research institution, starting from zero-baseline, the realistic expectation is incremental SET outputs from the second year following the establishment of the full comprehensive facility. The assumption is that the research infrastructure will have been established and research funding secured. The SET outputs will then depend on the research staff profile. This will include long-term training programmes for staff to obtain advanced degrees, overseas seminars attendance of conferences.

#### 10.2.3.1 SET KPI

The expectation is that during the 2025/26 Financial Year, the RRC will have consolidated its research capacity, emerging as a fully established a semi-autonomous research entity. The incremental SET outputs should reflect the institutional development as envisaged in section 8. The interns and students to be supported are a contribution by the RRC to the capacity building agenda of the road sector and not necessarily to be absorbed by the RRC. These can be staff working for SSRA or academic institutions as well as the State Ministries of Infrastructure. Table 15 provides the typical set of SET key performance indicators for the RRC.

**Table 15 Target SET key performance indicators**

SET Outputs	2022/23	2023/24	2024/25	2025/26	2026/27
Number of research skills workshops	1	1	1	1	1
Number of conferences papers presented	1	2	2	3	4
Organised national research dissemination conferences	New	1	1	1	1
Number of road sector publications and articles for general awareness (on-going, twice a year)	1	2	2	2	2
Number of external people trained	5	10	10	20	25
Number of interns supported	5	6	8	8	8
Number of interns absorbed by the RRC	-	New	3	4	2
Number of students supported	5	5	5	10	10
Number of research-based policy document	New	1	1	2	2
Number of projects in active development	2	2	2	4	4
Number of collaborative research projects	New	1	1	2	3
Contract R&D (SSP mil)	New	20	25	27	32

### 10.2.3.2 Human resources

The strategy is to develop young researchers from within the RRC, from the internship or student bursary programme. The member of staff with doctorate will be the staff member trained through the RRC Human Capital Development programme. Table 16 shows the overall SET staffing levels.

**Table 16 SET staffing levels**

KPI	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Number of SET staff	5	6	8	10	15	18
Number of SET staff at Candidate Researcher level	1	1	1	4	8	10
% SET staff who are Female at Candidate Researcher level	-	-	-	25	40	40
Number of SET staff at Researcher level	2	2	3	6	6	6
% SET staff who are Female at Researcher level	-	-	33	33	33	33
Number of SET staff at Senior Researcher level	1	1	2	3	4	4
% SET staff who are Female at Senior Researcher level	-	-	50	33	50	50
Number of staff with Doctorates (through Human Capital Development strategy)	-	-	-	-	1	1

## 11 Resource and potential funding allocation

In order to implement this strategic plan, the RRC will have to mobilize adequate resources from the Government and other stakeholders including development partners. Financial projections estimates are required for better planning and determine required resources to support the start-up phase and the annual operational expenses to implement the research programme.

### 11.1 Annual operational expenses

#### 11.1.1 Staffing requirements

The RRC is initially to utilise CML facilities and services to support the research activities. During the start-up phase, the Head of RRC is to be supported by a Deputy, one senior researcher and two researchers with one staff member at senior technician level, senior technologist to manage the materials testing functional Area/Unit and liaise with staff at CML. There is currently no Information Services Centre and an Information Specialist should be appointed just before the new facility is commissioned. Additional support staff will be required, including 2 drivers, 3 Administration and Financial support staff and cleaners.

The recruitment of staff (Strategic Statement 10) is a short-term priority and should therefore be undertaken during the Start-up phase as outlined in table 4 as follows:

- The RRTC should provide input on the staff composition of the RRC;
- Draft detailed job descriptions for each position, to be dictated by realistic locally available capabilities;
- Schedule for recruitment is drawn according to MRB processes;
- Consider suitably qualified internal staff within the MRB and DMR first;
- Advertise vacant positions and interview short-listed applicants; and
- Appoint suitably qualified persons for the RRC.

The indicative costs are shown in Table 17, in United Kingdom Pound (GBP) and in South Sudanese Pounds (SSP). The estimated annual staff cost is based on equivalent staff salary scales provided by the DG for DMR. The RRC should offer competitive remuneration packages of staff to be at par with others in the region, in order to create a working environment that can retain research specialist to sustain quality research outputs and mature into a recognized research centre.

**Table 17 Estimated annual staff cost: GBP (SSP)**

Position	Indicative Total Cost	
	GBP	SSP
Head of RRC	31 200	12 199 200
Deputy Head of RRC	22 440	8 774 040
Senior researcher	18 720	7 319 520
Researchers (x2)	13 440	10 510 080
Senior Technologist	11 400	4 457 400
<b>Total</b>	<b>97 200</b>	<b>43 260 240</b>

The rate of increase of the number of research personnel in the different grades, in future, is very much linked to the availability of funding to undertake research, which will also be linked to the creation of new research and training programmes.

### 11.2 Operational expenses

The cost of the RRC's operations and administrative activities is to be funded by the MRB on an annual basis. Annual operational expenses of the RRC should adequately be covered to ensure effective delivery of the research programme requirements. Table 18 shows an indicative cost estimate for such costs.

For future planning, a rule of thumb that can be used is the budgetary principle that allocates roughly 40 percent of the programme’s budget to facility operations, 40 percent of the budget for research and 20 percent to facility construction and other programme activities<sup>10</sup>.

**Table 18 Annual operational expenses**

Item	Description	Indicative Cost	
		GPB	SSP
1	Travel (meetings)	9 950	3 890 450
2	Operational supplies	8 500	3 323 500
2	Communications and standby Generator/electricity supply	10 500	4 105 500
3	Special research projects (e.g. monitoring of LTTP)	30 500	11 925 500
4	Knowledge dissemination	6 500	2 541 500
	<b>Total</b>	<b>65 950</b>	<b>25 786 450</b>

### 11.3 Estimated global start-up costs

The estimated global start-up costs are categorised according to key priority areas (KPA).

**KPA 1: Planning:** The MRB is to establish an interim Road Research Task Team (RRTT) to coordinate the implementation of the Strategic Plan during the first four to six months in view of the fact that RRC is initially to be hosted by DMR. The RRTT will require funding for meetings during the start-up phase

**KPA 2: Governance:** The RRTT is to establish two committees: Road Research Steering Committee (RRSC) and the Road Research Technical Committee (RRTC), for the purpose of managing research, setting the research agendas, priority setting and allocation of available research funds, research needs assessments and informing the activities undertaken by researchers. The committees will require funding for meetings, as they will be organized at a national level.

**KPA 3: Legal establishment:** Formulation and enactment of policy for establishing the RRC is required. The RRTT will seek legal opinion and advice for guidance in establishing RRC under the special schedule for autonomy. Special funding should be allocated to be able to facilitate the process. This may require technical assistance or special consultancy services, preferably by local expert.

**KPA 4 and 7: Human capital development:** The modern laboratory facility is planned to both serve as a research laboratory and as a centre for training of laboratory personnel in the country. Laboratory personnel need to learn new trends and to respond to the use of advanced equipment. The situational assessment also revealed there is currently no technician programme in the country that focuses on materials for the construction of road works. The RRC should contribute towards human capital development in the county by providing training for laboratory personnel and technologists. A proper assessment of existing capacity will provide an accurate indication of the demand for such training programmes. The personnel in the RRC laboratory should be competent and well qualified to be able to produce high quality results and provide quality training. Technical assistance will be required to assess demand for the training programmes.

Training is required to empower the senior technologist with the skills and understanding to implement ISO 17205 as well as other laboratory staff. External assistance to deliver on this will also be required.

**KPA 5: Research infrastructure:** The situational assessment revealed that laboratory infrastructure is weak to support research activities. The existing laboratory facilities lay out does not provide adequate and environmentally friendly working space for personnel and in relation to equipment location as well as linkage between the different laboratory functional areas. Research infrastructure development requires planning and special investment to upgrade the existing facility and equipment in order to support the development of the RRC to meet the requirements of a competitive RRC with integrated human capital development to

<sup>10</sup> Study of Operations and Maintenance Costs for NSF Facilities report NSB-2018-17, National Science Board, May 24, 2018



ensure delivery of research is sustainable over the long-term. Thus, research infrastructure not only needs to be built, it must be managed and adequately funded to be operational and maintained properly over the long term.

The assumption is that capacity utilization of the new facility will steadily increase over the years as more road infrastructure development projects are undertaken in the country and the RRC grows in stature. The expectation is that beyond the fifth year from its establishment, capacity utilisation will have reached 80%, steadily increasing from 40%, in the first year, at least 50%, in the second and 60% in the third, reaching 75% in the fourth year.

While the initial cost of construction will be determined from the Engineer's estimate, an estimated cost based on floor size is used for estimating an indicative cost for facility development. An estimated floor area of about 510 square metres should be adequate for a moderate size laboratory facility to provide for specific functional areas for concrete, bitumen and asphalt, soils and aggregate. An estimated cost of US\$700 per square metre is used to determine the cost for modern facility in table 19. The prices received from the contractors at tender or bidding stage will determine the final project cost.

CML needs to be serviced to a level that enables it to provide the required services in the interim as an institution of national and international interest. The facility should be refurbished to provide a safe and health working environment. There is need to provide ceilings, air conditioning and air extractor for the binders room. The details for the refurbishment were provided in the Preliminary Findings Report. The level of priority for action is immediate and therefore required within the first six months. Bringing the facility to serviceability includes calibration of existing equipment, maintenance and re-installation of rusted equipment and validation of tests.

Procurement of new testing equipment is required in order to undertake advanced testing to match the standard of a modern and comprehensive materials testing facility and be able to serve as the reference laboratory in the country.

**KPA 6: Research priority areas:** Funding is to be channelled towards undertaking the prioritised research projects, under mentorship, in the first year, through which capacity building will be implemented. The most likely initial research project that the RRC is expected to be responsible for, is the monitoring of existing trial sections, an annual amount should be reserved for this exercise. Call for new research ideas from all stakeholders is to be made each year.

**KPA 8 Partnership and collaboration:** In order to promote collaboration with various stakeholders in research and project delivery, funding allocation is required for drawing up agreements for implementation and direct interaction to effect the agreements, nationally and internationally. The agreements should consider intellectual property through collaboration. Linkage can be established with newly established RRC and institutions such as TRL of the United Kingdom, the Council for Scientific and Industrial Research (CSIR) in South Africa, the Australian Roads Research Board (ARRB), Building and Road Research Institute (BRR), Ghana and linkage to the Africa Community Access Programme (AfCAP), EU, JICA, USAID, UNOPS and regional academic institutions. AfCAP is a partnership and offers the greatest opportunity for collaborative research with other RRC. The African Transport Research Forum (ARTReF), which operates in 16 African countries, will be a key forum for the RRC. This will increase opportunities for staff exchanges and secondments, dissemination of research and involvement in committees of professional bodies, research and linkages to contractor, consultant organisations, thus increasing visibility of RRC.

**KPA 9: Products and services:** The product and services will include guide strategy development within MRB and SMOI and institutional capacities in the road sector. The implementation of road research projects requires sustainable knowledge management systems to ensure effective dissemination of the research findings of the RRC. The aim is to improve impact and awareness on research across the road sector. The RRC should be equipped with the tools to engage society through a variety of mechanisms to different audiences and designing of social responsibility projects. An estimate for procuring expert services to establish Knowledge Management System is included in the budget shown in Table 19.

**Table 19 Estimated start-up budget**

KPA Item	Description of key priority area	Estimated Cost	
		GBP	SSP
1	Planning	3 500	1 368 500
2	Governance	6 500	2 541 500
3	Legal establishment	1 500	586 500
4	Staff compliment (laboratory)	50 000	19 550 000
5	Research infrastructure		
	• Modern facility	357 000	139 587 000
	• Serviceability of existing CML	26 875	10 508 086
	• Advanced equipment	180 000	70 380 000
	• Laboratory Quality Management System	45 000	17 595 000
6	Research priority areas	25 000	9 775 000
7	Human capital development	80 500	31 475 500
8	Partnership and collaboration	4 500	1 759 500
9	Products and services and knowledge management system	35 000	13 685 000
<b>Total</b>		<b>815 375</b>	<b>318 811 586</b>

#### 11.4 Indirect expenses

In order to maintain on-going operations, the RRC will require that research project funding is available to cover the full costs to be able to undertake the research and maintain equipment and research infrastructure in general. Ongoing reinvestment should be planned for and should be significant enough to cover both indirect and direct costs. Due to lack of previous data on expenditure for research at DMR, the presented indirect expenses is subject to revision as and to when additional and more accurate information is made available. Table 20 provides the indicative level of required reinvestment over the first three-year period. Low funding levels will limit the ability to achieve the goal of attaining the status of an established research centre, as it will not be possible to hire and keep researchers with a direct consequence of low research outputs.

**Table 20 Projected indirect expenses**

Item	Description	Year 1	Year 2	Year 3
1	Power, water	1 560 000	1 560 000	1 560 000
2	Manpower	43 260 240	45 425 250	45 425 250
2	Expenditure on consumables	7 450 000	11 920 000	12 516 000
4	Repair and maintenance	1 250 000	125 000	125 000
5	Equipment calibration	3 450 000	3 519 000	3 554 190
6	Telephone	500 000	505 000	510 050
7	Travel for meetings	3 890 450	3 968 259	4 047 624
8	Operational supplies	3 323 500	3 389 970	3 457 769
9	Communications and standby electricity supply	4 105 500	4 146 555	4 229 486
10	Priority research projects	11 925 500	71 171 775	74 730 364
11	Knowledge dissemination	2 541 500	2 592 330	2 644 177
	<b>Total</b>	<b>82 131 690</b>	<b>148 323 139</b>	<b>152 799 910</b>

## 11.5 Potential funding allocation and mobilization

### 11.5.1 Potential allocations

The current situation reveals that the DMR has never been allocated funding to be able to build research capacity or conduct research. According to the information provided by the DG for DMR the allocation made in the 2018/2019 budget is shown in table 21. An amount of SSP 100 000 000 is allocated as seed funding for the establishment of the RRC. The allocated amount of SSP150 000 000 for research could only have been utilised through outsourcing the current staff complement. The amounts have not actually been provided.

**Table 21 Funding allocation 2018/2019 FY**

Broad category	% allocation	SSP Value
Establishment of RRC	12.3	100 000 000
Calibration of Equipment	2.7	22 000 000
Classification of soils	18.4	150 000 000
Supply of Equipment	66.6	542 010 487
<b>Total</b>	<b>100</b>	<b>814 010 487</b>

### 11.5.2 Resource mobilization

In order to implement this strategic plan, financial sustainability is key to the successful realisation of the vision. The RRC will need to mobilize adequate resources from the Government and other stakeholders including development partners. A number of options exist to explore options available to mobilize financial resources in addition to the annually recurrent budget that will be allocated from MRB.

- Strategy statement 30 requires that the RRC ensure that the Road Research Act is enacted to provide for the ring fencing of a proportion of the revenue from the 10 000 barrels/day oil for road research possibly through a special dispensation. This will provide a significant and more reliable source of funding if the disbursement model of revenue from oil for infrastructure development, as shown in Figure 4 is implemented with specific amount for the RRC.
- Entering into a long-term agreement to provide support to the proposed Office of Road Monitoring (ORM) in assembling data to determine whether best value for money is being achieved on project is an additional option for resource mobilization. The RRC will then play a role in the proposed value for money regulation system.
- Encourage industries to invest more in research, specifically in collaborations projects through the RRSC.
- The resource mobilisation can also be achieved through technical assistance provided by agencies such as African Development Bank (AfDB), AfCAP/DFID, EU, JICA or World Bank to support specific areas of the strategy. Funding can be sought from AfCAP to support the research priority list.
- By establishing the potential number of testing and fieldwork and technical audits to be undertaken, and appropriately charging at cost per test and services, it should be possible to get cash inflows to support the RRC over the coming years and in the long term become financially independent. This should reduce dependence on external funding from agencies such for support. The recommendation in the RSBP that each bid for a road project should call for an alternate design and cost proposal from the bidder allowing for the bidders to innovate and suggest alternate construction technologies, provides opportunities for testing and source of research funding.

## 12 Institutional commitment

The RRC is to dedicate its efforts to contribute towards the achievement of the GOSS Vision and development goals through undertaking research and finding innovative solutions that address the following elements of the Economic Development Pillar of the country's Vision:

- *Roads transport and infrastructure development that will provide opportunities in isolated regions and create a national market, and on providing social infrastructure development, including particularly water resource management and sanitation services.*
- *Rural transformation and developing economic activities that will contribute immediately to the quality of life of most South Sudanese.*

Its establishment will contribute to national development objectives and will create a platform for access to information on road research outcomes, to help foster a knowledge-based road sector. Institutional commitment by the MRB, as the implementing line Ministry, is required to ensure the successful transition of the RRC to a semi-autonomous institution.

The urgency by which the RRTT will kick-start the implementation of the Strategic Plan and meet the legal and administrative requirements for establishing the RRC will only happen with the dedication of the members of this team. The commitment of RRTT is a key factor that will indeed affect the momentum of establishing the RRC and the building of road research capacity in South Sudan.

The contributions from stakeholders during the consultation process demonstrated a buy-in to the idea of establishing a RRC. The dedication exists to drive this Strategic Plan, but it is only possible to manifest itself with the commitment by MRB to provide the required financial resources and creating an enabling environment for its implementation and future support for the RRC to flourish.

## 13 Next step

The next step is the implementation of the Strategic Plan to establish the RRC. The institutional commitment by the MRB, as the implementing line Ministry, will require support through Technical Assistance (TA). This will assist to successfully establish the RRC, as a semi-autonomous institution. This phase of the project is for put in place systems for the establishment and operationalisation of the RRC. This section sets out the proposal for the Technical Assistance. The TA is to focus on providing support to achieve the following:

- Establish a modern and comprehensive laboratory for the testing of materials used in road works, as well as training of laboratory personnel and providing a system to oversee the proficiency and quality of test results from private laboratories;
- Develop and introduce data management systems for research projects being undertaken throughout the country in line with those being developed through regional AfCAP projects;
- Establish in-house capacity for comprehensive materials investigations and geotechnical investigations required for road works, road condition investigations and analysis of pavement and surfacing failures, primarily related to research;
- Establish a knowledge management facility for cataloguing, storage and dissemination of road transport knowledge, and establish linkages between this facility and similar facilities in the region and internationally.

The activities to be undertaken in Phase 2 are to be guided by the action plans and timelines given in section 8. The TA is to be provided over a 12-month period. The performance indicators as outlined in section 11 will be used to monitor the progress during 12 months. The following are the key actions to be undertaken.

### 13.1 TASK 1: Human Capital Development

The TA will support development of career schemes required to ensure continuous personal and career growth of RRC staff. Activities will include:

- Assist in the recruitment of Head of RRC and arrangement for study visit to a research institution, aimed at understanding of aspects of research strategic management;
- Assists in the assessment of current staff;
- Assists appointment of initial RRC staff including Laboratory Manager and Technicians to ensure quality research outputs;
- Develop the appropriate programmes and necessary support and career development schemes, to ensure continuous personal and career growth.
- Informal mentoring as well as ad-hoc coaching as necessary, during the course of the assignment to build the capacity of researchers and research leaders.
- Specific training aspects on forensic investigations are also to be covered as part of internal training programme. In-house capacity building is to be provided for comprehensive materials investigations and geotechnical investigations required for road works, road condition investigations and analysis of pavement and surfacing failures, primarily related to research.
- Develop appropriate competency-based training programmes to enhance capacity for the road sector. This to be achieved through liaison with higher learning institutions, Ministry of Higher Education, Science and Technology, ECSS and other key stakeholders

### 13.2 TASK 2: Infrastructure Capacity Development

The main task for the Consultant is to assist in the planning for the establishment of a modern and comprehensive materials laboratory. The Consultant will not be involved in the procurement and construction process of the new facility, but provide assistance in the following activities:

- Facilitate GOSS approval for the proposed RRC.
- Establishment of Construction Project Steering committee (CPSC) for the construction of the modernised permanent facility
- Suitability evaluation of the physical layout of the facility, including review of space provided for the new laboratory. The CPSC will provide leadership in achieving this.
- Prioritisation of needed new equipment.
- Capacitation of Laboratory staff In order to maintain high quality results in a laboratory, the personnel is expected to be competent and well qualified. Action required:
- Assessment of newly recruited staff.
- Develop dedicated training plan for laboratory testing, on the basis of the assessment to ensure that the laboratory personnel is confident in testing and understand the importance of quality of data collected during testing.
- Develop and implement secondment programme for Laboratory Manager. The Consultant should be in a position to provide the opportunity for this secondment at an advanced laboratory facility.

### 13.3 TASK 3: Competency-Based Training Programmes

There is currently no institution offering training for laboratory technologists specifically in road construction materials. The goal is to build the capacity that will support the road sector in the country. Activities will include:

- Conduct a demand analysis study, to determine content and mode of delivery of the training programmes, as the curriculum should be industry driven, thereafter develop the appropriate curriculum.
- Assess the potential of institutional restructuring of the technical colleges that have the potential to offer appropriate training and therefore produce better-prepared laboratory personnel.

### 13.4 TASK 4: Data Management Systems

Activities will include:

- Laboratory information management for the purpose of good practice of collecting and storing data.
- An assessment of the cost benefit in acquiring an off-the shelf product or developing one is to be conducted and based on the assessment, recommendations made to the Head of the RRC and the Laboratory manager.
- Develop a specific project plan for documentation on procedures, to meet requirements for quality assurance and quality control scheme to enable the RRC to operate in line with the requirements of ISO 9001 Quality Management Systems (QMS) and ISO 17025, introduction of accreditation mechanisms with a view of attaining accreditation in the near future.

### 13.5 TASK 5: Knowledge Management Service Centre

Activities will include:

The core business of the RRC is research and the establishment of a Knowledge Services Centre as part of the infrastructure for the RRC is central to the management of information from research and transferring that knowledge for application and awareness. Activities will include:

- A knowledge management facility is to be established for cataloguing, storage and dissemination of road transport knowledge
- Develop a knowledge management framework to manage collection and storage the data and as new ideas are created during project execution.
- Establish linkages with similar facilities in the region and internationally. Data management systems are to be developed for research projects already undertaken and to be undertaken in future throughout the country, in line with those being developed through regional AfCAP projects.

The proper records keeping and document management will ensure that research staff have accessibility to the information for analysis but also the dissemination of research outcomes to the wider public.

### 13.6 Main cost component and budget

**Table 1: Global Price**

Item	Table Reference	Totals (GBP)
<b>Fixed Fees (Paid as Milestones)</b>		
Fee Component	Table 2	<b>48 750</b>
Incidental Expenditure	Table 3	<b>22,060</b>
<b>Subtotal Fixed Fees (Paid as Milestones)</b>		<b>70,810</b>
Reimbursable Expenditure	Table 4	<b>8,500</b>
<b>TOTAL GLOBAL PRICE (Used for Financial Evaluation)</b>		<b>R79 310</b>

**Table 2: Fee Component of Fixed Fees (Remuneration of Experts)**

Items				
Fee Component of Fixed Fee				
Position Title	Name of Expert	No. days	Daily Fee Rate (GBP)	Totals (GBP)
Team Leader/Research and Institutional Development Specialist		40	650	26,000
Materials Engineer/Laboratory Management Specialist		30	650	19,500
Ad Hoc Experts	Ad Hoc Experts	5	650	3,250
<b>Subtotal Fee Component (Value A in Table 1)</b>				<b>48 750</b>

**Table 3: Incidental Expense Component of Fixed Fees**

<b>Expenses Component</b>					
<b>Item</b>	<b>Description/ Comment</b>	<b>Unit</b>	<b>No of Units</b>	<b>Unit Price (GBP)</b>	<b>Totals (GBP)</b>
<b>Flights (by position)</b>					
Team Leader/Research and Institutional Development Specialist	International flight - standard economy class to and from Juba	Flights	3	850	2,550
Materials Engineer/Laboratory Management Specialist	International flight - standard economy class to and from Juba	Flights	3	850	2,550
<b>Accommodation including per diem (by position)</b>					
Team Leader/Research and Institutional Development Specialist	Standard Hotel accommodation and subsistence	Days	32	190	6,080
Materials Engineer/Laboratory Management Specialist	Standard Hotel accommodation and subsistence	Days	25	190	4,750
<b>Transport costs</b>					
Project Team	Transport between Pretoria and O R Tambo International Airport	Trips	6	80	480
Project Team	Cellular/SIM communication & data	Days	70	10	700
Project Team	In-country land transport for non-site activities	Days	30	80	2,400
<b>Other costs</b>					
Visa fee, registration stamps in Sudan, trip related costs, etc.	Lump sum				2,550
<b>Subtotal Expenses Component (Value B in Table 1)</b>					<b>22,060</b>



**Table 4: Reimbursable Costs**

No.	Item	Unit	No of units	Cost per unit (GBP)	Upper limits payable (GBP)
1	Procurement, installation and demonstration of the software for the laboratory management system				2,500
2	Study visit of Head of RRC to a research centre inclusive of air travel, local transport, per diem and accommodation				3,000
3	Three-week secondment of Head of Materials to an ISO 17025 accredited research laboratory. inclusive of air travel, local transport, per diem and accommodation				3,000
<b>Total Indicative Reimbursable Budget</b>			<b>8,500</b>		

**Table 5: Milestones and Payment Schedule**

No	Milestone Deliverable
1	Task 1 Report (A) – development of career schemes required to ensure continuous personal and career development
2	Task 2 report – Completion of task, providing details on infrastructure capacity development
3	Task 3 Report (B) – Completion of task, including detailed course content of competency-based training programmes. Competency-Based Training Programmes
4	Task 4 report – Laboratory information management system for the purpose of good practice of collecting and storing data for a laboratory, including a proficiency scheme
5	Task 5 report – Completion of task, establishment of Information Service Centre for cataloguing, storage and dissemination of road transport knowledge
6	Final report – Summary of task reports and final recommendations for further institutional development.

### Minimum Experience Requirements of Experts

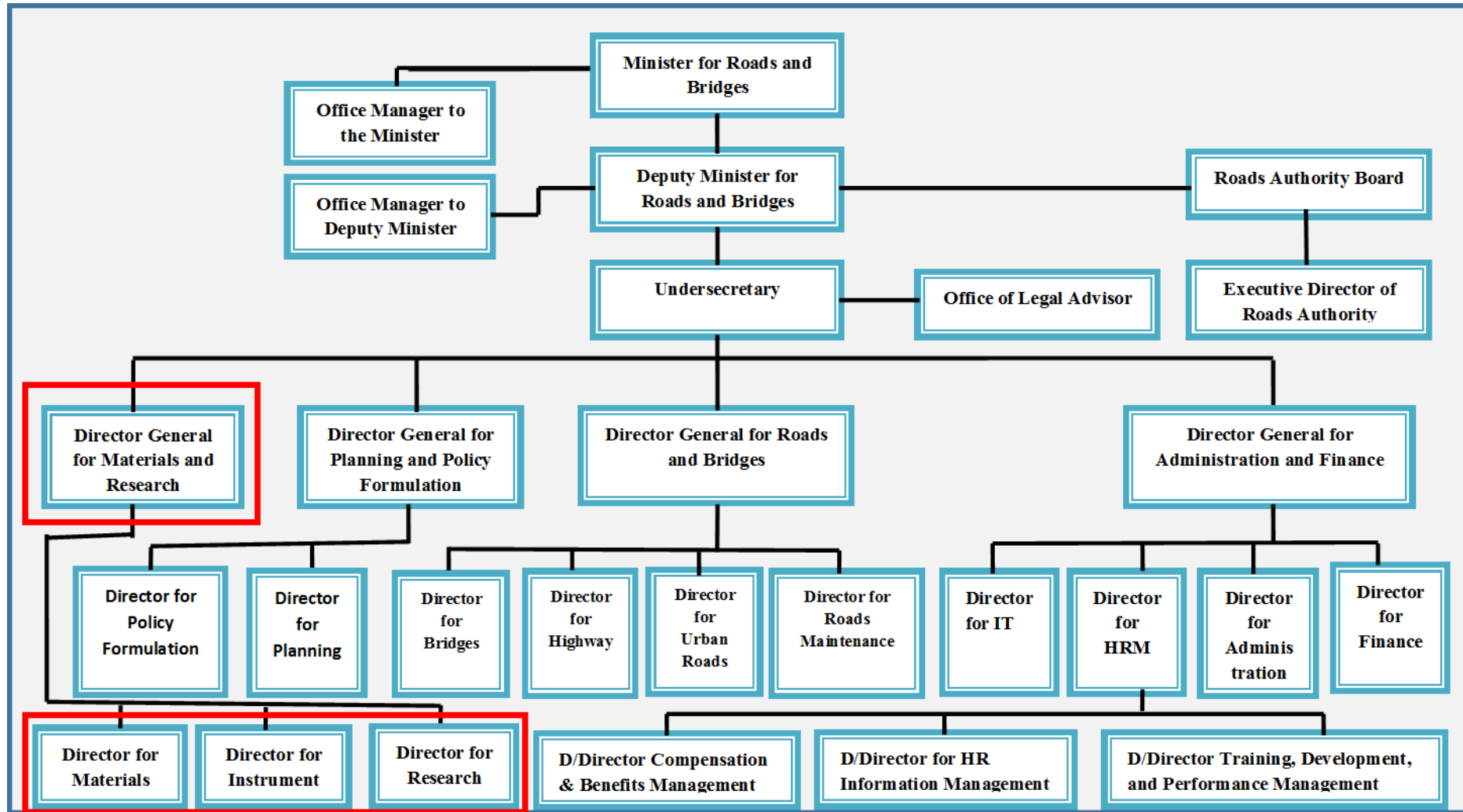
The team is expected to comprise of two (2) experts, with expertise and experience covering the range of skills listed above. One of the two experts is to be nominated as the Team Leader.

**Team Leader/Research Specialist Qualification and skills** - the Team Leader should have an in-depth knowledge of road engineering and must have not less than 15 years of relevant experience. He/she must have a proven record of undertaking research studies to an international standard and a proven background in team leadership and capacity building and knowledge transfer. He/she must have relevant experience of working with government departments and agencies in developing countries and emerging nations, strategic plan development and. Work experience in sub Saharan Africa in institutional development is essential, and experience in South Sudan would be a significant advantage. Education – MSc in civil engineering or a related field, plus 15 years of experience plus professional registration, will be acceptable.

**Materials Engineer/Laboratory Management Specialist Qualification and Skills:** Degree in Civil Engineering (or equivalent) and a minimum of 10 years' experience in the road sector, of which 5 years must be as a materials engineer in sub-Saharan Africa. Experience should also include field and laboratory testing of construction materials, in-service training of laboratory personnel including at least one year managing a materials testing laboratory. Proven expertise will be required in design and implementation of laboratory management systems and proficiency schemes and preferably in an ISO 17025 accredited research

laboratory. In addition the expert must be highly experienced in the management of road research laboratories, in materials design and construction techniques for low volume roads with excellent communication and report writing skills is essential.

## Annex 1 Structure for Ministry of Roads and Bridges



## Annex 2 Equipment condition inventory

S/No.	Equipment Name	Testing Type	Numbers	Status	Serial No.	Made	Last Calibrated
	<b>GENERAL</b>						
1	Riffler box 40 cm		1	Good Condition		UK	
2	Riffler box 15 cm		1	Good Condition		Uk	
3	Thermostatially Controlled Oven 250 Liter		2	1 Good Condition	-	Uk	
4	Metal Tray Size (90x90x6cm)		9	9 Good Condition	-	Uk	
5	Metal Tray Size (30x30x4 cm)		8	6 Good Condition		Uk	
6	Mixing Pans		6	4 Good Condition		Uk	
7	Hammer 1 & 2 Kg		4	2 Good Condition		Uk	
8	Weight Scale		10	2 Good Condition		Uk	
9	Rubber Mallet		3	1 Good Condition		Uk	
10	Scoops		1	Good Condition		Uk	
11	Sampling Spoon		2	Good Condition		Uk	
12	Venier Caliper		2	2 Good Condition		Italy	
13	Sieves Set		3	1 Good Condition		Italy&UK	
14	Brush Steel		2	1 Good Condition		Italy	
15	Plastic Cylinder		4	3 Good Condition		Italy	
16	Plastic Bags		10	3 Good Condition		Italy	
17	Wash Bottles		15	9 Good Condition		Italy	
18	Glass Plate		2	2 Good Condition		Italy	
19	Hot Plate		2	1 Good Condition		Italy	
20	Triple beam balance		3	2 Good Condition		Italy	
21	Electronic Balance 0.01g		2	1 Good Condition		Italy	
22	Heave duty Balance Capcity 150 kg		1	Good Condition		Italy	
23	Dial gauge (10mm/0.01mm)		8	4 New		Italy	
24	Specific Gravity Frame Complete		1	New	V085/AA/0063	Italy	
25	Glass Jar		2	1 Good Condition		Italy	
26	Pycnometer Bottls (Glass)		3	2 Good Condition		Italy	
27	Straight edge		1	Good Condition		Italy	

<b>SOILS LAB</b>							
S/No.	Equipment Name	Testing Type	Numbers	Status	Serials No.	Made	Last Calibrated
28	Groving Tool Type Casagrande & (ASTM)		12	4 Good Condition		Italy	
29	Porecelain Evaporating dish		6	4 Good Condition		Italy	
30	Liquid limit device (Casagrande)		4	1 Good Condition		"	
31	Liner Shrinkage Mould		8	7 Good Condition		"	
32	Spatulas (Knife)		6	2 Good Condition		"	
33	Moisture Content Tins		50	20 Good Condition		"	
34	Sample Extruder (10 & 5 cm dia)		4	4 New	S114/AB/0011	"	
35	Automatic Compactor		1	Not Working		UK	
36	Mould 1 Liter Base Plate +Colar		5	2 Good Condition		Italy&UK	
37	Mould 2 Liter Bade Plate + Colar		6	2 Good Condition		"	
37	Soaking Tank		1	Good Condition		UK	
38	Compaction Hammer 2.5Kg		6	"	S187/AB/0019	Italy	
39	Compaction Hammer 4.5Kg		14	5 N ,3 G ,Nw 6	S188/AA/0101	Italy	
40	CBR Machine		5	1 N ,1 G ,Nw 3	N,S211-10/AB/0035	Italy&UK	12/02/2008
41	CBR Moulds Complete		20	16 Good Condition		Italy&UK	
42	Shear Box		1	New ,Some parts Missing	FLM /73/72	INDIA	12/02/2008
43	Houger		2	New	S053/AA/0005	Italy	
44	Desicator		1	New	B057-03/AA/0200	Italy	
45	Dynamic Cone Penetromter (DCP) Roads		2	Not Working		It,gremen	
	<b>CEMEN/ CONCRETE/AGGREGATE</b>						
46	ACV Mould Complete		4	New		Italy	
47	Concrete Mixer		1	New	C161/AA/0005	"	
48	Vicat Apparatus		1	New		"	
49	Cement Moulds		2	New	E110/AB/0012	Italy	
50	Sand Equivalent Apparatus Sets		2	New	S158-07/AB/0006	Italy	
51	Concrete Mould 150x150x150 mm dia		16	8 Good Condition		UK	
52	Loss Angloes Machine (Complete)		1	1 Good Condition		UK	
53	Aggregate Impact Value (Complete)		1	Good Condition	A0B0-04/AA/0013	Italy	
54	Concrete Crushing Machine (Complete)		1	Good Condition	YIMC 114-7/AB/0084	Italy	02/12/2008
55	Elongation Index gauge		1	Good Condition		Italy	
56	Flakiness Index gauge		1	Good Condition		"	

S/No.	Equipment Name	Testing Type	Numbers	Status	Serials No.	Made	Last Carlibrated
57	Slump Cone Test device		2	Good Condition		"	
58	Tamping Rod		3	Good Condition		"	
59	Concrete Test Hammer (Schmide hammer)		1	Good Condition		"	
60	Vicatronic		1	New	E044N/AA/0230	Italy	
61	Point Load Machine (Cores ,Rocks)		1	Good Condition	41131	"	
62	Concrete Vibrating Machine		1	New	C270/AB/0003	"	
	<b>BITUMINOUS /ASPHALTIC CON</b>						
63	Softening Point Set		1	New	B072/AZ/0109	Italy	
64	Automatic Ring & Ball		1	New	B070N/AA/0043	"	
65	Flash Point & Fire Point		1	New		"	
66	Hot Plate		1	New	B086N/AA/0047	"	
67	Furnace (Flow Ring) (Oven)		2	New (B066N/AB/0004)	B064N/AA/0010	"	
68	Asphalt heater (Marshal)		1	New	B028-01/AB/0006	"	
69	Thermostaically Controlled Water Bath (Asphalt)		1	New	V241/AB/0002	"	
70	Prentrometer PI ( Asphalts)		3	New	B057-10/AB/0027	"	
71	Ceutrifucal Extiuction Machine		1	New	B011/AB/0021	"	
72	Marshal Compactor with Hammer (Complete)		1	New	B036/AB/0013	"	
73	Sample Extruder (5 cm di)		1	Good Condition		"	
74	TRL Machine		1	New	C321-10/AA/0017	"	
75	Bench Or Morter Mixer (Marshal)		1	New	E094/AB/0004	"	
76	Marshal Compaction Moulds Complete		15	New		"	
77	Auto Compression Machine with Flow & Stability gauge		1	Good Condition		UK	
78	Solvent Recovery device		1	New	V211/AB /0001	Italy	
79	Mixer Machine 130 °C		1	New	B027/AB/0002	Italy	
	Ramarks : (1)All the New Machince are Not Calibrated.						
	(2) Most of the equipment were not tested by electric power due to absent of electrician in the laboratory						
	3 All the above equipment were supplied without calibration machines						

### Annex 3 Group research areas prioritisation during stakeholder workshop 1

Group 1	Group 2
<b>Topic description</b>	<b>Topic description</b>
<ol style="list-style-type: none"> <li>1. Erosion and drainage control</li> <li>2. Alternative method of dealing with black cotton soil</li> <li>3. Soil property analysis</li> <li>4. Hydrological impact on the environment</li> <li>5. Optimization of community participation in road construction and maintenance</li> <li>6. Pavement design standards appropriate for the type of vehicles in use</li> <li>7. Establishment of local available resources</li> <li>8. Database on materials in South Sudan</li> <li>9. Establishment of baseline data construction cost</li> <li>10. Mapping of Material distribution</li> </ol>	<ol style="list-style-type: none"> <li>1. Human resources development, (training)</li> <li>2. Soil properties</li> <li>3. Soils and materials for road construction</li> <li>4. Road traffic and safety management</li> <li>5. Construction in swampy areas and with deep clay</li> <li>6. Hydrological impact of the environment</li> <li>7. Erosion and drainage control</li> <li>8. Pavement design standards appropriate for the type of vehicles in use in the country</li> <li>9. Alternative road construction materials: Establish baseline data on cost of road construction</li> </ol>
Group 3	Group 4
<b>Topic description</b>	<b>Topic description</b>
<ol style="list-style-type: none"> <li>1. Soils and materials for road construction</li> <li>2. Stabilisation techniques and cost effectiveness</li> <li>3. Hydrological impact of the environment</li> <li>4. Soil classification and properties analysis</li> <li>5. Pavement design standards appropriate for the type of vehicles in use in the country</li> <li>6. Database on materials in South Sudan</li> <li>7. Community participation and engagement in road projects – sensitisation of material extraction requirements in the area</li> <li>8. Establishment of cost regimes of projects</li> <li>9. Effects and control of traffic overloading</li> <li>10. Legal axle load control and enforcement</li> </ol>	<ol style="list-style-type: none"> <li>1. Soil and materials for road construction</li> <li>2. Material improvement for sustainability</li> <li>3. Road drainage system and land topography study-land contours system for roads design</li> <li>4. Establishment of cost regimes of projects</li> <li>5. Road safety management</li> <li>6. Up to date South Sudan Road Design Standard and Specification</li> <li>7. South Sudan soil classification mechanism</li> <li>8. Pavement design standards appropriate for the type of vehicles.</li> <li>9. Traffic analysis system: This may help in installation of effective traffic lights on the road networks</li> <li>10. Alternative methods of dealing with black cotton soil (soil improvement strategic)</li> </ol>

## Annex 4 Terms of reference for the Road Research Technical Committee (RRTC)

### Establishment

The Road Research Technical Committee (RRTC) is to provide advice to the Road Research Steering Committee (RRSC), and will provide reports, recommendations on the nature and scope of research projects and activities to be undertaken in the road infrastructure domain in South Sudan.

### Function and responsibilities

The RRTC's functions and responsibilities are to:

- Appointment of a chairperson for RRTC
- Advise and report the Director General for Research and Materials (in the interim) and Deputy Executive Director in the long term (once a semi-autonomous institution), on research needs and priorities for the Road Research Centre;
- Assist with technology foresight studies;
- Advise on strategic plans and research portfolio plans for the research programme;
- Assist with project portfolio analysis;
- Assist with the review of research proposals in line with the proposed research strategy;
- Periodic assessment of progress of ongoing projects and decisions;
- Assist in the review of outputs and outcomes of research projects;
- Liaise with RRSC on projects;
- Assist in assessing the impact of research activities.

### Membership

- Ministry of Roads and Bridges
- Ministry of Transport.
- Construction industry
- State Ministries of Physical Infrastructure (one representative)
- South Sudan Engineering Council
- South Sudan Roads Authority (SSRA),
- One academic institutional representation, at Head of Department level (Civil Engineering).

### Co-opted members

- As relevant to the RRTC, such other members as co-opted by the Chair in order to ensure representation consistent with the committee's responsibilities, this includes expert domain needs from academic institutions.
- The Committee's membership must include appropriate gender representation



## Annex 5 Terms of reference for the Road Research Steering Committee (RRSC)

### Establishment:

In order to guide the Centre and ensure that it carries out relevant research and operates effectively, a Road Research Steering Committee (RRSC) is to be established.

### Function and Responsibilities

The role of the RRSC will be to provide strategic guidance to the Centre and the functions and responsibilities of RRSC members will mostly include:

- Advise and report to the Director General Director for Research and Materials (in the interim), Deputy Executive Director on research infrastructure needs and priorities for the RRC
- Steering the establishment and operations of the RRC and assessing the adoption of 'good governance' principles;
- Endorsement of priority RDI projects recommended by the RRTC and identify and/or endorse allocation of funding to projects;
- Support the appointment/selection of project champions/teams;
- Promoting and fostering the work of Road Research Technical Committee
- Provide overarching project management through link with RRTC and output quality reviews;
- Review goals and monitor implementation of the research component of the Road Research Centre and Strategic Plan.
- Monitor effective technology transfer and implementation of outcomes.

### Membership

- Ministry of Roads and Bridges
- Ministry of Finance and Economic Planning
- Ministry of Higher Education
- Ministry of Housing Physical Planning
- State Ministries of Physical Infrastructure
- Ministry of Transport
- National Research Council
- South Sudan Engineering Council
- South Sudan National Bureau of Standards
- South Sudan Roads Authority
- Academic institutions, at the level of Dean (Faculty of Engineering/Head of Civil Engineering)

### Co-opted members

- As relevant to the RRSC, such other members as co-opted by the Chair in order to ensure representation consistent with the committee's responsibilities, this includes public interest representation from non-governmental organizations.
- The Committee's membership must include appropriate gender representation

## Annex 6 Costs for refurbishment

S/No.	Item description	Unit	Qty	Rate GBP	Amount GBP
<b>Element No. 01 Concrete lab (6.7*4.4)m</b>					
1	Welding of suspended metal (4*2 mm thickness flat bar) from the either rafter of purlins to hold timber	pcs	10	20	200.00
2	Fixing of timber 600*600 to form a ceiling frame for attaching plywood (measured separate)	lm	154	4	616.00
3	Supply and fix air condition unit spliter type of capacity of 18,000 btu including connection to the electrical cable	pcs	1	960	960.00
4	Apply one coat of emulsion paint undercoat and two coats emulsion of approved colour	sm	30	4	120.00
5	Fix plywood ceiling board to the prepare timber frame using nails join should be smooth	sm	30	12	360.00
<b>Sub-Total</b>					<b>2 256.00</b>
<b>Element No. 02. Soil lab (6.7*6.1)m</b>					
1	Welding of suspended metal (4*2 mm thickness flat bar) from the either rafter of purlins to hold timber	pcs	11	20	220.00
2	Fixing of timber 600*600 to form a ceiling frame for attaching plywood (measured separate)	lm	210	4	840.00
3	Supply and fix air condition unit spliter type of capacity of 18,000 btu including connection to the electrical cable	pcs	1	960	960.00
4	Apply one coat of emulsion paint undercoat and two coats emulsion of approved colour	sm	41	4	164.00
5	Fix plywood ceiling board to the prepare timber frame using nails join should be smooth	sm	41	12	492.00
<b>Sub-Total</b>					<b>2 676.00</b>
<b>Element No. 03 Foundation lab (6.7*4.8)m</b>					
1	Welding of suspended metal (4*2 mm thickness flat bar) from the either rafter of purlins to hold timber	pcs	10	20	200.00
2	Fixing of timber 600*600 to form a ceiling frame for attaching plywood (measured separate)	lm	168	4	672.00
3	Supply and fix air condition unit spliter type of capacity of 18,000 btu including connection to the electrical cable	pcs	1	1200	1 200.00
4	Apply one coat of emulsion paint undercoat and two coats emulsion of approved colour	sm	33	4	132.00
5	Fix plywood ceiling board to the prepare timber frame using nails join should be smooth	sm	33	12	396.00
<b>Sub-Total</b>					<b>2 600.00</b>
<b>Element No. 04 Asphalt lab (6.7*4.8)m</b>					
1	Welding of suspended metal (4*2 mm thickness flat bar) from the either rafter of purlins to hold timber	pcs	10	20	200.00
2	Fixing of timber 600*600 to form a ceiling frame for attaching plywood (measured separate)	lm	168	4	672.00
3	Supply and fix air condition unit spliter type of capacity of 18,000 btu including connection to the electrical cable	pcs	1	960	960.00
4	Apply one coat of emulsion paint undercoat and two coats emulsion of approved colour	sm	33	4	132.00
5	Fix plywood ceiling board to the prepare timber frame using nails join should be smooth	sm	33	12	396.00
<b>Sub-Total</b>					<b>2 360.00</b>
<b>Element No. 05 Two Containers</b>					

S/No.	Item description	Unit	Qty	Rate GBP	Amount GBP
1	Checking all electrical connections	Item	1	320	320.00
2	Servicing of the existing air conditions	Item	1	240	240.00
3	Checking the plumbing of the toilets	item	1	320	320.00
4	Cleaning of the compound	Item	1	240	240.00
	<b>Sub-Total</b>				<b>1 120.00</b>
	<b>Grand Total</b>				<b>11 012.00</b>

## Annex 7 Concept notes

### Note:

- Some of the research projects have been adapted from other AfCAP projects to optimise the generation of data for the benefit of the region.
- All projects are to target and highlight mainstreaming of gender awareness

### PROJECT 1: Identification of potential sources of materials for road construction, including alternative road construction materials

#### Context

The available data shows that road network in South Sudan is mostly “Earthen” road type, with a greater use of “Gravel/Murram”. The maximum use of naturally occurring unprocessed materials (Gravel/Murram and mixtures and gravels) is an important component of the design of low-volume roads (LVRs) in South Sudan. Generally, across sub-Saharan African countries, specifications for road construction materials tend to exclude the use of these materials in pavement layers in favour of more expensive crushed rock, because they often do not comply with traditional requirements. For low volume roads, ideally, surfaces and pavement layers should be built from local materials, yet this is not always the case and possible in most situations. Alternative and durable road surface options have been identified elsewhere in several studies as cost-efficient and sustainable options which reduce the maintenance burden. Studies undertaken under AfCAP in several countries have provided evidence which encourages the use of locally available materials that may not meet traditional specifications. The available information can be used to adapt, revise or create new material specifications for low volume roads in South Sudan. At the same time, treatments to improve some of these materials have been carried out and the results of this work can also benefit South Sudan. This Concept Note describes the methodology and resources required to carry out a project to allow the increased use of local and alternative road construction materials with greater confidence.

A vast area of South Sudan is covered with various non-traditional construction materials, including marshy areas. These materials have properties that exclude them from complying with traditional material specifications and should not be used in road construction. There is general concern in the road sector on the appropriateness of the traditional material specifications that are used to select materials for road construction in South Sudan. However, research and experimental work conducted in surrounding region, has shown that, despite their unusual or marginal properties, some of these materials can perform well when used in road construction. What is required is for South Sudan to undertake local research to generate the required knowledge for developing appropriate standards and specifications for the use of local materials.

#### Project Objectives

The main objectives of the project are to identify which local materials that can be used for road construction and where necessary develop appropriate specifications for their use. Two different aspects will be investigated, i.e. the use of local materials in unpaved and paved roads.

##### *Unpaved roads*

The specifications for unpaved roads generally require limits for grading, plasticity, material strength and aggregate strength. However, many areas of South Sudan only have natural soils, gravel-soil mixtures and gravels with grading and plasticity properties that indicate potentially poor performance. Investigation of a number of these materials where used for local road has indicated that they can provide adequate service, certainly for low-volume roads, but work needs to be done to identify the exact specifications needed for their characterisation.

##### *Paved roads*

The challenge the country faces is the upgrading of the enormous unpaved rural roads to bitumen standard. Innovative solutions are required to address these challenges to deliver a road network at a level of service that meets the country’s requirements. The road from Juba to Nimule was recently paved as a chip seal surface. The project will thus look at existing information and roads currently in service and develop specification criteria for the use naturally occurring and/or improvement of some of the local materials. The potential use of naturally occurring unprocessed materials in the structural layers of paved roads can also have significant cost benefits. Ad hoc work has been carried on over the years but the results of this valuable

information need to be synthesised, analysed and converted into useable specifications. Both natural and treated materials need to be assessed.

## Concept

The project will be carried out in a number of major tasks for each of the unpaved and paved road projects.

### For unpaved roads

1. Carry out a documentation review of local and international practice. This will involve searches of past records and internet searches for the appropriate and pertinent information. The RRC staff should be involved and develop skills in processes and methodology for carrying out literature reviews for Researchers.
2. Assess the results of experiments carried out in the country with particular attention to natural materials that were used in control sections of the Rajab Gumbo trial sections near Juba. The researcher/s will need to establish new sections and spend time observing their behaviour and performance. Conventional and non-conventional testing are to be carried out as well as aspects such as visual assessment, in situ testing, sampling and laboratory testing, traffic counting and analysis, etc.
3. Develop preliminary specifications based on field and laboratory test results, existing knowledge and experience. This will be based on a good understanding of the need, purpose and use of specifications and their implementation and control.
4. Construct and monitor experiments using these specifications.
5. Develop final specifications for the materials investigated.

### For paved roads

1. Carry out documentation review of regional and international practice as described above for unpaved roads.
2. Assess the results of the experiment on surfacings carried out on the Rajab Gumbo trial sections. This will involve a review of the road performance in relation to material specifications, climatic conditions and traffic carried. The impact of the different base courses on the performance of the surfacings including common materials that used and those not commonly used should be assessed. Other alternative materials and treatments should then be investigated. This will also involve the field and laboratory investigation including some additional laboratory and field testing. Additional laboratory testing will include CBR and stiffness (resilient modulus) tests at different moisture contents, durability testing where appropriate. With the establishment of the Road Research Centre and planned acquisition of new equipment more advanced testing can be undertaken to determine stiffness (resilient modulus).
3. Develop preliminary specifications based on the performance of these experiments and additional knowledge and local experience. Both treated and untreated materials will be investigated. This part of the project will include basic pavement analysis of the roads to correlate their performance with their structural capacity.
4. Construct and monitor experiments using these specifications. This should be done in conjunction with ongoing construction projects where short (250 to 500 m) sections using the experimental materials should be included. These should be built alongside control sections using the normal materials being used on the roads, with all construction and other characteristics being identical. Only one variable should be included in each experimental section (e.g. material with constant thickness or application rate of treatment, etc.). Current knowledge and experience in South Sudan will need to be applied to the experimental design. Investigation of the use of construction waste materials as well as the stabilization techniques should be considered under this task.
5. Write up the results and develop final specifications. – *This would be a longer term project, after at least three years of monitoring.*

The resources needed initially would be mostly the field evaluation and testing equipment. Apparatus such as DCPs, Troxlers, etc., should be available through South Sudan Road Authority (SSRA)/Directorate for Materials and Research (DMR) while more sophisticated equipment such as FWDs are best contracted in initially. It is thought that other equipment such as sampling equipment (compressors and jack-hammers), MERLIN, vehicles, camping equipment for field work, etc., will have been acquired through SSRA/DMR.

## Deliverables

The deliverables from this project will be both short term and medium to long term.

- Experience has shown that for studies of unpaved road results can be generated within one year as the performance of unpaved roads will be obvious within a short term. Although aspects such as the prediction of gravel loss will require some time (up to three years) to develop models, other criteria such as riding quality and maintenance needs can be assessed and defined relatively rapidly.

- Design selection procedures is one of the few early deliverables, in addition to investigation and monitoring reports will be forthcoming from the paved road part of the project, with the first recommendations and draft specifications only being confirmed after about three years.
- Design, construction and maintenance procedures and programmes refined through identification and comparison of performance characteristics under specific road environment conditions

### Implementation of Findings

Once appropriate and suitable specifications have been developed, results should be published and implemented by SSRA. This would need to be done in conjunction with stakeholder workshops, seminars, possibly and training courses.

### Expected Benefits

This project will investigate the use of non-conventional materials in pavements layers for LVRs and especially sealed LVRs with a view to providing recommendations and specifications for their future use. The potential cost benefits of using locally available, currently non-standard gravels compared to hauling materials currently meeting traditional specifications over great distances could be significant. Further benefits to be derived from the study are as follows:

- Design selection procedures identified,
- Performance assessment of locally available but not-traditionally used materials,
- Development of appropriate specifications based on unequivocal field performance data,

### Required inputs

#### Project Team/Personnel

Two key research teams, led by a senior researcher/engineer should be responsible for this project (one team focusing on unpaved roads and the other on paved roads). Every effort is to be made to include participation of female personnel.

- One of the researchers should be an experienced Pavement Engineer (preferably with a MSc but minimum BSc ), and one Civil Engineer with specialisation in materials or an Engineering Geologist specialising in materials, either qualified at MSc level.
- Two field technicians (one for each researcher) together with laboratory and field testing staff/labour. These technicians should be experienced in routine field testing (test pitting and profiling, density measurement, etc.).

### Budget

It is anticipated that the project duration should not exceed 12 months for unpaved roads and three years for paved roads. The estimated manpower input is as follows:

- Senior researchers: 100 man-days (unpaved roads) and 120 man-days (paved roads)
- Technicians: 180 man-days
- The indicative budget is **GBP 215,000** (assuming staff from RRC/University/SSRA will be employed on this project).

## PROJECT 2: Identification of suitable and cost-effective soil stabilisers for use as cement replacements

### Context

South Sudan has a shortage of quality materials requiring long haul distances and therefore cost of obtaining good road construction materials is increasing. The extraction of natural materials also affects the environment. There is therefore an increasing demand to use in-situ materials as much as possible in road construction to reduce costs and meet the requirements of sustaining the environment. It is not always the case to have quality materials that meet specification or performance requirements for construction. Innovative ways need to be investigated for the improvement of the in-situ materials to ensure better performing roads. The strategy is to improve the engineering properties of the in-situ materials through chemical stabilisation. This is achieved either by using traditional hydraulic binders such as cement and lime, or organic material such as bitumen. The traditional additives/binders are generally expensive and the industry has recognised the need for alternative products as replacements of the traditional additives/binders. However, a more profound knowledge of the chemistry of and the interactions between the different products and soil/aggregates must be acquired in order to successfully use these alternative additive/binders and have confidence in their capability to enhance pavement performance.

### Objective

The main objective of this project is to understand the interacting behaviour of non-traditional additives/binders and the extent to which they can effectively replace traditional additives/binders.

### **Concept**

Knowledge generation is required in support of a decision-making process on the development of guidance documents and the framework/screening tool, for assessing suitability of the alternative additives/binders. The assessment of non-traditional additive/binders needs to be supplemented with life-cycle analysis. The objective is to be achieved through the following:

1. Review of existing procedures for performance assessment of non-traditional additives/binders.
2. Laboratory assessment of the potential additives/binders.
3. Design and establish demonstration sections. Potentially, suppliers of proprietary products could be encouraged to fund these.
4. Construction of the trial sections using the promising additive/binder.
5. Monitoring of the trial sections. The programme will involve conventional and non-conventional laboratory testing. The assessment of performance will include visual assessment, in-situ testing, sampling and laboratory testing and traffic counting to correlate with observed form of distress.
6. Detailed analysis of the collected data from the trial sections, which should include project life-cycle cost analysis to determine the impact of using the non-traditional additive/binders compared with sections where conventional additive/binders are used.
7. Preparation of manual. The preparation of the manual will require that a panel of experts is involved in the review.

Regional guidelines for the establishment and monitoring of trial sections are available on the ReCAP website ([www.research4cap.org/](http://www.research4cap.org/)) for reference and can be adapted to the site-specific conditions. Data management will be crucial on this project.

### **Expected benefits**

The project will provide the opportunity to develop long-term research project management capability, innovativeness through the design optimisation in the application of non-traditional additive/binders, as well as field experience in data collection and testing. A decision-making process for the identification of suitable and cost-effective non-traditional binders and soil stabilisers is to be developed through this project. The increased use of non-traditional additives/binders will contribute towards reducing environmental impact and road construction costs. The project should offer an opportunity for a graduate student research project.

### **Deliverables**

Short-term deliverables will include guidelines for the collection of data and a decision-making process for the identification of suitable and cost-effective non-traditional binders and soil stabilisers.

### **Estimated duration: 24 Months**

Estimated Man-days: 280

Senior Researcher: 100

Researchers (x2): 120

Technician: 60

Estimated cost of review, data collection and validation with analysis: **GBP 160 000**

## **Project 3: Hydrological impact of the environment**

### ***Development of project area hydrological characteristics***

#### **Context**

Hydrological events, such as droughts and floods, vary spatially and temporally in nature. Drought is associated with extreme temperatures and flooding is associated with extreme precipitation, thus large-scale floods events. Droughts impact will affect the availability of water for construction while floods affect the functionality of the road infrastructure. Due to climate change, the prediction is that the number of hydrological events is to increase in future. The analysis in more detail of precipitation and temperature, in space and time, is vital in order to understand the consequences on the hydrological events due to the uncertainty of projected climate changes. Information is required

to understand the spatiotemporal variability of the future extreme precipitation and temperature for proper planning and the design of road infrastructure projects as well as decision-making process to address hydrological events.

On the other hand, it is also necessary to be able to assessing sensitivity of the baseline hydrological environment and the potential impacts of the proposed road infrastructure development upon it and propose mitigation measures in order to ensure that the potential adverse impacts of the proposed road infrastructure on the hydrological environment will be minimal or neutral.

South Sudan is one of the countries in Sub-Saharan Africa that tend to be particularly vulnerable to the effects of climate variability. The impact of the hydrological environment needs to be taken into account as accurately as possible in the implementation of road projects.

### **Objectives**

Project is aimed at relating development to hydrological characteristics inherent in the project area due to climate change in order to:-

- Assess the sensitivity of the baseline hydrological environment at the subject site and in the surrounding area with respect to the proposed road project.
- Identify any potential impacts on the hydrological environment associated with the proposed road project.
- Identify any constraints posed by the existing hydrological environment to the proposed project and to; · Recommend appropriate mitigation measures in order to ensure that the potential impact of the proposed project is minimal and neutral.

### **Concept**

The changes in the hydrological cycle will have serious impacts on ecological, social, and economic situations leading to severe challenges. To respond to the climate change challenge, one of the most important tasks is to understand influencing mechanism of hydrologic cycle by climate change and to predict the impact on road environment. The impact of climate change on precipitation and temperature extremes of long duration for given probabilities should be evaluated as well as the impact of climate change on flood volume extremes of long duration for given probabilities.

This can be achieved through hydrologic frequency analysis that deduce the design rainfall for the measured phase and the future by running distributed hydrological models with the input condition of design rainfall to deduce the flood volume extreme of different duration. Hydrologic frequency analysis are based on time series to analyze the law of hydrologic extremes. The key of hydrologic frequency analysis is to determine the probability distribution of extreme, thus the statistical law of the hydrologic extremes is applied.

Relevant documentation should be reviewed to categorize impact to aid in assessing the potential impacts of the road project on the hydrological environment in terms of criteria for assessing significance of an impact on the overall environment.

The field data collection phase methods will include road condition surveys, environmental surveys, and participatory studies, in order to obtain the full set of data to have a better understanding of the past hydrologic impact on road infrastructure.

### **Benefit**

The predicted significant increase in the frequency of flooding, will increase stormwater runoff and increasingly create significant roadway flooding which will cut off community accessibility, as there will be no vehicle access. The assessment of the sensitivity of the baseline hydrological environment will provide the information for developing model for the prediction of flooding. This will assist in the development and evaluation of potential engineering design solutions to mitigate against the flooding risk. The model/s will be validated using condition hydrologic information and develop guidance for the identification of problem areas through simulation. The benefits of specific solutions can be evaluated.

### **Estimated Duration and Resource Inputs**

- Estimated duration: 6 Months
- Estimated Man-days: 120 (50 for senior researcher; 70 for x2 researchers, data collection and processing)
- Estimated total cost: **GBP 68,000** and an additional lump sum will have to be reserved for the acquisition of application software (hydrological and/or statistical), if not available at any of the academic institutions.



## PROJECT 4: Soil classification and properties analysis

### *Natural material characterisation*

This project forms part of the implementation process of the findings of Project 6. Thus the output of project 6 will be used to undertake this project.

- Duration: 6 months
- Estimated Man-days: 50 (for researchers)
- Cost estimate: **GBP 33 000**

## PROJECT 5: Pavement design standards appropriate for the type of vehicles in use in the country

### *A synthesis of road design standards for South Sudan*

#### **Context:**

As the political stability of South Sudan is becoming more stable, the focus in the medium term is to facilitate the improvement of mobility and accessibility of rural communities to goods and services in the rural areas of the country. Appropriate pavement design methods and standards are needed to respond to country's challenges for the delivery of road infrastructure. This will require the development of a series of standards for pavement design.

#### **Objectives**

The main objectives of the project are to review the currently used Standard Specifications and identify their shortcomings for adaptation and/or adoption for the entire road network in South Sudan, in particular taking into account the type of vehicles on the roads. The identified shortcomings and problems will need to be addressed in the revised Standards.

#### **Concept**

This project will require minimal new research other than a review and adaptation based on the review of existing knowledge, from which gaps in knowledge can be identified. A specific research project can then be developed to focus on the specific areas in order to generate the required knowledge. In the interim, the research team can produce draft standards.. Once a draft standard/specification is developed it should be subjected to industry review for acceptance and thereafter implemented for a year or so to ensure that there are no problems and all issues are adequately covered before being revised and becoming a final legal and binding document.

#### **Expected Benefits**

Standard/specification should be localised to be appropriate and specifically to the conditions in the country. Having localised standard/specifications provide proper guidance in the implementation of road projects in a systematic and consistent way. Thus benefits accrued in having localised standards/specifications, include reduced project discrepancies and therefore disputes which impact on project schedules and costs.

- Estimated Duration and Resource Inputs
- Estimated duration: 6 Months
- Estimated Man-days: 100 (for researchers)
- Estimated total cost: **GBP 55,000**

## PROJECT 6: Soils Database and mapping of materials distribution in South Sudan

### **Mapping of natural materials location for road construction and development**

#### **Context**

One of the difficulties in planning and designing a cost-effective and economical road is the location of suitable materials for the different layers. Over the years, some experience in material location, which is a unique science, has been built up but in some sub-Saharan African including South Sudan. Although the maximum use of naturally occurring unprocessed materials (natural soils, gravel-soil mixtures and gravels) is an important component of the design of low-volume roads (LVRs) in South Sudan, there is no proper record of mapping of these materials in the archives of SSRA/DMR. It is thus important that natural materials of the entire country are mapped for possible usage in future. Together with the mapping of the location of the materials, general testing can be carried out and a database of the sources and potential uses of the materials developed for road agencies. This concept note describes the methodology and resources required to carry out this project for South Sudan. A GIS-based map showing the

likely locations of potential borrow pits or quarries in South Sudan with links to their typical properties and uses should be available for the entire country.

The difficulty in locating good construction materials in South Sudan has major cost implications and can also delay the completion of projects significantly, when identified sources do not provide adequate volumes of material or the quality deteriorates and new materials have to be sourced. A GIS-based system has been initiated by TRL but this includes only limited calcrete-related locations and test results. Although the system is limited to one construction material and one province in Mozambique, it can be customised for use in South Sudan.

### **Project Objectives**

The main objectives of the project will be to use the TRL system for the location and identification of naturally occurring unprocessed materials for road construction in South Sudan. It is anticipated that this project will build capacity in the area of mapping of road construction materials for the country.

### **Concept**

The basic system developed by TRL under the AfCAP programme will be used as the launching pad for the material location and database. The principles developed are sound and this project will require extending the findings to different materials with additional testing of the fundamental material properties. The project will be carried out in a number of tasks:

- Review the work carried out by TRL and obtain a thorough understanding of the remote sensing and botanical indicator principles applied. Check, using the literature, if there are any other techniques that could complement these, e.g., soil mapping, digital terrain modelling, etc.
- Obtain any additional and/or newer remote sensing data for South Sudan. Apply as many of the principles identified as possible to a small selected area in the country (preferably a problematic area) and develop a desk study base map based purely on accessible information that addresses all materials in the area. A good knowledge of the requirements of the different materials for road construction purposes will be necessary.
- The researcher/s will then need to visit the area assessed and carry out a detailed investigation of the local soils and geology, to confirm which of the techniques or principles employed works best for which materials. This will entail significant probing, pitting and sampling. Ideally, a three dimensional map of the upper 1.5 to 3.0 m of the entire area should be developed.
- Field investigations will involve test pitting and soil profiling, as well as sampling at selected sites showing potentially useful materials of any kind (natural soils, gravel-soil mixtures and gravels).
- Laboratory testing will include normal grading, Atterberg limits, CBR testing, resilient modulus and aggregate strength (ACV, AIV, 10%FACT, etc). X-ray diffraction (XRD) studies of some of the materials may also be useful. This would be carried out by CML.
- Based on the results obtained from the “pilot area”, the optimum assessment techniques should be identified. These must then be applied to a desk-study of a second selected area. Only those sites that show positive potential should then be evaluated and the success rate of the process determined. Areas that weren’t successful should be investigated to determine “what went wrong”?
- Once the process has been adequately fine-tuned, the entire country should be “mapped” and sampled according to the method developed.
- The results of the material location and sampling must then be placed in a data base linked to a GIS such that anyone requiring material information in the country can quickly access the available data.
- Prepare a manual on the use of the system and the data base including a method for users to supply all additional data to the data base manager for addition to the existing information.
- Once this has been successfully completed, the process should be applied to the entire country. This constitute a different project (Project 4) in different phases.

The resources needed initially would be mostly related to the GIS and means of analysing and interpreting the remote sensing data, particularly multi-spectral satellite or air-borne imagery. This would require purchasing such imagery and the software required for analysis and the resources to analyse relatively large files.

Field testing and sampling equipment would be normal apparatus except for the custom-made calcrete probe similar to the one used by TRL in their investigation. A mechanical excavator capable of excavating trenches to a depth of 3 m will need to be available for the sampling and means of transporting large quantities of sample back to SSRA/CML for testing will be required

### **Deliverables**

The deliverables from this project will be short term in developing the database. The preliminary study and much of the testing can be completed within one year and the procedure documented.

### Expected Benefits

A number of benefits will be achieved by having such a materials database. Firstly, the design of new and rehabilitated roads will be able to make use of the identified materials which can provide the optimum design based on the best local materials available. As the properties and extent of these will be known, the chances of delays and claims will be significantly reduced. The time normally required to locate materials at the pre-tender and tender stage will be reduced and more confidence will be held in the materials proposed. This project would also assist in developing new technologies for the road sector in South Sudan. The researchers in the Road Research Centre would develop experience that can assist when consultants cannot find suitable materials. The GIS system and database would ultimately become integral parts of the Road Asset Management System.

### Implementation of Findings

Once the database has been completed, it will provide the input for project 4 to undertake soil classification and properties analysis. The data must then be made available to the road sector stakeholders.

### Project Inputs

#### *Team/Personnel*

The project team would consist of two researchers (one concentrating on the materials location and sampling side the other on the GIS and database development aspects) who would work side by side.

It would be essential that the researchers involved in this project liaise closely with other government Institutions, such as Soils, Agriculture, Geological, Survey and universities in order to gain maximum benefit from the relatively “high tech” and rapidly developing science of remote sensing and satellite observation.

- The main researcher should be an experienced Materials Engineer or Engineering Geologist (preferably with a MSc degree but minimum of BSc), while the second should be a GIS expert, qualified at least at of BSc level.
- One or two experienced field technicians would be required together with laboratory and field testing staff/labour. The field technicians should be experienced in routine field testing (test pitting and profiling), sampling and sample management.

### *Budget*

#### **Estimated Duration and Resource Inputs**

- Estimated duration: 12 Months for unpaved roads; 3 Years for paved roads
- Estimated Man-days: 317 (for researchers; year 1)
- Estimated Man-days: 180 (for technicians; year 1)
- Estimated total cost: **GBP 135,000** (year 1)

## **Project 7: Community participation and engagement in road projects – sensitisation of material extraction requirements in the area**

### *Development of community awareness framework for road construction projects*

#### **Context**

Extraction of materials for road construction projects is essential. However, communities in the affected areas or adjacent to the borrow pits have mixed responses to the extraction of construction materials from their neighbourhood. Apart from the environmental impact that need to be minimised, they lose productive land and they may not feel that the compensation is inadequate. Roads cannot be constructed without sourcing these materials from borrow pits and quarries.

Having the support of the local community can make a significant difference to the process of acquiring the rights to the area the operation of the borrow pit or quarry. Quarries in most instances are the major employer in villages surrounding them. However, communities can only have an appreciation of the positive impact in the local economy once the quarry is operational. Getting the acceptance and building the support from the community to understand the need for extracting the materials is essential. A community awareness programme is necessary through involvement with local events is an essential part of business

#### **Objective**

To develop guidelines for improving access to communities and maintain the optimal level of material extraction acceptance. A framework should provide guidance in mobilizing and organizing communities to raise awareness and promote an understanding of the need for material extraction and benefits to the village economy.

### **Concept**

This project is aimed at promoting community awareness and appreciation of the importance and significance of material extraction for road construction. This will require establishing a team that will involve input by social scientists to develop appropriate research methodologies, including participatory research on effectiveness and efficiency of interventions to encourage communities to work as partners in the extraction of road construction materials. The outcome is to provide guidance on processes and procedures to be developed to ensure:

- Effective social mobilization within the communities
- Participation of communities in decision-making in relation to material extraction project activities
- Awareness of the communities in environmental related issues and material production processes
- Continuous advocacy and promotion for more partnerships, to secure village and political support and commitment.
- Improving of socioeconomic status of the people through community organization, and building their capacity to manage their participation in road construction material extraction activities.

Innovative approach will be utilized through which gender parity and mainstreaming of gender awareness is highlighted and should become more closely integrated in all activities.

### **Benefits**

Increased community awareness of the importance of material extraction and mobilizing community resources towards integrated sustainable road construction material extraction and optimization of community socioeconomic development. This will be achieved through reducing inequalities by focusing on participation and working environment condition that promote appropriate gender-neutral community based processes for sustainable road construction material extraction methods

- Duration: 6 months
- Estimated Man-days: 70 (60 for researchers, 10 for senior researcher)
- Cost estimate: **GBP 35 000**

## **PROJECT 8: Establishment of cost regimes of projects** *Causes of escalating project costs (tender stage)*

### **Context**

Observation by the Ministry of Roads and Bridges has noted increasing excessive project costs and therefore wishes that the RRC conducts a study to determine the factors influencing the observed development. The ultimate goal is to generate project cost data from road construction projects recorded data, which is to be stored into a formal database. The RRC is to research and generate the knowledge that should be managed and effectively transferred for application. The development of database is critical for the establishment of the threshold levels on project costs for the management of future project bidding processes.

Generated knowledge should also assist in understanding the impact of design and project preparation phase on construction costs. A systematic study will reveal the differences between the awarded and the actual costs and establish the actual percentage increase of the award costs for road the completed projects.

### **Objective**

The objectives of this project are to (1) generate data on the magnitude of costs of road construction projects in comparison to the tender values and (2) determine the differences in the magnitude of costs based on project type, project size and construction duration.

### **Concept**

The core work should involve the evaluation of data collection methods to facilitate future back-analysis and in order to quantify the project costs and appropriate application of generated knowledge. The assessment of the project costs is to be based on the review of existing projects in the past 15 years and of projects tendered and/or constructed. The projects will be subjected to a review by a team of researchers. The candidate projects will include both new

construction and rehabilitation projects as well as roads with varying ranges of traffic volumes. This should lead to varying designs being considered and specific issues being examined in detail to establish the causes of high project costs.

It is proposed that a standard ranking procedure be used for the determination of levels of project costs.

#### **Expected benefits**

A data will be generated appropriately be used for improving future project budgeting, planning as well as tendering processes.

#### **Deliverables**

Short-term deliverables will include a data-base of rates anticipated that the project duration should not exceed 6 months. The estimated man-power input is as follows:

Senior researcher: 20 man-days

Researchers x2: 60 man-days

**The estimated budget, for expert services is GBP 45,000.**

### **Project 9: Legal axle load control and enforcement**

#### ***Analysis of the effects of traffic overloading on pavement performance***

#### **Context**

The computation of traffic load is based on the permissible mass of an axle, an axle unit, a vehicle as a whole and combination of vehicles respectively. The permissible mass of vehicles is determined by regulations and these must be applied in respect of the vehicle concerned. Overloaded goods vehicles do considerable damage to the country's road infrastructure and it is important to ascertain the impact of overloading for the purpose of improving pavement design guidelines in South Sudan.

#### **Project Objectives**

The primary objective of the this project is to give a scientifically supported insight into the main effects of vehicle overloading on the functional and structural performance of the most representative types of pavements that bear the traffic of heavy vehicles on the road networks of South Sudan.

Two distinct situations will be addressed as regards typical pavement structures: those in roads carrying high traffic volumes which are continuously experiencing vehicle overloads; and those in lower trafficked roads, but nevertheless subject to high peak overloads.

Several aspects will be investigated, regarding not only the assessment of pavement behaviour using analytical tools and computer packages available, but also traffic characterisation for this purpose, namely with respect to axle load data acquisition and assembly procedures, as well as vehicle aspects such as the influence of tyre pressure on the results of the analysis.

Furthermore, other objectives to attain are:

- The improvement of pavement design guidelines, namely through the use of reasonable correction factors for traffic load estimations, taking into account overloading;
- Preliminary indications to operational aspects of a "vehicle overload control management system" such as the identification of road corridors and stretches where traffic and pavement characteristics have more influence on the location, type and number of weighing systems to install, as well as on the enhancement of control operations.

#### **Expected Benefits**

A number of benefits are expected from the stated project objectives.

- Contributions to the scientific and technical community, developing the skills of the local researchers through the use of analytical tools for pavement analysis, and providing inputs to those working in countries with

similar problems and road environments, enabling the comparison of research results and further developments in this area;

- Contributions to the activity of the road administration and other public bodies, through indications that are helpful for the establishment of an effective vehicle overloading control system;
- Optimisation of design and reduction of maintenance and rehabilitation costs, enabling a more realistic management of road infrastructures along their whole life cycle, with benefits to the economy of South Sudan.

#### **Estimated Duration and Resource Inputs**

- Estimate duration: 6 Months
- Estimated Man-days: 70 (for x2 researchers, 1 senior researcher)
- Estimated total cost: **GBP 37,000**

## **Project 10: Implementation of legal axle load control and enforcement**

### **Context**

Overloading causes damage to the country's road infrastructure and lead to premature deterioration of the road network and an extra demand on the government's budget for road maintenance. Measures need to be in place to control axle loading and eliminate the damaging of roads owing to overloading. The overloading control should occur in a uniform manner throughout the country and therefore a standard approach should be in place to provide clarity and certainty to in the freight transport industry and control officers.

### **Project Objectives**

The primary objective of the proposed project is to develop an overload control strategy for South Sudan and to identify the required policies and mechanisms that will ensure the effective implementation thereof.

Specific objectives are:

- Identify the main corridors for the movement of heavy vehicles in the country;
- Review all previously developed policies and the current overload control situation in South Sudan in terms of facilities, equipment and operations; and
- Make recommendations to improve overload control in South Sudan through improvements in facilities, procurement of appropriate equipment and operations.

### **Expected Benefits**

A number of benefits are expected from the stated project objectives:

Contributions to the scientific and technical community, developing the skills of the local researchers through the use of analytical tools for pavement analysis, and providing inputs to those working in countries with similar problems and road environment (particularly in relation to cross-border traffic with South Sudan, enabling the comparison of research results and further developments in this area;

Contributions to the activity of the road administration and other public bodies, through indications that are helpful for the establishment of an effective overload control system

Improvement of of road safety on the road network in South Sudan as a result of a reduction in illegally overloaded heavy vehicles. This should also have an impact on neighbouring countries;

A more conducive environment for road transport operators to compete on an equitable basis, thus promoting professionalism in road transport operations and ultimately accelerated economic growth in South Sudan;

Reduction on road maintenance and rehabilitation costs, enabling a more realistic management of road infrastructure along their whole life cycle, with benefits for the economy of South Sudan.

#### **Estimated Duration and Resource Inputs**

- Estimated duration: 12 Months
- Estimated Man-days: 1200 (80 for researchers, 40 for senior researcher)
- Estimated total cost: **GBP 66,000**