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Preparatory Activities for Transformation of the Kenyan MTRD into a Transport Research Centre

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FINAL REPORT



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List of Abbreviations

AFCAP	African Community Access Programme
AfDB	African Development Bank
AFD	Agence Française de Développement
CAD	Computer Aided Design
CB	Capacity Building
CER	Chief Engineer Roads
CTSC	County Transport and Safety Committees
DANIDA	Danish International Development Assistance
DG	Director General
DP	Development Partner
EC	European Commission
EDF	European Development Fund
EDMS	Electronic document Management System
EIA	Environmental Impact Assessment
EoI	Expression of Interest
ERB	Engineers Registration Board
EU/EUD	European Union/European Union Delegation
GDP	Gross Domestic Product
GIS	Geographic Information System
GoK	Government of Kenya
HDM4	Highway Development and Management Version 4
HMMS	Highway Maintenance Management System
HO/HQ	Head Office/Head Quarters
HRD	Human Resource Development
ICBTRS	Institutional Capacity Building to the Transport/Road Sector in Kenya
ICT	Information and Communication Technology
IDA	International Development Association
ILO	International Labour Organisation
INTP	Integrated National Transport Policy
IRAP	International Road Assessment Programme
JICA	Japan International Cooperation Agency
KeNHA	Kenya National Highways Authority
KeRRA	Kenya Rural Roads Authority

KfW Kreditanstalt für Wiederaufbau, German Development Bank

KIHBT Kenya Institute of Highways and Buildings Technology

KRB/KRBF Kenya Roads Board/Kenya Roads Board Fund

KRC Kenya Railways Corporation

KSh Kenya Shillings

KURA Kenya Urban Roads Authority

LVSRL Low Volume Sealed Roads

MIS Management Information System

MoF Ministry of Finance

MoLG Ministry of Local Government

MoR Ministry of Roads

MoRPW Ministry of Roads and Public Works

MTD Mechanical and Transport Department

MTRD Materials Testing and Research Department

NAO National Authorising Officer

NCA National Construction Authority

NEMA National Environment Management Authority

NRSAP National Road Safety Action Plan

NRSC National Road Safety Council

NTSA National Transport Safety Authority

NUTRIP Nairobi Urban Transport Improvement Project

PPP Public Private Partnership

PS Principal Secretary

QA Quality Assurance

QC Quality Control

RACECA Road and Civil Engineers Contractors Association

RFP Request for Proposals

RICS Road Inventory and Condition Survey

RMI Road Maintenance Initiative

RMLF Road Maintenance Levy Fund

RMMS Road Maintenance Management System

RNMS Road Network Management System

RO Regional Office

R2000 Roads 2000

RSIP Road Sector Investment Programme

SAGA Semi-Autonomous Government Agency

SIDA Swedish International Development Agency

TA Technical Assistance

ToR Terms of Reference

1. INTRODUCTION

The Africa Community Access Programme¹ (AFCAP) is a research programme funded by the UK government's Department for International Development (DFID), which is promoting safe and sustainable rural access in Africa.

AFCAP has been asked by the Materials Testing and Research Department (MTRD) of the newly-formed Transport and Infrastructure Ministry to support the further development of the framework for their **transformation to a Transport Research Centre**; and priority activities based on their mandate and the Strategic Plan (AFCAP Report on Development of Low Volume Roads Research Capacity in Kenya, March 2013), prepared under AFCAP/KEN/089G activities. This project is **an extension** to that work and is referred to as PHASE 1.

1.1 Background and Objective

To underpin Kenya's expected growth an efficient road and transport network is required for improved access to support all key sectors of the economy. It is recognised that research is required both to **inform and develop policy** and also has a critical role in the development and efficient management of transport infrastructure.

The Africa Community Access Programme¹ (AFCAP) is a research programme funded by the UK government's Department for International Development (DFID), which is promoting safe and sustainable rural access in Africa. The purpose of AFCAP's Technical Assistance is to help MTRD improve its long term capacity to undertake relevant, high quality, research that will assist Government develop evidence-based policy and programmes and also assist in the process of evaluation and monitoring to provide continual improvement in the transport sector.

The Kenyan Government Coalition's Manifesto for Transforming Kenya (2013 – 2017) sets out an agenda for economic growth under three Pillars:

- Unity
- Economy
- Openness

Under the Second Pillar, the Manifesto sets out its agenda for *Transport & Infrastructure – A 21st Century Transport & Infrastructure System*. The challenge set is to deal with an aging road and rail network in order to improve accessibility, trade activities, freight and safety. The solutions identified include:

- Reforms of the road Authorities and Departments
- Devolution of management of rural roads to the Counties
- Programme of upgrades to the major road network
- Strengthen trans-national corridors
- Improvements rail, marine, inland water and aviation transport

Under current reforms, it is proposed to establish a **National Transport Research Institute** which would support the following modes:-

- Road transport
- Rail transport
- Maritime and inland water transport
- Air transport, and
- Non-Motorised and Intermediate Means of Transport (NMIMTs).

In addition, MTRD would address research strategies in support of the Integrated National Transport Policy (2009).

'Transport research is required to inform not only policy formulation, but also in monitoring and evaluation of the various intervention strategies. It is therefore necessary to undertake research on the outcomes of the intervention strategies, the impact of transport on the economy and environment, transport safety and security, land use and transport, people attitudes and behaviour patterns in relation to transport, industry and transport, transport logistics, modernization of public transport amongst other issues. In Kenya, there is lack of a focal point to facilitate such research. In addition, there is need for dissemination of research findings to the relevant stakeholders' (INTP 2009).

The principle stakeholders comprise:

Roads

- KeRRA
- KURA
- KeNHA
- Kenya Roads Board
- KIHBT
- Mechanical and Transport Department
- Roads Department

Air

- Air Transport Department
- Kenya Airports Authority
- Kenya Civil Aviation Authority
- Air Accident Investigation Department

Marine and Inland Waterways

- Kenya Ports Authority
- Kenya Ferry Services
- Kenya Maritime Authority
- Kenya National Shipping Line
- Maritime and Shipping Department

Rail

- Kenya Railways Corporation
- Railway Development authority

Others

- National Transport & Safety Authority
- Ministry of Finance

MTRD intends to strengthen its core skills and research delivery and to evolve into a transport institute that will be recognized internationally as a centre of excellence. The long term outcomes of implementation of research findings is expected to **deliver more durable roads and transport, lower transport operating costs, shorter travel times, lower accident and fatality levels,**

improved designs and standards for construction and maintenance, and more efficient and cost effective operations.

AFCAP Project Objective

To assist MTRD further develop their strategic plans, scope out their priority projects and to help their preparations for transformation to a national transport research institute in order to build sustainable research capacity.

2. APPROACH and METHODOLOGY

2.1 Approach

The approach of this Technical Assistance programme is to bring specific experience from other national research institutes to inform the process and to determine appropriate models and international expertise to implement the strategic plans for transformation into a transport research centre over the next 5 to 10 years.

2.2 Methodology and Scope

There are 2 proposed core Activity Themes. These are detailed in the following table and their respective reports and comprise:

- **Development of MTRD strategy for Transport Research Capacity**
- **Development of Concept Model and Strategy for Transport Research Centre**

In addition, Study tours were planned to International Research Institutes.

ID	WORK PLAN / ACTIVITY
1	Development of MTRD strategy for Transport Research Capacity
PART A	<p>Review and update MTRD's strategic plan for research capacity building to support transport and infrastructure development and maintenance in the light emerging policies and priorities from MOTI, AFCAP 2 and also in relation to the EU TA programme which is currently supporting MTRD on the following:</p> <ul style="list-style-type: none"> • Review of Design Manuals • Low volume seals pavement design manuals • Urban design guidelines • Economic appraisal • Research database
	<p>Identify funding option components, actions and programme for implementation</p> <p>MTRD plan to approach a number of funders for the institutional components, for specific projects, for capacity building and training and for equipment/facilities. In addition, MOTI will be directly funding its own programme. A broad roadmap of current funding arrangements is needed so that a plan of action can be developed in Phase 2.</p>

PART B	<p>Develop strategy for upgrading of 8,000km of unpaved rural roads to low volume sealed standards in the next five years.</p> <p>Includes scoping and delivery of a programme of activities related to Strategic Transport Themes and KPI's agreed at the July MOTI Retreat which will require the 47 Districts to deliver around 40km/a of upgraded sealed LV roads. Part B provides a research strategy to support the delivery of the upgrading plan</p>
PART C	<p>Develop terms of reference for procurement of short term consultancy services for the development of design guidelines for low volume sealed roads</p> <p>Guidelines for design of low volume sealed roads need to be produced as a matter of urgency. An inventory of previous studies is to be developed and reviewed against current MTRD guidelines and a definitive document to be scoped and developed through TOR produced and implemented by the EU.</p>
2	Development of Concept Model and Strategy for Transport Research Centre
PART D	Development of Concept Model and Strategy for Transport Research Centre
	<p>- Assist MTRD develop long term vision and mission</p> <p>The plans will look forward 10 to 20 years and might encompass regional/international aims, as well as broadening the remit to transport and safety.</p>
	<p>- Assist MTRD explore scope and model options with MoTI</p> <p>MTRD will need to communicate proposed plans set up under Section 1 above with the PS and with MoTI and modify as necessary to gain approvals.</p>
	<p>- Develop institutional setting options within MoTI</p> <p>Institutional changes are taking place and will continue for the foreseeable future. Plans must be sufficiently flexible and adaptable to cover all future known options.</p>
	<p>- Set out timelines, programmes and roadmap</p> <p>An overall programme and roadmap will need to be developed, including milestones and key decision points.</p>
	<p>- Stakeholder Workshop</p> <p>Plan for a stakeholder workshop in Phase 2 to present and discuss the Draft Concept Models and Strategy Report for the Transport Research Centre.</p>

<p>3</p>	<p>Study Tours - Arrange overseas benchmark visits</p> <p>Arrange study tours to Australia and UK research institutes to look at institutional setting, technologies, programmes and delivery of research Also, to understand how they operate, their funding arrangements and technologies. The aims are to help inform establishment (and development) and also to develop long term assistance arrangements.</p> <p>The Study tours were originally planned for 2013. A UK Study tour took place to TRL in May 2014 (See Part E) and the visit to ARRB was postponed until AFCAP 2 is commissioned.</p>
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PART A: MTRD'S STRATEGIC PLAN FOR RESEARCH CAPACITY BUILDING TO SUPPORT TRANSPORT AND INFRASTRUCTURE DEVELOPMENT AND MAINTENANCE

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1. INTRODUCTION

The Materials Testing and Research Department (MTRD) of the newly-formed Transport and Infrastructure Ministry is developing a framework for their **transformation to a Transport Research Centre**; and priority activities based on their mandate and the Strategic Plan (AFCAP Report on Development of Low Volume Roads Research Capacity in Kenya, March 2013), prepared under AFCAP/KEN/089G activities. This project is **an extension** to that work and is referred to as PHASE 1. It is funded by the Africa Community Access Programme (AFCAP) a research programme funded by the UK government's Department for International Development (DFID).

1.1 Background and Objective

To underpin Kenya's expected growth an efficient road and transport network is required for improved access to support all key sectors of the economy. It is recognised that research is required both to **inform and develop policy** and also has a critical role in the development and efficient management of transport infrastructure.

The Kenyan Government Coalition's Manifesto for Transforming Kenya (2013 – 2017) sets out an agenda for *Transport & Infrastructure – A 21st Century Transport & Infrastructure System*. The challenge set is to deal with an aging road and rail network in order to improve accessibility, trade activities, freight and safety. The solutions identified include:

- Reforms of the road Authorities and Departments
- Devolution of management of rural roads to the Counties
- Programme of upgrades to the major road network
- Strengthen trans-national corridors
- Improvements rail, marine, inland water and aviation transport

Under current reforms, it is proposed to establish a **National Transport Research Institute** which would support the following modes:-

- Road transport
- Rail transport
- Maritime and inland water transport
- Air transport, and
- Non-Motorised and Intermediate Means of Transport (NMIMTs).

In addition to developing research strategies to address requirements of the Manifesto, MTRD would address research strategies in support of the Integrated National Transport Policy (2009). *'Transport research is required to inform not only policy formulation, but also in monitoring and evaluation of the various intervention strategies. It is therefore necessary to undertake research on the outcomes of the intervention strategies, the impact of transport on the economy and environment, transport safety and security, land use and transport, people attitudes and behaviour patterns in relation to transport, industry and transport, transport logistics, modernization of public transport amongst other issues. In Kenya, there is lack of a focal point to facilitate such research. In addition, there is need for dissemination of research findings to the relevant stakeholders'* (INTP 2009).

The principal Agencies, Departments and Authorities comprise:

Roads

- KeRRA
- KURA

- KeNHA
- Kenya Roads Board
- KIHBT
- Mechanical and Transport Department
- Roads Department

Air

- Air Transport Department
- Kenya Airports Authority
- Kenya Civil Aviation Authority
- Air Accident Investigation Department

Marine and Inland Waterways

- Kenya Ports Authority
- Kenya Ferry Services
- Kenya Maritime Authority
- Kenya National Shipping Line
- Maritime and Shipping Department

Rail

- Kenya Railways Corporation
- Railway Development authority

Others

- National Transport & Safety Authority
- Ministry of Finance

MTRD intends to strengthen its core skills and research delivery and to evolve into a transport institute that will be recognized internationally as a centre of excellence. The long term outcomes of implementation of research findings is expected to **deliver more durable roads and transport, lower transport operating costs, shorter travel times, lower accident and fatality levels, improved designs and standards for construction and maintenance, and more efficient and cost effective operations.**

Report Objective

Review and update MTRD's strategic plan for Research Capacity to support transport and infrastructure development and maintenance (produced in AFCAP Report on Development of Low Volume Roads Research Capacity in Kenya, March 2013, prepared under AFCAP/KEN/089G activities).

2. APPROACH AND METHODOLOGY

2.1 Approach

The approach of this Technical Assistance programme is to bring specific experience from other government programmes and from national research institutes to inform the process and to incorporate priorities emerging from the Government Manifesto *Transforming Kenya (2013 – 2017)*.

2.2 Methodology and Scope

The main theme is the Development of MTRD strategy for Transport Research Capacity and comprises the following activities:

ID	RESULT AREA / ACTIVITY
1	Development of MTRD strategy for Transport Research Capacity
1.1	<p>Review and update MTRD's strategic plan for research capacity building to support transport and infrastructure development and maintenance in the light emerging policies and priorities from MOTI, AFCAP 2 and also in relation to the EU TA programme which is currently supporting MTRD on the following:</p> <ul style="list-style-type: none"> • Review of Design Manuals • Low volume seals pavement design manuals • Urban design guidelines • Economic appraisal • Research database
1.2	<p>Identify funding option components, actions and programme for implementation</p> <p>MTRD plan to approach a number of funders for the institutional components, for specific projects, for capacity building and training and for equipment/facilities. In addition, MOTI will be directly funding its own programme. A broad roadmap of current funding arrangements is needed so that a plan of action can be developed in Phase 2.</p>

3 STRATEGIC PLANNING FOR RESEARCH TO INFORM POLICY

3.1 Context

Kenya Vision 2030 sets out the country's aims to become a newly industrialised country providing a high quality life for all citizens. The country's GDP is expected to grow at an annual rate of 7 to 10%. To underpin this growth an efficient transport network is required for improved access to support the key sectors of the economy. The percentage share of Transport Sector contributed by road sub-sector has averaged 64% over the four years to 2010. Air transport is the only other dominant mode at close to 20%. Rail is the main competitor for overland freight transportation, but its average share does not usually exceed 1% due to cumulative under-investment. Transport Services accounts for about 10%. Road transport accounts for about 93% of all freight and passenger traffic in Kenya. Roads are key enablers for economic, social and political development.

It has been recognised that research has an increased role in the development and management of the infrastructure. It is expected that more focussed activities will provide the basis for improving the long term capacity to undertake relevant, high quality, research that will assist Government develop evidence-based policy and programmes and also assist in the process of evaluation and monitoring to provide continual improvement in the transport sector.

The long term outcomes of implementation of research findings is expected to deliver more durable infrastructure, lower vehicle and stock operating costs, shorter travel times, lower accident and fatality levels, improved designs and standards for construction and maintenance, and more efficient and cost effective operations.

3.2 Assisting Development of Transport Policy

The Integrated National Transport Policy (INTP, 2009) sets out the agreed roadmap of policy development of the different transport modes which is being used to inform policy formulation.

Relevant Strategic Theme priorities comprise:

- A. Develop and manage transport infrastructure to facilitate efficient movement of goods and people whilst ensuring environmental sustainability
- B. Research and development for an efficient transportation system
- C. Develop and enforce regulations and standards for safe, secure and efficient transport systems
- D. Mobilise resources and capacity building.

The INTP sets out critical issues and policy for Transport Research and Development, as follows:

- **Critical Issues**

Transport research is required to inform not only policy formulation, but also in monitoring and evaluation of the various intervention strategies. It is therefore necessary to undertake research on the outcomes of the intervention strategies, the impact of transport on the economy and environment, transport safety and security, land use and transport, people attitudes and behaviour patterns in relation to transport, industry and transport, transport logistics, modernization of public transport amongst other issues. In Kenya, there is lack of a focal point to facilitate such research. In addition, there is need for dissemination of research findings to the relevant stakeholders.

- **Policy**

The GoK will establish a National Transport Research Institute to undertake research into aspects of transport and encompass all modes and will further provide appropriate incentives for the private sector to invest in transport research and development.

The critical issues for the various modes are identified as:

RAIL TRANSPORT

To achieve safe and effective rail service delivery, there is need to undertake research to support the development of a sustainable rail transport system. Railways currently do not have research facilities the materials, equipment and operations and for studying human behaviour.

MARITIME TRANSPORT

Development of the maritime transport industry in Kenya has been hampered by lack of research and development systems. Research and development is an important component of any modern maritime transport industry and further complements the preservation of the marine environment.

INLAND WATERWAYS TRANSPORT

Inland waterways transport system requires research on appropriate infrastructure and operational systems. Research is also required to undertake hydrographic and survey studies to develop charts that can be used for operations on a lake.

AVIATION

Effective operation and management of the aviation industry, including the formulation of policy requires adequate statistical data and information which is currently lacking.

3.3 Institutional Setting and Reform

The current institutional framework of the roads subsector is under review. Three existing Authorities - representing Rural Roads, Highways and Urban Roads; and a Roads Board are responsible for the management and development of the various road classes, reporting to the Principle Secretary (Infrastructure).

Four functional Departments and an Institute perform complimentary activities, as follows:

- Materials Testing and Research Department (MTRD)
- Roads Department
- Quality Assurance Department (QAD)
- Mechanical and Transport Department (MTD)
- Kenya Institute of Highways and Buildings Technology (KIHBT)

Reforms under consideration are transformation of MTRD, KIBHT and MTD into Semi-Autonomous Government Owned Entities (GOE's) in order to efficiently provide services to a Roads Authority and to the private sector.

3.4 Research to Support Government Road Targets

Specifically, in relation to roads, the Government targets are:

- Increase the paved network from the current 11,000km (7%) to 24,000 (15%) including 8,000km of LV roads, in five years using modern development instruments such as concessions, PPP, BOT and toll and maintenance arrangements
- Develop the necessary policies to ensure safety of all transportation systems with an emphasis on road safety
- Rehabilitate existing roads and open up new areas
- Upgrade unpaved road networks to make them accessible to motor vehicles.

The transport research centre will need to implement research to address these specific requirements.

3.5 Regional Research Hub

Significant changes are taking place throughout Africa in how research is carried out and implemented. Government research Institutes or units are currently under development in Ethiopia, Mozambique, and South Sudan as well as South Africa; and are being considered for Uganda, Tanzania and Ghana.

As part of a regional research initiative, plans are being considered to establish regional research hubs and Kenya is extremely well placed to take on that role for East Africa.

3.6 Vision and Mandate of MTRD Relating to Roads

The current vision of MTRD is ***“To be a world class institution for testing and research on roads and other infrastructure”*** while the mission is ***“To facilitate development of quality roads and other infrastructure through testing, research and advise on construction materials, methods and delivery options”***. It is responsible to the Principal Secretary (Infrastructure), MOTI.

The current MTRD Strategic Plan (2011/2012 – 2015/2016) has been developed in line with Kenya’s Vision 2030, Millennium Development Goals, and the Strategic Plans of the previous Ministry of Roads. The implementation of this strategic plan is based on the philosophy of customer and stakeholder participation, good governance and a professional approach to doing business. It provides oversight and regulatory role to all road Agencies and players in the Roads subsector and to some extent the broader infrastructure sector.

Three Authorities currently have a legal mandate to manage, develop, rehabilitate and maintain the road network in Kenya as follows:

a. Kenya National Highways Authority (KeNHA) responsible for the national road network (Class A, B and C roads) with a total length of about 14,000 km
b. Kenya Rural Roads Authority (KeRRA) responsible for the rural road networks (Class D, E and unclassified roads) totalling about 136,375 km.
c. Kenya Urban Roads Authority (KURA) responsible for road networks in cities and municipalities (Class UA, UC and UL), with a total length of about 15,000km.

The MTRD is charged with the responsibility of research and testing materials for quality and standard compliance both for Government and Private sector construction and Industry. Specifically, MTRD’s mandate is testing and research on roads and building construction materials,

road pavement design and construction specifications, construction quality control and assurance, and post construction evaluation of roads and other infrastructure.

The mandate of the Department is delivered through the following core functions:

- a) Provision of laboratory and testing facilities for:
 - (i) Geological and geotechnical investigations;
 - (ii) Geospatial surveys;
 - (iii) Hydrological surveys and hydraulic studies;
 - (iv) Traffic surveys and studies;
 - (v) Prospecting, examination and testing of construction materials;
 - (vi) Construction quality control; and
 - (vii) Post-construction monitoring and evaluation of roads, bridges, buildings and other connected civil works including Non-Destructive Testing;
- b) Testing, calibration, and verification of precision instruments, gauges, scientific apparatus, and other laboratory and field measurement equipment to ensure compliance with the provisions of both the Standards Act and the Weights and Measures Act;
- c) Certifying civil engineering laboratory technicians;
- d) Vetting of pavement designs for road upgrading, reconstruction, rehabilitation and strengthening works by roads authorities;
- e) Construction quality control oversight on public roads including post construction evaluation of completed works;
- f) Monitoring functional and structural performance of road pavements including axle load and pavement condition surveys on all public roads to facilitate preparation of public investment and annual works programmes by other road agencies;
- g) Maintenance of pavement construction and maintenance data base for public roads;
- h) Research on road development, maintenance, and operations including research on new construction materials, construction methods and road safety studies;
- i) Undertake collaborative research activities in liaison with other local and international organizations;
- j) Disseminate research undertakings and findings;
- k) Development and review of materials testing standards, road design manuals and standard specifications for construction and maintenance of roads in conjunction with other roads authorities and stakeholders;
- l) Provide materials testing and consultancy services at nominal charges to other government Departments, roads authorities and the public; and
- m) Advise the government on road construction, maintenance and operation standards, on physical, chemical and engineering characteristics of materials and on materials usage.

Its strategic goals are:

- 1 Quality Assurance

- 2 Research and Consultancy
- 3 Institutional Capacity
- 4 Financial Sustainability

Its strategic objectives are:

- Ensure prolonged road pavement life
- Ensure compliance with Structural integrity of buildings and bridges
- Enforce value for money in construction of roads and bridges
- Identify areas of research and innovations methods
- Establish a resource centre for technical knowledge.
- Provide consultancy services to the building and construction industry
- Expand and upgrade material testing facilities
- Expand and upgrade ICT systems
- Attain and retain optimum HR levels
- Transform the Department into SAGA
- Establish Materials Testing and Research Fund
- Establish resource mobilization mechanisms

The MTRD is to become a semi-autonomous Agency as part of the government transformation proposals and has a draft Legal Notice to this effect.

The following research and testing functions are considered to be constituent parts to build capacity:

Provide modern and comprehensive materials laboratory for the testing of materials used in road works
Provide in-house capacity for comprehensive materials investigations and geotechnical investigations required for road works, road condition investigations and analysis of pavement and surfacing failures
<p>Become a leading institution dedicated to research on matters related to roads in Kenya, including road policy, road transport, road asset management, road design, construction, maintenance and operation. Such research will be carried out in a number of ways, including:</p> <ul style="list-style-type: none"> ➤ Outsourced to academic institutions ➤ Through local and international consultants ➤ In collaboration with other national, regional and international research centres ➤ In-house
Provide services for quality control of construction projects
Undertake independent Technical Audits of selected road projects where quality is suspected to have been compromised
Develop and verify new design and operational standards for the use of materials, maintenance systems, road transport sector regulations etc.

MTRD is a functioning Department providing many of the services set out above. It has a particular focus on Low Volume roads for all the road sectors because the vast majority fall into this category. MTRD is being asked to respond to a very ambitious road building and rehabilitation programme and wishes to research new methods of design, construction and maintenance.

3.7 Existing Road Challenges and Priorities

Kenya has a public road network of 160,886 km of which 61,946km is currently classified while 98,940 km is unclassified. The Second Medium Term Plans (2013 – 2018) sets out substantial step change targets for construction, rehabilitation and maintenance compared with the First Medium Term Plan. The funds currently available for development and maintenance of roads are inadequate; therefore a substantial part of the road network is not sufficiently attended to, resulting in a huge maintenance backlog.

Other challenges to accelerated road and related economic development are:

- **Capacity Challenges:** Currently, there are capacity challenges relating to institutions, technical know-how within the sub-sector and contractors.
- **Axle Load Control:** The mechanism for controlling axle load is weak, leading to damage to the roads.
- **Road Reserves:** Encroachment on road reserves and drainage way leaves interferes with the development and maintenance of roads.
- **Land acquisition for road construction:** The cost of land is too high in comparison with the cost of the road construction.
- **Legal Framework for Private Sector Participation:** The legal framework for private sector participation in the roads subsector is inadequate.
- **Roads Construction Plant and Equipment:** The plant and equipment currently available for hire by contractors and roads agencies are inadequate, hence delays in road construction and maintenance.

Priorities, therefore, to achieve the above policies and programmes are:

- **To reduce transport costs and travel time** by improving the condition of national trunk roads and county roads;
- **To optimize use of available resources** by the devolved government in the development, rehabilitation and maintenance of roads
- **To enhance capacity** for local contractors
- **To find new ways to construct and maintain roads** at significantly reduced rates
- **To maximise effective use of existing natural material resources**
- **To build research capacity** and speed up implementation of research outputs.

The concept of **green economy** is addressing climate change, natural resource depletion, loss of bio-diversity and inequalities. Various international development agencies including UNEP, UNDP, UN DESA, World Bank and OECD are articulating and advocating for a transition to a green economy. Kenya is a signatory and a party to many multilateral environmental agreements (MEAs) that support aspects of green economy including the Kyoto Protocol, United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD) and the UN Convention to Combat Desertification (UNCCD). Kenya is also implementing other international development commitments like Agenda 21 and the MDGs that support environmental protection and sustainable development. Kenya has developed a national climate change response strategy

and seeks to embrace a low-carbon development pathway that is inclusive and equitable, and contributes to Kenya's global competitiveness. Two key Climate Change themes are relevant to Kenya roads:

- Adaptation – of road infrastructure to extreme weather events and affects
- Mitigation – move to more sustainable transport options, particularly public transport



Extreme climate events are causing damage to infrastructure

Climate Change in the Transport Sector is not well understood and the associated actions not well known. There are reasonably well developed international adaptation and mitigation practices that can be applied to improve the situation. These include:

- Creation of awareness, understanding and knowledge
- Improved integration of climate data and projections into transport and road planning
- Need for modelling impacts leading to cost-benefit analysis
- Need for risk assessments and vulnerability maps
- Implementation of emergency response programmes for extreme events
- Develop adaptation frameworks
- Produce guidance on mitigation measures
- Cover sustainable transport and mobility
- Modify institutional setting to accommodate climate issues
- Performance, monitoring and evaluation

4 STRATEGIC RESEARCH NEEDS FOR ROAD STAKEHOLDERS

Consultations with relevant stakeholders reported in the AFCAP LV Roads Research Report (March 2013) and the EU ICBTRS Inception Report (May 2013) give a consistent set of R & D needs across all Departments, Boards, Authorities and others. A list of those consulted is given as Appendix 1. Priorities identified from both the AFCAP and ICBTRS projects are set out below. For the most part, needs are aligned with current and emerging policies and priorities for MOTI. MTRD derives its priorities from MOTI requirements but takes into account the specific needs of the Road Authorities.

The following is a summary of R & D stakeholder needs from the EU and AFCAP reviews:

4.1 KeRRA

KeRRA's mandate is rural LV roads. However, all the Road Authorities have a significant proportion of LV roads under their control. By and large, all the main Road Authorities research needs are reflected in KeRRA's research priorities.

KeRRA's Board and senior management set out its Research Policy (2010) ranked in priority research topics as follows:

Research Topic	Priority Ranking	Possible Sources of Research Expertise and Funding
Construction Research		
Labour-based technology	1 st priority	ILO, SIDA, KIHBT
Alternative Surfacing and low cost seals	2 nd priority	CSIR, AFD, AFCAP, MT&RD, JKUAT, UoN
Use and field testing of local materials	3 rd priority	EU, SIDA, AFD, MT&RD, JKUAT, UoN
Chemical treatments	4 th priority	CSIR, MT&RD, JKUAT, UoN
Maintenance Research		
Road Maintenance Management System (RMMS) development	1 st priority	SIDA, EU, WB, KRB, SSATP
Maintenance for basic access	2 nd priority	WB, AFCAP, SSATP
Earth road maintenance	3 rd priority	SIDA, EU, WB, KRB, SSATP
Management Research		
Management of contracts	1 st priority	EU, SIDA, WB, SSATP

Accessibility planning	2 nd priority	ILO, AFCAP
Project management	3 rd priority	EU, SIDA, WB, SSATP
Contracting procedures	4 th priority	EU, SIDA, WB, SSATP
Human Resource development	5 th priority	EU, KIHBT
Socio-Economic Development Research		
Non-motorised intermediate means of transport	1 st priority	AFCAP, IFRTD, M&TD
Socio-economic impacts	2 nd equal priority	AFD, EU, KfW, AfDB, WB
Interaction between transport and health	2 nd equal priority	DPs, NACC, AFCAP
Environmentally friendly rural road works (including climate change)	2 nd equal priority	SIDA, NEMA
Road safety	3 rd priority	NRSC, IPAR, KIPPRA, DFID
Planning and Design Research		
Geographical Information Systems	1 st priority	CSIR, SIDA, AFCAP, JKUAT, UoN
Modelling (including data and management systems and design guides)	2 nd priority	CSIR, SIDA, AFCAP, JKUAT, UoN, WB
Socially Sensitive Alignment	3 rd priority	SIDA, AFCAP, JKUAT, UoN, SSATP
Drainage	4 th priority	SIDA, AFCAP, JKUAT, UoN

Those priorities highlighted in yellow are considered to be highest priorities currently.

KeRRA's Strategic implementation Plan contains the following relevant Objectives and Strategies to achieve its goals:

OBJECTIVE 2: Planning for design, Construction, Maintenance and Management of the Rural Road Network for sustainable, socio-economic development

Prepare a rural road assets and condition survey

Establish a Traffic Data Base

Mapping and Demarcation of Road reserves

Development of new roads construction technologies to conserve natural construction materials

Develop and implement axle load management regulations

Road safety

OBJECTIVE 3: Design, Construct and Rehabilitate Rural Roads to reduce transport cost and journey time for faster socio-economic development

Design of prioritised roads

Construct new roads (upgraded to bitumen)

Reconstruct/Rehabilitate dilapidated roads

Design & Construction of Bridges and other Drainage Structures

Research and development

OBJECTIVE 4: Maintenance of entire Rural Road Network to support accessibility to all production, market and social centres for enhanced economic growth

Routine and Periodic Maintenance of the roads network

Implement the Roads 2000 Strategy

Its R & D priorities therefore include:

Low Cost Seals for LV Roads and for Periodic Maintenance

- Continue to develop new low-cost seals approaches and to build experience through a range of trials.

DCP Pavement Design Manual - Implementation activities

- Establish a programme of implementation activities around the DCP Pavement Design Manual including intensive training and development of related documents (standard bidding documents, specifications, etc.)

Cold Mix Periodic Maintenance Research and Design Actions

- These actions support the Strategic Target of periodic maintenance for 1,000km
- A programme of funded research projects is required to adapt the Kenyan DCP Design Manual to be used for LV sealed roads using cold mix principles for periodic maintenance
- Production of resultant manuals and guides for periodic maintenance
- Trials and case studies
- Adoption by Government and training of staff, consultants and contractors

Prioritise Research Budgets for Regional Programme

- Engaging with Funders and Donors to implement research activities, capacity building and implementation of outcomes (AFCAP, KRB, WB, EuroAid, EDF 10, ROADS 2000, KFW, Finland)
- Training and capacity building for Counties
- Seek to establish rollout of LVR Research programme outputs for:
 - Western Kenya
 - Different soils
 - Counties

Labour-Based Technologies

To pioneer and to optimise improvements in labour-based technologies using international best practice approaches.

Databases

To develop more comprehensive and representative data and to collaborate with MTRD on its collection, maintenance, modelling and evaluation.

Materials Databases

To collaborate with MRTD to build and maintain a national inventory of materials resources and data.

Road Asset Management System

The system will require systematic regular data collection on the road network's pavement condition, traffic, extent, location etc. It will also require a computerised pavement management system (e.g. based on HDM-4) that allows analysis several years ahead. Such a system will be used by MOTI, MTRD, KRB and Authorities each drawing information from it to aid its decisions and feeding back into it

Assess need for Climate Change Adaptation Strategies

Kenya's road infrastructure is vulnerable to flooding, erosion, landslips and other associated phenomena. Risk assessment and mitigation strategies are commonplace internationally and should be studied for relevance and prioritisation for Kenya. Typical activities comprise:

- Education and awareness training
- Vulnerability assessment of critical infrastructure
- Risk Assessment and Mitigation
- Emergency Response

4.2 KURA

KURA requirements are a mix of research (improved data, guidelines); and operational support (procurement, contracts):

Urban Network Planning and Management

A Road Asset Management System is urgently needed across all RAs. It is a pre-requisite for effective management of the urban road network. There are complex processes that determine whether urban roads are fulfilling their role in the network. These include land-use changes especially at the periphery of towns and cities, trip decisions, the traffic capacity of existing roads, traffic management, and optimisation of signalisation and the coverage of the network. Improved planning tools and traffic information are needed.

Urban Road Design and Environmental Guidelines

There are several Guidelines currently in use by all three Road Authorities. MOTI is updating these and extending the topics and issues covered. There is no specific set of Guidelines that addresses urban road planning, design and provision specifically. Urban roads have specific requirements in terms of geometric design, intersection designs, capacity and safety standards. Network efficiency covers a wider-range of issues, and this needs to be captured in dedicated Guidelines and Manuals.

Traffic Management and Signalisation

Traffic management requires effective signal operations situated at appropriate locations. They need to work in a synchronised and predictable manner on the basis of a traffic management plan.

Road Safety

National Transport and Safety Authority (NTSA) has been recently set up and will need to work closely with MTRD, all RAs and any other agencies whose mandate includes the improvement of road safety.

Procurement and Costing

There is a multiplicity of costing methodologies and systems in use which need rationalisation. With regard to urban maintenance and development projects, there are environmental and social safeguards that need to be costed as well as the costs of mitigating traffic disruption, movement etc.

Contracts

Maintenance and improvement contracts currently disrupt traffic, the environment and mobility. Safeguards and standards need to be more rigorous and Contractors need to be encouraged to achieve speedy completion and quality. These aspects are not adequately captured in existing procedures.

4.3 KeNHA

Their requirements tend to focus on improved management, contract and procurement:

Asset Management

- National Road Directory Preparation
- Strategic and Business Planning
- Maintenance Planning and Programming, including Emergency Works

- Reducing Road Accidents and Fatalities

Road Contract options

- Public – Private Partnership model
- Performance - based Contract model
- Model Contract Documents, including MoM, BoQ for FIDIC ‘Method’ Contracts

Management Systems

- Road Maintenance Management System [RMMS] Development
- Road Management System [RMS] Development
- Structures Surveys and Databases
- Construction Materials Directories and Databases

Contract Procurement and Management

- Design Contract Management, including Feasibility Studies
- Standards, Manuals and Specifications Production and Use
- Environment, Social and Gender Impact Studies and Mitigation
- Construction Supervision Management
- Construction Technical Auditing

Quality monitoring and Control

- Construction Quality Monitoring and Measurement
- Quality Assurance, ISO 9001
- Performance Monitoring and Indicator Development

4.4 Key Documents, Reports and Programmes

A description of key relevant documents, policies, plans, guidelines, manuals and projects from Government, MDA's, MTRD, national and International documents that inform and help to prioritise research programmes is set out in Appendix 2.

Road Asset Management Programme

A Road Inventory and Condition Survey (RICS) were carried out of the Class A, B and C roads in 2001 using Geographical Positioning Systems (GPS). The RICS study led to the establishment of a database for classified roads with location data. A road inventory and condition survey for the hitherto unclassified component of the road network and the previously surveyed roads was carried out in 2006 by Kenya Roads Board (KRB). The surveys were undertaken on a district by district basis between May 2007 and April 2009. The surveys included detailed physical road and bridge and other structure data (including pavement surface type, carriageway width, culvert length retaining wall height etc.) and visual condition surveys (classified as excellent, good, fair, poor and very poor. It was shown to consist of 160,886 km of roads. Of these 61,936 km are ‘Classified’ (A, B, C, D,E, etc.) roads and 98,941 km are ‘Unclassified’.

Road condition surveys have been carried out with the categorisation in terms of 'Good', 'Fair', and 'Poor'. Condition within each road class varies greatly with higher class roads having an overall bigger proportion of 'Good' roads than roads in lower functional classes. International Trunk Roads (Class A) appear to be in the best condition and consist of 48% 'Good', 33% 'Fair' and 18% 'Poor'. Thereafter the proportion of road length classified as 'Good' declines fairly consistently for every lower road class - 30% Good for B and C, 12% for E and F and just 6% for Unclassified roads. The average condition of the entire network is 11% 'Good', 33% 'Fair', and 56% 'Poor'. This unsatisfactory situation is mainly due to the fact that the survey includes a large number of unpaved unclassified roads.

The condition of the network is currently now out of date. Each Road Authority (RA) will have up to date information for some roads under its care, however there is concerted effort to capture this data. The KRB GIS system is also not easily accessed by each RA, and is a standalone facility at present housed at KRB.

A new road network condition survey is to be carried out, funded by the WB and managed by KRB. The new survey will update the condition of the already inventoried network (all roads with a RoW greater than 9 m). The survey will also inventory road with a RoW of between 6m and 9m.

5 EXISTING STRATEGIC RESEARCH PLANS AND PROGRAMMES

The current Strategic Plan (2011/12 – 2015/16) sets out the following Goals and associated objectives and actions to respond to Vision 2030 and to achieve its plans:

Goal 1: Quality Assurance

OBJECTIVE 1: Ensure prolonged road pavement life

Apply specifications and quality control systems

Enforce and Audit quality control systems

Post construction evaluation of road pavements

Monitor pavement and advice on maintenance Interventions

OBJECTIVE 2: Ensure compliance with Structural integrity of buildings and bridges

Sensitize the public on quality requirements, the need for involvement of professionals in design, testing and construction works

Establish well equipped testing laboratories in the Counties

Sensitize Local authorities to review and enforce building by-laws

Put in place a monitoring system for bridges in conjunction with the Roads Authorities

OBJECTIVE 3: Enforce value for money in construction of roads and bridges

Vet feasibility studies and designs for road construction projects

Enforce quality control systems during construction

Vet and accredit materials technical staff and quality control systems

Post construction pavement evaluation

Develop and review of specifications and quality control systems

Research on alternative construction materials and advise on cost effective methods

Do Construction materials inventory

Research on low cost bitumen surface roads

Goal 2: Research

OBJECTIVE 1: Identify areas of research and innovations methods

Develop guidelines on the standards to be used in providing the services

Build capacity to be able to undertake consultancy

Upgrade and renewal of equipment

OBJECTIVE 2: Establish a resource centre for technical knowledge

Develop a research policy

Establish a research committee

Collaborate with other research institutions and Roads Authorities

Research on delivery systems

Research on low cost bitumen roads

Disseminate research findings

Collaborate with relevant international renowned research institutions

Goal 3: Testing and Consultancy Services

OBJECTIVE 1: Provide consultancy services to the building and construction industry

Develop guidelines on the standards to be used in providing the services

Build capacity to be able to undertake consultancy

Upgrade and renewal of equipment

OBJECTIVE 2: To identify areas of research and innovations methods

Develop a research policy

Establish a research committee

Collaborate with other research institutions and Roads Authorities

Research on delivery systems

Research on low cost bitumen roads

Disseminate research findings

Collaborate with relevant international renowned research institutions

OBJECTIVE 3: To establish a regional resource centre for technical knowledge and experience

Develop a digital data bank

Install a wide area network

Goal 4: Institutional Capacity

OBJECTIVE 1: Expand and upgrade material testing facilities

Acquire relevant publications

Refurbish the existing library

Install a wide area network

Recruit and train technical staff

Modernize test equipment

Refurbish physical facilities

OBJECTIVE 2: Expand and upgrade ICT systems

Improve communication

Recruit and training of technical staff

Develop and install Pavement Management System

Acquire modern and appropriate equipment

OBJECTIVE 3: Attain and retain optimum HR levels

Talent attraction, development and retention

Improve the work environment
Implement performance appraisal system
Enhance allowances
Outsource unskilled labour
Vet materials technical staff in road projects
Vet technical staff in private sector

OBJECTIVE 4: Transform the Department into a SAGA

Obtain appropriate legal and institutional framework
Operationalization of the SAGA

Goal 5: Financial Sustainability

OBJECTIVE 1: Establish Materials Testing and Research Fund

Development of legal framework
Identify sources of funding
Review fees and charges base for consultancy and testing services
Develop a marketing strategy
Develop funding mechanism from Road Authorities
Seek improved budgetary allocation from Treasury

OBJECTIVE 2: Establish resource mobilization mechanisms

Review fees and charges for the tests and consultancies
Widen fees and charges base for consultancy and testing services
Develop a marketing strategy
Develop funding mechanism from Road Authorities
Seek improved budgetary allocation from Treasury

5.1 Summary Strategies

The following **summary strategies** are currently being implemented to respond to Vision 2030 and related national and regional development challenges:

- Build capability by establishing a Low Volume Roads Research Centre within MRTD to specialise in delivery of relevant research projects
- Broaden and strengthen delivery of investigations, testing and design capability
- Restructure to align MTRD to more commercial operations
- Strengthen Quality Control services and plan for accreditation/certification activities
- Accelerate recruitment, staff development and training
- Increase efficiency by establishment of state-of-the-art ICT, Knowledge Management and document control systems
- Plan for transformation to a Semi-Autonomous Government Agency Status (SAGA)
- Strengthen regional presence by expanding current 11 regional laboratories to cover the 47 Counties

- Engage with funders and donors to maximise development funding in both short and long term
- Develop cooperation agreements with selected international research institutes and engage experts to provide Technical Assistance
- Set out long term development plans to become an internationally recognised research centre

5.2 Research Priorities relevant to the Strategic Plan

Priority research, development and dissemination programmes comprise:

- Improved technologies and methodologies for investigation, surveys, testing, modeling, monitoring and evaluating performance of roads
- Improved pavement designs for road upgrading, reconstruction, rehabilitation and strengthening works by roads authorities for prolonged life
- Construction and maintenance quality control systems including post construction evaluation
- Maintenance of pavement construction and maintenance data base
- Research on more economic road development, maintenance, and operations including research on new construction materials, construction methods and road safety studies
- Development and review of materials testing standards, road design manuals and standard specifications for construction and maintenance of roads in conjunction with stakeholders
- Database development and research management covering national materials inventory, properties of soils and rocks, roads condition and traffic flows
- Training and capacity building in research and innovation
- Publication and dissemination of research findings.

5.3 Status of research

MTRD carry out an extensive programme of research work relating to Low Volume Roads. The following list demonstrates the scale and breadth:

Research Projects

- Finalisation of Ken42 Study on Low Volume Roads, MTRD, for NORAD/GoK
- Trials on Labour Based Sealed Low Volume Pavements on Makenzie – Kandara Road (D415), Murang’a County, AFD Roads 2000 Project, Phase I, MTRD, for AFD/KeRRA
- Trials on Labour Based Sealed Low Volume Pavements in Meru, Tharake/Nithi, Embu, Machakos and Makuenu Counties under EU/GoK Roads 2000 Programme, Phase III, MTRD, for EU/KeRRA
- Trials on Labour Based Sealed Low Volume Pavements in Kiambu,, Nyandarua, Nyeri, Kirinyaga, Muranga, and Liakipia Counties under AfD/GoK Roads 2000 Programme, Phase II, MTRD, for AfD/KeRRA
- Trials on DCP Pavement Design Methodology in Kiambu, Nyandarua, Nyeri, Kirinyaga, Muranga and Laikipia Counties, MTRD, for AFCAP/KeRRA
- Trials on Sealed Single Layer Pavements for Low Volume Roads, MTRD, for KeRRA/KeNHA
- Study on GCS Stabilisation using Cement, Lime & Hydraulic Binders, MTRD, for IDA/KeRRA

- Study on Hand Packed Stone Pavement and Cobble Stone Surfacing, MTRD, for KeRRA/KURA/KenHA
- Study on Fibreglass Reinforced Polyester For Road Sign Base plates, Posts and Guard Rails, MTRD, for KeRRA/KeNHA/KURA
- Development of Design guidelines for Axle Loads Exceeding 130KN (13 tonnes), MTRD, for KenHA
- Design Manual on LV Roads, BCOM

6 EMERGING MOTI STRATEGIC THEMES

The Ministry is aligning transport and road activities closely together, and MRTD has been asked to develop its proposals for transport research to inform **transport policy**.

6.1 Transforming Kenya

The Kenyan Government Coalition's Manifesto for Transforming Kenya (2013 – 2017) sets out an agenda for economic growth under three Pillars:

- Unity
- Economy
- Openness

Under the Second Pillar, the Manifesto sets out its agenda for *Transport & Infrastructure – A 21st Century Transport & Infrastructure System*. The challenge set is to deal with an aging road and rail network in order to improve accessibility, trade activities, freight and safety. The solutions identified include:

- Reforms of the road Authorities and Departments
- Devolution of management of rural roads to the Counties
- Programme of upgrades to the major road network
- Strengthen trans-national corridors
- Improvements rail, marine, inland water and aviation transport

Specifically, in relation to roads, the Government will:

- Increase the paved network from the current 11,000km (7%) to 24,000 (15%) including 8,000km of LV roads, in five years using modern development instruments such as concessions, PPP, BOT and toll and maintenance arrangements
- Develop the necessary policies to ensure safety of all transportation systems with an emphasis on road safety
- Rehabilitate existing roads and open up new areas
- Upgrade unpaved road networks to make them accessible to motor vehicles.

The newly formed MoTI agreed future transport strategic themes and KPI's at a Retreat held at Naivasha from 17th to 20th July 2013.

Relevant strategic themes and KPI's comprise:

A. Develop and manage transport infrastructure to facilitate efficient movement of goods and people whilst ensuring environmental sustainability

1. Increase paved road network from 7 to 15% and maintain the road network from present coverage of 40% to 60%.
2. Reduce overall transit time in urban centres by 30%.
3. Develop and implement an integrated information system for transport and infrastructure services.

B. Research and development for an efficient transportation system

1. Research on construction materials and methods with a view to reduce overall infrastructure development costs by 25% in the next 5 years
2. Undertake operational research to identify opportunities to reduce operational costs in the Northern corridor by 25%
3. Undertake research on transport to enhance safety to reduce overall carnage by 50%
4. Carry out research to identify the most efficient financing and implementation of structures to reduce finance costs by 25%

C. Develop and enforce regulations and standards for safe, secure and efficient transport systems

1. Improve safety and security occurrence of transport systems by 50%

D. Mobilise resources and capacity building

1. Increase number of professional skilled persons to 40,000
2. Increase number of trained local contractors to 9000

6.2 Activities and Proposed Budgets

The following table summarises proposed research activities to achieve the objectives and indicators under the Ministry’s Theme relating to Research and Development. It also identifies targets and provisional budget requirements to achieve those targets.

THEME B: UNDERTAKE RESEARCH AND DEVELOPMENT FOR AN EFFICIENT TRANSPORT SYSTEM

	Objective	Performance Indicator	Target	Proposed Activities
3.1	To research on construction materials, methods and delivery options to reduce overall infrastructure development and maintenance costs by 25% in the next 5 years	Percentage reduction in overall infrastructure development and maintenance costs	25%	Development of research policy to support upgrading of 8,000 km of classified roads in counties to bitumen standards in the next 5 years Finalization of research on Low volume sealed roads and construction of road trials Mapping of natural construction material sources Profiling of subgrade soils along unpaved classified road corridors Research on pavement materials for heavy traffic loading

				Development and review of manuals and quality control systems
				Research on technology for Railway development and application for cost optimization
3.2	Undertake operational research to identify opportunities to reduce operational costs in northern corridor by 25% annually	Percentage reduction in operational costs in the northern corridor	25%	<p>Research on best practice to improve Mombasa port efficiency through streamlined activities and procedures</p> <p>Research to improve efficiency of airport passengers and freight through administrative streamlining, including customs</p> <p>Traffic studies and pavement condition surveys to advise on maintenance interventions and on alternative routes to enhance route capacity and operation speeds pending dualling of all sections</p>

	Objective	Performance Indicator	Target	Proposed Activities
3.3	Undertake research on transport to enhance safety to reduce overall carnage by 50% in the next 5 years	Percentage reduction in road carnage	50%	<p>Develop traffic accident data management and analysis system</p> <p>Study the effect of the surge of motorcycle traffic volume on the existing road capacity and safety</p> <p>Research on the effect of enhancing training on driver and pedestrian behaviour in road safety training curriculums.</p> <p>Review road safety provisions in the road design manual and maintenance standards.</p>
3.4	Develop an urban integrated model to reduce transit time by 50% in the next 5 years	Percentage reduction in urban transit time	50%	<p>Review public transportation policy for Nairobi and propose changes that promote use of public transport</p> <p>Optimise Railway links with road and air transport for both passengers and freight</p> <p>Review existing urban transport master plans and develop implementation strategy</p>
3.5	Carry out research to identify the most efficient financing and implementation structures to reduce finance costs by 25%	Percentage reduction in finance costs	25%	Assess all infrastructure projects to determine the most efficient financing options i.e. increase in exchequer budgetary provisions, fuel levy, or internal borrowing and identify those which can attract public or private investment, and develop implementation structures
3.6	Capacity Building and Other programmes		100%	

6.3 Development of the Low Volume Road Research Centre at MTRD

Under the AFCAP initiative, it has restructured its operations to accommodate a Low Volume Roads Research Centre and has restructured its operations in Nairobi to reflect future needs as it prepares for transformation to a SAGA. Its structure comprises five main Branch arms comprising:

- Research, Standards & Performance Monitoring
- Project Design and Construction Control
- Chemistry and Paints
- Physics and Instrumentation
- Planning & Technical Administration

The Research, Standards and Performance Monitoring Branch comprises of 2 Divisions, as follows:

- Research & Standards Division
 - **Low Volume Roads (LVR) Research Centre**
 - General Road Research Section
 - Road Design Manual and Standard Specification Research Section
- Pavement Monitoring & Rehabilitation Design Division
 - Pavement Inventory and Performance Monitoring Section
 - Pavement Rehabilitation and Overlay Design Section

MTRD uses a flexible matrix structure to manage its operations. Much of its work is project based and it assembles teams from resource centres for defined projects, under the direction of a Project Manager. The Centre is managed by a Research Coordinator, who reports to the Division Manager, Research and Standards.

6.4 Programmes and Activities

The following sections summarise roadmap priorities for building research capacity.

Broad Thematic Programme areas

Focus will be on selected activities from the following list:

- Policy, regulatory and reform-related issues
- Economics, financing and planning of road provision
- Road planning, operation and management
- Design and upgrading of 8,000km of LV roads to sealed standards
- Road engineering, geotechnics, materials and slope management
- Road maintenance
- Road user and pedestrian safety
- Road traffic management
- Travel behaviour
- Transport services and road user needs
- Social, environmental aspects of transport provision
- Sector statistics and data, monitoring and evaluation

Information Capture & Dissemination Opportunities (being undertaken by EU)

- Determine requirements with regards copyright and other governing legal instruments

- Determine type, location and relevance of existing knowledge (Manuals, books, reports, electronic media, maps, relevant regulatory, legal and policy documents etc.) relevant to thematic sub-sectors
- Capture and catalogue this knowledge (or links) to enable easy interrogation, location and access (in hard copy and electronic)
- Identify opportunities to become recipient of information generated through commissioned on-going and planned rural road projects in the country
- Identify relevant statistical sources and where necessary establish database and record holding facilities
- Develop a knowledge dissemination strategy, including dissemination opportunities provided by electronic and other media
- Provide visibility by maximising attendance at national and regional events, representation at workshops, seminars and the like
- Provide updated information to stakeholders base through publication of regular newsletters
- Determination of means of procurement of information, where needed
- Establishment of web site.

The following short term actions are being implemented:

Establishment of the Low Volume Roads Research Centre (AFCAP funding)

For the new LVR Research Centre there will be software, hardware, equipment, training and capacity programmes for Phase 2. Senior staff will need orientation training, attendance at specialist national and international technical conferences/workshops and study tours.

Establish Knowledge Management Programme (EU funding)

Cooperate with stakeholders in the assimilation of existing information and knowledge (both National and International) to be applied in an appropriately modified way to the Roads Sector.

DCP Implementation activities (AFCAP funding)

Contribute to a programme of implementation activities around the DCP Manual including intensive training and development of related documents.

Establish Databank (EU funding)

Cooperate with stakeholders to establish a comprehensive databank of relevant international and national publications, documents and records.

Establish Databases (EU funding)

Currently, various data are collected and stored across many MDA's. The reliability, quality and relevance of this data varies significantly. As use of good and representative data for research is paramount throughout the research and policy development cycle, it is proposed to establish a coordinated initiative to access and develop data from various sources to produce a consolidated database.

Extend Programme of Trials to other Counties (AFCAP Funding)

The current trials being undertaken for LVR seals will need to be extended to other regions and counties, to cover the full range of circumstances and geography's.

7 FUNDING OF RESEARCH AND DEVELOPMENT

The following are the main Research and Development funders:

- Roads Department
- Kenya Roads Board
- KeNHA
- KeRRA
- KURA
- National Council for Science and Technology
- Universities and other institutions of higher learning
- IAEA
- JICA
- World Bank
- NORAD
- European Commission (E.C)
- African Development Bank (ADB)
- French Development Agency (AFD)
- Kreditanstalt Für Wiederaufbau (KfW)
- Kenya Bureau of Standards (KEBS)

The road sub-sector is funded from:

- GoK
- Local Government revenues
- RMLF via KRB
- Transit tolls
- Agricultural Cess
- Development Partners (DPs)

Principal Funding for Roads Sub-Sector, Bln Kshs (RSIP, RFB)

MOR Funding	2006/7	2007/8	2008/9	2009/10	2010/11
Fuel Levy RMLF	15.77	18.00	20.30	21.29	26.65
Development Partners	10.44	23.00	21.94	30.75	40.02
Government of Kenya	19.81	17.09	20.41	27.70	37.55
Sub-total	46.02	58.09	62.65	79.78	104.22

The following summarises information on current Development Partner funding arrangements (ICBTRS Inception Report, 2013) and prospects for funding related to the MTRD Transformation:

7.1 Department for International Development (DFID)

DFID are not presently funding directly to the roads sector, but are supporting several initiatives including the African Rural Access Programme (AFCAP) in largely research and CB activities on LVSR technology, and also by providing funds for Trademark EA, which has indirect impact for the road sector.

Subject to funds approval, DFID intends to establish a Programme Management Unit to deliver its new **Rural Roads and Transport Services Research Programme**. The programme will comprise two components: a second phase of the Africa Community Access Project (AFCAP2); and a new Asia Community Access Project (ASCAP). AFCAP2 will work in up to 14 African countries and ASCAP in up to six Asian countries. The estimated cost of the two components will be £40 million over 10 years (2014 – 2024) with about £15 million for AFCAP 2 from 2014 to 2018. The programme will focus on high quality, applied research to rural transport problems, communicate the research outcomes to stakeholders, support the mainstreaming of the research results into practice and build research capacity in Africa and Asia.

AFCAP2 will build on the country partnerships established by AFCAP (Ethiopia, Mozambique, Tanzania, Kenya, Malawi, South Sudan and DRC). It will operate in up to 14 African countries; these are likely to include countries in West, East and Southern Africa but will not extend to North Africa. Preliminary interest has been expressed by Uganda, Zambia, Zimbabwe, Ghana, Botswana and Namibia. AFCAP has helped to provide safe, reliable and sustainable all-season access to markets, healthcare and education for rural communities across Africa and South East Asia, through strengthening and promoting research to influence policy and practice in Africa and South East Asia for the construction and maintenance of rural roads. AFCAP aspires to the improved provision and maintenance of over 130,000km of rural roads in Africa by 2020. Collaboration and high level government support were critical to success and an intrinsic part of the programme strategy from the outset. The programmes worked closely with national governments and other bilateral and multilateral donors to build on investments in road construction and maintenance.

Research programmes are aimed at improving the sustainable access of poor women and men in rural communities to social and economic opportunities through uptake of high quality research. The programmes will identify and support the uptake of low cost, proven solutions for rural transport that maximise the use of local resources (labour, materials, enterprise and ingenuity). AFCAP2 will fund applied research to rural transport problems, communicate the research outcomes to stakeholders, support the mainstreaming of the research results into practice and build research capacity in Africa and Asia. The programmes will develop both a knowledge management and capacity building strategy focusing on low volume rural transport within the first 9 months of the research programme. These strategies and the implementation of them will be aligned with broader transport knowledge management and capacity building strategies as appropriate.

The research capacity building strategy will incorporate a vision for rural access research in both Africa and Asia. This is likely to include support to national, sub-regional and regional research bodies. Within the lifetime of the projects it is anticipated that AFCAP2 and ASCAP will be housed and part funded by an African and Asian institution. Increasingly through the lifetime of the projects research grants are expected to be awarded to southern researchers. For example in Africa the Council for Scientific and Industrial Research (CSIR) could be a key capacity building partner.

Further options are also currently being considered by DFID. These include:

- Establishment and development of regional research hubs. Three centres might be set up, perhaps eventually coordinated by a recognised African authority
- Transport services R & D
- R & D relating to primary/trunk roads.

7.2 European Union

The EU has many components to a support programme for the Kenyan roads sector, under its 10th EDF programme. Funding for a Ksh1.5 Billion LVSR KeRRA project in 5 counties will start in 2013. The Institutional Capacity Building to the Transport/Road Sector (IBCTRS) 3 year programme is funded by the EU, and the EU will be chairing the sector donor working group.

It is considering funding the STE TA component of the MTRD Transformation (Phase 2) project and also a LTE TA for MTRD Transformation, Phase 3. In addition, it is proposing to fund the production of a LV Roads Design Manual which is being scoped under AFCAP MTRD Transformation, Phase 1.

7.3 World Bank

Approximately 1.2Billion USD in current programmes. Wide ranging interventions, based on three components, The Northern Transport Corridor improvement, A Kenya Transport Sector Study, and a National Urban Transport study.

The World Bank has some significant CB and training activities. Some CB with KURA on Urban issues is taking place, and with the Ministry of Roads (subtotal cost US\$4.60 million, of which US\$3.60 million IDA).

The World Bank has agreed to finance the KeNHA Lodwar- Nadapal Road, boosting Kenya's ambition to link its market with South Sudan. The road is part of the 595 Kilometre Eldoret-Nadapal Road project that has been planned since the landlocked country gained its autonomy. Works for the 340-km section between Juba and Nadapal (340 kilometres) has already commenced after the World Bank provided some funding. The Corridor would run from Eldoret, through the border post of Nadapal, and finally to Juba. The World Bank has pledged to finance the construction of the road under its East Africa Regional Transport and Trade Facilitation Program (SS-EARTTFP)

MTRD has options for funding two priority components from the Northern Corridor Programme; the first, covering equipment purchase, has been taken up and the second, for Transformation, is pending.

7.4 Swedish International Development Agency (SIDA)

Roads 2000 implementation under Nyanza 2000 project. Now complete, with no plans for further engagement by SIDA in the roads sector. Comprised training for roads contractors in labour based construction. Also KeRRA staff from the districts trained.

7.5 Embassy of Finland (PALWECO)

A large scale rural development programme, around 9 Million Euros up to end June 2016, with roads being about 30% of the programme. Approximately 163km will be rehabilitated.

The programme will be carrying out training on labour based technology with local contractors and KeRRA staff in the region.

7.6 KFW (GERMANY)

The programme will be carrying out training with local contractors and KeRRA staff in the regions. Training on labour based technology.

7.7 Agence Francais de Development

Implementing roads projects in central Kenya under Roads 2000 Plan to upgrade 100km to gravel roads and 100km of Low Volume Sealed Roads sections.

7.8 Cross Sectoral African Development Bank (AFDB)

Operations focus to date has been on road development, mostly design and construction. They have been involved in a 250km KenHA road link to Ethiopian border. Mass transit systems in Nairobi are being planned, through an urban component. Also CB components to their programmes are being planned.

7.9 UN Habitat

Support to Kenyan Urban areas for all aspects related to mobility - so will be roads, pedestrian crossing, and other planning for public transport, such as the Bus Rapid Transport system. Staff in house with KURA providing technical support.

7.10 The International Labour Organisation (ILO)

Production of manuals for small-scale contractor training on labour based road works, best practises, as well as TA for KeRRA. Training carried out with KeRRA staff and selected contractors.

APPENDICES

APPENDIX 1: LIST OF CONSULTEES

Those consulted in the development of the AFCAP strategy and priority research programme comprise:

MOTI

- Eng John K Mosonik, Principal Secretary Infrastructure
- XX, Roads Secretary

KeRRA

- Eng Mwangi Maingi, Director General
- Eng FD Karanja, General Manager, P&R 2000
- Eng Abraham Korir, Research Unit Officer
- King'ori Samuel, ICT Officer
- Eng SM Osiro, General Manager, Maintenance
- Eng PN Gatumia, Manager (Roads)
- Asfaw Kidanu, ILO Chief Technical Advisor, Roads 2000
- Eng. J. K. Gakubia

MTRD

- Eng SK Kogi, Chief Engineer (Materials)
- Eng MO Ndeda (Research)
- Eng DW Wanyiri, Project Engineer, DCP Design
- Eng JW Kiragu, Coordinator, Labour-Based Programme

ROADS DEPARTMENT

- Eng PM Mwinzi, Chief Engineer (Roads)
- Eng F Gitau, Deputy (Roads)

KENYA ROADS BOARD

- Dr FN Nyangaga, Executive Director
- Eng JZ Ruwa, General Manager, Planning and Programming
- Eng HW Kihumba

KURA

- Eng Dr T Nyomboi
- Eng MM Nyonge

KeNHA

- Eng H Gakuru

Consultants

- Eric Goss, Team Leader, AFD Roads 2000 Central, Phase II
- Asfaw Kidanu, ILO, KeRRA
- Jon Hongve, AFCAP Consultant, Design & Construction Oversight of Research Sections
- Mike Pinard, LV Road Specialist
- John Mills, TL, ICBTRS
- Steven Crosskey, ICBTRS (KeRRA)
-

Development Partners

- Eng. A. Gitonga, European Commission
- Eng. P. Methu, CAS
- Eng. Rosemary Kung'u, Kfw
- Peter Njenga, IFRTD

APPENDIX 2: KEY DOCUMENTS, REPORTS AND PROGRAMES

The following is a list of key relevant documents, plans and projects from Government, MDA's, MTRD, national and International documents that inform and help to prioritise research programmes:

Government

- **Transforming Kenya – Securing Kenya's Prosperity, 2013 – 2017**
A harmonized Manifesto of the Coalition setting out its plans under three Pillars. Challenges for Transport and Infrastructure are set out, also opportunities and solutions. Specific plan and targets are addressed for roads and transport.
- **Vision 2030**, Government of the Republic of Kenya, 2007
This publication is a summary of Kenya's new long-term national planning strategy, officially known as Kenya Vision 2030. The publication briefly states the main goals of the Economic, Social and Political pillars that underpin Vision 2030. It also summarises the major (or flagship) projects to be embarked upon in the medium-term period of the Vision i.e. from 2008-2012.
- **Integrated National Transport Policy - May 2009**
The transport sector is recognized as a key pillar and a critical enabler in the achievement of economic, social and political development strategy. The sector is further expected to remain a key component in tackling such challenges as reduction of poverty by half by the year 2015. As a result a Policy Paper *on Integrated National Transport Policy for Kenya under the theme "Moving a Working Nation"* was published in 2009 after a series of participatory consultations. It identifies a number of challenges inhibiting the transport sector from performing its role at national, regional and international economies and provides strategies on how to move forward.
- **National Environmental Policy – Draft 2012 – Ministry of Environment & Natural Resources**
This National Policy aims to provide a holistic framework to guide the management of the environment and natural resources in Kenya. It further ensures that the linkage between the environment and poverty reduction is integrated in all government processes and institutions in order to facilitate and realize sustainable development at all levels in the context of green economy enhancing social inclusion, improving human welfare and creating opportunities for employment and maintaining the healthy functioning of ecosystem. The Draft Policy recognizes that industrial and infrastructural developments, besides contributing to economic growth and job opportunities, also contribute significantly to environmental degradation. This calls for an environmentally-friendly industrial and infrastructural development strategy that integrates and promotes cohesion of development and environmental policies and enhances transfer of environmentally sound technologies.
- **The National Transport and Safety Act 2012 – Kenya Gazette October 2012**
Survey reports indicate that road accidents in Kenya roads claim about 3,000 lives annually. It is estimated that the economy further loses approximately Ksh. 14 billion or 5 % of its gross domestic product on accident related expenses (MoTC, 2004). In an effort to curb further road carnage the Government of Kenya enacted The National Transport and Safety Authority Act 2012 of 26th October 2012 established the Kenya National Roads Authority under the Ministry of Transport. The Act also introduced stringent laws as a deterrent to careless driving. According to Kenya Gazette the functions of the Authority

- besides development and implementation of road safety strategies, shall be include research and audits on road safety.
- **Political Vision 2030**, Moving to the Future as One Nation, Government of the Republic of Kenya, 2007
- **Draft Policy** on Aligning the Roads Sub-Sector with the Constitution, Ministry of Roads, September 2012
- **Third Annual Progress Report 2010-2011**, On the Implementation of the First Medium Term Plan (2008-2012) of Kenya Vision 2030, Ministry of State for Planning, National Development and Vision 2030, April 2012
- **Examination Report into the Systems, Policies, Procedures and Practices of the Roads Sub-Sector**, Kenya Anti-Corruption Commission, July 2007
- **The Medium Term Plan (MTP) 2008 – 2012, Government of Kenya**
- **Joint Statement of Intent, GoK and Development Partners, 2010 – 2013**

MRTD

- **MTRD Draft Strategic Plan 2012 – 2016, Ministry of Roads, 2012**

KeRRA

- **KeRRA Strategic Plan 2013 – 2018, Ministry of Roads, June 2012**
- **KeRRA Research Policy, Ministry of Roads, June 2010**

International

ASANTRA's Five Year Strategic and Business Plan, 2004 – 2000

- Country Programme Document (CPD), UNDP, 2009 - 2012
- Kenya Poverty and Inequality Assessment, Vol 1, World Bank, June 2008
- Kenya Joint Assistance Strategy (KJAS), 2007 – 2012
- Project Review of ILO Technical Assistance to Roads 2000, June 2011
- Design Manual for Low Volume Sealed Roads, Ministry of Public Works, Malawi, October 2012
- Malawi DCP Design Manual, 2012
- Manual for labour-based Construction of Bituminous Surfacing on LV Roads, TRL & DFID

Green Economy and Climate Change

- Kenya Green Economy, Scoping Study, Min of Env and Min Resources, August 2012
- Operational Plan 2011-2015, DFID Climate and Environment Department, May 2011.
- United Nations Economic Commission for Africa (2011). Climate Science, Information, and Services in Africa: Status, Gaps and Policy Implications. African Climate Policy Centre Working Paper No 1.
- United Nations Economic Commission for Africa (2011). Vulnerability and climate change hotspots in Africa- mapping Based on Existing Knowledge African Climate Policy Centre Working Paper No 2.
- United Nations Economic Commission for Africa (2011). United Nations Economic Commission for Africa (2011)
- Climate Change Risk Assessment for the Transport Sector (2012) DEFRA UK
- Beyond Copenhagen: The UK Government's International Climate Change Action Plan (2010) Department of Energy and Climate Change
- Guidelines for Climate Proofing Investment in the Transport Sector: Road Infrastructure Projects (2011), ADB.

Technical Publications, Manuals and Guides

- Pavement Design Standards, Ministry of Roads
- Road Design Manuals, Ministry of Roads
- AFCAP Design Manuals for Low Volume Roads, Ethiopia, Parts A to G, 2011 to 2012
- AFCAP/KEN/89 Research Project for Establishment of Appropriate Design Standards for Low Volume Sealed Roads in Kenya. Design Report, July 2012
- Roadwork Equipment for Emerging Economies - Robb Petts – Intech Associates 2012
- General Training Plan, Roads 2000 GTP – Andreas Beusch & Henry Orwa IB Intech Associates, 2005 – updated 2009
- Management of Improvement Works Volume 2 – Andreas Beusch and John Ndemi – Norken Ltd 2005 – Government of Kenya, UNDP & ILO/ASIST
- Cost Estimation Manual for Road Maintenance Works – 2011 Government of Kenya & JICA
- Procurement Manual for Works in Kenya - Public Procurement & Oversight Authority - 2009
- Community Participation in Road Maintenance - IT Transport – DFID 2003
- Guidelines for Low – Volume Sealed Roads – SADC July 2003 – funded by DFID, NORAD & SIDA

**PART B: STRATEGY FOR UPGRADING OF 8,000KM OF UNPAVED RURAL
ROADS TO LOW VOLUME SEALED STANDARDS IN THE NEXT FIVE YEARS**

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INTRODUCTION

This report sets out a strategy to achieve the Government policies for delivery of upgrading of Low Volume Roads relating to construction, rehabilitation and maintenance. It also addresses methods of reducing Whole Life Costs (WLC) of roads by 25%. It describes the scale of the challenge to achieve upgrading of 8,000km of LV roads to paved standard and the paradigm shift that will be necessary to accomplish the targets. It then describes the role of Research and Development (R&D) to support the programme and maps out the research areas to provide the innovation and technical guidance to enable the step changes to be made.

Transforming Kenya

The Kenyan Government Coalition's Manifesto for Transforming Kenya (2013 – 2017) sets out an agenda for economic growth under three Pillars:

- Unity
- Economy
- Openness

Under the Second Pillar, the Manifesto sets out its agenda for *Transport & Infrastructure – A 21st Century Transport & Infrastructure System*. The challenge set is to deal with an aging road and rail network in order to improve accessibility, trade activities, freight and safety. The solutions identified include:

- Reforms of the road Authorities and Departments
- Devolution of management of rural roads to the Counties
- Programme of upgrades to the major road network
- Strengthen trans-national corridors
- Improvements rail, marine, inland water and aviation transport

Specifically, in relation to roads, the Government will:

- Increase the paved network from the current 11,000km (7%) to 24,000 (15%) including 8,000km of LV roads, in five years using modern development instruments such as concessions, PPP, BOT and toll and maintenance arrangements
- Develop the necessary policies to ensure safety of all transportation systems with an emphasis on road safety
- Rehabilitate existing roads and open up new areas
- Upgrade unpaved road networks to make them accessible to motor vehicles.

Purpose of Report

To underpin Kenya's expected growth an efficient road and transport network is required for improved access to support all key sectors of the economy. The Government's programme requires a strategy involving upgrading of 8,000km to low volume sealed (light traffic) pavements and 5000 km to medium and heavy traffic pavements. It is anticipated that specifics on the strategy to deliver the 5000km of medium to heavy traffic pavements will be incorporated during a separate phase of the programme.

The purpose of the report is to draw attention to the exceptional nature of the plans, the level of mobilisation of Kenyan resources needed and the response needed to deliver such an ambitious programme. It is intended as a working document that can be used to focus attention of all key implementing authorities to be further developed into a robust plan.

SECTION A sets out headline policy, targets and relevant plans for delivery of the agreed targets. A significant and sustained step change in historical levels of delivery will be necessary to achieve these goals.

SECTION B sets out a broad Research and Development programme that is required to support the delivery of the roads programme.

The Role of Research in Delivery of the Programme

It is recognised that research is required both to **inform and develop policy** and also has a critical role in the development and efficient management of transport infrastructure. 'Transport research is required to inform not only policy formulation, but also in monitoring and evaluation of the various intervention strategies. It is therefore necessary to undertake research on the outcomes of the intervention strategies, the impact of transport on the economy and environment, transport safety and security, land use and transport, people attitudes and behaviour patterns in relation to transport, industry and transport, transport logistics, modernization of public transport amongst other issues. In Kenya, there is lack of a focal point to facilitate such research. In addition, there is need for dissemination of research findings to the relevant stakeholders' (INTP 2009).

Implementation will be greatly assisted by work historically carried out on road trials using new technologies and currently on development of design manuals. Trials on Low Volume Sealed Roads have been carried out in Kenya since the 1970's, funded by various Development Partners, including the UK's TRL Ltd with support from NORAD and DfID.

Major advances have been made through research in construction and maintenance of Low Volume gravel roads, which are costly to maintain and difficult to provide all-weather access. Adoption of Low Volume seals greatly reduces upgrading costs and also saves maintenance costs. These two savings release additional funding for increased lengths of construction.

Also, significant improvements in design will be made through preparation of a Manual for Low Volume Roads, funded by the EU.

SECTION B sets out a broad Research and Development programme that is required to support the delivery of the roads programme. It sets out priority and supporting themes and projects to be addressed by MTRD and initiates a process of dialogue and discussion with the other implementing agencies to address their R & D needs to support the roads programme. It is proposed to refine the themes and projects during the next phase of the project.

SECTION A: STRATEGY TO DELIVER MOTI POLICIES AND PLANS

The following sections set out headline policy, targets and relevant plans for delivery of the agreed targets. A significant and sustained step change in historical levels of delivery will be necessary to achieve these goals. Innovation, creativity, high levels of cooperation and new ways of working will all be required. The scale of the challenge is set out below and the changes needed for delivery. Options and associated onerous requirements are discussed and a way forward is identified.

It is recognised that the scale of the delivery is unprecedented in Africa although Kenya has undergone several accelerated roads programmes, the first being the Rural Access Road Programme (RARP) in the 1970's and 80's. There are examples internationally of exceptional road construction delivery and some of the factors for success can be assessed. Providing there are sufficient funds available for this programme, there are a number of options for going forward to create and sustain a paradigm shift of this magnitude and to set out a research programme to support its delivery.

A.1 Delivery of Programme

This Report is intended to headline options and activities and examine some of the necessary components for delivery of the road upgrading programme in order to stimulate discussion and to assist in the decision making for the planning and implementation process. It is not intended to be definitive nor prescriptive. Through discussion and consultation, it is anticipated that the report would need to be followed by the production of a more detailed Programme Implementation Plan (PIP) in early 2014.

Policy and Targets - the rapid expansion and improvement of the road infrastructure to increase access and economic development. Targets are 25% reduction in construction and maintenance costs and delivery of 8000km LV roads, in 5 years.

The targets can be achievable if the following are adopted and implemented:

- New standards to eliminate over-design
- Adoption of LV sealed roads to reduce maintenance costs
- Improved construction quality and supervision to prolong road life
- Prompt maintenance interventions to reduce whole life costs.

These actions will produce **more for less**.

Strategic plan - delivery relies on a range of stakeholders including Authorities, Departments, Counties, consultants and contractors mobilising resources and activities in a very well-coordinated programme. That plan should define and action the following:

- Recognition of the scale of the challenge and associated paradigm shift needed in delivery
- Options and innovations
- Roadmap
- Map of delivery partners
- Definition of specific responsibilities
- Set out activities and timelines
- Methodology for management, coordination and delivery
- Secure budgets and funding
- Training and capacity building programme

- Education and dissemination
- Monitoring and evaluation

1.1 Scale of the Challenge

The roads sector of Kenya has set a target to deliver 8,000km of upgraded LV roads to sealed standards within 5 years (6,000 rural roads and 2,000km national roads). It achieved less than 1,000km in the previous 5 years. The scale of the challenge is therefore exceptional and will require a paradigm shift in behaviors and delivery. New approaches will need to be agreed and delivered in a coordinated and unbureaucratic manner, with exceptional levels of management and coordination, across the whole of Kenya by a trained, competent, workforce with new skills, appropriately funded, supported by innovative technologies and underpinned by new standards, guidelines and Standard Forms of Contract.

The following summarises primary constraints to delivery of the new targets that must be addressed and overcome:

- Status Quo – the roads construction and management sector is fragmented. Previous targets for construction, management and maintenance have not been met and delivery has been constrained through cash flow, capacity, inefficiency and lack of support facilities. Current reforms are designed to address key weaknesses but will take time to implement and their effects will not be immediate.
- Reforms – the redistribution of responsibilities between the Road Authorities and the Counties will take time to take effect and, during the changes, momentum is lost at a time when acceleration is desired.
- Restructured road reserve corridors and poor physical planning in urban areas has created increased costs of construction, delays and bureaucracy.
- Knowledge and experience – The implementing agencies have not been sufficiently applying knowledge and technology that is available. Very significant changes in technologies and designs are taking place for sealing, upgrading and maintaining low volume and gravel roads. These changes come from improved understanding on infrastructure planning, design, construction, rehabilitation and maintenance.
- Delivery challenges – Capacity building will be required to the Counties and also a significant increase in capacity is needed to achieve the step change in delivery. Although sufficient plant may be available, prioritization of deployment will be difficult. Additional material resources are needed and to be distributed in an efficient manner. Procurement and quality controls will have to become streamlined and administration improved.
- Institutional – the current institutional framework is undergoing changes required in the constitution and will need to be clarified/resolved as soon as possible.

1.2 Options and Innovations

This type of step change in delivery of a road upgrading programme will require dedicated leadership, an agreed strategy for delivery, clear budgets and cash, fast-track approvals and exceptional communication. It also requires clear responsibilities, technical innovation, dedicated service providers and detailed, useful information. Change-oriented options and plans will require constant updating and a flexible approach will be needed to address new challenges.

In order to achieve a significant change in a delivery programme there will need to be a change in method of **management** and also a change in **delivery mechanisms**. The following examples illustrate several delivery and funding models:

1. United Kingdom Roads Programme

During the 1950's and 60's the UK Government embarked on a major Motorway and Trunk Road programme to address the increased need for travel and freight transport. It also wished to manage and maintain its entire network, including rural roads. The programme was **managed** by today's equivalent of:

- Department of Transport (DfT) – all modes of transport
- Highway Agency – Trunk road network
- Local Authorities – County Roads
- Devolved Administrations (Wales, Scotland and N Ireland)
- Transport for London
- Transport Research Laboratory.

TRL (Transport Research Laboratory, formerly TRRL) was established to carry out and **deliver** research and development for all the above programme needs. It established laboratories, research facilities, technical and research staff, publishing and training facilities and education and dissemination activities. Its purpose was to carry out R & D programmes to support policy development; programmes, plans and projects; testing; monitoring and evaluation; development and upgrading of Standards, design guides; and independent and impartial advice.

The UK Government historically established a comprehensive Transport Research Centre and a Highways Agency to deliver its trunk roads expansion programme which collaborated with Local Authorities responsible for development of the rest of the network. It applied its knowledge and experience to assist other governments in Europe and America and developed a support function to rapidly developing countries in Africa and Asia.

In Europe, TRL was instrumental in establishing a research hub called Forum for European Highway Research Laboratories (FEHRL) which is a vehicle for cooperative research across the 25 European Countries.

The rapid, economic and safe expansion of the road network could not have been achieved without the direct support of R & D from TRL. Once the major developments and innovations had been achieved the Government privatized TRL in 1996 through a tendering process. Throughout the process TRL peaked at about 3000 staff and is currently at about 300 staff.

International, national and local consultants and contractors now form Supply Chains to **deliver** construction and maintenance via Term Management Contracts. Innovation is expected through TRL and also the suppliers and selection criteria are based predominantly on technical competency and innovation - the roads programme is paid through fuel levies and taxes. A small but growing proportion comes from tolls.

2. India Roads Programme

India manages its roads programme through:

- Ministry of Road Transport & Highways(MORTH)
- National Highways Authority of India(NHAI)
- Ministry of Rural Development(NORD)

The Indian rapid roads expansion programme of National Trunk Roads is being funded through NHAI using long term road concessions and PPP, driven through ad-hoc consortia, funded through Development loans and repaid by Road User Charging. Roads Authorities were overhauled to deploy the programme and international experts were recruited. Innovation is expected from Private Sector.

Historically, CRRRI CSIR (Central Road Research Institute), India's national laboratory, established in 1952, a constituent of Council of Scientific and Industrial Research (CSIR). CRRRI provides technical support to the Road Authorities and testing, standards and training. It is engaged in carrying out research and development projects on design, construction and maintenance of roads and runways, traffic and transportation planning of mega and medium cities, management of roads in different terrains, improvement of marginal materials, utilization of industrial waste in road construction, environmental pollution, road traffic safety and analysis & design, performance monitoring/evaluation, service life assessment and rehabilitation of highway & railway bridges.

The institute provides technical and consultancy services to various user organizations in India and abroad. It also carries out capacity building in the area of highway engineering. It organises National & International Training Programmes and continuing education courses to disseminate the R&D finding to the masses.

Major clients are:

- Ministry of Road Transport & Highways(MORTH)
- National Highways Authority of India(NHAI)
- Ministry of Rural Development(NORD)
- Public Works Departments of States and Union Territories
- Airport Authority of India
- Road Research Laboratories of State PWDs
- Private Consultants and Individuals

3. Gulf State of Qatar

The Qatari Government established an implementing Authority for its roads programme, Ashghal (Public Works Authority). Innovation and technical support has historically been from national Universities and Standards have been adopted from foreign countries, either British or American.

To support its massive roads programme which is needed for regional and Gulf economic expansion, gas and oil sector support and for its growing international sports programme it decided to import foreign expertise and technology. It established 5 year Term Framework Agreements with International Consultants and Contractors paid by oil and gas revenues, on a BOT model. Innovation is expected by the suppliers and is the primary evaluation criteria for selection. By the end of the 5 year Frameworks, the suppliers will train Ashghal staff and build sufficient capacity and skill for gulf nationals to take over management and maintenance of the network.

Kenya's Needs

Kenya's expansion programme need is similar to that of the UK but it does not have the financial or technical expertise readily deployable. The India models demonstrate how taxes and private sector participation can be deployed and the Qatar model demonstrates how expertise can be imported if sufficient funds are available. However, by looking at best local and international

practice, recent innovations in road design and construction, and mechanisms for cost savings, it is possible to build desirable components into a successful Kenyan programme:

The following are considered key or essential components:

- **Management Delivery options:**
A special purpose management and delivery team will be required to help the PS to coordinate implementation by involved agencies. This could be along the lines of say the Roads 2000 programme, or a Task Force or procurement of a Programme Management Unit (PMU) Delivery Team following the Qatar model:
 - Task force with special powers and responsibilities using a continual improvement approach
 - Programme Management Unit Delivery Team with approved term contract suppliers using whole life cycle approaches
 - Logical Framework would be required to ensure delivery milestones were met and remedial actions set up in a timely manner.
- **Organisational Framework**
 - Use hub structure on a regional basis (up to 10 across Counties)
 - Establish demonstration hub and replicate
 - Set up demonstration projects within hub using force account with approved consultants/contractors/supervisors
 - Break larger sections (up to 50km) sections up into 5km contracts to enable involvement of youth and women cooperatives.
 - Establish support training and information support programme
 - Replicate in different regions taking into account local needs
- **Innovative delivery options**
 - Framework contracts for prequalified suppliers
 - Term contracts for design, construction and maintenance
 - Assisted consortia established
 - Supply chains set up
 - Bottlenecks programme
- **Technical innovation**
 - Use International experience
 - Develop and maintain fast track Standards, guidelines and quality control
 - Produce Work Methods
 - Carry out trials on any proposed specification/technical departures
 - Trial marginal materials
 - Trial less costly designs
 - Research and Development support
 - Bottlenecks programme
- **Knowledge generation and sharing**
 - Data collection, outputs and outcomes defined
 - Trials, monitoring and evaluation undertaken
 - Training and Capacity building undertaken by KeRRA and KURA
 - Education and workshop forums by KIHBT, KeRRA and KURA.

1.3 Delivery Partners

The following represents the key Agencies and their respective functions:

- Roads Department (RD) – Coordination

- Treasury – Development funding and assistance with other funding sources
- Kenya Roads Board (KRB) – Maintenance funding
- MTRD – Research and Development (R&D)
- KeRRA – Planning, design and contract administration for construction and maintenance of national rural roads, technical assistance to counties.
- KenHA – Construction and maintenance of national roads
- KURA – Planning, design and contract administration for construction and maintenance of national urban roads, technical assistance to counties.
- Counties – Construction and maintenance of county roads
- KIHBT – Technical/staff capacity building
- MTD – Equipment and materials production

1.4 Specific Responsibilities of Partners for Delivery

- RD – Planning and coordination of programme, inventories
- MTRD – Pavement design, axle load surveys, construction material inventory, construction control oversight, monitoring and evaluation
- Treasury – Road development funding and cash flow
- KRB – Road maintenance funding and cash flow
- MTD – Supply of crushing plants, cutback bitumen emulsions at county levels, stone aggregate, manufactured gravel and concrete products
- KeNHA – Design and implementation, education and dissemination
- KeRRA – Design and implementation of rural county roads, education and dissemination
- KURA – Design and implementation of LV urban roads, education and dissemination
- KIHBT – Training of foremen, plant operators, supervisors, inspectors and technologists
- Counties – Implementation of County Roads

1.5 Management, Coordination and Delivery

The following is a list of components that could be incorporated into the delivery plan:

- Innovation plan and step change requirements
- Performance requirements
- Programme Management support to RD
- Term contracts
- New Forms of Contract adopted
 - Public – Private Partnership model
 - Performance - based Contract model
 - Model Contract Documents, including MoM, BoQ for FIDIC ‘Method’
- Management systems in place
 - Road Maintenance Management System [RMMS] Development
 - Road Management System [RMS] Development
 - Structures Surveys and Databases
- LV Roads delivery Forum
- Research Forum and National/Regional Innovation funds
- Authorisation requirements (eg recruitment)
- Continual Improvement

1.6 Budgets and Funding

It is anticipated that funding for the 8,000km LV roads upgrading programme using innovative approaches would be substantially less than that required if conventional approaches were applied and would be by a mix of contributions from Government, KRB and Development Partners.

- The key components for indicative 5-year budgeting purposes are:
 - Design, construction and supervision: Ksh 240 billion (based on unit cost of **Kshs 30M/km @8,000km**), i.e. 48 billion per year
 - Policy formulation and Coordination and Performance Monitoring Kshs 12 billion (based on 5% of construction and supervision costs) i.e. 2.4 billion per year
 - Training cost Kshs 4.8 billion (based on 2 % of construction and supervision costs) i.e. 960 million per year.
 - Supporting research programmes Ksh 2.4 billion (based on 1% of construction and supervision costs) i.e. 480 million per year.
 - **TOTAL of above is approximately Kshs 259.2 billion (51.88 billion per year)**
- **Traditional costs of a similar upgrading programme using conventional road designs would be of the order of Ksh 480 billion** (based on **current cost of Ksh60M/km**), thereby achieving 46% reduction in costs.
- A number of funding mechanisms will need to be mobilized to fund the programme from:
 - MoF
 - RMLF
 - KFW
 - WB
 - DfID
 - AfDB
 - EU
 - AFCAP 2
 - Youth Fund
- An option for delivery could be to set up basket funding with Development Partners
- Another option would be to delineate specific programmes to each partner but managed by a Joint Development Forum.

1.7 Training and Capacity Building Programme

A long term and continual training and capacity building programme will need to be agreed, funded and implemented:

- Tailored training for 8000km delivery
- Set out staffing and training requirements for each partner
- Set out staffing and training requirements for Counties
- Education and dissemination
- MTRD requirements
 - Materials Engineers (on the job)
 - Laboratory technicians
 - Researchers
 - Designers/reviewers

- KIBHT
 - Train-the-trainer
 - Foremen
 - Inspectors/Supervisors
 - Plant operators
 - Professional engineers
- Counties
 - Supervisors
 - Project Managers
 - Technologists/technicians

1.8 Monitoring and Evaluation

In order to determine the effectiveness of the plans and programmes, it will be necessary to perform monitoring and evaluation activities. This will inform continual improvement requirements and aid forward planning. The project management cycle should comprise:

- Data collection and refinement
- Modelling
- Performance and Reporting
- Review
- Interventions

Implementers:

- Agreeing and monitoring targets/KPI's
- Targets equate to 43km upgraded roads per year per County
- Interfaces, 6000km KeRRA, 2000km KeNHA

2. STRATEGIC OBJECTIVES AND ACTIVITIES FOR THE UPGRADING OF 8,000 KM PAVED STANDARDS IN FIVE YEARS

2.1 Review of Institutional Framework for Management of the Road Network and the Road Sub-Sector

The expansion of the paved road network from the current 11,000 km (7 %) to 24,000 km (15%) in five (5) years as set out in the Jubilee Manifesto for the transformation of Kenya is an onerous undertaking which, to achieve, will require paradigm shifts in the management of the road sector guided by:

- (i) the national values and principles of governance set out by Article 10 of the Constitution;
- (ii) the values and principles of public service set out by Article 232 of the Constitution;
- (iii) the principles of leadership and integrity set out in Chapter Six of the Constitution; and
- (iv) the principles of intergovernmental relations as envisaged in the Intergovernmental Relations Act, 2012.

Urgent review of the institutional framework is underway to give effect to the Fourth Schedule of the Constitution of Kenya, 2010. According to the Fourth Schedule the functions of the National and the county governments with respect to roads are as follows:

- National Government:
 - (a) Road Traffic;
 - (b) The construction and operation of national trunk roads; and,
 - (c) Standards for the construction and maintenance of other roads by counties.
- County Governments:
 - (a) County roads;
 - (b) Street lighting;
 - (c) Traffic and parking; and,
 - (d) Public road transport.

The Fourth Schedule does not however provide for the definitions of national trunk roads and county roads. However, pending the enactment of a statute by Parliament providing for explicit definitions, it is assumed that national trunk roads are those currently under the jurisdiction of the KeNHA and county roads those currently under the jurisdiction of KURA and KeRRA in accordance with the First Schedule of the Kenya Roads Act, 2007.

To achieve efficient and effective management of the network and the expansion of the paved road network by 8,000 km review, consolidation and rationalization of legal and institutional framework of the road sub-sector agencies is required to provide for appropriate mandates. The network split between National and County roads must first be carried out and once this is done the institutional framework can be finalized and gazetted. Institutions functions may include:

i. MOTI - Roads Division

- Advise the government on all matters of policy relating to public roads
- Oversee effective coordination of policy implementation
- Determine the provisions to be made for capital and recurrent expenditure
- Ensure that:

- All agencies have management structures and systems for monitoring management performance against plans and targets and that corrective action is taken when necessary
 - appropriate strategic plans and annual programmes are in place
 - appropriate systems and practices are established for management, financial planning and control
 - monitoring targets are set.
- ii. Materials Testing and Research Division/Agency**
- Research on roads construction materials, methods and delivery options, and on traffic management and road safety.
 - Development and review of design and construction standards, and standard forms of contracts and quality control systems.
 - Pavement inventory and performance monitoring
 - Materials testing services
 - Inventory of construction material sources Focus should be on locally available materials and their characteristics/properties rather than on those that meet existing conventional specs that tend to exclude materials that have performed well on LVSRs
- iii. Mechanical and Transport Department (MTD)**
- Transport and plant & equipment hire services.
 - Production and provision of basic construction materials on commercial basis: crushed stone aggregates and chippings, concrete products (i.e. culverts, IBD, kerbs, channels, etc, bitumen binders and bituminous mixes and blended gravel for gravel pavements and gravel wearing courses).
- iv. Engineers Board of Kenya**
- Coordinate internship of graduate engineers
 - Registration and licensing of engineers
 - Registration and licensing of engineering consulting firms
 - Ensure that professional engineering services are provided by qualified engineers.
- v. Kenya Institute of Highway and Building Technology**
- Provide training programmes to build human resource capacity for infrastructure development and maintenance.
 - Develop policy on technical training and capacity building
 - Provide capacity building and technical training needs assessment
- vi. National Construction Authority**
- Promote and stimulate the development, improvement and expansion of the construction industry
 - Registration and accreditation of contractors
 - Accredite and certify skilled construction workers and supervisors

vii. Kenya Rural Roads Authority (KeRRA)

- Development, maintenance and administration of national rural roads
- Monitoring of standards of rural road construction as set by the MoTI
- Technical Support to County Governments on:
 - Project design, documentation, and management including contract administration
 - Procurement of consultancy services for feasibility studies, design and project supervision
 - Procurement of works
 - Maintenance standards and management systems

viii. Kenya National Highways Authority (KeNHA)

- Development, maintenance and administration of national trunk roads

ix. Kenya Urban Roads Authority

- Development, maintenance and administration of national urban roads
- Monitoring of standards of urban road construction as set by the MoTI
- Urban transport planning and development of transport models to reduce transit time and enhance safety
- Development and administration of special purpose vehicles for expansion and maintenance of urban infrastructure through public private partnerships

x. County Governments

- Development, maintenance and administration of county roads
- Tap into the current KeRRA technical capacity in the counties to provide the requisite support

2.2 Proposed Strategies

The following tables sets out proposed primary objectives, with associated strategies and activities, for each of the key implementing agencies. Through dialogue, discussion and agreement, it is planned to firm up on these tables, including development of performance indicators and target by Plan Years.

1 Principal Secretary/Infrastructure Secretary

Objective	Strategy	Activity	Performance Indicator	Target by Plan Year					Total Plan Target
				1	2	3	4	5	
Improve efficiency and effectiveness of road sector institutions and increase capacity to enable expansion of the paved road network from the current 11,000 km (7%) to 24,000 km (15%) in five(5) years	Review, consolidate, and rationalize the legal and institutional framework for effective and efficient management of the road network and to align functions with the provisions of constitution of Kenya, 2010	Prepare sessional paper							
		Public/Stakeholder Consultations							
		Review of relevant statutes and develop a draft bill							
		Seek Cabinet Approval							
		Submission of draft Bill to Parliament							
Explore sources of additional financing required for expansion of the network	Involve public and private sector in financing infrastructure development and maintenance	Review paper on best practice for PPP							
		Invite proposals							
	Increase development allocation from fiscus								
	Seek additional support from development partners	Set up joint Funding Forum							
Establish means of delivering step change	Procure Programme Management Unit (PMU)	TOR and RFP							
Government oversight of programme	Establish Task Force (TF)	TOR and mandate							
Programme implementation plan (PIP)	Joint implementation via PMU and TF	Prepare and approve PIP							
Faster procurement	Deploy contractors through new term contracts and area contracts	Produce procurement plan							
Establish supporting research programme	Produce joint strategic research plan	Organise Workshop							

2. Materials Testing and Research Division (MTRD)

Objective	Strategy	Activity	Performance Indicator	Target by Plan Year					Total Plan Target
				1	2	3	4	5	
Research on roads construction materials, methods and delivery options, to reduce overall infrastructure development and maintenance costs by 25% in the next five years	Develop research policy and strategy to support expansion of the paved road network and scope out research projects	Develop strategy for upgrading of 8000 km to low volume sealed standard	Report						
		Develop strategy for building of research capacity	Report						
	Research on construction materials, methods and delivery options to prolong pavement life and reduce to development and maintenance costs	Research on construction materials							
		research on low volume sealed roads							
		Develop pavement design guidelines and manuals to support upgrading of 8000 km to low volume sealed roads standards							
		Dissemination of research findings							
		Build research data bank							
		Facilitate quality assurance and enforcement of value for money in design and construction of roads	Development and review of design manual and standards construction specifications						
	Review standard forms of contracts and quality control systems								
	Vet feasibility studies and designs								
	Establish well equipped testing laboratories in the counties								
	Reduce costs of project design	Mapping of gravel and hard stone sources							
		Profiling of alignment soils along unpaved road corridors							
		Traffic and axle load surveys							

Objective	Strategy	Activity	Performance Indicator	Target by Plan Year					Total Plan Target
				1	2	3	4	5	
	Build research and capacity to enable effective and efficient support to national agencies and county governments	Transform MTRD to a SAGA							
		Expand and upgrade materials testing facilities							
		Expand and upgrade ICT systems							
		Develop and install pavement management systems and research database							

3 Mechanical and Transport Division (MTD)

Objective	Strategy	Activity	Performance Indicator	Target by Plan Year					Total Plan Target
				1	2	3	4	5	
Provide transport plant and equipment hire services and basic construction materials on commercial basis to reduce overall infrastructure development and maintenance costs by 25% in the next five years	Provide transport and plant & equipment hire services at Counties to reduce the cost of road maintenance and upgrading unpaved roads to low volume sealed standards	Provide vehicle hire services for supervision and administration to executing agencies at national and county levels							
		Provide trucks for transportation of goods and construction plant and equipment hire services at national and county levels							
	Improve plant and equipment stock and maintenance specifically for LV sealed roads	Audit and set out procurement needs							
	Cooperate with plant operator training and distribution of equipment and plan	Collaborative plans							
	Provide basic construction materials on commercial basis to reduce cost of road maintenance and upgrading unpaved roads to low volume sealed standards	Install plants and provide stone aggregates, bitumen binders, bituminous mixes and blended gravel at Counties							
		Install plants for the manufacture of the following concrete products at county level: concrete culverts, IBD, kerbs and channels							
Use available materials more effectively	Coordinate national material inventory with local supply needs	Work with MTRD							
Improve marginal materials	Provide processing facilities to recover , recycle, and upgrade materials	Work with MTRD							

4 Engineers Board of Kenya

Objective	Strategy	Activity	Performance Indicator	Target by Plan Year					Total Plan Target
				1	2	3	4	5	
To enhance professional capacity for the expansion of the infrastructure	Introduce compulsory structured three year practical training (internship) programme for all Kenyan engineering graduates to enable timely achievement of professional and technical qualifications	Investigate international practice							
		Establish and implement acceleration programme							
	Fast track registration and licensing of engineering consulting firms	Create tender benefits for registered firms							
	Ensure that professional engineering services are provided by qualified engineers	Require all intermediate and senior staff are qualified							
To educate and disseminate relevant information for capacity building	To produce engineering proceedings and case studies to address innovation and technology development	Establish programme of lectures, case studies and publications							
To participate in an Engineering Academy	Confer Fellowships for achievement	Establish fellowship							
To participate more at county levels	Strengthen regional presence	Decentralise							

5 Kenya Institute of Highway and Building Technology

Objective	Strategy	Activity	Performance Indicator	Target by Plan Year					Total Plan Target
				1	2	3	4	5	
Provide training programmes to build technical human resource capacity for infrastructure development and maintenance.	Institutional transformation to provide technical training and competencies in project management, procurement (works, services and goods) and contract administration at management level and in construction and maintenance technology at supervisors and artisan levels	Establish needs assessment criteria							
		Prioritise training programmes across all key disciplines							
	Develop policy on training, technical human resource capacity building for the road sub-sector								
	Provide capacity building and technical training based on needs assessment to the road sub-sector institutions								
Design specific courses and training to support upgrading of LV roads to sealed standards	Use facilities at all three campuses at Ngong, Nairobi and Kisii using in-house and external trainers for capacity building	Establish new training programmes							
Step change training and development	Use ‘train the trainer’ approach	Involve international experts							
Accelerate training programme	Establish training network with other partners such as Nairobi University, Technical University of Mombasa	Set up cooperative forum							

6 National Construction Authority

Objective	Strategy	Activity	Performance Indicator	Target by Plan Year					Total Plan Target
				1	2	3	4	5	
Promote and stimulate the development, improvement and expansion of the construction industry	Accelerated registration and licencing of contractors: 1. National 2. Regional 3. International	Set up central coordination programme							
		Establish fast track for counties							
Improve capacity of contractors well placed to deliver LV sealed roads	Categorize and approve contractors according to value of work , capability and according to whether specialist foundation Contractors, Roads or other Civil Works Contractors.								
Specific approval for LV roads using labour-based techniques	Registration and accreditation: 1. Construction 2. Maintenance	Training on LV construction and maintenance techniques							
Improve capacity of local SME's	Facilitate establishment of consortia and JV's								
Bring international best practice	Facilitate cooperative agreements, subcontract arrangements, JV's								
Increase transparency and reduce corruption	Improve tendering transparency by working with government in establishing review panel specifically for LV Roads								

Objective	Strategy	Activity	Performance Indicator	Target by Plan Year					Total Plan Target
				1	2	3	4	5	
Improved contractor capacity	Capacity building through training, financial assistance, and sourcing assignments for member contractors.								
Competent and skilled workforce	Accredit and certify skilled construction workers and supervisors								

7 Kenya Rural Roads Authority (KeRRA)

Objective	Strategy	Activity	Performance Indicator	Target by Plan Year					Total Plan Target
				1	2	3	4	5	
Provide technical support to County Governments on design, construction and maintenance of rural roads	Technical support in project design , documentation and management including fast track procurement of contracts for consultancy services and construction works								
	Streamline quality procedures in accordance with such standards as may be defined by the National Government								
	Fast track collecting and collating data that may be necessary for efficient forward planning								
	Ensuring enforcement of policies on rural roads set by the National Government								
	Establish priority supporting research programme								
	Disseminate research findings and policy guidelines by National government								

8 Kenya Urban Roads Authority

Objective	Strategy	Activity	Performance Indicator	Target by Plan Year					Total Plan Target
				1	2	3	4	5	
Urban transport planning and development of transport models to reduce transit time and enhance safety	Development and administration of special purpose vehicles for expansion and maintenance of urban infrastructure through public private partnerships								
Improved Public Transport	Use of Bus Rapid Transit (BRT), bus lanes, light rail, commuter rail, integrated transport								
Reduced Congestion	Use of ITS, tolling, congestion charging, park and ride								
Introduce innovation and latest technology	Establish priority supporting research programme								
Build capacity	Disseminate research findings and policy guidelines by National government								

9 Kenya National Highways Authority (KeNHA)

Objective	Strategy	Activity	Performance Indicator	Target by Plan Year					Total Plan Target
				1	2	3	4	5	
Upgrading t of 6000 Km of unpaved trunk roads to bitumen standards in the next five years	Upgrading 2000 Km to low volume sealed standards								
	Upgrading 4000 Km of heavily trafficked roads to high volume standard								
Establish improved procurement procedures	Use of BOT, DBFO, Design and build, Consortia, Term Maintenance, Approved Supplier								
Develop improved contract practices	Management contracts,, Framework agreements, Call-off Contracts, Joint Venture, PPP								
Introduce innovation and latest technology	Establish priority supporting research programme								
Build capacity	Disseminate research findings and policy guidelines by National government								

10 County Governments

Objective	Strategy	Activity	Performance Indicator	Target by Plan Year					Total Plan Target
				1	2	3	4	5	
Upgrading of 7000 Km of unpaved trunk roads to bitumen standards in the next five years	Upgrading 6000 Km to low volume sealed standards	Work collaboratively with other Counties							
		Participate in Task Force							
		Work collaboratively with KeRRA							
	Upgrading 1000 Km of urban roads to paved standards	Work Collaboratively with KURA							
	Establish regional hubs of Counties	Use first as a demonstration project							
	Establish collaborative arrangements on a regional basis	Set up 'clusters' within geographical regions							
	Fast track training programme of Supervisors	Mobilise all training institutes for tailored programme							
	Develop recruitment strategy	Implement recruitment programme, including contract hires.							
	New and improved contract arrangements								
	Share best practice	Term Contracts							
		Approved suppliers							
		Consortia/JV's							

3 PROPOSED TOR FOR THE PROGRAMME MANAGEMENT UNIT

The Programme Management Unit (PMU) would be made up of selected individuals under the leadership of a Team Leader, mandated to coordinate activities to deliver the programme and accountable for progress.

Task: deliver 8,000km in 5yrs at 25% reduction in whole-life cost:

- Established by PS, reporting to Roads Secretary
- Mandated to coordinate the implementation and delivery of 13,000km of upgraded roads, including 8,000km upgraded LV roads
- Interfacing with Implementing Agencies Management Steering Group (MSG - representatives of current agencies initially and County Government)
- Establish Project Plan, logical framework, budget and cost management, progress and performance, monitoring and evaluation and continual improvement
- Use of international best practice, innovation and creativity, appropriate cutting-edge technology and new ways of working

4 ROADMAP AND WAY FORWARD

ESSENTIAL ELEMENTS FOR SUCCESS

- **Agreed 8,000km Strategy and Plan for Upgrading Roads**
- **Establishment of Programme Management Unit (PMU)**
- Use of surface seals technology and international African experience for upgrading LV roads
- Development of road design manual specifically for low volume roads, endorsed and agreed as national manual, with a cadre of trained design professionals, supported by specifications and construction guidelines
- By-in, involvement, training and capacity building at County level
- Involvement of all implementing agencies and other stakeholders
- Cooperation and support from all funders and Development Partners

Having recognized the shift needed to achieve a significant change in a delivery programme, including the need for a change in method of management and also a change in delivery mechanisms, a model and roadmap could be agreed with all stakeholders to set out the way forward, including milestones and deliverables. A methodology for appraisal, evaluation and continual improvement would be agreed.

IMPLEMENTATION MATRIX

Establish Roads Programme Management Unit reporting to Roads Secretary and establish agreed strategy for:

- Options and innovations
- Roadmap
- Map of delivery partners
- Definition of specific responsibilities
- Set out activities and timelines
- Methodology for management, coordination and delivery
- Secure budgets and funding
- Training and capacity building programme
- Education and dissemination
- Monitoring and evaluation

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ROADMAP OF WAY FORWARD

1. PS to distribute Draft strategy for 8,000km upgrading report for consultation
2. All implementing agencies to prepare for Workshop and their presentations.
3. Workshop meeting in early 2014 for discussion
4. Finalise 8,000km strategy, agree actions and implementation plan
5. Set up PMU
6. Initiate implementation matrix, including management and delivery mechanisms and specifics on following:
 - Delivery Partners
 - Specific responsibilities of partners for delivery
 - Management, coordination and delivery
 - Budgets and Funding
 - Training and Capacity Building Programme
 - Monitoring and Evaluation

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SECTION B: DRAFT RESEARCH POLICY FOR UPGRADING RURAL ROADS

SECTION B sets out a broad Research and Development programme that is required to support the delivery of the roads programme. It summarises relevant activities to achieve the objectives, indicators and targets under the Ministry's Theme relating to Research and Development. The activities relate to upgrading of 6,000km of County Roads and 7,000km of National Roads to bitumen standards, specifically focussing on 8,000km upgraded LV roads

The newly formed MoTI agreed future transport strategic themes and KPI's at a Retreat held at Naivasha from 17th to 20th July 2013. The following table sets out the four strategic themes and KPI's covering transport efficiency, Research and Development, enforcement and capacity mobilisation. It is followed by a summary table of proposed activities to achieve the objectives and indicators under the Ministry's Theme relating to Research and Development. It also identifies targets and provisional budget requirements to achieve those targets.

Relevant strategic themes and KPI's comprise:

E. Develop and manage transport infrastructure to facilitate efficient movement of goods and people whilst ensuring environmental sustainability

1. Increase paved road network from 7 to 15% and maintain the road network from present coverage of 40% to 60%.
2. Reduce overall transit time in urban centres by 30%.
3. Develop and implement an integrated information system for transport and infrastructure services.

F. Research and development for an efficient transportation system

1. Research on construction materials and methods with a view to reduce overall infrastructure development costs by 25% in the next 5 years
2. Undertake operational research to identify opportunities to reduce operational costs in the Northern corridor by 25%
3. Undertake research on transport to enhance safety to reduce overall carnage by 50%
4. Carry out research to identify the most efficient financing and implementation of structures to reduce finance costs by 25%

G. Develop and enforce regulations and standards for safe, secure and efficient transport systems

1. Improve safety and security occurrence of transport systems by 50%

H. Mobilise resources and capacity building

1. Increase number of professional skilled persons to 40,000
2. Increase number of trained local contractors to 9000

The following table summarises relevant activities to achieve the objectives, indicators and targets under the Ministry’s Theme relating to Research and Development. The activities relate to upgrading of 6,000km of County Roads and 7,000km of National Roads to bitumen standards. This report relates only to the LV roads component and amounts to 8,000km in total across all Authorities, to be delivered over 5 years (identified by green shading). The development of research policy is set out in a separate report ‘Draft Research Policy for upgrading rural roads’(November 2013).

THEME B: UNDERTAKE RESEARCH AND DEVELOPMENT FOR AN EFFICIENT TRANSPORT SYSTEM

	Objective	Performance Indicator	Target	Proposed Activities
3.1	To research on construction materials, methods and delivery options to reduce overall infrastructure development and maintenance costs by 25% in the next 5 years	Percentage reduction in overall infrastructure development and maintenance costs	25%	Development of research policy to support upgrading of 8,000 km of classified roads in counties to bitumen standards in the next 5 years
				Finalization of research on Low volume sealed roads and construction of road trials
				Mapping of natural construction material sources
				Profiling of subgrade soils along unpaved classified road corridors
				Research on pavement materials for heavy traffic loading
				Development and review of manuals and quality control systems
				Research on technology and systems for road maintenance management optimisation

B.1 MTRD RESEARCH OBJECTIVES, TARGETS AND ACTIVITIES

This section sets out MTRD’s proposed research objective and associated activities to deliver MOTI targets. These proposals have been developed through extensive dialogue and discussion with all the Departments, Implementing Agencies, Counties and their agents/consultants and contractors. It is not exhaustive and will be continually updated and augmented by proposals and requirement from all stakeholders. It will also be affected by availability of funds and available budgets. Through a process of consultation, the projects will be prioritized so that maximum value and usefulness to Government targets can be achieved.

Section B.2 identifies **general** priorities for research put forward by other Authorities and Departments identified through the current AFCAP and EU TA support programmes to MOTI. The following table gives a summary breakdown of current proposed activities followed by suggestions of proposed research projects.

MOTI OBJECTIVE 3.1: To research on construction materials, methods and delivery options to reduce overall infrastructure development and maintenance costs by 25% in the next 5 years

ASSOCIATED ACTIVITIES
Development of MTRD research programme to support upgrading of 8,000 km of classified roads in counties to bitumen standards in the next 5 years
Finalization of current research on low volume sealed roads and construction of road trials
Mapping of natural construction material sources
Profiling of subgrade soils along unpaved classified road corridors
Maintenance planning and implementation
Development and review of manuals and quality control systems

1 Development of research programme to support upgrading of 8,000 km of classified roads in counties to bitumen standards in the next 5 years
--

PROPOSED ACTIVITIES

- **Research and benchmark current infrastructure costs for upgrading and rehabilitation of LV roads**
- **Through Stakeholder consultation, identify methodology to reduce capital cost, time of delivery and life cycle costs and set up development programme of actions**
- **Carry out gap analysis of current capabilities/capacity and those necessary to deliver upgrading programme**
- **Documentation and appraisal of current national and international research practise and documents relevant to upgrading programme**
- **Establishment of a policy development, monitoring and evaluation facility**

PROJECTS

- **Improved Pavement Designs, Construction and Maintenance**

A programme of updated pavement design guidelines and related documents is needed for construction and maintenance.

- **Standards, Guides and Manuals**

A programme of production of Standards, guides and manuals is required to be produced and programmed. This will be informed by a parallel EU TA programme which is currently supporting MTRD on the following:

- Review of Design Manuals
- Low volume seals pavement design manuals
- Urban design guidelines
- Economic appraisal
- Research database

- **Road Maintenance Management System (RMMS) development**

The RMMS will require systematic regular data collection on the road network's pavement condition, traffic, extent, location etc. It will also require a computerised pavement management system (e.g. based on HDM-4) that allows analysis several years ahead. Such a system will be used by MOTI, MTRD, KRB and Authorities each drawing information from it to aid its decisions and feeding back into it

- **Databases** To develop more comprehensive and representative data and to collaborate with MTRD on its collection, maintenance, modelling and evaluation.
- **Modelling** (including data and management systems and design guides)
- **Establish Material Testing Programme for Counties**

Currently, there are 11 No regional laboratories. There is a need to increase this (upto 47) to provide testing services to the Counties. A regionalisation strategy will need to be developed and agreed with the Counties, Implementing Authorities and donor-funded projects and a long term plan to recruit, train and develop staff and procure/ commission/maintain testing equipment.

- **Non-motorised intermediate means of transport.** Guidelines for integration and access.
- **Contractor support and advice through information, education and dissemination.** A training and capacity building programme is needed.
- **Climate change resilience and adaptation strategies.** Kenya's road infrastructure is vulnerable to flooding, erosion, landslips and other associated phenomena. Risk assessment and mitigation strategies are commonplace internationally and should be studied for relevance and prioritisation for Kenya. Typical activities comprise:
 - Education and awareness training
 - Vulnerability assessment of critical infrastructure
 - Risk Assessment and Mitigation
 - Emergency Response
- **Road Safety**

National Transport and Safety Authority (NTSA) has been recently set up and will need to work closely with MTRD, all RAs and any other agencies whose mandate includes the improvement of road safety.

- **Training and capacity building**

Carry out training needs analysis with prioritised training programme.

2	Finalization of research on low volume sealed roads and construction of road trials
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PROPOSED ACTIVITIES

- **Develop terms of reference for procurement of short term consultancy services for the development of design guidelines for low volume sealed roads (DGLVSR)**

Pavement Design Guidelines for LV Sealed Roads are currently being undertaken using an MTRD document Ref: M.1970/35/R/6 Vol 1, dated 21st June 2013. These are based on information contained within Road Design Manual Part III. They require augmentation and refinement before review and final implementation as a published document.

Guidelines for design of low volume sealed roads need to be produced as a matter of urgency. An inventory of previous studies is to be developed and reviewed against current MTRD guidelines and a definitive document to be scoped and developed through TOR produced and implemented by the EU.

- **Design and implement education and dissemination programme for DGLVSR**
- **Develop/update support documents for DGLVSR**
- **Monitor and evaluate trials on LVSR and incorporate as appendices to DGLVSR**

3 Mapping of natural construction material sources**PROPOSED ACTIVITIES**

- **Materials Database & National Inventory**

A National data base of materials for construction and products is needed to support the Governments road construction and maintenance programme. MRTD has initiated 3 projects and this should be followed by a prioritised national roll-out programme.

- **Needs assessment for use of marginal materials, mining, quarry and other wastes**

Needs assessment to be followed by research programme into behaviour and improvement projects.

4 Profiling of subgrade soils along unpaved classified road corridors**PROPOSED ACTIVITIES**

- **Use of rapid methods for profiling and classifying subgrade materials for road corridors**

5 Research on pavement materials for heavy traffic loading**PROPOSED ACTIVITIES**

- **Review current pavement design manual and update to cover for high volume roads**
- **Develop and implement axle load management regulations**

6 Maintenance planning and implementation**PROPOSED ACTIVITIES**

- **Prepare and undertake a comprehensive rural road assets and condition survey**
- **Establish a comprehensive traffic data base**
- **Develop and implement axle load management regulations**
- **Data collection, modelling and maintenance planning**
- **Review and update routine road maintenance**
- **Review and update periodic maintenance**
- **Update bridge, structures and drainage maintenance**
- **Research low cost seals for periodic maintenance**
- **Research cold mix asphalt for periodic maintenance and design**

7 Development and review of manuals and quality control systems

PROPOSED ACTIVITIES

- **Quality Controls**

A programme of quality Control documents and procedures is needed to provide consistency and uniformity of design, construction and maintenance. Associated requirements for MRTD to develop include:

- certification
- verification
- accreditation
- Construction Quality Monitoring and Measurement
- Quality Assurance, ISO 9001
- Performance Monitoring and Indicator Development

- **Bridge design and upgrading**
- **Manuals and guides for periodic maintenance**

8 Training and Capacity Building

PROPOSED ACTIVITIES

- **Training** will be a combination of courses, workshops and mentoring. A budgeting and programming plan will need to be devised and implemented.
- **Labour-Based Technologies** To pioneer and to optimise improvements in labour-based technologies using international best practice approaches.

B.2 RESEARCH ACTIVITIES NEEDED BY IMPLEMENTING AGENCIES

This Section will be developed with the implementing agencies, through discussion and meetings through to February 2014, when a workshop is planned to formalize a supporting research programme. General priorities for research have been put forward by Authorities and Departments through the current AFCAP and EU TA support programmes to MOTI.

Consultations reported in the AFCAP LV Roads Research Report (March 2103) and the EU ICBTRS Inception Report (May 2013) give a consistent set of R & D needs across all Departments, Boards, Authorities and other relevant stakeholders. For the most part, needs are aligned with current and emerging policies and priorities for MOTI.

Priorities areas for research put forward by implementing agencies include:

- **Low Cost Seals for LV Roads and for Periodic Maintenance**
- **DCP Pavement Design Manual - Implementation activities**
- **Cold Mix Periodic Maintenance Research and Design Actions**
- **Labour-Based Technologies**
- **Databases**
- **Materials Databases**
- **Road Asset Management System**

- **Assess need for Climate Change Adaptation Strategies**
- **Asset Management**
- **Road Contract options**
- **Contract Procurement, Management and Costing**
- **Quality monitoring and Control**
- **Urban Network Planning**
- **Urban Road Design and Environmental Guidelines**
- **Traffic Management and Signalisation**
- **Road Safety**

PART C: DEVELOP TERMS OF REFERENCE FOR PROCUREMENT OF SHORT TERM CONSULTANCY SERVICES FOR THE DEVELOPMENT OF DESIGN GUIDELINES FOR LOW VOLUME SEALED ROADS

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DEVELOPMENT OF A LOW VOLUME ROAD DESIGN MANUAL

1 INTRODUCTION

The Kenyan Road Design Manual was developed in the late 70's and early 80's based on research in Kenya. It is considered to be very successful but it did not provide pavement designs for cumulative standard axle loadings below 500,000. Most of the roads with traffic below 250,000 cumulative standard axles have to be improved to all weather standard. However, gravel is becoming less abundant, and therefore more expensive; gravel roads require continuous and expensive maintenance for reshaping and re-gravelling; the dust nuisance is a health hazard; and, in wet weather, gravel roads can become impassable if maintenance is inadequate. Thus the design of more durable roads with lower whole life costs has become a high priority. There is therefore a need for a national road design manual for such roads.

2 PURPOSE AND OUTPUT OF THIS PROJECT

The purpose of this project is to set out an agreed procedure/plan to develop a low volume road design manual for Kenya. The output will therefore be a detailed project proposal and 'roadmap' outlining all the steps necessary to produce such a manual and the resources necessary to do so. It is envisaged that the project will comprise several phases and will culminate in a final, endorsed and agreed national manual for the design of low volume roads and a cadre of professionals who are familiar with it and able to employ it successfully.

A design manual in itself is not enough. A set of general specifications will also be required which will have to provide for both labour-based and equipment-based construction methods.

To accompany the design manual and the specifications it is often necessary to provide a set of construction guidelines or work methods to help inexperienced contractors, especially if new techniques are involved. This does not form part of these proposals but could be the subject of an additional phase.

3 PRELIMINARY ACTIVITIES

The first step was to meet with and discuss the requirements with key individuals and to determine the current situation in Kenya vis-a-vis low volume road design. Consultation meetings were held with:

- a) Chief Engineer Stephen Kogi, MTRD
- b) Steve Crosskey, ICBTRS Key Expert/KeRRA
- c) Eng David Karanja, KeRRA
- d) Eng Asfaw Kidanu, ILO/KeRRA
- e) Eng Maurice Ndeda, MTRD

A number of documents were provided including:

- a) Road Design Manual Part I – Geometric design of rural road.
- b) Road Design Manual Part III – Materials and Pavement Design for New Roads.
- c) Road Design Manual Part V – Rehabilitation and Overlay Design manual
- d) Pavement Design Guidelines for Low Volume Sealed Roads.
- e) Low Volume Sealed Roads Workshop Report.

The Pavement Design Guide for Low Volume Sealed Roads is understood to be an interim document that will be superseded when the new manual is complete. Currently, it is a short document summarising some best estimates of suitable thickness and materials designs for 5 categories of road ranging from very low

volume roads capable of carrying traffic no more than 25,000 esa up to a road category capable of carrying up to 1.0 million esa.

4 OUTLINE OF THE PROJECT

The project consists of several separate phases. Phase 1A comprises one task namely:

Proposed Activity 1

Peer review of the Kenyan Pavement Design Guidelines for Low Volume Sealed Roads, dated June 2013, identifying urgent amendments and additions to enable the document to be issued as an interim manual for immediate use.

This task is the first task of the overall project and deals with a limited range of options.

Phase 1B comprises the following:

- 1) Review of existing information including local and international research and international practices in the design of LVRs
- 2) Development of a draft manual for Kenya including obtaining local experiences and opinions
- 3) Presentation of the draft manual and discussions/workshops to finalise its detailed contents
- 4) Printing, dissemination and training of users

5 CURRENT UNDERSTANDING OF LOW VOLUME ROAD DESIGN AND DEFINED ACTIVITIES.

Understanding the behaviour of road pavements is difficult and therefore developing a good and reliable design manual is equally difficult. The main reason for this is the very large number of factors (or variables) on which the behaviour of roads depends and their interactions. These are simply classified under the headings of materials, traffic, climate, drainage, road geometry, geology of the terrain, maintenance and quality of construction.

The properties of the road-building materials alone, including the subgrade, are clearly very critical but these themselves are complex and interactive. These properties include particle size distribution, plasticity, strength, durability, expansivity, plus the characteristics of any binding materials or additives.

It is not necessary to elaborate on all these complexities at this stage. The point is that it has proven difficult to fully understand road behaviour and this has sometimes been a problem. As a consequence of the complexities, errors of understanding have occurred and some of these errors have proved difficult to correct. This is because they have become so established that nothing short of a paradigm shift is required and this is resisted because it involves reputations, vested interests and apparent unwillingness move out of the comfort zone to try new and unconventional approaches.

Three examples will suffice to illustrate the nature of these issues,

- subgrade strength criteria,
- relaxed specifications for LVRs

- lack of traditional fatigue of AC surfacing

Details of these will become apparent in the following text.

There are two primary aspects of pavement design that determine the layer thicknesses and layer strengths. These are

- a) Protecting the subgrade from deformation and shear failure.
- b) Ensuring that the pavement layers themselves do not fail because of inadequate strength.

There are therefore two principal areas for exploring potential sources of cost reductions.

5.1 Subgrade Protection

There are three primary sets of data that indicate that the traditional criterion for the protection of the subgrade is overly conservative.

The first is simply that the subgrade strain criterion developed at the AASHO Road Test in 1962 is based on the likely failure of a very weak subgrade. The Road Test subgrade had a soaked CBR of less than 3% and, during the spring thaw, was very weak indeed. The criterion developed by Shell is based on critical strain and has been used by theoreticians for road design for 50 years. It has been applied to all subgrades irrespective of material type, strength, density, moisture content etc. Some research organisations and some highway authorities have produced their own subgrade criterion which are less conservative than the AASHO result but it is still applied universally to all subgrades.

Relatively recently a study was carried out by Vincent Janoo, working in the US Army's engineering research department, in which 12 road sections were constructed in the army's accelerated pavement test facility comprising 4 subgrade materials at 3 different moisture contents. Each road was trafficked to failure to test the subgrade strain criterion (amongst other things). The results are shown in Figure 1. It can be seen that the American data indicate that there are *more than 3 orders of magnitude difference* between the weak subgrades and the strong ones.

The relationship used in the Kenyan manual (Page 8.7) is less conservative than the AASHO equation, as shown in the Figure, and lies between the two lines shown for strong and medium strength subgrades from the American study. Its origin is not identified in the manual but it clearly reflects the fact that subgrades are generally stronger than assumed in the AASHO/Shell criterion.

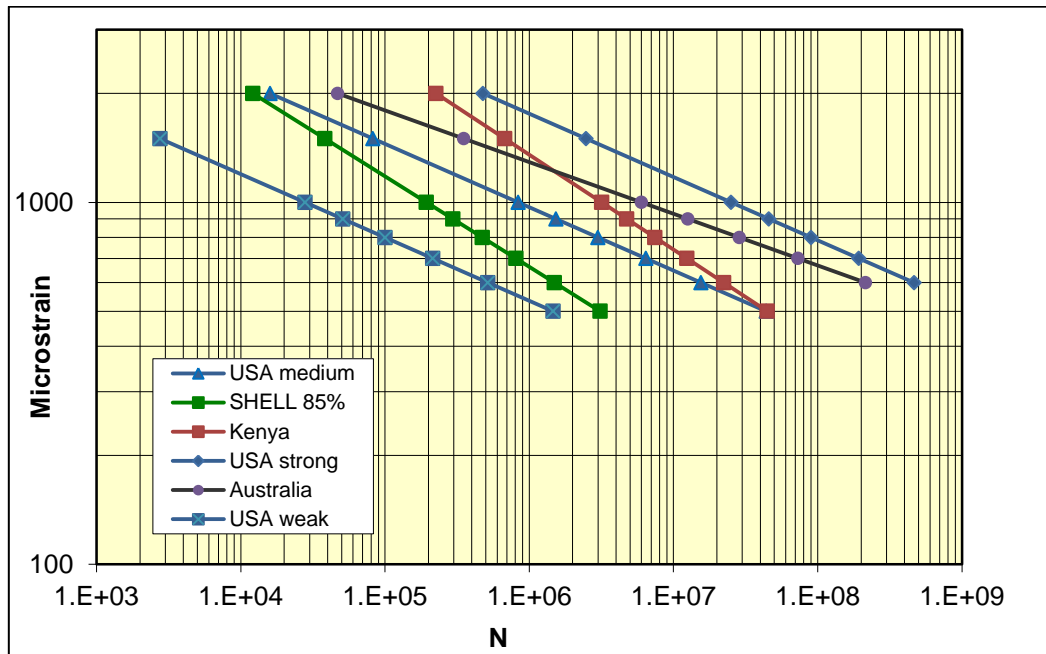


Figure 1 Subgrade strain criteria

Proposed Activity 2

An improvement can be made by adopting a different criterion for each subgrade strength class. A review of the American data is required to identify strength ranges and to develop possible modifications for the Kenyan manual. The designs in the manual also need to be checked to see if the published subgrade criterion is actually a critical design factor. Such criteria are often safely exceeded when practical considerations such as minimum construction thicknesses and material strengths of the other pavement layers are taken into account.

Proposed Activity 3

The next step would be to see what the effect would be on the thickness designs. At first sight it looks as if thicknesses could be reduced for the stronger subgrades but perhaps not for the weaker ones. However, for the weaker subgrades the design charts advocate the addition of selected fill so the final outcome of the calculations cannot be anticipated at this stage.

Other experimental evidence for the strength of subgrades and the conservative nature of the subgrade criteria lies in the fact that subgrade failure has rarely been observed unless wholesale pavement failure has occurred through flooding, washouts, or complete lack of maintenance that has led to failures in all layers.

Secondary evidence is also available from earlier US Army research on the trafficability of soils carried out some 50-60 years ago. The soils were tested in the field by trafficking them with loaded army trucks until they failed. This was because it is important for the army to know for any given soil at any known moisture content, just how many army trucks could pass through the road. In the theatre of war, good army supply chains are absolutely vital and if the soil is not strong enough to carry sufficient vehicles, the army needed to strengthen it. The valuable point here is that these experiments were done with the subgrades in constant and known moisture conditions. Unfortunately these experiments are now so old that all the reports that were written are no longer available, but one key summary paper was published in 1976. The US Army seemed reluctant to publish widely and this key paper is very short and contains errors and

omissions but the chart shown in Figure 2 illustrates the traffic capacity of bare soils (one coverage is about 3 passages of the wheel).

It should be pointed out that the failure condition was quite a deep rut (ie more deterioration than could be tolerated in a subgrade) but the traffic capacities are high for, say, a 5 kip (5000 lb) wheel load and a subgrade strength of 25% CBR. The data illustrates the sensitivity of the carrying capacity to wheel load and CBR and implies that considerable relaxation of specifications should be possible for the lightest road category.

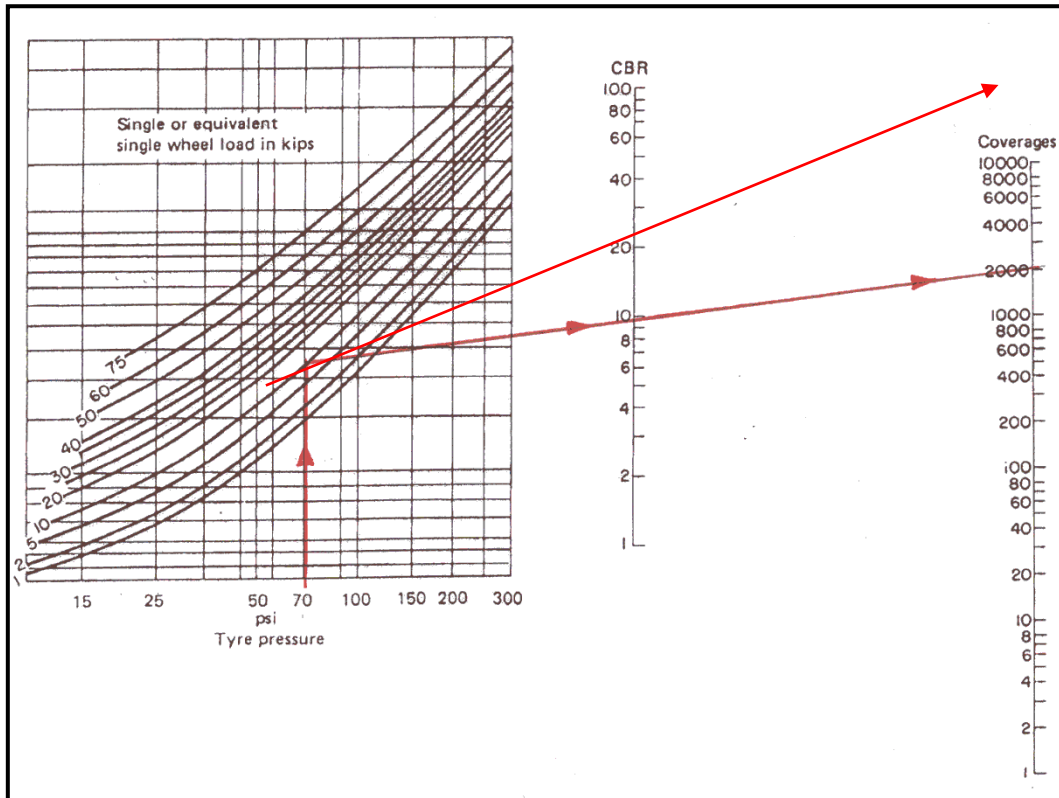


Figure 2 US Army nomograph for soil capacity

5.2 Ensuring that the pavement layers themselves do not fail because of inadequate strength

The most common method of reducing costs is to make use of materials that do not meet standard specifications but have been shown to work satisfactorily in many circumstances. Engineers perceive risks attached to such a practice but consideration of the genesis of some of our long-held specifications should be enough to convince them that we now have much more data to support revised and relaxed specifications than we ever did to develop some of the original specifications in the first place.

It is sometimes quite difficult to determine why a pavement fails because there are so many factors that affect its performance, and one suspects that blame is often attached to minor shortfalls in meeting specifications but which probably had little or nothing to do with the failure at all. However, such practices reinforce the idea of a precise and *never-to-be-violated* specification and mitigate against relaxing them even for low volume roads.

The evidence for excellent performance from materials that do not meet current specifications and therefore evidence for relaxing specifications in appropriate circumstances is now overwhelming. Almost every time a study is completed that demonstrates this, revised but still somewhat tentative specifications are proposed because nobody wants to go too far in one step. The trend is slow but continuous but considerable savings are now possible without increased risks. Furthermore other aspects of design can be altered to reduce risks, for example, improved drainage provision, better, more durable surfacing, timely and appropriate maintenance, etc.

The following chart is an example of the use of relaxed specifications for LVRs developed from a long-term study by TRL in southern and eastern Africa (Greening and Gourley, 1999). As with any study of this kind, examples of roads covering the full range of subgrade strength, traffic, climate and so on are impossible to find and so judicious interpolation of the data was required. The results generally err on the conservative side hence further relaxation of the specifications are possible after further research.

Table 1: Plasticity requirements for natural gravel road base materials

Subgrade class ⁴	Property of base	Traffic class (mesas)				
		LV1	LV2	LV3	LV4	LV5
		<0.01	0.01-0.1	0.1-0.3	0.3-0.5	0.5-1.0
S2	Ip PM Grading	<12 <400 B	<9 <150 B	<6 <120 A ⁵	<6 <90 A ⁵	<6 <90 A ⁵
S3	Ip PM Grading	<15 <550 C ¹	<12 <250 B	<9 <180 B	<6 <90 A ⁵	<6 <90 A ⁵
S4	Ip PM Grading	Note ² <800 D ³	<12 <320 B	<12 <300 B	<9 <200 B	<9 <90 A ⁵
S5	Ip PM Grading	Note ² - D ³	<15 <400 B	<12 <350 B	<12 <250 B	<9 <150 A ⁵
S6	Ip PM Grading	Note ² - D ³	<15 <550 C ¹	<15 <500 B	<12 <300 B	<9 <180 A ⁵

Notes:

1. Grading 'C' is not permitted in wet environments or climates ($N < 4$); grading 'B' is the minimum requirement
2. Maximum $I_p = 8 \times GM$
3. Grading 'D' is based on the grading modulus $1.65 < GM < 2.65$
4. All base materials are natural gravels; Subgrades are non-expansive
5. Envelope A varies depending on whether the nominal maximum particle size is 37.5, 20 or 10mm

The study also showed that the requirements for selection and use of lateritic gravels for bases were slightly different to those given for other natural gravels. For example, the maximum allowable plasticity was found to be higher.

More recent research has indicated that further relaxation is possible under some circumstances. However all research requires appraisal and review before adoption in national standards and this is one of the purposes of this project.

It has been found that the in-situ moisture content of roadbases almost never rises above the optimum moisture content for compaction to mod AASHTO standard. At such a moisture content, a wide variety of materials that fail to meet the ‘soaked CBR greater than 80%’ criterion are very strong and capable of carrying high levels of traffic.

Figure 3 for example, taken from a recent study in Mozambique, shows the lack of a relationship of any kind, let alone a weak one, between the soaked CBR of the roadbases and the performance of the sample of roads (a figure of 40 or less on the performance axis denotes good performance). All of the roads have been in service for a considerable time and, as can be seen, a significant number do not meet the CBR greater than 80% criterion. Many of these roads have carried much more traffic than the LVR limit. The two roads showing poor performance suffered from deterioration of the bituminous surface through ageing/oxidation and embrittlement of the bitumen i.e. a form of deterioration completely unrelated to roadbase CBR.

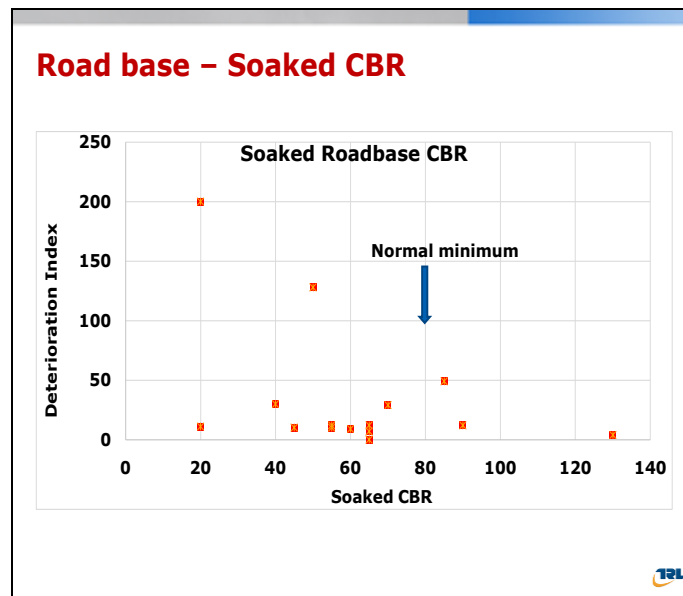


Figure 3 Correlation of performance with roadbase soaked CBR

A number of similar graphs for some of the other strongly held specifications illustrate the same effect. Obviously the statistical sample here is quite small but evidence like this has been coming from many studies, the sum total of which provides undeniable and overwhelming evidence for relaxing specifications for LVRs.

Proposed Activity 4

The successful use of materials with relaxed standards for LVRs during the last 20 years needs to be reviewed and compared with potential relaxations for use in Kenya. This is not an onerous task but universal agreement amongst ‘experts’ is not available simply because some are prepared to relax standards more than others. In the end the final decisions about how far to go will require debate and consensus in Kenya.

6 WHOLE LIFE COSTS

In comparison with a gravel road, the cost structure of sealed LVRs is quite different, usually costing more initially but requiring much less maintenance in the long run. Scarcity of gravel, longer haul distances and huge maintenance requirements now make gravel roads uneconomic and unsustainable in many areas and, in whole life costs terms, other solutions are superior. However, whole life costs can only be estimated if demonstration examples of the candidate structures have been monitored for long enough for their long-term performance to be evaluated. In the meantime, examples from other countries can act as a guide and such evidence must form part of any review.

Proposed Activity 5

Although evidence for this is now overwhelming, precise economic calculations are not always possible because some of the options have not been tested for long enough or often enough to calculate the whole life costs properly and with statistical reliability, hence trials and continued performance monitoring and evaluation are required as part of a research strategy. In the interim assessments need to be made from consideration of the international literature and draft/preliminary WLCs calculated.

7 CURRENT RESEARCH IN KENYA

Some trials sections have already been constructed in Kenya but they are very new. They are of considerable importance because they include designs that have not been adequately tested in research studies elsewhere. These trials need to be monitored and their performance assessed fully to provide data for the theoretical underwriting of the new structural designs and relaxed specifications to enable the matrix of designs across traffic and subgrade strength for the various methods to be developed. An interesting feature of these trials is that the surfacing of all of them is identical (cold AC mix) hence it is the differential performance of the roadbases and the adequacy of the thickness designs that is the primary output.

Proposed Activity 6

Although it is early in the life of these trials, it is important to review the designs and to complete various evaluation tests. For example, deflection data will provide a means of evaluating the effectiveness of the designs for subgrade protection and DCP tests will enable the in situ material strengths to be compared with design expectations and potential levels of relaxation of specifications.

8 CONTENT OF THE LVR MANUAL

Several LVR manuals have been compiled for other countries in Eastern and Southern Africa in recent years (Ethiopia, South Sudan, Malawi, Tanzania) and also for countries in South East Asia. The engineering design requirements for such roads includes a minimum of structural design (pavement layer thickness) and materials selection and use but other aspects of LVRs also differ from those of more heavily trafficked roads, for example, horizontal and vertical alignment, cross sections and drainage, as well as the resources that are put into preliminary surveys of various kinds (geotechnical, materials, hydrology, etc). The degree of effort that is required for many aspects of the design of high volume roads cannot be justified for LVRs hence simpler, less costly methods should be adopted. As a result, the content of these manuals varies

considerably. The first task is therefore to define the scope of the proposed Kenyan LVR manual. The following Table lists the range of topics that might be considered for inclusion.

Table 3: Range of Topics Suitable for Inclusion in an LVR Manual

	Topic	Differences
1	Pavement structural design	Less substantial (thinner and relaxed standards)
2	Materials (subgrade, sub-base and roadbase)	Relaxed standards
3	Surfacings	More variety
4	Geometric design	Lower standards
5	Site investigation	Simpler, less comprehensive
6	Route selection	Similar
7	Design options for geotechnical problems	Simpler, less expensive
8	Drainage, hydrology and hydraulic design	Simpler
9	Water crossing structures	Simpler and less expensive
10	Road safety	Ideally similar standard but, in practice, less so.
11	Maintenance	Often different
12	Environmental aspects	Similar in principle but less severe
13	Whole life costs	Lower
14	Work methods (how to construct)	Different
15	Problem soils	Similar

Part 3 of the current Road Design Manual deals with topics 1, 2, and 3. Part 1 deals with geometric design. The other topics are dealt with elsewhere. Some differences exist for LVRs in many of the topics in the Table and these may be considered sufficiently different to warrant inclusion in the LVR manual. It is proposed at this stage that the LVR manual should mirror the contents of the main pavement design manual (Part 3 of the Road Design Manual) but should also include information about variations in geometric design standards. Climate change effects would be covered under topic 12 above.

Proposed Activity 7

Review the geometric standards for LVRs and suggest improvements

9 REVIEW OF PART 3 OF THE ROAD DESIGN MANUAL.

It is not the purpose of this project to review the main pavement design manual but in the process of carrying out this assignment there are several aspects of the manual that clearly need review. For example,

1. Since the manual was written, the pattern of axle loading has almost certainly changed and the average values for the esas of vehicles (used in the absence of an axle load survey) has probably changed too.
2. The upper traffic limit now needs to be extended to higher traffic levels.
3. There are a number of areas where more detail is required. For example, the design of AC surfacing for severe conditions has improved considerably and details are needed in the manual unless they are contained elsewhere.

These are just three aspects that became apparent during the course of this LVR review and is not comprehensive.

Proposed Activity 8

This activity is drafting the manual itself

Proposed Activity 9

A full review of Part 3 of the Road Design Manual is recommended as part of this proposed project.

Proposed Activity 10

Distribute to key stakeholders and organise workshop(s) for discussions and feedback

Proposed Activity 11

Edit draft and prepare for publication

Proposed Activity 12 (Phase 2)

Develop and deliver a training programme

A further phase of the project entails updating the manual on a regular basis resulting from advances in knowledge resulting from research carried out in Kenya and also research carried out internationally. Much of this is expected to be the addition of more options.

10 SUMMARY OF MAIN ACTIVITIES

Activity No.	Description
1	<i>Review of the Kenyan Pavement Design Guidelines for Low Volume Sealed Roads, identifying urgent amendments and additions to enable the document to be issued as an interim manual for immediate use</i>

2	<i>Review subgrade strain criteria. Develop possible modifications for the Kenyan manual. Check the existing manual to identify where the published criterion is actually a critical design factor.</i>
3	<i>Determine the effect of revised subgrade criteria on the thickness designs</i>
4	<i>Review the relaxed material standards developed for LVRs and compare with potential relaxations for use in Kenya</i>
5	<i>Review the international literature and draft/preliminary WLCs calculations for the various design options</i>
6	<i>Review the experimental designs and complete various evaluation tests.</i>
7	<i>Review the geometric standards for LVRs and suggest improvements</i>
8	<i>Draft the manual</i>
9	<i>A full review of Part 3 of the Road Design Manual</i>
10	<i>Distribute to key stakeholders and organise workshop(s) for discussions</i>
11	<i>Edit draft and prepare for publication</i>
12	<i>Phase II – develop and deliver a training programme</i>

11 RESOURCES REQUIRED

Based on previous projects of a similar nature a total input of 6 man months is needed for Phase I. Two persons are required to deliver the project as quickly as possible. Both should be very experienced pavement design engineers in low volume roads but one will be the senior consultant who will direct the project. It is anticipated that 10man weeks are needed for the senior consultant and 16 for the other)

12 TIMETABLE

The proposed timetable is as follows:

Activity No.	Begin	End	Duration	Deliverable
1	January 2014	January	4 weeks	Interim Manual
2	January 2014	April		
3	January 2014	April		
4	January 2014	April		
5	January 2014	April		
6	January 2014	April		
7	January 2014	April		Review Part 1 of PDM
8		May		Draft Manual
9		June		Review Part 3 of PDM
10		June		Workshop
11		July		Publication
12	July, Phase II	September		Training programme

13 TOTAL COSTS

Phase 1: 26 man weeks plus costs

Phases 2 and 3 to be determined

For continuity purposes it is recommended that all 3 phases are budgeted together and continuous.

PART D: DEVELOPMENT OF CONCEPT MODEL AND STRATEGY FOR TRANSPORT RESEARCH CENTRE

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1. INTRODUCTION

The Materials Testing and Research Department (MTRD), of the newly-formed Transport and Infrastructure Ministry, is developing a framework for their **transformation to a Transport Research Centre**; and priority activities based on their mandate and their Strategic Plan (AFCAP Report on Development of Low Volume Roads Research Capacity in Kenya, March 2013), prepared under AFCAP/KEN/089G activities. This project is **an extension** to that work and is referred to as PHASE 1. It is funded by the Africa Community Access Programme (AFCAP) a research programme underpinned by the UK government's Department for International Development (DFID).

1.1 Background and Objective

To underpin Kenya's expected growth an efficient road and transport network is required for improved access to support all key sectors of the economy. It is recognised that research is required both to **inform and develop policy** and also has a critical role in the development and efficient management of transport infrastructure.

The Kenyan Government Coalition's Manifesto for Transforming Kenya (2013 – 2017) sets out an agenda for *Transport & Infrastructure – A 21st Century Transport & Infrastructure System*. The challenge set is to deal with an aging road and rail network in order to improve accessibility, trade activities, freight and safety. The solutions identified include:

- Reforms of the road Authorities and Departments
- Devolution of management of rural roads to the Counties
- Programme of upgrades to the major road network. Increase the paved network from the current 11,000km (7%) to 24,000 (15%) including 8,000km of LV roads, in five years
- Strengthen trans-national corridors
- Improvements to rail, marine, inland water and aviation transport

Under current reforms, it is proposed to establish a **National Transport Research Institute** which would support the following modes:-

- Road transport
- Rail transport
- Maritime and inland water transport
- Air transport, and
- Non-Motorised and Intermediate Means of Transport (NMIMTs).

In addition to developing research strategies to address requirements of the Manifesto, MTRD will address strategies in support of the Integrated National Transport Policy (2009). *'Transport research is required to inform not only policy formulation, but also in monitoring and evaluation of the various intervention strategies. It is therefore necessary to undertake research on the outcomes of the intervention strategies, the impact of transport on the economy and environment, transport safety and security, land use and transport, people attitudes and behaviour patterns in relation to transport, industry and transport, transport logistics, modernization of public transport amongst other issues. In Kenya, there is lack of a focal point to facilitate such research. In addition, there is need for dissemination of research findings to the relevant stakeholders'* (INTP 2009).

MTRD intends to strengthen its core skills and research delivery and to evolve into a transport institute that will be recognized internationally as a centre of excellence. The long term outcomes of implementation of research findings is expected to **deliver more durable roads and transport, lower transport operating**

costs, shorter travel times, lower accident and fatality levels, improved designs and standards for construction and maintenance, and more efficient and cost effective operations.

Report Objective

To assist MOTI in their preparations for transformation of MTRD to a national transport research institute in order to build sustainable research capacity.

2. APPROACH AND METHODOLOGY

2.1 Approach

The approach of this Technical Assistance programme is to bring specific experience from other national research institutes to inform the process and to determine appropriate models to implement the strategic plans for transformation into a transport research centre of excellence over the next 5 to 10 years.

2.2 Methodology and Scope

The main theme is the Development of Concept Model and Strategy for Transport Research Centre and comprises the following activities:

ID	RESULT AREA / ACTIVITY
	Development of Concept Model and Strategy for Transformation to a Transport Research Centre
1	<p>Arrange overseas benchmark visits</p> <p>Arrange study tours to Australia and UK research institutes to look at institutional setting, technologies, programmes and delivery of research Also, to understand how they operate, their funding arrangements and technologies. The aims are to help inform establishment (and development) and also to develop long term assistance arrangements.</p>
2	<p>Assist MTRD develop long term vision and mission</p> <p>The plans will look forward 10 to 20 years and might encompass regional/international aims, as well as broadening the remit to transport and safety.</p>
3	<p>Assist MTRD explore scope and model options with MoTI</p> <p>MTRD will need to communicate proposed plans set up under Section 1 above with the PS and with MoTI and modify as necessary to gain approvals.</p>
4	<p>Develop institutional setting options within MoTI</p> <p>Institutional changes are taking place and will continue for the foreseeable future. Plans must be sufficiently flexible and adaptable to cover all future known options.</p>
5	<p>Set out timelines, programmes and roadmap</p> <p>An overall programme and roadmap will need to be developed, including milestones and key decision points.</p>
6	<p>Stakeholder Workshop</p> <p>Organise a stakeholder workshop to present and discuss the Draft Concept Models and</p>

3 LONG TERM VISION AND MISSION

3.1 Context

Kenya Vision 2030 sets out the country's aims to become a newly industrialised country providing a high quality life for all citizens. The country's GDP is expected to grow at an annual rate of 7 to 10%. To underpin this growth an efficient transport network is required for improved access to support the key sectors of the economy. The Ministry of Transport and Infrastructure and its supporting Departments and Authorities, currently plays a critical role in the development and maintenance of the network.

The percentage share of Transport Sector contributed by road sub-sector has averaged 64% over the four years to 2010. Air transport is the only other dominant mode at close to 20%. Rail is the main competitor for overland freight transportation, but its average share does not usually exceed 1% due to cumulative under-investment. Transport Services accounts for about 10%. Road transport accounts for about 93% of all freight and passenger traffic in Kenya. Roads are key enablers for economic, social and political development.

It has been recognised that research has an increased role in the development and management of the infrastructure. It is expected that more focussed activities will provide the basis for improving the long term capacity to undertake relevant, high quality, research that will assist Government develop evidence-based policy and programmes and also assist in the process of evaluation and monitoring to provide continual improvement in the transport sector.

3.2 Assisting Development of Transport Policy

The 2030 Vision aspires for a country firmly interconnected through a network of roads, railways, ports, airports, water and sanitation facilities, and telecommunications. By 2030, no region of the country would be classified as "remote". In addition, the City of Nairobi would be firmly interconnected through a network of roads, railways, ports, airports, waterways and telecommunications. The Vision proposes intensified application of Science, Technology and Innovation to raise productivity and efficiency levels. It recognises the critical role played by research and development (R&D) in accelerating economic development in all the newly industrialising countries of the world. The Government will create and implement an STI policy framework to support Vision 2030. More resources will be devoted to scientific research, technical capabilities of the workforce. Key transport plans and flagship projects proposed included:

- The First National Spatial Plan:
- A 50-year Integrated National Transport Master Plan:
- Dredging and /deepening of Mombasa Port
- Nairobi metropolitan region bus rapid transit system
- Development of light rail for Nairobi and its suburbs:
- Development of a new transport corridor to Southern Sudan and Ethiopia:
- Rehabilitation and maintenance of airstrips and airport expansion and modernisation:
- Ferry Services Programme

Key Transport Plans and flagship projects identified in the Jubilee Manifesto include:

- Prioritise and upgrade rural road, feeder road and major road network
- Improve and upgrade rail network to increase freight from 5% to 50%

- Construct commuter rail networks in all major cities
- Reconstruct JKIA and make it a regional airport hub
- Expand network of airstrips
- Develop national and international ports
- Develop policies to ensure safety of the transport system

The Integrated National Transport Policy (INTP, 2009) sets out the agreed roadmap of policy development of the different transport modes which is being used to inform policy formulation.

Relevant Strategic Theme priorities comprise:

- | | |
|----|---|
| E. | Develop and manage transport infrastructure to facilitate efficient movement of goods and people whilst ensuring environmental sustainability |
| F. | Research and development for an efficient transportation system |
| G. | Develop and enforce regulations and standards for safe, secure and efficient transport systems |
| H. | Mobilise resources and capacity building. |

The INTP sets out critical issues and policy for Transport Research and Development, as follows:

- **Critical Issues**

Transport research is required to inform not only policy formulation, but also in monitoring and evaluation of the various intervention strategies. It is therefore necessary to undertake research on the outcomes of the intervention strategies, the impact of transport on the economy and environment, transport safety and security, land use and transport, people attitudes and behaviour patterns in relation to transport, industry and transport, transport logistics, modernization of public transport amongst other issues. In Kenya, there is lack of a focal point to facilitate such research. In addition, there is need for dissemination of research findings to the relevant stakeholders.

- **Policy**

The GoK will establish a National Transport Research Institute to undertake research into aspects of transport and encompass all modes and will further provide appropriate incentives for the private sector to invest in transport research and development. It will also carry out research on road safety in collaboration with NTSA>

The critical issues for the various transport modes are identified in the INTP as:

ROAD TRANSPORT

Transport by its nature is ever changing and requires organized research to be carried out on a continuous basis. This will facilitate in development of a data bank from which trends in the sector can be monitored and projected. Areas, which require research to be carried out, among others, are:

1. Cost-effectiveness/benefits of transport sector interventions including master plans
2. Available road building materials and how they behave
3. How available local materials can be improved to meet set standards and specifications of road building and maintenance
4. Trends in road safety situation to show what types of interventions are required
5. Incorporation of NMIMTs
6. Relationship between transport and socio-economic development.

RAIL TRANSPORT

To achieve safe and effective rail service delivery, there is need to undertake research to support the development of a sustainable rail transport system. Railways currently do not have research facilities for materials, equipment and operations and for studying human behaviour.

MARITIME TRANSPORT

Development of the maritime transport industry in Kenya has been hampered by lack of research and development systems. Research and development is an important component of any modern maritime transport industry and further complements the preservation of the marine environment.

INLAND WATERWAYS TRANSPORT

Inland waterways transport system requires research on appropriate infrastructure and operational systems. Research is also required to undertake hydrographic and survey studies to develop charts that can be used for operations on a lake.

AVIATION

Effective operation and management of the aviation industry, including the formulation of policy, requires adequate statistical data and information.

3.3 Institutional Setting and Reform

The current institutional framework of the roads subsector is under review. Three existing Authorities - representing Rural Roads, Highways and Urban Roads; and a Roads Board are responsible for the management and development of the various road classes, reporting to the Principle Secretary (Infrastructure).

Four functional Departments and an Institute perform complimentary activities, as follows:

- Materials Testing and Research Department (MTRD)
- Roads Department
- Quality Assurance Department (QAD)
- Mechanical and Transport Department (MTD)
- Kenya Institute of Highways and Buildings Technology (KIHBT)

Reforms under consideration are transformation of MTRD, KIBHT and MTD into Semi-Autonomous Government Owned Entities (GOE's) in order to efficiently provide services to a Roads Authority and to the private sector. As the same time, consideration is being given to the INTP proposals to broaden MTRD's remit to Transport Research.

The precise scope of the Transport Research Centre and associated activities should be discussed and agreed and incorporated into its Mandate. Whilst it is relatively straightforward to apply MTRD's skills and expertise to similar activities to those it currently undertakes, such as runway pavement designs or rail infrastructure maintenance, it is likely that operational or vehicle-related activities would be included.

3.4 Research to Support Government Road Targets

Specifically, in relation to roads, the Government targets are:

- Increase the paved network from the current 11,000km (7%) to 24,000 (15%) including 8,000km of LV roads, in five years using modern development instruments such as concessions, PPP, BOT and toll and maintenance arrangements
- Develop the necessary policies to ensure safety of all transportation systems with an emphasis on road safety
- Rehabilitate existing roads and open up new areas
- Upgrade unpaved road networks to make them accessible to motor vehicles.

The transport research centre will need to implement research to address these specific requirements.

3.5 Regional Research Needs

Significant changes are taking place throughout Africa in how research is carried out and implemented. Government research Institutes or units are currently under development in Ethiopia, Mozambique, and South Sudan as well as South Africa; and are being considered for Uganda, Tanzania and Ghana.

As part of a regional research initiative, plans are being considered to establish regional research hubs and Kenya is extremely well placed to take on that role for East Africa.

4 DEVELOPMENT OF SCOPE AND TRANSFORMATION MODEL

It is planned to develop of a research centre of excellence with much enhanced facilities and infrastructure with a linked capacity building programme. These plans would require a financial support from a number of sources such as MOTI, Roads Board, AFCAP, EU and World Bank to create a long term funding platform. Within a long term Government Transport vision, MTRD would be ideally placed to become a Road and Transport Research Institute and eventually an East African Regional Centre of Excellence.

4.1 Scope of Research Activities

Typical activities to deliver research strategies and programmes are set out in Figure 1.



MTRD already covers many of the activities in the outer circle in relation to roads. In future it will seek to provide more services relating to the inner circled activities comprising:

- Training and capacity building
- Product development
- Advice and consultancy
- Monitoring and evaluation.

Road and transport research is designed to address national and regional policies and to reflect, strategies, priorities in order to deliver programmes, plans and projects, See Figure 2 below. Monitoring and evaluation is essential to determine effectiveness of the activities and to inform future policy improvements. This section of the report addresses relevant policies and strategies in order to inform the research process. Research and development (R & D) is needed to provide new methods, materials, and practices for the roads sector, and technology transfer in terms of dissemination and implementation are

needed to ensure that the R & D results are implemented by roads agencies. As illustrated in Figure 3, the sequence of events from the research idea to implementation of the research product comprises a number of inter-dependent, decision-making activities with the same issues having to be dealt with in different policy arenas. Moreover, the various inter-linked processes tend to be iterative, involving numerous activities and feedback loops.

The path from research, through development, to dissemination and full implementation can vary widely over time, depending on a variety of factors including the type and complexity of the research, the relative advantage it offers over existing practice, how easy it is to be trialled, compatibility with existing standards and practice and attitudes to risk.

Figure 1: Typical research activities carried out in a research institute (courtesy TRL)

Vision	Sets out the country's <i>goals</i> and objectives in the transport sector, including a <i>vision</i> for transport and road research.					
	Policy	Based on the <i>Vision</i> ; sets out the <i>policy</i> on research. Requires legislative support.				
		Strategy	Develops a <i>strategy</i> for achieving the research <i>policy</i> .			
			Programs	Incorporate research policy and strategy in national <i>programs</i> .		
				Plans	Detail specific means of achieving research programs	
					Implementation	Ensures agreed <i>plans</i> implemented within broader <i>programme</i> on research.
					Monitoring and evaluation	Checks whether projects achieved policies

Figure 2: Elements of an enabling framework on transport and road research

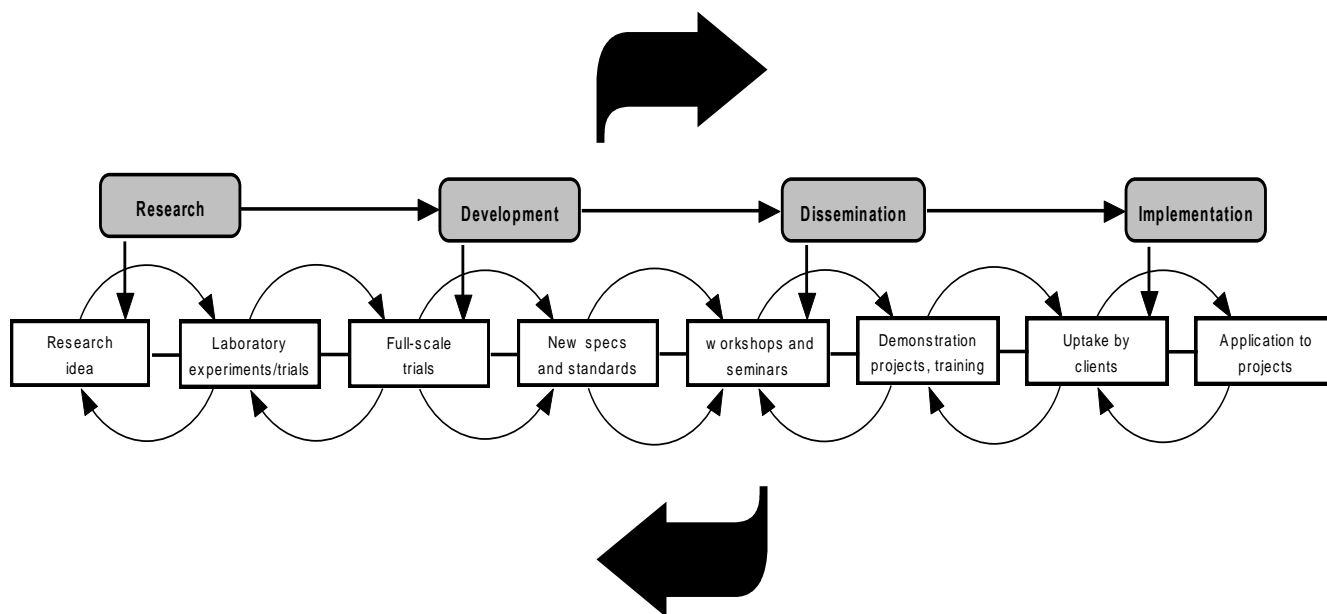


Figure 3: Processes for developing and implementing research

4.2 Alternative Models for Transformation

MTRD’s current mandate is testing and research on roads and building construction materials, road pavement design and construction specifications, construction quality control and assurance, and post construction evaluation of roads and other infrastructure.

The Integrated National Transport Plan (INTP, 2009) sets out a policy to establish a National Transport Research Institute to undertake research into aspects of transport and encompass all modes.

Options and Recommendations

Policies on scope of research, relating to the decision whether the Centre addresses ‘transport’ and ‘roads’ depends on a number of factors including:

- Is research needed to inform roads policy, transport policy or integrated transport policy?
- What are the current strategies and priorities for economic development?
- How well developed is transport infrastructure?
- Can research for both be afforded?
- Is there a current institute capable of taking on a transport research mandate?

There are three basic options being used internationally:

1. Road Research Centre only

These were established historically to support roads infrastructure development programmes. National examples include India, Australia, Ethiopia, Tanzania, Ghana and Mozambique. In Africa road research centres have historically been separate because of the low priority of other modes of transport. That situation is changing.

2. Separate Road and Transport Research Centres

With the accelerated growth of maritime, aviation and rail transport and the need for integrated logistics and freight, many countries have evolved some form of transport research as well as roads. In some cases the research Centre’s have evolved in Universities, in others research has just been for one mode of transport (eg rail or aviation). Roads have almost always been more dominant. Examples are America, China and France.

3. Combined Road and Transport Research Centre

With the rapid increase in multi-modal transport, transport hubs, integrated journeys, transport services, Integrated transport systems (ITS) there is an increased emphasis on transport research, freight and journey management. Examples of partially or fully combined research centres are UK, Sweden, Germany, Czech Republic. There are a number of Transport research Centres in Europe, see below;



(Courtesy ECTRI)

It is recommended that MTRD is transformed into a Transport Research Centre and there is an agreed evolutionary path to incorporating transport activities from its current road specialisation.

That pathway comprises:

- Legal Instrument established with Draft Bill and subsequent Act of Parliament
- Budget and strategic plan approval

- Priority on supporting the roads programme and building relevant capacity and skills
- Establish transport research in areas complimentary to MTRD's road programme, such as railway infrastructure, geotechnics, airport pavements, transport data and modelling.
- Establish Divisions for the different modes of transport
- Through agreement on Government prioritisation and transport stakeholders, build additional skills and capability and links to other Centres of Excellence, academia and international institutes to build new research skills in both roads and transport.

4.3 Models for Institutional Setting and Funding

Decisions on institutional setting and level of autonomy is affected by a number of considerations. Some of the relevant factors include:

- Extent of desire to introduce creativity, flexibility, independence, impartiality and self-determination of an institute
- Ability of government to achieve step change improvements in levels of administrative beurocracy, standards of leadership and management, procurement and delegation of powers to an institute
- Level of recognition of unique nature of R & D and related scientific excellence and the need to have a separate style of management and development of the institute and its scientists.
- Level of commitment to establishing and maintaining a true Centre of Excellence
- Ability to fund R & D in a sustainable manner from a range of sources
- Ambition to become a regional hub and international Centre.

Options and Recommendations

Set out below are three simple illustrative institutional models for the establishment/transformation of a Transport Research Centre. These are based on current international practice on scope and institutional setting for road and transport centres. Specialist knowledge and expertise is needed to cover legal definitions of companies, corporations, institutes, private and public sector organisations, their appropriate funding models, and related precedents.

1. **Integral** part of a Ministry of Transport or Roads, usually associated with a Central Materials Laboratory. Examples of Government Research Centres are:
 - Central Road Research Institute, India (CRRRI)
 - VTI, Swedish Transport Research Centre
 - CML, Tanroads , Tanzania
 - LCPC, France

Funding: From Exchequer for establishment, facilities and staff. Any external work or testing returned to government. Research programme budget agreed through negotiation annually. Non spent budget returned annually.

Advantage: In-house and its priorities are set by Government. Can carry out collaborative work 'government – to – government'. Ability to carry out external work through approval.

Disadvantage: Managed by public administrators so constrained by government procurement, little direct control and potential beurocracy restrictions. Research dictated by current government policies and strategies. Remuneration tied to Government grades and employment packages so can be difficult to recruit and maintain high caliber staff.

2. **Semi-Autonomous Government Agency (SAGA).** A semi-autonomous government agency is a semi-private agency where it operates without government supervision under its own charter. A government ministry or department is managed by the public administrators. Usually, the former

delivers its services more promptly because of the business nature while the latter is purely a public service.

Are established using statutory instruments to provide services and an Act of Parliament. Institutionally, can be as close or independent of Government as is necessary to meet its Vision, Mission and objectives. Usually has some form of Board of Directors and a CEO. Government may appoint the CEO or a Chairman and Non-Executive Directors. Directors have responsibilities and liabilities through a Companies Act.

Examples of SAGA's are:

- Australian Road Research Board (ARRB)
- South African Council for Scientific and Industrial Research, Transportec, CSIR

Funding: Majority of funding from Exchequer, with rest from wide range of clients, including international governments. Surplus funding can be reinvested back into research and facilities.

Advantage: In-house with priorities set by Government but with management control by Agency on development and commercial activities. Some autonomy on business and staff development. Independent remuneration packages are flexible so recruitment and retention not normally a problem.

Disadvantage: Limited accountability and financial capacity. The exchequer is expected to take on any contingent liability and financial overruns.

3. **Private Company.** There are several categories of 'private company' and Non-State Actors (NSAs). A private company limited by shares, usually called a private limited company (Ltd) or a company limited by guarantee incorporated under national laws. It has [shareholders](#) with [limited liability](#) and its [shares](#) may not be offered to the general public, unlike those of a [public limited company](#) (plc).

A privately held company or close corporation is a business [company](#) owned either by [non-governmental organizations](#) or by a relatively small number of [shareholders](#) or company members which does not offer or trade its company [stock \(shares\)](#) to the general public on the [stock market](#) or exchanges, but rather the company's stock is offered, owned and traded or exchanged privately. More ambiguous terms for a privately held company are unquoted company and unlisted company.

Normally has a Board of Directors. There will be minority or zero shareholding by Government. Government contracts subject to open competition from consultants and SAGA's.

Privatisation of public to private sector organisations has taken place.

Funding: wide range of clients, including government, normally through a competitive bidding process. Examples of private research organisations in the road and transportation sector are rare:

- Transport Research Laboratory (TRL Ltd), a subsidiary of a non-profit distributing parent company, TRF, limited by guarantee through around 80 sector members. Formerly a Government Research Department.
- Transportation Research Board, TRB, a Division of the National Research Council— a private, non-profit distributing institution that is the principal operating agency of the National Academies

Advantage: Full control over commercial activities and operational management. Ability to mix national /international work and public/private work. Also able to build business entrepreneurially. Ability to invest and re-invest internally and to create subsidiaries and Joint Ventures. Remuneration packages set by market conditions.

Disadvantage: government has no control. Potential loss of underpinning Government work and business exposed to market threat of competitors and ownership. Research programme dictated purely by markets.

There is a further category of business, which is a **corporation**. It can be public or private, is an organization formed with governmental approval to carry on business (or other activities), which can issue shares of stock to raise funds with which to start a business or increase its capital. One benefit is that a corporation's liability for damages or debts is limited to its assets. For private business corporations the Articles of Incorporation must include the name of the responsible party or parties (incorporators and agent for acceptance of service), the amount of stock it will be authorized to issue, and its purpose. Corporation shareholders elect a board of directors.

Examples of exemplary national research institutes, covering both roads and transport, are set out in the Appendix. They comprise:

- ARRB, Australia
- TRL, UK
- CSIR, South Africa
- Transportation Research Board, USA

They demonstrate a wide variety of institutional setting, remits, legal status, management, strategies and delivery mechanisms from which the following recommendation is made:

It is recommended that Kenya Government transforms MTRD into a Transport Research Institute as a SAGA.

This is based on the following observations:

- *When a research centre is wholly **integral** to a Ministry it does not have sufficient control on cash flow, investment and planning and is subject to the vagaries of annual budgets and external influences. Where a Government is constrained by beaurocracy, inefficient procurement and administrative procedures, this adversely affects the performance of the centre. Recruitment and retention is a systemic problem unless remuneration is competitive.*
- *A **private company** needs sustainable income from a range of clients, to be competitive and to have excellent facilities and staff to be sustainable. Although a number of Governments aspire to this institutional setting, there are very few successful examples in practice.*
- *In principle, a **SAGA** has all the advantages of the other options but with very few of the disadvantages. Its establishment and facilities are paid annually through a line budget item and periodic investments are negotiated. A funded government research programme, covering all relevant Directorates/Agencies, is set and approved by 1/3/5yr budgets. The government research-funded programme is topped up by contracts with other Governments, public and private clients and the surpluses reinvested back into additional facilities and self-funded research.*
- *MTRD is a functioning research and testing centre with a long history of delivery and a high reputation for quality and standards. It is understaffed, under-resourced and its buildings and facilities are in need of rehabilitation and replacement. Through careful investment and independent management, it is extremely well placed to deliver a very high Return on Investment (ROI) and, through its research programme, be instrumental in delivering the onerous targets and required reduced costs of transport construction and management. **To***

achieve this, MTRD will need external assistance in its transformation and capacity building over several years.

- *Support **funding** to transform MTRD into a Centre of Excellence is potentially available from the World Bank and from DfID (AFCAP)/EU grants. External research funds are potentially available from Development Partners, if capacity can be increased.*

5 RECOMMENDED MODELS AND STRATEGY FOR DELIVERY

There are 2 key components for delivery of an operational Research Institute:

1. **Management of the transformation and establishment of a newly formed Institute**
2. **Operational delivery and management of a challenging and broadened research programme**

5.1 Management of transformation and establishment of an Institution

Transformation from a Department to a semi-autonomous Agency will have several stages of development, with plans to be made and implemented in the short term to initiate the process. It is intended to transform to an Institute whether the SAGA takes place or not and so most of the activities remain the same.

Phases, roadmap and programme **components** envisaged are:

Phase 1: Preparatory Studies for transformation (6 months)

This report covers Phase 1:

- MTRD's draft strategic plan for research capacity building to support transport and infrastructure development and maintenance
- Strategy for research capacity and scope out research projects to support upgrading of 8,000km of unpaved rural roads to low volume sealed standards in the next five years
- Development of Concept Model and Strategy for Transport Research Centre
- Overseas benchmarking visits

Phase 2: Studies and preparations for transformation (6 months from Feb 2014)

Will be developed through an EU TA grant, and comprises:

- Finalise strategic plan for research capacity
- Finalise research scope to support upgrading 8,000km of LV roads
- Contribute to the establishment of a research forum
- Detail the model concept and strategy for transformation
- Carry out scoping and procurement activities for phase 3.

Phase 3a: Implementation Preliminaries (6 to 12 months)

Will be developed through procurement and comprises:

- Procurement of Programme Management consultant
- Procurement of legal, technical, architectural and engineering consultants
- Legal Instrument established with Draft Bill and subsequent Act of Parliament
- Programme management plans
- New Facilities design concept
- Detailed Implementation, administrative and HR plans
- Budget and strategic plan approval by MOTI
- Treasury approval of budget
- Agreement on priority research projects and funding model
- Funding arrangements with Banks and development partners

Phase 3b: Implementation (24 to 36 months)

Will be developed through procurement and comprises:

- Procurement of international research institute services
- Procurement and implementation of research programmes

- Operational set up and establishment
- Detailed design of buildings and facilities
- Procurement of contractors and construction supervision
- Development and capacity building programme to become a national centre

Phase 4: Development (up to 10 years)

- Construction of buildings, facilities and regional laboratories
- Long term training and capacity building
- Long term development and optimisation to become a sustainable internationally recognised Institute.

The **components** have a number of activities associated with them. Some of those activities would be managerial, others technical/projects or operational. The model is designed so that different elements are capable of being funded from a number of sources in combination. Those sources are planned to be:

- **Offices and Laboratories:** MOTI, World Bank
- **Staff, establishment and facilities:** MOTI, Roads Board
- **Long term TA Support for underpinning and capacity building:** AFCAP, EU
- **Core Programme Management Contract:** World Bank
- **Projects:** World Bank, AfDB, other Development Partners, Roads Board, Consultants, Contractors, Product Manufacturers
- **Specialist Training:** AFCAP, EU, Roads Board
- **Equipment:** World Bank and AFCAP.

5.2 Operational Delivery and Management of Broadened Research Programme

In order to achieve the tranformation in an orderly fashion, to grow capacity and also to deal with the challenges of delivering a very ambitious government roads programme, support will be needed to MTRD in a number of disciplines and related activities. Support needs will change and evolve through the above phases and there will need to be flexibility in the means of delivering the support services. In these circumstances it is preferable to commission a single organisation to perform a complete Programme Management function, who will coodinate and direct activities; and to secure a range of services through a consortium agreement and from short and long term sub-contracts.

The organisational delivery will have four key components:

- PROGRAMME MANAGEMENT
- INSTIUTIONAL AND COMMERCIALIATION
- INFRASTRUCTURE/ESTABISHMENT IMPLEMENTATION
- TRASPORT RESEARCH DELIVERY

PROGRAMME MANAGEMENT	<ul style="list-style-type: none"> ▪ Plan, coordinate and deliver 5 to 10 year programme ▪ Procure and manage components and delivery ▪ Organise finances, funding and cash flow
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The Programme Management Unit (PMU) will have demonstrable international experience of road research and its implementation. It will direct the transformation and coordinate the programme of activities to deliver an operational Institute through the Phases.

It will examine selected international institutions and their operations and experiences in order to use appropriate best practice, adapted to local needs. It will establish all necessary collaborations, consortia and subcontracts to perform all component tasks, plans, projects and operations.

The involvement of national and international stakeholders, Development Partners, the research community and international experts is a very important component and their support and participation in the development of research capacity is a prerequisite.

The output of this overarching Contract will be a financially sustainable Institute that has all the facilities and skills necessary to deliver a national research programme and disseminate results that directly contribute to national economic growth.

Institutional and Commercialisation

- Transformation to SAGA/Institute
- Business and operational plans and implementation
- Commercial Development plans and implementation
- Funding, bids, contracts

Organisational and administrative transformation plans are required for commercialisation of laboratories, product testing and technology development. Extensive support needed in producing international Standards and Manuals, in training and capacity building. Assistance is required to build and progress relations with donors and other funders to develop and implement a commercial business development and management strategy.

The Institutional and Commercialisation component is the development of the business case, business plans and commercial plans through Years 1 to 3, 5 and for periods 5 to 10 years. Detailed plans are required for the first three years with milestones, deliverables and measured outcomes. A full roadmap is required with detailed priority actions, activities and associated finances, cash flow and costs.

The procured consultants will use their experience in establishing and transforming national research capability and in the successful delivery of output/outcomes and their contribution to the national economy. Their experience and capability in securing government and external contracts will be used to win profitable work streams and to build local capacity.

These plans will include for enhanced offices, facilities, laboratories, survey and testing capability, both in Nairobi and at the Local Authorities.

It is proposed that the establishment of the buildings, laboratories and facilities are managed and directed by the Programme Management Consultants. The Chief Engineer, MTRD will use the services of a TA to oversee them. A series of subcontracts are envisaged to establish the physical infrastructure. In addition, a range of STE's are envisaged for specific specialised inputs.

Infrastructure/ Establishment Implementation

- Buildings, facilities, laboratories, equipment and services
- Regional laboratories and services
- HR implementation, capacity building & strengthening
- Operational management and quality

The delivery of improved buildings, laboratories and facilities; and their operational management, must be planned, costed and programmed around current operations. The design concept, its phases and its implementation will need to be developed so that Detailed Designs and associated Construction Contracts

can be let. The Design Concept includes the production of concept drawings, plans, 3D perspectives, inventories and sketch layouts for Labs/ Offices/Conference facilities.

Experts and advisors will be needed to plan these works and activities and to provide capacity building. These will include:

- Architect
- Facilities and design concept advisor
- Knowledge management, IT and ICT expert
- Laboratory services expert
- Research operations expert
- Financial/budgeting expert
- Transport experts

It is noted that there will be overlap between the activities in this component and the Institutional and Commercialisation component.

Transport Research Delivery	<ul style="list-style-type: none"> ▪ Strategic planning and project proposals ▪ Project manage research programme ▪ Technical training, audit and review ▪ Education and dissemination
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In order to deliver the capacity building and capability in an accelerated way a collaborative approach will be used. This component may be let as one Contract. This may also involve using TA inputs supplied under various arrangements with the Development Partners. In addition to subcontracts of work, expert national and international researchers will be needed, as well as secondment of experts into MTRD. It is proposed to involve other research centres, consultants, universities and individual experts in a combination of in-house and externally commissioned studies/projects.

The largest proportion of this component will be for research on Low Volume Roads using the research strategies and priority projects already underway. Other research activities will be for national (high volume) roads and for transport services.

It is proposed to establish several Transport Research Divisions within the Institute. This will be achieved through TA services, tasked with establishing and coordinating a priority programme of research. This will initially be through external contracts and arrangements with transport specialists and will be supported by a recruitment and capacity building programme.

APPENDIX: EXAMPLES OF ROAD AND TRANSPORT RESEARCH CENTRES

ARRB, Australia

ARRB provides research, consulting and information services to the road and transport industry.

ARRB applies research outcomes to develop equipment that collects road and traffic information and software that assists with decision making across road networks. ARRB is the leading provider of road research and best practice workshops in Australia.

Trusted advisor to road authorities for technical input and solutions

For over 50 years, ARRB Group Ltd (ARRB) has provided trusted advice, technical expertise and solutions to transport and road authorities across the world. ARRB's member agencies include federal, state and local government bodies and is a not-for-profit entity. ARRB and its members recognise the critical role they play in supporting one another to improve productivity, safety, sustainability and amenity outcomes for the public.

Key strategies include:

- conducting multi-disciplinary programs of research on national priorities for Austroads
- consulting services for members and the industry
- creating a hub for road industry knowledge and experience which provides certainty and reliability in information
- expanding knowledge sharing and transfer activities to meet industry needs
- developing and commercialising innovative technology and systems.

Areas of expertise

ARRB Group's capabilities cover the full spectrum of road transport operations including:

- materials, pavement and concrete design and testing
- transport policy, operations and economics
- infrastructure asset management
- bridge management and evaluation
- equipment manufacture and data collection services
- road safety
- traffic engineering & road design
- heavy vehicle testing and simulation
- parking
- climate change
- land transport resources and information
- knowledge transfer and capacity building.

Customers include:

- all state and territory road authorities within Australia
- national governments in Australia and New Zealand
- local government including local councils and associations
- state government
- national bodies and associations
- Australian and international aid agencies
- transport and mining companies
- private and engineering consultancies
- major construction firms
- defence, water, parks and wildlife government departments.

Strategic Plans, Values and Vision 2011-2020

ARRB's member organisations include federal, state and local government bodies responsible for managing the nation's transport and road networks. ARRB and its members, both individually and collectively as Austroads, recognise the critical role that they play in supporting one another to improve productivity, safety, sustainability and amenity outcomes for the public.

ARRB supports the activities and outcomes of its members and other customers across a range of industry sectors by:

- delivering technical expertise in areas of particular importance to Australasian road authorities through the Sustainable Expertise Model (SEM)
- managing a \$10 million research investment portfolio on behalf of road agencies
- sourcing and disseminating to members and customers world-class research and technical information
- operating as a commercially viable and sustainable business.

Delivering sustainable expertise

ARRB leverages the technical know-how of its resident experts and those of other bodies to oversee key programs and deliver practical solutions in areas of particular importance to Australasian road authorities. This approach also fosters expertise in regions and organisations where such investment is not yet sustainable. The key to success is collaborative relationships with member agencies, data providers and other sources of technical expertise.

Managing research investment

ARRB manages on behalf of its members a portfolio of research investment in the Australasian road network. As their trusted advisor, ARRB seeks to maximise members' return on this investment, supported by appropriate education, training and knowledge-transfer activities. Ultimately, it is about ensuring road authorities have access to world-class research.

Sharing industry knowledge and technical insight

ARRB shares knowledge through an extensive network including the MG Lay Library, the ARRB Journal, ARRB's biennial research conference, workshops, industry conferences, and participation in international research and technology development activities. At the heart of this is its ongoing links with leading local and international bodies, coupled with a commitment to providing members with the latest developments.

Investing in a stronger future for our members

By seeking to recover the full cost of work it undertakes, ARRB generates funds that are subsequently re-invested in various programs for the benefit of members. This comes about by having a sound understanding of member and industry needs, efficient project delivery systems and processes, and cost-effective support functions and facilities.

The way we work

ARRB is guided by a set of values that support the needs of members and customers. We collaborate with our members to bring out the best in each other, we understand what matters most to members and customers, and we respect people for who they are and for their knowledge, skills and experience.

We also aim to understand the challenges facing members and provide relevant insights and advice, we foster innovation and undertake world-class research that benefits all road-users, and we strive to uphold the highest professional standards while providing sound advice from a position of independence.

Bringing our work to life

While the provision of world-class research and advice is at the core of our business, ensuring it has practical application ensures road authorities and the broader transport sector can leverage our insights for the benefit of all road users.

WAPARC

The Western Australian Pavement Asset Research Centre (WAPARC) is a collaboration between ARRB, Main Roads Western Australia and several WA universities. It has a dual aim of developing pavement research capability in Western Australia and investigating pavement performance. ARRB acted as trusted pavement research advisors to Main Roads before the establishment of WAPARC and is fulfilling the Centre Director role, ensuring its focus on local issues while informing and being informed by the National Austroads program.

TSD and ROADCRACK

ARRB is working collaboratively with an international equipment developer, Austroads and our members to better understand and maximise the potential benefits of new technologies for assessing the structural capacity of the \$200bn road network. The Traffic Speed Deflectometer and RoadCrack offer a means of doing this with considerable cost and safety benefits.

Local Government PBS Access Tool

A major barrier to increased national productivity of the \$60bn freight task is 'last mile access' for large vehicles on local roads. Using research from several disciplines, ARRB is working with national, state and local government stakeholders to develop a means of rapidly assessing the suitability of local roads for carrying and safely accommodating large higher productivity vehicles.

Rail Knowledge Portal

The MG Lay Library has been commissioned to develop and maintain a knowledge bank of rail research and information by the co-operative research centre (CRC) for rail innovation, giving our members access to information relating to both major forms of land transport, reflecting their own increasing integration into the broader transport portfolio.

TRL, UK

TRL provides independent and impartial world-class research, consultancy, testing and certification for all aspects of transport.

Originally established in 1933 as part of the UK government, TRL privatised in 1996 to become a fully independent private company. TRL is wholly owned by the Transport Research Foundation (TRF), a non-profit-distributing foundation with no shareholders, enabling profits made by TRL to be passed to TRF and re-invested in scientific research. TRF is comprised of over 80 sector members from the transport industry, ensuring TRL continues to undertake the high-quality research it's renowned for.

We're committed to working with a wide range of customers in both the public and private sectors to help create the future of transport. Our 320 staff, many of whom are world-recognised experts, work at the cutting edge of transport, generating innovative solutions for customers on a wide range of projects from transportation to safety and environmental issues, from risk and infrastructure management to simulation and testing.

TRL's unique facilities ensure we're ideally placed to provide appropriate solutions to our customers and enable us to meet their wide range of requirements.

People

Rob Wallis is Chief Executive of TRL and its parent company, the Transport Research Foundation (TRF). Rob has over 30 years of ICT and professional / business services leadership experience, working across private, public and non-profit sectors in the UK and internationally. Industry specialisations include transport, logistics, supply chain and automotive sectors. Before joining TRL in 2013, Rob was with BSI (British Standards Institution) as Managing Director, Europe, Middle East & Africa (EMEA), an international division serving clients in over 70 countries. Prior to BSI, he held managing director and senior director roles leading transport-focused businesses at EDS, LogicaCMG and Hedra, having begun his career at the CAA.

Tim Andrews

Finance Director

Tim is the Finance Director of TRL and has 25 years experience working in medium-sized enterprises, mainly in Senior Finance Roles. Before taking on his present role, Tim led TRL's Transportation and Product Testing Divisions. He is a Fellow of both the Chartered Institute of Management Accountant and the Chartered Institute of Highways and Transportation.

Ian Graham

Commercial Director

Ian is Commercial Director for TRL and a Director of TRL and TRF. Ian has over 30 years' experience leading and working in businesses, primarily technical consultancies, across a range of high hazard/high business impact market sectors including road, rail and aviation. Ian is responsible for TRL's strategic and operational growth which includes international and rail expansion. He is a Chartered Director and Fellow of the IoD.

Tim Strong

Director, Transportation

Tim is responsible for TRL's Transportation Division, delivering innovative services and solutions to clients in software development (products and consultancy), urban and inter-urban network performance, human factors, driving simulators, simulation and modelling and Intelligent Transport Systems consultancy. Tim has over 10 years experience in delivering transportation projects and programmes of work.

Bob Collis

Director, Infrastructure

Bob has over 30 years experience in the appraisal, development and design of highway, airfield and public transport schemes. Bob is responsible for TRL's Infrastructure and Environment Division, serving UK and international customers in infrastructure design, asset management, environmental assessment and sustainability. He's also responsible for TRL offices in Scotland and Wales.

Neil Paulley

Director, TRL Academy

Neil has 35 years experience in transport planning and has worked extensively in the area of transport policy and demand forecasting. As Director of the TRL Academy, Neil has responsibility for science and engineering activities and their strategic development at TRL, for formulating and ensuring delivery of long-term research programmes and for ensuring technical quality across the company.

Customers

A TRL customer is often a customer for life. We consistently strive for excellence in the way we deliver projects and share knowledge.

Our respected industry reputation speaks for itself. A collaborative approach, exceptional customer service and innovative technical abilities mean we consistently win projects in a challenging market.

We have robust partnering relationships with many government organisations in the UK and internationally as well as with many private organisations. Key customers include the Department for Transport, the Highways Agency and Transport for London as well as Shell, QinetiQ, O2 and Pfizer, to name but a few.

Our customers include organisations from multiple sectors including:

- governments
- consultants
- emergency services
- IT
- motor sport
- security
- legal
- software
- local authorities
- manufacturers
- commerce
- aid agencies
- regulatory bodies.

Transport Infrastructure Engineering, CSIR, South Africa

Projects are undertaken in collaboration with international, national, provincial and municipal road authorities and agencies, universities, private sector associations, consultants, manufacturers, producers and contractors, while international networks facilitate the transfer of cost-effective technologies to South Africa. Team members also transfer knowledge to build sector capacity locally.

Core focus areas

- Road engineering and materials
- Rail infrastructure engineering.

Capabilities, research areas, competences and facilities

Capability	Pavement design and construction
<i>Research areas</i>	Design, construction and maintenance of transport infrastructure assets (roads, streets, airports, railways); and support a sustainable and cost-effective transport network
<i>Competences and facilities</i>	<ul style="list-style-type: none"> • Materials, including traditional, alternative, waste and novel materials, also supporting environmental engineering and climate change mitigation and adaptation

- Engineering design, analysis and modelling supporting sustainable construction
- Vehicle-pavement and infrastructure-environment interaction
- Geotechnical engineering

Capability	Accelerated pavement testing
<i>Research areas</i>	Data on behavioural characteristics and performance of road pavement materials and structures; accelerated loading testing; and international collaboration in accelerated road pavement testing
<i>Competences and facilities</i>	<ul style="list-style-type: none"> • Performance data capturing techniques and instrumentation • Real field characterisation of material behaviour (as opposed to laboratory models) • Structural capacity determination of existing road structures • Comparative testing of various road pavement structure types

Capability	Advanced materials testing
<i>Research areas</i>	Standard and special testing services; and development of specific equipment and test methods to meet the transport infrastructure engineering sector SET needs
<i>Competences and facilities</i>	<ul style="list-style-type: none"> • Soils and granular materials laboratory • Asphalt laboratory • Dynamic testing laboratory • Bituminous binders laboratory • Chemical laboratory • Mechanical workshops

Transportation Research Board, USA

The mission of the Transportation Research Board is to provide leadership in transportation innovation and progress through research and information exchange, conducted within a setting that is objective, interdisciplinary, and multimodal.

TRB IN THE NATIONAL ACADEMIES

TRB is one of six major divisions of the National Research Council— a private, non-profit institution that is the principal operating agency of the National Academies in providing services to the government, the public, and the scientific and engineering communities. The National Research Council is jointly administered by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. TRB’s varied activities—described below—annually engage more than 7,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest by participating on TRB committees, panels, and task forces. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation.

SERVICES

A resource to the nation and to the transportation community worldwide, TRB provides an extensive portfolio of services:

- ▶ Opportunities for information exchange on current transportation research and practice,
- ▶ Management of cooperative research and other research programs,
- ▶ Analyses of national transportation policy issues and guidance on federal and other research programs, and
- ▶ Publications and access to research information from around the world.

Fostering Information Exchange

TRB conducts a variety of programs and activities designed to support dialogue and information exchange among researchers, practicing transportation professionals, and others concerned with transportation.

Annual Meeting

Each January, more than 10,000 transportation professionals from around the world—including representatives of federal, state, and local government agencies; universities; and industry—gather in Washington, D.C., to participate in the world’s largest forum designed specifically for the formal and informal exchange of information among transportation researchers and practitioners. Approximately 3,000 presentations, including more than 1,500 peer-reviewed technical papers, are given throughout the week of this gathering. In addition, more than 200 TRB standing committees and numerous subcommittees hold open meetings to discuss current research and identify research needs.

Conferences and Workshops

Every year, TRB organizes 70 or more specialty conferences and workshops on subjects and issues of interest to the transportation community. These events provide opportunities for information sharing and in-depth exploration of specific topics, ranging from low-volume roads and statewide transportation planning to light rail transit, marine salvage, highway safety, and community impact assessment.

Standing Committees and Task Forces

In 1920 the Board established three technical committees to promote research and disseminate highway research findings. Today TRB maintains more than 200 standing committees and task forces that address all aspects and modes of transportation. More than 4,000 administrators, operators, engineers, attorneys, researchers, educators, and others concerned with transportation serve on these committees and task forces without compensation. Committee members identify research needs; provide information to the transportation community on research priorities and procedures; review papers for presentation at the TRB Annual Meeting and for publication; encourage the incorporation of appropriate research findings into practice; and develop special programs, conferences, and workshops. Standing committees and task forces are organized into 11 groups, each overseen by a separate council. Six of the groups, including some 150 committees, address various functional aspects of transportation, with a major focus on highways. Each of the remaining five groups concentrates primarily on a specific transportation mode.

<p>Modes Public Transportation Freight Rail Aviation Marine</p>	<p>Functions Policy and Organization Systems Planning and Environment Design and Construction Operations and Maintenance System Users Legal Resources</p>
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Electronic Networking

Information on the Board’s organization, committee activities, and upcoming conferences and meetings, as well as most recent full-text reports, can be found on TRB’s website (www.TRB.org). Users can search the current Publications Catalog and order reports online, apply to become a TRB affiliate, and register for the Annual Meeting and other events. TRB also distributes a complimentary weekly electronic newsletter, which provides timely information on TRB reports and activities as well as other news and information of interest to the transportation community. In addition, many TRB committees host electronic mailing lists and discussion groups that allow transportation professionals with common interests to pose questions and share information and experiences.

Field Visits

Each year, TRB technical staff visit the administrators and professional staff of all state transportation departments, many academic and research institutions, and other transportation-related agencies and organizations to exchange information concerning research and practice. These visits have four primary objectives:

- ▶ To identify specific problems and issues of importance to state departments of transportation and other transportation agencies and organizations;
- ▶ To offer assistance and information that can help in addressing these problems and issues;
- ▶ To identify topics and emerging issues that may be appropriate for TRB to address in the future, in its continuing efforts to support the needs of sponsors and the broader transportation community; and
- ▶ To assess the quality and value of services currently being provided by TRB and identify other activities or services that may help TRB better serve its sponsors and other constituencies.

Managing Research

TRB administers a number of major research programs sponsored by other organizations. The oldest and largest of these programs, the National Cooperative Highway Research Program (NCHRP), is sponsored by the state transportation departments in cooperation with the Federal Highway Administration. The Transit Cooperative Research Program (TCRP), initiated in 1992, is sponsored by the Federal Transit Administration. Both are applied research programs in which the potential users of research results have a direct role in project selection. In 2002 TRB began administering the Commercial Truck and Bus Safety Synthesis Program (CTBSSP), which is sponsored by the Federal Motor Carrier Safety Administration. The Congressionally requested Airport Cooperative Research Program (ACRP), which began work in 2006, is sponsored by the

Federal Aviation Administration (FAA). Two other new programs got under way in 2006--the Hazardous Materials Cooperative Research Program (HMCRP) and the National Cooperative Freight Research Program (NCFRP), both of which were authorized in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU).

Under all of these programs, TRB organizes panels of experts to provide guidance on technical aspects of the research and to translate the problems into project statements with well-defined objectives. Research proposals are then solicited from private and public research organizations with capability and experience in the problem areas to be studied. The technical panels review the proposals, recommend contract awards, monitor research in progress, provide technical guidance, and determine the acceptability of the final reports. More than 3,000 experienced practitioners and research specialists currently serve on Cooperative Research Program panels. TRB also manages programs of smaller studies focused on synthesizing current practices and analysing legal issues in both the NCHRP and the TCRP programs. Findings and publications from these synthesis and legal research projects have been well received by highway and transit practitioners.

National Cooperative Highway Research Program

Sponsored by the member departments of the American Association of State Highway and Transportation Officials (AASHTO) in cooperation with the Federal Highway Administration, the National Cooperative Highway Research Program was created in 1962 as a means to accelerate research on acute problems that affect highway planning, design, construction, operation, and maintenance nationwide. All of the state highway and transportation departments contribute to an annual cooperative pool of more than \$30 million to fund the program's activities. AASHTO committees and member departments and the Federal Highway Administration recommend research topics each year, and the AASHTO Standing Committee on Research (SCOR) determines both the projects to be funded and the levels of funding for those projects. A close working relationship with AASHTO during execution of the projects and the participation of experienced practitioners on project panels help ensure the application of completed NCHRP study results. For example, recent NCHRP projects have developed a recommended Mechanistic-Empirical Design Guide and software for pavements to be considered for adoption by AASHTO, and the multiple volumes of a 23-volume report, Guidance for Implementation of the AASHTO Strategic Highway Safety Plan.

Transit Cooperative Research Program

The Transit Cooperative Research Program was initiated in 1992 by three cooperating organizations: the Federal Transit Administration, the program sponsor, which has provided approximately \$8 million annually; the Transit Development Corporation, a nonprofit educational and research organization established by the American Public Transportation Association, which provides program governance through the TCRP Oversight and Project Selection (TOPS) Committee; and the National Academies, acting through TRB, which serves as program manager.

Under TCRP the transit industry develops innovative near-term solutions to operating problems and adapts appropriate new technologies and approaches to help meet the demands placed on the nation's public transit systems. The program's research covers topics relating to all aspects of public transportation, including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices. Each year, the TOPS Committee selects a program of research from the large number of candidate research problem statements submitted by organizations and individuals in the transit community. In recent years, TCRP projects have produced the second edition of the Transit Capacity and Quality of Service Manual and a series of volumes on transit security-related research, cover a variety of topic.

Airport Cooperative Research Program

The Airport Cooperative Research Program (ACRP) was authorized in legislation enacted in December 2003, and requires provision of funding through the annual federal appropriations process. ACRP, which began work in 2006, is an industry-driven applied research program that develops near-term, practical solutions to problems faced by airport operators. The congressionally authorized program is sponsored by the Federal Aviation Administration (FAA). Research topics are selected by an independent governing board appointed by the U.S. Secretary of Transportation that includes individuals from airports, universities, FAA, and the aviation industry.

National Cooperative Freight Research Program

The NCFRP carries out applied research on problems facing the freight industry that are not being adequately addressed by existing research programs. Sponsored by the Research and Innovative Technology Administration of the U.S. Department of Transportation, NCFRP will cover a range of issues to improve the efficiency, reliability, safety, and security of the nation's freight transportation system.

The Hazardous Materials Cooperative Research Program

The HMCPRP is a stakeholder-driven, problem-solving program, researching real-world, day-to-day operational issues in hazardous materials transportation with near- to mid-term time frames. The program, which began work in late 2006, is sponsored by the Pipeline and Hazardous Materials Safety Administration of the U.S. Department of Transportation.

Commercial Truck and Bus Safety Synthesis Program

The CTBSSP is a relatively small cooperative research program administered by TRB. This program, sponsored by the Federal Motor Carrier Safety Administration, supports projects that summarize existing practice in a specific technical area of commercial truck and bus safety. On the basis of an industrywide solicitation, a program oversight panel selects synthesis topics and provides general guidance for the program.

Strategic Highway Research Program 2

Congress authorized the second Strategic Highway Research Program (SHRP 2) in 2005 to investigate the underlying causes of highway crashes and congestion in a short-term program of focused research. To carry out that investigation, SHRP 2 targets goals in four interrelated focus areas:

- ▶ **Safety:** Significantly improve highway safety by understanding driving behavior in a study of unprecedented scale.
- ▶ **Renewal:** Develop design and construction methods that cause minimal disruption and produce long-lived facilities to renew the aging highway infrastructure.
- ▶ **Reliability:** Reduce congestion and improve travel time reliability through incident management, response, and mitigation.
- ▶ **Capacity:** Integrate mobility, economic, environmental, and community needs into the planning and design of new transportation capacity.

SHRP 2 is being conducted under a memorandum of understanding among the American Association of State Highway and Transportation Officials, the Federal Highway Administration, and the National Research Council. The multiyear program (four years of funding, seven years to complete) began work in March 2006. With estimated funding of about \$150 million, SHRP 2 is guided by an oversight committee and four

technical coordinating committees, one in each of the four focus areas. More targeted task groups provide assistance in areas requiring specific technical expertise, including preparation of requests for proposals and review of proposals.

Innovations Deserving Exploratory Analysis

TRB also administers the Innovations Deserving Exploratory Analysis (IDEA) programs, which encourage investigation of innovative but untested concepts offering the potential for technological breakthroughs in transportation. The investigations are pursued through small contracts designed to demonstrate the feasibility of the concepts. Participating researchers respond to solicitations for proposals in areas of general interest to the transportation community. IDEA investigations have led to the development of a number of transportation technologies that offer alternatives to current practice, as well as departures that promise solutions to long-standing problems.

The NCHRP IDEA Program, which supports highway and intermodal investigations, is funded by the state transportation departments through the National Cooperative Highway Research Program. Transit IDEA is financed through the Transit Cooperative Research Program. The Federal Railroad Administration sponsors the High-Speed Rail IDEA Program and cosponsors the Transportation Safety Technology IDEA Program, along with the Federal Motor Carrier Safety Administration.

Providing Policy Analysis and Advice

Since 1982, TRB has conducted more than 100 studies at the request of Congress, executive-branch federal agencies, the states, and other organizations on an array of complex and often controversial transportation topics of national significance. Examples include counterterrorism, truck size and weight regulation, airport capacity, transit use, high-speed rail, airline deregulation, dredging, environmental policy, school transportation safety, and automotive safety. New studies are initiated annually.

Each study is conducted by a specially appointed independent committee. Committee members are selected to represent appropriate areas of expertise and a balance of perspectives on the issues involved; members serve without compensation. The committee process is open to public scrutiny and comment, in accordance with the Federal Advisory Committee Act Amendments of 1997. Every final report undergoes a rigorous institutional review, in which outside experts examine the report in accordance with guidelines developed by the National Academies to ensure that the committee has provided a balanced and fair assessment of the topic addressed.

Examples of the impacts that specific TRB studies have had on transportation policy include: implementation of the recommendations in *The National Highway Traffic Safety Administration's Rating System for Rollover Resistance* concerning the rollover propensity of sport utility vehicles by NHTSA; the U.S. Department of Transportation's decision against recommending a regulation governing airline price competition in response to recommendations in *Entry and Competition in the U.S. Airline Industry*; and the adoption by the U.S. Department of Homeland Security of guidance from *Hazardous Materials Shipment Information for Emergency Response* in planning pilot studies for hazmat security systems.

Through special expert committees, TRB also provides a forum for conducting periodic or continuing reviews of specific transportation research and technology programs. Such committees have provided guidance on the overall highway research program, the Long-Term Pavement Performance studies, and technology transfer activities. Other study committees have provided advice on highway cost allocation studies, research programs of the Federal Railroad Administration, development of standards for intelligent transportation systems, the Bureau of Transportation Statistics' survey programs, and the federal transportation science and technology strategy.

Issuing Publications and Research Information

Through its publications and research information services, TRB disseminates transportation research results worldwide.

Publications

TRB produces and distributes about 200 publications annually. Most of the printed publications are also available electronically through the TRB website. The following are the major publications series:

- ▶ Transportation Research Records: Journal of the Transportation Research Board contains technical papers that have been accepted for publication through a rigorous peer-review process refereed by TRB technical committees.
- ▶ Special Reports present the results of policy studies, including studies mandated by Congress or requested by executive-branch federal agencies. These studies are conducted by expert committees appointed by the National Research Council (NRC).
- ▶ Cooperative Research Program (CRP) Reports, Syntheses of Practice, Research Results Digests, Web-Only Documents, and Legal Research Digests contain the findings of individual research projects sponsored by TRB's Cooperative Research Programs. Syntheses of Practice are also published for the Commercial Truck and Bus Safety Synthesis Program.
- ▶ Conference Proceedings contain papers, presentations, and summaries of discussions from conferences, workshops, and symposia convened by TRB.

- ▶ Transportation Research Circulars present technical material considered to be of immediate interest to the transportation community.

In addition, TRB issues a variety of other publications, ranging from the Highway Capacity Manual to general-interest periodicals. *TR News*, the Board's bimonthly magazine with an international circulation of 10,000, features timely articles on innovative and state-of-the-art research and practice in all modes of transportation. *Ignition*, issued quarterly, contains news of the IDEA programs. The TRB Transportation Research E-Newsletter, with more than 30,000 subscribers, provides free weekly updates on TRB reports and events, together with other news and research information of interest to the transportation community.

Online Research Information

TRB produces and maintains the Transportation Research Information Services (TRIS), the world's largest and most comprehensive online bibliographic database of published and ongoing transportation research. Currently, TRIS contains more than 600,000 records (abstracts and citations) on the various modes and disciplines in transportation, including planning, management, economics, design and construction, materials, environmental issues, safety and human factors, and operations. Each year, about 30,000 references from technical journals, conference proceedings, technical reports, and monographs are added to the database. Through a cooperative agreement with the Bureau of Transportation Statistics, the TRIS Database is available on the Internet through the website of the National Transportation Library. This service, TRIS Online, can be accessed through the TRB homepage at www.TRB.org. TRIS is also available through two fee-based services, Dialog and Silverplatter's TRANSPORT CD-ROM.

TRB produces and provides web access via www.TRB.org to a database of current research in transportation, the Research in Progress (RiP) Database. The RiP website provides access to more than 9,500 descriptions of current or recently completed transportation research projects from federal and state transportation agencies, universities, and international organizations.

The TRB Publications Index is a searchable index of the Board's papers and reports. This index now provides links to the full text of the publications or to direct ordering information. TRB's website also contains the largest database on intelligent transportation systems—the Caltrans PATH Database, produced by the Institute of Transportation Studies at the University of California, Berkeley. The Caltrans PATH database is also included in TRIS.

Response to Inquiries

TRB responds annually to several thousand specific requests from state transportation departments and TRB affiliates for information concerning transportation research and practice. The TRB Library and TRIS staffs handle and provide personalized responses to most requests. When appropriate, inquiries are referred to staff specialists for action.

TRB: AN EVOLVING ORGANIZATION

TRB's formation and evolution have strongly shaped its mission and services. Its current organization both reflects its history and provides an appropriate framework for delivering the services that TRB provides to sponsors, affiliates, and others concerned with transportation.

History

TRB was established in 1920 as the National Advisory Board on Highway Research to provide a mechanism for the exchange of information and research results about highway technology. Renamed the Highway Research Board (HRB) in 1925, the organization accomplished its mission through standing committees, publications, and an annual meeting. In the decades that followed, HRB steadily increased in size. Information exchange remained its sole mission until the 1950s, when it began to undertake management of ad hoc research projects. The first continuing research management activity—the National Cooperative Highway Research Program—started in 1962. During the 1960s, the Board's activities became increasingly multimodal in outlook. In 1974 the Highway Research Board became the Transportation Research Board. Since then, TRB's portfolio of services has expanded significantly—first in the early 1980s, when it began conducting studies of national transportation policy issues, and again in the 1990s, when Congress, the U.S. Department of Transportation, and the state departments of transportation asked TRB to undertake additional tasks, including management responsibilities for the Transit Cooperative Research Program, guidance of ongoing research programs such as the Long-Term Pavement Performance studies, and management of the Innovations Deserving Exploratory Analysis programs. More recent additions have included new cooperative research programs in airports, freight, and hazardous materials transportation, and the second Strategic Highway Research Program.

Organization

The TRB Executive Committee, whose members are appointed by the chairman of NRC, exercises oversight responsibility for the Board's programs and activities. Members include senior transportation industry executives, top officials of public-sector transportation agencies, and distinguished researchers from academia. The TRB Executive Office provides policy and operational guidance for TRB programs and activities, oversees committee and panel appointments and report review, provides support and direction for human resource issues and staffing needs, develops and directs the Board's communications and outreach efforts, and provides staff support to the Executive Committee and its Subcommittee for NRC Oversight. The Executive Office also manages the editing, production, design, and publication of many TRB reports, including the journal series, magazine, and other titles.

TRB's programs and staff members are organized into the following divisions:

- ▶ Technical Activities supports standing committees and task forces, organizes the TRB Annual Meeting and other conferences and workshops, and conducts field visits to transportation agencies, organizations, and research institutions.
- ▶ Studies and Special Programs convenes specially appointed expert committees to conduct policy studies and program reviews, maintains the TRIS database, provides library services, prepares synthesis reports on behalf of the Cooperative Research Programs, and manages the Innovations Deserving Exploratory Analysis (IDEA) programs.
- ▶ Cooperative Research Programs manages the National Cooperative Highway Research Program, the Transit Cooperative Research Program, the Airport Cooperative Research Program, the National Cooperative Freight Research Program, and the Hazardous Materials Cooperative Research Program.
- ▶ Strategic Highway Research Program 2 manages a targeted, short-term, results-oriented program of contract research designed to advance highway performance and safety for U.S. highway users.
- ▶ Administration and Finance provides financial, information technology, and other administrative support, including financial oversight of the contracts and grants that support the work of TRB, administration of publications sales and distribution, and maintenance of benefits and services for sponsor and affiliate organizations.

The Marine Board, formed in 1965 and previously situated within another unit of NRC, became part of TRB in 1999. The Marine Board provides a forum for the exchange of information relating to maritime transportation and related economic, environmental, and technology issues in a broader context. It identifies potential topics for policy studies, conferences, and other activities. The Marine Board is administratively housed within TRB's Technical Activities Division.

Sponsors and Affiliates

Sponsors and affiliates provide support for TRB core programs and activities. The two-way flow of benefits resulting from affiliation with TRB was a key part of the Board's founding concept. Today TRB has a tiered program that allows sponsors and affiliates to customize the services and benefits they receive in exchange for their fundamental support for TRB programs and activities that are of interest to the entire transportation community. There are five levels of core support: sponsor, sustaining affiliate, organizational affiliate, individual affiliate, and student affiliate. Basic affiliate benefits include reduced registration fees for the TRB Annual Meeting, a complimentary subscription to *TR News*, discounts on most TRB books and reports, use of the TRB Library, and assistance with use of TRB computer-based information services.

Sponsors are the major source of financial support for TRB's core technical activities. Federal, state, and local government agencies and professional societies and organizations that represent industry groups are eligible to be TRB sponsors. The level of a sponsor's contribution is determined on the basis of the services and benefits an organization wishes to receive; there is a minimum annual contribution, except for state transportation agencies, whose allocations are determined by formula. Sponsors include the transportation and highway departments of the 50 states, the District of Columbia, and Puerto Rico; the component administrations of the U.S. Department of Transportation; various other federal agencies; and a number of other private and public organizations. Sponsor organizations enjoy ex officio representation on the TRB Executive Committee either directly or, in the case of the state transportation departments, through their association. A list of current sponsors is available on the TRB website at www.TRB.org/directory/sponsors.asp.

Sustaining Affiliates include agencies and organizations that wish to contribute substantially to the support of TRB core programs but that do not elect to or, because of their status as individual corporations or businesses, are ineligible to become sponsors. Like sponsors, sustaining affiliates negotiate their

contributions on the basis of the level of services they wish to receive, subject to a minimum annual contribution. A list of current sustaining affiliates is available on the TRB website at www.TRB.org/directory/sustainers.asp.

Organizational Affiliates include organizations, institutions, agencies, and businesses, which can choose to contribute at one of three different levels of support, depending on the level of services desired. In addition to basic affiliate benefits, organizational affiliates receive most publications at no cost as well as complimentary registrations to the TRB Annual Meeting. A list of current organizational affiliates is available on the TRB website at www.TRB.org/directory/affiliates.asp.

Individual Affiliates and Student Affiliates (full-time students at accredited postsecondary institutions) enjoy basic affiliate benefits and may subscribe to TRB publications at a substantially reduced cost.

Finances

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PART E: REPORT ON STUDY TOUR TO UK

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List of Abbreviations

DFID Department for International Development
AFCAP African Community Access Programme
HA Highways Agency
LVSR Low Volume Sealed Roads
MTRD Materials Testing and Research Department
PS Principal Secretary
RMMS Road Maintenance Management System
SAGA Semi-Autonomous Government Agency
TMEA Trademark East Africa
TA Technical Assistance
ToR Terms of Reference

1. INTRODUCTION

The Africa Community Access Programme¹ (AFCAP) is a research programme funded by the UK Government's Department for International Development (DFID), which is promoting safe and sustainable rural access in Africa.

AFCAP has been asked by the Materials Testing and Research Department (MTRD) of the newly-formed Transport and Infrastructure Ministry to support the further development of the framework for their **transformation to a Transport Research Centre**; and priority activities based on their mandate and the Strategic Plan (AFCAP Report on Development of Low Volume Roads Research Capacity in Kenya, March 2013), prepared under AFCAP/KEN/089G activities. This project is **an extension** to that work and is referred to as PHASE 1.

AFCAP Project Objective

To assist MTRD further develop their strategic plans, scope out their priority projects and to help their preparations for transformation to a national transport research institute in order to build sustainable research capacity.

2. APPROACH and PROGRAMME

2.1 Approach

The approach of this Technical Assistance programme is to bring specific experience from other national research institutes to inform the process and to determine appropriate models and international expertise to implement the strategic plans for transformation into a transport research centre over the next 5 to 10 years.

2.2 Scope

There are 2 core Activity Themes:

- **Development of MTRD strategy for Transport Research Capacity**
- **Development of Concept Model and Strategy for Transport Research Centre**

As part of the second theme, study tours were planned to International Research Institutes. It was originally planned to have study tours to Australia and UK research institutes to look at institutional setting, technologies, programmes and delivery of research. Also, to understand how they operate, their funding arrangements and technologies. The aims were to help inform establishment (and development) and also to develop long term assistance arrangements.

There were several delays in making the trips by MOTI and eventually AFCAP cancelled the Study Tour to Australia under AFCAP 1. Further consideration will be given to undertaking a study tour to ARRB in Australia under AFCAP 2. This report records the key meetings, agreements and actions for going forward from the UK Study Tour.

2.3 Programme

Eng John Mosonik, Principal Secretary (Infrastructure), Kenyan Ministry of Transport and Infrastructure (MOTI) and Eng Stephen Kogi (Chief Engineer) Materials and Research Testing Department, MOTI attended the UK study tour between Wednesday, 14th May and Saturday 17th May 2014. Meetings were arranged as follows:

- Wednesday 14th am: DFID and Adam Smith International
Wednesday 14th pm: TRL

- Thursday 14th am: Highways Agency
Thursday 14th pm: TRL
- Friday 14th am: TRL
- Friday 15th: Travel to London - official meetings completed.

3. Meetings, agreements and actions

The following summarises scope of meetings, agreements and actions:

3.1 DFID, Wednesday 14th am

Attendees: Liz Jones, Senior Infrastructure Advisor and Professor Stefan Dercon, Chief Economist

The **purpose** of the meeting was:

1. To initiate dialogue directly with DFID to cooperate in developing a sustainable rural roads programme to underpin economic development of Kenya.
2. To discuss the need for a direct injection of funds to the road sector in Kenya in a similar manner to those in Uganda and Tanzania
3. To agree long term underpinning of the Kenyan Transport Research Centre, including TA assistance.
4. To explore the potential for Kenya to become a regional research hub.

It was agreed that:

- Further discussions should take place with DFID, including at DFID Kenya.
- AFCAP 2 would consider applications for funding of activities from MTRD related to the establishment of the Transport Research Centre.

Action: to continue discussions at the AFCAP Steering Committee meetings in Kenya in June.

3.2 ASI, Wednesday 14th am

Attendees: Matt Uzell, Adam Smith International (ASI) and Akram Ahmed (TRL)

The **purpose** of the meeting was:

To discuss how the Trade Mark East Africa (TMEA) Framework Contract held by ASI and TRL could be utilised for both Short-term and Long-term Technical Assistance activities to assist MTRD.

TMEA is an initiative funded by a range of development agencies to promote regional and economic integration in East Africa by working closely with the East African Community institutions, national governments and business and civil society organisations.

Working with partners in the East African Community to reduce the cost of transportation and increase trade competitiveness, TMEA is implementing a wide variety of programmes and projects. These include infrastructure development such as one stop border posts; organisational development and reform with regional integration and trade related public sector organisations; implementation of advocacy campaigns by civil society and the private sector; organisational development of civil society organisations. The current budget over a four year period is projected to be \$300m

It was agreed that:

- ASI would meet with TMEA in Kenya to explore possibilities of early TA to support the current gap activities between AFCAP 1 and AFCAP 2.
- ASI would report back on progress to TRL and MTRD

Action: to apply to funds from TMEA for MTRD Transport Research Centre activities.

3.3 TRL, Wednesday 14th pm

Attendees: Dr Annabel Bradbury, Neil Paulley, Akram Ahmed and Jacquie Berry

The **purpose** of the meeting was:

- Introduction to TRL, its organisation and activities
- Discussion on Kenyan objectives for Transport Research Centre and LV roads
- Introduce the TRL Academy

3.4 Highways Agency, Thursday 15th am

Attendees: Graham Dalton, CEO Highways Agency (HA), Mike Head (Cardno IT Transport) and Bob Collis (TRL)

The **purpose** of the meeting was:

- To understand the institutional setting, formation and mandate of the Highways Agency, and its relationship with DfT, Local Authorities and its research providers.
- To learn about its contractual suppliers arrangements, Area Maintenance Contracts, etc.
- To hear about how innovations are contributing to more economic, safer, less congested and sustainable roads.

Graham Dalton gave a presentation on the HA's operator role for the UK Strategic Road Network, activities, budget and challenges. Of particular interest was the forthcoming change of status of the HA to a Government-owned company.

It was agreed that:

- Government-to-Government cooperation should take place to help with Kenya's economic development goals.
- Links should be established with a relevant HA representative for further knowledge sharing.

Action: TRL to facilitate identification and establishment of HA Contact.

3.5 TRL, Thursday 15th pm

Tour of TRL facilities, laboratories and to view various field testing equipment, by Mary Treen, followed by presentations and discussions.

Attendees: Dr Helen Viner, Bill McMahan, Derek Palmer, Akram Ahmadi, Bob Collis, Mike Head

The **purpose** of the meeting was:

- To receive presentations on 'The need for research', transport economics, and DFID-funded NIAF 2 project in Nigeria
- To discuss how TRL could contribute to the development of a Transport Research Centre in Kenya

It was agreed that:

- MTRD had an interest in potentially using some of TRL's testing and laboratory facilities in the future
- The scope and activities underway in Nigeria for the DFID NIAF programme was of specific interest
- Some form of Call-off arrangement for MTRD to access TRL skills would be useful.

Action: TRL to see if the TMEA Framework can be used for a call-off arrangement and for MTRD to look to producing a service agreement with TRL.

3.6 TRL, Friday 16th am

Attendees: Rob Wallis, CEO TRL, Gary Taylor Cardno IT Transport, Mike Head, Bob Collis, Akram Ahmedi, John Fletcher

The **purpose** of the meeting was:

- For the delegation to meet Rob Wallis, TRL CEO
- For Rob Wallis to give a presentation on TRL's formation, remit, operations, finances and research strategy
- To discuss TRL's relationship with government and the private sector research policy development, research programme, outputs and outcomes.
- To explore how TRL can assist MOTI and also MTRD in its transformation to a Transport Research Centre
- Agree long term support/activities.
- To note the scope and programming of AFCAP 2.

It was agreed that:

- TRL wished to support the Kenyan Government in a long term programme around the scope and activities set out in the AFCAP report on 'Preparatory Activities for Transformation of the MTRD into a Transport Research Centre' (November 2013).
- MOTI would like to form a long term cooperation arrangement with TRL
- The possibility of establishing a call off contract should be investigated
- TRL would be interested in bidding for a Programme Management contract relating to transformation
- TRL would be interested in participating on specific research projects.
- TRL's skills and expertise in Road Safety is of direct interest to MOTI.

It was **noted** that the TRL CEO offered to make a visit to Kenya.

Actions: TRL to enter into an MOU with MOTI.

Mike Head to circulate the Final AFCAP Report to attendees.

MTRD to start applications for priority projects for funding under AFCAP 2.

MOTI to respond on their road safety requirements.