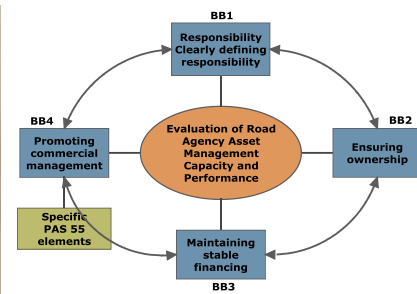


7th Africa Transportation Technology Transfer (T2) Conference Holiday Inn, Bulawayo

11th – 15th May 2015

Report on Workshops supported by AFCAP



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Abstract

The 7th Africa Transportation Technology Transfer (T2) Conference was held in Bulawayo, Zimbabwe, from 11th to 15th May 2015. The objective of the conference was to provide a forum to share, exchange and debate experiences, best practices, and new technologies in the provision, maintenance and management of transport systems. The Conference Theme was “Mobilising resources for transport infrastructure development and maintenance for poverty alleviation in Africa.”

The Africa Community Access Partnership (AFCAP) supported seven workshops and one field visit as part of the conference programme. The workshops were well attended and focused on a range of current issues relevant to the development of the rural transport sector in Africa. The purpose of this report is to ensure that the key issues arising at the workshops are recorded for wider dissemination and implementation where appropriate.

Key words

Knowledge Management, Transport Services, Asset Management, Monitoring and Evaluation, Biomimicry, Rural Roads, Institutional Development.

AFRICA COMMUNITY ACCESS PARTNERSHIP (AFCAP)

Providing solutions for safe and sustainable rural access across Africa

AFCAP is a research programme, funded by UK Aid, with the aim of promoting safe and sustainable rural access for all people in Africa and Asia. The AFCAP partnership supports knowledge sharing between participating countries in order to enhance the uptake of low cost, proven solutions for rural access that maximise the use of local resources. The AFCAP programme is managed by Cardno Emerging Markets (UK) Ltd.

See www.afcap.org

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Acronyms, Units and Currencies

\$	United States Dollar
ADB	Asian Development Bank
AFCAP	Africa Community Access Partnership
ASANRA	Association of Southern African National Road Agencies
ASCAP	Asia Community Access Partnership
COP	Community of Practice
CSIR	Council for Scientific and Industrial Research
DFID	Department for International Development
ESA	Equivalent Standard Axle
ETB	Emulsion Treated Base
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GPS	Global positioning system
ILO	International Labour Organisation
LVR	Low Volume Road
LVSR	Low Volume Sealed Road
MDG	Millennium Development Goal
NGO	Non Governmental Organisation
PMU	Project Management Unit
RIDP	Rural Infrastructure Development Programme
RMI	Road Management Initiative
SDG	Sustainable Development Goal
TRL	Transport Research Laboratory
UK	United Kingdom (of Great Britain and Northern Ireland)
UKAid	United Kingdom Aid (Department for International Development, UK)
UN	United Nations

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1 Executive summary

The 7th Africa Transportation Technology Transfer (T2) Conference was held in Bulawayo, Zimbabwe, from 11th to 15th May 2015. The objective of the conference was to provide a forum to share, exchange and debate experiences, best practices, and new technologies in the provision, maintenance and management of transport systems. The Conference Theme was “Mobilising resources for transport infrastructure development and maintenance for poverty alleviation in Africa.”

The Africa Community Access Partnership (AFCAP) supported seven two-hour workshops and one field visit as part of the conference programme. The workshops focused on a range of current issues relevant to the development of the rural transport sector in Africa. The purpose of this report is to ensure that the key issues arising at the workshops are recorded for wider dissemination and implementation where appropriate.

Workshops were held on the following topics:

- Knowledge Management
- Innovation in Design and Construction of Low Cost Pavements and surfacings
- Maintenance of rural access roads – A continuing, unresolved, enigma. Why? And what can we do to solve this problem?
- Monitoring and Evaluation Systems of Rural Infrastructure Development Programmes For Sustainable Development
- Towards Roads Designed for Flooding; Biomimicry in Road Design and Construction.
- Transport Services
- Evaluation of Road Agency Performance in Road Asset Management

The field visit was titled “Practical Demonstration on Provision of Affordable Access through Road Maintenance, Spot Improvement and Upgrading Interventions” and included a demonstration of a tractor-towed grading operation.

The workshops were well attended and the levels of participation were high. Important views and insights were obtained, and greater awareness was achieved in some important areas. The following is a summary of key findings and resolutions:

- Knowledge Management: The key ingredient to promote research uptake is public-private sector collaboration in knowledge creation, management and targeted dissemination to policy makers, practitioners and the general public.
- Innovations in the design and construction of rural roads: AFCAP is supporting research in new methods of road design and construction that would make it possible to provide surfaced road accesses to many rural communities where currently it is difficult or impossible to do so because of unfavourable soil and environmental conditions.
- Maintenance of rural access roads: In spite of the significant progress achieved in setting up road funds following the Road Maintenance Initiative (RMI) of 1987, the persistent lack of allocation of adequate resources for road maintenance remains vexatious and contentious; this requires a paradigm shift in the philosophy of politicians and authorities on the subject, with more specific legislation to ring-fence the road funds, as well as identifying other sources to expand the revenue base, all of which issues may warrant another RMI.
- Monitoring and Evaluation Systems: It is important to have monitoring systems on development projects that are flexible enough to take into account the monitoring requirements at project level, nationally and for the Sustainable Development Goals.

- Biomimicry in Road Design and Construction: There are real opportunities presented by the concept of biomimicry; with an open minded approach it is possible for biomimicry technology to contribute to better road provision.
- Transport Services: There is a strong link between road infrastructure and transport services; both are critical to improve access to markets, goods and services and are fundamental to the achievement of the SDGs.
- Evaluation of Road Agency Performance in Road Asset Management: Resuscitation of the RMI reforms is crucial in order to sustain the gains in institutional development in the roads sector in Africa, that otherwise these will gradually be lost.

2 Background

2.1 7th Africa Transportation Technology Transfer (T2) Conference

The 7th Africa Transportation Technology Transfer (T2) Conference was held in Bulawayo, Zimbabwe, from 11th to 14th May 2015. The objective of the conference was to provide a forum to share, exchange and debate experiences, best practices, and new technologies in the provision, maintenance and management of transport systems. It also provided a forum for sharing and exchange of existing and new approaches on technology transfer that enable countries to develop safe, efficient, reliable and affordable transport systems. The conference format included technical presentations, workshops, poster sessions, social events and product exhibitions.

The Conference theme was "Mobilising resources for transport infrastructure development and maintenance for poverty alleviation in Africa."

The conference was hosted by the Zimbabwe Ministry of Transport and Infrastructure Development in collaboration with the Association of Southern African National Road Agencies (ASANRA).

Three sessions within the overall conference programme were dedicated to parallel workshops and field visits. These were held on Day 2 (12th May) and Day 3 (13th May) between 14:00h and 16:00h, and on Day 4 (14th May) between 08:00h and 12:30h. A total of nine workshops and three field visits were held. AFCAP supported seven of the workshops and a field visit to view tractor-based maintenance of an unpaved road near Bulawayo.

2.2 Workshop Objective

The objective of the AFCAP workshops was to facilitate discussion, knowledge exchange and learning on a range of factors affecting rural access and mobility. These factors include rural transport policy, social and economic impacts of road investments, engineering design standards, road maintenance and coping with climate change, and transport services.

2.3 Workshops Format

The format of each workshop was flexible and was adapted according to the style of the Workshop Facilitator and the subject area. In each of the workshops a Key Speaker introduced the subject through a 20 to 30 minute presentation. This presentation highlighted critical issues arising from recent research or practical experience concerning the workshop subject. In most of the workshops a "panel of experts" comprising leading specialists in the subject area made a brief response in support of the Key Speaker's arguments and highlighting any additional issues. The discussion was then opened to the other workshop participants.

The Workshop Facilitator was responsible for chairing the workshop and ensuring that the discussion focused on the key issues raised by the Key Speaker and the expert panel, endeavouring to gain consensus on ambiguous issues where possible. The Facilitators recorded key issues arising and any agreements and differences of opinion on critical issues, which are presented in this report.

2.4 Workshops Proposals

Companies, NGOs and individuals were invited by AFCAP management to submit proposals for facilitating workshops at the T2 conference. Workshop proponents were free to suggest any theme for the workshop, but proposals that responded to the conference theme and

key AFCAP thematic areas of road maintenance, design standards for low volume roads and rural road safety were given preference.

The following proposals were received, and were all accepted for inclusion in the programme.

	Objective and Themes	Facilitator	Key speakers
1	Knowledge Management To explore and raise awareness about the function and modalities of knowledge management and research uptake at the level of African road research institutions and other stakeholders.	Gama Sibanda (ILO)	Madelein van Heerden (CSIR) Ernst Benedikt Riehle (GIZ Namibia)
2	Innovation in Design and Construction of Low Cost Pavements and surfacings Outputs of the research work on low cost surfacing in Mozambique including the use of non-conventional materials and the design of 'low cost long-life pavements' for LVRs; mainstreaming innovative LVR construction approaches; labour based application of low cost seals in Uganda.	Eric Gumbie (Director, Ministry of Transport, Zimbabwe)	Kenneth Mukura (TRL)
3	Maintenance of rural access roads – A continuing, unresolved, enigma. Why? And what can we do to solve this problem? To discuss the fundamental building blocks that affect the provision of adequate road maintenance including institutional, technical, management, operational and funding issues in order to identify constraints to effective maintenance.	Bernard Musarurwa (Consultant)	Mike Pinard (Regional Consultant)
4	Monitoring and Evaluation Systems of Rural Infrastructure Development Programmes For Sustainable Development To facilitate knowledge exchange, discussion and learning on the cost-effective design and implementation of M&S systems, methods and indicators, which can be applied to measure the impact and sustainability of rural infrastructure development programmes.	Robin Workman (TRL)	Arthur Chibwana, (National Programme Coordinator for RIDP, Malawi)
5	Towards Roads Designed for Flooding; Biomimicry in Road Design and Construction. To create awareness, interest and knowledge about Biomimicry and how it can be applied to build with Nature rather than against it.	Kenneth Mukura (TRL)	Gama Sibanda (ILO and Biomincry Professional)
6	Transport Services (TS) To discuss key issues affecting rural people's access to markets, services and opportunities and the policy implications of TS studies for African countries.	Josephine Mwankusye (Consultant)	Paul Starkey (AFCAP PMU) and other contributors
7	Evaluation of Road Agency Performance in Road Asset Management To strengthen the knowledge base and awareness on road management good practices and road asset management performance assessment and to discuss rebuilding the institutional memory on the principles of road sector reform and commercialization of road management.	Joey Malota (ASANRA Programme Officer)	Mike Pinard (Regional Consultant)
8	Practical Demonstration on Provision of Affordable Access through Road Maintenance, Spot Improvement and Upgrading Interventions Demonstration of how to effectively and affordably carry out spot improvements and routine maintenance works on unpaved roads using basic equipment (agricultural tractor, towed grader) and local labour.	Rob Petts and Kingstone Gongera	

3 Joint AFCAP/ASCAP-GIZ Workshop on Knowledge Management

3.1 AFCAP Knowledge Management Context

AFCAP and ASCAP support research on rural roads and rural transport to improve accessibility, safety and sustainability in Africa and Asia. One of the outputs of the programme is knowledge and a knowledge management strategy has been drafted to optimise the access, dissemination, quality and use of the knowledge. Part of the programme efforts will go into supporting African road research institutes and related organisations with defining, organising and supporting their knowledge management function through various activities (training, TA).

3.2 GIZ Context

GIZ has a strong interest in knowledge management and research uptake among decision makers and practitioners. GIZ also has strong expertise in establishing and supporting effective communities of practice, and in fostering regional and international exchange on best practice e.g. via on-site and online trainings.

3.3 Workshop Objective

The workshop aimed to explore and raise awareness about the function and modalities of knowledge management and research uptake at the level of African road research institutions and other stakeholders (e.g. those working on agricultural logistics, use of IMTs in rural areas, rural health/EMS provision)

3.4 Workshop Programme & Methodology

Activity Number	Activity	Methodology	Resource Persons
1	Introduction and Workshop context	Overview by Caroline Visser	Caroline Visser - Knowledge Management & Communications Manager, AFCAP/ASCAP (Cardno IT Transport)
2	Presentations (Knowledge management function)	Speaker 1 – Knowledge Management systems within research institutes	Madelein van Heerden (CSIR)
		Facilitated Q&A	
		Speaker 2 –Knowledge Management @GIZ Transport - Urban and Rural Transport Projects	Ernst-Benedikt Riehle (GIZ)
		Facilitated Q&A	
3	Panel Discussion (Research uptake: Feeding research evidence into policy-making and practice)	Facilitated discussion Prepared lead questions Follow up questions by facilitator Contributions from the floor	Ernst-Benedikt Riehle (GIZ) Gary Taylor, AFCAP Team Leader (Cardno IT Transport) Dr Fikiri Magafu Head of Road Research Centre - PMO RALG Tanzania
4	Inventory of Practitioner Needs (Community of practice: what does it take?)	Introduction by Caroline Visser including challenges and lessons learned with current community of practice	Caroline Visser - Knowledge Management & Communications Manager, AFCAP/ASCAP (Cardno IT Transport)
		Facilitated discussion: Each participant filled a card with specific questions on the Knowledge chain	

3.5 Challenges and Recommendations Flagged Following Presentations

- Some people are not motivated to share knowledge. There is a need to incentivise knowledge sharing.
- It is sometimes difficult to know the good work done by various players. Stakeholders should capture and share success stories.
- There is a general preference for imported technologies at the expense of local innovation.
- There is need to integrate knowledge management tools to enhance knowledge sharing.
- There is a challenge in engaging different stakeholders with different interests and power. We need to do a comprehensive stakeholder analysis and continuously engage all stakeholders to inform them about the process and secure their buy-in.
- Knowledge often gets lost during institutional restructuring.

3.6 Prepared Questions for Panellist on Research Uptake

1. What is your experience regarding research uptake and what does success look like?
 - Use of old research results to justify current actions. E.g. planning based on vehicular transportation is no longer valid.
 - Success is indicated by action.
 - There must be movement from research to curriculum development and training.
 - Research uptake should happen in both policy making and implementation.
 - Successful technology can be sabotaged by inappropriate incentives e.g. labour based methods in Kenya.
 - Research needs to produce reliable and dependable data.
 - Research uptake and policy change often take a long time.
2. What are the roles of public and private sector stakeholders?
 - Private sector lobbies and sells the technologies they have developed.
 - Public sector commissions research and develops specifications and guidelines.
3. How should research results be packaged and communicated to policy makers (not necessarily technical)?
 - Keep it simple but powerful – articulate benefits e.g. cost savings, reduction in environmental damage and link to contemporary language and terminologies.
 - Seeing is believing – conduct study tours to successful projects.
 - There needs to be a champion embedded in an organisation to take policy forward.
4. How should research results be packaged and communicated to implementers (largely technical)?
 - Develop guidelines and handouts.
 - Hold technical forums.
 - Public institutions must take ownership of the process.
 - Public sector officials do what they are told.
5. How can we leverage social media to disseminate research results and secure stakeholder buy in?
 - Social media can be powerful if the institutions develop clear guidelines.
 - Foster cross sectoral dialogue: transport, agriculture, health etc.

3.7 Way Forward

- AFCAP was requested to curate knowledge properly, preferably through multi-sourced knowledge repositories.
- Participants alluded to the need for interdisciplinary collaboration that culminates in production of publications that are put in a common repository.
- Participants emphasised the need to involve industry in knowledge management to ensure uptake.
- There was consensus on the need to demonstrate viability of research output.

3.8 Community of Practice

Each participant was provided with cards to populate the following table as much as they could to answer the questions “What should be the role of the community of practice during the various stages of the Knowledge Chain?”

Stage of the Knowledge Chain	Role of Community of Practice (COP)	Responsible Key Stakeholders
Research (AFCAP wide)	Develop concept notes and motivate for research	COP members
	Collate and prioritise research needs	AFCAP and Roads Authorities
	Assemble multi-disciplinary research teams	Institutions engaged in Research
	Mobilise funding for research	Governments, Industry, Academia
	Provide information and/or facilitate access to information by Research teams	COP members
Compilation	Peer review of research output to ensure quality control and instil consumer confidence in research output	Academia and applied researchers Publishers
	Turn complicated reports into simple format	AFCAP and researchers
Dissemination	Leverage internet, Social Media, TV and print media	AFCAP and COP members
	Utilise Champion to disseminate message	Roads Authorities, beneficiary communities
	Publish research findings in Journals, Newsletters and present papers at Conferences	T2 Centres, AFCAP, Regional Bodies
	Upload to structured databases	AFCAP and COP members
Adaption to local context	Pilot projects to calibrate recommendations to local context	Roads Authorities and Researchers
	Engage local stakeholders such as during public gatherings	Politicians, religious leaders, community leaders, Business associations, Roads Authorities
	Cost benefit analysis of adapting the new solutions	Researchers
Demonstration	Identify demonstration sites, mobilise resources and construct demonstration sites	Roads Authorities, researchers, consultants, contractors and funding institutions
	Develop strategy for embedment to local standards and guidelines	Researchers, Roads Authorities
	Conduct study tours	Media, beneficiaries
Training	Identify training needs for communities and technical practitioners, develop materials and conduct requisite training	Roads Authorities and Training Providers

Stage of the Knowledge Chain	Role of Community of Practice (COP)	Responsible Key Stakeholders
	Mobilise funding for Training	Training institutions and Government
	Sensitise policy makers	Technocrats
Embedment (Mainstreaming to policy and practice)	Utilise Champion within responsible institution	Roads Authorities
	Develop Specifications, Guidelines and Manuals	Roads Authorities
	Hold sensitisation seminars	Roads Authorities
	Enact rules and regulations	Policy makers, industry
	Evaluate research uptake and compliance with regulations	Roads Authorities

4 Innovations in Design and Construction of Low Cost Pavements and Surfacing

4.1 The Issues

Issues that make it difficult to construct and maintain roads in an affordable manner were:

- The cost of construction of roads has increased by 400% in the last decade; this is unsustainable.
- The cost of road maintenance is also very high and also unsustainable.
- The result is a huge backlog on upgrading, rehabilitation and maintenance of roads.
- The resource/revenue base is insufficient to meet needs.

4.2 The Solutions

Effective solutions are to develop and adopt low cost pavements and surfacing for low volume roads (LVRs), and develop quicker and cheaper road and surfacing construction techniques. To achieve this, there would need to be extensive research of low cost pavements and surfacing, as well as construction techniques.

Low cost does not mean low value nor inferior quality but rather the minimising of costs through innovation without adversely affecting quality and performance. Some of the concepts that should be considered are as follows:

- Use of locally available materials.
- Designing for local materials.
- Cheaper pavement strengthening measures.
- Resilient pavement and surfacing *technology*.
- Construction and maintenance *system/technology choice*.
- Innovation - *making construction quicker and easier* –using less expensive technology

4.3 Innovative Technologies

Innovative technologies presented in the workshop were:

Armoured Pavement Base

The basic principle is *micro-piling* in which aggregate is hammered into compacted road base with a vibratory steel roller till it can penetrate no more. The embedment of the aggregate into the base produces high densification of the base material and high strengths. The random distribution of aggregate also prevents cracking

Blending Of Base Materials

Blending of two or even three materials is sometimes done to get a material with the desired grading and Atterberg indices, where any one of the materials on its own would be of inferior quality for the road pavement. Case studies of the blended base construction in Mozambique were presented. In one case sand was blended with clay in a 70:30 proportion to get base material that was stronger than either material.

Amalgamated Surfacing

Amalgamate means to mix, combine. In this technique two surfacing layers are fused together, one into another. In a case study given, a tack coat of 40-60mm aggregate is sealed with 5-13mm aggregate. The tack coat is bigger than usual, and the seal coat smaller than conventional, with the result that the two surfacing layers fuse into one another.

In other cases, the surfacing is fused with base course so that there is no distinct plane between the different layers, and neither layer would fail independently. The base in such cases is usually untreated weak base. The surfacing has high stability before application of binder, and consequently much less binder is required. The resulting expectation is a high durability and low cost surfacing.

Otta Seal: New Techniques

Emulsion is used as a binder rather than cutback bitumen. Emulsion better than cutback bitumen because when it breaks the residue is 80/100 bitumen which is better for hot climates

Binder application is done in two stages. Firstly, a binder spray is done before application of the aggregate as usual and secondly on top of the aggregate. This allows the binder to penetrate the aggregate faster with the assistance of gravity, thus requiring less rolling than usual. Also, it is efficient on materials - less aggregate and binder are required, and there is no aggregate loss.

Emulsion sprayed on top should break first before rolling (should turn from brown to black).

Cold Sand Asphalt

Cold sand asphalt is a thick sand seal. A single sand seal layer would be 5mm thick or more, and a double sand seal 10 mm thick or more. This gives a surfacing of high durability and lower life-cycle costs.

Technology Choice in ETB Construction

Intermediate technology using a tractor to pull a water sprayer, disc harrow and compactor provides a cheaper way of emulsion treated bases (ETB) construction than conventional equipment, and at the same time faster than labour-based methods.

4.4 Discussion

There was a lot of interest in the presentation. Issues that were raised and questions asked by delegates are outlined below.

Armoured Pavement Base

- Depth of penetration of the aggregate that is required: The aggregate is rolled in to refusal. It should be sufficient enough to cover the whole base surface, and not too much to remain loose on the base.
- Strength of aggregate to prevent breaking down of aggregate: There was concern from the delegates that rolling the aggregate to refusal may cause the aggregate to break up. It was learnt that in the case study done in Mozambique, limestone was used, with an ACV of 36.
- What degree of initial compaction is desirable, so as to enable some aggregate penetration to take place?
- What traffic levels (ESA) are suitable for this technique? The workshop was advised that traffic of 0,5M was applicable in the case presented. A traffic range of 0,05M to 1M should be catered for with the technique.
- What was the cost of the armoured base? The workshop was advised that it was about \$60,000/km compared to \$150,000/km for conventional construction.

Blending of Base Materials

The principle of blending materials was accepted, and there was no discussion on this topic.

Amalgamated Surfacing

This technique was new to delegates. There was not much discussion except a query on the type of aggregate that could be used in the technique.

Otta Seal: New Techniques

Questions arose on the following:

- Specifications of the aggregate and binder
- How the emulsion binder would be prevented from sticking to roller drums and peeling off. It was explained that this would not happen if the roller surface was wet.

General Discussion

Delegates also raised the following general issues:

- Are labour based projects coming back?
- How long should trial sections be observed for before adoption of technology?
- Are reports of the research available and where?
- Who trained the contractors? It was advised that this was done by TRL.
- Can such trial work be done by tender, and how would rates be established?

4.5 Resolutions

It was agreed that:

- Member countries should adopt these new technologies and carry out their own trials.
- In any case where an innovative approach is contemplated and desirable, properties of the materials encountered should be understood and designed for.
- Control sections should be done to enable assessment of probability of success and adoption of trials
- Research reports and results should be made available
- Specifications should be written for each pavement and surfacing techniques, giving, among other things:
 - Types of applicable soils – sand, clay etc.
 - Type and strength of aggregate - 10% FACT; ACV etc.
 - Construction techniques
 - Drainage design
 - Work item description to enable tendering

5 Maintenance of Rural Access Roads: A Continuing Unresolved Enigma. Why and What can we do about it?

5.1 Workshop Arrangements

Engineer Bernard Musarurwa was the facilitator of the workshop. The workshop started with a presentation by Mr. Mike Pinard, leading to a series of questions that were posed to a panel of three members, followed by contributions from the floor.

The three panellists were:

1. Mr Joseph O. Haule, the Roads Fund Manager of the Road Fund Board of the United Republic of Tanzania; jhaule@raha.com; <www.roadfundtz.org>
2. Mr Robert Mapemba, the Rural Roads Infrastructure Manager in the Rural Infrastructure Development Programme at the Programme Implementation Unit in Lilongwe, Malawi; bobmapemba@yahoo.com; www.ridp.org.mw;
3. Mr. Kingstone S. Gongera, the Principal Director of Clanview Civils Consultancy; <ksgongera@gmail>. Mr Gongera is a former Chief Engineer (Roads) in the District Development Fund, responsible for the rural roads network in Zimbabwe.

5.2 Key Speaker

From the title of the paper, the Key Speaker sought to provoke debate on why the allocation of financial resources for the development and maintenance of rural access roads has remained inadequate in spite of all the efforts and good intentions fostered by the Road Maintenance Initiative (RMI) which forestalled the formation in many African countries of road funds to collect and channel road user charges for the development and maintenance of rural roads.

The Key Speaker discussed the building blocks of the RMI and lamented the fact that it appears that whilst this has resulted in the arterial roads being in place and in reasonable condition, the situation remains that the secondary and tertiary roads are by and large still missing. The burden appears to be the failure to preserve the roads assets, caused by inadequate maintenance that would otherwise reduce future costs to provide rural access roads.

The Key Speaker lamented the fact that maintenance remains an unresolved enigma, making the issue mysterious, perplexing, a conundrum, and a paradox. He suggested that perhaps this was because the maintenance of rural roads was perceived as mundane, without the glamour of new roads. This resulted in road maintenance being treated as dispensable, and often being deferred. In fact, he suggested that budgetary allocations for road maintenance were about half of the amount required, resulting in delayed maintenance, causing a backlog thereof.

The Key Speaker outlined the various exogenous factors that may be contributing to the situation. These ranged from political interference in the administration of the road fund and the allocation of funds, to institutional factors to do with the types and setup of the road agencies. Other factors may include technical, financial and operational aspects, all inhibiting sustainable maintenance of the roads networks.

Beyond the budgetary constraints, other impediments may be caused by inadequate planning and inappropriate standards and specifications to ensure meeting the routine and periodic maintenance requirements. Other contributory operational aspects may include the type of the contractors engaged, the involvement of the community or lack thereof, and the types of equipment used. The

institutional arrangements, whether these are centralised or localised, may also affect the maintenance of roads, especially regarding the allocation and disbursement of the funding.

5.3 Panel Responses

The question was then paused to the panellists: what can be done?

Mr Joseph O. Haule was the first to contribute to the discussion. He highlighted the problem of attitude, the need to enlighten the politicians and authorities in the importance of maintaining roads. He suggested that there was need to devise advocacy tools to educate senior government officials and the politicians on the consequences of inadequate allocation of funds for road maintenance. He noted that generally the road fund levy was inadequate and needed to be increased, as well as the need to diversify to other sources of revenue, including charging more as penalties for breaches. Mr. Haule proposed that the road user charges formulae be backed up by specific legislation. He concluded his contribution by discussing the merits and demerits of the various types of the institutional arrangements of road agencies from centralised to decentralised, noting the potential dangers of councillors becoming contractors, with the inherent risk of corruption.

Mr. Robert Mapemba observed that there was no word for “maintenance” in the local languages of Malawi, which could explain the attitude of lack of appreciation by politicians for road maintenance, who seem to exalt more in new roads than old ones. He noted that donors are happy to fund new construction and not maintenance, and that there was a bias for paved trunk roads as opposed to unpaved roads. Perhaps there is need to adopt the PPP (Public Private Partnership) financial model that provides for not only capital expenditure, but also operational and maintenance budgetary provisions in the cash streams.

Mr Kingston S. Gongera opened his contribution by stating that 70% (seventy percent) of the population in most African countries lives in the rural arrears, and it is engaged in rural agriculture for subsistence and as the main economic activity. Thus rural access roads serve both as economic and social contributors. Mr. Gongera raised the question of whether it was not better to focus on a core network than to strive and struggle with all the gazetted roads, by accepting what is affordable versus what is desirable, in the planning of provision and maintenance of roads networks. He proposed that there be pre-finance capital with built-in provision for maintenance. Mr. Gongera went on to demonstrate the advantages of tractor-based road maintenance activities vs a motorised grader, with the tractor offering the versatility of being able to be hooked with a trailer to haul materials and labour, a bowser for water, a mower for cutting grass, and a tyre-drag. He also touted the convenience of locally-based maintenance units responsible for the roads in a district as being more efficient than centralised operations.

5.4 Contributions from Participants

There were several contributions from the floor. One of the more notable ones was made by Mr. John Hine who suggested that engineering expectations were perhaps too high, and priority should be on “passable’ instead of comfort. He repeated calls for the need for a second RMI, and that politicians should be ignored on matters of priority for roads. Mr. Ronald Lwakatare of Tanzania spoke about the need for mentorship with support from consultants, and the use of appropriate technology. Mr. Tony Greening opined that force accounts should not be treated as a sin. There was a proposal that there should be more low cost sealing of low volume roads to enhance preservation of the road asset. Other issues that were mentioned included:

- The public should put more pressure on the road agencies to perform better.
- District engineers need mentoring by more experienced engineers.

- Road agencies need long term maintenance plans so as to avoid a sudden rush of activity at election time.
- Does decentralisation of responsibility for district roads work? There are case studies suggesting that decentralisation does not work for roads. It may be better to centrally manage rural roads rather than split the network into small areas under weak local government. However the prioritisation of works should be done at the local level.
- We need better data to demonstrate to politicians the cost and impact of not maintaining roads.
- Road funds need a fair formula for allocation of funds to rural roads.
- For rural roads a force account approach may be more efficient and cheaper than using contractors.
- A review should be carried out of what maintenance approaches have been successful and why.

Mr. Pinard wrapped up the workshop with closing remarks that endorsed the need for a second RMI, and a paradigm shift in the allocation of funds for road maintenance.

6 Monitoring and Evaluation systems of rural infrastructure development programs for sustainable development

6.1 Introduction

This workshop was proposed by Mr. Arthur Chibwana. The subject was the monitoring and evaluation of rural infrastructure development programmes and how this can assist with sustainable development. The stated objective of this workshop was “to facilitate knowledge exchange, discussion and learning on a range of factors affecting the cost-effective design and implementation of M&S systems, methods and indicators, which can be applied to measure the impact and sustainability of rural infrastructure development programmes in ASANRA countries.”

The workshop was planned on this basis, but more detailed questions were agreed in advance of the presentation in order to guide the workshop participants into a focused discussion that could provide some clear guidance to AFCAP in the future.

6.2 Background to the presentation

During the last few years, the UN development agenda has received increased attention in terms of planning the future after 2015 when the period for the Millennium Development Goals (MDGs) expires. The new development agenda was shaped in large measure by the key outcomes of the Rio+20 conference, The Future We Want, which set out a mandate to set up an Open Working Group to develop a set of sustainable development goals (SDGs) for consideration and appropriate action by the UN General Assembly. There are 17 SDGs approved by the UN Assembly at its 69th Session in 2014. Each SDG is accompanied by a detailed list of objectively verifiable target indicators and SDG 9 explicitly deals with infrastructure, and SDG 9.1 deals with the development of “quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all”. In the context of the post 2015 SDG agenda, donors such as the European Union and Governments are already beginning to question the empirical contributions of road investments to food security, rural livelihoods, gender equality, poverty reduction, and climate change, i.e. the core SDGs.

The Rural Infrastructure Development Programme (RIDP), funded by the EU and the Government of Malawi under the 10th EDF, was designed on the basis of previous public works programmes that date back some 10 years, and has been implementing interventions in 17 districts to rehabilitate rural roads, upgrade timber decked bridges to concrete, establish irrigation schemes and water conservation, using labour-intensive approaches and village clubs. The M&E system of RIDP included baseline surveys, quarterly monitoring, most significant change, household surveys, focus group interviews, ten seed technique, and club assessments. RIDP is presented as a practical example of the M&E approaches, selected results achieved, and the main lessons learnt during the last 4 years.

6.3 Workshop Planning

The facilitator assisted the workshop organiser in the selection and organisation of the expert panel. Two panellists agreed to participate:

- Ms. Nite Tanzarn
- Mr. Per Christiansen

Both of the panellists have good experience in the monitoring and evaluation of rural infrastructure projects.

A planning meeting was held with the facilitator, the key speaker and the two panellists the day before the workshop in order to develop a strategy for running the workshop and obtaining a satisfactory result. The original workshop proposal contained a draft programme, but this was modified by the workshop team to incorporate the main items below:

- 2.00pm Opening of workshop and introduction to the key speaker. Introduction to the subject and background of key speaker.
- 2.10pm Presentation of subject paper by key speaker.
- 2.30pm Proposal of two key questions to guide the participants towards the objectives of the workshop.
- 2.35pm Comments and questions on the presentation by the expert panellists.
- 2.45pm Opening the floor to clarifications, questions and comments on the subject of the presentation. Facilitator to guide the discussions and keep the workshop focused on the objectives.
- 3.45pm Summary of the key points discussed, confirm agreement on the conclusions related to the focus questions presented earlier in the workshop.
- 3.55pm Summary by facilitator and vote of thanks to key speaker and expert panellists
- 4.00pm Close

The workshop was scheduled to be held on Wednesday 12th May 2015 at 2pm. It was held in Hall B.

Due to delays in the morning sessions, the workshop started a little late at 2.30pm. It was agreed with the participants that the session would conclude 30 minutes behind schedule at 4.30pm, so that the workshop would utilise the full 2 hours that was planned. The workshop was attended by approximately 35 participants, taking into account that some participants arrived and left during the course of the presentation and discussions.

6.4 The Key Speaker

The facilitator introduced the key speaker Mr. Arthur Chibwana:

Mr. Chibwana has an M.A. in Economics & Social Studies, Diploma in Integrated Rural Development and BA in Public Administration. He has been involved in planning, managing, monitoring and evaluating rural development projects in Malawi for more than 10 years. This time has included management and technical leadership of a number of government and donor funded national level projects designed to reduce poverty, improve rural accessibility, enhance food security and facilitate the participation of rural communities in development through decentralised structures. Since 2011 Mr. Chibwana has been the National Programme Coordinator of RIDP in Malawi, funded by the EU, and is responsible for all aspects of the programme. Included in this programme are:

- Rural road rehabilitation and maintenance
- Small scale irrigation
- Forestry
- Capacity building and social development issues, such as gender, HIV AIDS, human rights and youth.

Formerly Mr. Chibwana was National Coordinator for the Income Generating Public Works Programme and the Malawi Rural Travel and Transport Programme, as well as being Principal Secretary in the Malawi civil service.

6.5 Summary of the presentation

The presenter, Mr. Arthur Chibwana, made the presentation within 25 minutes. A summary of the main points is given below:

- Mr. Chibwana noted that the monitoring system being presented is a work in progress. It is based on the RIDP project in Malawi, which is funded by the EU. The main aim is to enhance the capacity of district councils. The reporting of the system fits with the national indicators, as well as fitting with the needs of all stakeholders.
- Mr. Chibwana introduced the monitoring concept of 'Most Significant Change' (MSC) and explained how it works. In order to try and monitor the impact of the project, the monitoring is extended to 3-4 years past the end of the project. Data collection is carried out side by side with the communities and is therefore very participatory. Progress was shown as good, with all aspects achieving 100% or more.
- Road Maintenance Clubs were used to obtain the monitoring data. The project also involved these clubs in income generating activities. MSC informs everyone what is being achieved and also looks at livelihoods as an indicator. It uses SMART indicators (Specific, Measurable, Achievable, Relevant and Time-bound), which help to achieve measurement of impact and sustainability.
- It is possible for the monitoring system to link to other projects and programmes. Monitoring takes into account global, national and programme requirements, but all stakeholders must agree on the indicators. Travel time was used as an indicator. However, Malawi has a lot of poor people so it can be hard to know who you are affecting. It is essential to look at poverty profiles and define how to collect data.
- The impact is measured 3 to 4 years after the project is complete. There are synergies between sectors, as RIDP is a project that involves different types of infrastructure, such as roads, bridges, irrigation, forestry, etc. Bearing in mind the SDGs – this system puts sustainable development at the core. The project has continually had dialogue with the stakeholders and has developed an exit strategy.

6.6 Focus Questions

Two focus questions were proposed to the audience:

1. Can AFCAP learn from this model of monitoring and evaluation and is it replicable for AFCAP projects?
2. Is the model flexible enough to adequately take account of SDGs and national planning & monitoring requirements in individual countries?

There were no adverse comments on the proposed questions, so they were accepted as the focus questions for the workshop.

6.7 Comments by the expert panel

The facilitator introduced the expert panel:

Per Christiansen: Per is a civil engineer and has worked as a trainer in Africa since 1990, mainly with Danida, but is experienced on both the donor and client side of development projects.

Nite Tanzarn: Nite is an academic, teaching at Makerere University in Uganda. Her background is in management and research on various projects with World Bank and other donors.

Per Christiansen comments:

Per complemented Mr. Chibwana on his presentation and noted that engineers are used to more hard-core monitoring, so MSC is a new concept for them. Donor funded programmes have fed into national monitoring systems but have more resources – it is necessary to develop and further such systems. There is a need to include impact monitoring as a separate activity – maybe we need separate skills for this?

SDGs and their indicators are an important consideration. There is work ongoing on SLoCaT, which can be taken further to mainstream indicators into AFCAP monitoring systems. Per also recommended to disaggregate the data by gender.

Nite Tanzarn comments:

Ms. Tanzarn commended Malawi for their framework linking achievement to goals of the project and commented that it was well thought out within the framework.

Question: Was there a budget for technical assistance and implementation and if so, how much? Operating costs were not that high.

Ms. Tanzarn had a comment that we should look at gender inequalities in order to understand the data better. The quantitative data is balanced with the qualitative, but changes are hard to quantify, like gender, so you can lose out.

Relating to the first question, “What can AFCAP learn”? – Ms. Tanzarn proposed to answer this with a question – what is M&E? What is research? They are two sides of the same coin. What about the learning aspect of M&E? This should be incorporated. M&E and learning should inform decision making to improve performance. Monitoring should generate evidence, with accountability. Upward accountability, based on communication – this is an important aspect of reporting and needs a comprehensive framework. The concept of ‘MEAL’ was proposed – Monitoring, Evaluation, Accountability and Learning – which is integral to AFCAP research. We need sustainability beyond the life of the project. It is important to bring everyone on board.

6.8 Plenary discussion

Following the presentation and the comments by the expert panellists, the floor was opened for a plenary discussion.

Comments, clarifications and questions

Comment: John Hine commented that it was an excellent presentation and noted that it covered the majority of the districts in the country. Malawi was able to provide good data, which involved a wide range of people. This led to a question:

Question: The advantages include that the community have been involved. Clearly people want a blend of things to be monitored and this has been provided, but is it really the blend they want? How can we find this out?

Answer: People can be detracted from the process, so it is important to establish monitoring at the beginning of a project and determine what the people actually want. In this case the EU established an understanding at the beginning of the project and kept reminding people what was agreed.

Question: Outcome indicators, did the MSC assume this or do we know what it is? What are the individual contributions and income indicators?

Answer: Outcomes were assumed in the beginning. It is necessary to have time to establish the information, we shouldn't rush to go to the impact. Important to note how we learn. Roads are 60% of the project, but can be combined with food. The challenge is when different departments require different information.

Question: Do communities determine the interventions or are they project defined?

Answer: They are largely project defined.

Comment: Inputs and outputs. Some indicator data can be obtained from the bureau of statistics. This can be linked to the role of the monitor. Can outputs be linked to national outcomes?

Reply: Mr. Chibwana replied that the monitoring is not necessarily successful, but we have to look at rural roads differently, it is not straightforward. National plans and sector plans can fit in to the process.

Question: How can we measure impact? How can it be monitored sustainably beyond the end of the project?

Answer: The monitoring responsibility is handed over to the Ministry at the end of the project.

Comment: M&E should start at the concept stage of the project, with baseline studies. Clubs can be used but they must relate with the community and community chiefs. We should also look at other data that may be available and see whether there is any relevance to previous programmes.

Question: There will be many non-classified roads, how are these managed?

Answer: Roads are to promote agriculture and access to social services, politics does not need to be involved. There are two sources of funding for non-classified roads, but in this case the Road Fund will provide for it.

Comment: If there is a change in income of agriculture, it may have an impact on rural roads?

Question: How can we impart knowledge to communities and clubs?

Answer: Clubs involve communities along the road. It is essential to give them feedback on progress of the project and of the monitoring. The project goes to all the clubs and tells them about the progress and about what will happen in the future.

Question: In terms of handing over to the Ministry for impact monitoring, how is it done? Is there a documented system? Are the people taking over trained in the system? How does the Ministry take it forwards?

Answer: Decentralisation is a challenge. The system is well documented and the Ministry will be provided with the necessary information. However, we need to promote doing the monitoring together as a package, so that the learning happens as the project proceeds. The key is to keep it simple.

Question: Why are all the progress reports over 100%?

Answer: The project is operating like the private sector. Targets were set before, but the percentage is showing progress against the projection for August 2015, not against the original targets. The EU provided the project with additional funding and the targets were revised accordingly, which is why some targets show over 100%.

Comment: The Ministry will not have the resources and flexibility of a project.

Comment: The capacity and funding for monitoring and evaluation is often minimal. There is a fundamental capacity problem. There is a need to standardise indicators, and T2 can help to do this.

6.9 Summary of discussions

The discussions were summarised by the facilitator:

- This is an integrated project with very specific characteristics. The sum of the project is greater than the parts.
- This shows a very professional approach to monitoring and evaluation. Indicators can be standardised between the competing national, international and project needs.
- There is an impact focus, which is often lacking in roads projects, as most projects do not provide funds beyond the life of the project for monitoring. This project has integrated the Ministry to do this.
- The concept of 'MEAL' was proposed, which is Monitoring, Evaluation, Accountability and Learning'.
- National Development Objective – The project is multi-sector, but has managed to put in place a monitoring and evaluation system that effectively deals with this.
- The project involves the community at all levels and at all stages in order to be sustainable, i.e. using road maintenance clubs and giving them regular feedback.
- The project uses outcome and impact monitoring, so that the real benefits of the infrastructure can be found several years after it has completed. An attempt has been made to make this sustainable by involving the Ministry, who will take over after the project completion date.
- The Ministry has resources, funds and the documentation to take over the impact monitoring (but not specific training yet).

6.10 Conclusions and Recommendations

The session was wrapped up with a summary of the main agreements on the focus questions and some recommendations for AFCAP.

Question 1 asked: Can AFCAP learn from this model of monitoring and evaluation and is it replicable for AFCAP projects?

- The consensus was that yes, AFCAP can learn from this type of monitoring. It has potential to be used, but is possibly wider than necessary as AFCAP is not as multi-sectoral as the RIDP project in Malawi.
- It was also thought that this type of monitoring and evaluation would have more wide ranging uses on other projects and for other practitioners, apart from AFCAP, especially in terms of impact.
- The monitoring is innovative in the way that it works with communities, and that can be an important learning point for AFCAP.
- The model is also an example in how it attempts to monitor impact beyond the life of the project, which is a useful learning point for AFCAP.
- There was not a consensus on whether the monitoring could be useful for AFCAP in its present form, as AFCAP has its own monitoring system and there would need to be more work to find out if and how it could be applied.

Question 2 asked: Is the model flexible enough to adequately take account of SDGs and national planning & monitoring requirements in individual countries?

- We heard from the presentation and as a result of the questions that the model can adequately take account of national, international and project requirements in terms of indicators and other requirements (i.e. SDGs).
- The model can be multi-sectoral and can provide a blend of monitoring outputs, but the challenge is to get that blend right in terms of what the people want to know.
- Ultimately the model is flexible and can provide a good example of how to deal with differing monitoring requirements.
- The model has the potential to provide AFCAP with information that will allow it to better understand the varied requirements of different monitoring needs and how they relate to the SDGs.

7 Biomimicry Workshop

7.1 Workshop Format

The Workshop was informed by a presentation entitled: Towards Roads Designed for Flooding; Biomimicry in Road Design and Construction, which was presented by Gamelihle Sibanda, who is a Certified Biomimicry Professional, Civil Engineer, Institutional and Construction Enterprise Development Adviser. (gamasibanda@gmail.com)

The Facilitator was Kenneth Mukura of TRL (UK)

The Panellists were: Dr. Jasper Cook
Eng. Dave Jennings
Eng. Eric Gumbie.

7.2 Workshop Objectives

1. To create awareness that with the reality of shortage of road building materials, climate change and shift towards integrated planning we need new innovations in the design and construction of roads.
2. To create awareness, interest and knowledge about the emerging discipline of Biomimicry (innovation inspired by nature) and how it can be applied to build with Nature rather than against it.

7.3 Key Issues Discussed

1. Why the current model of designing and building roads has become obsolete in relation to the obtaining reality.
2. Insights on how the proposed innovation path can be navigated.

Old Reality

For decades teachers of highway engineering courses have been preaching the mantra that there are three main things that destroy roads – water, water and water! Engineers have been taught that as soon as they see water they must channelise it and drain it away as quickly as possible. They have also been taught to build embankments to elevate roads above the surrounding environment in order to protect the road pavement from water.

New Reality

Material for building embankments and road pavement layers according to current specifications is running out rapidly.

Climate change is making rainfall patterns erratic; with the frequency and intensity of rainfall posing bigger hazard risks to roads in terms of higher magnitude of run-off and prolonged flooding than in the past. Human damage to the environment has exacerbated the situation. For example, both in rural and urban areas deforestation and degrading of wetlands has diminished natural ecosystems based resilience to hazards such as flooding; effectively turning them into disasters.

In urban areas paving using concrete reduces the quantity of water that can percolate into the ground. This increases runoff and flooding. To compound the problem, in general boreholes have to be deepened regularly as the water table is not being adequately recharged.

The days of silo planning and development are over. Roads are no longer planned independent of other socio-economic infrastructure and services. The road of the future is linked to water harvesting, energy generation, food production and many other complementary initiatives.

7.4 Case Studies

Mozambique

The world still has a vivid memory of a woman being hoisted into a rescue helicopter after delivering baby Rosita Pedro in a tree above raging floods in 2000. Since then flooding has become almost endemic in some parts of the country. This means for Mozambique road designers and builders flooding should become a normal design consideration.

South Africa

The Tshwane Metro (which hosts the capital Pretoria) in South Africa receives about 4.5 billion cubic metres of rainfall annually. As soon as this water falls most of it, thanks to engineered structures, is quickly channelized into storm drains and taken out of town. Thereafter, the country goes to Lesotho to import water. This does not sound like an intelligent way of doing things. Fortunately, in its vision 2055, the city plans to ban impervious paving and adopt strategies that will delay water within its boundaries. This will require new by-laws on water storage and a new breed of engineers who can design with water retention in mind.

Somalia

Somalia is an arid country known for its frequent droughts and famine. As a result there are a lot of settlements along the banks of the few rivers such as the Shebelle. Flash floods are also common. People lose lives, property and livestock when the rivers burst their banks within a short time. A few years ago a team of humanitarian workers was sent to Somalia to assess the effects of a drought so the vulnerable population could be assisted. A few days into the assessment there were flash floods and the team's terms of reference were changed and returned a few days later with a report on the effects of flooding, including on access roads that were to be used for relief aid. This illustrates the folly of continuing to design our roads ignoring the realities of nature.

What Does All This Mean?

The short answer is that we need a paradigm shift and come up with a new mantra, new materials, new design standards, new construction methods and new tools to measure performance and impact of our roads that are adapted to the new reality – roads that are designed for flooding. The long answer is that we need to find new ways to design and build with nature, not against natural forces. Does this mean we have to throw away all the knowledge we have? Yes and no. This is a process, not an event. However, a paradigm shift implies drastic changes also have to be made. The good news is that we have blue prints for working with nature. Do not get me wrong, there is no written manual stashed somewhere. For the past 3.8 billion years nature has been testing and refining strategies to solve pretty every challenge that humans (as part of nature) could face. Using the emerging discipline of Biomimicry it is possible to abstract nature's strategies to solve human challenges.

Biomimicry Example: Eastgate Centre in Zimbabwe

The Eastgate Centre is an office and shopping building in Harare, Zimbabwe. It is a first of its kind in Africa. Its design emulates the ventilation system found in termite mounds such as those built by the *Microtermes* species. The building has won numerous building excellence and innovation awards. Conditions in a termite nest, such as that of the fungus growing termites, have to be maintained at about 30°C for the survival and thriving of termites and the cultivation of fungi which they eat. They achieve this while external day/night temperatures vary as much as 30°C by using a ventilation system and the stabilising capacity of the thermal mass of earth. Their heat source is themselves and

their fungal gardens. They have figured the perfect air-conditioning systems without use of fossil fuels.

A cost comparison study (Pierce, 1998) showed that Eastgate Centre used 35% less total energy than the average consumption of six other buildings with full heating, ventilation and air conditioning (HVAC) in Harare. Eastgate Centre’s energy consumption per unit area is 48% to 83% of other typical buildings with full HVAC in Harare (Pierce, 1998).

What Has Been Tried So Far?

Countries such as Japan, USA, UK, Belgium, and Netherlands have developed porous asphalt, porous concrete and porous asphalt-concrete. Pervious/permeable open graded asphalt and pervious/porous, gap graded concrete are mainly used for low traffic infrastructure such as walkways, sidewalks, parking lots, speed dips and residential driveways. Some pervious pavements are linked to underground water storage e.g. under car parking lots. In Ethiopia there have been successful trials with construction of water storage containers to harvest water from the road.

Physical, chemical and biological mechanisms help remove contaminants e.g. microbes can breakdown organic pollutants and yield clean water to recharge the water table.

The main drawback of current asphalt and concrete pervious technologies is the high costs and use of non-renewable sources of materials. The pavement layers still require protection from water. Furthermore, the technologies have advantages and disadvantages as illustrated in Table 1 below.

Table 1: Advantages and disadvantages of permeable pavements.

Permeable Pavements	
Advantages	Disadvantages
<ul style="list-style-type: none"> • Reduces occurrence of flooding • Increases ground water recharge • Reduces stormwater runoff quantity and flowrate • Reduces contaminants from roadway from reaching surface waterways • Reduces need for traditional stormwater infrastructure • In cold climates reduces maintenance due to buckling and cracking • Reduces risk of hydro-planning • Noise and temperature reduction • Prevents water splash and spray 	<ul style="list-style-type: none"> • Increases initial installation costs • Increased maintenance due to clogging (e.g. pressurised air/water) • Reduces roadway wear life • Concerns of roadway contaminants infiltrating and polluting water table • Infiltrating water potentially compromises integrity subsurface utilities (pipes, cables) • Functionality of pervious pavements can be compromised by improperly repaired utility cuts • Learning curve by contractors to comply with new specifications and need for new equipment

How Biomimicry Solutions Can Be Applied

Bio-inspired solutions may include some of the following principles from nature

1. Growth instead of asset depreciation (e.g. like India’s Meghalaya's Living Bridges)
2. Self-cleaning

3. Self-repair in case of damage or normal wear
4. Use of low energy processes like solar, wind, gravity, waves
5. Use of water as a solvent instead of chemicals that pose a health risk
6. Strength from form/shape instead of from additional materials

We need to learn from nature. For example, in nature there are hard materials that are “manufactured” and used under water such as corals and shells.

Challenges

In order to gain traction on the idea of roads that are adapted to the new reality of material shortages, climate change and integrated planning, several challenges have to be addressed.

The first challenge is one of mind-set. Just as Galileo faced resistance when he argued that the earth is not flat, but spherical the proponents of roads that welcome flooding will first endure ridicule followed by persecution by those who want to hold onto the old reality. Finally, when the new approach is proven to work everyone will triumphantly state that it was the obvious thing to do.

The second challenge is technological. Hard evidence will need to be produced to win over the sceptics. For, example, they will argue that Nature does not build roads, let alone cars. Whilst this is true, Biomimicry has been successfully applied in transport infrastructure (e.g. trains), buildings, aviation, energy generation, medicine, business strategies etc. To access Nature’s “blue prints” the point of departure is not to define questions from a human construct. For example, instead of asking how Nature makes air conditioners one has to ask how nature regulates temperature and then look for organisms (such as termites that inspired the Eastgate Centre) that have solved such a challenge. Similarly, instead of asking how Nature builds roads, the questions have to be unpacked to address various elements such as how Nature builds (strong, flexible, durable etc.) materials in water. Who knows, maybe we may even discover a better means of community access than roads!

The third challenge is how to mainstream the research findings. This will require buy-in by road authorities in terms of new standards and by training institutions that are comfortable in their old “proven” ways. The least resistance will come from small and medium opportunistic contractors who are not heavily invested in legacy technologies.

Key Points

The main points of this thought provoking paper and presentation were:

1. Water is the enemy – To the engineer water damages roads and should be discharged away from the road. However, water that is discharged from the roads affects agriculture. In fact rain falling on impervious roads affects run-off by intensifying it. A comprehensive and multi-sectorial solution could be that the water discharged from the road be stored for agriculture.
2. The road of the future should harvest water so that it can be purposefully used to feed underground reservoirs or for energy generation.
3. Roads should maintain their integrity when flooded and this calls for alternative:
 - a. Materials for road construction
 - b. Design methods
 - c. Construction methods.

7.5 Comments from Panellists

Dr. Cook

1. Biomimicry is being used in bioengineering for protection of embankments and slopes. It is also being used in environmentally optimised design (EOD) so it is feasible.
2. Water saving or conservation in roads may be more applicable in urban areas than rural areas.

3. Concepts that are costly for rural roads may not be compatible with the main objectives of providing rural access which should be low cost.

Dave Jennings

1. Concepts may be area specific i.e. for example a leaving bridge requires certain types of plants to be sustainably constructed.
2. There is need for different solutions for different situations.
3. Vegetation development is a key issue in low volume roads.

Eng. Eric Gumbie

1. It is clear that water is a problem for roads.
2. There is need to develop engineering solutions for these problems.
3. The aspect of biomimicry is an interesting one which may need to be pursued.

7.6 Plenary

The following issues were raised during the plenary session:

1. While biomimicry may seem far-fetched and perhaps crazy, shortage may drive change and this will provide opportunity for biomimicry.
2. There are examples of the use of microbes for self-cleaning and self-healing concrete.
3. There are examples in Mozambique of harvesting water from the roads into sandy environments for use later in the dry season.
4. In designing roads there is need to segment roads and find areas where concepts of biomimicry can be applied.
5. Shortage of materials is a critical issue and new solutions are required.
6. There is need to find out and perhaps develop vehicles which are more friendly to roads.
7. Whilst acknowledging the challenges flagged by the paper and proposed intervention some senior practitioners felt the younger generation should tackle the challenge.
8. Generic solutions will need to be calibrated to the local context.
9. The proposed road may not use the materials we are used to and the methodology of construction may be fundamentally different from current practice. In future transport may not necessarily imply construction of a road.
10. New solutions should seek to influence both infrastructure (e.g. roads) and users (e.g. vehicles).
11. We need to work with nature and not against it. An example was shared from Botswana, a dry country, where the collapsible soil needed water to break the bonds for proper compaction. A new solution did not require use of water (which was needed for human consumption and livestock animals); instead used high energy three sided compactors which reduced water consumption by two thirds.
12. New solutions should not only seek to change the paradigm in road construction but also address spot improvement of specific areas that make the whole road inaccessible.
13. While proposals could have been presented for funding under AFCAP 1 there was need for an appropriate forum to explain biomimicry in detail as has happened in this workshop so that the financiers may have a good understanding and see value in the proposals.

7.7 Way Forward

The following items were raised and proposed:

1. It is important to carry out a horizon scanning and find out what's possible.
2. In developing solutions it is important to bear in mind that roads are for traffic.
3. There is need to look at materials that have developed in marine environment such as stratified limestone and corals which may have inherent resilience against effects of water.

4. The workshop recommended that a proposal be submitted to AFCAP to fund research to investigate the viability of the proposed Biomimicry solutions.

7.8 Conclusion

Effecting change is a mammoth task - with humans, only wet babies welcome change. However, as the old adage goes, the person who moved a mountain started with one stone. A quote from Richard Buckminster Fuller sums it up, "You do not change things by fighting the existing reality. To change something, build a model that makes the existing model obsolete".

There are real opportunities presented by the concept of biomimicry and an open minded approach is necessary to take biomimicry technology in road provision forward.

8 Transport Services

8.1 Venue, programme and attendance

The Transport Services workshop was held on 14th May, 2015 at the Holiday Inn Hotel in Bulawayo, Zimbabwe. The workshop was attended by representatives of the following countries and organizations:

- AFCAP
- TRANSAID
- AMEND
- TRL
- University of Zimbabwe
- Traffic Safety Council of Zimbabwe
- T2 centres
- Country representatives (Tanzania, Malawi, Zimbabwe, Kenya, Uganda, Nigeria)
- Private Consultants
- RIDP Malawi
- UAO
- ASANRA
- HelpAge International
- TFG

The workshop was facilitated by Ms Josephine Mwankusye, a Private Consultant in Transport Issues and a member of the Tanzania National Forum for Transport and Development (TFG).

8.2 Workshop Activities

The welcome remarks were made by Ms Josephine Mwankusye the Key Facilitator, who introduced the session objectives as follows

- Discussion on key issues affecting rural people's access to markets, services and opportunities and the policy implication of TS studies for African Countries
- Discussion on the results of the recent AFCAP – supported 'research cluster' relating to transport services and road safety in Tanzania
- Suggesting specific follow-up actions that can be taken up by the participants, national authorities and /or AFCAP, including possible future 'research clusters' in AFCAP countries.

8.3 Key Speaker

The facilitator then introduced the Key Speaker Mr Paul Starkey, the Transport Services and Research Manager-AFCAP. The Key speaker presented the highlights on the Rural Transport Intervention and specifically the need for transport services in rural areas followed by the summary and key findings of the AFCAP research conducted in Tanzania. He highlighted the importance of Rural Transport Interventions including

- Rural Road construction and maintenance
- The Integrated planning and provision of different services (water, education, health, markets , etc) along with village transport infrastructure
- The promotion and introduction of intermediate and Non motorised Transport Services
- The wide use of motorcycles in rural areas for various needs
- The control and management of conventional transport services (i.e. fares, licences, subsidies, new forms of completion).

The Key Speaker's presentation was followed by brief presentations of the key research findings from specific research studies in Tanzania as follows:

- IFRTD - Transport Services and the first Mile
- IFRTD – Rural Transport Indicators
- AMEND - Motorcycle Services in Rural Areas and Safety Issues
- AMEND- The use of Motorcycles and regulatory issues and the involvement of Motorcycle Associations
- TRANSAID- The use of Motorcycles and Training needs
- HelpAge International – Rural Transport Services and needs of the elderly people.

8.4 Observations from Plenary Discussion

- Key stakeholders in Rural Transport need to understand the rural transport requirements and needs in terms of infrastructure development and maintenance and provision of effective transport services
- The community needs to be educated on the safety issues
- A study needs to be conducted on motorcycle operators attitude towards training and obtaining licences
- Further studies are required for rural transport indicators and planning
- More training both theoretical and practical on rural transport services is required including regulatory issues.

8.5 Group Discussion And Feed Back

After the plenary session participants worked in two (2) small groups in order to discuss raised and identified issues and come up with recommendations for the way forward.

Group 1 : Motorcycle-Related Issues

- Training content, mechanism and capacity building:
 - Full training programme
 - Basic safety awareness programme
- Women and motorcycles ; need for more studies and encouragement
- Multiple passengers - need for more studies on safety issues
- Passenger driven safety initiatives – need to be encouraged for training and acquisition of licences
- More robust crash data collection
- Business case and guidelines to maximise benefits and minimise dis-benefits.

Group 2: Rural Transport Indicators 1

- We need to understand why indicators are required – what is rationale? How to engage policy makers. Transport services research should be geared towards change/influence in policies
- Need useful RTSi for planning and at a district level basis, value in locally recognised transport indicators before they can be internationally recognised (as with RAI)
- Rigorous study and more discussion to outline (and validate) results and selection of prioritised indicators – needs to be presented to a critical audience
- Should move towards house hold (hh) interviews (expensive) or FGDs with stakeholders – view of local population and interactions with RTS, baseline data. Roadside surveys miss out hh's, many of whom don't travel at all
- Need to ask how far people travelled from house hold (hh) to main roads to justify the need for transport interventions.

9 Evaluation of Road Agency Performance in Road Asset Management

9.1 Venue, programme and attendance

The workshop was held on 14th May, 2015 at the Holiday Inn Hotel in Bulawayo, Zimbabwe. The workshop was attended by over fifty delegates from different countries with a wide spectrum of professional backgrounds.

The workshop was facilitated by Mr Joey Malota, Programmes Officer for ASANRA.

The welcome remarks were made by Mr Malota. He welcomed the delegates to the workshop and introduced the speaker Mr Mike Pinard and the workshop topic.

9.2 Objectives of the workshop

The objectives of the workshop were;

- To strengthen the knowledge base and awareness on road management good practices and road asset management performance assessment,
- To discuss rebuilding the institutional memory on the principles of road sector reform and commercialisation of road management,
- to discuss how road agencies operate and determine optimal strategies for improvement of road asset management,

9.3 Main highlights of the presentation

Mr Mike Pinard made a presentation based on a study carried out on the comparison and contrast of two approaches that have been used recently to assess the performance of selected road agencies in the Southern Africa Development Community (SADC) Region. These are the Commercialised Road Management (CRM) approach, which is based on Road Management Initiative (RMI) that was developed by the Sub-Saharan Africa Transport Policy Program (SSATP) and the Publicly Available Specification 55 (PAS 55) approach that was developed by the United Kingdom Institute of Management (IAM) and the British Standard Institution. The following were the main highlights of the presentation;

- Road agencies performance was generally related to the extent to which the road agencies complied with the principles the CRM approach in terms of meeting the requirements of the four building blocks pertaining to Responsibility, Ownership, Financing and Management requirements with latter being more comprehensively dealt with in the PAS 55 approach,
- Basic principles of commercialisation or road management are also gradually being forgotten some 20 years after the RMI was first launched,
- The gains achieved during the early days of the road sector reforms are gradually being lost as some agencies are shifting towards operating in a manner that resembles the bureaucracies they were supposed to replace.

9.4 Common Observations

After the presentation and Questions and Answers Session a panel of three experts was requested to answer the following pre-arranged four questions in order to draw common understanding of the results of the study.

- What are the challenges that affect the ability of the road agencies to operate in an effective and efficient manner?
- Are the road sector reforms that were developed under the Road Management Initiative in 1987 still relevant today?

- Is there need to embark on a revitalisation of the RMI type reforms adapted to current requirements?
- Is there a need to develop a standard road agency performance measurement framework?

From the first question the following challenges were singled out as the main impediments to the ability of road agencies to perform well;

- Political interference
- New political regimes do not seem to understand and agree with the requirements of the RMI recommendations,
- Late release of funding from treasury/road fund
- Implementation of unplanned activities
- Absence of appropriate evaluation and monitoring systems
- Insufficient funding
- Lack of capacity of private sector, contractors and consultants
- Lack of autonomy
- Reform process incomplete
- Misappropriation of funds
- Corruption
- Huge backlog maintenance

On the second question the delegates unanimously agreed that the road sector reforms are still valid today.

On the third question both the panellists and delegates agreed that there is need to revitalise the RMI reforms adapted to the current requirements.

On the last question the delegates also unanimously agreed that there is need to develop a standard road agency performance measurement framework.

9.5 Recommendations

The following recommendations were made at the end of the workshop;

- There is need to resuscitate the RMI reforms but in a way that participating countries have greater ownership of the process,
- There is need for ongoing evaluation of the performance of the road agencies, both within and across countries,
- A standard road agency performance measurement framework should be developed, by incorporating those complementary elements of PAS evaluation framework that are not adequately captured in the CRM evaluation framework to produce an enhanced framework for application in the region,
- The evaluation output should be linked to appropriate performance indicators to benchmark the agencies' performance in order to identify areas of improvement.

10 Conclusion

The AFCAP-supported workshops at the 7th Africa Transportation Technology Transfer (T2) Conference were well attended and the levels of participation were high. This reflected the relevance of the subjects that were selected for discussion and the preparedness of the facilitators and key speakers. Important views and insights were obtained through contributions from the

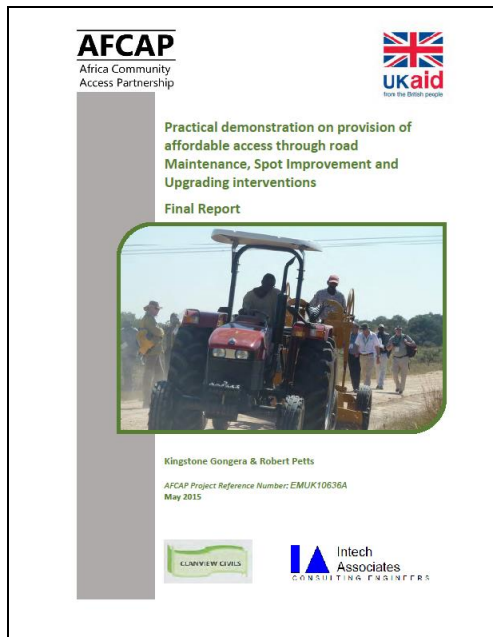
workshop participants. The workshops contributed to greater awareness of key issues affecting the rural transport sector in Africa.

It is recommended that ASANRA should take the lead in promoting the key findings and resolutions of the workshops and monitoring their implementation. AFCAP should provide support to this process and a review of progress in this regard should be carried out at the next T2 conference.

Key resolutions include:

- Promote public-private sector collaboration in knowledge creation, management and targeted dissemination to policy makers, practitioners and the general public in order to promote research uptake.
- Continue research on innovations in the design and construction of rural roads in order to provide surfaced road access to more rural communities.
- Resuscitate the RMI process in order to secure current gains in institutional development in the roads sector in Africa and to promote a paradigm shift in policy on road maintenance, particularly with regard to funding.
- Implement monitoring and evaluation systems on development projects that are flexible enough to take into account the monitoring requirements at project level, nationally and for the Sustainable Development Goals.
- Investigate the potential role of biomimicry technology in the provision of rural access.
- Develop the linkages between road infrastructure and transport services, both of which are critical to improve access to markets, goods and services and are fundamental to the achievement of the SDGs.

Annex A: Report on Field Demonstration of Tractor Based Technology



Please right click on this image to open the file.

Annex B: Attendance at Workshops

1	Knowledge Management
1	Annabel Bradbury- TRL-UK
2	Natsai Shoko
3	Omange George
4	Nite Tanzarn
5	Margaret Ogai, Kenya Roads Board, Kenya
6	Fikiri Magafu
7	Bernard Musarurwa- Consultant, Zimbabwe
8	Wilfried Brock- Roads Authority, Namibia
9	J. M. Mbarva -Ministry of Transport Kenya
10	Luis Fernandez
11	E. Chinyadza
12	N. Rashirai
13	Shedrack Willilo
14	Barbra Mpofu- TSCZ
15	Jonah Mangami- TSCZ
16	Ernest Muchena- TSCZ
17	Proctor Utete- TSCZ
18	Claudious Muzuva- TSCZ
19	Erkenwald Khiba Road Fund Administration/ Namibia
20	John Bota- Department Of Roads (Zimbabwe)
21	Eng Hagai K. Bishanga- TANT2 Centre
22	Powell Mlambo- Chinhoyi University of Technology (Zimbabwe)
23	Steven Jones- University of Alabama
24	Jethro Mazire- Department of Roads (Zimbabwe)
25	Darina Zmitrovich
26	Ignatious Ngoma
27	Ephata Mlavi
28	Silvester T. Haonga -TANT2 Centre
29	Caroline Barber
30	Lucas Wakudumo- Roads Authority Namibia
31	Madelein van Heerden- CSIR
32	Atherton Zindoga- Department of Roads (Zimbabwe)
33	Josephine Mwankusye
34	Caeser Kurewa- Policy Planning and Coordination (Zimbabwe)
35	David Bogacu- Principal Road Engineer
36	Gamelihle Sibanda
37	Mazana M
38	Reginald Katsande Administration- Department of Roads (Zimbabwe)
39	Lovemore Dondofema- Department of Roads
40	Shretha Chandra Bahadur

41	M Mapasure- Instaroad (Zimbabwe)
42	Paul Starkey
43	G. Mateta
44	Palesa Hekandjo
45	Joey Malota
46	Margaret Mashingaidze- Department of Roads (Zimbabwe)

Tuesday 12th May

2	Innovation in Design and Construction of Low Cost Pavements and surfacings
1	Honeychile Tyetye- RDA Zambia
2	Loyce Saili- RDA Zambia
3	Per Christiansen- Mozambique
4	Masiyiwa Lesley- Bulawayo Polytechnic College
5	Musikavanthu Markshomer- Department of Roads
6	D. C. Makamache- National Railways of Zimbabwe
7	D. Sibanda- Bulawayo City Council
8	T. Chinyani- National Railways of Zimbabwe
9	G. Sango- National Railways of Zimbabwe
10	J. Mafu- SIRDC (Zimbabwe)
11	Engineer S. Chambati- ARUP (Zimbabwe)
12	Ndengani Sammy- DRC
13	Thompson Banda- RDA Zambia
14	Patrick Nerera- Lafarge (Zimbabwe)
15	B. Magumise Zimbabwe
16	Kangara Jaranani- Department of Roads (Zimbabwe)
17	A. Nyikadzino- Department of Roads (Zimbabwe)
18	G. Mateta
19	Maron T. Pasipamire- Department of Roads (Zimbabwe)
20	Sandra Chikudza- Department of Roads (Zimbabwe)
21	Andrew Kagode
22	Arnold Jeme- Department of Roads (Zimbabwe)
23	Douglas Dera- Department of Roads (Zimbabwe)
24	Arlington Dzawo- Department of Roads (Zimbabwe)
25	Christopher Hatinzwani- ZINARA
26	Sydney M. Matsepe
27	Presley Chilonda- RDA Zambia
28	Namatirai Cheure- University of Zimbabwe
29	Jasper Cook
30	Kudzai Dzapasi- Standards Association of Zimbabwe
31	Irene D. Michael- Department of Roads (Zimbabwe)
32	A. Ngulube- Department of Roads (Zimbabwe)
33	Thomas Bishop- AMEND
34	A. G. Matemera- Finnemore Enterprises (Zimbabwe)
35	P.R. Mukome- Department of Roads (Zimbabwe)
36	C. Mukupira- Central Vehicle Registry (Zimbabwe)
37	Kudzai Mushunje- National University of Science and Technology

38	Togarepi Makadho- Department of Roads (Zimbabwe)
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Tuesday 12th May

3	Maintenance of rural access roads – A continuing, unresolved, enigma. Why? And what can we do to solve this problem?
1	Ronald Lwakatare- Tanzania
2	Arthur Chibwana- RIDP Malawi
3	James Ngoma- Meteorological Services Department (Zimbabwe)
4	Eng Hudson Kihumba
5	Joseph Haule
6	Julius Komba- CSIR
7	Bencolias Tinkaligaile
8	Samson Shumba- University of Zimbabwe
9	Billy Tshibambe- DRC
10	R. Makamure- Zimbabwe
11	Andrew Mcloughin- AFCAP
12	Ernest Shenje- Department of Roads (Zimbabwe)
13	Linda Ziwenga- Department of Roads (Zimbabwe)
14	Zephaniah Samwel- University of Alabama
15	Mathapelo Daenane- Roads Directorate (Lesotho)
16	Lerato Molefe- Roads Directorate (Lesotho)
17	Augustine Chigwereve- Department of Roads (Zimbabwe)
18	W. Kuotcha
19	Joey Malota
20	S. Kadangwe
21	P. Chimuka- Department of Roads (Zimbabwe)
22	Duncan Matheka- AMEND Kenya
23	Albert Masheka- Instaroad (Zimbabwe)
24	A. Kabende
25	Joseph Goma
26	Tony Greening
27	Robert Mapemba
28	Prosper Dhliwayo- Department of Roads (Zimbabwe)
29	Magaruwa Ringston- Department of Roads (Zimbabwe)
30	Stanley Mareya
31	Finale Mapurisa- Department of Roads (Zimbabwe)
32	F. Mazodza- Star FM Zimbabwe
33	Godknows Marawanyika- National Handling Services (Zimbabwe)
34	W. Hawanga
35	Robin Workman- TRL UK
36	Steven Kamutema- Department of Roads (Zimbabwe)
37	Victoria Dzawo- Department of Roads (Zimbabwe)

Wednesday 13th May

4	Monitoring and Evaluation Systems of Rural Infrastructure Development Programmes For Sustainable Development.
1	Annabel Bradbury
2	Ronald Lwakatare

3	Palesa Hekandjo
4	Nite Tanzarn
5	Margaret N. Ogai - Kenya
6	Omange George- Nigeria
7	Eng. H.W. Kihumba
8	Wilfried Brock- Roads Authority Namibia
9	Bencolias Tinkaligaile- Tanzania
10	Shedrack Willilo
11	Billy Tshibambe- DRC
12	Kangara Jaranani- Department of Roads (Zimbabwe)
13	Paul Chawagarira- Chinhoyi University of Technology
14	Erkenwald Khiba- Namibia
15	A. Mutungwazi- Department of Roads (Zimbabwe)
16	Andrew Kagode
17	Jethro Mazire- Department of Roads (Zimbabwe)
18	W. Kuotcha
19	Joey Malota
20	Sam Kadangwe
21	Ephata Mlavi
22	Caroline Barber
23	Ernest Riehle
24	A. Kabende
25	Dennis Mapfurira- Department of Roads (Zimbabwe)
26	Josephine Mwankusye
27	Richard M. Milinga- Roads Authority (Namibia)
28	Tom Bishop- AMEND Kenya
29	Luis Fernandez- Mozambique
30	Caeser Kurewa- Policy Planning & Coordination (Zimbabwe)
31	Per Christiansen- Training Advisor Mozambique
32	Magaruwa R. - Department of Roads (Zimbabwe)
33	Mariko Mulauzi- Department of Roads (Zimbabwe)
34	Teklu Adamu
35	Caroline Visser

Wednesday 13th May

5	Towards Roads Designed for Flooding; Biomimicry in Road Design and Construction.
1	James Ngoma Meteorological Services Department (Zimbabwe)
2	Darina Zimtrovich
3	Gamalihle Sibanda
4	Samwel Zephaniah- University of Alabama
5	A. Matemera- Finnemore Enterprises (Zimbabwe)
6	Kenneth Mukura- TRL
7	Faithful Mazodza- Star FM Zimbabwe
8	J. Kamutema - Department of Roads (Zimbabwe)
9	M. Mapasure
10	A. Nyikadzino- Department of Roads (Zimbabwe)

11	D. Sibanda-
12	Tony Greening
13	Michael Burrow- University of Birmingham
14	Margaret Mashingaidze- Department of Roads (Zimbabwe)
15	Lillian c. Nkomozepi- Department of Roads (Zimbabwe)

Thursday 14th May

6	Transport Services
1	Honeychile Tyetye – RDA Zambia
2	Loyce Saile- RDA Zambia
3	Annabel Bradbury
4	Palesa Hekandjo
5	Arthur Chibwana
6	Lesley Masiyiwa
7	Godfrey Sango- National Railways of Zimbabwe
8	Tendai Chinyani- National Railways of Zimbabwe
9	Shedrack Willilo
10	Jonah Mangami
11	Maron Pasipamire- Department of Roads (Zimbabwe)
12	Steven Jones- University of Alabama
13	Darina Zimtrovich
14	Arlington Dzawo- Department of Roads (Zimbabwe)
15	W. Kuotcha
16	Caroline Barber- TRANSAID
17	Ernest Riehle
18	Albert Masheka- Instaroad Zimbabwe
19	Josephine Mwankusye
20	Zephaniah Samwel- University of Alabama
21	Tom Bishop- AMEND
22	Duncan Matheka- AMEND
23	A. Sango- Ministry of Transport Zimbabwe
24	Finale Mapurisa- Department of Roads (Zimbabwe)

Thursday 14th May

7	Evaluating Roads Agency Performance in Road Asset Management
1	Honeychile Tyetye – RDA Zambia
2	Loyce Saili- RDA Zambia
3	Ronald Lwakatare
4	Margaret W. Ngotho Ogai, Kenya
5	James Ngoma – Meteorological Services Department (Zimbabwe)
6	Omange George- Nigeria
7	Per Christiansen- Mozambique
8	Eng H. W. Kihumba
9	Musikavanthu Markshomer- Department of Roads (Zimbabwe)
10	Jabulani Mafu- SIRDC Zimbabwe
11	Julius Komba- CSIR

12	Bencolias Tinkaligaile, TANROADS
13	E. Chinyadza- National Handling Services (Zimbabwe)
14	Billy Tshibambe- DRC
15	Thompson Banda- Road Development Agency Zambia
16	Paul Chifakacha- Group Five (Zimbabwe)
17	Luis Fernandez- Mozambique
18	Ndengani Samuel- DRC
19	Erkenwald Khiba, Namibia
20	Eng. Hagai Bishanga-TANT2 Centre
21	Ernest Shenje- Department of Roads (Zimbabwe)
22	Andrew Kagode
23	Joey Malota
24	Sam Kadangwe
25	Silvester T. Haonga - TANT2 Centre
26	Pedzisai Chimuka - Department of Roads (Zimbabwe)
27	Presley Chilonda- Road Development Agency Zambia
28	Christopher Hatinzwani- ZINARA
29	Ephata Mlavi- Tanzania
30	Ignatious Ngoma
31	Namatirai Cheure- University of Zimbabwe
32	Samson Shumba- University of Zimbabwe
33	Kudzai Dzapasi- Standards Association of Zimbabwe
34	A. Kabende
35	Caeser Kurewa- Policy Planning and Coordination - Ministry of Transport Zimbabwe
36	Irene D. Michael- Department of Roads (Zimbabwe)
37	A. Ngulube- Department of Roads (Zimbabwe)
38	Gamalihle Sibanda- Department of Roads (Zimbabwe)
39	Stanley Mareya
40	Faithful Mazodza- Star FM Zimbabwe
41	E. Haripindi- The Herald Newspaper
42	W. Hawanga